Two Types of Factors in the Analysis of Semantic Differential Attitude Data

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Evidence is presented for the existence of two types of factors when semantic differential data are factor analyzed by treating each concept-scale combination as a variable: (1) factors defined by scales *within* given concepts and (2) factors defined by scales *across* concepts. These two types of factors were found for each of two independent data sets. The findings suggest changes in the procedures investigators typically use to select scales, to analyze their three-dimensional array, and to obtain attitude scores.

Originally developed as a psycholinguistic tool to assess the dimensionality of connotative meaning, the semantic differential technique (Osgood, Suci, & Tannenbaum, 1957) has subsequently been used in a wide variety of situations for a wide variety of purposes. In its original use, interest was primarily in assessing the dimensionality of connotative meaning across a wide range of heterogeneous concepts. In one of its subsequent applications, however, interest has been in assessing the connotative meaning of a homogeneous domain of concepts, usually for the specific purpose of assessing *attitude* toward that domain. Although the intentions of the psycholinguist and the attitude researcher differ, the latter group has nevertheless tended to employ procedures for selecting scales, for combining scales to define scores, and for analyzing the data that are similar to the procedures originally used. Use of the original procedures when measuring attitude may obscure important information and, more importantly, limit the validity of the technique as a measure of attitude. This study enumerates some of these misapplications and presents empirical data to support its arguments.

APPLIED PSYCHOLOGICAL MEASUREMENT
Vol. 2, No. 4 Fall 1978 pp. 469-480

Across numerous factor analyses of psycholinguistic semantic differential data, investigators have consistently found evidence for the existence of three major dimensions of connotative meaning—Evaluation, Activity, and Potency. That is, scales typically load on one of these three meaning dimensions, and these dimensions in combination typically account for the major proportion of the explained variance.

In attitude studies, however, there is extensive evidence (e.g., Gulliksen, 1958; Osgood et al., 1957; Heise, 1969) to indicate that the loading of given scales on given meaning dimensions is a function of the particular class of concepts employed. The label concept-scale interaction has been used to refer to this situation, where "the meanings of scales and their relations to other scales vary considerably with the concept being judged" (Osgood et al., 1957, p. 187). Even though there are several possible interpretations of concept-scale interaction, depending upon whether it is a true instance of concept-scale interaction or whether it is due to any one of several methodological artifacts (Heise, 1969), its empirical existence has been supported extensively. Its occurrence indicates that investigators should not assume the dimensionality of scales on the basis of previous research based on heterogeneous concepts or previous research based on a class of concepts different from the one currently being studied. Further, it indicates they should not sum across scales presumably representing a given meaning dimension in order to obtain a more reliable score until they have determined that these scales do in fact represent the same meaning dimension *in their specific application,* i.e., with respect to their specific concepts.

In addition to providing further empirical evidence of concept-scale interaction, a factor analysis of a semantic differential developed by Kubiniec and Farr (1971) reported evidence of a pattern of factors in which scales representing the same meaning dimension tended to cluster together *within* each of several concepts as well as loading on independent factors *across* concepts. That is, two interpretable categories of factors appeared in their data: (1) a category consisting of factors defined by high loadings on most or all scales *within* each of several specific concepts, and (2) a category consisting of factors defined by high loadings of a small number of scales *across* all concepts within a domain.

This pattern was discovered as a result of analyzing their semantic differential in a manner different from that usually employed. The ratings obtained from a semantic differential create a three-dimensional array consisting of subjects × concepts × scales. This array is typically reduced to two dimensions by summing or averaging responses over one of these three dimensions, by "stringing out" concepts and subjects or scales and subjects, or by analyzing one concept at a time. Kubiniec and Farr, on the other hand, "strung out" concepts and scales. That is, each concept-scale combination served as a variable, with subjects as the second dimension of the data box. The existence of the two patterns they obtained would not have been evident if responses had been summed or averaged across concepts, or if concepts and subjects or scales and subjects had been "strung out." The pattern obtained suggests that important information may be obscured when individual concepts are not represented in the analysis of semantic differential data, when the instrument is being used to assess the connotative meaning of a specific class of concepts rather than to assess the dimensionality of connotative meaning.

