PERCEPTION OF OCCUPATIONAL NAMES: A MULTIDIMENSIONAL SCALING APPROACH[1]

John Saltiel

For some time now, sociologists have regarded occupational position as the foundation of the stratification system. Largely because of the important connection between occupation and the allocation of rewards, occupational position has come to be viewed as a general indicator of social status (Blau & Duncan, 1967; Duncan et al., 1972). This focus on the socioeconomic dimension of occupations is in large part responsible for the enormous effort expanded to develop scales that measure prestige or socioeconomic status (Duncan, 1961; Goldhorpe & Hope, 1974; Siegal, 1971). Furthermore, since this vertical dimension has been regarded as central in the attainment process, status attainment researchers have come to focus on levels of aspiration to the exclusion of other attributes of occupations that may be relevant for the occupational decision making process (Slocum, 1974; Woelfel, 1975). Thus, while current status attainment models have proven quite successful in explaining the processes by which statuses are allocated, they have not provided much evidence about the factors affecting choices at similar status levels. To do so requires a multidimensional view of the occupational structure that is firmly linked with a theory of the attainment process.

The view that the occupational structure is something more than status levels is not new in sociology and the literature is replete with attempts to develop multidimensional schemes. Unfortunately, these efforts have not focused explicitly on the relationship between the various attributes of occupation and the attainment process, but rather have conceptualized the occupational structure in terms of attributes identified by the theorist as being of importance in differentiating among occupational groups. Thus, Morris and Murphy (1959) argued for the importance of a situs dimension; Bielby and Kallenberg (1975) sought to identify the components of rewards, requirements and resources by which occupational groups were differentiated; Kohn (1969) focused on the importance of self direction in work; and Temme (1975) has presented a conceptualization based on routines, requisites and rewards.

Occupational and vocational psychologists, because they have been primarily concerned with interests and choices, have also proposed classifications based on non-socioeconomic aspects of work. While there are important differences among these theories, most of the work is a varient of the trait factor approach which assumes that the matching of individual abilities, needs, and interests with vocational opportunities can solve the problems of occupational choice (Osipow, 1968; Temme, 1975). The view of the occupational structure that emerges is directly related to this assumption. Thus, Roe's (1956) classification in terms of orientation toward people is related to the development of need hierarchies, while Holland's (1966) six types of occupational environments are matched with similar types of modal personality orientations. While these efforts have promoted a wide range of research, attempts to empirically cluster occupations using a wide variety of cognitive and non-cognitive traits have not been very successful (Shaycroft, 1971). Furthermore, the tendency to treat occupations as discrete categories restricts the utility of these schemes for attainment research.

Of greater potential interest to status attainment researchers are the attempts to examine the underlying attributes of occupations that are relevant for the intergenerational mobility process. Using mobility inflow and outflow data, Blau and Duncan (1967) showed that virtually all intergenerational movement occurred along two dimensions, although only the socioeconomic dimensions were clearly interpretable.

In a futher analysis of the Blau and Duncan data, Klatzky and Hodge (1971) used canonical correlation analysis to demonstrate that the most important dimension determining mobility is socioeconomic status. While this view is a basic assumption of mobility research (Featherman et al., 1975), nevertheless Klatzky and Hodge point to the importance of a second (unanalyzed) canonical variate and their data shows that intergenerational mobility is more likely to entail factors other than SES than is intragenerational mobility. Furthermore, Horan's (1974) attempt to ascertain the structure of mobility in an urban Indian city using both prestige and a caste based occupational situs variable additionally points to the importance of examining non-socioeconomic attributes of occupations in attainment research. For example, the implicit notion that there are several attributes of father's work that are transmitted to children and in turn influence their career orientations was developed by Mortimer (1974) who examined the occupations of fathers and the work preferences of sons for a sample of university students. Analysis of the data suggested that son's occupational choices are associated with the following dimensions of fathers' work: autonomy, rewards, and funtional foci.

The main problem with the mobility studies is the attempt to infer the underlying attributes of occupations on the basis only of the similarity between fathers' position and sons' preference. Nevertheless, these studies provide a solid basis for expanding well developed social psychological models of status attainment (such as the Wisconsin model) to the problem of occupational choice. The key variable in these models is the role of significant others in forming and communicating expectations for individuals which then serve as a motivational force on subsequent aspirations and attainments (Haller & Portes, 1973). The mobility studies cited above suggest that such communications involve not only the status levels of occupation, but a variety of non-socioeconomic attributes as well. This being the case, it is important to ascertain how the relevant population perceives the occupational structure, for it is these perceptions that form the corpus of information out of which occupations are evaluated, expectations are formed and communicated, and choices are made.

