Using Confirmatory Multidimensional Scaling as a Method for Assessing Measurement Equivalence Across Cultures: The Case of the EVAT Scale.

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Abstract

The Work Values Scale EVAT (based on its initials in Spanish) was created in 2000 to measure values in the work context. The instrument operationalizes the four higher-order-values of the Schwartz Theory (1992) through sixteen items focused on work scenarios. The questionnaire has been used among large samples of Mexican and Spanish individuals (Arciniega & González, 2006: 2005, González & Arciniega 2005), reporting adequate psychometric properties. The instrument has recently been translated into Portuguese and Italian, and subsequently used in a large-scale study with nurses in Portugal and in a sample of various occupations in Italy. The purpose of this research was to demonstrate the cross-cultural validity of the Work Values Scale EVAT in Spanish, Portuguese, and Italian, using a new technique of measurement equivalence: confirmatory multidimensional scaling (CMDS). Our results suggest that CMDS is a serviceable technique for assessing measurement equivalence, but requires improvements to provide precise fit indices.

Introduction

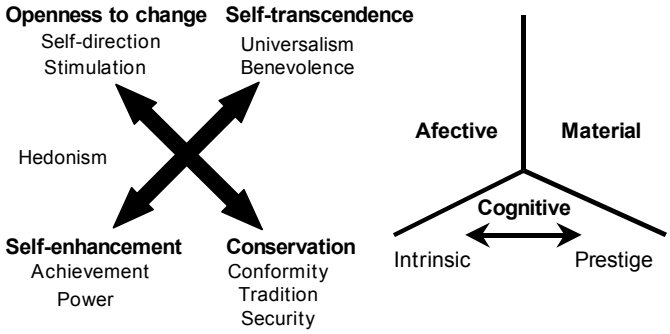
While, work and general values are, from a semantic perspective, highly related constructs they have been analyzed from distinct perspectives in the field of research. (Sagie, Elizur & Koslowsky, 1996; Schwartz, 1999). In other words, work values have been studied and measured in isolation from main stream research in general values (Rokeach, 1973; Schwartz, 1992). The study of general values has developed a well-supported definition of the construct (*e.g.* Rokeach, 1973; Schwartz, 1992), and even more important, a dynamic structure that allows for classification (Schwartz, 1992).

During the last decades deep attention has been paid to the structure of both constructs. While in the field of general values the dynamic structure of values proposed by Schwartz (1992) is the most widely known theory, in the area of work values, the structure proposed by Elizur (1984) has shed light for many researchers in the systematic study of the construct.

Schwartz's Theory of Values(1992) establishes that the essence of a value is the motivational goal it expresses. Based on this idea, the author has derived ten types of values that form a dynamic structure (see figure 1, left), where types sharing a similar motivational goal appear closer between them (for a full description of the ten motivational types see Schwartz, 1992). On the other hand, types representing incompatible motivational goals occupy opposing sides of the continuum. As seen in figure 1 (left), the 10 types form four high-order values. It is possible to distinguish two large bipolar dimensions. Each dimension presents opposite high-order values on each of its poles. The four high-order values are labeled: self-enhancement, self-transcendence, openness to change and conservation. The first two are part of a bipolar dimension that refers to

opposite motivational objectives: one, to enhance personal interests even at the expenses of others and the other, to transcend selfish concerns and promote the welfare of others. The other bipolar dimension clusters two different objectives: one refers to the extent to which they motivate persons to follow their own and unique intellectual and emotional interests, and the other, centered on preserving the *status quo* and the stability in relations with persons and institutions (Schwartz, 1992). Figure 1 shows which value types are contained by each high-order value.

Figure 1. The four high-order values of the Schwartz's theory (1992) and the three dimensions of the modality facet of Elizur's model (1984).



Considering the modality of the outcomes, Elizur (1984) proposed a structure for the construct of work values based on three dimensions (see figure 1, right). He labeled these dimensions as instrumental (or material), cognitive and affective. The proposed structure has been validated in different countries (Elizur, 1984; Elizur, Borg, Hunt and Beck, 1991) and seems to be robust.

Ros and collaborators (1999) proposed and proved that the four higher-order values of the Schwartz theory and the three dimensions of the modality facet of work values established by Elizur (1984) can converge, if the cognitive dimension is divided into two sub-dimensions: prestige and intrinsic (see Figure 1 right). Once the cognitive dimension is divided, each dimension of the modality facet encounters its parallel in one of the four higher-order values. That is, the higher-order value openness to change parallels the intrinsic dimension, conservation the instrumental or material dimension, self-enhancement the prestige, and finally, the high-order value self-transcendence parallels the affective dimension. Based on this construct structure, Arciniega and González (2000) developed an instrument for measuring work values.

The Work Values Scale EVAT (based on its initials in Spanish) operationalizes the four higher-order-values of the Schwartz Theory (1992) through sixteen items focused on work scenarios. The questionnaire has been used among large samples of Mexicans and Spaniards (Arciniega & González, 2006: 2005, González & Arciniega 2005), reporting adequate psychometric properties. Recently the instrument has been translated into Portuguese and Italian, and used in a large-scale study with nurses in Portugal (Soares, 2008), and in a sample of various occupations in Italy.

