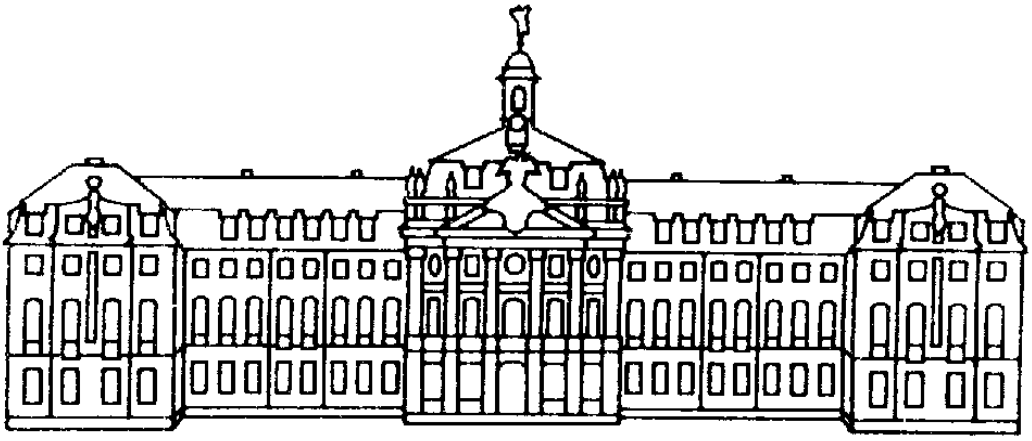

Value structure - On the use of weakly constrained confirmatory MDS

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Abstract

Ordinal Multidimensional Scaling (MDS) has become a central approach for analyzing value structures in cross-cultural studies. Starting from regional hypotheses, MDS displays the discriminability of value types in an easily accessible geometric representation. Furthermore, this approach is relatively free from mathematical restrictions and additional assumptions not relevant to the problem under study (Borg & Shye, 1995). However, MDS configurations of identical data sets may differ, depending on the respective starting configuration. Such artefacts can be avoided by computing a weakly constrained confirmatory MDS. Drawing on Schwartz' (1992) value theory, the construction of a design matrix is proposed which specifies his model geometrically. This matrix serves as the basis for deriving a starting configuration that is tailored to the value instrument applied (Bilsky, Gollan & Döring, 2007). Its use is demonstrated by analyzing data sets collected with different instruments.

Introduction

The value theory of *S.H. Schwartz* (1992) has been the starting point for a multitude of studies in culturally diverse countries. In these studies, the correspondence between his model and empirical data has usually been tested by ordinal Multidimensional Scaling. Overall, the central features of his theory could be confirmed (e.g., Schwartz & Sagiv, 1995; Schwartz, Melech, Lehmann, Burgess, Harris & Owens, 2001). However, studies repeatedly revealed minor or major deviations from the hypothesized structure. Whether these deviations reflect systematic deviations that call for interpretation or just methodological artefacts, is sometimes difficult to decide.

As regards *methodological artefacts*, differences between the value model and an empirical structure may result from different factors. Thus, the choice of the statistical package (e.g., HUDAP, SPSS, or SYSTAT), the measures of fit (loss function), or the starting configuration may make a difference. Unfortunately, information about data handling and data analysis is often underreported in empirical studies.

To avoid at least part of the ambiguities which derive from mere statistical differences, a *weak confirmatory approach* (Borg & Staufenbiel, 2007) is proposed for the structural analysis of values (items) and value types. Such an approach seems appropriate, because Schwartz (1992) offers an explicit, theoretically grounded hypothesis about their structural relation. Suggesting a weak confirmatory approach is further supported by some more general methodological considerations of Borg and Groenen (2005):

> The MDS program optimizes Stress, which is substantively blind: that is, it is not tailored to the particular questions that are being asked. ... Minimizing Stress gives a solution that is locally optimal. Yet, other local minimum solutions may exist with a similar Stress, or possibly even with lower Stress ... The question is which solution should be preferred. If a hypothesis for the data is available,

then, of course, we would be particularly interested in the solution that most directly speaks to this hypothesis. This is obviously the solution that most closely satisfies the hypothesis, even if its Stress is somewhat higher than the Stress for other solutions. (p. 228)

Central to a weak confirmatory approach is the *starting configuration* which assigns every variable (value item) its place within the hypothesized structure of values. However, as items are but representatives of more general value types (global values), their location within the overall value structure has to be defined first. This is accomplished by deducing a *design matrix* from the Schwartz model. Both, the deduction of a design matrix and a starting configuration are outlined next.

