

Testing the Circular Structure of Human Values: A Meta-Analytical Structural Equation Modelling Approach

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Schwartz' theory of human values has found widespread interest in the social sciences. A central part of the theory is that the 10 proposed basic values (i.e., achievement, power, self-direction, hedonism, stimulation, benevolence, universalism, conformity, security, and tradition) are arranged in a circular structure. The present study applies a meta-analytical structural equation modelling approach to test the circular structure. The model tested was the quasi-circumplex model, which is considered the most appropriate representation of the circular structure. Moreover, the study explores how far the circular structure varies with the used samples and methodological characteristics of the studies. The meta-analysis comprised 318 matrices with the correlations among the 10 values gathered from 88 studies and the European Social Survey (overall $n = 251,239$). To reduce heterogeneity across the matrices, cluster analysis was used to sort the matrices into eight clusters with a similar correlation profile and tested the circular structure in each cluster. The results showed that three clusters demonstrated a good fit with the data and an adequate match to the theoretically proposed structure. The clusters' cultural and methodological profiles indicate potential moderators of the circular structure which should be considered in future research.

Keywords: circumplex, structural equation modelling, heterogeneity, MASEM, meta-analysis

1 Introduction

Schwartz' value theory (1992; 1994) has become a popular framework for considering values in research. A central part of the theory is its statement that the 10 proposed values (i.e., achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, security, and power) form a *circular structure* (see Figure 1) in which values expressing similar motivational goals are close to each other and move farther apart as their goals diverge. Furthermore, the theory states the *near-universality* (i.e., similarity) of the structure across cultures (Bardi and Schwartz 2003; Schwartz 2005), which indicates the usefulness of values for cross-cultural research. The circular structure is a central feature of the theory as it implies compatible versus conflicting values (Schwartz 1992; Schwartz and Boehnke 2004). For instance, pursuing values that reflect social influence may conflict with benevolence values whereas self-direction and stimulation values focusing on novelty and new experiences concur.

Although value theory has stimulated a significant amount of research, studies investigating the circular structure and the near-universality of the theory have mostly relied on subjective interpretations gained from rather exploratory analysis (Hinz, Braehler, Schmidt and Albani 2005; Lindeman and Verkasalo 2005; Schwartz and Bilsky 1987). In cases where researchers applied more strict methods (e.g.,

Perrinjaquet et al. 2007; Schwartz and Boehnke 2004; Vecchione, Casconi and Barbaranelli 2009) the researchers came to diverging conclusions.

The present study conducts a meta-analysis of studies that measured the 10 basic human values. The study has two goals. First, the study investigates whether characteristics of the samples or studies explain the heterogeneity of the correlations among values across studies. Second, we aim to test the circular structure with meta-analytical structural equation modelling.

2 Research on the Circular Model of Human Values

Most empirical analyses of the circular structure refer to smallest space analysis (or multidimensional scaling). The results of such analyses in 40 countries showed that the 10 values – operationalized as partitions of the two-dimensional plane – had a circular order (Schwartz and Sagiv 1995). The drawback of these analyses is that they imply difficulties to apply objective evaluation criteria (e.g., the fit of the data to a sinusoid curve or the “similarity” of correlations), hence, resulting in subjective interpretations of graphical representations or correlation patterns. Moreover, the use of multidimensional scaling has been demonstrated to be biased toward showing a circular structure (Hubert, Arabie and Meulman 1998).

Testing the circular structure, however, requires linking the structure to a mathematical model, which is a *circumplex* (Guttman 1954). A circumplex structure is defined by a specific order of correlations among variables. Guttman (1954) described the term “circumplex” as a pattern of cor-

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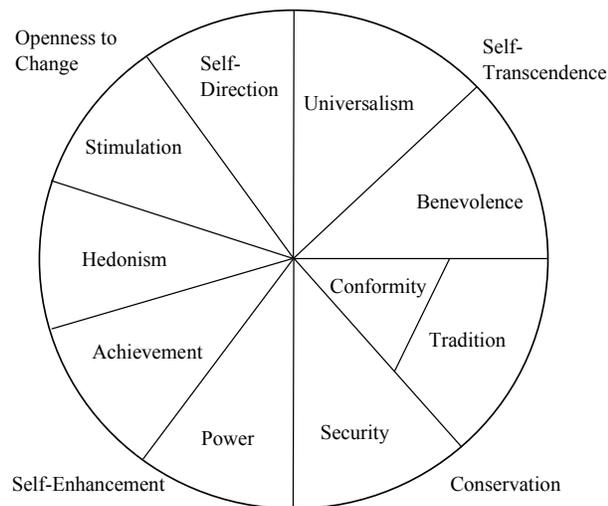


Figure 1. The Circular Structure of Human Values (Schwartz, 1992)

relations in a correlation matrix in which the correlations decrease across the diagonals of the matrix and again increase when a certain diagonal has passed. This pattern of correlations can be represented by the order of the variables' locations on the circumference of a circle. In this circle, two adjacent variables show the highest possible correlation, and the correlation decreases with increasing distance until an angle of 180 degrees has been reached. The variables at opposite sides can be negatively or positively related, or they can be unrelated. Guttman differentiated between two specific circumplex models. The *circulant* model assumes equal distances along the circumferences (i.e., equal correlations between adjacent variables), and the less restrictive quasi-circumplex model allows unequal distances (i.e., unequal correlations). Because Schwartz did not postulate that the values show equal distances, the *quasi-circumplex* model is the assumed structure of human values.

