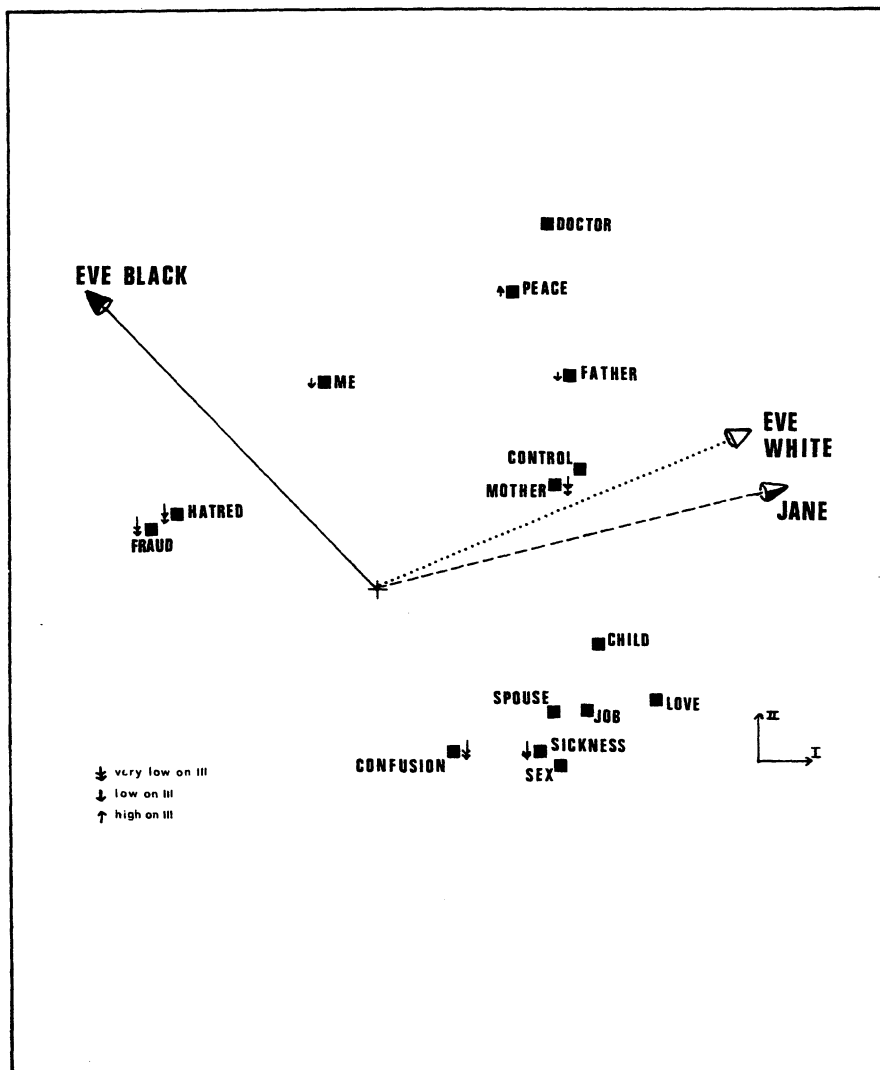


SEMANTIC DIFFERENTIAL DATA

9

triple personality study



9.1 INTRODUCTION

In this section we will present an example of the power of three-mode principal component analysis in constructing one unified description of data collected under different circumstances, and (possibly) referring to the same underlying structure. Specifically, we will analyse data from probably the most famous case of a multiple personality: Eve White, Eve Black, and Jane (Thigpen & Cleckley, 1954). Osgood & Luria (1954)¹ published scores on semantic differential scales for each personality at two occasions (testings I and II). In essence the data set is a four-mode one, i.e. personality \times testing \times concept \times scale. We will, however, treat them as three-mode data, and the 6 administrations (k-mode) of 10 scales (j-mode) by 15 concepts (i-mode) are the material on which this re-analysis is based. Besides presenting a unified analysis of these data, the example sets out to show how individual differences in the use of semantic differential scales can be analysed with three-mode principal component analysis. Other examples of three-mode analysis on semantic differential data can be found in the references, via the subject classification of applications in the Appendix (see also Kroonenberg, 1983, in press).

