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ABSTRACT

Q-technique factor analysis identifies clusters or factors of people, rather than of variables, and has proven very popular, especially with regard to testing typology theories. The present study investigated the utility of three different protocols for obtaining data for Q-technique studies. These three protocols were: (1) a conventional ipsative 9-category Q-sort; (2) a normative response format using unnumbered graphic scales subsequently scored on a 1-to-15 scale; and (3) a normative 5-point Likert scale. Subjects were 10 psychologists reacting to 97 variables in each of the 3 protocols. It was found that normative rating data may be useful in Q-technique studies, at least under some circumstances. It is also suggested that aggregating Q-technique data across repeated measurements may also be useful in some studies. Seven tables and five figures present study data. (Contains 28 references.) (Author/SLD)

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THE UNNUMBERED GRAPHIC SCALE AS A DATA-COLLECTION METHOD: AN INVESTIGATION COMPARING THREE MEASUREMENT STRATEGIES IN THE CONTEXT OF Q-TECHNIQUE FACTOR ANALYSIS

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ABSTRACT

Q-technique factor analysis identifies clusters or factors of people, rather than of variables, and has proven very popular, especially with regard to testing typology theories. The present study investigated the utility of three different protocols for obtaining data for Q-technique studies. It was found that normative, rating data may be useful in Q-technique studies, at least under some circumstances. It is also suggested that aggregating Q-technique data across repeated measurements may also be useful in some studies.

Factor analysis has been available to researchers at least conceptually since the turn of the century (Spearman, 1904), but as a practical matter has been widely used only with the more recent availability of both modern computers and statistical software packages. Factor analysis examines patterns of relationships among entities (most often variables) across replicates (usually people), with a view toward creating clusters or factors of the examined entities. Several matrices of association can be examined as the basis for the clustering process, including the variance-covariance matrix (e.g., Thompson & Borrello, 1987a), but most analysts employ a matrix of bivariate correlation coefficients for this purpose.

Typically, the matrix of associations is computed from a two-dimensional initial data matrix, e.g., rows representing scores of people, with the scores organized into columns representing the variables being measured. Analyses based on raw data matrices delineated in this manner are termed *two-mode* factor analyses (Gorsuch, 1983, Chapter 15).

Although the most common two mode analyses are based on data matrices with people defining rows, and variables defining columns, there are a number of two-mode analyses available to the researcher. Cattell (1966) conceptualized the possibilities as involving any combination of two dimensions (thus constituting a surface) from a "data box" defined by three dimensions: (a) variables, (b) subjects (often people), and (c) occasions of measurement.

Table 1 presents the six "techniques" conceptualized and labelled by Cattell (1966), as well as illustrative applications of several of the techniques. Although all six techniques are available to researchers, R-technique (cf. Thompson & Borrello, 1992b) and Q-technique (cf. (Thompson & Miller, 1984), respectively, are the most commonly applied analyses in contemporary practice.

INSERT TABLE 1 ABOUT HERE.

Whichever technique we apply, we generally want the number of row replicates to be several times larger than the number of the entities that we are factoring. For example, in R-technique we want several times more subjects than factored variables, and in Q-technique we want several times more variables than factored people. This is to allow the patterns of relationships among the factored entities to be replicated over quite a number of rows in the raw data matrix, so that we can be sure that the estimated relationships are stable, and therefore that the factors we extract from the matrix of associations will also be stable.

Thus, Q-technique factor analysis is well suited to the more intensive study of a relatively small number of subjects. Q-technique is about the business of defining types (or prototypes) of people, and so is very useful in testing typological theories. Q-technique analysis directly tests typological premises. As Kerlinger (1986, p. 521) explains, in Q

> one tests theories on small sets of individuals carefully chosen for their "known" or presumed

> possession of some significant characteristic or characteristics. One explores unknown and unfamiliar areas and variables for their identity, their interrelations, and their functioning.

Excellent in-depth treatments of Q-technique factor analysis are available from Stephenson (1953), Kerlinger (1986, Chapter 32), and Gorsuch (1983). Carr (1992) provides an excellent shorter treatment.

Methodological Issues in Q-technique Studies

The analysis of Q-technique data proceeds in the usual manner of any R-technique factor analysis, except that the raw data matrix that is used to compute the factored matrix of associations is "transposed" from the typical ordering of data matrices that is used in the more familiar R-technique analyses. The data are analyzed and factors of people or subjects are identified. The basis for the groupings of the subjects can be evaluated by consulting the factor scores (e.g., Thompson, in press) that the variables receive on each factor. Thompson (1980b) illustrates this process.

Variables

The variables in a Q-technique analysis can be variables of many kinds, e.g., statements responded to with respect to degree of agreement or disagreement, or photographs responded to with respect to physical attractiveness. There are two major choices regarding the selection of variables. One choice (e.g., Thompson, 1980b) is to use variables that are themselves implicitly *structured*

(Kerlinger, 1986). For example, if the subjects responded to the 42 items on the Love Attitudes Scale (Hendrick & Hendrick, 1990), the responses would be structured, because the scale includes seven items measuring each of the six types of love posited by Lee (1973).