As mentioned above, the circular structure has mostly been investigated with multidimensional scaling or other exploratory techniques (e.g., Hinz et al. 2005; Lindeman and Verkasalo 2005; Schwartz and Bilsky 1987; Spini and Doise 1998) with contradictory results. Others (Perrinjaquet et al. 2007; Schwartz and Boehnke 2004) used confirmatory methods in which the degree of misfit can be evaluated with a chi-square test and fit measures that quantify the departure of the empirical correlation matrix from the theoretically expected matrix. Most notably, Schwartz and Boehnke (2004) used a confirmatory factor analysis in which they specified constraints on the factor inter-correlations in such a way that these correlations displayed a quasi-circumplex structure. The authors tested alternative models that make different assumptions (e.g., circulant versus quasi-circumplex structures and models with differing numbers of factors). The circumplex structures were tested by fixing the correlations among the values to follow a prespecified reference matrix. The authors tested a variety of models by either changing the entries

of the reference matrix or allowing residual covariances to address models with a higher number of latent variables. The drawback of their study, however, was that the authors pooled correlation matrices from 46 samples and, consequently, did not investigate potential differences across cultures. Moreover, the study considered only the older measurement instrument "Schwartz value survey" (SVS).¹

Another test was provided by Perrinjaquet et al. (2007) who tested the quasi-circumplex structure in a Swiss and a French sample. The authors applied Schwartz and Boehnke's approach and, in addition, used a structural equation modelling approach specifically developed for testing circumplex structures (Browne 1992; Fabrigar, Visser and Browne 1997; Remington, Visser and Fabrigar 2000). Again, only SVS data were considered, and focusing on these two samples made it possible that cultural specificities prevented finding the structure. By conducting a meta-analysis, hence, the present study allows the investigation of differences across studies and enables a testing of the circular structure by using all available evidence.

3 Methods

3.1 Literature Search

We used the PsycInfo database and Google Scholar to search studies that contained the phrases "Schwartz Value Survey" or "Portraits Value Questionnaire" (PVQ). In addition to regular unpublished and published research papers, data gathered by the European Social Survey² (ESS) were included. The ESS is a large cross-national survey that is

¹ The SVS was the original survey to measure the values. It consisted of single items referring to specific values. Later (2001), Schwartz developed the "Portrait Value Questionnaire" (PVQ) in which respondents had to compare themselves with an imaginary person that was described as exhibiting certain values.

² See the ESS' website www.europeansocialsurvey.org

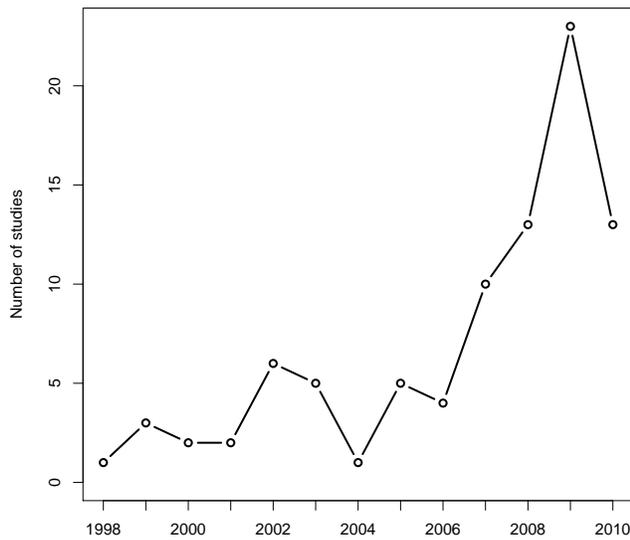


Figure 2. Number of Studies on Schwartz values (excluding the ESS)

undertaken every two years. It measures a wide range of issues, for instance, political attitudes, life satisfaction, and health. In addition, values are measured with the PVQ. In recent years, the ESS value data have become an important part in published work on values because it provides researchers with the opportunity to compare values across countries (e.g., Davidov 2008; Davidov, Schmidt and Schwartz 2008; Verkasalo, Lonnqvist, Lipsanen and Helkama 2009; Vyroost, Kentos and Fedakova 2007).

Studies were selected as appropriate for the meta-analysis if they a) were based on empirical data, b) had investigated a nonclinical sample, c) had used the SVS or PVQ, e) had measured all 10 values, and f) used non-ESS data. Studies relying on ESS data were excluded as the ESS data were directly used in our analyses. Nonpublished manuscripts, dissertations, and conference papers were also included.

3.2 Search Results

The literature search initially resulted in 392 studies that fulfilled the inclusion criteria. In 41 cases, neither the article nor the authors email addresses could be located. These studies were excluded. Because only a minority ($k = 42$; 11%) of the located articles presented a correlation matrix, emails requesting the correlation matrix were sent to 230 authors of 309 articles. As a result, 60 of the 230 authors (26%) sent us correlation matrices or raw data³; only 13 authors rejected our request. In all, 157 authors did not respond (even after a third reminder), were not available, or reported no longer having access to the data.

Finally, the meta-analysis included 318 correlation matrices gained from 88 studies. Of these, 95 correlation matrices were provided by the ESS (which was counted as a single study). The overall sample size was 251,239, varying between 27 and 4,937 individuals per correlation matrix (median = 251, SD = 894.68). The number of countries in

which research on values had been conducted was 65 (see Table 1). Countries with the largest number of correlation matrices were Germany ($m = 26$), Finland ($m = 23$), Spain ($m = 18$), and Israel ($m = 16$). Figure 2 shows the number of studies per year, indicating an immense increase in the interest in human values in recent years.⁴

3.3 Coded Sample and Study Characteristics

Cultural region. To address the study's first goal, we coded the country in which the primary study had been conducted. Because the number of countries was too large to systematically address culture in our meta-analysis, we relied on the empirical results of a large cross-cultural project (i.e., the GLOBE project⁵) about clusters of cultures (i.e., cultural

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⁴ The correlation matrices, containing the correlations, standard deviations of each correlation coefficient indicating the amount of heterogeneity, and the minimum and maximum correlation coefficient can be obtained by the first author upon request.

