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Values**

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A Test of the Circumplex Structure of Human Values

Abstract

Schwartz's value system has been widely used in different disciplines (e.g., psychology, management, and marketing). Although the value structure seems to be validated when data is analyzed through multidimensional scaling, the authors demonstrate, using a sample of Swiss respondents, that the factorial and circumplex structure of human values is not supported when confirmatory analysis approaches (e.g., CIRCUM and confirmatory factor analysis) are used. This paper provides some tentative explanations and makes suggestions as to possible improvements.

Keywords: Human values, circumplex structure, Schwartz's value system.

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Introduction

“Values are concepts or beliefs about desirable end states or behaviors that transcend specific situations, guide selection or evaluation of behavior and events, and are ordered by relative importance” (Schwartz & Bilsky, 1987, p. 551). Values represent the main goals that relate to all aspects of behavior (Kluckholm, 1951; Rokeach, 1973; Schwartz, 1992; Smith & Schwartz, 1997). Probably the most popular stream of research on individual values in the past 15 years has been conducted by Schwartz and colleagues (e.g., Schwartz, 1992, 1994; Schwartz & Bilsky, 1987, 1990; Schwartz & Sagiv, 1995). A study of “Social Science Citation Index” listings finds more than 590 quotations from Schwartz (1992) in journals during the period from March 1993 to October 2005. Building on and extending Rokeach’s (1973) work, Schwartz derived a typology of values. Ten types of values were identified as reflecting a continuum of related motivations: ‘self-direction,’ ‘stimulation,’ ‘hedonism,’ ‘achievement,’ ‘power,’ ‘security,’ ‘conformity,’ ‘tradition,’ ‘benevolence,’ and ‘universalism’ (see Schwartz (1992) for a complete description). This continuum gives rise to a (quasi) circumplex structure when presented graphically in a two-dimensional space (see Figure 1) that classifies value types by their degree of compatibility and conflict (Schwartz, 1992, 1994; Schwartz & Boehnke, 2004; Schwartz & Sagiv, 1995). For example, ‘achievement’ and ‘power’ are situated next to each other. The simultaneous pursuit of these value types is compatible because both involve intrinsic motivation for self-enhancement. Conversely, ‘power’ which emphasizes self-enhancement is located opposite to ‘universalism’ and ‘benevolence’ which reflect self-transcendence. Simultaneous pursuit of both groups of values would give rise to psychological and social conflict (Schwartz, 1992).

[Insert Figure 1 here]

A circumplex representation of data is based on assumptions about the nature of the constructs under investigation (Acton & Revelle, 2004; Larsen & Diener, 1992; Fabrigar, Visser, & Browne, 1997; Pincus, Gurtman, & Ruiz, 1998). The circumplex system was introduced by Guttman (1954), who described it as a “system of variance which has a circular law of order” (p. 325). According to Guttman, “in a circumplex system, variables would be of equal “complexity” (or rank) but would differ among themselves in the kind of content they define” (p. 260). A circumplex structure should meet three assumptions: (1) differences among variables are reducible to differences in two dimensions (the circle as a *minimal representation*), (2) all variables have equal projections (the *constant radius* property), and (3) discrete variables are uniformly distributed along the circle’s circumference (the *equal-spacing* property) (Gurtman, 1994; Fabrigar et al., 1997). All three assumptions must be met for a circumplex structure to be confirmed. When the variables are uniformly distributed along the circle’s circumference, the model is said to be *circulant*, and when the variables are not uniformly distributed, the model is said to be *quasi-circumplex* (Guttman, 1954). Schwartz and Boehnke (2004) mention that Schwartz’s value system (SVS) makes no assumption as to whether value types are spaced equally in a circulant model or unequally in a quasi-circumplex model. However, Schwartz (1994) explains that the number of items used to operationalize each value type depends on the breadth of the goal and the values that express this goal (e.g., 8 items for ‘universalism,’ but only 2 for ‘hedonism’), which implies unequal spacing.

The structure and content of SVS has received impressive empirical support in research, with 97 samples from 44 countries totaling more than 25,000 respondents (Schwartz, 1992, 1994; Schwartz & Sagiv, 1995). Moreover, SVS has been widely used in studies in psychology (e.g., Feather, 1995; Wilson, 2005), international management (e.g., Egri & Ralston, 2004; Ralston et

al., 1999), and marketing (e.g., Grunert & Juhl, 1995; Steenkamp, ter Hofstede, & Wedel, 1999), showing some predictive validity. However, some authors have questioned SVS psychometric properties, pointing out measurement and multicollinearity problems (e.g., Ben Slimane, El Akremi, & Touzani, 2002; Burroughs & Rindfleisch, 2002; Cable & Edwards, 2004; Odin, Vinais, & Valette-Florence, 1996; Olver & Mooradian, 2003; Thøgersen & Ölander, 2002). When using SVS, several authors compute value scores and higher order constructs by averaging items related to particular values (e.g., Feather, 1995; Steenkamp et al., 1999). As a consequence, measurement errors are left out (Hair et al., 1998), decreasing construct reliability and masking discriminant validity and multicollinearity problems (Edwards, 2001; Fischer & Smith, 2004; Peter, Churchill, & Brown, 1993). To the best of our knowledge, none of the studies using SVS tests both its psychometric properties and its circumplex structure.

Most empirical tests of the SVS circumplex structure are based on multidimensional scaling (MDS) (Schwartz & Boehnke, 2004 being an exception), which is mainly an exploratory technique (Gurtman & Pincus, 2000; Tracey, 2000; Young, 1987). The main objective of this article is to compare validations of the circumplex structure using one exploratory and two confirmatory data analysis methods, based on a large sample of Swiss respondents. Considered to be universal, the circumplex structure of SVS should be validated for Switzerland whichever exploratory or confirmatory statistical approach is applied (Denison & Fornell, 1990). The first section of this article presents previous tests of Schwartz's value system including the verification of its circumplex structure. The next section briefly presents the research instrument and sampling details. The third section follows the traditional multidimensional scaling (MDS) approach to SVS as applied to the Swiss data collected for this research. The fourth and fifth sections present confirmatory analyses respectively with CIRCUM and with a constrained

confirmatory factor analysis (CFA) based on structural equations. The last section discusses the findings and concludes with suggestions.

Previous Tests of Schwartz's Value System

Early measurement by Schwartz and Bilsky (1987, 1990) relied on 36 items based on Rokeach's (1973) work (RVS-36) to test the circumplex structure of values. Schwartz (1992) expanded the list of items to 56 (SVS-56) to cover the 10 value types to a greater extent. A 37-item abbreviated version (SVS-37) of this list is sometimes preferred in long questionnaires. Recently, Schwartz et al. (2001) and Spini and Doise (1998) replaced the value item 'detachment' with two items, 'private life' and 'self-indulgence,' to improve the reliability of the scale, bringing the total to 57 items (SVS-57). SVS was also tested using the Portrait Values Questionnaire (PVQ-29), which is cognitively less complex than the SVS because it presents short verbal portraits of 29 different people (Schwartz et al., 2001). Each portrait describes a person's goals, aspirations or wishes that point implicitly to the importance of a value. Schwartz et al. (2001) used PVQ-29 to provide an independent test of the content and structure of their theory of human values. Furthermore, a Short version of Schwartz's Value Survey (SSVS) has been proposed and evaluated by Lindeman and Verkasalo (2005), which consists in direct rating of the importance of the 10 value dimensions with their respective value items as descriptor.

Previous Empirical Assessments of SVS Content

In a series of multi-national studies using exploratory MDS techniques, Schwartz and colleagues established the content validity of the 10 value types and their circular nature (Bilsky & Schwartz, 1994; Prince-Gibson & Schwartz, 1998; Ros, Schwartz, & Surkiss, 1999; Schwartz, 1992, 1994; Schwartz & Bilsky, 1987, 1990; Schwartz & Sagiv, 1995; Schwartz et al., 2001;

Smith & Schwartz, 1997; Struch, Schwartz, & van der Kloot, 2002). Other authors also tested and found some support for Schwartz's values using MDS (Aavik & Allik, 2002; Bilsky & Koch, 2002; Bubeck & Bilsky, 2004; Burroughs & Rindfleisch, 2002; Grunert & Beckmann, 1999; Grunert & Juhl, 1995; Kozan & Ergin, 1999; Lindeman and Verkasalo, 2005). Spini and Doise (1998) and Devos, Spini, and Schwartz (2002) used a combination of MDS at the value item level and exploratory factor analysis (EFA) at the value type level to test the SVS structure. Misplaced items were identified based on MDS. Indices for the 10 value types were then derived, with the remaining items to be used in EFA. In both papers, a two-dimensional representation of the 10 value types, consistent with Schwartz's theoretical structure, was obtained. However, this two-dimensional representation only accounted for 46% of the total variance. Similarly, Allen and Ng (2003) used EFA (principal components analysis by alternating least square or PRINCALS) on sum scores and reported low reliability.

Gendre, Dupont, and Schwartz (1992) tested the structure of the terminal and instrumental values separately on a Swiss sample (172 respondents), using exploratory factor analysis at the value item level. They identified nine and eight factors respectively, matching Schwartz and Bilsky's (1987) value types relatively well. However, if EFA allows researchers to test the convergent and discriminant validity of a scale (Hair et al., 1998), it remains an exploratory technique unsuitable for formally testing a circumplex structure.