Method

A prototypical specification of value structure

Design matrix. Our confirmatory approach starts from the structural models outlined by Schwartz (1992). They serve as templates for defining a *design matrix* which specifies the prototypical location of each of the ten *value types* by coordinates in two-dimensional space (Bilsky, Gollan & Döring, 2007, 2008). For economical reasons, the following description concentrates on Schwartz' revised model (Figure 1b) which is usually cited in literature. However, other models (e.g., the original model; Figure 1a) can be specified accordingly.

Dynamic structure of relations among value types according to Schwartz (1992)

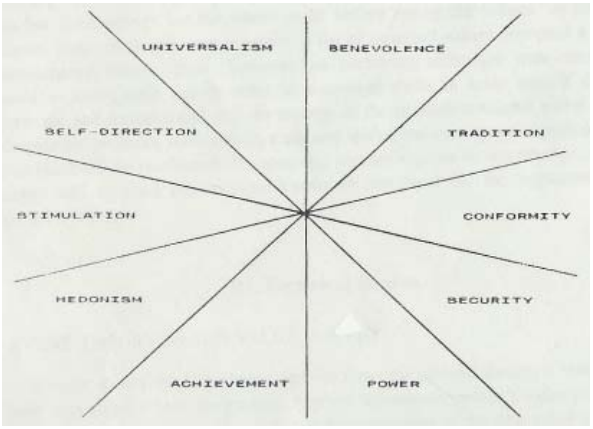


Figure 1a Dynamic structure of relations among value types: Original model (Schwartz, 1992, p.14)

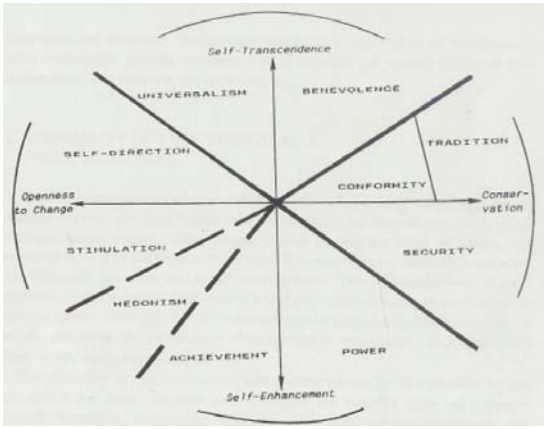


Figure 1b Dynamic structure of relations among value types: Revised model (Schwartz, 1992, p.45)

In his revised model, Schwartz represents the 10 value types by nine sectors. One of these sectors further divides into an inner and an outer part, each of them representing a different value type. Schwartz does not consider equally sized (40°) angles of these sectors as a defining feature of his model. However, without further evidence, adopting a simple and regular structure seems adequate and functional in the present context.

This configuration serves as the basis for specifying the *prototypical location* of each value type by corresponding coordinates (Bilsky et al., 2007). These coordinates are determined trigonometrically by referring to the unit circle: Thus, nine of the ten value types are represented by points on the periphery of the circle; their coordinates derive from the centre of that circular arc which is marked by the respective (value-) sector. The coordinates of the tenth value type (conformity) are determined correspondingly, though with a radius of 0.5 instead of 1.0. Table 1 shows the resulting *design matrix*.