Specifically, the pattern suggests that investigators should *not* automatically assume that subjects will respond similarly to a series of concepts simply because the concepts represent the same domain. There *could* be differences, and failure to ascertain these differences could result in invalid conclusions. Furthermore, such differences from concept to concept may be of interest in and of themselves. They may, for example, suggest that attitude toward the concept domain is better conceptualized as multidimensional than as unidimensional.

The purpose of this study was to use the same "stringing out" method as that used by Kubiniec and Farr with two independent sets of semantic differential data (different populations, different scales, and different concept domains) to determine whether the same two categories of factors they found, i.e., within-concept factors and across-concept factors, would be replicated. The first analysis was similar to the Kubiniec and Farr study in that one homogeneous domain of concepts was used. The second analysis, however, included *two* homogeneous domains of concepts, providing a more stringent test of the validity of the across-concept factors. In this second analysis, the across-concept factors would have to be defined only across the concepts *within* each of the two domains in order to be meaningful; the existence of factors defined by a small number of scales across *both* domains of concepts would suggest a methodological artifact, i.e., a response style, rather than a meaningful factor pattern.

Analysis I[1]

Subjects were students enrolled in one of three graduate level courses in a college of education. The total sample size was 311 (139 men; 172 women).

Six concepts, all representing the quantitative domain of mental abilities, were used. They included: ALGEBRA, NUMBERS, STATISTICS, MATHEMATICS, CALCULATIONS, and FORMULAS.

Fourteen bipolar adjective scales were used. They were: enjoyable-unenjoyable, attractive-repellant, pleasant-unpleasant, valuable-worthless, simple-complex, lucid-obscure, interesting-boring, clear-hazy, good-bad, meaningful-meaningless, intelligible-unintelligible, easy-difficult, important-unimportant, and useful-useless.[2]

Unlike the Kubiniec and Farr study, all of the scales included were selected on the basis of their meaningfulness to the specific concepts being rated, rather than because they represented one of Osgood's three major meaning dimensions. More specifically, since the interest was in measuring attitude, all of the scales included were presumed to represent the Evaluative meaning dimension.

The concept-scale combination variables (6 concepts × 14 scales = 84 variables) were analyzed using principal factor analysis. Since a homogeneous domain of concepts was used, correlations among the factors were expected. Hence, oblique rotation was used. A simple loadings rotational procedure (Jennrich & Sampson, 1966) with $\gamma = 0$ was used. The number of factors to be rotated was initially estimated by Cattell's scree test (Cattell, 1966, p. 206) as 10. Trial rotations from 8 to 12 factors indicated that a 9-factor solution was most satisfactory; evidence of factor fission (Cattell, 1966, p. 209) was observed with 10 or more factors.

Results

"Stringing out" analysis. Table 1 presents the rotated factor loadings ⩾.30. Since all of the scales used were Evaluative in nature, it might have been anticipated that all of the scales would have clustered together in one meaning dimension, i.e., Evaluative. However, as indicated in Table 1, while all of the scales *did* tend to cluster together *within* concepts (Factors I, II, III, and IV), they also broke up into subcategories, defining factors *across* concepts (Factors V, VI, VII, and IX). For example, the scales Lucid, Clear, and Intelligible split off from the other Evaluative scales to define Factor V; similarly, for the scales Simple and Easy (Factor VII) and the scales Valuable, Meaningful, Important, and Useful (Factor VI). Finally, it is of interest to note that the primary Evaluative scale, the Good scale, itself defined a factor (Factor IX) rather than clustering with the other Evaluative scales.

Thus, even with a presumably homogeneous set of scales, all representing the same connotative meaning dimension as well as a homogeneous set of concepts, there is evidence of concept-scale interaction. In this case, however, the nature of the concept-scale interaction differed from that which is typically found. While no scale changed meaning dimension (since all of the scales were Evaluative scales), the Evaluative scales split up, creating subcategories of Evaluation. This finding is consistent with that of Komorita and Bass (1967), who found three factors for each of two concepts using only Evaluative scales.

Thus, similar to the Kubiniec and Farr findings, there is clear evidence of the existence of two patterns of factors. Moreover, the factors obtained appear to be meaningful. The factors defined by loadings of most or all scales *within* a

[1] These data were originally obtained to study the nature of the dimensionality of attitude toward quantitative concepts. See Mayerberg and Bean (1974) for further information about the instrument. Table 1 is taken from pages 316–317 of this study.

[2] Henceforth, only the positive ends of the scales will be listed.

