



The Vancouver Index of Acculturation (VIA): New evidence on dimensionality and measurement invariance across two cultural settings

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The Vancouver Index of Acculturation (VIA) is a self-report bidimensional instrument that has been employed in several cultural contexts to assess migrants' orientations toward mainstream and heritage traditions. Although it has shown good reliability and validity in the past, recent theoretical developments and empirical studies have suggested the VIA might assess more than two dimensions. Moreover, measurement invariance of this instrument across demographic subgroups has never been assessed before. With the aim of evaluating these psychometric issues, exploratory factor analysis and Rasch modeling were conducted on data from two samples of immigrants to Canada ($N = 224$) and to Italy ($N = 266$). Results supported the hypothesized two-factor structure, with Rasch modeling showing that items within a subscale differed in terms of "difficulty" in being endorsed, but still belonged to a single factor. Differential item functioning analysis results showed measurement invariance across gender, age and education sub-groups. Most results converged across the two samples.

Keywords: Vancouver Index of Acculturation, Dimensionality, Measurement invariance, Rasch model, Exploratory factor analysis, Psychological acculturation, Differential item functioning

Introduction

Achieving a better understanding of acculturation is essential for modern Western societies, where high rates of immigration are combined with increasing cultural diversity. At the level of the individual person, psychological acculturation occurs when there is a prolonged and continuous contact between members of different ethnocultural groups, and people have to adapt to a cultural context different from the one in which they have been socialized. This dynamic process begins with intercultural contact and requires negotiating changes in multiple domains, including values, behaviors, and identities (Tropp, Erkut, García Coll, Alarcón, & Vázquez García, 1999; Berry, Phinney, Sam, & Vedder, 2006). Psychosocial research on acculturation has focused on three main issues: (1) attitudes, or the different ways in which people maintain aspects of their heritage cultural identity while relating to other groups, especially the mainstream

group, in a plural society; (2) changes in behavior that take place with exposure to the mainstream cultural group; and (3) the various stresses that accompany migration and/or cultural minority status (Berry, 1997; Ward & Geeraert, 2016).

From a theoretical perspective, the psychosocial approach to acculturation has changed over the years. In 1964, developed the unidimensional model of acculturation, positing that acculturation takes place along a single continuum with a clear temporal sequence. Migrants begin at one pole, representing heritage cultural involvement, where they maintain their pre-migration values, behaviors, and identity. Acculturation involves moving to the opposite pole, representing mainstream cultural involvement, where their pre-migration values, behaviors, and identity are replaced by that of the society in which they now live. Since Berry's seminal work in the 1970s (for a review see Berry, 1997), however, researchers have increasingly conceived acculturation as a process of change that occurs independently along more than one dimension. A bidimensional conceptualization admits a range of individual differences in the degree to which people adopt culturally based values, behaviours, and identities along two dimensions. For example, while one migrant may have a positive orientation only toward their heritage cultural

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stream, another one may have a positive orientation toward both heritage and mainstream cultural traditions (Flannery, Reise, & Yu, 2001; Ryder, Alden, & Paulhus, 2000).

In 2000, Ryder et al. directly compared unidimensional and bidimensional models of acculturation, demonstrating that the heritage and mainstream cultural orientations were orthogonal and displayed distinct patterns of correlations with other key third variables (Ryder et al., 2000). These findings support the claim that a bidimensional perspective allows for a better understanding of the adaptation process underlying acculturation (Navas et al., 2005). As some authors have long suggested (Berry, 1997; Horenczyk, 1996; Navas et al., 2005), the adaptation process is complex, since different options can be adopted and preferred at the same time, and it is relative because it does not take place in the same way in the different life domains (e.g., public areas as work or politics versus private areas as family relationships and ways of thinking). The advantage of the bidimensional model over the unidimensional one is that the former accounts for flexibility in how migrants' orientations toward their heritage and mainstream cultural groups may develop in different ways (Flannery et al., 2001) and can vary independently in their strength (Ryder et al., 2000).

For the purpose of reliably measuring heritage and mainstream cultural orientations, Ryder et al. (2000) developed the Vancouver Index of Acculturation (VIA), which has become a popular self-report instrument among acculturation researchers. Ryder et al. established the VIA as a psychometrically sound bidimensional acculturation measure, and the current work builds on these initial findings by further investigating the dimensionality and measurement invariance of the VIA.

The Vancouver Index of Acculturation (VIA)

The VIA is a 20-item instrument that measures orientations towards heritage and mainstream cultural groups, covering several of the public and private domains scholars found to be relevant when measuring the acculturation process (Celenk & Vijver, 2011, 2014), including values, social relationships, and adhesion to cultural norms (see Table 1). Item statements are general rather than formulated for specific target groups. With respect to the majority of the bidimensional acculturation instruments, it purposely does not assess the language domain because it is preferable to assess it apart, given its pivotal role in the acculturation process (Doucerain, Segalowitz, & Ryder, 2017). Moreover, language is implicit in several of the items. For example, the endorsement of the item related to enjoying humor implies linguistic competence.

The 20 items were generated in pairs with regard to content area, with one item referring to the mainstream culture and the other mirror item referring to the heritage culture. High scores on each 10-item subscale represent a positive

orientation toward the specific cultural group. The two cultural orientations tended towards statistical independence in several samples (especially in second generation subsamples; Ryder et al., 2000, p. 58), and showed distinct correlation patterns with other measures used to assess the scale's validity (i.e., demographics, personality, self-construal, and psychological adjustment).

An important feature of the VIA is the *endorsement*, rather than *frequency format* of the questions, which likely contributed to the orthogonality of its subscales. In the *endorsement format*, respondents rate to what extent they agree or disagree with each statement. This approach, "guarantees relative 'conceptual independence': an answer to one question in the pair does not necessarily constrain a response to its counterpart" (Kang, 2006, p. 676). In contrast, conceptual independence cannot be assured when respondents rate items in terms of behaviors frequency or proportion of ethnic ties in their social network (*frequency format*). For example, for people who spend most of their spare time with mainstream entertainments, there will be little time left for being engaged in heritage entertainments, and vice versa, thus creating an inverse relation between two respective items that assess the frequency of these activities (Doucerain, Segalowitz et al., 2017).

Another positive aspect of the VIA is its relatively small number of items. Indeed, bidimensional scales typically include large number of items in order to cover the multiple domains involved in acculturation (see Navas et al., 2005), including for example, social relations, language, eating habits, utilization of media and so on. This typical lack of parsimony has practical implications. Too many items (e.g., Gim Chung, Kim, & Abreu, 2004; Tsai, Ying, & Lee, 2000; Zea, Asner-Self, Birman, & Buki, 2003) can be burdensome for respondents, and can raise more serious problems when respondents have a low level of competence in the mainstream language (Ryder et al., 2000). Brevity is of course a double-edged sword, with low participant burden coming at the expense of a more comprehensive multidimensional assessment of acculturation. For example, the VIA does not assess language and identity domains. Yet, given that recent theoretical and methodological perspectives on acculturation suggest assessing it with domain-specific measures (e.g., an identity scale to measure mainstream and heritage identification), the VIA provides a good alternative to assess acculturation briefly and overall.

As a third positive point, the VIA proved to be internally reliable. Cronbach's alpha values were excellent for both heritage and mainstream subscales, both in Ryder and colleagues' initial article, as well as in a more recent meta-analysis of reliability estimates (Huynh, Howell, & Benet-Martínez, 2009). It should be noted, however, that a few of the items (three per subscale) are phrased in terms of "enjoyment" (e.g., I enjoy entertainment from my native culture).