Table 1 Prototypical specification of value structure: Design matrix - revised model (Schwartz, 1992, p. 45)

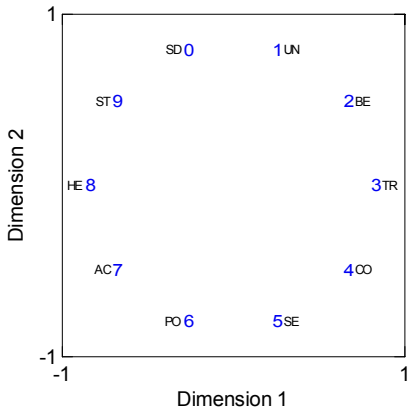
Dim1	Dim2	Type	Type-Nr.	Angle
0,00	-1,00	PO	6	270
-0,64	-0,77	AC	7	230
-0,98	-0,17	HE	8	190
-0,87	0,50	ST	9	150
-0,34	0,94	SD	0	110
0,34	0,94	UN	1	70
0,87	0,50	BE	2	30
0,98	-0,17	TR	3	350
0,49	-0,09	CO	4	350
0,64	-0,77	SE	5	310

Starting configuration. Values can be assessed differently. Schwartz, for instance, developed two instruments for assessing personal values, the *Schwartz Values Survey* (SVS) and the *Portraits Value Questionnaire* (PVQ). For both instruments different versions exist, varying with respect to length. In each of them, the ten global values (value types) are operationalized by two or more items. Consequently, all items *indicating the same global value* are represented in the starting configuration by *identical coordinates* as specified in the design matrix.

Of course, value types need not be represented by more than one item. In fact, value assessment may even be accomplished on the type instead of an item level. This is, for instance, the case, when evaluating the relative importance of value types in a paired comparison task (e.g., Bilsky et al., 2008). In this case the design matrix and the starting configuration are identical.

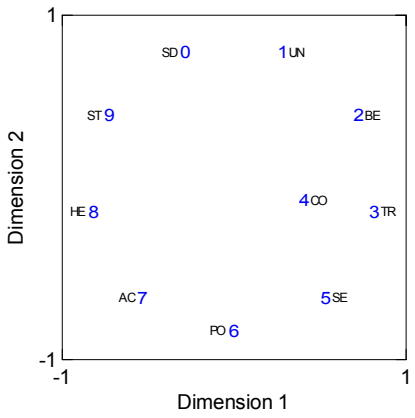
Figures 2a and 2b show the prototypical localization of the ten value types in two dimensional space, according to Schwartz' original and revised value model.

Starting configuration (Schwartz, 1992, p.14)



(a) Original model

Starting configuration (Schwartz, 1992, p.45)



(b) Revised model

Figure 2 Prototypical specification of value structure for design matrix and starting configurations in two dimensions (Bilsky, Gollan & Döring, 2007, 2008)

Applications

In the following, two examples are given for demonstrating the application of a weak confirmatory MDS to value data. In both examples, correlations between items were submitted to ordinal Multidimensional Scaling. Computations were accomplished by means of SPSS-PROXSCAL. This program allows for the use of custom-designed configurations - here, the use of the starting configurations outlined before.

Computerized paired comparisons of values (CPCV)

The first example refers to a study, in which an online approach of value assessment was used (Bilsky, Brocke & Gollan, 2008). In this study, subjects worked on a total of 45 graded paired comparison tasks. On each trial, two of the ten value types proposed by Schwartz (1992) were presented. Subjects were asked to indicate the degree to which one value type is more important to them than the other. Figure 3 gives an example of a CPCV-item.