Alternatively, if the variables are presumed to be representative of a single population of items or variables, then the study would be considered *unstructured*. For example, if the subjects responded to the 55 items on the Love Relationships Scale (Thompson & Borrello, 1987b), the responses would be presumed to be unstructured, because the scale was developed inductively without premises regarding an underlying structure (Thompson & Borrello, 1992a).

Response Format

Quasi-normal Q-sort. Though many response formats are candidates for the measurement protocols used to collect the data that will be the basis for Q-technique factor analysis (Daniel, 1989), most researchers employ a Q-sort (Kerlinger, 1986, Chapter 32) protocol in Q-technique studies. Q-sorts require all subjects to each put stimuli (e.g., cards each listing a statement) into a predetermined number of categories, with a predetermined number of items also being placed in each category. Most commonly the predetermined numbers of categories that go into each category are created so as to yield a normal or a quasi-normal, symmetrical distribution of scores. Kerlinger (1986, p. 509) provides an illustrative example for a Q-sort involving 90 statements sorted as follows:

n items	3 +	4 +	7 +	10 +	13 +	16 +	13 +	10 +	7 +	4 +	3 = 90
Categ. .	10	9	8	7	6	5	4	3	2	1	0

This response format yields data that are considered *ipsative* (Cattell, 1944), because the protocol invokes a forced-choice response format in which responses to one item inherently constrain the possible choices for subsequent items. Though ipsative data are not suitable for use in R-technique factor analysis (Thompson, Levitov & Miederhoff, 1982), ipsative data are quite useful in studying commonalities in *intra*individual differences, as in Q-technique factor analysis.

The Q-sort protocol is appealing, because the protocol yields data for each subject that are <u>exactly</u> equally distributed, i.e., data that for each subject are symmetrical, and with exactly the same skewness and kurtosis. This is appealing, because when we correlate the data across the subjects, none of the correlation coefficients are attenuated by differences in score distributions. Of course, product-moment correlation coefficients evaluate the degree to which data rows are ordered similarly across a given pair of columns of data.

However, even when rows are ordered *identically* across a given pair of data columns, the product-moment correlation coefficient between the two columns will be less than one unless the two variables are also equal in their distribution shapes. As Glass and Hopkins (1984, p. 91) note, "*r* can equal 1.0 only when the marginal distributions of *X* and *Y* have precisely the same shape."

Dolenz (in press) explains these dynamics in accessible detail.

Mediated Q-sort. The Q-sort is appealing because the protocol allows subjects to provide data regarding a lot of variables without being cognitively overwhelmed. For example, it is not conceivable to ask subjects to rank-order variables without any ties. The task of rank-ordering 90 items would confuse and irritate even the most patient and brightest subject.

However, Thompson (1980a) has proposed a *two-stage* measurement protocol that does yield data that are rank-ordered with no ties. First, subjects complete a conventional Q-sort protocol. Second, subjects are then asked to rank-order the statements within each of the Q-sort categories. This strategy yields more variance in responses, and so theoretically should allow isolation of more stable factors of subjects.

Unnumbered graphic scale. *Normative* measurement (Cattell, 1944) allows subjects to rate (as against rank) data, and the response to one item does not in any way mechanically constrain subjects' responses to other items. With Likert scales, for example, the response to item one does not physically constrain my response to other items. The only constraints are self-imposed psychological constraints in the event that I elect to respond consistently to items containing roughly the same content.

What drives reliability of scores is having greater variance in our data (Reinhardt, 1991). Traditionally, there was considerable debate about whether it might be desirable in attitude measurement to employ a 1-7 Likert scale, as against a 1-5 scale, whether a 1-9 scale might be more preferable still, and so forth. Certainly, more response alternatives allow subjects to provide more variable responses, if they wish to do so. As Nunnally (1967, p. 521) explains, "It is true that, as the number of scale points increases, the error variance increases, but at the same time, the true-score variance increases at an even more rapid rate." Thus, Guilford (1954, p. 291) suggests that "it may pay in some favorable situations to use up to 25 scale divisions." As Thompson (1981, p. 5) notes, "use of a large number of scale steps only becomes undesirable when subjects become confused or irritated at being confronted with a cognitively overwhelming number of response alternatives." Confused or irritated subjects may not pay as much attention to rating tasks, and may therefore provide less reliable data.

However, Thompson (1981) described a response format that may reduce cognitive press on subjects while still yielding normative data that are more variable. This response format has been labelled an *unnumbered graphic scale*. Subjects are presented with a straight line drawn between two antonyms (e.g., "Disagree" and "Agree") and are asked to draw a mark through the line at the position that best indicates the extent of their agreement with a given statement. These marks are subsequently scored by the researcher using an equal-interval measurement scaled with a relatively large number of categories, e.g., 1-15. This protocol puts a limited cognitive burden on subjects, but can still yield more variable scores.