The purpose of this research was to demonstrate the cross-cultural validity of the Work Values Scale EVAT in Spanish, Portuguese, and Italian, using two techniques of measurement equivalence: multi-group confirmatory factor analysis (MGCFA) and confirmatory multidimensional scaling (CMDS).

Method

Participants.

Participants in the present study were drawn from three different countries. Each sample was composed of 220 employees. As a prerequisite to testing measurement invariance across samples it is necessary to ensure sample comparability. A common and suitable procedure for this is to use samples that are matched on the basis of a predetermined set of characteristics (Steenkamp & Baumgartner, 1998). Therefore, samples in the present study consisted of working adults with at least 13 years of formal education, and with equivalent age composition (as described further).

Mexico sample.- A 220 subjects sample was extracted randomly from a large database of 3,201 employees from 30 different companies belonging to the same holding, from 11 different cities in central and northern Mexico (Arciniega & González, 2005). Sixty-one percent (61%) of the participants were male. Participants voluntarily and anonymously completed the original Spanish language version of sixteen items of the EVAT scale.

Portugal sample.- The 220 individuals of this sample were selected randomly from a database of a large scale study with nurses in Portugal (N= 1,100: Soares, 2008). Twenty percent (20%) of the participants were male. Participants voluntarily and anonymously completed the Portuguese language version of the EVAT scale.

Italy sample.- The 220 participants were Italian citizens living in the Tuscany region, and 38.6 % were male. Participants voluntarily and anonymously completed the Italian version of the EVAT scale.

Table 1 shows age composition of each sample. A χ^2 test was computed between the percentages, suggesting that samples were equivalent with respect to this demographic variable ($\chi^2_{(6)}$= 3.09, p=.80).

Table 1.- Age composition by sample.

	< 25 years	26-35 years	36-45 years	> 45 years
Mexico	30%	47%	12%	11%
Portugal	29%	50%	14%	7%
Italy	36%	42%	11%	11%

Measures.

The *Escala de Valores hacia el Trabajo* (EVAT: Arciniega & Gonzaléz, 1992), is a sixteen item self-report measure that operationalizes the four higher-order values of the Schwartz's theory (Schwartz, 1992), contextualized to the work environment. The sixteen items of the instrument are based on the *Portraits Values Questionnaire* (Schwartz, Melech, Lehman, Burgess, Harris, & Owens, 2001). The questionnaire uses short verbal portraits that describe the goals and wishes of sixteen employees, implicitly expressing their work values (*e.g. He always strives to make sure that all employees receive the same treatment and opportunities*). Respondents are asked to rate

themselves in terms of each of the sixteen portraits, and use a 7-point Likert-type scale (7= *very much like me*, 1= *not like me at all*) to score their comparisons.

To create the Portuguese and Italian versions of the EVAT, back translation processes were followed based on the method proposed by Brislin (1986). Both the Portuguese and Italian versions of the instrument are available from the authors.

Analysis.

First, we ran a CFA of the hypothesized structure on each of the three samples. In order to test the measurement equivalence of the EVAT across the three samples, we used a multigroup confirmatory factor analytic application of LISREL 8.51 (Joreskog & Sorbom, 2001) to test two models. Model 1 posits an equivalent factor structure (i.e., items relate to the same factors) across groups and thus represents a test of configural invariance. Model 2 is a nested sequence of Model 1, adding the constraint that factor pattern coefficients for like items are equal across groups. Thus Model 2 provides a test of metric invariance.

Second, we computed three independent multidimensional scaling configurations, one for each of the samples. We then selected the configuration that best represented the theoretical construct structure. Afterward, we used the coordinates of this representation as the base for computing the other two configurations. This process consisted of fixing constraints to a MDS configuration that had been labeled by Borg and Groenen (2005) as a confirmatory MDS. The essence of the method is comparing the goodness of fit indices of a free configuration (i.e., without constraints) versus a MDS configuration where the coordinates in one or two axis are fixed (i.e., base configuration), and evaluating the degree of the reduction in the goodness of fit (e.g. S-stress).

Results and Conclusions

Concerning the independent CFA's for each of the three samples, we found adequate goodness of fit indices between each sample and the proposed four oblique factors model. The CFI for the Mexican sample was of .962 (RMSEA=.053), that for the Portuguese was of .950 (RMSEA=.053), and a CFI of .942 (RMSEA=.048) was obtained with the data from Italy.

For the multi-group confirmatory factor analyses, the fit indices for each of the two models are presented in Table 2. As expected, Model 1 provides the best overall level of fit relative to the others models. It appears that the 4 oblique factor model, with 4 items per factor, provides an adequate representation of the data in each of the three samples.