Schmitt et al. (1993) used CFA to test the reliability of the SVS, with data collected twice within a six-week interval from the same Israeli sample. They tested the reliability of each value type separately without testing the circumplex structure of the model. Such an approach is inappropriate because it fails to detect specification errors that occur across value dimensions and fails to reject misspecified items (Fornell & Yi, 1992; Kenny & McCoach, 2003).

Furthermore, discriminant validity cannot be evaluated (Kenny & McCoach, 2003). Spini (2003) used multigroup confirmatory factor analyses of unidimensional structural equation models to test the appropriateness of SVS as an instrument for cross-cultural research. His results show acceptable levels of equivalence across cultures for most value types taken separately. However, again, the circumplex structure of the value types was not tested.

Few studies have used confirmatory techniques to investigate the SVS structure. Test results are mixed at best (see Table 1). Odin et al. (1996) tested the structure and predictive validity of SVS using CFA based on a representative sample of the French population (2522 respondents). They showed that the model had a poor structural fit and needed to be respecified. After deleting several items and splitting some values into sub-values, the authors derived a more parsimonious (i.e., with a smaller number of items) model with a better fit. Both the original and modified models had little but significant predictive power as to consumption behaviors. However, the predictive power of the modified model was not significantly greater. Ben Slimane et al. (2002) used CFA to test the SVS structure in Tunisia. The original 10 value-type model fitted poorly even after having deleted 16 items with weak factor loadings or significant cross-loadings. In both the Odin et al. (1996) and the Ben Slimane et al. (2002) studies, the authors did not test the circumplex structure of SVS.

Tests of the Circumplex Structure of Schwartz's Value System

Tsai and Böckenholt (2002) tested the circumplex structure of SVS using Guttman's (1954) additive circumplex model based on the comparison of the 45 pairs formed on the basis of the combination of the ten value types. The circular ordering of value types more or less followed the theory with the exception of 'benevolence.' However, a χ^2 test showed that even the less constrained model fitted poorly, mainly because a larger than expected number of respondents

selected the indifference category when comparing two values. Tsai and Böckenholt (2002) formally tested the circumplex structure of SVS, however they could not test the factorial structure of the 56 value items because of the paired-comparisons used to collect the data.

In a recent study, Brunsø, Scholderer, and Grunert (2004) developed a new approach to test the circumplex structure of SVS, based on the assumption that the correlation pattern between the 10 ordered value types and an external variable can be approximated by a quadratic trend line. This quadratic trend line can then be tested using repeated-measures ANOVA. Based on two large samples from Germany and Spain, they found some support for the circumplex structure of SVS and significant relationships with the dimensions of a food-related lifestyle scale. However, only 30 items from SVS-56 were retained and sum scores for the 10 value types were used despite low reliability (average Cronbach alphas of .58 and .57). Moreover, the trend line was tested against a quadratic rather than sinusoidal function that would have been more appropriate (Gurtman, 1992; Wiggins, Steiger, & Gaelinck, 1981).

[Insert Table 1 here]

SVS is rarely validated within a full confirmatory framework that takes into account both measurement error and the circumplex nature of the factorial dimensions. A notable exception can be found in Schwartz and Boehnke (2004) who used constrained CFA to test the SVS circumplex structure. Despite the encouraging results obtained with this approach, the study has several limitations: (1) While CFAs confirm the existence of 10 value types, some goodness-of-fit indices show that the data poorly fits the 10 models tested ($\chi^2/df > 21.33$, Root Mean Square Error of Approximation (RMSEA) $> .061$) (Carmines & McIver, 1981; Hu & Bentler, 1999); (2) important CFA fit indices such as Comparative Fit Index (CFI), Goodness-of-Fit Index (GFI) or Adjusted Goodness-of-Fit Index (AGFI) are not provided, making it difficult to conclusively

assess model fit; (3) item loadings are below the recommended threshold of .6 (.56 and .53 on average) indicating possible lack of convergent validity (Bagozzi & Yi, 1988; Fornell & Larcker, 1981); (4) while items with inadequate factor loadings were appropriately deleted, the fate of items with significant cross-loadings is not addressed; finally (5) tests for discriminant validity are not provided although large correlations between adjacent value types are reported (average correlation is .68). Such multicollinearity may lead to nonsignificant coefficient estimates (even though the overall regression may be highly significant), reverse coefficient signs, and unstable parameter estimates (Grewal, Cote, & Baumgartner, 2004; Jagpal, 1982; Marsh et al., 2004). Based on the above account of the extant literature, it appears that further testing of the circumplex structure is needed.

Method

We assess the psychometric properties and the circumplex structure of SVS using both exploratory and confirmatory techniques. Following Schwartz's own work, MDS is used first. As an exploratory technique, MDS is appropriate as a screening device for most tests (Gurtman, 1994). Second, because MDS does not allow for the formal testing of the circumplex structure of SVS, we use CIRCUM, a CFA approach specifically developed to evaluate circumplex structures (Browne, 1992; Fabrigar et al., 1997). Finally, because CIRCUM cannot test the circumplex structure for the latent variables along with the simple factorial structure for the manifest variables (i.e., it does not take into account measurement error at the item level), we use AMOS 4.0 (Arbuckle & Wothke, 1999) to run a constrained CFA¹.

¹ Computations are available upon request.

Sample

The study was conducted in the French-speaking part of Switzerland. Survey data from self-administered questionnaires was collected from a sample of 1405 respondents. The male/female split was 60/40, students and non-student adults were equally represented, average age was 29.9 (standard deviation = 12.7). 14% had completed 8 years of education or less, 28 % between 9 and 12 years, 52% between 13 and 16 years (Bachelors), 4% held a Masters' degree and 1.5% a Doctoral degree.

Measurement

Individual values were measured using the French translation of the 56 value items SVS² previously used in Switzerland by Gendre et al. (1992). The instructions and scoring procedures developed by Schwartz (Schwartz & Sagiv 1995) were followed: value items were presented in two lists representing terminal values (30 items) and instrumental values (26 items), with a short explanation for each item. Value items from different value types were presented in mixed order and measured on 9-point Likert scales ranging from “opposed to my values” [-1] through “important” [3] to “very important” [6] and “of supreme importance” [7] as guiding principles in life. Prior to rating the value items on each list, respondents were asked to choose and rate their most and least important values as anchoring points (Munson & McIntyre, 1979).

²The 56-item version of the questionnaire was retained because it remains the most widely used by researchers (e.g., Egri & Ralston, 2004; Schultz et al., 2005).

Multidimensional Scaling

Following Schwartz (1992, 1994) and Schwartz and Sagiv (1995), MDS was used to compare the empirically derived circumplex structure with the theoretical SVS structure. MDS is a data reduction method similar to factor analysis (Davison, 1983; Schiffman, Reynolds, & Young, 1981) which helps to visualize the data structure. An overall assessment of the fit between theory and empirical data can be achieved using a “configurational verification” approach (Davison, 1983; Gurtman, 1994; Schwartz, 1992, 1994). MDS also helps to identify – and eventually eliminate – value items that are not located in their expected region (Feather, 1995; Grunert & Juhl, 1995).

Schiffman et al. (1981, pp. 238-239) show that available MDS programs provide quite similar results when data are not too noisy. However, ALSCAL (Takane, Young, & de Leeuw, 1977) provides more accurate results when data are noisy, which is often the case with a large number of items. For that reason, ALSCAL (SPSS) was used rather than the SSA algorithm (Borg & Lingoes, 1987) initially used by Schwartz. Prior to performing MDS, data were standardized within subjects as suggested by Hofstede (1980), Leung and Bond (1989), and Smith and Schwartz (1997) in order to correct for response set biases such as yea saying and extreme or median response styles (Baumgartner & Steenkamp, 2001; Schwartz et al., 1997).

Two goodness-of-fit measures, stress index (Kruskal, 1964) and total variance accounted for (squared multiple correlation or RSQ) (Borg & Lingoes, 1987), were used to check the interpretability of solutions. Schiffman et al. (1981) argue that RSQ is “the best indicator of how well the data fit the model” (p. 175). The empirical results for the two-dimensional solution postulated in Schwartz’s theory are in line with earlier SVS test results (e.g., Grunert & Juhl, 1995; Schwartz, 1992, 1994; Schwartz & Sagiv, 1995). For the two-dimensional solution, stress

is .34, which is comparable to the values reported by Schwartz (1992)³ and RSQ is .51 (RSQ coefficients were not reported by Schwartz). Stress coefficients should preferably be lower than .10 (Kruskal & Wish, 1978) and RSQ values higher than .60 (Hair et al., 1998), suggesting, as already noticed by Odin et al. (1996), that a larger number of dimensions would be more appropriate⁴. The first criterion for a circumplex structure (i.e., differences among variables should be reducible to differences in two dimensions; see Fabrigar et al., 1997) is therefore not met. However, Coxon (1982) suggests that there are no decisive rules for selecting the number of dimensions to be retained in MDS and Borg and Lingoes (1987) suggest that the interpretability of the solution is more important than usually accepted thresholds for stress and RSQ. Therefore, the two-dimensional solution may be deemed acceptable, given the clear circular structure displayed in Figure 2.

[Insert Figure 2 here]

To check whether this structure is similar to that postulated by Schwartz, boundary lines were set around spatial concentrations of value items for each value type, avoiding overlap between regions as much as possible (Lingoes, 1977, 1981), based on the same criteria as those proposed

³ Using Smallest Space Analysis (SSA), Schwartz (1992) reported stress coefficients ranging from .21 to .32. Because the ALSCAL algorithm minimizes Takane et al. (1977) SSTRESS formula and SSA algorithm minimizes Kruskal's (1964) SFORM 1 stress coefficient, ALSCAL provides solutions with higher stress. Therefore, an SSA-based software, MINISSA (MDSx version), was used. Results were graphically similar to those from ALSCAL. A stress of .25 was obtained.