Table 1
Simple Loadings Rotated Factor Pattern Matrix

		Factors								
		Category I: Within Concepts				Category II: Across Concepts				
Concept	Scale	I	II	III	IV	V	VI	VII	VIII	IX
ALGEBRA										
	enjoyable				67					
	attractive				64					
	pleasant				70					
	valuable				55		(28)			
	simple				30			68		
	lucid				61	37				
	interesting				59					
	clear				62	37				
	good				48					54
	meaningful				64					
	intelligible				63	(25)				
	easy				43			57		
	important				47		32			
	useful				53		33			
NUMBERS										
	enjoyable								50	
	attractive								44	
	pleasant								53	
	valuable						52			
	simple							63		
	lucid					59				
	interesting									
	clear					57				
	good									78
	meaningful						51			
	intelligible					48				
	easy							58		
	important						62			
	useful						52			
STATISTICS										
	enjoyable	66								
	attractive	66								
	pleasant	70								
	valuable	38					46			
	simple	36						64		
	lucid	64				33				
	interesting	61								
	clear	65				(29)				
	good	37								62
	meaningful	49					40			
	intelligible	57				(25)				
	easy	42						58		
	important	41					58			
	useful	32					53			

Table 1 (continued)
Simple Loadings Rotated Factor Pattern Matrix

		Factors								
		Category I: Within Concepts				Category II: Across Concepts				
Concept	Scale	I	II	III	IV	V	VI	VII	VIII	IX
MATHEMATICS										
	enjoyable		30						38	
	attractive								36	
	pleasant								32	
	valuable						63			
	simple							77		
	lucid					63				
	interesting								31	
	clear					55				
	good									75
	meaningful						46			
	intelligible					47				
	easy							70		
	important						64			
	useful						72			
CALCULATIONS										
	enjoyable		86							
	attractive		82							
	pleasant		87							
	valuable		(24)				52			
	simple							75		
	lucid		(26)			45				
	interesting		77							
	clear		(24)			41				
	good		33							70
	meaningful		42				38			
	intelligible		35			40				
	easy		(21)					64		
	important		(28)				56			
	useful		(22)				61			
FORMULAS										
	enjoyable			69						
	attractive			76						
	pleasant			75						
	valuable			41			44			
	simple			32				61		
	lucid			65		(29)				
	interesting			64						
	clear			54		(29)				
	good			47						50
	meaningful			54						
	intelligible			59		(26)				
	easy			42				51		
	important			34			56			
	useful			36			53			

Note: All loadings ⩾ .30 are listed. To indicate structure more clearly, some loadings between .20 and .29 are also listed, in parentheses. The entire matrix of loadings is available from the authors. For ease of interpretation, the factors have been reordered.

given concept are not surprising and are readily interpretable; they reflect a global or generalized attitude toward a given concept. Similarly, the factors defined by loadings of a small number of scales *across* concepts are interpretable: They reflect somewhat more specific dimensions of attitude toward the domain as a whole. The subsets of scales clustering together (e.g., simple and easy; lucid, clear, and intelligible; valuable, important, meaningful, and useful) are intuitively pleasing. Subsets of variables such as simple and valuable, or easy and useful, on the other hand, would not have been as interpretable.

Thus, using a different population, a different class of concepts, a different set of scales (representing only one rather than three connotative meaning dimensions), and a different data reduction technique, the factor pattern obtained in Analysis I was similar to that reported by Kubiniec and Farr. In both cases, the factor pattern obtained was readily interpretable (see Farr & Kubiniec, 1972; Mayerberg & Bean, 1974).

Three-mode analysis. An alternative to reducing semantic differential data from three dimensions to two dimensions is employing three-mode factor analysis (Tucker, 1966). Actually, the factor analysis of concept-scale variables used in Analysis I is the first step in the three-mode method. A three-mode factor analysis produces the following *additional* information: (1) a factor pattern matrix for concepts, derived from the average concept by concept correlation matrix; (2) a factor pattern matrix for scales, derived from the average scale by scale correlation matrix; and (3) a core matrix showing the interrelationships among the three factor analytic solutions.