Table 1*List of VIA items: Heritage and Mainstream subscales.*

Heritage Items	Mainstream Items	Abbreviation
H1: I often participate in my native cultural traditions	M1: I often participate in mainstream Italian/Canadian cultural traditions	Participation in traditions
H2: I would be willing to marry a person from my native culture	M2: I would be willing to marry a typical Italian/Canadian person	<i>Not included here</i>
H3: I enjoy social activities with people from the same native culture as myself	M3: I enjoy social activities with typical Italian people	Enjoy social activities
H4: I am comfortable working with people of the same native culture as myself	M4: I am comfortable working with typical Italian/Canadian people	Comfortable working
H5: I enjoy entertainment (e.g. movies, music) from my native culture	M5: I enjoy Italian entertainment (e.g. movies, music)	Enjoy entertainment
H6: I often behave in ways that are typical of my native culture	M6: I often behave in ways that are typically Italian/Canadian	Typical behaviour
H7: It is important for me to maintain or develop the cultural practices of my native culture	M7: It is important for me to maintain or develop Italian/Canadian cultural practices	Importance cultural practices
H8: I believe in the values of my native culture	M8: I believe in mainstream Italian/Canadian values	Belief in values
H9: I enjoy the jokes and humour of my native culture	M9: I enjoy typical Italian/Canadian jokes and sense of humour	Enjoy humour
H10: I am interested in having friends from my native culture	M10: I am interested in having typical Italian/Canadian friends	Interest in friends

This response format is reminiscent of quality of life or adaptation measures, and may contribute to inflated correlations between VIA scores and typical adjustment and sociocultural adaptation measures.

Nevertheless, because of the above advantages, the VIA has been employed in a number of studies, involving participants from different cultural groups, countries of origin, and receiving countries (e.g., Moroccans, Lebanese, Palestinians, Syrians, Koreans, Turkish, Russian-speakers; Britto & Amer, 2007; De Leersnyder, Mesquita, & Kim, 2011; Doucerain, Deschênes, Gouin, Amiot, & Ryder, 2017; Doucerain, Segalowitz et al., 2017; Gattino, Miglietta, Rizzo, & Testa, 2016; Zhang & Li, 2014; Jurcik et al., 2015). These studies have consistently showed good reliability and validity of the VIA, but two psychometric issues remain unaddressed. We now turn to these two issues: dimensionality, and measurement invariance.

Outstanding psychometric issues concerning the VIA

Dimensionality: Although numerous studies have shown that the VIA is a reliable and valid bidimensional measure, some questions remain regarding dimensionality *within* heritage and mainstream subscales. Recent theoretical perspectives on acculturation underscore that acculturation is contextual (e.g., Jurcik et al., 2014; Ward & Geeraert, 2016), and that people's cultural values, identities, and behaviors change at different rates and differently across life domains (Schwartz, Unger, Zamboanga, & Szapocznik, 2010). In line with these ideas, some recent studies (Britto & Amer, 2007; De Leersnyder et al., 2011) have used disaggregate VIA subscale scores, suggesting that each subscale could cover more

than one dimension. In their study regarding cultural identity and family context among Muslim young adults in America, Britto and Amer (2007) disaggregated both heritage and mainstream sub-scales into three summed scores each, corresponding to three supposed underlying dimensions: *Values and traditions* (four items); *Social interactions* (four items); and *Cultural interests* (two items). Exploring emotional acculturation of Korean immigrants in the US and of Turkish immigrants in Belgium, De Leersnyder et al. (2011) computed two summed scores from eight items in the mainstream subscale: *Values and customs* (4 items) and *Attitudes toward social contacts* (4 items). De Leersnyder et al. justified their choice by pointing out that according to recent research, "attitudes towards values and customs may be acquired at a different stage than attitudes towards contacts with the members of the cultural majority" (p. 453).

Nevertheless, the above statement does not necessarily imply that the VIA's heritage and mainstream subscales are each multi-dimensional. Instead, it could mean that items dealing with values and customs and those dealing with entertainment and social activities cover, respectively, more and less demanding aspects of the same underlying latent acculturation construct. In other words, culturally more and less challenging items of the VIA may still be indicators of the same latent variable (e.g., mainstream acculturation), but they may differ in the *level* of mainstream acculturation that respondents need to experience in order to agree with them. More demanding items may simply require higher levels of acculturation to be endorsed by participants. If item differences can be represented as different locations along the same latent acculturation continuum (with less demanding items on the lower end and more challenging items on

the higher end), calculating two separate scores (one for the more demanding items and one for the less demanding ones) would not be appropriate, as they imply different underlying dimensions.

Measurement invariance: In addition to reliability and validity, evidence of measurement invariance of the VIA, which to our knowledge has never been assessed before, is also necessary. Broadly speaking, an instrument shows measurement invariance when its psychometric properties are invariant across subpopulations that differ on a qualitative characteristic, such as gender, educational attainment or any other aspect pertinent to the context of its application. This condition is a prerequisite for meaningful comparisons across groups. In other words, researchers have to be confident in measurement invariance prior to conducting substantive comparisons across groups of respondents (de Ayala, 2009; Meredith, 1993). In the case of acculturation instruments such as the VIA, it is important to ascertain that items function in the same way not only with respect to basic demographic variables such as gender, education and age, but also with respect to the length of time spent in the mainstream cultural context. Comparisons of recent vs. well-established immigrants are common, and one cannot simply assume that the subjective meanings of items dealing with social and cultural habits or preferences remain the same over the course of the acculturation process. For example, enjoying mainstream entertainment might be highly discriminant for sojourners but much less distinctive for long-term residents.

The present study

The first aim of this study was to disentangle the above question about the dimensionality of the VIA (Aim 1). In particular, we hypothesized that the distinction between acculturation facets that require more or less extensive commitment and cultural change would be better captured by item differentiation in terms of difficulty (i.e., how “easy” or “hard” it is for respondents to endorse them), rather than by items belonging to different latent dimensions. A second aim was to assess the VIA’s measurement invariance across gender, age, education and length of stay categories (Aim 2). To bolster confidence in our results, we examined these issues of dimensionality vs. item difficulty and of measurement invariance in two different cultural and immigration contexts, Italy and Canada. Scale psychometric properties might vary to some extent according to the cultural context in which the instrument is administered, and including two very different immigration contexts allowed us to distinguish between culturally-specific and more generalizable results. Note that our emphasis was on generalizability and not on drawing substantive comparisons between these two contexts.

Methods

Participants and procedure

The study was based on two archival datasets involving first-generation immigrants with different ethnic backgrounds in Canada and Italy. Italy has for a long time been an “emigration country”, changing to an “immigration country” in the 1990s. Today, immigrants¹ represent 8.2% of the population (ISTAT, 2015b), around 60% of whom live in the industrialized northern-center of the country. Aside from immigrants coming from other European countries, Moroccans are the largest and most established immigrant group in Italy, counting about half a million members in 2016. Overall, the employment rate in this community is 44%, predominantly in the industry and building (39%) and commerce (20%) sectors. The average level of education is quite low compared to the Italian-born population. Whereas 60% of Italians have at least a high school education (ISTAT, 2015a), compulsory education is the highest educational level among 45% of Moroccan immigrants (Ministero del Lavoro e delle Politiche Sociali, 2016).

In contrast, immigration has been a defining feature of Canada’s history. Twenty-one percent of its population is foreign-born, with the vast majority of immigrants living in the country’s largest urban areas (Statistics Canada, 2013). In addition, Canada’s immigrant population is much more diverse than in Italy, with people coming from almost 200 countries. Immigrants also typically have high education levels: the proportion of immigrants with a graduate university degree is double than that of the Canadian-born population (Statistics Canada, 2017).

The composition of both samples to a large extent reflect these differences in immigration contexts. The Canadian sample comprised 224 people who were born outside of Canada (71 males, $M_{\text{age}} = 31.67$, $SD_{\text{age}} = 8.85$), whose official status was either permanent resident (58%) or citizen (42%), and who self-identified as Hispanic/Latino (e.g., Brazilian, Chilean, Mexican, Cuban; 34%), or Caucasian/White (e.g., Russian, German, Latvian, French, Scottish, Italian; 66%). On average, participants had lived in Canada for 7.52 years ($SD = 6.71$), and had completed 17.59 ($SD = 4.79$) years of education. They came from a variety of countries: 74 from Central or South America, 68 from the former Soviet Union, 56 from Europe, 19 from the USA, 2 from the Middle-East, 2 from Oceania, and 1 from North Africa. Participants were recruited in the Montreal urban area, located in the eastern province of Quebec.