⁴ MDS analyses with ALSCAL were undertaken for 3, 4, and 5 dimensions. There were significant improvements when the number of dimensions increased: stress .23 and RSQ .62 for 3 dimensions, stress .17 and RSQ .70 for 4 dimensions, stress .13 and RSQ .77 for 5 dimensions. Using MINISSA, stress coefficients of .17, .13, and .10 were obtained for solutions with 3, 4, and 5 dimensions.

by Schwartz (1992, see p. 22 for details). In Figure 2, the partition lines between value types are drawn according to the a priori assignment of specific value items to each value type.

Following Schwartz (1992), value types with overlapping items were combined, resulting in seven distinct regions: ‘universalism,’ ‘benevolence and tradition,’ ‘conformity,’ ‘security,’ ‘achievement and power,’ ‘stimulation and hedonism,’ and ‘self-direction.’ In accordance with Schwartz’s own criteria, the joint domain of ‘stimulation and hedonism’ and the value type ‘self-direction’ were not confirmed.

Moreover, 25% of the value items (14 out of 56) were misplaced, i.e. they were found in regions other than expected: Ten items (BE8, BE6, UN6, SE5, SE7, PO4, AC4, SD4, SD5, and SD6) were slightly misplaced in adjacent regions, thus did not need to be deleted (Grunert & Juhl, 1995; Schwartz, 1992; Schwartz & Sagiv, 1995). Four items (SE6, TR6, BE7, and BE9) were badly misplaced in more distant regions and thus were deleted before further analyses. These empirical results are in line with previous studies presented in Table 1. For example, in the 40 samples reported by Schwartz (1992), 11.63% of the items were misplaced. In the 97 samples studied by Schwartz (1994), only 44 value items were located in their corresponding region in at least 75% of samples. When including locations in adjacent regions, only 47 items showed consistent meanings across at least 83% of samples. In Schwartz and Sagiv (1995), 13 value items were deleted. Our study confirms the expected compatibilities between values (i.e., value regions are adjacent), as well as their expected conflicts (i.e. value regions are in opposite

locations). Indeed, the order of values is the same as in Schwartz's theory⁵. Table 2 summarizes our findings and highlights whether SVS items are situated in their appropriate value domain.

[Insert Table 2 here]

To assess the ordering of the 10 value types, Schwartz (1992, pp. 30-31) also developed a goodness-of-fit measure: the minimal number of single inversions in the ordering of adjacent value types (called "moves") that would be required to make the observed order match the ideal order. In the present study, 1.5 moves are required to obtain the ideal order. Our findings are comparable to those reported in the literature: the median number of moves of the 97 samples reported in Schwartz (1994) is 1.7 and 1.88 in the 88 samples reported in Schwartz and Sagiv (1995).

Following Schwartz's (1992) own criteria, the SVS circular structure is thus supported. However, since MDS is a data exploration and mapping technique, it cannot be used to characterize a configuration as circumplex on the sole basis of visual inspection (Bezembinder & Jeurissen, 2003; Fabrigar et al., 1997; Tracey, 2000). The use of MDS as a method to test for circumplex structures has been criticized because it tends to produce curved patterns (Hubert, Arabie, & Muelman, 1998) and thus is biased toward yielding circular structures (Tracey, 2000). According to Fabrigar et al. (1997, p. 190), measures of goodness-of-fit used in MDS, such as indices of stress, "are not particularly informative with respect to circumplex structure, because these indices merely assess the goodness-of-fit of a two-dimensional scaling solution. No restriction is placed on the solution that the object must be located along the circumference of a circle in a

⁵ MDS was applied separately on the student and non-student sub-samples, revealing no significant differences. For that reason, only global results are reported.

two-dimensional space. Thus the goodness-of-fit could be excellent even though the data do not have a circumplex structure”. It is therefore appropriate to use confirmatory data analysis to formally test the circumplex structure of SVS.

Confirmatory Factor Analysis with CIRCUM

Testing Circumplex Structures with CIRCUM

The second step was to test the SVS structure using a circumplex structure analysis based on a correlation matrix. CIRCUM (Browne, 1992; Browne & Cudeck, 1992) was specifically designed to test circumplex models using Fourier series correlation functions. It provides maximum likelihood (ML) parameter estimations and several goodness-of-fit indices. Unlike those provided by MDS, the CIRCUM fit indices are quite informative because the model tested corresponds to a circular representation of the data in which the correlation among variables is a function of their distance on the circle (Fabrigar et al., 1997). CIRCUM is widely used to test circumplex data structures for personality and other psychological constructs (e.g., Acton & Revelle, 2002; Ekkekakis, Hall, & Petruzzello, 2005; Gurtman & Pincus, 2000; Remington, Fabrigar, & Visser, 2000; Strack, Choca, & Gurtman, 2001).

CIRCUM does not test the circumplex structure for the latent variables together with the simple factorial structure for the manifest variables (i.e., it does not take into account measurement error of the individual manifest variables). However, because most of the studies using SVS average out value item scores to compute value type indices (e.g., Feather, 1995; Steenkamp et al., 1999), it is important to directly test the circumplex structure of the 10 value types, independently from item structure. Even if this procedure treats the error variances as known parameters rather than values that are statistically estimated (Bagozzi & Edwards, 1998; Kenny & McCoach, 2003), it is

valid because SVS postulates a circumplex structure at the latent variable level, not at the manifest variable level (Schwartz & Boehnke, 2004). This technique also has the advantage of being simple, but requires that value items share enough common variance (Bagozzi & Edwards, 1998).

Following the recommended procedure (e.g., Feather, 1995, Schwartz & Sagiv, 1995), indices were computed for each of the 10 value types by averaging the scores of items retained from the MDS. Before computing the indices, error variances were estimated by computing their reliability (Bagozzi & Edwards, 1998), resulting in alpha coefficients (Cronbach, 1951) ranging from .483 for 'tradition' to .742 for 'universalism' (UN = .742, BE = .661, TR = .483, CO = .667, SE = .621, AC = .631, PO = .734, HE .576, ST = .717, SD = .612). The generally accepted threshold for Cronbach's alpha is .70, although this limit may be lowered to .60 in exploratory research (Nunnally, 1978; Robinson, Shaver, & Wrightsman, 1991). Such values for alpha coefficients show that value items share some common variance and are therefore a basis for averaging value items. However, they indicate a relatively weak reliability for most of the value types.

Using CIRCUM, a three-component model ($m=3$) was specified; it is the least restrictive and most widely used model for testing a circumplex structure (Browne, 1992). Furthermore, additional free parameters did not improve the model fit. The equal spacing - equal communalities (circulant) model was first tested. The equal spacing constraint (variables are uniformly distributed around the circle) was then relaxed. Finally, both constraints were relaxed.

Consistent with common practice (Byrne, 2001; Hu & Bentler, 1999), multiple indices have been used to estimate model fit, including (1) χ^2 likelihood ratio; (2) F_0 , the maximum likelihood discrepancy function, which is a measure of absolute fit; (3) GFI (Jöreskog & Sörbom, 1986),

which is analogous to a squared multiple correlation; (4) AGFI (Jöreskog & Sörbom, 1986), which is a parsimony weighted measure of model fit (both GFI and AGFI were computed from formulas presented in Maiti & Mukherjee, 1990); (5) RMSEA (Browne & Cudeck, 1992; Steiger & Lind, 1980), which is also a parsimony weighted measure of model fit; and (6) Normed Fit Index (NFI) (Bentler, 1990), which is a measure of incremental fit often used to compare nested models (here the circulant model, i.e., equally spaced with equal communalities, is used as baseline for comparison).

Empirical Findings from Circum

Table 3 presents the fit indices for the three different models. As indicated in the table, the highly constrained model does not fit the data very well. While GFI is slightly above conventional standards ($> .90$), AGFI is smaller than $.90$, indicating a lack of parsimony due to the constraints (Hu & Bentler, 1999). Furthermore, RMSEA remains far too high ($.106$), given that it should be below $.06$ (Hu & Bentler, 1999)⁶. Removing the equal-spacing constraint (quasi-circumplex model) leads to a small improvement in the model fit (see NFI), GFI and AGFI both improve beyond the $.90$ standard. However, the RMSEA still remains too high ($.096$). Finally, relaxing the equal communalities further improves model fit, however still not with an acceptable level for RMSEA ($.090$). These results are consistent with those of Tsai and Böckenholt (2002), who tested the SVS circumplex structure using Guttman's (1954) additive model, which is comparable to the Fourier series correlation functions used by CIRCUM (Browne, 1992).

⁶ Browne and Cudeck (1992) suggest that RMSEA should ideally be below $.05$, acceptably below $.08$ and coefficients greater than $.10$ constitute poor model fit. However, using simulations, Hu and Bentler (1999) show that when using a cutoff point of $.07$ or $.08$, RMSEA substantially underrejects misspecified models.

[Insert Table 3 here]

Goodness-of-fit indices provide little support for a circular ordering of values. Since they do not provide information as to whether the actual location of values is consistent with Schwartz's theoretical model, the extent to which value locations depart from the equally spaced model should also be established. The polar angles for the 10 values in each of the three models are summarized in Table 4. Figure 3 graphically represents the polar angles of the unequally spaced - unequal communalities (unconstrained) model, which has the best fit indices. 'Universalism' was used as the reference variable (location set at 0°).