It is conceivable that such data might be sufficiently variable that the data could be employed as the basis for Q-technique factor analysis. The viability of such a strategy must be empirically evaluated over several studies if we are to have confidence in conclusions regarding the utility of this protocol in Q-technique studies.

Of course, using normative data will mean that the bivariate correlation coefficients analyzed in a Q-technique analysis will inherently be attenuated by variations in the distributions shapes of scores for different individuals, and that these differences will affect the identification of the factors extracted from the correlations. The assumption that distributions of scores are the same across people is perfectly met with both Q-sort and mediated Q-sort measurement protocols, and will not be perfectly met with normative data.

However, it is conceivable that tolerating some deviations in distribution shapes will not devastate the factor analytic solution, and may be worth it if not requiring people to make forced choices yields more accurate reflections of their feelings. It is ironic that we typically do not see much attention paid to distributional requirements that also apply in R-technique factor analyses, while we seem to have obsessive concerns regarding the same dynamics in Q-technique analyses that employ the same mathematics.

<u>Purposes of the Present Paper</u>

The present study was conducted to explore the utility of various measurement protocols in Q-technique factor analytic studies. Specifically, the study was conducted to investigate two research questions. First, are inter-person correlations reasonably comparable across three measurement protocols, when the protocols are all completed by one cohort of subjects? Second, are subjects located in approximately the same places in Q-technique factor spaces in separate analyses conducted across the three measurement protocols?

Method

Subjects and Measurement Protocols

As in all Q-technique studies, it was necessary to have more variables than the people who were to be factored. Subjects in the present study were 10 psychologists.

The psychologists reacted to 97 variables in each of three measurement protocols. The protocols were administered in a randomly counterbalanced order. The 97 variables consisted of the 42 items from the Hendrick and Hendrick (1990) Love Attitudes Scale and the 55 items from the Thompson and Borrello (1987b) Love Relationships Scale.

The three measurement protocols involved: (a) a conventional ipsative 9-category ("1" = "Very Strongly Agree" to "9" = "Very Strongly Disagree") Q-sort; (b) a normative response format using unnumbered graphic scales subsequently scored on a 1 ("Disagree") to 15 ("Agree") scale; and (c) a normative 5-point ("1" = "Strongly Agree" to "5" = "Strongly Disagree") Likert scale. The score categories and anchors were selected with the intention of honoring typical practice in the use of each protocol, and one of the three protocols (i.e., the unnumbered graphic scale) invoked reverse scaling to minimize response set influences on the subjects.

The distribution of scores employed in the ipsative, Q-sort was:

_n_ items	6 +	9 +	11 +	14 +	17 +	14 +	11 +	9 +	6 = 97
Category	1	2	3	4	5	6	7	8	9

Within the two, separately administered, normative measurement protocols, for example, item 1 was presented as follows:

1. Sex always makes a person feel in love with the lover.

   STRONGLY AGREE 1 2 3 4 5 STRONGLY DISAGREE

1. Sex always makes a person feel in love with the lover.

   DISAGREE ____ AGREE

Results

Table 2 presents descriptive statistics for each of the 10 subjects across each of the three measurement protocols. Table 3 presents the bivariate correlation coefficients across the 10 subjects and the three response formats.

INSERT TABLES 2 AND 3 ABOUT HERE.

Table 4 presents the Q-technique factor structure from the analysis of the data from the *Q-sort* protocol. Figure 1 presents these results in graphic form, indicating the position of each of the 10 subjects in the two-dimensional Q-technique factor space.

INSERT TABLE 4 AND FIGURE 1 ABOUT HERE.

Table 5 presents the Q-technique factor structure from the analysis of the data from the *unnumbered graphic scale* protocol. Figure 2 presents these results in graphic form, indicating the position of each of the 10 subjects in the two-dimensional Q-technique factor space.

INSERT TABLE 5 AND FIGURE 2 ABOUT HERE.

Table 6 presents the Q-technique factor structure from the analysis of the data from the *unnumbered graphic scale* protocol. Figure 3 presents these results in graphic form, indicating the position of each of the 10 subjects in the two-dimensional Q-technique factor space.

INSERT TABLE 6 AND FIGURE 3 ABOUT HERE.

Ancillary Analysis of Data Concatenated or Pooled Across Protocols

An ancillary analysis was conducted in which the data from each subject were concatenated. For example, subject "A"'s responses to the unnumbered graphic scale data were added to the raw data matrix after that subject's responses from the Q-sort protocol, and the subject's responses to the items from the Likert-scale session were added after these. This resulted in a vector of 291 (97 x 3) scores for each subject.

These data were analyzed for two reasons. First, isolating locations in factor space of the 10 subjects using this data might provide a good anchor for comparison purposes across the three protocols, since the concatenations provide so many row replicates. Second, it was decided that it might be useful to explore the utility of using repeated-measures protocols to better delineate positions of factored persons within factor spaces.