The problem of portraying the occupational structure as it is perceived by some aggregate would seem to be amenable to a procedure which elicited direct pair comparison estimates of the dissimilarities between occupations. The resultant proximity data could then be analyzed by an appropriate multidimensional scaling (MDS) technique. Such techniques scale the stimuli along a similarity or distance continuum rather than according to the amount of some attribute possessed by the stimulus (Torgerson, 1958). Furthermore, these techniques have the potential of yielding the underlying structure of the stimuli and portraying it in a multidimensional space. Such approaches to measuring the occupational structure have been initiated by Burton (1972) who had subjects partition a set of occupational names by a sorting task and then used nonmetric M-D-SCAL (Kruskal, 1964) program to analyze the data. This procedure resulted in three dimensions which were labelled prestige, dependency and skill. More recently, Coxon and Jones (1974) analyzed respondents estimates of the overall similarity between pairs of sixteen occupational titles using the Individual Differences Scaling Model (INDSCAL). The group space that was estimated from these data revelaed two fairly clear dimensions: educational requirements and "people orientation". And, in an interesting piece of related research, Laumann and Guttman (1966) utilized small space analysis to group occupations on the basis of associational propensitites. The data fit a three dimensional solution, although only a prestige dimension was clearly interpretable.

While these approaches are very suggestive, they are unsatisfactory in a number of respects. The nonmetric procedures utilize an ordinal level of meaurement and thus lack the degree of precision that is obtainable with continuous ratio scaled measures. The advantage of using such measures is to produce a space in which the distances are in one to one correspondence with the initial input data. Such precision also permits the accurate measurement of change over time. The INDSCAL procedure, although it permits the use of ratio or interval data, has similar problems. There is not data set that correponds exactly to the group space and, furthermore, the dimensional uniqueness of the solution along with the fact that the dimensions are frequently correlated limits its utility for measuring changes in the aggregate structure over time (Danes, 1975). What is required is a metric procedure that loses no information between the original data and the final solution and that permits accurate over time measurements. This chapter presents a method for measuring the occupational structure that meets these criteria and discusses the results on one study utilizing this approach.

Theory and Method

The position taken here is that two way metric MDS developed by Torgerson (1958) and later elaborated by Woelfel (1975), provides an extremely powerful methodological tool that meets the above stated criteria quite well. The theory underlying its use in the present context relies on an examination of the fundamental psychological processes of human perception. The essential assumption is that the process of differentiation.

Fundamentally, this process involves taking note of similarities and differences between objects with regard to certain underlying attributes. Thus, for example, one identifies a yellow ball as different from a red ball because he or she recognizes them to be dissimilar by a certain amount in terms of the attribute color. Although these two objects presumably differ only in color, it is usually the case that objects differ with regard to many attributes at once. It is the sum total of all these dissimilarities that can be taken as a measure of the overall difference or dissimilarity between two objects.

Occupations, too, can be distinguished from one another on the basis of a variety of attributes (i.e., status, autonomy, working conditions, etc.). Furthermore, it is conceiveable to speak of overall dissimilarities among occupations insofar as they differ in large or small part among more or fewer attributes. For example, it makes sense to say that a U.S. Congressman and a U.S. Senator are more similar to each other that either one is is to a mechanic or a teacher.

This dissimilarities among occupations as perceived by indiviudals can be represented by a continuous numbering system such that two occupations considered to be completely identical are assigned a paired dissimilarity score of zero, and occupations of increasing dissimilarity are represented by numbers of increasing value. When an adequate sample of respondents has estimated the dissimilarities among a set of occupations c, the result is a c x c x n three dimensional matrix which may then be averaged over the n cases to yield a c x c matrix **D**, where any entry d_{ij} represents the average dissimilarity score between occupations i and j as seen by the sample members. This matrix has the capacity to describe the pattern of differences among the stimuli across whatever attributes the respondents perceive those stimuli to differ. Given appropriate sampling, **D** represents the structure of the occupational system as it is preceived in the aggregate by members of the population from which the sample was drawn. Since the direct paired comparison estimates by which the data are taken do not require that the attributes along which comparisons are made be specified in advance, this technique is well suited for use among different populations who might perceive the occupational structure differently.

As the scaling theory has been presented, the major variable is that of dissimilarity or distance. Thus, the primary problem of measurement is that of measuring the distances between occupations. In this case, ratio judgements of separation that use a standard comparison for each judgement are used. That is, the measurement of the distances can be accomplished by arbitrarily designating the distances between any two cognitize objects as a standard and comparing the distance between any other pair of objects to this standard. Consequently, what is needed are judgements of dissimilarities among occupations made by respondents expressed as ratios to some standard unit provided by the experimenter. This can be accomplished by a question of the form: "If **x** and **y** are **u** units apart, how far apart are **a** and **b**?"

Research with this type of instrumentation has shown that satisfactory reliability (about .90) can be obtained with as few as 50 cases, provided that the concepts are from the same domain and the population is fairly homogenous (Barnett, 1972; Gillham & Woelfel, 1977).

Once the data has been gathered on all the pairwise comparisons, the result is an aggregate definition of a set of occupations in the form of a matrix of continuous dissimilarity scores. While this matrix contains an immense amount of information about the interrelationships among the occupations that were scaled, much of this information is in latent form. Fortunately, techniques for the recovery of this latent information have been well developed.