9.2 THE SEMANTIC DIFFERENTIAL TECHNIQUE²

The semantic differential technique is a combination of association and scaling procedures designed to give an objective mea-

1. Page references are to the reprinted version in Snider & Osgood (1969).
2. This subsection is at times an almost literal citation from Osgood & Luria (p.505).

sure of connotative meaning. A linguistically complex assertion such as "My father has always been a rather submissive person", can be at least partially represented on bi-polar seven point scales

MY FATHER active - : - : - : - : X : - : - passive
 MY FATHER soft - : X : - : - : - : - : - hard

The greater the strength of association, e.g. "extremely submissive, a regular doormat", the more polarized towards 1 or 7 the check mark on the scales. Since many scales of judgement are highly intercorrelated (e.g. good-bad, fair-unfair, honest-dishonest, kind-cruel, and so forth, all reflect mainly the single "evaluative" factor in judgements), a limited number of dimensions can be used to define a semantic space within which the connotative measuring of any concept can be specified. Factor analytic studies of semantic differential data consistently show that there are three major dimensions of rating response: *Evaluation, Activity, and Potency* (see e.g. Heise, 1969, p. 412-415).

Table 9.1 Triple personality study: concepts and scales

<i>Concepts</i> *						
	LOVE		mental SICKNESS		self-CONTROL	
	CHILD		my MOTHER		HATRED	
my	DOCTOR		PEACE of mind		my FATHER	
	ME		FRAUD		CONFUSION	
my	JOB		my SPOUSE		SEX	
<i>Scales</i> **						
valuable - worthless		E	fast - slow	A	large - small	P,a
clean - dirty		E	active - passive	A	strong - weak	P
tasty - distasteful		E	hot - cold	A	deep - shallow	P,e
			relaxed - tense			E,a

* The abbreviations used for the concepts are in upper case
 ** E = evaluation, A = activity, P = potency; upper case letters indicate high loadings on a factor (in 'standard' settings); lower case letters indicate medium loadings on a factor (in 'standard' settings).

Source: Osgood & Luria (1954; 1969, p. 506).

The form of semantic differential used in the study of the triple personality of Eve White, Eve Black, and Jane is given in Table 9.1 (adapted from Osgood & Luria, p.506).

9.3 OSGOOD & LURIA'S ANALYSIS

Osgood & Luria, lacking a technique for simultaneously treating all their data, obtained measures of semantic similarity and structure by computing generalized distances between each pair of concepts for each of the six administrations of the scales. This generalized distance $d_{ii',k}$ between concept i and i' for administration k summed over the $m(=10)$ scales is defined as

$$d_{ii',k} = \sum_{j=1}^m (z_{ijk} - z_{i'jk})^2 \quad i, i' = 1, \dots, \ell; k = 1, \dots, n$$

For the justification of this measure they refer to Osgood & Suci (1952; see, however, Torgerson, 1958, pp. 294-296). The $d_{ii',k}$ used by Osgood & Luria were derived from factor scores which were the result of factoring the concept by scales matrices for each person (omitting relaxed-tense), rather than the raw data. As they used only three factors their $D_k = \{d_{ii',k}\}$ matrix has rank 3 as well, and it can, therefore, be plotted 'error-free' in three dimensions which are found by factoring the D_k matrices (see Osgood & Suci, 1952). These three factors were computed by Osgood & Luria for all six administrations, and were presented as 'ball-diagrammes' (see Figure 9.3).

In order to compare the six administrations the intercorrelations of the D_k were computed. The concept distances between testings (t, t') for each personality p ($p=1,2,3$) over all scales, i.e.

$$d_{iptt'} = \sum_{j=1}^m (z_{ijpt} - z_{ijpt'})^2,$$

and between personalities (p, p') for each testing t

$$d_{ipp't} = \sum_{j=1}^m (z_{ijpt} - z_{ijp't})^2$$

were also computed, to assess the differences between and within personalities. These concept distances are given in Table 9.2. From this table we see that the largest differences are between Eve Black on the one hand and Eve White and Jane on the other. The differences between Eve White and Jane are so small that concepts singled out by Osgood & Luria as most discriminating between them have concept distances of the same order of magnitude as the test-retest concept distances, except for sex.