Table 7 presents the factor structure from this analysis. Figure 4 presents a plot of the factor space. Figure 5 presents a plot of the factor spaces from all four analyses, to facilitate invariance of person locations within the Q-technique factor spaces across the three measurement protocols.

INSERT TABLE 7 AND FIGURE 4 ABOUT HERE.

Discussion

The study first research question asked, are inter-person correlations reasonably comparable across three measurement protocols, when the protocols are all completed by one cohort of subjects? Table 1 presents the descriptive statistics for all 30 vectors (10 people x 3 measurement protocols) of 97 scores. Since equivalence of shape is a precondition for scores being highly correlated, as emphasized previously, these statistics provide a perspective on the range of plausible values for the Table 3 correlation coefficients.

Of course, the ipsative Q-sort yielded scores with identical means (here 5.00), standard deviations (2.21), coefficients of kurtosis (-.82), and coefficients of skewness (.00) for all 10 subjects. Thus, all 45 pairs of inter-person correlation coefficients ([(10 x (10 - 1)) / 2] = [(10 x 9) / 2] = 45) for these data will reach values of +1.0, if the variables are ordered identically across pairs of people.

As expected, Table 2 indicates that the unnumbered graphic scale data had the largest standard deviations (ranging from 3.39 for subject "D" to 6.34 for subject "F"). Also as expected, the 5-point Likert-scale data had the smallest standard deviations (ranging from 1.03 for subject "J" to 1.87 for subject "F").

However, what is more surprising is that the normative data have reasonably equivalent shapes, even though the measurement protocol did not constrain this feature of the responses. The unnumbered graphic scale data had coefficients of kurtosis ranging from -1.87 to -.90, and coefficients of skewness ranging from -.65 to +.34. The 5-point Likert-scale data had coefficients of kurtosis ranging from -1.89 to -.51, and coefficients of skewness ranging from -.42 to +.50. Thus, the unnumbered graphic scale data were more variable (i.e., had larger standard deviations), but were distributed similarly to the Likert-scale data.

In Table 3 the *intra-person* correlation coefficients are organized into a simplex format and are underlined. Correlations between two sets of responses both involving normative rating data are double-underlined. Correlations between two sets of responses involving one normative data set and one ipsative (Q-sort) data set are single-underlined.

Theoretically, three expectations can be offered regarding the Table 3 results. First, since as noted previously the unnumbered graphic scale was scored in the opposite direction than the Q-sort and the Likert data were scored, the Q-sort and the Likert data should be positively correlated *intra-individually* while the correlation coefficients between the Q-sort and the graphic scale data and between the Likert and the graphic scale data should be negatively correlated *intra-individually*. Second, if (a) the data were reliable and (b) persons each have different views regarding love, then the *intra-person* coefficients near the diagonal of the matrix should generally be larger than the *inter-person* coefficients that are further from the diagonal. Third, if the psychometric nature of the measurement protocol drives responses, then the *intra-person* correlations between two *normative* sets of responses should be larger than the *intra-person* correlations between one *normative* set of responses and one *ipsative* set of responses.

With regard to these expectations, first, the *intra-person* coefficients did have the expected signs. Second, the *intra-person* coefficients near the diagonal of the Table 3 matrix generally were larger than the *inter-person* coefficients that are further from the diagonal. This suggests that the data were reasonably reliable, even though the *intra-person* coefficients were attenuated both by repeated measurement (i.e., stability) and by variations in the measurement protocols. Most of the *intra-person* coefficients in Table 3 ranged from about |.7| to |.8|, while most of the *inter-person* coefficients ranged from about |.3| to |.5|. Thus, *intra-person* coefficients tended to be about 2 to 6 times larger than the *inter-person* coefficients (e.g., $\underline{r}^2 = .7^2 = .49$ is roughly 2 times $\underline{r}^2 = .5^2 = .25$).

Third, seven of the 10 coefficients both involving *normative* measurement protocols involved larger correlation coefficients than did *intra-person* coefficients involving mixed protocol types. However, it is striking that the *intra-individual* coefficients for given subjects were so homogeneous. Together with reasonable comparability of score distribution shapes for the *normative* data, noted previously, this raises the intriguing possibility that researchers may be able to conduct Q-technique studies without requiring subjects to Q-sort variables.

The study's second research question asked, are subjects located in approximately the same places in Q-technique factor spaces generated in separate analyses conducted across the three measurement protocols? This question provides another perspective on whether the Q-technique results are invariant over measurement protocols.

As indicated by the results portrayed in Figures 1 through 3, the 10 subjects were arrayed in approximately the same positions in the factor analyses across the three data sets. Thus, the three measurement protocols yielded very similar structures in the present study. Persons "I" and "E" were most similarly located across analyses, while persons "F" and "C" were least similarly located across protocols.

The ancillary analysis yielded similar results. The present study involved the unique opportunity to pool or aggregate data across three measurement occasions, albeit repeated measurements that at least in the present study also involved variations in the measurement protocols. Thus, each person's response patterns were correlated with each other person based on 291 (97 x 3) rather than on only 97 data points. The pooled analysis theoretically should result in more stable locations of the individuals within the factor space. Again, the 10 subjects were located in roughly the same locations in this analysis, as indicated in Figures 4 and 5.