¹The Italian law is based on *ius sanguinis* (right of blood), according to which citizenship is automatically acquired only by birth to an Italian parent. Immigrants can obtain Italian citizenship by marrying an Italian citizen or by continuously residing or working in Italy for at least 4 (for European Union citizens) or 10 (for non-EU citizens) years.

Although French is the official language of Quebec, Montreal is a highly bilingual city and immigrants often learn to adapt to both Francophone and Anglophone ethnolinguistic groups (see Yakobov, Jurcik, Solopieieva-Jurcikova, & Ryder, 2019). More details about various recruitment strategies used in obtaining this sample can be found in Jurcik et al. (2015, 2019²). In contrast, the Italian sample comprised 266 people (158 males, $M_{\text{age}} = 35.78$, $SD_{\text{age}} = 11.87$), most of whom were born in Morocco (73%). On average, they had lived in Italy for 9.78 years ($SD = 7.81$) and had completed 11.22 years of education ($SD = 5.20$). Participants were recruited in the northern part of Italy.

Measures

In both Canadian and Italian samples, only 18 items of the VIA were analyzed. They are shown in Table 1. We eliminated Item 2 of both heritage and mainstream subscales (“I would be willing to marry a person from my heritage culture/Canadian person or Italian person”) because this item may be irrelevant for many participants in community samples like ours, who were already married when they immigrated. This item reflects the fact that the VIA was originally designed for a student population.

In the Canadian sample, items were rated on a 9-point Likert-type scale, ranging from 1 = *Strongly disagree* to 9 = *Strongly agree* and Cronbach’s alphas were .89 in the heritage subscale and .83 in the mainstream subscale. Given that data were collected in the Francophone province of Quebec, participants rated each item of the VIA with respect to two mainstream cultural groups: English- Canadians and French-Canadians. For each participant, the mainstream score was the one scored highest on average for the whole set of items, and the corresponding items were used as mainstream items in all analyses, following previous research (e.g., Jurcik et al., 2015). For example, if a participant had an average overall score of 5 for English-Canadian items and 6 for French-Canadian items, then French-Canadian items were used as the mainstream items. The questionnaire was administered in English. In the Italian sample, items were scored on a 4-point Likert-type format (1 = *Completely disagree*; 4 = *Completely agree*) and Cronbach’s alphas were .83 in the heritage subscale and .87 in the mainstream subscale. We chose to reduce the number of response categories in light of previous findings suggesting that nine response categories could be too many when Arab respondents are involved (Amer, 2002; Britto & Amer, 2007). The questionnaire was administered in Italian, after confirming that participants were comfortable in that language. The scale was translated by the Italian research team and then back-translated by a professional to protect equivalence in meaning as much as possible.

Analytical approach

Dimensionality assessment (Aim 1): We used exploratory factor analysis to examine the dimensionality of the Vancouver Index of Acculturation (VIA). Specifically, we used a minimum residual extraction method, with promax rotation. In the Italian sample, due to having only four ordered response options, we conducted factor analyses on matrices of polychoric inter-item correlations. The R package “psych” was used for all factor analyses (Revelle, 2017). We combined several indicators to determine the number of factors to retain: namely, the Very Simple Structure (VSS) criterion (Revelle & Rocklin, 1979); Velicer’s Minimum Average Partial criterion (MAP; Velicer, 1976); and parallel analysis with 5000 iterations (Horn, 1965).

To compute the VSS criterion, a simplified version of the original factor matrix composed of just the greatest (in absolute value) loading for each variable was generated. The VSS criterion compares the fit of this simplified model to the original correlations, and tends to peak at the optimal number of factors. The Velicer MAP is based on a series of average partial correlations among the variables after successively partialing out the effect of the factors. The step yielding the lowest average squared partial correlation corresponds to the optimal number of factors. Parallel analysis compares the observed eigenvalues extracted from the data with eigenvalues obtained from factor analyzing simulated, randomly generated data. The smallest observed eigenvalues larger than that obtained from random data (95th percentile) corresponds to the optimal number of factors. Simulation studies have shown that compared to parallel analysis of principal components, parallel analysis of principal factors tends to lead to the retention of too many factors (Buja & Eyuboglu, 1992); accordingly, more weight was given here to results from parallel analysis of principal components (Crawford et al., 2010). In addition, we inspected the scree plot of factor eigenvalues and the pattern of loadings to assess inter-pretability of factors and simplicity of the factor structure.

In the first step, we verified the bidimensional nature of the VIA (mainstream and heritage subscales) by including all 18 items in the analysis. In a second step, we probed the factor structure of each subscale by analyzing heritage and mainstream items separately.

Item difficulty (Aim 1): In order to assess item difficulty, we used the Rasch measurement approach. Specifically, we

² A subset of the current Canadian sample ($n=99$) was also analyzed in Jurcik et al. (2019) although the focus of this latter study was different: relations between acculturation, mental health and ethnic density in Montreal were explored in migrants with trauma, as opposed to a detailed dimensional evaluation of the VIA in different settings. Furthermore, participants from the Former Soviet Union would likely have been included in Jurcik et al. (2015), but this latter study also had a focus on ethnic density, acculturation and adjustment, similar to Jurcik et al. (2019).

applied the Partial Credit Model (Wright & Masters, 1982), a unidimensional model for ordered categories. In the Partial Credit Model, the probability of a given item response (e.g. a score of 6 on the item M4) is a function of the person location (person ability, or position on the latent continuum; e.g., where she stands on the mainstream acculturation dimension) and the relative difficulty of choosing that response category (threshold parameter; e.g., how much mainstream acculturation is necessary to move from score 5–6 on item M4). Item difficulty is the location of the item on the latent continuum and it is defined as the average of its category thresholds. Person and item locations are expressed in a logit (log odds units) scale, where a score of zero represents the average difficulty of the items.

We used the following statistics to evaluate model fit: person Reliability Index (RI), with $RI > .70$ indicating adequate reliability (Boone, Staver, & Yale, 2014) and the Infit and Outfit statistics, with values in the range 0.7–1.3 considered acceptable (Wright & Linacre, 1994). RI is defined as the ratio between the estimated “true variance” (i.e., the variance of the person locations on the latent continuum minus the error variance) and the total variance (i.e., the sum of true and error variance). The Infit and Outfit statistics are based on weighted (Infit) and unweighted (Outfit) squared standardized residual between observed and model-expected responses. Prior to the assessment of item performance, we investigated whether the model’s assumptions (unidimensionality and local independence) were met and whether response categories were functioning adequately. Dimensionality was checked by performing a Principal Component Analysis (PCA) of model residuals and the correlations between residuals were used to check local independence. The expectation was that the variance of the first component of the PCA on model residuals would be < 2.0 and that residual correlations would be $< .40$ (Linacre, 2009). The functioning of response categories was checked by the inspection of the threshold estimates; i.e., the estimates of the location, on the logit scale, of the point of transition from one category to the next. When ordered item categories perform well, the transition locations would be ordered; in the case of disordered thresholds, two or more adjacent categories would need to be collapsed.

Measurement invariance using differential item functioning approach (Aim 2): Differential item functioning (DIF) was examined with reference to gender, percentage of years residing in Italy/Canada (under and above the median value), years of education (under and above the median value), and age (under and above the median value). A DIF was considered present when the contrast (i.e., the difference between the difficulty parameters estimated in the two groups) was in absolute value greater than .64 and statistically significant ($p < 0.05$) (Boone et al., 2014). Partial Credit Models and DIF analyses were performed by Winsteps software

(Linacre, 2009).

Results

Dimensionality of the VIA (Aim 1)

Bidimensionality of the VIA: Preliminary tests showed that the data were suitable for factor analysis. In both samples, items correlated well with one another and none of the correlations were exceedingly large, as evidenced by KMO indices greater than .80 (KMO = 0.85 in both samples), statistically significant Bartlett’s tests (Canadian sample: $\chi^2 = 1873.07$, $df = 153$, $p < 0.0001$; Italian sample: $\chi^2 = 2015.13$, $df = 153$, $p < 0.0001$), and determinants greater than 0.00001 (Canadian sample: 0.0002; Italian sample: 0.0004). We expected that an exploratory factor analysis of all VIA items would yield a two-factor structure with these two factors clearly discriminating between heritage and mainstream items.