⁵ GLOBE (Global Leadership and Organizational Behavior Effectiveness Program (House, Hanges, Javidan, Dorfman and Gupta

Table 1: Cultural Regions and Number of Correlation Matrices from Referring Countries

<i>Anglo Cultures</i>		<i>Sub-Sahara</i>		<i>Southern Asia</i>	
England	11	<i>Africa</i>		Philippines	5
Australia	9	Cameroon	4	India	1
Canada	7	Namibia	1	Indonesia	1
USA	5	Cote d'Ivoire	1	<i>Eastern Europe</i>	
New Zealand	4	Ethiopia	1	Estonia	7
Ireland	3	Senegal	1	Poland	6
<i>Arabic Cultures</i>		Uganda	1	Croatia	6
Turkey	7	<i>Northern Europe</i>		Hungary	5
Arabia	1	Finland	23	Greece	5
Lebanon	1	Denmark	8	Slovenia	4
Oman	1	Sweden	5	Czech Republic	4
<i>Confucian Asia</i>		Norway	4	Russia	4
China	5	Iceland	1	Slovakia	3
Singapore	3	<i>Latin Europe</i>		Ukraine	3
Hong Kong	1	Spain	18	Bulgaria	3
South Korea	1	Israel	16	Cyprus	2
China	1	Italy	10	Romania	2
Japan	1	France	7	Albania	1
<i>German Speaking</i>		Portugal	5	Georgia	1
Countries		<i>Latin America</i>		Latvia	1
Germany	26	Brazil	11	Yugoslavia	1
Belgium	14	Costa Rica	5		
Switzerland	6	Mexico	5		
Austria	4	Argentina	2		
Netherlands	4	Chile	2		
Luxembourg	1	Peru	2		
		Colombia	1		

Three mixed-culture studies were excluded from the table.

regions) that show similar values (Gupta, Hanges and Dorfman 2002). Table 1 shows the cultural regions and the corresponding countries.

Measurement instrument. As mentioned above, we included studies using the SVS or the PVQ. Although both instruments measure the 10 values, they strongly differ in the format of their question wording. As a consequence, we suspected that these formal characteristics would affect the correlations among the 10 values, hence, leading to differences in the circular structure. Therefore, it was coded whether a respective correlation matrix was based on the SVS or PVQ.

Publication form. It was further coded whether the respective correlation matrix was based on data published in peer reviewed journals. This information was included to investigate the existence of a publication bias, that is, the tendency of scientific journals to publish significant relationships between variables with higher probability than non-significant relationships (Borenstein, Hedges, Higgins and Rothstein 2009).

European Social Survey. It was coded whether a correlation matrix stemmed from the ESS. The ESS collects data using a standardised procedure, which should diminish random errors and idiosyncratic characteristics of other (i.e., non-ESS) studies likely to affect and blur the correlation structure. Consequently, we expected evidence for a circular structure should be more prevalent in ESS studies.

Age. Finally, it was coded whether the respective study

used either a student or adolescent sample or a nonstudent sample (e.g., population surveys or surveys with specific occupational groups). We regarded it as possible that the value structure may be associated with age – with a more diversified structure occurring in later ages.

Table 2 shows the characteristics of the coded correlation matrices. Most of the correlation matrices stemmed from Eastern and Latin European region ($m = 59$, respectively), as well as the German speaking countries ($m = 52$). The most frequently used measurement instrument was the PVQ ($m = 241$), which can be explained with the increase of research in recent years in which the PVQ became available (Schwartz et al. 2001). Moreover, most of the correlation matrices (i.e., 76%) originated from published studies ($m = 241$), and only 24% of the correlation matrices ($m = 76$) stemmed from conference papers, dissertations, or other unpublished manuscripts. Finally, about 60% of the matrices ($m = 192$) were based on nonstudent samples.

2004) is a research project involving 17,000 organizations in 62 countries that focuses on the values and practices of organisations and overall cultures.

Table 2: Sample or Study Characteristics

Sample or Study Characteristic	m	Percentage
<i>Cultural region</i>		
Eastern Europe	59	19%
Latin Europe	59	19%
German speaking countries	52	16%
Nordic Europe	41	13%
Anglo Cultures	39	12%
Latin America	28	9%
Arab Cultures	11	3%
Confucian Asia	12	4%
Sub-Sahara Africa	8	3%
Southern Asia	6	2%
Mixed	3	1%
<i>Measurement instrument</i>		
PVQ	240	76%
SVS	74	24%
<i>Publication form</i>		
Published	241	76%
Unpublished	76	24%
<i>European Social Survey (ESS)</i>		
No	223	70%
Yes	95	30%
<i>Age</i>		
Nonstudents	192	61%
Students	125	39%

m = number of correlation matrices;

PVQ = Portrait Value Questionnaire; SVS = Schwartz Value Survey

3.4 Analysing the Heterogeneity of the Correlations among Human Values

As the meta-analysis contained samples from different cultures, the homogeneity assumption (i.e., that the correlation matrices are drawn from one population) was invalid a priori. Beyond culture as a possible cause of heterogeneity, other study and sample characteristics were expected to also cause heterogeneity. Thus, before testing of the circular structure, two approaches were used to investigate potential reasons for the heterogeneity, that is, meta-regression and cluster analysis of the correlation matrices.