In fact, the pooled analytic strategy may be very useful in future studies. Variations on this strategy might be recommended. For example, a researcher might ask subjects to complete a single measurement protocol twice without protocol variation, and then pool the two data sets. Another variation might involve standardizing the scores into Z score form prior to aggregation.

In summary, the present study suggests that at least in some cases even normative data may be analyzed using Q-technique factor analysis. Such measurement protocols may impose less demands on subjects, and may more accurately reflect subjects' feelings, by not constraining subjects to discriminate among items about which subjects may really not feel differently. Of course, Q-sort protocols are useful when one is investigating variables all of which are highly socially desirable, and which do not yield score variance unless the variables are measurement in forced-choice formats. But when normative data are going to be subjected to Q-technique analyses, the researcher must still investigate the equivalence of distrubition shapes, just as more R-technique analysts also ought to attend to this requirement. And when normative data are subjected to Q-technique analyses, it may be helpful to employ more than the usual number of variables, so that attenuation from heterogeneity of distribution shapes may be partially mitigated by using more row replicates.

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Table 1
Six Variations of Two-Mode Factor Analysis

Technique Label	Columns Defining Entities to be Factored	Rows Defining the Patterns of Associations	Example Application
R	Variables	Subjects	Thompson & Borrello (1987b)
Q	Subjects	Variables	Thompson (1980b)
O	Occasions	Variables	Jones, Thompson & Miller (1980)
P	Variables	Occasions	Cattell (1953)
T	Occasions	Subjects	Frankiewicz & Thompson (1979)
S	Subjects	Occasions	

Table 2
Descriptive Statistics
Across 10 Subjects and 3 Response Formats
for Ranking/Rating of v=97 Variables

Person	Mean	Std Dev	Kurtosis	Skewness	Minimum	Maximum
A1	5.00	2.21	-.82	.00	1	9
A2	7.36	5.19	-1.55	.14	1	15
A3	3.01	1.40	-1.32	.05	1	5
B1	5.00	2.21	-.82	.00	1	9
B2	9.60	4.94	-1.05	-.65	1	15
B3	2.71	1.29	-.84	.50	1	5
C1	5.00	2.21	-.82	.00	1	9
C2	9.09	5.49	-1.52	-.29	1	15
C3	2.61	1.58	-1.48	.35	1	5
D1	5.00	2.21	-.82	.00	1	9
D2	6.38	3.39	-1.31	.12	1	13
D3	3.32	1.11	-1.36	-.11	1	5
E1	5.00	2.21	-.82	.00	1	9
E2	6.02	4.82	-1.45	.34	1	15
E3	3.55	1.46	-1.40	-.42	1	5
F1	5.00	2.21	-.82	.00	1	9
F2	7.44	6.34	-1.87	.12	1	15
F3	3.04	1.87	-1.89	-.03	1	5
G1	5.00	2.21	-.82	.00	1	9
G2	6.93	3.95	-1.08	.00	1	15
G3	3.12	1.08	-.85	.10	1	5
H1	5.00	2.21	-.82	.00	1	9
H2	7.92	4.14	-1.33	-.23	1	15
H3	3.49	1.21	-1.19	-.20	1	5
I1	5.00	2.21	-.82	.00	1	9
I2	7.25	4.48	-1.31	-.02	1	15
I3	3.01	1.25	-1.38	.01	1	5
J1	5.00	2.21	-.82	.00	1	9
J2	7.87	3.98	-.90	-.09	1	15
J3	2.65	1.03	-.51	.40	1	5

Note. Subjects were randomly assigned letters "A" through "J", to protect their anonymity. Response formats are indicated by the number following each letter, where: "1" = *Q-sort* with a specified quasi-normal distribution of items; "2" = *unnumbered graphic scale* scored on a 1 to 15 equal interval scale; "3" = 5-point *Likert scale*.

Table 3

Intra- and *Inter-person* Correlation Coefficients Across 10 Subjects and 3 Response Formats (v=97 Variables)