Table 9.2 *Triple personality study: concept differences between personalities and testings*

Concepts	Between personalities						Within personalities		
	Within testings						Between testings		
	D_{W-B}		D_{J-B}		D_{W-J}		D_{I-II}		
	I	II	I	II	I	II	B	W	J
Child	1.65	1.40	1.47	1.41	.68	.54	.96	.71	.37
Love	1.58	1.44	1.62	1.81	.35	.57	.67	.42	.23
Hatred	1.54	1.31	1.37	1.19	.51	.23	.19	.51	.44
Fraud	1.46	1.35	1.29	1.22	.73	.34	.12	.64	.40
Job	1.30	1.43	1.19	1.54	.49	.43	.62	.27	.42
Sickness	1.24	1.38	1.30	1.47	.40	.32	.45	.45	.19
Me	1.21	1.40	.83	.77	.60	.88	.32	.36	.42
Sex	1.10	.62	1.45	1.76	.63	<i>1.20</i>	.34	.62	.47
Father	1.06	.60	1.06	.43	.25	.43	.71	.53	.09
Confusion	.86	.96	.98	.88	.71	.42	.67	.64	.44
Peace	.86	.66	.81	.61	.21	.28	.35	.40	.41
Control	.78	.80	.92	1.01	.34	.39	.25	.32	.24
Mother	.71	.78	1.02	.68	.66	.23	.78	.54	.46
Spouse	.67	.96	1.04	1.75	.61	.89	.62	.30	.47
Doctor	.23	.23	.30	.12	.28	.25	.05	.15	.27

Note: numbers in italics indicate the concepts that (according to Osgood & Luria) serve best to characterize differences between Eve White and Jane

Adapted from Osgood & Luria (1954; 1969, p.513).

The most conspicuous aspect of Osgood & Luria's analysis is its indirect way in arriving at a geometric representation of the concepts. Furthermore, no goodness-of-fit is reported for their three-dimensional solution of concepts, nor is information given on the acceptability of a three-dimensional solution for the scales.

In a later discussion of this paper Osgood, Suci & Tannenbaum (1957) present the three (rotated) factors for the scale spaces of the first testing (I) of Eve White, Eve Black, and Jane. These factor loadings show a strong first rotated factor (49%, 59%, and 48% explained variation for the personalities respectively) on which nearly all scales load positively and which is interpreted as a 'general' evaluative factor. The second and third factors resemble each other far less (as shown by their Spearman correlations .56, .14, and .59 for the second factors, and .87, .24, and .21 for the third factor respectively), but Osgood et al. see sufficient similarities in them to state "we have evidence, then, for essentially the same three major factors operating in the several personalities of this disturbed patient, although there is considerable shifting in meanings of specific scales between personalities ..." (p. 262). Inspecting their factor loadings and the correlations between them we tend to think they overstate their case. In addition, it is questionable how useful the statement about shifting scales is without reference to the concepts to which the dimensions and scales apply. Because of this it should be useful to look at the data in their entirety using a less arbitrary method for their analysis, and attempt to answer the question: "In which way do the three personalities differ, and in which way do they resemble each other?"

9.4 PREPROCESSING OF THE DATA

Before analysis the scales valuable-worthless, tasty-distasteful, deep-shallow, active-passive, were recoded, so that they also were scored in a 'positive' manner analogous to the presentation in Table 36 in Osgood et al. (1957).

As in our other examples, a central question is the treatment of the means before the analysis proper. As it is assumed in semantic differential research that the centre of the scale (here :4) is the neutral point, and that a concept which has a 4 on all scales is a "meaningless" concept (cf. Osgood & Luria, p. 507), it seems most proper to subtract the scale midpoint 4 from all values. An

alternative would be to subtract the scale averages at each administration, as was probably done during the factor analysis performed by Osgood & Luria. The disadvantage of the latter approach would have been that shifts in overall level of scoring between personalities and testings would have been eliminated from the analysis.

9.5 THREE-MODE ANALYSIS

After investigating solutions with varying numbers of components for the three modes, it was decided to report the details of the 3x2x2-solution, i.e. 3 concept components, 2 scale components, and 2 personality components. In passing we will refer to components from other solutions.