Meta-regression. To analyse the unique role of each of the coded study and sample characteristic for the heterogeneity of the correlations, we regressed each of the 45 correlations contained in each matrix on the characteristics (Thompson and Sharp 1999). To address unequal samples sizes, we used the weighted least squares estimator (Cheung 2008).

Cluster analysis. We further followed recommendations by Cheung and Chan (2005a) to sort the matrices with the correlations among the ten values into more homogeneous clusters with similar correlation patterns. To this end, a cluster analysis was applied on a 318 x 45 data matrix. The entries of this matrix were correlations among the human val-

ues, contained for the 318 studies and 45 pairs of variables. The distances among the correlations were calculated using the Euclidean distance (Rapkin and Luke 1993). As a clustering algorithm, the Ward algorithm was used. To analyze the meaning of these clusters, the clusters were related to the study and sample characteristics. The cluster analysis as well as the meta-regression were conducted with the open source software R, base package (R Development Core Team 2008). Whereas the literature (Everitt 1980; Milligan and Cooper 1985) has discussed stopping rules that help to decide which number of clusters to choose, this study used the cluster analysis only descriptively to reduce the degree of heterogeneity by choosing clusters referring to similar correlation matrices that can be meaningfully interpreted. The decision was based on the dendrogram indicating a considerable reduction of the heterogeneity by choosing these clusters (Rapkin and Luke 1993). In the following step, it was evaluated if the clusters still showed a substantial degree of heterogeneity.

3.5 Tests of the Circular Structure

The analysis of the circular structure relied on recent developments in meta-analytical structural equation modelling (Cheung 2002; Cheung and Chan 2005b). The procedure consisted of two steps. The first step tested whether the correlation matrices within the clusters showed a substantial degree of heterogeneity. To this end, a multiple group model was specified in which each of the primary studies in each cluster was treated as a separate group. For instance, the test for cluster A resulted in a multigroup model with 36 groups. The parameters of this model were the correlations among the values.

To test for heterogeneity, equality constraints were specified on the cells of the matrix of these correlations across the studies. Each constraint reflected the assumption that the respective correlation does not differ across the studies beyond an degree expected by sampling error. A chi-square test and the fit indexes informed about the reasonableness of the set of constraints. As fit indexes, we used the root mean square error of approximation (RMSEA) and the comparative fit index (CFI). In particular, we regarded a RMSEA value of less than .06 and a CFI value close to .95 to indicate a high degree of homogeneity (Cheung and Chan 2005b; Hu and Bentler 1999). As we previously had clustered the correlation matrices in an exploratory manner, the chi-square statistic and its p-value could not be interpreted as a strict statistical test any more. Instead, we considered the fit of the model as signifying the degree of heterogeneity of the correlation matrices within each cluster. Beyond these homogeneity analyses, the first step resulted in a maximum likelihood estimate of the population correlation matrix for each cluster which was used as the input in the second step – that is, the test of the circular structure.

The starting point of this test is the specification of the so-called *Fourier series correlation function*, which describes the relationship between the correlation of two variables and the polar angle between the variables. This function mathematically represents the circumplex, as the cor-

relations decrease with increasing polar angles and increase when 180° has been reached. This model is an improvement of Anderson's (1960) stochastic process model, which was only applicable to nonnegative correlations, whereas the Fourier series function can treat positive and negative correlations.

Browne (1992) provided software (i.e., CIRCUM) which applies the correlation function to estimate the involved polar angles. Furthermore, CIRCUM provides confidence intervals around the polar angles and the "minimum common score correlation", that is, the correlation among the estimated error-free scores at the opposing locations. Parameter values (e.g., polar angles) are estimated by minimising the maximum likelihood fitting function typically used in structural equation modelling (Bollen 1989)

$$FS, \Sigma = \ln |\Sigma| - \ln S + trS\Sigma - 1 - p$$

by which the difference between the empirical covariance matrix S and the covariance matrix implied by the model and the chosen parameter estimates, Σ , is minimised (p is the number of variables in the matrix).

To evaluate the model, CIRCUM provides a chi-square test and the fit index RMSEA to evaluate the fit of the model. In addition, CIRCUM delivers estimates of the *communality* of each variable. Communalities < 1 imply a divergence of the variable from the circumplex (i.e., the variable is located closer to the midpoint). By specifying equality constraints on the communalities, hence, one can test the hypothesis that all variables have equal distances from the midpoint of the circumplex (i.e., equal radii, cf. Acton and Revelle 2004; Tracey 2000). However, Schwartz did not postulate equal radii. Recently, he emphasised (personal communication) that his theory only states that the values imply a circular order. Thus, the communalities were not required to be equal.

Beyond the test of the circular structure, a further theoretical issue is the direction of the correlations among opposing values. Based on Schwartz' statement that opposing values imply conflicting motivational goals, one would expect negative correlations between opposing values. On the other hand, it is known that value measurement is influenced by response styles (i.e., social desirability, or acquiescence bias, Lee, Soutar and Louviere 2008; Maio 2010; Schwartz, Verkasalo, Antonovsky and Sagiv 1997), which would increase positive correlations and decrease or even change the sign of negative correlations. The reason is that response styles act as a common cause of two variables and, hence, generate a positive association between these variables. This positive association should then, depending on the strength of the response style, compensate for the theoretically expected negative correlation between the variables. To this end, minimum correlations, far from substantial negative correlations were considered to indicate response styles.