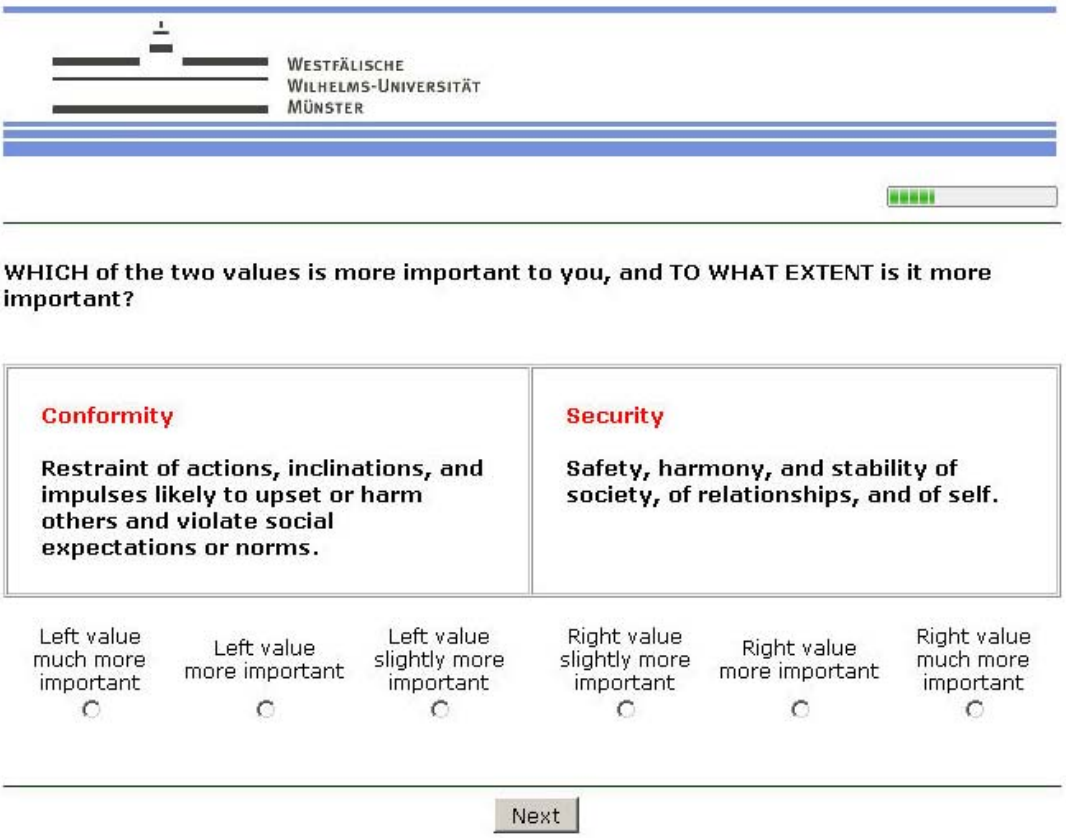
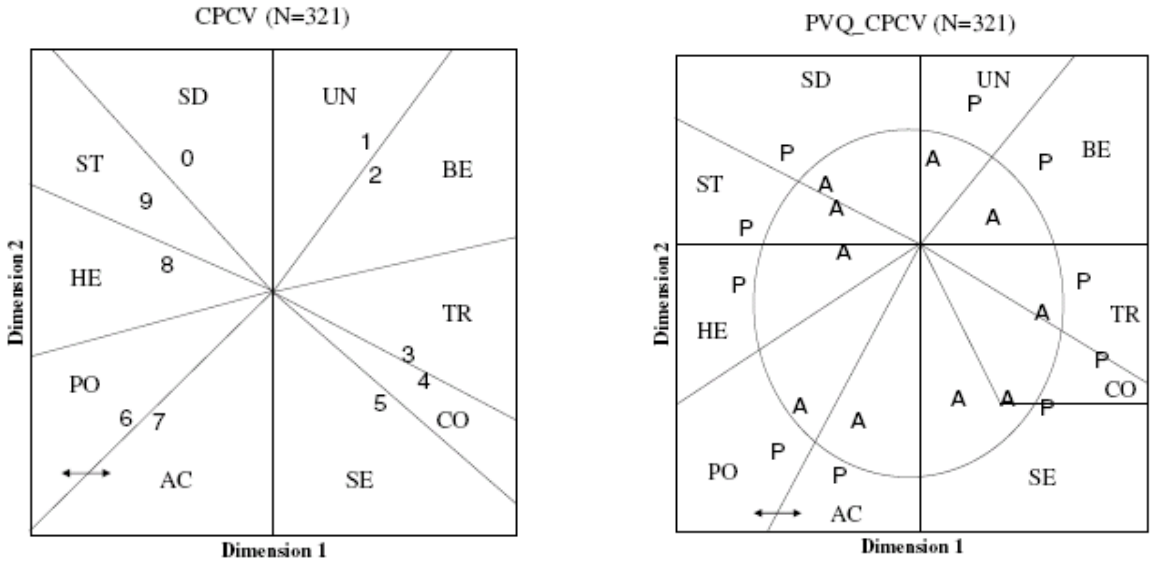


Figure 3 Computerized Paired Comparison of Values: sample item

To validate this approach, the CPCV-importance scores were correlated with scores from an online version of Schwartz' Portrait Values Questionnaire (PVQ40) which was completed in the same session. Weak confirmatory MDS analyses based on Schwartz' original model (Schwartz, 1992, p.14; see Figure 2a) were conducted to examine whether and to what extent data from the paired comparison task match Schwartz' assumptions about the structure of human values. CPCV- and PVQ-scores were analyzed both separately, and jointly in an MTMM matrix by means of an ordinal MDS.