Scale space. In contrast to most analyses of semantic differential data only two scale components were deemed necessary. With these two components most similarities and differences between the personalities can be described. A third scale component explains, by the way, another 3% of the total variation; this contrasts fast versus large, clean, and valuable. Table 9.3 and Fig. 9.1 show the two-dimensional scale space. Conspicuous is the ab-

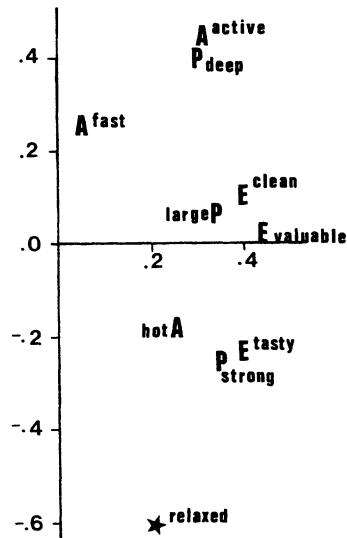


Fig. 9.1 Triple personality study: scale space

Table 9.3: Triple personality study: scale space

scale		S1	S2
valuable	E	42	1
clean	E	39	12
tasty	E	38	-23
fast	A	5	25
active	A	31	45
hot	A	25	-18
large	P	34	8
strong	P	33	-26
deep	P	30	42
relaxed	E,a	21	-62
% explained variation		59	11

Note: decimal points omitted

sence of an EPA-structure. It seems a matter of taste what to call the axes, clearly the standard terminology is only partly helpful. Osgood et al. (1957) labelled their first (rotated) axes, which resemble somewhat ours -S1, *evaluation*. They referred to the second axes of Eve White I, Eve Black I, and Jane I as *potency* axes. The differences between their second axes, and their differences with ours preclude such a label in this case. Our second component (S2) is dominated by relaxed (E,a), active (A), and deep (P), and seems difficult to interpret within the standard framework. We will come back to this later in connection with the discussions about concepts and personalities.

Concept space. In comparison with Osgood & Luria's complicated way to derive the concept space, the configuration of concepts emerges naturally in three-mode analysis, and its dimensionality can be assessed more or less independently of the dimensionality of the scale space. Three dimensions were necessary to give a reasonable representation of the concept space (Table 9.4)

Table 9.4: *Triple personality study: concept space*

	C1	C2	C3
doctor	23	53	- 1
peace	19	45	20
father	26	31	-21
control	28	19	1
mother	24	17	-32
child	31	- 6	-13
love	39	-14	5
job	30	-16	- 8
spouse	25	-17	8
sickness	23	-23	-38
sex	26	-25	5
confusion	11	-23	-50
me	- 8	30	-24
hatred	-27	11	-43
fraud	-30	8	-38
% explained variation	38	21	10