Subsequent to the completion of Analysis I, additional subjects were measured using the same semantic differential instrument, yielding data for a total of 667 subjects. This data set was then analyzed using three-mode procedures, so that a comparison could be made of the two-dimensional approach and the three-dimensional approach.[3]

The three-mode analysis began with a factor analysis of concept-scale variables. A nine-factor solution was obtained, which was essentially the same as that described previously. As indicated above, a three-mode analysis provides three matrices in addition to the factor matrix of concept-scale variables. The factor pattern matrix for concepts consisted of one general factor, with all concepts loading highly on it. This result was expected, since all six concepts were chosen to represent a single homogeneous concept domain. The factor pattern matrix for *scales* contained three factors, all of which were easily interpretable: IMPORTANT, PLEASANT, and EASY. (Each factor was named for its highest loading.) The core matrix showed the interrelationships among the three-factor analytic solutions. Since there was only one concept factor, the core matrix was two-dimensional and showed how the nine concept-scale factors related to the three scale factors. It was clear that the single most detailed piece of information obtained from the three-mode procedure was the concept-scale factor solution. As indicated earlier, the concept-scale factor solution is readily obtainable from a conventional two-mode factor analysis such as the one presented in Table 1.

Analysis II[4]

As indicated earlier, stronger evidence of the meaningfulness of the two types of factors would be forthcoming if an analysis of semantic differential data representing two *different* concept domains resulted in the presence of factors defined by loadings of the scales across concepts *within* each of the two concept classes and the absence of factors defined by scales *across* con-

[3] A full presentation of the three-mode factor analysis has been prepared for publication as a separate paper.

[4] The data analyzed in Analysis II originated from the same instrument as that used in the Kubiniec and Farr study. The analysis presented here, however, differs from theirs in three ways: (1) it includes two concept domains instead of one; (2) it was analyzed using principal factor analysis with oblique rotation rather than principal components analysis with orthogonal rotation; and (3) it included both men and women. See Kubiniec and Farr (1971) for further information about the instrument.

cept classes. That is, responses to concepts within a given concept domain should be more similar than responses to concepts across concepts domains. Hence, whereas factors defined by loadings within each of the two domains would be reasonable, factors defined by loadings across the two domains would not. Analysis II, consisting of two domains of concepts, allows us to determine whether this is, in fact, the case.

Subjects were freshmen in a state university. The total sample size was 584 (324 men; 260 women). The concepts rated by the subjects related to one of two concept domains. The first domain, the self-concept domain, consisted of the following three concepts: MY PAST, MY REAL SELF, and MY IDEAL SELF. The second domain, the academic domain, consisted of the following three concepts: STUDYING, LEARNING, and READING.

Fifteen bipolar adjective scales, presumably reflecting the three major dimensions of connotative meaning, were used. The Evaluative scales were good-bad, useful-useless, important-unimportant, interesting-boring, and enjoyable-unenjoyable; the Potency scales were strong-weak, serious-humorous, masculine-feminine, severe-lenient, and rugged-delicate; the Activity scales were active-passive, excitable-calm, complex-simple, tense-relaxed, and energetic-lethargic.

As was the case with Analysis I, the concept-scale variables (6 concepts × 15 scales = 90 variables) were analyzed using principal factor analysis with oblique rotation. A simple loadings rotational procedure (Jennrich & Sampson, 1966) with $\gamma = 0$, was used. The number of factors to be rotated was initially estimated by Cattell's scree test (Cattell, 1966, p. 206) as 15. Trial rotations from 12 to 16 factors indicated that a 14-factor solution provided the most interpretable structure.

Results

Table 2 presents the rotated factor loadings $\geq .30$.[5] The most important aspect of Analysis II, given the purpose of this study, is the fact that, with one exception (Factor XIV),[6] no factors were defined by scales loading across concepts *across* the two concept domains. Such factors would not be expected psychologically; that is, there is no reason to expect subjects' responses to the academic concepts to be similar to their responses to self-concepts. As indicated in Table 2, however, half of the factors were defined by loadings on concepts in the Academic domain, while half were defined by loadings on concepts in the Self domain, lending credence to the argument that the factors obtained when concepts and scales are "strung out" to create variables are meaningful factors rather than methodological artifacts.

As in the Kubiniec and Farr study and in Analysis I, there was evidence of concept-scale interaction. That is, the five scales selected to represent each of the three meaning dimensions—Evaluative, Potency, and Activity—did not cluster together to form three factors. Rather, the scales separated into several small clusters. Factor I, for example, was defined by only two Evaluative scales, Factor II by two Activity scales, Factor III by one Potency scale, Factor VIII by two Potency scales, Factor XIV by two Activity scales, and so forth. Further, scales representing all three meaning dimensions combined to define within-concept factors (e.g., Factors VII and XIII).