The central findings of these analyses are presented in figures 4a and 4b. As can be seen, our results correspond to the Schwartz model, except for the reversed localization of achievement and power. This reversal has been found repeatedly in cross-cultural studies.



(a) Ordinal MDS of CPCV-scores in two dimensions; *Stress-I* = 0.11

(b) Ordinal MDS of an MTMM-matrix of CPCV- and PVQ-scores in two dimensions; *Stress-I* = 0.15
PVQ=A (absolute scores), CPCV=P

Figure 4 Computerized Paired Comparisons of Values (CPCV): Structural Validation

Cross-cultural comparisons of value structure: the European Social Survey

The second example relates to value data collected in the first round of the European Social Survey (ESS1)[1]. In this survey, value assessment was accomplished with the 21-item form of Schwartz' Portrait Value Questionnaire (PVQ).

Data cleaning and the handling of missing data were realized in the way suggested by Schwartz[2]. Weakly constrained confirmatory MDS were then conducted for representative samples from 20 countries participating in the first round of the ESS. The first set of analyses (Janik, 2008) was based on Schwartz' *revised* model (Schwartz, 1992, p.45) in order to facilitate comparisons with other studies (e.g., Mohler & Wohn, 2005). Table 2 gives an overview of the respective results.

As can be seen, data from Greece, Hungary, and Portugal show some remarkable deviations from the hypothesized structure. Results from the other samples, however, essentially validate the Schwartz model. Thus, further analyses must answer the question of whether the present deviations should be attributed to reliability, or to cultural specifics.

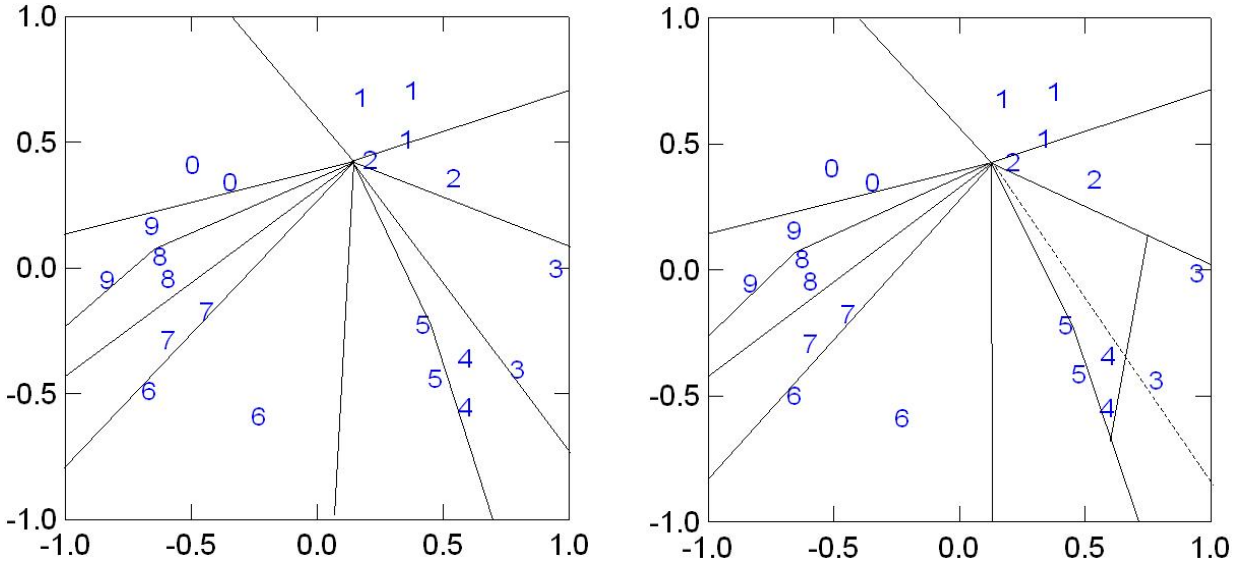
[1] *ESS round 1:* R Jowell and the Central Coordinating Team, European Social Survey 2002/2003: Technical Report, London: Centre for Comparative Social Surveys, City University (2003); http://www.europeansocialsurvey.org/index.php?option=com_content&task=view&id=78&Itemid=190