Note: decimal points omitted

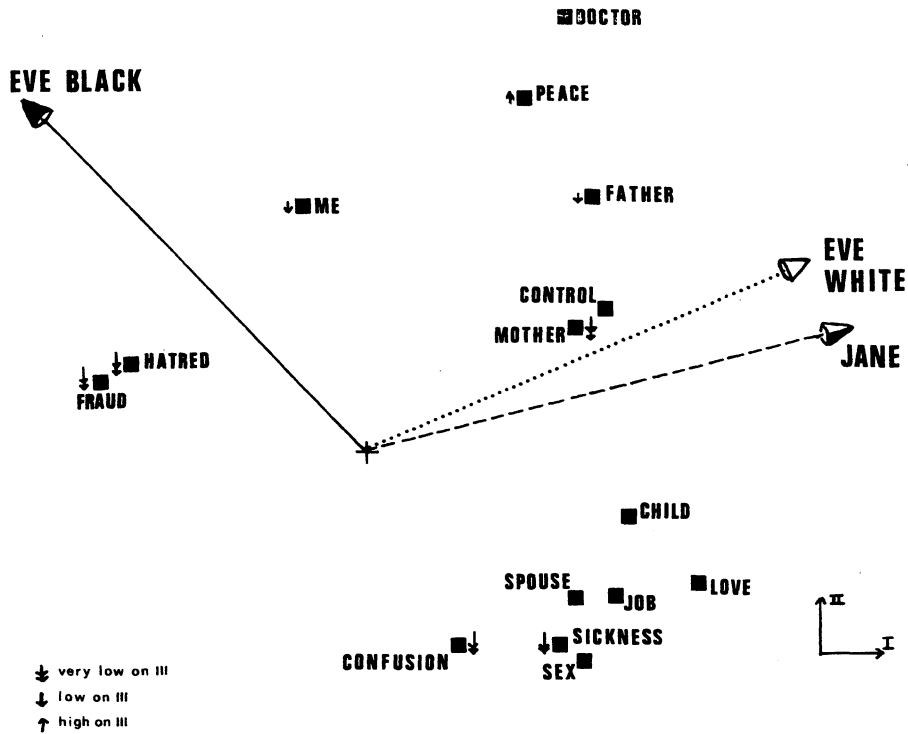


Fig. 9.2 Triple personality study: Concept space

It is very instructive to compare the first two dimensions of the concept space (Fig. 9.2) with the ball-diagrammes of Osgood & Luria reproduced here in Fig. 9.3. The arrows in Fig. 9.2 roughly correspond to the longest axis in the concept spaces for each of the personalities in the Osgood & Luria analysis (Fig.9.3). The TUCKALS concept space thus represents the characteristics of all three personalities simultaneously. The large differences between Eve White and Jane on the one hand, and Eve Black on the other hand are also evident in the *personality space* (Table 9.5), the *TUCKALS3-core matrix* (Table 9.6), and the *TUCKALS2-core matrix* from a 3x2-solution (Table 9.7). These tables give a coherent, quantitative indication of the differences between the personalities at different levels of summarization, in contrast with Osgood & Luria, who