Italian sample: The Velicer MAP achieved its minimum value (0.04) and the VSS criterion (complexity 1) its maximum value (0.74) with two factors. Similarly, parallel analysis suggested the existence of two components (and four factors—but see: Buja & Eyuboglu, 1992; Crawford et al., 2010). A scree plot of factor eigenvalues also showed a clear inflexion point with only two eigenvalues above. Inspection of the pattern matrix for a 2-factor solution (see Table 2) revealed that heritage vs. mainstream items clearly loaded on separate factors. With item H8 as the only exception (*Belief in values*; see Table 2), items had loadings above 0.40 on their respective factors. In addition, differences between highest and lowest loadings were greater than 0.40 for all items except for items 1 and 8 of the heritage subscale, indicating that cross-loading was not an issue overall.

To follow up on the results of the parallel analysis, we also examined the pattern matrix of 3-factor and 4-factor solutions (Table 2). In both cases, most items still loaded on the first two factors. The other factors showed issues of cross-loadings and, in the case of the 4-factor solution, only one item loaded strongly on the fourth factor. In addition, a Heywood case was detected in the 3-factor solution (H4 *Comfortable working*). In short, these pattern matrices suggested noise around a 2-factor solution rather than substantially interpretable three- or four-factor solutions.

Canadian sample: The Velicer MAP achieved its minimum value (0.02) with three factors and the VSS criterion (complexity 1) its maximum value (0.76) with one factor. As in the Italian sample, parallel analysis suggested the existence of two components (or three factors), and a scree plot of factor eigenvalues showed a clear inflexion point right below two factors. Given these divergent results, we inspected the pattern matrix for 2, 3, and 4-factor solutions in order to judge the interpretability of these different solutions (see Table 2). The 2-factor solution showed heritage and main-

Table 2*Factor Analysis of all VIA items.*

Items	Italian Sample								Canadian Sample									
	2 factors		3 factors			4 factors			F4	2 factors		3 factors			4 factors			
	F1	F2	F1	F2	F3	F1	F2	F3		F1	F2	F1	F2	F3	F1	F2	F3	F4
H1	-0.34	0.43	0.45	-0.37		0.44	-0.47			0.47	0.38	0.39	0.56	0.23				
H3		0.93	0.94			0.92				0.81	0.78		0.78			0.29		
H4		0.88	1.00		0.46	0.97		0.42	-0.26	0.68	0.70		0.59		0.38			
H5		0.82	0.80			0.83			0.22	0.77	0.73		0.65					
H6		0.68	0.69			0.69	-0.26			0.61	0.54		0.28	0.57				
H7		0.57	0.54			0.56				0.75	0.63		0.60	0.76	-0.20	-0.23		
H8	-0.26	0.26			-0.45	0.22		-0.44		0.63	0.51		0.50	0.55	0.20			0.32
H9		0.71	0.68			0.70				0.58	0.53		0.27	0.20		0.67		
H10		0.72	0.65	0.20	-0.32	0.68	0.26	-0.31		0.86	0.80		0.73		0.20			
M1	0.55	-0.25	-0.28	0.58		-0.26	0.51		0.20		0.54	0.44	0.23		0.5			
M3	0.90	0.20	0.20	0.87	0.28		0.76	0.30			0.84	0.85		0.5	0.60			
M4	0.83	0.22	0.34	0.76	0.70	0.29	0.60	0.73			0.61	0.21	0.70	-0.22		0.62		
M5	0.73			0.75			0.43		0.68		0.56	0.58			0.21	0.46		
M6	0.63		-0.20	0.62		-0.20	0.50		0.26		0.57	0.49			0.45			
M7	0.70			0.67			0.77				0.61	0.47	0.42		0.81			-0.23
M8	0.65			0.63			0.74				0.71	0.63	0.27		0.61			
M9	0.58			0.59			0.50			0.25	0.38	0.27	0.38				0.23	0.63
M10	0.87	0.44	0.40	0.85		0.41	0.82			0.24	0.55	0.25	0.58		0.32	0.45		

Note. Values represent factor loadings.

stream items clearly loading on separate factors. With one exception (M9 *Enjoy humour*), items loaded on their respective factors with loadings above 0.40. In addition, differences between highest and lowest loadings were greater than 0.30 for all items except item 9 of the mainstream subscale, indicating that cross-loading issues were minimal. The 3-factor solution essentially replicated the 2-factor solution, with the third factor being represented by only four items that cross-loaded on factors 1 and 2.

Cross-loading was also observed in the 4-factor solution. If we disregard this issue, mainstream items in this solution are split into two factors: items 1, 6, 7, and 8 loading on factor 2, and items 3, 4, 5, and 10 loading most highly on factor 3. The latter set (M3 *Enjoy social activities*, M4 *Comfortable working*, M5 *Enjoy entertainment*, M10 *Interest in friends*) seems to reflect acculturation facets that require less extensive commitment and cultural change than the former set of items (M1 *Participation in traditions*, M6 *Typical behaviours*, M7 *Importance of cultural practices*, and M8 *Belief in values*). Supporting this notion, the mean of factor 3 items ("easy/superficial" acculturation facets, $M = 7.58$, $SD = 1.11$) is statistically significantly higher than the mean of factor 2 items ("difficult/core" acculturation facets, $M = 6.13$, $SD = 1.35$), $t(430.37) = 12.37$, $p < 0.001$, $95\%CI = [1.22; 1.68]$. Notably, however, none of the criteria we used (parallel analysis, Velicer's MAP, and scree plot) suggested a four-factor solution.

The properties of the mainstream subscale will be explored in more detail in the next sections. In the meantime, supporting our hypothesis, the results suggest that heritage and mainstream items clearly load on two different factors and therefore support the use of two subscales, in both the Italian and Canadian samples. In addition, overall, the results did not support more than two factors in each sample, as would be the case if mainstream and heritage orientations were themselves multidimensional.

Dimensionality of heritage and mainstream subscales: A scale factor structure can be confounded by method effects associated with systematic variations in item wording (Schriesheim & Eisenbach, 1995). In the case of the VIA, mirror item stems are evaluated with respect to two different cultural groups, a wording characteristic that may have influenced the factor structure identified in the above section. In order to make sure that method effects did not obscure finer differentiations in factor structure, we conducted separate factor analyses of mainstream and heritage VIA items with the expectation that each set would yield a one-factor solution.

Heritage items: In the Italian sample, the Velicer MAP achieved its minimum value (0.06) and the VSS criterion (complexity 1) its maximum value (0.86) with one factor. Parallel analysis suggested the existence of one component (and three factors) and a scree plot of factor eigenvalues showed a clear inflexion point right below one factor. In-

spection of the pattern matrix for a 1-factor solution (see Table 3) revealed that with the exception of one item (H8 *Belief in values*), all factor loadings were above 0.50. In addition, two Heywood cases were detected in the 2-factor solution, suggesting over-extraction of factors.

In the Canadian sample, the Velicer MAP achieved its minimum value (0.03) and the VSS criterion (complexity 1) its maximum value (0.89) with one factor, as in the Italian sample. Parallel analysis suggested the existence of one component (and two factors), in line with a scree plot of factor eigenvalues. As seen in Table 3, loadings for the 1-factor solution were all well above 0.40 and the majority were above 0.60. As in the Italian sample, two Heywood cases were detected in the 2-factor solution. To summarize, collectively the results support the unidimensionality of the heritage subscale of the VIA in both samples, and therefore also across response formats (4 vs. 9 response categories).

Mainstream items: In the Italian sample, the Velicer MAP achieved its minimum value (0.05) and the VSS criterion (complexity 1) its maximum value (0.9) with one factor. Parallel analysis suggested the existence of one component (and three factors), as did a scree plot of the factors eigenvalues. As shown in Table 3, factor loadings for a one-factor solution were all above 0.60. We also examined the pattern matrix of a 2-factor solution, but two Heywood cases were detected, which suggests over-extraction of factors. Together, these findings strongly support the unidimensionality of the mainstream subscale in the Italian sample.