4 Results and Discussion

4.1 Analyzing the Heterogeneity of the Correlations: Meta-Regression

Table 3 summarizes the results of the meta-regression, in which each of the 45 correlations among the values were regressed on the study and sample characteristics. The table shows the percentage of significant regression effects among the 45 analyses. In addition, the table shows the average effect indicating if correlations were systematically higher or lower across the categories of the study characteristic. Table 3 shows that most of the correlations among two respective values showed significant average differences across the study characteristics. The medium explained variance across the 45 regression analyses was $R^2 = 29.5\%$, ranging from 11% (the correlation between conformity and hedonism) to 50% (the correlation between tradition and universalism). The characteristics showed significant associations with the correlations reaching from 64.4% of the regression analyses (age) to 80% (publication form). These results show that these characteristics moderate the correlations among the values and explain the heterogeneity to a substantial degree.

Systematic influences of the sample characteristics on the correlations were, however, only small. Correlations based on the SVS tended to be somewhat larger on average compared with correlations based on the PVQ. Similarly, ESS correlations were slightly higher than non-ESS correlations. The publication form, although having the highest percentage of significant associations to the correlations, had no mean influence. The most substantial effect occurred for student samples, which – contrary to our expectations – had lower average correlations.

4.2 Cluster analysis of the correlation matrices

The cluster analysis resulted in eight clusters that represented a reasonable trade-off between a reduction of heterogeneity and interpretability. Table 4 contains an overview of the cluster characteristics. As an aid, we created short descriptive labels that refer to the most salient characteristics.

Cluster A ("Nordic European students"). This cluster is characterised by 42% matrices from Nordic European countries and a large (61%) number of student samples. The PVQ was used in only about half (i.e., 58%) of the cases, and 86% of the matrices stemmed from published studies.

Cluster B ("Eastern European ESS studies"). The most prevalent feature of this cluster is the large number of matrices from Eastern European countries (79%). Furthermore, the matrices almost always (i.e., 95%) originated from the ESS data base. Consequently, the measure used was the PVQ, and the samples were nonstudents.

Cluster C ("Ambiguous cluster"). The most prevalent feature of this cluster is its independence from most of the coded study characteristics. All of the cultural regions emerged with a nearly equal percentage (i.e., ranging from 6 to 19%). Moreover, seven of the eight matrices gained from Sub-Saharan Africa were contained in this cluster. PVQ and

Table 3: Results of the Meta-Regression

Study characteristic	# significant regression effects	Mean regression effect	Min	Max
Measurement instrument	32 (71.1%)	.05	-.20	.30
ESS	35 (77.8%)	.04	-.16	.22
Publication form	36 (80.0%)	.00	-.19	.17
Age	32 (64.4%)	-.08	-.15	.04

Dummy codes for the independent variables: Measurement instrument: PVQ = 0, SVS = 1; ESS: non-ESS = 0,

ESS: 1; publication form: published = 0, unpublished: 1; Age: nonstudents = 0, students = 1;

Min = Smallest occurring regression coefficient across the 45 regression analyses,

Max = largest occurring regression coefficient

SVS studies were almost equally distributed, and the cluster consisted equally of students and nonstudent samples. The only dominant characteristic is the high rate of published studies (92%).

Cluster D (“Latin European and American students”). This cluster consists of unpublished studies from German speaking, Latin European, and Latin American countries. Most of these studies (70%) were conducted with student samples. The most frequently used measure was the PVQ.

Cluster E (“European non-ESS studies”). With a total coverage of 75%, this cluster consists of Eastern European, Latin European, and German speaking countries. A second characteristic is that this cluster only consists of non-ESS studies, and hence, this cluster is a complement to clusters B and F. The PVQ was used in 79% of the cases, and 71% of the articles were published.

Cluster F (“German and Nordic European ESS studies”). This cluster is characterised by studies from German speaking and Nordic European countries, almost all originating from the ESS (82%). Consequently, the used measure was the PVQ, and the samples were most frequently non-students.

Cluster G (“Mixed population from Latin European and Anglo cultures”). Similar to cluster B, cluster G is rather ambiguous. The most salient characteristic of this cluster are the equal proportions of students and nonstudents from Latin European and Anglo cultures. The PVQ was used in 75% of the cases and the publication rate was 57%.

Cluster H (“Anglo and Latin American SVS studies”). This cluster contains matrices from Anglo and Latin American countries and to a smaller degree, German speaking countries (18%). Moreover, the largest number of studies using the SVS is found in this cluster and the percentage of student samples is high (65%).

Overall, the associations between the clusters and the coded sample and study characteristics were not as clear as expected by conventional wisdom. The implication of the results is that differences between the correlation structures cannot be explained by simple cross-cultural differences. Rather, these differences stem from the complex interactions of the culture, the measurement instrument, the survey method, and the respondents’ age. The most salient example is cluster B, which contained almost only Eastern European ESS studies. Thus, this cluster is characterized by the combination of the survey method (ESS) and culture. With

regard to culture, we labelled the clusters by those regions with the highest number of matrices. These regions were those in which studies on values had been most frequently undertaken (i.e., European countries). The four least often investigated regions, Sub-Sahara Africa, Confucian and Southern Asia, and the Arab countries, however, did not form culture specific clusters but were assigned to the remaining clusters. Matrices from Sub-Sahara African countries were assigned to the ambiguous cluster C, and only one of eight matrices was assigned to cluster D. Asian (both Confucian and Southern) matrices were allocated to clusters A, C, and H. Finally, Arabic matrices were sorted into a variety of clusters with the highest frequency to cluster C (18% of all Arabic studies), D (36%), and H (18%).