Obtaining the underlying vector space $\mathbf{V}_k$ from the mean distance matrix **D** is a relatively straightforward procedure. Following Torgerson (1958), the **D** matrix is first transformed to a scalar products matrix **B**. The linear transformation that accomplishes this is given by the equation:

$$b^*_{ij} = 1/2 \left(\frac{\sum_{i=1}^{n} d^2_{ij}}{N} + \frac{\sum_{j=1}^{n} d^2_{ij}}{N} - \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} d^2_{ij}}{N^2} - d^2_{ij} \right)$$

Each element in this matrix has the property that:

$$b^*_{ij} = p_i p_j \cos \alpha_{ij}$$

where,

p_i = length of vector i
p_j = length of vector j
α_{ij} = the angle between i and j

When this matrix is factored by any standard factor analytic procedure the result is a spatial coordinate system represented in a c x k factor matrix **F**, whose k columns are orthogonal vectors, and where and entry f_{ij} represents the coordinate value of the i^{th} occupation on the j^{th} dimension. One of the most important consequences of this procedure is that the original matrix **D** can be recovered from the factor matrix **F** with no loss of information. Further, the underlying vector space $\mathbf{V}_k$ has the property that the occupations defined as similar by the sample will be located close to each other in the space. Thus, the precise definition of an occupation for a given population is given by its coordinates in $\mathbf{V}_k$. It is this precision in mapping occupations, as well as the mathematical operations that are possible because of it, that provides the primary advantages of this technique over the nonmetric MDS procedures discussed above.

Data Collection

The findings to be reported consist of a preliminary effort to assess the validity of this MDS procedure for scaling occupations. The data were gathered as part of a research project on the effects of interpersonal influence on the occupational decision making process of rural high school students. The entire high school population (150) from a small Montana town first completed a modified form of the Wisconsin Significant Other Battery (WISOB) (Haller & Woelfel, 1969) which elicited data on student background characteristics, their occupational significant others, and their occupational and educational goals. From those occupations listed by the students as potential job choices, the thirty-four most frequently mentioned (see Table 1) were chosen for inclusion in the occupational similarities questionnaire. While it would have been desirable to scale a larger number of titles, the technique of direct paired comparisons, which requires that n(n-1)/2 distance estimates be made, calls for a larger sample than was available.

The scaled occupations covered a fairly broad range which included such familiar titles as doctor, lawyer, nurse, secretary, etc., as well as occupations that reflect the opportunity structure of the rural western community from which the sample was drawn (i.e., rancher, forest ranger, railroad worker). Additionally, it was decided to include housewife among the stimuli to be scaled. The primary reason for its inclusion was that housewife remains a significant future status for a very large number of females. While there is some debate over the issue, students of the occupational structure have increasingly come to view housewife as an occupation, albeit an unique one (Hall, 1975).

The thirty-four occupations yielded 561 non-redundant pairs for comparison. Since such a judgemental task would be exceedingly complex and fatiguing for any one person, each respondent was asked to make comparisons on a subset of the pairs selected randomly.

In the instructions to the occupational similarities questionnaire, respondents were asked to estimate the distances between pairs of occupations using as a standard that postman and bankteller are fifty (50) units apart. This standard was chosen for several reasons. First, there is no large prestige difference between these two occupations (Duncan, 1961), and consequently the standard does not imply that prestige should be used as an attribute in evaluating the differences between occupations. The difference of 50 units was chosen because prior research with similar instrumentation suggests that this standard is probably midway between the largest and smallest estimates likely to be encountered. Respondents were carefully instructed that if they perceived two jobs to be more different than postman and bankteller to use a number larger than fifty, if less different, to use a number smaller than fifty.[2]

The occupational similarities questionnaire was administered to all those identified as significant others for occupation, for it is their perceptions of the occupational structure that are relevant for the occupational choice process. Those significant others who were students were administered the questionnaire in school, while those who were not students received the form in the mail. Follow up phone calls were used with the mailed questionnaires which gave the researchers an opportunity to fully explain the instructions. A total of 297 usable forms were obtained out of a possible 702 for a return rate of 42.3%. The data yielded an average of 60.1 dissimilarity estimates for each pair of occupations.

The relatively low response rate raises the possibility that the dissimilarity comparisons were of such difficulty as to produce a strong response bias. Fortunately, prior research, as well as data from this study, suggests that this was not the case. Multidimensional scaling techniques have been frequently employed by psychometricians, market researchers and communication researchers with few reported difficulties (Shepard et al, 1972). Nevertheless, to the best of this author's knowledge, these instruments are usually administered in a group setting or through personal interviews. The data gathered in this study strongly support the idea that the low return rate is mostly a function of the mode of administration of an unusual type of questionnaire. For example, we obtained 87% usable forms from the group administration and only 30% from the mailed sample. More revealing, however, is the fact that the group administration was given only to the high school students, and those whose questionnaires had to be discarded were virtually identical with those whose WISOB questionnaires were judged unusable. Thus, for this portion of the sample, we conclude that the dissimilarity comparisons presented no great difficulties for the respondents.