In the Canadian sample, the Velicer MAP achieved its minimum value (0.03) and the VSS criterion (complexity 1) its maximum value (0.79) with one factor. Parallel analysis suggested the existence of one component (and three factors), as did a scree plot of factor eigenvalues. As shown in Table 3, factor loadings for a one-factor solution were all above 0.40. As a follow-up analysis, we also examined the pattern matrix of a 2-factor solution. This solution reproduced the distinction between “easy/superficial” vs. “difficult/ core” aspects of acculturation identified earlier and showed appropriate loadings (for each item, highest loadings were at least 0.40, with no cross-loading). However, it is important to note that none of the criteria we used (parallel analysis, Velicer’s MAP, and screeplot) suggested a 2-factor solution.

In summary, supporting our hypothesis, there is strong evidence for unidimensionality of the mainstream subscale in the Italian and Canadian samples. Nevertheless, in the Canadian sample, the pattern of loadings for a 2-factor solution is consistent with a distinction between “easy/superficial” vs. “difficult/core” aspects of acculturation. We now turn to Rasch analysis to explore further these issues of item difficulty.

Item difficulty under the partial credit model (aim 1)

Preliminary analyses: check of assumptions and of disordered thresholds: As is customary when using a Rasch measurement approach, the dimensionality of the VIA was further checked by performing a Principal Component Analysis (PCA) on the residuals of the Partial Credit Model. When analyzing all 18 items together, the eigenvalue of the first PCA component was > 2 in both Italian and Canadian samples, and some correlations among residuals were > 0.40 in the Italian sample, signaling that more than one dimension was necessary to account for the responses on the 18 items. The inspection of the first component loadings revealed that items of the Heritage subscale were clearly separated from those of the Mainstream subscale – consistent with the results of exploratory factor analyses conducted in the previous section. Thus, we proceeded analyzing the PCA on model residuals, separately for the two subscales, finding that for both the Italian and Canadian Heritage and Mainstream subscales, the dimensionality diagnostic was good and none of the residual correlations were > 0.40 .

With respect to the functioning of the response categories, the heritage item dealing with *cultural practices* (H7) showed disordered thresholds in the Italian sample, where items were scored on a four-point scale. In contrast, all items showed disordered thresholds in the Canadian sample, where items were scored on a 9-point scale. Reducing the number of categories to 5 by aggregating adjacent categories (i.e., 1–2, 3–4, 5, 6–7, 8–9), only two items had disordered thresholds: the *Enjoy entertainment* item in the heritage subscale (H5) and the *Comfortable working* item in the mainstream subscale (H4). Since items with disordered thresholds were few and they were not the same in both samples, we did not perform any further aggregation; therefore, the next analyses were conducted on 4-point (Italian sample) and 5-point scale items (Canadian sample).

Item fit and difficulty estimates

According to the Partial Credit Model, score reliability was good in the Canadian sample (heritage subscale: 0.79, mainstream subscale: 0.74) and for the Italian mainstream subscale (0.81). A less satisfactory value was obtained for the Italian heritage subscale (0.63). Some item misfit was observed using INFIT and OUTFIT statistics (see Table 4). Item H1 (*Participation in traditions*) showed some misfit in both samples. Other item misfits were country specific: H8 (*Belief in values*) did not fit in the Italian sample, whereas items M9 (*Enjoy humour*), H10 and M10 (*Interest in friends*) showed some misfit in the Canadian sample. The range of item difficulty was appreciable (about 2 logits) in three of the four subscales: Italian Mainstream (-1.3; 1.02), Canadian Mainstream (-0.94; 0.97) and Canadian Heritage (-0.75; 1.12); while, for the Italian Heritage subscale, the difference

Table 3*Factor analysis of VIA items within subscales.*

Items	Heritage items						Mainstream items					
	Italian sample			Canadian sample			Italian sample			Canadian sample		
	1 factor	2 factors		1 factor	2 factors		1 factor	2 factors		1 factor	2 factors	
	F1	F1	F2	F1	F1	F2	F1	F1	F2	F1	F1	F2
1	0.53	0.39	0.20	0.49		0.49	0.63		0.62	0.45		0.40
3	0.85	0.96		0.77	0.92		0.84	1.04		0.76	0.54	0.26
4	0.82	1.08	-0.30	0.69	0.88		0.77	0.78		0.70	0.92	
5	0.78	0.74		0.69	0.57		0.76	0.30	0.52	0.65	0.70	
6	0.72	0.59		0.64	0.30	0.38	0.70	-0.22	1.02	0.48		0.44
7	0.62		0.65	0.76	-0.20	1.12	0.68	0.49	0.20	0.53	-0.25	0.94
8	0.37	-0.40	1.04	0.70	0.21	0.53	0.66	0.42	0.25	0.67		0.61
9	0.69	0.58		0.60	0.49		0.62		0.71	0.52	0.61	
10	0.67	0.43	0.32	0.81	0.84		0.70	0.77		0.68	0.56	

Note. Values represent factor loadings.

between the hardest and the easiest items was only about half a logit (-0.29; 0.36).

Arranging the items according to the three conceptual categories of “Traditions and values”, “Social contacts” and “Cultural interest” allowed us to better understand whether difficulty patterns were present (see Table 5). As expected, items dealing with traditions and values were more difficult on average. In fact, in all four subscales the mean difficulty was above the general mean value. On the other hand, items concerning social contacts were easiest in all four subscales on average. This was especially true for the mainstream subscales, where the differences between mean difficulty of *social contact* items vs. *traditions and values* items were more than half a logit (0.80 in the Italian sample and 1.24 in the Canadian sample).

Beside the commonalities highlighted above, some differences between Italian and Canadian difficulty rankings are noticeable. Considering the heritage subscale, the easier items assessed entertainment (H5) and social activities (H3) in the Italian sample, vs. jokes and humour (H9) in the Canadian sample. The hardest item was also different: maintaining/developing cultural practices (H7) where immigrants to Italy were involved, and participation in traditions (H1) in the case of immigrants to Canada. In terms of the mainstream subscale, the easiest and hardest items were having friends (M10) and participation in traditions (M1) respectively in the Italian sample, while they were comfortable working (M4) and behaving in a typical way (M6) in the Canadian sample. Moreover, in the Italian sample, the mainstream item dealing with values (M8) was less difficult than expected, since it showed a negative sign (considering the value plus and minus 2SE, i.e., $-0.27 \pm 2*0.08$). This indicates that this item

was easier than the average difficulty of Italian mainstream items, contrary to expectations.

Measurement invariance using differential item functioning (DIF; aim 2): The sample was categorized into groups using a median split for continuous variables (high and low education, younger and older, high and low percentage of lifetime spent in the receiving country, and by sex). For each variable, we checked that item location did not differ across groups. For sex, age and education, results showed an absence of problematic DIF, both for the mainstream and heritage subscales, and both in the Italian and Canadian samples. None of the contrasts, or the difference between the difficulty estimates in the two groups (males vs. females; higher vs. lower education; younger vs. older), were jointly statistically significant and in absolute value greater than 0.64.

On the other hand, for the percentage of life spent in the receiving country, items H8, H10, and M10 showed notable DIF between recent and long-term immigrants in Italy, whereas DIF was negligible in the Canadian sample. Specifically, recent immigrants in Italy found both items H10 and M10 more difficult. Namely, immigrants with the same level of acculturation found these items harder to endorse if their stay in Italy was shorter. In other words, recent immigrants in Italy needed to report a higher level of acculturation than more long-term immigrants to endorse these items. It was also more difficult for more recent immigrants in Italy to endorse the item dealing with the maintenance of heritage values (H8).