Evidence for the existence of two types of factors, i.e., within-concept factors and across-concept factors, was less clear than was the case in Analysis I. While there were several across-concept factors, i.e., factors defined by one scale or a small subset of scales clustering together

[5] In that the two-category factor pattern was not as evident in Analysis II as it was in Analysis I, and the primary interest in Analysis II was in whether there would be any factors defined by scales *across* the two concept domains, the factors in Analysis II were reordered in Table 2 to maximize ease of interpretation with respect to the two concept domains, rather than with respect to the two categories of factors as was done in Analysis I (Table 1).

[6] Factor XIV appears to be an excitable/tense factor; these two scales loaded on this factor for all three of the Self domain concepts as well as for both the STUDYING and LEARNING concepts in the Academic domain.

Table 2
Simple Loadings Rotated Factor Pattern Matrix

		Academic Domain Factors							Self Domain Factors						
Concept	Scale	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
STUDYING	good				33										
	strong					55									
	active					48									
	useful				61										
	serious				34										
	excitable		39												(27)
	important				65										
	masculine			77											
	complex		(26)												
	interesting	54				36									
	severe						50								
	tense		32				31								31
	enjoyable	53				35									
	rugged						35								
	energetic					32									
LEARNING	good				49										
	strong					47									
	active					37									
	useful				63						30				
	serious				(27)										
	excitable		31												38
	important				64										
	masculine			69											
	complex		(29)				34								
	interesting	58													
	severe						57								
	tense		37				(29)								30
	enjoyable	65													
	rugged						49								
	energetic					32									
READING	good							49							
	strong					(20)		54							
	active							54							
	useful				39										
	serious							31							
	excitable		48					(29)							(28)
	important				43										
	masculine			84											
	complex		52												
	interesting	62				(26)		38							
	severe														
	tense														
	enjoyable	57				(29)		43							
	rugged														
	energetic							40							

(continued on the next page)

Table 2 (continued)
Simple Loadings Rotated Factor Pattern Matrix

		Academic Domain Factors								Self Domain Factors					
Concept	Scale	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
MY PAST	good												56		
	strong												58		
	active												46		
	useful												56		
	serious								45						
	excitable												(23)		62
	important												65		
	masculine										49				
	complex											59			
	interesting												62		
	severe								36						
	tense												(23)		48
	enjoyable												75		
	rugged										54				
	energetic												51		
MY REAL SELF	good												41		
	strong										44		37		
	active									45			40		
	useful										37		46		
	serious								63						
	excitable														77
	important												51		
	masculine										55				
	complex											49			
	interesting												57		
	severe								42						
	tense												(24)		54
	enjoyable												59		
	rugged										65				
	energetic									47			33		
MY IDEAL SELF	good													60	
	strong										33			57	
	active									35				39	
	useful													51	
	serious								66						
	excitable														60
	important													67	
	masculine										51			41	
	complex											37			
	interesting													61	
	severe								42						
	tense									34				(26)	35
	enjoyable													67	
	rugged										49				
	energetic									49				34	

Note: All loadings ≥ .30 are listed. To indicate structure more clearly, some loadings between .20 and .29 are also listed, in parentheses. The entire matrix of loadings is available from the authors. For ease of interpretation, the factors have been reordered.

across concepts within one of the two (Self and Academic) domains (e.g., Factors I, III, VIII, and XI), there were few within-concept factors. The only factor in the Academic domain that suggested a within-concept factor was Factor VII. Contrary to Analysis I, however, Factor VII was *not* a global or general factor for the specific concept READING; only 7 of the 15 scales loaded ⩾ .30 on this factor. The only factors in the Self domain that suggested within-concept factors were Factor XIII, reflecting a somewhat global attitude toward the concept MY IDEAL SELF (9 of the 15 scales loaded ⩾ .30 on this factor), and Factor XII, reflecting a somewhat global attitude toward the concepts MY PAST *and* MY REAL SELF (for each of the two concepts, 8 of the 15 scales loaded ⩾ .30 on this factor).