Although there is no evidence that the questionnaire posed extraordinary difficulties for respondents, the low return rate on the mailed sample presents a problem of possible bias. Unfortunately, we do not have adequate data to compare the characteristics of respondents with nonrespondents. This problem is alleviated somewhat with the recognition that even if there was a difference between respondents and nonrespondents on their occupational position, for example, it does not necessarily follow that the pattern of findings would differ in any significant way. For, as the prestige studies have shown, there is a remarkably high degree of consensus on the occupational prestige strucutre among persons in various social positions, and this consensus seems to hold among raters who employ different criteria of rating (Reiss, 1961: 162-238). Thee seems little reason to believe that what holds for prestige ratings would not also hold for other attributes of occuption that form the basis of dissimilarity judgments. Therefore, we cautiously conclude that this data set provides a satisfactory representation of how this community preceives the occupational structure.

Results

The mean distance matrix for the scaled occupations is presented in Table 1. While the complex interrelationships can not be easily grasped directly from this matrix, a cursory examination of the data begins to indicate the utility of this approach. For example, the respondents judged nurse to be closer to doctor, social worker, veterinarian and lab technician than to occupations such as secretary, lawyer, mechanic, and game warden.

Table 1. Mean Distance Matrix for Thirty-four Occupations

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	0.0																
2	45.3	0.0															
3	91.3	56.9	0.0														
4	84.2	49.8	73.5	0.0													
5	84.4	73.1	93.3	85.4	0.0												
6	117.3	74.7	62.4	39.4	97.3	0.0											
7	71.1	82.4	99.4	80.8	36.1	126.1	0.0										
8	53.1	41.4	75.1	37.6	69.0	68.4	70.8	0.0									
9	92.5	78.9	61.4	62.5	71.8	67.8	80.6	79.5	0.0								
10	48.2	53.8	79.6	38.6	76.9	105.8	75.8	65.1	46.9	0.0							
11	113.5	57.0	51.4	34.7	76.0	25.1	86.9	81.3	63.8	77.3	0.0						
12	64.8	56.1	58.8	51.4	67.0	67.9	74.7	58.3	59.7	59.4	74.3	0.0					
13	71.7	56.6	75.8	64.1	44.7	75.1	36.6	75.3	74.4	73.1	74.7	62.8	0.0				
14	71.1	56.2	94.3	57.7	69.1	103.6	73.9	63.3	95.2	40.4	82.8	69.3	63.2	0.0			
15	[illegible]	63.2	73.2	70.3	44.6	77.1	45.5	73.3	77.7	78.4	48.2	63.4	41.7	68.1	0.0		
16	105.2	60.0	76.2	73.1	75.4	87.4	84.0	80.7	75.2	80.9	76.4	80.3	64.7	85.3	73.7	0.0	
17	49.7	39.9	95.3	38.8	68.6	90.0	87.3	69.8	103.9	52.6	78.6	78.9	57.7	41.1	57.8	83.7	0.0
18	58.1	60.1	90.7	61.9	87.9	96.0	100.7	67.2	91.6	36.7	82.4	87.8	83.9	53.4	80.5	70.2	71.9
19	84.7	50.0	45.5	41.4	82.9	36.6	109.3	82.7	80.5	76.5	40.1	82.3	65.7	79.7	64.7	96.8	91.8
20	79.8	61.3	63.3	63.2	50.9	70.7	78.3	78.0	71.0	78.7	52.8	58.8	47.7	77.8	41.7	72.7	69.5
21	78.7	79.5	101.2	78.0	36.7	94.8	39.0	86.1	89.4	82.4	82.3	70.4	55.1	68.4	55.9	79.9	73.4
22	80.2	86.6	98.9	88.1	43.1	99.0	47.0	82.5	116.4	78.9	71.1	72.8	48.2	62.8	33.1	72.3	60.5
23	50.0	70.9	99.3	67.9	56.4	95.2	55.9	66.8	116.4	63.0	83.6	72.2	56.5	41.6	65.3	89.5	47.9
24	71.4	81.4	106.8	83.2	33.3	102.1	53.4	71.1	101.3	75.8	91.6	72.9	56.8	44.6	72.6	64.3	55.5
25	66.6	55.3	65.0	89.1	56.9	83.5	57.7	66.7	83.8	75.6	57.5	28.6	56.7	75.1	41.4	74.6	66.4
26	71.8	58.7	57.0	38.3	70.7	49.9	78.9	67.1	76.9	81.5	41.5	61.3	68.2	74.3	69.3	86.5	75.3
27	82.3	52.6	60.8	30.9	68.8	43.5	83.5	60.7	88.1	84.3	40.4	68.8	75.7	78.4	70.0	50.8	69.5
28	53.1	66.6	96.0	53.4	76.5	82.3	71.6	80.5	106.3	63.7	68.2	67.5	66.9	48.5	78.7	82.8	52.5
29	78.7	43.1	74.6	61.3	68.9	71.5	70.9	46.5	90.1	93.7	64.2	58.5	91.8	83.3	70.6	24.6	69.6
30	67.0	63.2	73.6	68.1	72.0	78.1	72.8	61.5	92.5	75.3	71.3	74.3	59.7	69.6	77.8	80.2	41.5
31	83.6	53.3	48.6	46.7	116.5	43.1	96.6	43.5	87.2	67.2	55.4	73.4	88.3	95.9	79.6	83.8	60.4
32	57.1	74.2	89.5	77.1	56.9	100.5	59.4	60.9	107.7	46.6	78.4	68.7	64.4	28.5	61.5	96.0	25.8
33	74.5	80.0	92.4	93.6	39.3	98.1	31.1	72.8	86.5	79.7	73.3	58.3	74.3	64.9	59.2	68.8	67.0
34	49.7	55.5	55.4	78.4	85.3	75.7	96.7	55.4	67.8	74.6	70.3	72.9	67.4	80.3	72.8	83.0	65.5