Discussion

In this study, we evaluated psychometric properties of the Vancouver Index of Acculturation in order to determine

Table 4*Partial Credit Model of VIA items.*

Items	Heritage items								Mainstream items							
	Italian sample				Canadian sample				Italian sample				Canadian sample			
	Difficulty estimates	SE	Infit	Outfit	Difficulty estimates	SE	Infit	Outfit	Difficulty estimates	SE	Infit	Outfit	Difficulty estimates	SE	Infit	Outfit
1	0.12	0.09	1.23	1.32	1.12	0.08	1.56	1.59	1.02	0.09	1.05	1.15	0.75	0.09	1.28	1.34
3	-0.26	0.09	0.77	0.81	-0.01	0.09	0.84	0.78	-0.07	0.08	0.80	0.72	-0.54	0.11	0.71	0.70
4	-0.11	0.09	0.86	0.88	-0.11	0.09	0.96	1.02	-0.26	0.08	0.95	0.92	-0.94	0.12	0.90	0.78
5	-0.29	0.09	0.89	0.84	-0.33	0.09	0.97	1.03	0.07	0.08	0.91	0.93	-0.44	0.11	0.84	0.76
6	0.09	0.09	0.89	0.85	0.16	0.09	1.17	1.22	0.35	0.08	0.95	1.00	0.97	0.09	1.21	1.22
7	0.36	0.08	0.98	1.00	0.33	0.08	0.83	0.75	-0.07	0.08	1.10	1.04	0.57	0.09	1.13	1.17
8	0.08	0.09	1.40	1.38	-0.16	0.09	0.9	0.99	-0.27	0.08	1.06	1.05	0.13	0.09	0.88	0.86
9	0.11	0.08	1.02	1.06	-0.75	0.10	1.07	1.06	0.52	0.08	1.16	1.11	-0.07	0.09	1.18	1.41
10	-0.11	0.09	0.99	0.98	-0.24	0.09	0.69	0.73	-1.30	0.10	1.09	1.01	-0.42	0.11	0.86	0.68

Table 5*Partial Credit difficulty estimates grouped by content area.*

Item	Heritage items		Mainstream items	
	Italian sample	Canadian sample	Italian sample	Canadian sample
<i>Traditions and values</i>				
1	0.12	1.12	1.02	0.75
6	0.09	0.16	0.35	0.97
7	0.36	0.33	-0.07	0.57
8	0.08	-0.16	-0.27	0.13
Mean	0.16	0.36	0.26	0.61
<i>Social contacts</i>				
3	-0.26	-0.01	-0.07	-0.54
4	-0.11	-0.11	-0.26	-0.94
10	-0.11	-0.24	-1.30	-0.42
Mean	-0.16	-0.12	-0.54	-0.63
<i>Cultural interest</i>				
5	-0.29	-0.33	0.07	-0.44
9	0.11	-0.75	0.52	-0.07
Mean	-0.09	-0.54	0.30	-0.26

whether (a) this instrument measures more than the two expected dimensions, as some previous research seemed to suggest (Britto & Amer, 2007; De Leersnyder et al., 2011), or (b) the conceptual distinction between more demanding and less demanding aspects of acculturation stressed by these authors was captured by a difference in item difficulty. To disentangle these two possibilities, exploratory factor analyses and Partial Credit Models were applied to datasets collected from two different cultural contexts: Canada and Italy.

For the factor analytic approach, most of the criteria supported the theoretical bidimensional structure of the VIA. The Very Simple Structure (VSS) criterion and the Velicer's Minimum Average Partial (MAP) criterion gave the expected dimensionality 5 times out of 6; moreover, in the only situation they failed to confirm our expectation (analyzing all 18 items together in the Canadian sample), the results were

not consistent: MAP suggested three dimensions whereas VSS indicated only one. Parallel analysis of principal components consistently supported the expected dimensionality in all cases. Parallel analysis indicated more dimensions when based on principal axis factoring, but past research has shown that this approach tends to over-extract factors (Buja & Eyuboglu, 1992) and that the principal component parallel results should be trusted more, especially when there are few orthogonal or weakly related factors with a large number of variables per factor, as in the present situation (Crawford et al., 2010).

Thus, in both samples the bidimensionality of the VIA was supported, and this conclusion is reinforced by the findings of the residuals analysis under the Partial Credit Model. Item fit to the Partial Credit Model was reasonably good; only the item dealing with the participation to mainstream

and heritage traditions showed some misfit in both samples. The other few items demonstrating misfit were country specific.

As expected, and consistent with Britto and Amer (2007), items dealing with tradition and values were on average more difficult than items assessing social contacts or cultural interests. This pattern was particularly evident in the mainstream subscales and in the Canadian sample. Despite this general agreement, the location of specific items on the acculturation latent continua were quite generally sample- and subscale-specific. In other words, the ranking of item difficulty was not the same in the four conditions (heritage and mainstream subscales in each of the two sample). This could imply that the ease or difficulty migrants have toward the various cultural domains assessed by the VIA is the result of interactions between the specific cultural context they came from and the specific cultural context they join.

The spread of item difficulty also seemed to be context dependent. For example, in the Italian sample the heritage subscale showed relatively little spread in item difficulty. This result could be related to the fact that the participants were a homogeneous North African group living in a Catholic country that has been experiencing sustained immigration only for the last three decades. The sample homogeneity is also likely to underlie the low Winstep reliability index (of the two components of this reliability index, error variance was comparable to those of the other subscales, whereas persons' locations variability was lower). In contrast, the Canadian sample was much more diverse, and participants from different cultural origins may find different domains of acculturation easier/difficult to negotiate.

This specific finding raises some considerations about the relationships among the different life domains involved in acculturation and their complexity, such that some domains are more easily acquired than others, reflecting differences in difficulty in obtaining knowledge, as well as changing attitudes, intentions, and behaviors. On the other hand, the item difficulty differences found in our study may also in part reflect the measurement approach used, which includes items worded in an enjoyment/satisfaction format referring to both less demanding cognitive appraisals along with other items referring to more demanding behavioral participation. Nevertheless, any discussion of the implications of the interrelation between acculturative demands and domains is well beyond the scope of the current study, which was primarily focused on evaluating the dimensionality of the VIA.

With respect to the second aim – the evaluation of VIA measurement invariance – an important result was the absence of differential item functioning (DIF) for gender, age and education in both subscales and both samples. Few items showed DIF related to length of stay in the new country, and only in the Italian sample. Overall, these findings indicate that VIA scores can be compared across groups.

In conclusion, our results support the bidimensionality of the instrument. The VIA covers numerous domains relevant to acculturation; however, these domains do not seem to be differentiated in terms of separate underlying dimensions. Rather, core aspects of cultural involvement assessed by this scale seem to be organized in terms of difficulty, with some tasks possibly being more demanding than others. These results are consistent with researchers who underlined differences between items dealing with traditions and values and items concerning social interactions and cultural interests. These sets of items were indeed not equivalent in terms of difficulty. However, they still assessed the same latent variable (i.e., mainstream or heritage acculturation). In other words, the acculturation tasks reflected in these items “hung together” in participants' perception, rather than forming qualitatively different categories of acculturative experiences. Thus, these results challenge traditional conceptualizations of acculturation, which usually make the implicit assumption that different dimensions, or qualitatively different conceptual categories, underlie acculturation's different domains. The possibility that content differences are reflected in difficulty (or intercept) differences instead of different latent variables could apply also to other instruments, and the Rasch approach combined with tools to ascertain dimensionality could be a fruitful approach in other research areas that extend beyond the study of acculturation (see for an example Gattino, Miglietta, & Testa, 2008).

Some strengths and limitations of the study are noteworthy. The convergence of our main results across response format and across samples with very different characteristics (different mainstream cultures, homogeneous vs heterogeneous immigrant groups) is a major strength of the study. The main limitation is that our sample sizes did not allow us to assess item difficulty using a model where discrimination parameters were also estimated. The presence of (few) poorly functioning items could be due to the violation of the discrimination uniformity assumption (as can be seen from the factor loadings). Unfortunately, a sample size of at least 500 participants is necessary to estimate a model in which discrimination parameters are estimated (i.e., a generalized Partial Credit Model). Moreover, a larger sample would have allowed for the estimation of the model on the Canadian 9-point response scale.

How many response categories to use is another important issue; response scales with many categories result in a more precise measurement only if each category is functioning properly (2010, Andrich, 1995; Giampaglia, 2004). In this study, we reduced the Canadian 9-point scale to a 5-point scale in order to have ordered category parameters (i.e., thresholds) and a 4-point scale was employed in the data collection of the Italian Moroccan sample. This difference did not have any implications for our results because the samples were analyzed separately; however, it raises some interesting

questions about the items' scale format that deserve further investigation, also in the light of previous findings suggesting that nine response categories could be too many when Arab respondents are involved (Amer, 2002; Britto & Amer, 2007).