[Insert Table 4 and Figure 3 here]

The results show that the ordering of the values is consistent with Schwartz's theory. However, the differences between the angles of the two unequally spaced models and those of the equally spaced model are relatively important. Examining the unequally spaced-unequal communalities model representation (Figure 3), it should be noted that 'achievement' and 'power' (6°) as well as 'universalism' and 'benevolence' (12°) are very close to each other. On the other hand, 'tradition' and 'conformity' (22°) are clearly separate from one another. This is in contradiction with the "definitive" model proposed by Schwartz (1992) and tested by Schwartz and Boehnke (2004), which hypothesized that these two values should be located at the same polar angle. However, deviations from the ideal model are consistent with those in the graphical representation of the MDS results shown in Figure 2, where 'achievement' and 'power' already formed a joint domain. The other two joint domains from the MDS, 'stimulation' and 'hedonism' (24°) and 'benevolence' and 'tradition' (22°) are also closer than postulated by a circumplex structure (equally spaced).

Another useful piece of information provided by CIRCUM is the communality indices of the measured variables. These indices represent the correlation between each measured variable and its common score (Fabrigar et al., 1997). When squared, the communality indices represent the amount of common variance in each measured variable. The larger the index, the greater the common score variance and, thus, the less unique variance present in each measured variable. Indices estimates in Table 4 point to measurement error in the 10 value types. In the next section we test the circumplex structure of the value dimensions with AMOS by simultaneously estimating the factorial structure of the value items and their measurement error. It is to be noted that values with the smallest communality indices ('tradition' and 'hedonism') also have the smallest reliability indices (Cronbach alpha).

No constraints were placed on the minimum common score correlation (i.e., the correlation between variables at 180°) (Browne, 1992). The three models have minimum common score correlations of .231, .121, and .139 respectively, which are far from the ideal circulant model value of -1.

Constrained Confirmatory Factor Analysis

As mentioned earlier, CIRCUM was not designed to test the circumplex structure for latent variables together with the simple factorial structure for manifest variables. The averaging procedure used in computing the value types assumes that they are free from measurement error (Kenny & McCoach, 2003). This procedure may not provide adequate representation of constructs due to possible lack of reliability and validity, resulting in highly biased estimates (Bagozzi & Edwards, 1998; Bollen, 1989; Grewal et al., 2004; MacCallum & Austin, 2000). To overcome this weakness, we used constrained CFA (see Gaines et al., 1997; Tracey, 2000; Wiggins et al., 1981). The evaluation of circumplex models using structural equation modeling

was first proposed by Jöreskog (1974) and first applied by Wiggins et al. (1981). The test of a circulant model using structural equation modeling can be performed by specifying a reference matrix of expected value correlations and by testing the fit of the reference matrix to the observed data (Jöreskog, 1974, 1978). As mentioned earlier, such an approach was recently used by Schwartz and Boehnke (2004) to test the circumplex structure of SVS, although with ambiguous results.

A Three-Step Approach to Constrained Confirmatory Factor Analysis

To test the circumplex structure of the SVS, three steps were taken. A first reference matrix was specified to test an ideal circulant model in which opposed values were perfectly negatively correlated (Gaines et al., 1997). Gurtman's (2001) A statistic was used to compute the expected intercorrelations between all pairs of values, with $A = (90 - D)/90$, where D is the angular discrepancy in degrees⁷. A statistics are presented above the diagonal in Table 5. A second reference matrix was specified to test an empirical circulant model based on a data-driven

⁷ As discussed in Gurtman (2001), a number of measures can be used to compute the expected intercorrelations between all pairs of values for this ideal circulant model, assuming that they are a monotonic function of angular discrepancy between pairs of values. Earlier papers by Gurtman and colleagues (Gurtman, 1992, 1993, 1994; Pincus et al., 1998) propose the cosine difference (already used by Wiggins et al., 1981) as a measure of circular correlation as it has the desirable properties of ranging from -1 to +1. This measure was also used by Gaines et al. (1997) to test the circumplexity of interpersonal traits using constrained CFA. This measure is a special case of the Fourier series correlation function used in CIRCUM (Browne, 1992; Fabrigar et al., 1997). However, as noted by Gurtman (2001), it is not linearly related to angular discrepancy throughout its continuum. Instead A is proportional (Wagner, Kiesler, & Schmidt, 1995) and nearly coincides with the cosine correlation throughout much of its range (Gurtman, 2001). Hoyt et al. (1993) suggest a measure similar to A based on the chord distance rather than the angular discrepancy. However, this measure is implicitly based on a polygon rather than a circular representation and is not linearly scaled to the angular discrepancy (Gurtman, 2001). To verify this, we also tested the ideal circulant model using an intercorrelation matrix calculated with the cosine difference. Results were not significantly different from those derived from the A statistic.

approach identical to that used by Schwartz and Boehnke (2004) given that the ideal circumplex model, with its perfect negative correlations assumption, is very restrictive (Schwartz & Boehnke, 2004; Wiggins et al., 1981) and because Schwartz et al. (1997) identified the presence of some response style bias (resulting in a positive correlation between value item scores). The average intercorrelation between all adjacent values was computed, yielding a reference correlation of .72 (maximum correlation). The same procedure was applied to all pairs of opposing values, resulting in a reference correlation of .23 (minimum correlation). The distances between pairs of values were then computed by dividing the difference between the maximum and the minimum correlations, yielding the following correlations: .60, .47, and .35. The expected intercorrelations between all pairs of values of this empirical circumplex matrix are presented below the diagonal in Table 5. Third, As a means of comparison, a quasi-circumplex model was tested, with freely estimated correlations between all pairs of values (unequally spaced-equal communalities). A completely free (unequally spaced-unequal communalities) non-circumplex model could not be estimated due to under-identification (Bollen & Jöreskog, 1985; Hair et al., 1998). There was no need to test a modified quasi-circumplex model with ‘tradition’ and ‘conformity’ at the same polar angle as Schwartz and Boehnke (2004), because the results obtained with MDS and CIRCUM show that these two dimensions are indeed distinct.

Since MDS and reliability analyses revealed that some value items did not load properly on their expected value dimension, the above three models were tested on the full 56-item structure, on the 52 items structure retained from the MDS analysis, and finally on the 32 items structure with salient loadings higher than .40 (Schwartz & Boehnke, 2004) and cross-loadings smaller than .25 (Hair et al., 1998; Hinkin, 1995; Nunnally, 1978). AMOS 4.0 software (Arbuckle & Wothke, 1999) and maximum likelihood (ML) estimation were used for all models. ML estimation was

used because of its robustness when the data deviate from multivariate normality (Browne & Shapiro, 1988; McDonald & Ho, 2002). To test the ideal circumplex and empirical circumplex models, the correlations between the value dimensions were constrained, based on the reference matrices presented in Table 5, in order to ensure equal spacing. For all three models, the variances of the value dimensions were constrained to 1 to ensure equal communalities. Moreover, as noted by Gaines et al. (1997), the ideal circumplex model cannot be directly estimated because the covariance matrix of the constraints is non-positive definite. To solve this problem, Gaines et al. (1997) recommend computing the parameters using ridge estimation (Jöreskog & Sörbom, 1989; McQuitty, 1997; Wothke, 1993). Ridge estimation introduces a small bias (it affects the χ^2 of the model as well as other fit indices such as GFI) in return for greater efficiency (Grewal et al., 2004). A ridge constant of .05 was specified, which is small enough to minimize its effect on model fit indices (McQuitty, 1997).

Multicollinearity Issues

The estimation of the parameters for the quasi-circumplex model was problematic due to high correlations between adjacent value types, suggesting high levels of multicollinearity (Grewal et al., 2004; Jagpal, 1982; Marsh et al., 2004). To check for multicollinearity, we examined conditioning indices and variance-decomposition proportions associated with each value types (see Belsley, 1991 and Belsley, Kuh, & Welsch, 1980 for a discussion). According to Belsley (1991), a conditioning index greater than 30 and at least two variance-decomposition proportions greater than .5 for cases when there is only one near dependency, or the sum of the variance-decomposition proportions greater than .5 when there are several competing near dependencies indicate serious multicollinearity. In our 56-item data, 4 conditioning indices exceed 30 (41.2 for 'benevolence,' 35.0 for 'security,' 34.2 for 'universalism,' and 32.4 for 'self-direction') and one

was close to this value (29.5 for ‘achievement’). An examination of the variance-decomposition proportions shows that there is serious multicollinearity between ‘security,’ ‘universalism,’ ‘self-direction,’ and ‘achievement’ as well as between ‘benevolence’ and the intercept term, which indicates the presence of a social desirability bias. The same value types present multicollinearity in the 52- and 32 item data sets. In the 32 item data set, multicollinearity between ‘security,’ ‘universalism,’ ‘self-direction,’ and ‘achievement’ is reduced to an acceptable level (conditioning indices smaller than 29.5), however not between ‘benevolence’ and the intercept term (conditioning index = 37.4). A close examination of conditioning indices and variance-decomposition proportions at value-item level shows that multicollinearity problems are mainly caused by seven items: BE2 (‘honest’), BE4 (‘loyal’), BE5 (‘responsible’), BE7 (‘true friendship’), SE7 (‘healthy’), AC2 (‘capable’), and SD3 (‘freedom’).