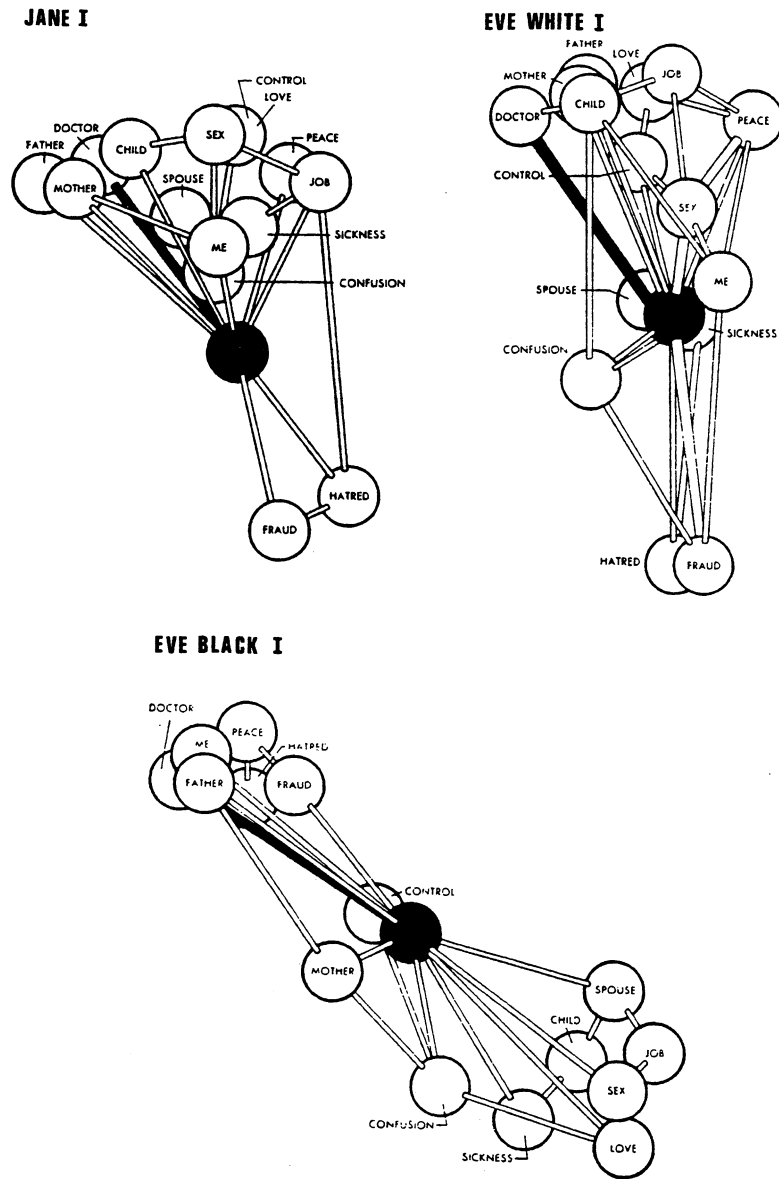


Fig. 9.3 Triple personality study: Osgood & Luria's concept spaces

interpret largely on the basis of qualitative comparisons between the personalities. It is especially the compactness of representation and the simultaneous portraying of the relationships between administrations which makes a three-mode analysis attractive in this case.

Table 9.5: *Triple personality study: personality space*

		P1	P2
Eve Black	I	-11	62
Eve Black	II	-13	76
Eve White	I	47	10
Eve White	II	44	16
Jane	I	51	6
Jane	II	54	3
% explained variation		45	24

Table 9.6.: *Triple personality study: TUCKALS3 core matrix*

		personality component 1 (Eve White & Jane)		personality component 2 (Eve Black)	
		S1	S2	S1	S2
concept	C1	18	0	- 4	2
compo-	C2	3	- 1	13	1
nents	C3	0	- 9	- 0	- 4
% explained variation by combinations of components					
concept	C1	35	0	2	0
compo-	C2	1	0	20	0
nents	C3	0	8	0	1

Table 9.7.: *Triple personality study: TUCKALS2 core matrix*

		Eve Black		Eve White		Jane	
Testings		S1	S2	S1	S2	S1	S2
I	C1	- 5	0	8	1	9	0
	C2	8	0	3	- 1	2	0
	C3	- 1	- 1	2	- 5	- 1	- 5
II	C1	- 6	2	7	0	10	0
	C2	10	1	4	- 1	3	0
	C3	0	2	0	- 5	- 1	- 4

Concept-scale interactions. In this subsection we will turn to a description of the relationships between the scales and concepts for each of the personalities. For the moment we will treat Eve White and Jane as one personality, and only comment on their differences later on.

Eve Black's scale and concept relationships are given by a joint plot in Fig. 9.4, and they are summarized in Table 9.7 by her T2-core planes. The location of the concepts is a good compromise of the figures for Eve Black I & II as presented by Osgood & Luria. Insight into the scale-concept relationships is especially important in this case as the scale space does not show the usual EPA-structure, so that these labels are not applicable here. Summarizing the relationships in a few words one could say that all concepts related to day-to-day life (job, spouse, child, sex, love) are evaluated negatively, and are considered neutral with respect to scales as active, deep, and relaxed. Those concepts related to Eve Black's mental make-up (confusion and mental sickness) are also evaluated negatively, but somewhat active and deep and rather tense as well. Eve Black regards with favour her therapist, herself, peace of mind, hatred, and fraud, and has a moderately favourable opinion of her parents, as well as a moderately active and deep, and a rather tense judgement of them.

From Tables 9.2 and 9.5 it is clear that *Eve White* and *Jane* are very much alike, as illustrated in Fig. 9.5 and reasonably 'normal'. All concepts related to day-to-day life and therapy are positively evaluated, while hatred and fraud are not. Me is seen as a neither good nor bad concept and somewhat fast, weak and distasteful, as well as rather tense, active and deep. Noteworthy is furthermore that confusion and sickness are neutrally evaluated, and are very tense, active, weak, distasteful and cold.