As mentioned earlier, the relatively few domains investigated by the scale can be concurrently considered a strength and a weakness of the instrument. On the one hand, a short set of items prevents the questionnaire from being burdensome to respondents; on the other hand, few items inevitably lead to general rather than detailed coverage of acculturation experiences. In future research, it would be important to investigate how the current discussion of dimension vs. task difficulty applies to other acculturative domains not covered by the VIA, such as language and identity. For example, whether including a new cultural group into one's self concept differs from other acculturation tasks in difficulty only or whether it should be conceived as another dimension altogether is an open question.

Further studies are needed to investigate item invariance across countries with similar groups of immigrants, in order to evaluate the comparability among acculturation scores attained in different cultural contexts. This approach could help overcome a limitation that this study shares with many others in the acculturation literature; namely, inattention to the socio-ecological contexts of acculturation (for some exceptions, see Birman, Trickett, & Buchanan, 2005; Doucerain, Dere, & Ryder, 2013; Doucerain, 2019; Jurcik, Ahmed, Yakobov, Solopieieva-Jurcikova, & Ryder, 2013, Jurcik et al., 2014, 2015, 2019) and may contribute in explaining some of the inconsistencies found in the current study between samples and settings. For instance, varying neighbourhood contexts and interrelations between people within such settings may contribute to some acculturation experiences becoming differentially more challenging or easier than others. More specifically, variations in access to, and attitudes towards, mainstream and heritage cultural practices could partly depend on neighbourhood immigrant density. Similarly, the extent to which items pertaining to social participation are related to those pertaining to enjoyment or preferences may depend on the sociocultural context where acculturation is taking place. For example, in places where immigrants are highly discriminated against, they might have few opportunities to "participate" and their participation may therefore be unrelated to their preferences or to what they enjoy. Finally, since the VIA has generally been studied in community and student contexts, there may also be a benefit to exploring the factor structure and clinical utility of the VIA in increasingly culturally diverse patient populations (Jurcik et al., 2019). Unfortunately, research to date in this area has been sparse.

Conclusion

Over the last several decades, acculturation research has become a prolific field of inquiry and researchers are increasingly using tools that go beyond self-report instruments, including, for example, biomarkers, daily diaries, and social networks (Douceirain, Deschênes et al., 2017). These are promising and even necessary developments, but they do not abolish the need for good bidimensional self-report measures of acculturation. Most acculturation researchers still rely on such instruments, and those for whom acculturation is only a peripheral interest (e.g., in the health domain) still need a "quick and dirty" yet accurate way to assess acculturation. A similar case can be made for practitioners who operate under time pressure with culturally diverse clients but need assessment tools that enhance prevention and treatment planning (see Jurcik et al., 2014). Both cases underscore the need for psychometrically sound bidimensional acculturation scales—which, unfortunately, many are not (Kang, 2006). Such measures are essential to serve the overall goal of better understanding and promoting immigrants' acculturation and adaptation, and prominent for intergroup relations.

The VIA is a popular acculturation instrument that has shown good reliability and validity in the past. However, some psychometric issues were still outstanding in terms of dimensionality and measurement invariance. The current work targeted these issues in order to ascertain that the VIA deserves its place in the acculturation researcher's toolkit. Our results suggest that it does.

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References

- Amer, M. M. (2002). Evaluation of measures of acculturation and mental health for second generation and early immigrant Arab Americans Unpublished master's thesis. Ohio: The University of Toledo.
- Andrich, D. (1995). Models for measurement, precision, and the non dichotomization of graded responses. *Psychometrika*, 60, 7–26.
- Andrich, D. (2010). Understanding the response structure and process in the polytomous Rasch model. In M. Nering, & R. Ostini (Eds.). *Handbook of polytomous item response theory models*. United Kingdom: Routledge.

- Berry, J. W. (1997). Immigration, acculturation, and adaptation. *Applied Psychology: An International Review*, 46, 5–68. <https://doi.org/10.1111/j.1464-0597.1997.tb01087.x>.
- Berry, J. W., Phinney, J. S., Sam, D. L., & Vedder, P. E. (2006). *Immigrant youth in cultural transition: Acculturation, identity, and adaptation across national contexts*. Lawrence Erlbaum Associates Publishers.
- Birman, D., Trickett, E. J., & Buchanan, R. M. (2005). A tale of two cities: Replication of a study on the acculturation and adaptation of immigrant adolescents from the Former Soviet Union in a different community context. *American Journal of Community Psychology*, 35, 83–101. <https://doi.org/10.1007/s10464-005-1891-y>.
- Boone, W. J., Staver, J. R., & Yale, M. S. (2014). *Rasch analysis in the human sciences*. New York, London: Springer Dordrecht Heidelberg <https://doi.org/10.1007/978-94-007-6857-4>.
- Britto, P. R., & Amer, M. M. (2007). An exploration of cultural identity patterns and the family context among Arab Muslim young adults in America. *Applied Development Science*, 11, 137–150. <https://doi.org/10.1080/10888690701454633>.
- Buja, A., & Eyuboglu, N. (1992). Remarks on parallel analysis. *Multivariate Behavioral Research*, 27, 509–540. https://doi.org/10.1207/s15327906mbr2704_2.
- Celenk, O., & van de Vijver, F. J. R. (2014). Assessment of acculturation and multiculturalism: An overview of measures in the public domain. In V. Benet-Martinez, & Y.-Y. Hong (Eds.). *Oxford handbook of multicultural identity: Basic and applied psychological perspectives* Oxford: Oxford University Press pp. 205.
- Celenk, O., & van de Vijver, F. J. (2011). Assessment of acculturation: Issues and overview of measures. *Online Readings in Psychology and Culture*, 8(1), 10.
- Crawford, A. V., Green, S. B., Levy, R., Lo, W. J., Scott, L., Svetina, D., et al. (2010). Evaluation of parallel analysis methods for determining the number of factors. *Educational and Psychological Measurement*, 70, 885–901. <https://doi.org/10.1177/0013164410379332>.
- de Ayala, R. J. (2009). *The theory and practice of item response theory*. New York: Guilford Press.
- De Leersnyder, J., Mesquita, B., & Kim, H. S. (2011). Where do my emotions belong? A study of immigrants' emotional acculturation. *Personality & Social Psychology Bulletin*, 37, 451–456. <https://doi.org/10.1177/0146167211399103>.
- Doucerain, M. M., Dere, J., & Ryder, A. G. (2013). Travels in hyper-diversity: Multiculturalism and the contextual assessment of acculturation. *International Journal of Intercultural Relations*, 37, 686–699. <https://doi.org/10.1016/j.ijintrel.2013.09.007>.
- Doucerain, M. M., Deschênes, S. S., Gouin, J., Amiot, C. E., & Ryder, A. G. (2017). Initial Mainstream cultural orientations predict early social participation in the mainstream cultural group. *Personality & Social Psychology Bulletin*, 43, 245–258. <https://doi.org/10.1177/0146167216679642>.
- Doucerain, M. M., Segalowitz, N., & Ryder, A. G. (2017). Acculturation measurement: From simple proxies to sophisticated toolkit. In S. J. Schwartz, & J. Unger (Eds.). *The Oxford handbook of acculturation and health*. New York, NY: Oxford University Press.
- Flannery, W. P., Reise, S. P., & Yu, J. (2001). An empirical comparison of acculturation models. *Personality & Social Psychology Bulletin*, 27, 1035–1045. <https://doi.org/10.1177/0146167201278010>
- Gattino, S., Miglietta, A., & Testa, S. (2008). Dimensionality in Pettigrew and Meertens' blatant subtle prejudice scale. *TPM – Testing, Psychometrics, Methodology in Applied Psychology*, 15, 135–151.
- Gattino, S., Miglietta, A., Rizzo, M., & Testa, S. (2016). Muslim acculturation in a Catholic country: Its associations with religious identity, beliefs, and practices. *Journal of Cross-Cultural Psychology*, 47, 1194–1200. <https://doi.org/10.1177/0022022116661244>.
- Giampaglia, G. (2004). Quante e quali categorie di risposta? Il contributo del modello di Rasch alla costruzione di un buon questionario [How many and what categories of response? The contribution of the Rasch model to construction a good questionnaire]. *Polena*, 3, 45–78.
- Gim Chung, R. H., Kim, B. S., & Abreu, J. M. (2004). Asian American multidimensional acculturation scale: Development, factor analysis, reliability, and validity. *Cultural Diversity & Ethnic Minority Psychology*, 10, 66–80. <https://doi.org/10.1037/1099-9809.10.1.66>.
- Gordon, M. M. (1964). *Assimilation in American life: The role of race, religion, and national origins*. Oxford University Press on Demand New York: Oxford University Press.
- Horn, J. L. (1965). A rationale and test for the number of factors in factor analysis. *Psychometrika*, 30, 179–185.
- Horenczyk, G. (1996). Migrant identities in conflict: Acculturation attitudes and perceived acculturation ideologies. In G. M. Breakwell, & E. Lyons (Eds.). *International series in social psychology. Changing European identities: Social psychological analyses of social change* (pp. 41–250). Woburn, MA, US: Butterworth-Heinemann.
- Huynh, Q. L., Howell, R. T., & Benet-Martínez, V. (2009). Reliability of bidimensional acculturation scores: A meta-analysis. *Journal of Cross-cultural Psychology*, 40, 256–274. <https://doi.org/10.1177/0022022108328919>.
- ISTAT (2015a). *Rapporto sul benessere equo e sostenibile-BES (Report on Equitable and Sustainable Well-being)* Retrieved from <https://www.istat.it/files/2015/12/02-Istruzione-formazione-Bes2015.pdf>.
- ISTAT (2015b). *Immigration statistical report: International and internal migration* Retrieved from <https://www.istat.it/en/archive/immigrants>.