[2] http://essedunet.nsd.uib.no/cms/topics/1/4/all.html

Table 2 **European Social Survey (ESS1): Structural analyses of values (PVQ), using a weak confirmatory MDS on the basis of Schwartz' revised model (Figure 1b): overview of results**

Country		Distinct Regions	Sequence of Types	Deviations
Austria	AT	10	1,2,3,4,5,6,7,8,9,0	
Belgium	BE	10	1,2,3/4,5,6,7,8,9,0	
Switzerland	CH	10	1,2,3,4,5,6,7,8,9,0	
Czech Republic	CZ	8	[1+2],3/4,5,6,7,8/9,0	UN + BE not separated; HE behind ST
Germany	DE	10	1,2,3/4,5,6,7,8,9,0	
Denmark	DK	10	1,2,3,4,5,6,7,8,9,0	
Spain	ES	10	1,2,3,4,5,6,7,8,9,0	
Finland	FI	10	1,2,3/4,5,6,7,8,9,0	
France	FR	10	1,2,3,4,5,6,7,8,9,0	
Great Britain	GB	10	1,2,3/4,5,6,7,8,9,0	
Greece	GR	8	1,2,5,3/4,6,7,[8+9],0	HE + ST not separated; SE + CO/TR reversed; HE_10 between PO + AC
Hungary	HU	10	1/2,5,3/4,6,7,8,9,0	UN behind BE; SE + CO/TR reversed
Ireland	IE	10	1,2,3/4,5,6,7,8,9,0	
Israel	IL	10	1,2,3/4,5,6,7,8,9,0	
Netherlands	NL	10	1,2,3/4,5,6,7,8,9,0	
Norway	NO	10	1,2,3/4,5,6,7,8,9,0	
Poland	PL	10	1/2,3/4,5,6,7,8,9,0	UN behind BE
Portugal	PT	10	1,2,5,3/4,6,7,8/9,0	SE + CO/TR reversed; HE behind ST
Sweden	SE	8	1,2,3,[4+5],6,7,8,9,0	CO + SE not separated
Slovenia	SI	10	1,2,3/4,5,6,7,8,9,0	

The second set of confirmatory MDS referred to Schwartz *original* model (Schwartz, 1992, p.14). These complementary analyses were run in order to investigate whether the alternative starting configuration produces similar results. Figure 5 shows exemplary plots of the German sample for both, the original and the revised model. As can be seen, the configurations are almost identical.



(a) Starting configuration: Schwartz (1992, p.14); N = 2685, *Stress-I* = 0.10

(b) Starting configuration: Schwartz (1992, p.45); N = 2685, *Stress-I* = 0.10

Figure 5 European Social Survey (ESS, 1st round): Structural analysis of values (PVQ21) - German sample

Final Remarks

The present paper is mainly a technical report. Its primary aim is to suggest a standardized way of running an MDS of values without being trapped by methodological artefacts. Such artefacts may, for example, obscure an existing systematic impact of external (e.g. cultural) variables on value structure because substantial and method effects cannot be disentangled.

Avoiding such artefacts seems possible because Schwartz' (1992) value theory lends itself to a geometrical specification of his structural hypotheses. This specification facilitates the definition of starting configurations that can be used in a weak confirmatory MDS approach (Borg & Staufenbiel, 2007). As stated by Borg and Groenen (2005) - we would be, of course, particularly interested in MDS solutions that most directly speak to our hypotheses.

The empirical examples reported here serve primarily illustrative purposes. Nevertheless, our findings strongly support Schwartz' cross-cultural theory about the dynamic relations between human values. However, a systematic presentation of these findings is beyond the scope of this paper.

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