Presumably, the lack of clear concept factors is due to the fact that in Analysis II, scales representing each of three meaning dimensions rather than only the Evaluative meaning dimension were used. One would expect a tendency for all of the scales to cluster together if they all represent the same meaning dimension. On the other hand, when scales are selected to represent each of three meaning dimensions, one would *not* expect all of the scales to cluster together.

As was the case with Analysis I, the factors obtained in Analysis II appeared to be meaningful. Across concepts within a domain, the same scales rather consistently loaded on a given factor. Further, the scales that did cluster together reflected similar terms; with respect to the connotative meaning dimensions, they typically represented the same meaning dimension.

Another reflection of the meaningfulness of the factor pattern obtained is evident in a comparison of the factors defined by the two domains. For the self-concept domain, two global Evaluative factors were obtained: one for the combination of the concepts MY PAST and MY REAL SELF (Factor XII) and one for the concept MY IDEAL SELF (Factor XIII). Although it is reasonable to expect that people's perception of their past would be similar to their perception of their "real" self, it is *not* reasonable to expect that people's perceptions of their past or their real self would be similar to their perception of their "ideal" self.

In the Academic concept domain, on the other hand, evidence for the existence of global Evaluative factors was minimal. This is not surprising; as Osgood stated (Osgood et al., 1957, p. 187), ". . . the more evaluative (emotionally loaded?) the concept being judged, the more the meaning of all scales shifts toward evaluative connotations." Surely "self" concepts are more emotionally loaded than Academic concepts.

There is one final comparison of interest in Analysis II. The scales that combined to define factors in the Self domain were by and large different from the scales that combined to define factors for the Academic domain. For example, while there was a serious/severe factor (Factor VIII) and a simple factor (Factor XI) for the Self domain, no similar factors existed for the Academic domain; while there was an interesting/enjoyable factor (Factor I) and a masculine factor (Factor III) for the Academic domain, no counterpart existed for the Self domain. (The masculine scale clustered with other Potency scales in the Self domain, defining Factor X). In effect, this is yet another indication of the existence of concept-scale interaction. Again, the evidence clearly indicates that the function served by a given scale (i.e., the connotative meaning dimension it reflects) varies as a function of the particular concept or concepts being rated.

Conclusions and Implications

Across different sets of scales, different concept classes, and different populations, similar patterns of results were obtained; namely, factors defined by scales *within* concepts and factors defined by scales *across* concepts. Further, there was evidence of concept-scale interaction. The implications of these findings for investigators using the semantic differential to assess the meaning of homogeneous concept domains are important. Specifically, the findings suggest changes in the procedures investigators typically use to select scales for inclusion in their instrument, to analyze their three-dimensional array, and to obtain attitude scores.

In the original use of the semantic differential (i.e., defining the basic dimensions of connotative meaning), it was reasonable to select large heterogeneous groups of scales representing several meaning dimensions as well as a large heterogeneous group of concepts and to assess the dimensionality of the scales across concepts. In the analysis of a semantic differential specifically devised to assess attitude within a given domain, however, different strategies are required. Specifically, the concepts must be carefully selected to represent the specific area of interest; it is neither necessary *nor* desirable to include a variety of concepts if the investigator is interested in, for example, assessing attitude toward a particular organization. Further, the scales selected should meaningfully relate to the particular set of concepts included. For example, scales such as hot-cold, sweet-sour, and high-low do not seem to be as relevant when rating the concept MYSELF as are scales such as successful-unsuccessful, important-unimportant, or strong-weak. Still further, the dimensionality of this particular combination of scales and concepts must be empirically determined; the evidence for concept-scale interaction is too strong to naively assume that a scale which loaded on the Evaluative dimension in previous research will necessarily represent the same Evaluative dimension in a new study using a different domain of concepts.

Finally, in determining this dimensionality, the concepts and scales should be "strung out"; that is, each concept-scale combination should be treated as a separate variable. Such a procedure allows for differences in responses from concept to concept to become evident, rather than obscuring these differences by summing or averaging responses. Stated another way, the findings in this study suggest a series of "don'ts" for investigators; namely, (1) don't presume the meaning of scales on the basis of previous research; (2) don't sum across scales presumably reflecting the same meaning dimension without evidence that the scales do, in fact, represent a unidimensional factor; (3) don't sum across concepts within a concept domain unless there is evidence that the responses to the various concepts are highly similar; and (4) don't sum across concepts reflecting different concept domains.