- Jurcik, T., Ahmed, R., Yakobov, E., Solopieieva-Jurcikova, L., & Ryder, A. G. (2013). Understanding the role of the ethnic density effect: Issues of acculturation, discrimination, and social support. *Journal of Community Psychology*, 41, 662–678.
- Jurcik, T., Sunohara, M., Yakobov, E., Solopieieva-Jurcikova, L., Ahmed, R., & Ryder, A. G. (2019). Acculturation and adjustment of migrants reporting trauma: The contextual effects of perceived ethnic density. *Journal of Community Psychology*, 1–16. <https://doi.org/10.1002/jcop.22183>.
- Jurcik, T., Yakobov, E., Ahmed, R., Solopieieva-Jurcikova, L., Sunohara, M., & Ryder, A. G. (2014). Social ecology and the recontextualization of acculturation: Exploring the psychological role of ethnic density. In J. Merton (Ed.), *Acculturation: Psychology, processes, and global perspectives*. Hauppauge, NY: Nova Science.
- Jurcik, T., Yakobov, E., Solopieieva-Jurcikova, L., Ahmed, R., Sunohara, M., & Ryder, A. G. (2015). Unraveling ethnic density effects, acculturation and adjustment: The case of Russian-speaking immigrants from the former Soviet Union. *Journal of Community Psychology*, 43, 628–648. <https://doi.org/10.1002/jcop.21708>.
- Kang, S. (2006). Measurement of acculturation, scale formats, and language competence: Their implications for adjustment. *Journal of Cross-cultural Psychology*, 37, 669–693. <https://doi.org/10.1177/0022022106292077>.
- Linacre, J. M. (2009). *Winsteps (Version 3.68.0)* [Computer Software]. Chicago, IL: Winsteps.com.
- Meredith, W. (1993). Measurement invariance, factor analysis and factorial invariance. *Psychometrika*, 58, 525–543.
- Ministero del Lavoro e delle Politiche Sociali (2016). *The moroccan community. Annual report on the presence of migrants in Italy*.
- Navas, M., García, M. C., Sánchez, J., Rojas, A. J., Pumares, P., & Fernández, J. S. (2005). Relative Acculturation Extended Model (RAEM): New contributions with regard to the study of acculturation. *International Journal of Intercultural Relations*, 29, 21–37. <https://doi.org/10.1016/j.ijintrel.2005.04.001>.
- Revelle, W. (2017). *Psych: Procedures for psychological, psychometric, and personality research*. Retrieved from Evanston, Illinois: Northwestern University. <https://CRAN.R-project.org/package=psych>.
- Revelle, W., & Rocklin, T. (1979). Very simple structure: An alternative procedure for estimating the optimal number of interpretable factors. *Multivariate Behavioral Research*, 14, 403–414.
- Ryder, A. G., Alden, L. E., & Paulhus, D. L. (2000). Is acculturation unidimensional or bidimensional? A head-to-head comparison in the prediction of personality, self-identity, and adjustment. *Journal of Personality and Social Psychology*, 79, 49–65. <https://doi.org/10.1037//0022-3514.79.1.49>.
- Schriesheim, C. A., & Eisenbach, R. J. (1995). An exploratory and confirmatory factor-analytic investigation of item wording effects on the obtained factor structures of survey questionnaire measures. *Journal of Management*, 21, 1177–1193. <https://doi.org/10.1177/014920639502100609>.
- Schwartz, S. J., Unger, J. B., Zamboanga, B. L., & Szapocznik, J. (2010). Rethinking the concept of acculturation: Implications for theory and research. *The American Psychologist*, 65, 237–251. <https://doi.org/10.1037/a0019330>.
- Statistics Canada (2013). *Immigration and ethnocultural diversity in Canada: National household survey 2011*. Ottawa, ON: Statistics Canada.
- Statistics Canada (2017). *Education in Canada: Key results from the 2016 Census*. November 29, Retrieved January 10, 2018, from <http://www.statcan.gc.ca/daily-quotidien/171129/dq171129a-eng.htm?HPA=1>.
- Tropp, L. R., Erkut, S., García Coll, C., Alarcón, O., & Vázquez García, H. A. (1999). Psychological acculturation: Development of a new measure for Puerto Ricans on the U.S. Mainland. *Educational and Psychological Measurement*, 59, 351–367. <https://doi.org/10.1177/00131649921969794>.
- Tsai, J. L., Ying, Y. W., & Lee, P. A. (2000). The meaning of “being Chinese” and “being American”: Variation among Chinese American young adults. *Journal of Cross-cultural Psychology*, 31, 302–332. <https://doi.org/10.1177/0022022100031003002>.
- Velicer, W. F. (1976). Determining the number of components from the matrix of partial correlations. *Psychometrika*, 41, 321–327.
- Ward, C., & Geeraert, N. (2016). Advancing acculturation theory and research: The acculturation process in its ecological context. *Current Opinion in Psychology*, 8, 98–104. <https://doi.org/10.1016/j.copsy.2015.09.021>.
- Wright, B. D., & Linacre, J. M. (1994). Reasonable mean-square fit values. *Rasch measurement transactions*, 8, 370. Retrieved from: <http://www.rasch.org/rmt/rmt83b.htm> on December 21, 2015.
- Wright, B. D., & Masters, G. N. (1982). *Rating scale analysis: Rasch measurement*. Chicago: MESA Press.
- Yakobov, E., Jurcik, T., Solopieieva-Jurcikova, L., & Ryder, A. (2019). Acculturation and expectations: Unpacking adjustment mechanisms within the russian-speaking community in Montreal. *International Journal of Intercultural Relations*, 68, 67–76. <https://doi.org/10.1016/j.ijintrel.2018.11.001>.
- Zea, M. C., Asner-Self, K. K., Birman, D., & Buki, L. P. (2003). The abbreviated multidimensional acculturation scale: Empirical validation with two Latino/Latina samples. *Cultural Diversity & Ethnic Minority Psychology*, 9, 107–126. <https://doi.org/10.1037/1099-9809.9.2.107>.
- Zhang, R., & Li, L. M. W. (2014). The acculturation

of relational mobility: An investigation of Asian Canadians. *Journal of Cross-cultural Psychology*, 45, 1390–1410. <https://doi.org/10.1177/0022022114542850>.