The occurrence of two ESS clusters (cluster B and F) demonstrates the homogenising effect of using the same survey method. As we discuss below, these two clusters had the highest amount of within-cluster homogeneity. However, high homogeneity (i.e., similar correlation profiles) should not be equated with a high validity of the measures – for instance, regarding the circular structure. This issue will be addressed in this paper’s general discussion.

4.3 Investigating the Circular Structure of Human Values

The goal of the cluster analysis was to reduce heterogeneity. Consequently, we tested whether the degree of heterogeneity in each cluster was still significant (Cheung and Chan 2005a). Table 4 depicts the results. As can be seen, the chi-square tests and the fit indexes (i.e., RMSEA, CFI) generally indicated a substantial heterogeneity). The only exceptions were found in the clusters B and F, which contained correlation matrices created from ESS data. Although heterogeneity was still significant, we regard its degree as acceptable (according to the RMSEA).

As the next step, we tested the circular structure of the values in the eight clusters with CIRCUM. Figure 3 shows the results of the tests. The figure depicts the short label for the cluster, the number of correlation matrices (m) on which the cluster relies, the number of individuals (N), and the fit measures (chi-square test statistic and the RMSEA). Furthermore, Figure 3 shows the locations of the 10 values. We marked those values that deviate from the theory in terms of their order with an asterisk. In all of the eight clusters,

Table 4: Description of the Clusters and Tests for Homogeneity of the Correlation Matrices

Cluster	Description	Label	m	n	Test for homogeneity		
					χ^2 (df)	RMSEA	CFI
A	<i>Culture</i> : Nordic Europe (42%), the rest diverse <i>Measurement instrument</i> : PVQ (58%) <i>Published</i> : 86% <i>ESS</i> : 0% <i>Nonstudents</i> : 39%	Nordic European students	36	11,152	17,316.99 (1575)*	.18	.47
B	<i>Culture</i> : Eastern Europe (79%) <i>Measurement instrument</i> : PVQ (100%) <i>Published</i> : 100% <i>ESS</i> : 95% <i>Nonstudents</i> : 100%	Eastern European ESS studies	43	74,136	17,608.30 (1890)*	.069	.96
C	<i>Culture</i> : Culturally diverse <i>Measurement instrument</i> : PVQ (53%) <i>Published</i> : 92% <i>ESS</i> : 17% <i>Nonstudents</i> : 53%	Ambiguous cluster	36	20,220	17,629.79 (1575)*	.135	.81
D	<i>Culture</i> : Latin Europe (21%), Latin America (17%), and German speaking countries (21%) <i>Measurement instrument</i> : PVQ (85%) <i>Published</i> : 36% <i>ESS</i> : 4% <i>Nonstudents</i> : 30%	Latin European and Latin American students	47	18,615	7,911.48 (2070)*	.085	.80
E	<i>Culture</i> : Eastern Europe (26%), Latin Europe (26%), and German speaking countries (23%) <i>Measurement instrument</i> : PVQ (79%) <i>Published</i> : 71% <i>ESS</i> : 0% <i>Nonstudents</i> : 63%	European non-ESS studies	35	19,399	15,498.37 (1530)*	.128	.82
F	<i>Culture</i> : German speaking (36%) and Nordic (34%) European countries <i>Measurement instrument</i> : PVQ (100%) <i>Published</i> : 98% <i>ESS</i> : 82% <i>Nonstudents</i> : 96%	German and Nordic European ESS studies	50	86,337	11,602.72 (2205)*	.050	.97
G	<i>Culture</i> : Latin Europe (30%) and Anglo Cultures (24%) <i>Measurement instrument</i> : PVQ (75%) <i>Published</i> : 57% <i>ESS</i> : 7% <i>Nonstudents</i> : 50%	Mixed population from Latin European and Anglo cultures	54	17,077	9,523.23 (2385)*	.097	.84
H	<i>Culture</i> : Anglo Cultures (29%), Latin America (24%), and German speaking countries (18%) <i>Measurement instrument</i> : SVS (60%) <i>Published</i> : 76% <i>ESS</i> : 6% <i>Nonstudents</i> : 35%	Anglo and Latin American SVS studies	17	4,743	3,394.60 (720)*	.12	.94

* p < .05; m = number of matrices; PVQ = Portrait Value Questionnaire; SVS = Schwartz Value Survey; ESS = European Social Survey