A recommended ad-hoc solution to counter multicollinearity in structural equation modeling is to add constraints to the model (Grewal et al., 2004; Krishnamurthi & Rangaswamy, 1987). Two constraints were therefore imposed on the correlation matrix to minimize this problem and to obtain stable parameter estimates: nonnegativity (offending values fixed at .05) and correlation below .80 (Dillon, Kumar, & Mulani, 1987; Fornell, 1983; Gerbing & Anderson, 1987; Wothke, 1993).

[Insert Table 5 here]

Finally, in all models, the error terms for UN1 (protecting the environment) and UN2 (unity with nature) were allowed to correlate (Bagozzi, 1981; Cheung & Rensvold, 2001; Fornell, 1983), considering that these measures may share variance unique to the protection of the environment in addition to ‘universalism.’ Previous studies (e.g., Schwartz, Sagiv, & Boehnke, 2000) identified the presence of two subtypes (‘social concern’ and ‘nature’) within ‘universalism.’ The

subtype ‘nature’ (including value items UN1 and UN2) was more strongly associated with environmental attitudes and actions than other ‘universalism’ items (Schwartz & Boehnke, 2004). To test their ninth model, Schwartz and Boehnke (2004) also freed the covariances between error terms for the items composing these two subtypes of ‘universalism’, and found support for their distinctiveness. As expected, freeing this covariance also significantly improved the fit indices of the models in the present study (Cheung & Rensvold, 2001).

Assessing Model Fit

At first, as a means of comparison, the same indices as those reported by Schwartz and Boehnke (2004) and recommended by Hu and Bentler (1998, 1999) were computed: the χ^2 statistic and χ^2/df (conventional cutoff point below 3; Carmines & McIver, 1981), the Standardized Root Mean Squared Residual (SRMR), RMSEA, and the Akaike Information Criterion (AIC). Furthermore, to be able to compare CFA results with those obtained from CIRCUM, several additional fit indices are reported, such as GFI, AGFI, and NFI. We also used Non-Normed Fit Index (NNFI⁸) and CFI, a large selection of model fit indices being necessary because most fit indices exhibit some kind of bias (MacCallum & Austin, 2000; Marsh, Hau, & Wen, 2004). RMSEA and SRMR decrease (i.e., improve) with the number of items and variables in the model (Anderson & Gerbing, 1984; Breivik & Olsson, 2001; Kenny & McCoach, 2003). Schwartz and Boehnke (2004) use RMSEA and SRMR on the ground that they are relatively insensitive to sample size. However, since SVS has a large number of items, RMSEA and SRMR are generally biased downwards. Despite this “favorable” bias, RMSEAs and SRMRs in both their and our

⁸ NNFI (Bentler & Bonett, 1980) is also known as the Tucker-Lewis index (TLI) (Tucker & Lewis, 1973).

study are generally above maximum thresholds recommended (.05 for RMSEA and .08 for SRMR; Browne & Cudeck, 1992; Hu & Bentler, 1999). GFI and AGFI have been discarded by Schwartz and Boehnke (2004) on the ground that they increase (i.e., improve) with sample size. However, they are relatively stable as the number of items and variables in the model increases (Fan, Thompson, & Wang, 1999; Hu & Bentler, 1999; Kenny & McCoach, 2003). Since sample size is large in our data set, GFIs and AGFIs are biased upward. Despite this “favorable” bias, GFIs and AGFIs in our study are generally below minimum thresholds recommended (.90 for GFI and AGFI; Hu & Bentler, 1999). We also use CFI (conventional cutoff point at .95), NFI and NNFI (both with a conventional cutoff point at .90) because they have been shown to be robust to sample size (Hu & Bentler, 1998; Fan et al., 1999) and number of items and variables (Anderson & Gerbing, 1984; Kenny & McCoach, 2003).

The fit indices for the ideal circulant models are presented in Table 6D. The results show that all three models (56, 52, and 32 items) display inadequate levels of fit. The overall fit indices GFI and AGFI range from .610 to .711, χ^2/df are close to or larger than 10, RMSEA are all larger than .79, and SRMR are larger than .132. For the incremental indices, CFI, NFI, and NNFI are smaller than .412 and AIC are larger with values between 6911.9 and 14719.2.

[Insert Table 6 here]

The fit indices for the empirical circulant model are presented in Table 6E. Relaxing the correlation constraint of -1 for opposing values improves the fit of the empirical circulant models compared to the ideal circulant models. The different fit indices, however, display conflicting results: On the one hand, RMSEA and SRMR provide acceptable levels of fit between .058 and .060 and between .073 and .081, respectively. On the other hand, χ^2/df ranges from 5.769 to 6.003 and GFI and AGFI from .762 to .884. The comparative indices also display inadequate

levels of fit: CFI, NFI and NNFI range between .603 and .792 (when they should be in any case above .9) and AIC values are larger than 2,827.3. Again, the results show that after scale purification, the data better fit the models, except for χ^2/df , SRMR, and RMSEA. This shows that these three indices are sensitive to the number of items and that the models should not be accepted only on the basis of these indices. Furthermore, when comparing these results with those obtained with CIRCUM, an opposite relationship appeared in the fit indices. With CIRCUM, GFI and AGFI results are better than RMSEA results. Because in CIRCUM value items are aggregated at the factor level, the fit indices are not influenced by the number of items and therefore exhibit more reliable results.

For both, the ideal circulant and empirical circulant models, we used a ridge constant to overcome the problem caused by the correlation matrix being non-positive definite. Although ridge estimation is now commonly incorporated into structural equation modeling programs such as LISREL to deal with issues of multicollinearity, little is actually known about the practical benefits of using ridge estimation in structural equation models (Grewal et al., 2004; Kennedy, 1992). However, McQuitty (1997) shows that ridge estimation does not have a significant effect on coefficient estimates, but inflates the model's fit indices. In the present study, this is not critical because none of the models exhibit acceptable levels of fit. Both circulant models should be rejected irrespectively of the scale purification technique.

Finally, a quasi-circumplex model was tested, in which the equal spacing constraint was relaxed. Relaxing the constraint resulted in a positive definite covariance matrix, which could be estimated using ML estimation without a ridge constant. The fit indices for this quasi-circumplex model are presented in Table 6F. Compared to the ideal and empirical circulant models, the release of the equal spacing constraint improves the fit indices. However, fit indices remain

relatively weak for the 56 and 52-item models, except for RMSEA (.058 and .056) and SRMR (.069 and .065). χ^2/df , GFI, AGFI, CFI, NFI, and NNFI do not reach their cut-off value and AIC is too high. The 32-item model reaches slightly better levels of fit for RMSEA (.051) and SRMR (.051) and almost acceptable levels for GFI (.914), AGFI (.893), CFI (.855), NFI (.824), and NNFI (.830). AIC (2,191.6) is improved, but χ^2/df remains above 3 with a value of 4.685. The error terms for UN1 and UN2 were allowed to correlate, which may have led to an artificial inflation of the fit of the models (Fornell, 1983). The pattern in the model fit indices leans toward rejecting the model. Indeed, the most robust indices in terms of sample size and models size (number of items and factors) are also those with the lowest index values. The high values of GFI and AGFI are likely to be due to sample size and the low values for χ^2/df , SRMR, and RMSEA are likely to be due to the large number of items and the large number of factors.

Construct Reliability and Discriminant Validity

Because relaxing the equal spacing constraint resulted in multicollinearity, as shown by conditioning indices, construct reliability and validity as well as discriminant validity of the 32 items and 10-value types scale must be evaluated. Table 7 presents standardized loadings for the 32-item quasi-circumplex model. All value items have significant loadings on their hypothesized factor, as expected since items were retained only when factor loadings were equal to or greater than .40. However, 15 of the 32 items do not reach the .60-level recommended by Bagozzi and Yi (1988) to ensure construct reliability, raising some questions about the reliability of SVS. The construct reliability of value types was further assessed using alpha (Cronbach, 1951) and rho coefficients (Jöreskog, 1971). As shown in Table 7, all but two coefficients (those of ‘universalism’ and ‘stimulation’) fail to reach the recommended .70 level (Fornell & Larcker, 1981; Nunnally, 1978; Ping 2004). A test to assess construct validity was conducted by

examining the average variance extracted (AVE) for each value type (Fornell & Larcker 1981; Ping 2004). None of the AVE reaches the recommended level of .50 (Fornell & Larcker 1981), providing no support for the convergent validity of the SVS measures.

[Insert Table 7 here]

Multicollinearity is closely related to discriminant validity (Grewal et al., 2004). If items are too correlated across value types, they lack discriminant validity. To test the discriminant validity of value types, shared variance (squared correlation) between pairs of constructs was compared with the corresponding AVE (Fornell & Larcker, 1981). Out of the 45 possible pairs of value types, 14 (or 31%) lack discriminant validity. Furthermore, out of the 10 pairs of adjacent value types, 7 (or 70%) lack discriminant validity: ‘self-direction-stimulation,’ ‘stimulation-hedonism,’ ‘achievement-power,’ ‘power-security,’ ‘security-conformity,’ ‘conformity-tradition,’ and ‘benevolence-universalism.’ This clearly illustrates the lack of discriminant validity of SVS value types due to multicollinearity.

Discussion and Conclusion

In this article, the circumplex structure and the psychometric properties of SVS were tested using exploratory and confirmatory statistical approaches. As mentioned in the introduction, a circumplex structure should meet three conceptual assumptions: (1) differences among variables should be reducible to differences in two dimensions, (2) all variables should have equal projections, and (3) discretely measured variables should be uniformly distributed along the circle’s circumference.