	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2
A1	1.0000										
A2	-.6944**	1.0000									
A3	.7320**	-.7661**	1.0000								
B1	.4532**	-.4502**	.4520**	1.0000							
B2	-.3441**	.2261*	-.4483**	-.5758**	1.0000						
B3	.3246**	-.3422**	.2966**	.6456**	-.4008**	1.0000					
C1	.4213**	-.4348**	.5532**	.3681**	-.2459*	.3392**	1.0000				
C2	-.3256**	.3380**	-.4769**	-.2433*	.1354	-.1886	-.7283**	1.0000			
C3	.2744**	-.3071**	.3187**	.2923**	-.0284	.3479**	.6563**	-.7466**	1.0000		
D1	.5426**	-.4066**	.4655**	.4638**	-.4118**	.4122**	.3702**	-.1448	.1700	1.0000	
D2	-.4274**	.3698**	-.4298**	-.4094**	.4252**	-.3124**	-.3816**	.1149	-.1138	-.7230**	1.0000
D3	.4692**	-.3862**	.4066**	.5622**	-.4158**	.4634**	.3001**	-.0545	.1609	.7735**	-.7769**
E1	.5319**	-.4148**	.4790**	.3638**	-.2812**	.3721**	.3915**	-.2605**	.2506*	.5128**	-.3400**
E2	-.5231**	.4173**	-.4688**	-.3943**	.2150*	-.3671**	-.4079**	.3100**	-.2876**	-.5026**	.3961**
E3	.5360**	-.4851**	.5040**	.4359**	-.2918**	.3726**	.4101**	-.3016**	.1981	.4585**	-.4385**
F1	.4702**	-.4647**	.4318**	.4255**	-.1010	.2882**	.3511**	-.3162**	.2357*	.3979**	-.2317*
F2	-.3492**	.4985**	-.4352**	-.4109**	.0993	-.2861**	-.2719**	.2331*	-.3012**	-.2482*	.1268
F3	.2945**	-.3956**	.4069**	.2613**	-.0794	.1819	.2139*	-.1261	.1432	.1737	-.1798
G1	.3766**	-.3368**	.3373**	.3787**	-.2345*	.2699**	.3191**	-.2356*	.2476*	.1809	-.1499
G2	-.2109*	.2682**	-.3002**	-.3027**	.2804**	-.1880	-.1799	.0478	-.0647	-.0739	.0611
G3	.1783	-.2325*	.1646	.1609	-.0724	.0780	.2653**	-.3172**	.2786**	.1087	.0636
H1	.6149**	-.4593**	.5026**	.4894**	-.3146**	.3575**	.3085**	-.3307**	.2744**	.5532**	-.4579**
H2	-.6247**	.4417**	-.4869**	-.4972**	.3425**	-.3966**	-.3186**	.2776**	-.2124*	-.5519**	.4817**
H3	.3233**	-.2415*	.2810**	.2960**	-.1653	.1326	.1091	-.1215	.1027	.4986**	-.4123**
I1	.6362**	-.5455**	.6544**	.4617**	-.4604**	.3137**	.4574**	-.3419**	.2476*	.5234**	-.4524**
I2	-.5725**	.4864**	-.5883**	-.4086**	.4578**	-.3405**	-.3740**	.3045**	-.2689**	-.4475**	.3020**
I3	.5743**	-.4794**	.5653**	.4092**	-.4921**	.3687**	.4054**	-.3252**	.2442*	.5143**	-.3731**
J1	.4043**	-.4865**	.5262**	.2553*	-.2879**	.1641	.3979**	-.2356*	.1939	.2128*	-.1804
J2	-.4820**	.5187**	-.4541**	-.3043**	.2386*	-.2208*	-.3351**	.1937	-.2226*	-.2771**	.1645
J3	.5387**	-.5351**	.5888**	.3470**	-.4166**	.2754**	.4611**	-.3398**	.3372**	.3287**	-.2859**

Table 3 (cont.)

	D3	E1	E2	E3	F1	F2	F3	G1	G2	G3	H1
D3	1.0000										
E1	.4227**	1.0000									
E2	-.4743**	-.7485**	1.0000								
E3	.4687**	.7363**	-.8888**	1.0000							
F1	.3255**	.4128**	-.3084**	.3391**	1.0000						
F2	-.1708	-.2853**	.2393*	-.2137*	-.6256**	1.0000					
F3	.1586	.2542*	-.1502	.1979	.5663**	-.7109**	1.0000				
G1	.1648	.2723**	-.1991	.1808	.2489*	-.3009**	.2542*	1.0000			
G2	-.1178	-.2097*	.1476	-.2228*	-.1895	.2385*	-.3337**	-.5708**	1.0000		
G3	-.0245	.2261*	-.1122	.0887	.2740**	-.2070*	.1775	.3914**	-.3510**	1.0000	
H1	.5241**	.5681**	-.4938**	.4811**	.4277**	-.3730**	.2769**	.3149**	-.1537	.2218*	1.0000
H2	-.5322**	-.5644**	.4635**	-.4846**	-.3937**	.3233**	-.2957**	-.2742**	.1296	-.1768	-.8579**
H3	.4848**	.3311**	-.3823**	.3533**	.3389**	-.1881	.0969	.1168	.0643	.1517	.5453**
I1	.4396**	.5085**	-.4899**	.4941**	.4234**	-.3462**	.3020**	.2809**	-.3384**	.2522*	.5170**
I2	-.3791**	-.4349**	.4551**	-.3780**	-.3172**	.3248**	-.2535*	-.2868**	.3058**	-.2060*	-.4822**
I3	.4376**	.5105**	-.4804**	.4413**	.3228**	-.2995**	.1774	.2628**	-.2795**	.1985	.5218**
J1	.2536*	.4574**	-.4050**	.4133**	.3660**	-.3180**	.3398**	.3149**	-.4314**	.2870**	.2383*
J2	-.2278*	-.3896**	.3320**	-.3395**	-.3860**	.4962**	-.4223**	-.3967**	.3814**	-.2938**	-.2866**
J3	.3616**	.4018**	-.3545**	.3643**	.3789**	-.3235**	.3478**	.3698**	-.4691**	.1885	.3150**