The ready interpretability of the two types of factors obtained as a result of treating each concept-scale combination as a variable deserves discussion here. As indicated earlier, several procedures have been used by investigators to reduce semantic differential data to two dimensions. Curiously, the procedure used by Kubiniec and Farr and in this research is atypical. Why is this the case? Surely summing or averaging across scales (within each of the meaning dimensions) or across concepts potentially obscures useful information. A "stringing out" approach, then, would seem to provide more comprehensive data than a summing or averaging approach.[7]

Of the three "stringing out" approaches, i.e., subjects × concepts, subjects × scales, and concepts × scales, the last approach would seem to be the most useful and interpretable, at least when the purpose is to assess attitude toward a given concept domain. It appears to be an obvious extension of the usual approach to correlating data for a given group. That is, the usual data matrix consists of subjects (rows) × items or tests (columns), leading to an item × item correlation matrix. The extension of this would seem to be to begin with a data matrix consisting of subjects (rows) × responses to specific combinations of concepts and scales (columns), leading to an item by item correlation matrix, where item is a response to a particular scale when used with a particular concept.

[7] Use of the "stringing out" approach was recommended by Maguire (1973) in his review of semantic differential methodology.

"Stringing out" concepts and scales seems to have three desirable outcomes. First, it allows the investigator to directly observe the extent of and nature of concept-scale interaction, rather than merely having to consider this phenomenon as a possible source of error. Second, the approach provides the investigator with *two* types of factors to interpret, i.e., factors *within* concepts and factors *across* concepts. The two types of factors may be extremely useful in either an heuristic or a predictive sense. Third, it provides investigators interested in analyzing their data three-dimensionally with the first component of their analysis. Moreover, the three-mode analysis briefly summarized in this paper suggests that the single most useful component of the three-mode factor analysis is, in fact, the factor analysis of the concept-scale variables. Depending on the investigator's purpose, then, it might be sufficient to "string out" concepts and scales and to analyze the data using the traditional two-dimensional factor analysis rather than the more complex three-mode factor analysis.

In spite of these potential advantages, however, the method of "stringing out" concepts and scales is seldom used. Systematic study should be made of the relative advantages and disadvantages of each of the "stringing out" techniques.

The similarity in structure found in this research across two different semantic differentials raises interesting questions for further research. Further investigation of the psychological meaning of these two types of factors across various attitude domains is desirable. Such investigation would provide insight into attitude measurement using the semantic differential, as well as allowing the multidimensionality of attitude to become evident and accounted for. The existence of the two types of factors appears to be of heuristic value. The two types of factors may further prove to be of predictive value. Future research should investigate the predictive validity of within-concept factors and across-concept factors.

References

Cattell, R. The meaning and strategic use of factor analysis. In R. Cattell (Ed.), *Handbook of multivariate experimental psychology.* Chicago: Rand McNally, 1966.

Farr, S. D., & Kubiniec, C. Stable and dynamic components of self-report self-concept. *Multivariate Behavioral Research,* 1972, *7,* 147–163.

Gulliksen, H. How to make meaning more meaningful. *Journal of Contemporary Psychology,* 1958, *3,* 115–119.

Heise, D. Some methodological issues in semantic differential research. *Psychological Bulletin,* 1969, *72,* 406–422.

Jennrich, R., & Sampson, P. Rotation for simple loadings. *Psychometrika,* 1966, *31,* 313–323.

Komorita, S., & Bass, A. Attitude differentiation and evaluative scales of the semantic differential. *Journal of Personality and Social Psychology,* 1967, *6,* 241–244.

Kubiniec, C., & Farr, S. D. Concept-scale and concept-component interaction in the semantic differential. *Psychological Reports,* 1971, *28,* 531–541.

Maguire, T. O. Semantic differential methodology for the structuring of attitudes. *American Educational Research Journal,* 1973, *10,* 295–306.

Mayerberg, C. K., & Bean, A. G. The structure of attitude toward quantitative concepts. *Multivariate Behavioral Research,* 1974, *9,* 311–324.

Osgood, C., Suci, G., & Tannenbaum, P. *The measurement of meaning.* Urbana, IL: University of Illinois Press, 1957.

Tucker, L. R. Some mathematical notes on three-mode factor analysis. *Psychometrika,* 1966, *31,* 279–311.

Acknowledgments

The authors gratefully acknowledge Thomas O. Maguire's useful comments about our "stringing out" procedure.

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