We started our analysis by using MDS, with relatively good graphical display but unsatisfactory fit indices. More specifically, differences among values could not be reduced to differences in

two dimensions, not meeting the first criterion for a circumplex structure. Because MDS does not allow us to formally test the circumplex structure of SVS and because the graphical display of the values was deemed acceptable, this first analysis was complemented with CIRCUM, a confirmatory technique specifically developed to test circumplex structures. Three different models were tested: a strongly constrained circulant model, a quasi-circumplex model, and finally, an unconstrained model. Among these three models, only the unequally spaced - unequal communalities model comes close to acceptable levels of fit. None of the three conditions for a circumplex structure was met.

However, because CIRCUM could not test the circumplex structure for the latent variables together with the simple factorial structure of the manifest variables, confirmatory factor analyses were conducted using AMOS. Three different models were tested, an ideal circulant model, an empirical circulant model, and finally a quasi-circumplex model, using different item purification techniques. Both the ideal and the empirical circulant models had poor fits independently of the level of purification of the items, leading to the rejection of the equal spacing hypothesis. The quasi-circumplex model which relaxes the equal spacing constraint provided significantly better results. Only the model with the most restrictive purification technique (i.e., salient loadings larger than .4 and cross-loadings smaller than .25 resulting in a 32-item scale) comes close to an acceptable level of fit. However, only a measurement model was estimated. The fit indices are expected to decrease and reach unacceptable levels when nesting such a measurement model into a structural model (Anderson & Gerbing, 1988; Fornell & Yi, 1992). Finally, the reliability of the measures as well as their construct and discriminant validity were tested. Results show that the measures have low levels of reliability and weak construct and discriminant validity.

Overall, the findings show that while exploratory approaches to test SVS circumplex structure provide acceptable results (as was already supported by the literature, see Table 1), confirmatory tests provide weak support, mainly due to problems of construct and discriminant validity, resulting from multicollinearity between value types.

In practice, to solve problems of discriminant validity and multicollinearity, researchers usually average value items to compute value dimensions and higher order constructs, even when they identify weak construct reliability (e.g., Feather, 1995; Steenkamp et al., 1999). This approach is not recommended as it results in masking measurement problems (Grewal et al., 2004).

As stated by Grewal et al. (2004), nothing can replace good quality measures and researchers should make every attempt to use reliable and valid measures of well identified constructs. Several factors could be the cause of the weak results of this study and identifying them may, therefore, provide the opportunity to improve the SVS scale: First, the number of value types (10) is probably too large to be practical and to ensure discriminant validity. In a 10 dimension-circumplex model, the intercorrelations between adjacent value types are .60, which is too high. Grewal et al. (2004) demonstrated that when multicollinearity is between .60 and .80, Type II error levels can be substantial (greater than 50% and frequently above 80%) when construct reliability is weak (.70 or lower). A model with 8 dimensions would reduce these intercorrelations to .50, which should ensure discriminant validity (assuming an acceptable level of construct validity) and significantly reduce multicollinearity problems without losing too much substance.

A second issue is the reliability of the value items. The number of items measuring the 10 values ranges from 2 for ‘hedonism’⁹ to 9 for ‘universalism’ and ‘benevolence,’ raising reliability and discriminant validity issues. Several value items have weak loadings on their value dimension, others have important cross-loadings, which amplify the problem of multicollinearity. This reliability issue may be exacerbated by the length of the SVS instrument (Bouckennooghe et al., 2005; Stern, Dietz, & Guagnano, 1998; Van den Broeck, Vanderheyden, & Cools, 2003). When integrated into a survey, the total number of items may easily reach 100 (Burroughs & Rindfleisch, 2002), resulting in respondent fatigue. A shorter scale with more focused items should allow reducing response biases produced by respondent fatigue and carelessness (Hinkin, 1995). Schwartz et al. (2001) also acknowledge that the SVS may be psychologically too demanding for some respondents, which may result in reliability problems.

Schwartz’s value theory has a very significant conceptual appeal, however the SVS scale as a psychometric instrument has some important weaknesses. Reducing the number of value dimensions to 8, (for instance by combining ‘tradition’ and ‘conformity’ into a parcel (Bagozzi & Edwards, 1998; Hall, Snell, & Foust, 1999) and deleting hedonism) and respecifying some value items are necessary to improve the psychometric properties of the scale. Such an improved measurement tool should provide better foundations for the testing of the circumplex structure of human values. The need for improvement was confirmed in the past and a few attempts have been made. PVQ (Schwartz et al., 2001), Personal Striving Value Survey (PSVS) (Oishi et al., 1998), and SSVS (Lindeman and Verkasalo, 2005) are, in this matter, already an improvement.

⁹ A third item ‘self-indulgence’ has recently been added to ‘hedonism’ in the latest version of the SVS (see Spini, 2003; Schwartz et al., 2001; Schwartz & Boehnke, 2004).

However, further research still needs to test the circumplex structure of human values as measured by these new instruments.

Finally, an important validity criterion for a scale is nomological validity (Cronbach & Meehl, 1955; Gurtman, 1992; Brunsø et al., 2004). The predictive validity of SVS has already been assessed in several studies. However, given the potential presence of unstable parameter estimates resulting from multicollinearity (Grewal et al., 2004; Jagpal, 1982; Marsh et al., 2004), new tests are necessary.

The present study also has some limitations that offer opportunities for further research. One of these limitations is that the structure of SVS was tested in only one country, namely Switzerland. Our reasoning was that if this structure were universal, as claimed by Schwartz and colleagues (e.g., Schwartz & Bilsky, 1987, 1990; Schwartz, 1992, 1994), it should be valid in any country. This was supported by the MDS analysis, which yielded results comparable to those found in previous studies. However, using a cross-cultural sample may provide a stronger inference, discounting possible problems related to cross-cultural equivalence (Spini, 2003; Steenkamp & Baumgartner, 1998).

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Table 1. Main Studies Testing Schwartz' Value System

Author(s)	Country	Sample	Method	Results
Schwartz & Bilsky (1987)	2 countries (Israel and Germany)	786 (455 + 331)	MDS (SSA) in each country separately – RVS-36	7 value types and distinction between terminal and instrumental values. Only 1 value item in the German sample was misplaced.
Schwartz & Bilsky (1990)	7 countries	3,723	MDS (SSA) in each country separately – RVS-36	Cross-cultural replication and validation of Schwartz and Bilsky's (1987) results. At most 4 misplaced value items.
Schwartz (1992)	20 countries	9,140 (40 samples)	MDS (SSA) on each sample separately – SVS-56	All 10 value types emerged as distinct regions in only 35% of the samples. The number of correct value item locations ranges from 38 to 51 with a median at 46.
Gendre, Dupont, & Schwartz (1992)	Switzerland	172	EFA with VARIMAX rotations on terminal and instrumental values – RVS-36	9 and 8 factors respectively for the terminal and instrumental values matching Schwartz and Bilsky's (1987) value domains relatively well.
Schmitt et al. (1993)	Israel	224 (twice at a six week interval)	CFA (LISREL) on each value domain separately – 45 items from SVS-56	SVS is reliable and stable over time.
Schwartz (1994)	44 countries	25,863 (97 samples)	MDS (SSA) on each sample separately – SVS-56	All 10 value types emerged as distinct regions in only 29% of the samples. 44 value items were located in their corresponding region in at least 75% of samples.
Bilsky & Schwartz (1994)	Germany	331	MDS (SSA) – RVS-36	8 value types emerged as distinct regions, values from the 'security' and the 'conformity' value types were intermixed.
Schwartz & Sagiv (1995) part A	40 countries	22,186 (88 samples)	MDS (SSA) on each sample separately – SVS-56	All 10 value types emerged as distinct regions in only 26% of the samples. 44 value items were located in their corresponding region in at least 75% of samples.
Schwartz & Sagiv (1995) part B	3 countries (Israel, Japan, Australia)	1,136 (207 + 542 + 387)	MDS (SSA) on each sample separately – SVS-56	All 10 value types emerged as distinct regions in only 1 of the 3 samples. 16% of value items emerged in different regions.
Grunert & Juhl (1995)	Denmark	174	MDS (SSA) – SVS-56	4 value types emerged as distinct regions, and 3 pairs of value types were intermixed. 8 value items were misplaced but emerged in adjacent regions.
Odin, Vinais, & Valette-Florence (1996)	France	2,522	CFA (SEPATH) on each value type independently – SVS-56	A re-specified more parsimonious model with 42 value items had better predictive validity.
Smith & Schwartz (1997)	54 countries	About 44,000 (97 samples)	MDS (SSA) on each sample separately – SVS-56	Each of the 10 value types formed a distinct region or a joint region with its postulated neighbors in over 90% of samples. All the value items emerged most frequently in their respective region.
Spini & Doise (1998)	Switzerland	175	MDS (SSA) on individual values and EFA on value types – SVS-57	Two-dimensional space accounting for 46.22% of the total variance. Inversion between 'stimulation' and 'hedonism'. 46 remaining items.