More interesting, however, are the spatial coordinates

Table 1. (continued)

	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
18	0.0																
19	79.3	0.0															
20	78.7	50.3	0.0														
21	81.4	80.8	63.6	0.0													
22	76.3	72.4	63.1	44.2	0.0												
23	64.0	88.0	77.8	61.3	52.9	0.0											
24	77.0	87.3	81.8	46.6	37.2	30.0	0.0										
25	72.7	57.8	21.4	65.9	48.5	69.1	82.8	0.0									
26	79.0	42.2	74.1	104.6	100.9	87.9	116.4	63.9	0.0								
27	77.0	49.7	68.2	88.3	110.9	87.9	107.3	74.0	38.7	0.0							
28	45.0	76.8	74.9	80.4	96.4	59.0	67.0	68.5	51.3	59.5	0.0						
29	66.5	63.5	74.2	78.2	86.2	91.5	70.7	57.1	59.9	55.3	77.0	0.0					
30	52.3	73.8	89.6	85.0	91.5	79.6	80.2	60.1	61.1	77.0	56.9	80.1	0.0				
31	78.4	55.2	93.0	96.5	116.5	107.7	93.4	63.9	57.0	39.5	81.0	73.1	74.7	0.0			
32	69.2	83.4	72.5	55.2	49.6	48.8	62.3	61.6	87.7	88.3	59.1	76.5	69.0	92.4	0.0		
33	83.4	84.0	68.8	35.5	61.3	61.9	52.7	59.1	83.4	95.2	78.6	78.8	88.4	95.1	64.1	0.0	
34	59.2	75.2	83.5	87.2	90.8	83.6	80.3	59.2	65.2	70.8	87.5	83.3	65.2	54.6	[illegible]	83.3	0.0

NOTE: Occupations are:

1. Secretary
2. Teacher
3. Lawyer
4. Nurse
5. Mechanic
6. Doctor
7. Construction Work
8. Social Work
9. Pilot
10. Stewardess
11. Veternarian
12. Policeman
13. Carpenter
14. Waitress
15. Rancher
16. Pro Athlete
17. Housewife
18. Model
19. Biologist
20. Forest Ranger
21. Truck Driver
22. Ranch Hand
23. Store Clerk
24. Gas Station Attendant
25. Game Warden
26. Lab Technician
27. Physical Therapist
28. Beautician
29. Athletic Coach
30. Interior Decorator
31. Psychologist
32. Cook
33. Railroad Worker
34. Writer

for each occupation which are presented in Table 2. An examination of the coordinate values suggest that the first dimension can be interpreted as a socio-economic dimension. To test this interpretation, the loadings on this dimension were correlated with the SEI scores constructed by Duncan (1961). Using the thirty occupational titles which matched up with the Duncan titles, a correlation coefficient of .85 was obtained. Since the coordinates on the first dimension account for about 34% of the distance in the space, this correlation suggests that socioeconomic status is a major attribute of the underlying space. This finding is in accordance with the prevailing presumption of the centrality of the socioeconomic dimension of occupation and is especially worthy of note because the technique did not necessitate such an outcome. While this is clearly a significant attribute of the occupational structure, the findings reported here also suggest the value of examining other dimensions as well.

From an examination of the scale values of the second dimension as well as the two dimensional plot presented in Figure 1, it appears that this represents a masculine-feminine dimension. That is, the occupational titles with high positive values on this dimension are those that are primarily occupied by males, and those with high negative values tend to be held by females.[3]