	H2	H3	I1	I2	I3	J1	J2	J3
H2	1.0000							
H3	-.5208**	1.0000						
I1	-.5507**	.3778**	1.0000					
I2	.5011**	-.3363**	-.8677**	1.0000				
I3	-.5338**	.3746**	.8671**	-.9142**	1.0000			
J1	-.2060*	.1246	.4021**	-.3235**	.3341**	1.0000		
J2	.2894**	-.0858	-.3707**	.3486**	-.3382**	-.5578**	1.0000	
J3	-.3438**	.0988	.4428**	-.4071**	.3814**	.6665**	-.6671**	1.0000

* $p < .05$ ** $p < .01$

Table 3 (cont.)

Note. Within-subject (*intra-person*) correlation coefficients are organized into a simplex format and are underlined. Correlations between two sets of responses both involving normative rating data are double-underlined. Correlations between two sets of responses involving one normative set of responses and one ipsative (Q-sort) set of responses are single-underlined.

Table 4
Varimax-rotated Structure Matrix
for the *Q-sort* Data (v=97 Variables)

Person	Factor I	Factor II
D1	.83206	.03167
H1	.81733	.12765
A1	.72051	.38076
I1	.68553	.36893
E1	.64651	.36767
B1	.61581	.29868
F1	.54209	.37255
J1	.15402	.79801
G1	.15273	.68335
C1	.34240	.61921

Table 5
Varimax-rotated Structure Matrix
for the *Unnumbered Graphic Scale* Data (v=97 Variables)

Person	Factor I	Factor II
D2	.79798	-.05794
H2	.74061	.23688
B2	.64361	.08235
E2	.63280	.28273
I2	.62389	.42287
C2	.33421	.31514
J2	.17018	.78838
F2	.10606	.76654
A2	.44650	.65128
G2	.05011	.59080

Table 6
Varimax-rotated Structure Matrix
for the *Likert-scale* Data (v=97 Variables)

Person	Factor I	Factor II
D3	.83914	.02011
E3	.71196	.21198
H3	.67846	-.08101
I3	.66307	.32920
B3	.52804	.28372
J3	.36349	.65301
C3	.13566	.63783
G3	-.08876	.61640
F3	.12670	.58797
A3	.56341	.57212

Table 7
Varimax-rotated Structure Matrix Across 10 Subjects
Pooled Across 3 Response Formats
To Constitute a Data Matrix with v=97x3=291 Variables

Person	Factor I	Factor II
D	.84118	.13448
H	.75926	.36614
E	.73497	.20040
I	.63916	.50984
B	.59769	.47956
J	.34179	.78267
G	.14221	.76800
F	.21491	.74161
A	.54005	.61243
C	.46980	.52878

Figure 1
The 10 Subjects Arrayed in Factor Space
for the *Q-sort* Data (v=97 Variables)

```
    Factor II
        I
        I
        I
        I       J
        I
        I       G
        I           C
        I
        I
        I
        I                     F   I A
        I
        I                       B
        I                       E
        I                               H
        I
        I                               D
- - - - + - - - - - - - - - - - - - - - - - Factor I
        I
        I
        I
        I
```

Note. This figure is a graphic presentation of the factor structure/pattern coefficients from the Q-technique factor analysis. For example, subject "D" had "loadings" of +.83206 and +.03167, respectively, and is therefore located at this Cartesian coordinate in the graph of the factor space.

Figure 2
The 10 Subjects Arrayed in Factor Space
for the *Unnumbered Graphic Scale* Data (v=97 Variables)

```
   Factor II
        I
        I
        I
        I    J
        I F
        I
        I             A
        I G
        I
        I                   I
        I
        I         C
        I                   E
        I                       H
        I
        I                     B
        I
- - - - + - - - - - - - - - - - - - - - - -  Factor I
        I
        I                         D
        I
        I
```

Figure 3
The 10 Subjects Arrayed in Factor Space
for the *Likert-scale* Data (v=97 Variables)

```
    Factor II
        I
        I
        I
        I
        I
        I
    G   I   C       J
        I   F             A
        I
        I
        I
        I                      I
        I                 B
        I                        E
        I
        I
        I                            D
- - - - + - - - - - - - - - - - - - - - - - Factor I
        I
        I                      H
        I
        I
```

Figure 4
The 10 Subjects Arrayed in Factor Space
for 10 Subjects *Pooled Across* 3 Response Formats
To Constitute a Data Matrix with v=97x3=291 Variables