Table 1. (Cont'd)

Author(s)	Country	Sample	Method	Results
Prince-Gibson & Schwartz (1998); Ros, Schwartz, & Surkiss (1999)	Israel	999 (480 males + 519 females)	MDS (SSA) on each sample separately – SVS-37	Ten value types emerged as distinct regions in both male and female sample. In the male sample, the regions of the ‘security’ value type and the ‘conformity/tradition’ value type reversed the predict order. 29 value items emerged in their predicted values types in both samples and 4 value additional value items emerged in their predicted value types in one sample and in an adjacent value types in the other sample.
Kazan & Ergin (1999)	Turkey	435	MDS (SSA) – SVS-56	Nine value types emerged as distinct regions. 31 value items appear in their predicted value types.
Grunert & Beckmann (1999)	East and West Germany	155 (85 + 70)	MDS (SSA) on pooled data – SVS-56	Partial confirmation of the value content. No clear distinct regions emerged for several value types, but values were intermixed with those of a type postulated to be adjacent.
Schwartz et al. (2001) part II	3 countries (Italy, South Africa, Uganda)	10,203 (5,870 + 3,493 + 840)	MDS (SSA) on each sample separately – PVQ-29	All 10 value types emerged as distinct regions in only 1 of the 3 samples, 7 and 5 value types in the other samples.
Schwartz et al. (2001) part III	Israel	200	MDS (SSA) – PVQ-29 and 46 items from SVS-57	MTMM showed convergent and discriminant validity. Low reliability, but good predictive validity.
Struch, Schwartz, & van der Kloot (2002)	60 countries in 8 cultural regions	11,244	MDS (nonmetric) for men and women on each sample – 45 items from SVS-56	Retain the first two dimensions from a four-dimensional solution. Two misplaced value items in the female total sample and zero in the male total sample. Large degree of similarity between men and women,
Tsai & Böckenholt (2002)	United States	273	Two-level linear paired comparison model on the 10 value types.	The ordering of the value types is consistent with SVS theory except for ‘benevolence.’ However, the model fits poorly.
Aavik & Allik (2002)	Estonia	121	EFA (Principal Component) and MDS (nometric) – SVS-56	Seven dimensions resulted from the EFA. From the MDS, the ‘achievement’ and ‘power’ domains were misplaced.
Devos, Spini, & Schwartz (2002)	Switzerland	265	MDS (SSA) on individual values and EFA on value types – SVS-57	Two-dimensional space accounting for 45.3% of the total variance. Between 39 and 45 remaining items.
Ben Slimane, El Akremi, & Touzani (2002)	Tunisia	400	CFA (LISREL) – SVS-56	A re-specified model provided a better goodness-of-fit than the theorized model. 40 remaining items.
Bilsky & Koch (2002)	Canada	144	MDS – Morris’ “Ways to Live,” “Kilmann Insight Test,” (KIT) and PVQ-29	Mixed results: PVQ yielded a separation of values along the ‘self-enhancement vs. self-transcendence’ dimension, but results concerning KIT and “Ways to Live” were poorer.
Burroughs & Rindfleisch (2002)	United States	373	Partial disaggregation CFA and MDS (ALSCAL) on standardized sum scores – SVS-56	Two-dimensional space provides a good representation of the data. Low internal consistency for all 10 value dimensions.

Table 1. (Cont'd)

Author(s)	Country	Sample	Method	Results
Allen & Ng (2003)	Australia	134	Principal components (PRINCALS) on sum scores – 52 items from SVS-56	Two-dimensional space. The locations of the 10 dimensions are consistent with the theory. Modest reliability in terms of alpha coefficients.
Spini (2003)	21 countries	3,787	Multigroup CFA (LISREL) of unidimensional structural equation models – SVS-57	Support for configural and metric equivalence, as well as factor variance invariance, for all values except 'hedonism'.
Brunso, Scholderer, & Grunert (2004).	Germany and Spain	2,042 (1,042 and 1,000)	Repeated-measure ANOVA on value type sum scores – 30 items from SVS-56	Quadratic relationship with a food-related lifestyle scale in support of the circumplex structure of SVS.
Sagiv & Schwartz (2004)	Israel	365	MDS (SSA) – SVS-57	8 value types emerged as distinct regions and 2 pairs of value types were intermixed. 39 remaining items.
Bubeck & Bilsky (2004)	Germany	1,555	MDS (SSA) – PVQ-29 (with children and adolescents aged 10 to 17)	8 value types emerged as distinct regions and 2 pairs of value types were intermixed. The order of the types around the circle partly deviates from the theorized structure.
Schwartz & Boehnke (2004)	27 countries	10,857 (46 samples)	CFA and constrained CFA (LISREL) – SVS-57	Confirmation of the 10 basic value types, as a modified quasi-circumplex rather than a simple circumplex structure. 46 remaining items in the final model.
Lindeman and Verkasalo (2005)	Finland	607 + 3,087 + 112 + 38	MDS (KYST) – SSVS-10, SVS-57, PVQ-40	Circular representation of the 10 value dimensions with SSVS. Significant correlations between the dimensions obtained with SSVS-10, SVS-57, and PVQ-04.

MDS = Multidimensional scaling, SSA = Smallest space analysis; CFA = Confirmatory Factor Analysis.

RVS-36 = 36 items Rokeach value survey; SVS-56 = 56 items Schwartz value survey; SVS-57 = 57 items Schwartz value survey; SSVS – 10 items short Schwartz value survey; PVQ-29 = portrait values questionnaires (29 portraits); PVQ-40 = portrait values questionnaires (40 portraits).

Table 2. List of Value Items and their Value Types

Value Type	Value Item	Position^{* **}
UN1	Protecting the environment	
UN2	Unity with nature	
UN3	A world of beauty	
UN4	Broad-minded	
UN5	Social justice	
UN6	Wisdom	Slightly misplaced
UN7	Equality	
UN8	A world at peace	
UN9	Inner harmony	
BE1	Helpful	
BE2	Honest	
BE3	Forgiving	
BE4	Loyal	
BE5	Responsible	
BE6	A spiritual life	Slightly misplaced
BE7	True friendship	Badly misplaced
BE8	Mature love	Slightly misplaced
BE9	Meaning in life	Badly misplaced
CO1	Obedience	
CO2	Honoring of parents and elders	
CO3	Politeness	
CO4	Self-discipline	
TR1	Accepting my portion in life	
TR2	Devout	
TR3	Humble	
TR4	Respect for tradition	
TR5	Moderate	
TR6	Detachment	Badly misplaced
SE1	Clean	
SE2	National security	
SE3	Reciprocation of favors	
SE4	Social order	
SE5	Family security	Slightly misplaced
SE6	Sense of belonging	Badly misplaced
SE7	Healthy	Slightly misplaced
PO1	Social power	
PO2	Authority	
PO3	Wealth	
PO4	Preserving my public image	Slightly misplaced
PO5	Social recognition	
AC1	Successful	
AC2	Capable	
AC3	Ambitious	
AC4	Influential	Slightly misplaced
AC5	Intelligent	
HE1	Pleasure	
HE2	Enjoying life	
ST1	Daring	
ST2	A varied life	
ST3	An exciting life	
SD1	Curious	
SD2	Creativity	
SD3	Freedom	
SD4	Choosing own goals	Slightly misplaced
SD5	Independent	Slightly misplaced
SD6	Self respect	Slightly misplaced

* Locations resulting from the MDS, ** Slightly misplaced = the value item shows up in an adjacent region, badly misplaced = the value item shows up neither in one of the adjacent value region.

Table 3. Summary of CIRCUM Fit Indices

Model	df	χ^2	F_0	GFI	AGFI	RMSEA [90% CI]	NFI
A. Equally spaced-equal communalities (circulant)	41	689.90	.462	.915	.887	.106 [.099, .113]	—
B. Unequally spaced-equal communalities (quasi-circumplex)	32	442.44	.292	.945	.905	.096 [.088, .104]	.359
C. Unequally spaced-unequal communalities	23	285.43	.187	.964	.914	.090 [.081, .100]	.586

Table 4.
CIRCUM Point Estimates for Polar angles and Commuality Indices

Model	UN	BE	TR	CO	SE	PO	AC	HE	ST	SD
A. Equally spaced-equal communalities (circulant)										
Polar angles	0	36	72	108	144	180	216	252	288	324
Communalities	.74	.74	.74	.74	.74	.74	.74	.74	.74	.74
B. Unequally spaced-equal communalities (quasi-circumplex)										
Polar angles	0	9	27	45	59	114	160	172	211	222
Communalities	.75	.75	.75	.75	.75	.75	.75	.75	.75	.75
C. Unequally spaced-unequal communalities (non-circumplex)										
Polar angles	0	12	34	56	93	175	181	227	251	315
Communalities	.77	.80	.65	.83	.95	.83	.74	.61	.78	.95

Table 5.
Reference Matrices of Expected Factor Intercorrelations for CFA:
Ideal Circulant Model above the Diagonal and Empirical Circulant
Model below the Diagonal

Values	UN	BE	TR	CO	SE	PO	AC	HE	ST	SD
Universalism (UN)	1.00	.60	.20	-.20	-.60	-1.00	-.60	-.20	.20	.60
Benevolence (BE)	.72	1.00	.60	.20	-.20	-.60	-1.00	-.60	-.20	.20
Tradition (TR)	.60	.72	1.00	.60	.20	-.20	-.60	-1.00	-.60	-.20
Conformity (CO)	.47	.60	.72	1.00	.60	.20	-.20	-.60	-1.00	-.60
Security (SE)	.35	.47	.60	.72	1.00	.60	.20	-.20	-.60	-1.00
Power (PO)	.23	.35	.47	.60	.72	1.00	.60	.20	-.20	-.60
Achievement (AC)	.35	.23	.35	.47	.60	.72	1.00	.60	.20	-.20
Hedonism (HE)	.47	.35	.23	.35	.47	.60	.72	1.00	.60	.20
Stimulation (ST)	.60	.47	.35	.23	.35	.47	.60	.72	1.00	.60
Self-Direction (SD)	.72	.60	.47	.35	.23	.35	.47	.60	.72	1.00