Table 2

Spatial Coordinates for Thirty-four Occupations

Occupation	I	II	III
Secretary	-21.2	-42.3	-25.7
Teacher	15.8	-15.5	-4.9
Lawyer	44.3	13.2	-17.7
Nurse	27.1	-13.5	15.4
Mechanic	-33.2	30.5	-3.9
Doctor	55.9	18.9	27.5
Construction Worker	-42.8	19.5	-22.0
Social Worker	7.9	-18.7	-13.9
Pilot	30.1	24.2	-51.3
Stewardess	-7.0	-32.1	-24.2
Veternarian	32.6	25.2	22.8
Policeman	4.4	8.9	-19.3
Carpenter	-14.9	16.0	0.0
Waitress	-27.3	-24.4	11.3
Rancher	-10.1	28.3	6.7
Professional Athlete	7.5	19.6	-6.8
Housewife	-16.5	-30.1	18.4
Model	-2.7	-26.3	2.2
Biologist	33.3	11.1	23.5
Forest Ranger	1.7	30.4	5.7
Truck Driver	-37.3	24.2	2.1
Ranch Hand	-47.4	25.9	18.6
Store Clerk	-40.9	-14.9	19.2
Gas Station Attendant	-48.2	-0.3	5.6
Game Warden	-2.9	15.9	-5.9
Lab Technician	38.2	-4.3	4.9
Physical Therapist	40.1	-1.5	13.9
Beautician	-5.6	-29.5	22.8
Athletic Coach	13.8	7.4	3.8
Interior Decorator	4.4	-25.3	-1.3
Psychologist	49.5	-20.5	-3.5
Cook	-34.2	-16.4	10.5
Railroad Worker	-32.2	21.9	-11.0
Writer	17.9	-15.9	-23.6

The remaining dimensions are not as easily interpreted. The difficulty in doing so, however, does not present a problem for several reasons. First, the major purpose of MDS in this research has been to present a cognitive mapping of the occupational structure as the respondents perceive it. Since the procedure by which the coordinates were obtained was determined by the amount of orthogonal distance accounted for, these coordinate values will not necessarily correspond to psychological attributes of the stimuli. While it may seem desirable to rotate the space and try to identify the underlying attributes of the structure, this is