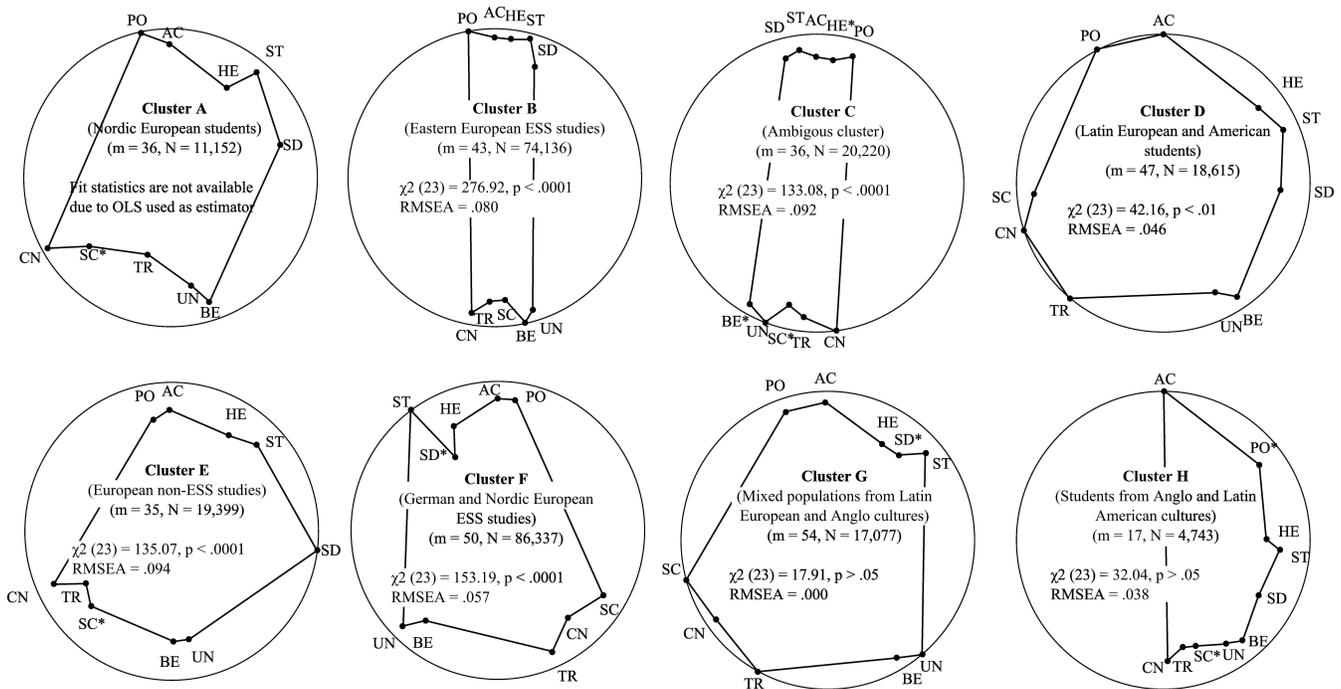


Figure 3. Results of the Circumplex Analyses

achievement was used as the reference variable with its location fixed to 0° . To demonstrate the relative communalities, we located the respective value type with the highest communality estimate on the circumference and depicted the nine remaining values in a relative position. With one exception, all analyses ran without any problems. The exception was cluster A, for which CIRCUM was unable to invert the correlation matrix. As a solution, we used ordinary least squares as the estimator, which resulted in estimates of polar angles and communalities. However, when using this estimator, the software does not provide fit measures to evaluate the solution.

As Table 5 shows, the degree of fit to the circular structure varies across the eight clusters. Half of the solutions (clusters D, F, G, and H) show acceptable RMSEA values (i.e., less than .06). Beyond the statistical fit, cluster D shows the best match to the theoretically proposed ordering of the values. The only deviation is the rather far distance between tradition and conformity as well as their equal communality. These issues contradict Schwartz' (Schwartz 1992) statement that both values have the same polar angle with conformity lying closer to the midpoint of the circle. Furthermore, clusters F and G show a good match with Schwartz' theory. The only deviation is the incorrect location of self-direction which was located between hedonism and stimulation in both clusters. It should be noted, however, that hedonism, stimulation, and self-direction are very closely located to each other and their confidence intervals overlap. As a consequence, these deviations from the theory are only marginal in their meaning.

A common characteristic of the clusters with a good theoretical fit is that these clusters contain many matrices from

German speaking and Latin European countries. Together, both cultural regions comprise 42%, 54%, and 47% of the matrices in clusters D, F, and G, respectively. In addition, cluster E, which approximates the circumplex, also contains a substantial number of Latin European countries. Hence, the circular structure seems to be more appropriate in German speaking and Latin European countries. In addition, these clusters relied heavily on the PVQ as the measurement instrument, whereas other clusters with a less appropriate statistical or theoretical fit (e.g., clusters C and H) used the SVS to a higher degree.

Cluster H, albeit showing a good statistical fit, corresponds rather weakly to the theory. All values are located in the right hemisphere of the circle, reflecting the high and positive correlations among the 10 values. This finding suggests the existence of a general underlying factor. As cluster H is characterised by a high rate of SVS studies (60%), using the SVS may be a threat to the circular structure, potentially in an interaction with the use of student samples.

Clusters B and C indicate a clear failure to fit the circular structure. In both clusters, the values form an almost identical two-factor solution with openness and self-enhancement values on one side, and conservation and self-transcendence values on the other side. Whereas this result is difficult to interpret for cluster C because of its ambiguous meaning, cluster B consists almost entirely of Eastern European non-ESS studies. The two-factor pattern, however, does not seem to be characteristic of the Eastern European region per se as Eastern European countries were also part of the better fitting cluster E.

Table 5: Results of the Circumplex Analyses

Cluster	Label	χ^2 (df)	RMSEA	Statistical fit	Theoretical fit
A	Nordic European students	n A		Unknown	Good Deviation from the theory: Security is located between tradition and conformity
B	Eastern European ESS studies	276.92 (23)*	.080	Inadequate	Very bad Deviation from the theory: Openness values and conservation values are closely located and suggest a two – factor structure
C	Ambiguous cluster	133.08 (23)*	.092	Inadequate	Very bad Deviation from the theory: Hedonism is located between achievement and power; security is located between universalism and tradition; benevolence is located between universalism and self-direction; openness values and conservation values are closely located and suggest a two factor structure
D	Latin European and Latin American students	42.16 (23)*	.046	Acceptable	Very good Deviation from the theory: Conformity and tradition are located with a different polar angle
E	European non-ESS studies	135.07 (23)*	.094	Inadequate	Good Deviation: Security is located between tradition and benevolence
F	German and Nordic European ESS studies	153.19 (23)*	.057	Acceptable	Good Deviations from the theory: Selfdirection is located between hedonism and stimulation; security and power are more distant than postulated in the theory; universalism and stimulation are more distant than postulated in the theory
G	Mixed population from Latin European and Anglo cultures	17.91 (23) ^{n.s.}	.000	Very good	Good Deviation from the theory: Selfdirection is located between hedonism and stimulation; stimulation and universalism are more distant than postulated; power and security are more distant than postulated
H	Anglo and Latin American SVS studies	32.04 (23) ^{n.s.}	.038	Very good	Bad Deviation from the theory: All values are located in one hemisphere of the cycle which suggests the presence of a general factor; power is located between achievement and hedonism; security is located between universalism and tradition