Model 2 indicates relatively little decrement in fit relative to Model 1. Specifically, though the change in χ^2 from Model 1 to Model 2 is statistically significant, the additional fit indices are nearly identical to those for Model 1. In addition, the change in fit from Model 1 to Model 2 is within the critical values suggested by Cheung and Rensvold (2002) for the CFI. Models 2 a-d represent tests of metric invariance across all possible 2 group comparisons in the present study (i.e., Mexico vs. Italy, Mexico vs. Portugal, and Italy vs. Portugal). For each of these models all of the fit measures indicate that the null hypothesis of invariance should not be rejected. Thus, it appears that the EVAT measure is conceptually equivalent across all three groups.

Table 2.- Results for the sequence of measurement invariance tests for the EVAT scale.

Model	χ^2	*df*	$\Delta\chi^2$	Δdf	*p*	RMSEA	CFI	ΔCFI
Mexico - Italy - Portugal								
1 Configural invariance	384.86	239				.053	.955	
2 Metric invariance	466.46	261	81.6	22	.00	.06	.936	-.02
Mexico – Italy								
1*b* Configural invariance	253.7	158				.053	.957	
2*b* Metric invariance	274.3	169	20.7	11	.04	.055	.950	-.01
Mexico - Portugal								
1*c* Configural invariance	265.49	160				.055	.958	
2*c* Metric invariance	318.72	171	53.2	11	.00	.063	.941	-.02
Italy - Portugal								
1*d* Configural invariance	250.34	160				.051	.947	
2*d* Metric invariance	308.82	171	58.5	11	.00	.061	.919	-.03

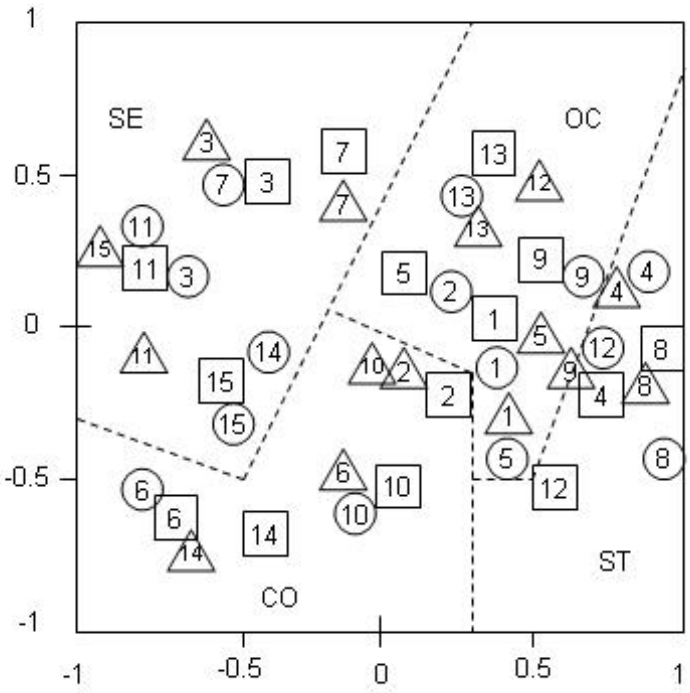
We computed independent MDS configurations for each of the three samples (see figure 2). Then we selected the configuration obtained from the Italian sample as the base configuration, considering it the best representation of the theoretical structure. Finally, we computed confirmatory MDS´s for the Mexican and Portuguese samples fixing the coordinates obtained from the Italian sample using the Proxscal algorithm included in the version 15.0 of the SPSS package. Table 3 shows the raw goodness of fit indices for the three samples, and the constrained indices for the Mexican and Portuguese samples. The light decrement in the goodness of fit indices allows us to say that the three configurations are equivalent.

Table 3.- Goodness of fit of the free and constrained configurations.

Configuration with the data from:	*S-stress of the free configuration*	*S-stress fixing the coordinates to the base configuration*
Italy (base configuration)	.067	----
Mexico	.074	.204
Portugal	.047	.108

Multi-group confirmatory factor analysis is a widely used technique for assessing measurement equivalence across groups. As can be seen in table 1, changes in the goodness of fit are evaluated probabilistically, giving the process objectivity. Researchers can clearly determine if they are measuring with configural or metric invariance, and decide if they can compare measurements across groups or not. If configural invariance is validated, but metric invariance is rejected, it is hard to know where the lack of fit is. A snapshot of the raw MDS configurations (Figure 2), can supply clues as to why one or more items, in one or more factors, are not clustering properly with the rest of the items operationalizing a specific construct or constructs.

Figure 2.-MDS configurations of the three samples.



Notes: SE= self-enhancement, OC= openness to change, CO= conservation, ST= self-transcendence. Triangles represent items of the Mexican configuration, circles of the Portuguese, and squares of the Italian configuration.

Future research should concentrate on running parallel simulations of MGCFA and CMDS, in order to determine possible cut-off values for the S-stress index. In other words, to establish a range for the S-stress that could be equivalent to configural and metric invariance.

Our results suggest that CMDS is a serviceable technique for assessing measurement equivalence, but requires improvements to provide precise fit indices. It can also be said that CMDS is a helpful complementary tool of MCFA when assessing measurement equivalence across groups.

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