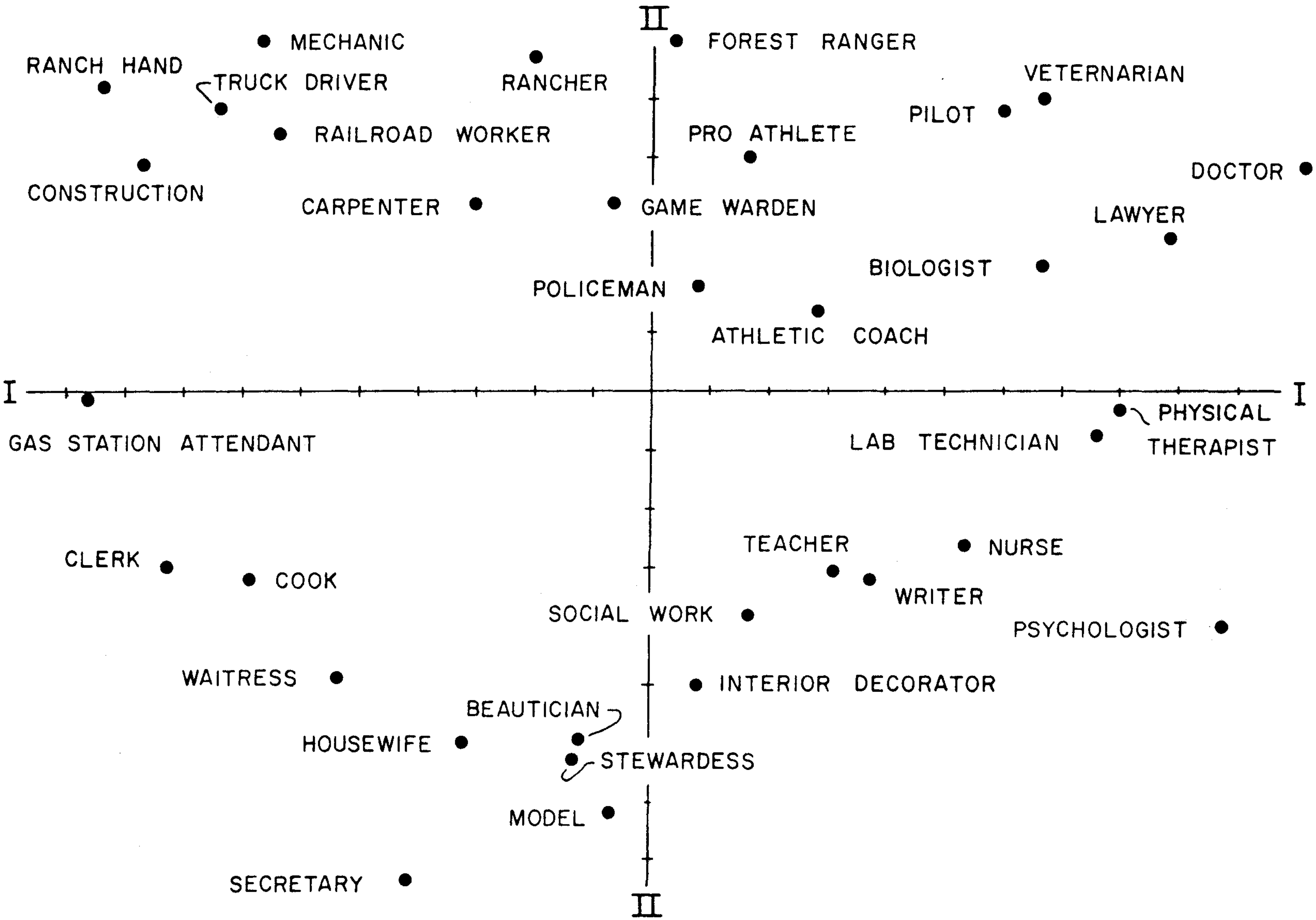

FIGURE 1: TWO DIMENSIONAL CONFIGURATION OF THIRTY-FOUR OCCUPATIONS

frequently not possible, and it is by no means necessary. This position contrasts sharply with much work in factor analysis which assumes that factors will correspond clearly with some identifiable attributes. In MDS, however, the orthogonal factors (dimensions) should be thought of only as a convenient reference frame. Within this grid, attribute lines may well take any orientation, and it is quite likely that each dimension is characterized by a complex of attributes (Barnett & Woelfel, 1976) and the number of attributes may very well exceed the number of dimensions (Schmidt, 1972). Hence, rotation is not likely to produce identifiable attributes. Because of this complexity, and without further data, we are reluctant to speculate on a dimensional interpretation. This does not imply, however, that the scale values on the remaining dimensions should be ignored. For it is the coordinates values on all dimensions taken simultaneously which produce the precise location of each occupation.[4]

If this mapping of the occupational domain has validity, it should account for some known unidimensional attributes of occupation. Since socioeconomic status is apparently a major attribute of occupation, it was expected that the scale values computed in this research should account for a large proportion of the variation in the SEI scores. To test this hypothesis, scale values were computed for the thirty occupations for which matching titles with the Duncan prestige scores were available and then correlated with the prestige scores. The first dimension accounted for about 72% of the variation in prestige scores, with each additional dimension adding only small increments. Nevertheless, virtually all of the variation in SEI scores (R^2 = .95) was accounted for by the scale values on the first twenty dimensions as should be expected.

It was not expected, however, that only one attribute would be used to define the occupational structure. In fact, the utility of MDS rested on the assumption that occupations are defined in terms of a number of attributes. If this were the case, then it would be expected that only a small proportion of the variation in the space could be accounted for by any one attribute. Socioeconomic status again was used as the attribute to test this hypothesis. The data indicated that the SEI scores accounted for 41% of the distance in three space and about 22% of the variation in the total space. Clearly then, these occupations were defined by several attributes in addition to socioeconomic status, although it is not yet clear what these attributes may be.[5]

Conclusions

The purpose of this chapter was to demonstrate the utility of metric multidimensional scaling for occupational scaling. Based on direct pair comparison estimates gathered from a sample of high school students and their significant others, thirty-four occupations were scaled. The resultant data described a portion of the occupational structure as perceived by the sample. Analysis of the scale values indicated that two major attributes were clearly identifiable: socioeconomic status and sex. While no claims are made as to the generalizability of these findings due primarily to the nature of the sample, the finding of SES as a primary attribute does provide evidence as to the validity of the technique.

The implication of this approach extend beyond this particular example. For example, this methodology could be incorporated into well developed models of the status attainment process to allow for successful research on occupational choice. Woelfel (1975) has argued cogently that the reason that aspiration level research has been so successful and choice research a camparative failure is closely related to the level of precision with which the key variables could be measured. That is, status attainment investigators have worked with measures that were interval or quasi interval in nature, such as the Occupational Aspiration Scale (Haller & Miller, 1972). Consequently, when researchers were faced with the problem of aggregating the multiple and frequently disparate expectations of significant others into a single composite variable, it was relatively easy to do (Sewell, et al, 1969; Woelfel & Haller, 1971). In occupational choice research, however, where the expectations held by significant others are the names of occupations which are classified only nominally rather than as points on a continuum such as status levels, it has not been possible to form a composite variable which measures those expectations. The method proposed in this paper allows for a solution in that occupations are arrayed as a continuum in multidimensional space. Consequently, the expectations that others hold for the individual can be aggregated by a number of procedures. Given that each occupation is defined by its coordinates in a k dimensional space, one method of aggregating expectations would be to compute a multidimensional average by averaging the coordinate scores on each dimension. Since the occupational choice of the individual can also be represented by a set of coordinates in k space, it would be possible to utilize all the relevant variables for the occupational choice process (i.e., significant other influence, SES, mental ability, etc.) in a set of ordinary multiple regression equations to predict occupational choice (Woelfel, 1975).

Closely related to research into the occupational choice process is the possibilty of developing a classification of occupations based on the definition of respondents which could be useful in guidance and counselling. Many of the prior attempts at classification which are based on a variety of attributes of job holders have frequently been criticized because of the characteristics of people performing adequately within occupational groups are extremely diverse (Shaycroft, 1971; Berg, 1971). while there is little doubt that interest inventories and aptitude tests are useful tools, the effective practice of vocational guidance must be linked to a firm knowledge of how students select future careers. Considering the importance of interpersonal influence and the typically small role played by counsellors as a source of influence (Woelfel, 1972), the guidance counsellor frequently finds himself in a situation of attempting to direct a young person towards a position that is in conflict with a preexisting pattern of influence. With the use of the type of occupational 'map' discussed in this chapter, the counsellor can, if necessary, direct the student on the basis of interests, abilities, etc., towards an occupation that is close to his or her original aspiration.