The differences between *Eve White* and *Jane*, as perceived by Osgood & Luria, do not show very clearly here. It is possible to derive a third personality component which contrasts *Eve White* and *Jane*, but it explains less than 1% of the total variation. An analysis of the concept-scale relationships for this third personality component shows that *Eve White* compared to *Jane* finds confusion and sickness more distasteful, weak, and tense. In other

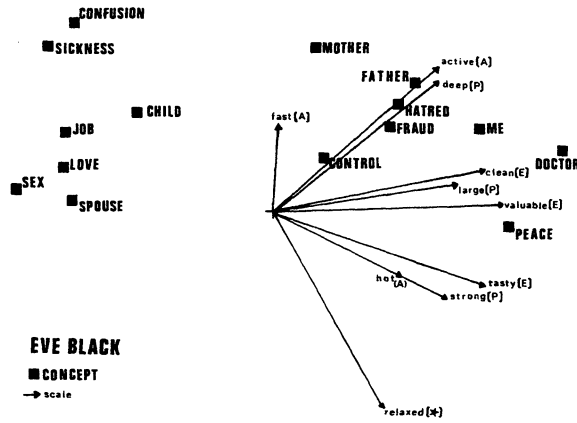


Fig. 9.4 Triple personality study: Eve Black's concept-scale space

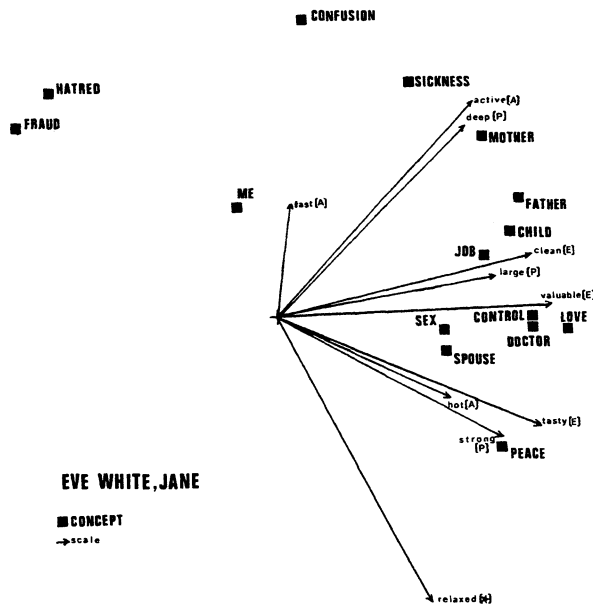


Fig. 9.5 Triple personality study: Eve White's and Jane's concept-scale space

words, Jane apparently thinks less unfavourable of the concepts related to her mental state. The effect is, however, rather small. These differences can be discerned, by the way, in Osgood & Luria's ball-diagrammes, but the different reactions to these concepts do not show up in Table 9.2, probably due to summing over scales.

9.6 DIFFERENCES WITH OSGOOD & LURIA

There are differences between our analyses, and those of Osgood & Luria. In the first place we find a far stronger similarity between Jane and Eve White than Osgood & Luria suggest, and the differences we do find are not those they mention as important.

Their conclusion that "Jane is becoming *less* diversified semantically (more 'simple-minded') rather than the reverse" (p. 516), with "... all of her judgments tending to fall along a single factor of *good-strong* vs. *bad-weak*" (p. 514), is only very weakly supported by our analysis. If we take 'simple-mindedness' to mean that one of the combinations of scale and concept axes increases at the cost of the others, then indeed we observe from Jane's T2-core planes (Table 9.7) that $\tilde{c}_{C1,S1}$ increases from 9 to 10, and the other large element $\tilde{c}_{C3,S2}$ decreases (in absolute size) from -5 to -4. Thus the evaluative-like first scale component becomes more important with respect to day-to-day concepts, therapy, and hatred and fraud, while active, deep, tense judgements of mother, sickness, confusion, hatred and fraud become less. If this change warrants the strong statement of Osgood & Luria is rather doubtful.

The statement that there is an "increasing simplification in structure characteristic of all three personalities" (p. 517) cannot be supported in the same manner (see Table 9.7). A more detailed analysis, and possibly a replication of their analysis coupled with separate analyses via singular value decomposition for each of the personalities might show how these differences arise - a course which we will not pursue here.

9.7 CONCLUDING REMARKS

In this example we showed how three-mode principal component analysis can fruitfully be used to provide a unified description of the scale and concept usage in the case of a multiple personality. At the same time this study can serve as an example of how individual differences can be handled in semantic differential research far more easy than was customary in the early stages of its development.