Table 6. Fit Indices for the Different CFA Models with Estimated with AMOS

D. Ideal Circulant Model (equally spaced-equal communalities)	df	χ^2	χ^2/df	GFI	AGFI	RMSEA [90% CI]	SRMR	CFI	NFI	NNFI	AIC
(a) 56 items	1483	14493.2	9.773	.640	.612	.079 [.078, .080]	.132	.378	.354	.354	14719.2
(b) 52 items*	1273	13008.0	10.218	.640	.610	.081 [.080, .082]	.132	.385	.363	.360	13218.0
(c) 32 items**	464	6783.9	14.621	.711	.671	.098 [.096, .101]	.159	.412	.397	.372	6911.9
E. Empirical Circulant Model (equally spaced-equal communalities)											
(a) 56 items	1483	8902.4	6.003	.779	.762	.060 [.059, .061]	.076	.645	.603	.631	9128.4
(b) 52 items*	1273	7343.7	5.769	.801	.785	.058 [.057, .060]	.073	.682	.640	.669	7553.7
(c) 32 items**	464	2699.3	5.817	.884	.868	.059 [.056, .061]	.081	.792	.760	.778	2827.3
F. Quasi-circumplex Model (unequally spaced-equal communalities)											
(a) 56 items	1442	8224.4	5.703	.797	.776	.058 [.057, .059]	.069	.676	.634	.654	8532.4
(b) 52 items*	1232	6693.0	5.433	.819	.798	.056 [.055, .058]	.065	.714	.672	.692	6985.0
(c) 32 items**	423	1981.6	4.685	.914	.893	.051 [.049, .054]	.051	.855	.824	.830	2191.6

* 52 items retained in the MDS. ** 32 items retained with a salient loading criterion at .40 and cross-loadings smaller than .25.

Table 7. Confirmatory Factor Analysis Results
(32 items, quasi-circumplex model)

Value Type	Value Item	Standardized Loading	t-value	CR	AVE	α
UN	UN1	.489	17.010	.707	.382	.699
	UN5	.740	27.272			
	UN7	.572	20.352			
	UN8	.642	23.239			
BE	BE1	.611	22.198	.670	.290	.668
	BE2	.549	19.597			
	BE3	.485	17.037			
	BE4	.532	18.918			
	BE5	.505	17.825			
TR	TR2	.458	14.242	.430	.277	.412
	TR4	.587	17.839			
CO	CO1	.646	24.549	.683	.352	.667
	CO2	.603	22.596			
	CO3	.607	22.797			
	CO4	.508	18.475			
SE	SE1	.602	21.622	.585	.264	.542
	SE3	.457	15.935			
	SE4	.528	18.658			
	SE5	.451	15.702			
PO	PO2	.556	19.669	.606	.340	.608
	PO3	.605	21.580			
	PO4	.587	20.874			
AC	AC1	.663	24.374	.661	.399	.651
	AC2	.509	17.960			
	AC3	.706	26.118			
HE	HE1	.684	22.290	.590	.419	.575
	HE2	.609	20.353			
ST	ST1	.615	22.742	.729	.475	.717
	ST2	.685	25.831			
	ST3	.759	29.182			
SD	SD1	.611	19.857	.561	.390	.555
	SD2	.637	20.480			
Model Fit Indices		$\chi^2 = 1981.6$ ($p = .000$), $df = 423$, $\chi^2/df = 4.685$ SRMR = .051, GFI = .914, AGFI = .893, CFI = .855 RMSEA = .051 [90% CI of .049 to .054] AIC = 2191.6, NFI = .824				

NOTE: CR = Construct Reliability, AVE = Average Variance Extracted, α = Cronbach's alpha. -1 = opposed to my values, 7 = of supreme importance

Figure 1. Theoretical Structural Relations among the 10 Value Types

(Adapted from Schwartz, 1992)

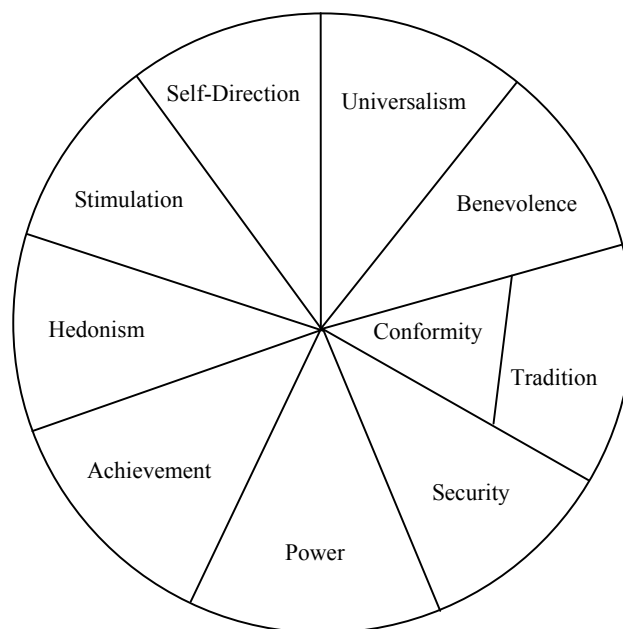


Figure 2. MDS for the Global Sample

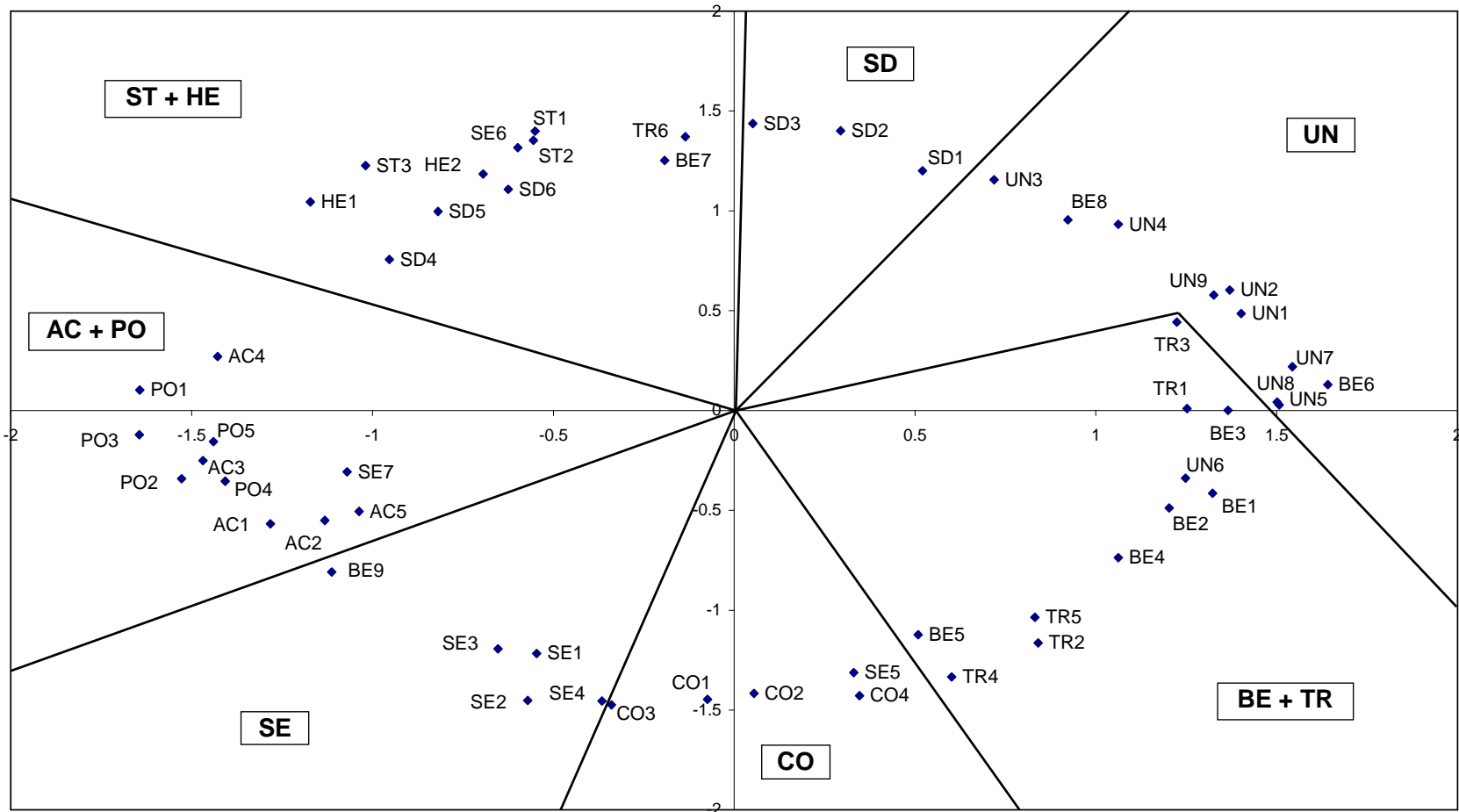


Figure 3.
**Polar Angles of the Unequally Spaced-
Unequal Communalities Model from CIRCUM**