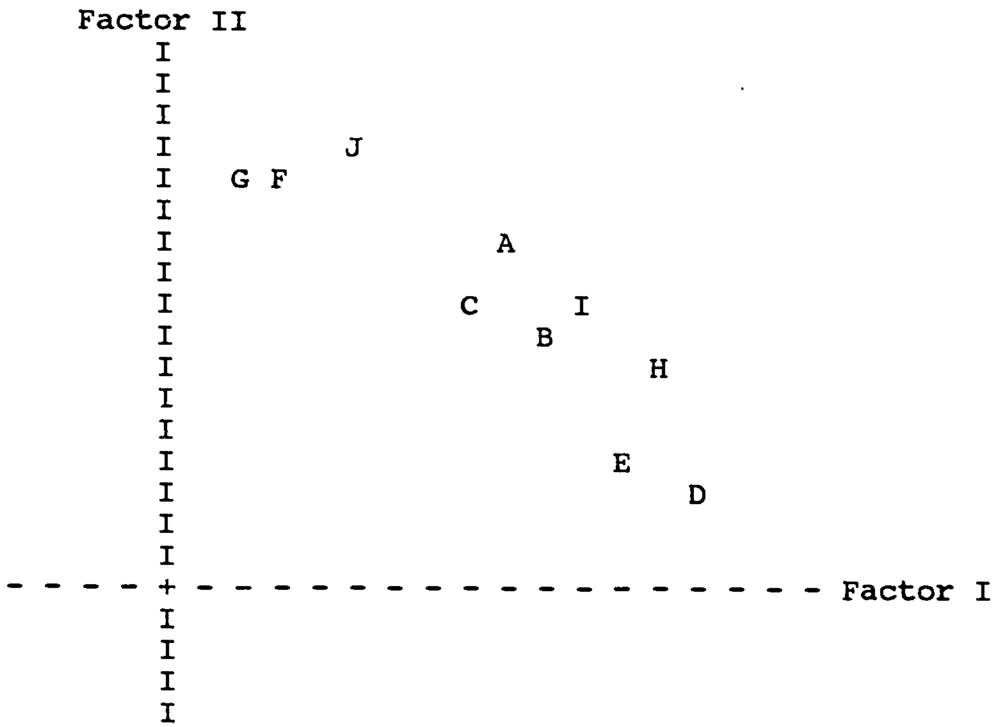
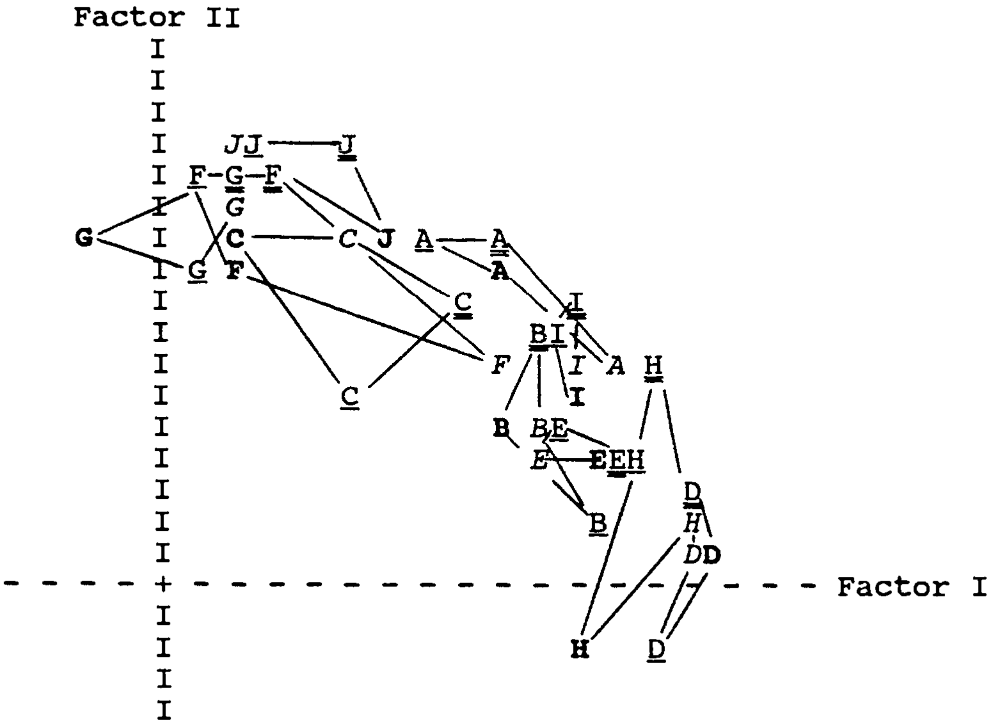


Figure 5
The 10 Subjects Arrayed in Factor Space
Across All Four Factor Analyses



Note. The locations of the 10 subjects in the *Q-sort analysis* involving v=97 variables are italicized. The locations of the 10 subjects in the unnumbered graphic scale analysis involving v=97 variables are single-underlined. The locations of the 10 subjects in the **Likert-scale analysis** involving v=97 variables are bolded. The locations of the 10 subjects in the pooled analysis involving v=291 variables are double-underlined.