* p < .05

In addition to the test of the circular structure, we inspected the minimum common score correlations, that is, the lowest correlations of opposing values. These were -1.00 (cluster A), $.11$ (cluster B), $.32$ (cluster C), $-.11$ (cluster D), $-.03$ (cluster E), $-.20$ (cluster F), $.04$ (cluster G), and $.62$ (cluster H). The perfect negative correlation in cluster A reflects the large number of negative correlations in this cluster (i.e., 27 of the 45 correlations were negative). At the other extreme, the large positive correlation of $.62$ in cluster H corresponds with our interpretation that the measures in this population are heavily influenced by a general factor, possibly response style. For those clusters with a good fit to the theoretically proposed circumplex (cluster D, F, and G), the minimum common score correlation varies from $-.20$ to $.04$, which may reflect the existence of response styles but not

to such a degree that would call the validity of the circular structure into question.

5 General Discussion

This study investigated, by means of a meta-analytical structural equation modelling approach, the validity of the circular structure of 10 basic values. Moreover, sources of heterogeneity of the correlations among these values were investigated with meta-regression and cluster analysis. Tests in the eight chosen clusters showed that the validity of the circular structure varied across the clusters with three clusters showing a good statistical and theoretical fit and notably two clusters clearly failing to fit the circular structure.

5.1 Clusters as Latent Subpopulations

One issue of concern is the meaning of the eight clusters. Whereas some clusters had a clear cultural profile (e.g., 79% Eastern European Studies in cluster B), most clusters were composed of several cultural regions, thus, rendering the meaning of the clusters ambiguous. In the same manner, the other sample and study characteristics were spread across the clusters rather unsystematically (e.g., use of the SVS in cluster H) but not implying a sharp contrast across the clusters as one would expect, for instance, PVQ clusters versus SVS clusters. On the other hand, the complex composition of the clusters shows that the validity of the circular structure cannot simply be attributed to cultural regions or the value measure used. Instead, the circumplex depends on interactions of culture and other characteristics. Examples were cluster H, in which the interaction of age and culture (i.e., Anglo and Latin American countries) resulted in highly correlated values, or cluster B that consisted only of Eastern European countries surveyed within the ESS.

However, the clusters' rather ambiguous profile does not contradict the validity of the cluster solution. The clusters, instead, can be regarded as unknown or latent subpopulations in which the circular model holds to a different degree. Moreover, as our results show, members of these subpopulations can belong to different cultures. Such an interpretation follows the literature on latent class analysis or finite mixture models (Goodman 2002; McLachlan and Peel 2000) which defines populations by linking individuals to distributions of variables or parameters of a model (e.g., a causal model or, as in the present case, a circular model) that hold for members of the population. Thus, a valuable future research goal could aim at identifying subpopulations with different correlations structures instead of focusing on prespecified cultural groups (Perrinjaquet et al. 2007).

Furthermore, future research could strive to investigate country level factors that influence the value structure (Schwartz 2006). It is plausible that the country characteristics or societal values or norms enforce linkages between individual values. For instance, the correlation between tradition and universalism could be enhanced by universalistic norms that are incorporated into customs. In the same manner, societal norms that embrace modernism, change, and innovation would lead to a stronger association between universalism and openness values and, hence, change the circular structure.

Beyond investigating the validity of the circular model, such approaches can have theoretical or methodological value. The theoretical value could consist in identifying populations with different meanings of values. For instance, the emerging two-factor solution in clusters B and C could imply that values in these populations can reflect a modernism versus traditionalism dimension.

5.2 Limitations of the Study

The study has the following limitations. First, we used correlation matrices calculated with observed sum scores that are contaminated by measurement error and may blur the

circular structure. Furthermore, we had to assume cross-country equivalence (Davidov et al. 2008; Steenkamp and Baumgartner 1998). Strictly, groups of individuals can only be compared regarding their correlation structure if a) the latent structure is similar across the groups, b) the factor loadings are equal, and c) the variances of the latent variables are equal (Marsh and Hocevar 1985; Steinmetz, Schmidt, Tina-Booh, Schwartz and Wieczorek 2009). By using observed sum scores, we had to assume the invariance of these parameters, rather than test for it.

Second, although we used cluster analysis to decrease the amount of heterogeneity, the omnibus test of homogeneity still indicated a substantial degree of within-cluster heterogeneity. Because we tested the circular structure with maximum likelihood estimated population correlation matrices, whether these estimates are unbiased when there is still heterogeneity in the data remains unknown. However, comparison with the weighted averages of the correlations showed that the maximum likelihood estimates were very similar to the averages.

Despite these limitations, the present study hopefully contributes to the literature by summarising existing evidence about relationships among human value and testing the circular structure with currently most sophisticated methods. By showing both fit with and divergence from the proposed structure, the study provides both support for Schwartz' theory and hopefully is able to stimulate future research.

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