One final implication of this method is the possiblities it holds for the measurement of change in the occupational structure over time. With the use of such a metric technique it would be possible to generate successive dissimilarity matrices at several points in time and to measure the motion in the system. As Marshall and Gorman (1975) have recently argued, the high stability of the prestige hierarchy over time (Hodge et al., 1964) may be more a function of the instrument than the phenomenon it claims to measure. The procedure articulated in this chapter would allow for more precise tests of stability of the occupational structure over time, as well as more accurate cross cultural comparisons.

Ultimately, as Marshall and Gorman (1975) point out, the utility of any alternative measure of the occupational structure lies in the ability to offer greater explanatory power than does the traditional approach of viewing occupations only as status levels. Since the primary argument presented in this chapter is that an aggregate conception of the occupational structure can be measured validly and economically, research along the lines suggested becomes a distinct possiblity.

NOTES

1. The research reported here was supported by the Montana State University Agricultural Experiment Station (Project number: MONB00465). The author is grateful to Joseph Woelfel, C. Jack Gilchrist and Wayne Larson for helpful comments on earlier drafts.

2. Unfortunately, with the exception of a paper by Gordon (1976), there has been little work on the effects of different criterion pairs with different initial separation values. Gordon showed that subjects have a remarkable ability to adapt to different criteria. As far as a particular criterion pair is concerned, he suggests that this must be dealt with within the context of concepts to be scaled.

3. The same analysis was carried out with housewife left out and produced an almost identical configuration.

4. This position does not negate the importance of determining the true dimensionality of the space or of attempting to identify the attributes underlying the stimuli. Much evidence suggests how difficult this task is. In a recent review, Barnett and Woelfel (1976) have demonstrated the drawbacks of several commonly used procedures (the scree test, measures of stress, and the interpretation of dimensions) and suggest instead the scaling of attributes along with the concepts of interest in the same space. Since these procedures were not used in this study, no definitive statements about the true dimensionality or the

precise identification and orientation of attributes in the space are being made.

5. Previous research, cited earlier in this chapter, suggest a number of attributes that provide a useful starting point. The limited data available for this chapter, however, did not allow for the possibility of fully exploring underlying attributes, determining their relative importance, and finding their orientation in the space.

REFERENCES

Barnett, G.A. (1972) "Reliability and metric multidimensional scaling." Unpublished paper. East Lansing: Michigan State University, Department of Communication.

Barnett, G.A. & J. Woelfel (1976) "On the dimensionality of psychological processes." Paper presented to the annual meeting of the Psychometric Society, Murray Hill, NJ.

Berg, I. (1971) Education and Jobs: The Great Training Robbery. Boston: Beacon Press.

Bielby, W.T. & A.L. Kalleberg (1975) "The differentiation of occupations." Paper presented to the Annual Meetings of the American Sociological Association.

Blau, P.M. & O.D. Duncan (1967) The American Occupational Structure. New York: Wiley.

Burton, M. (1972) "Semantic dimensions of occupation names." In R.N. Shepard, A.K. Romney & S.B. Nerlove (eds.), Multidimensional Scaling. pp. 55-71. New York: Seminar Press.

Coxon, A.P.M. & C.L. Jones (1974) "Occupational similarities: subjective aspects of social stratification." Quality and Quantity, 8, 139-158.

Danes, J.E. (1975) "Multidimensional scaling models for communication." Unpublished paper. East Lansing, Michigan State University, Department of Communication.

Duncan, O.D. (1961) "A socioeconomic index for all occupations." In A.J. Reiss (ed.) Occupations and Social Status. pp. 109-138. New York, Free Press.

Duncan, O.D., D.L. Featherman & B. Duncan (1972) Socioeconomic Background and Achievement. New York: Seminar Press.

Featherman, D.L., F.L. Jones & R.M. Hauser (1975) "Assumptions of social mobility research in the U.S.: The case of occupational status." Social Science Research 4, 329-360.

Gillham, J.R. & J. Woelfel (1977) "The Galileo system of measurement: Preliminary evidence for precision, stability and equivalence to traditional measures." Human Communication Research 3, 243-263.

Goldthorpe, J.J. & J. Hope (1974) The Social Grading of Occupations. London: Oxford University Press.

Gordon, T.F. (1976) "Subject abilities to use metric MDS: Effects of varying the criterion pair." Paper presented to the Association for Education in Journalism [chapter 9].

Hall, R.H. (1975) Occupations and the Social Structure. 2nd edition. Englewood Cliffs, NJ: Prentice-Hall.

Haller, A.O. & I.W. Miller (1971) The Occupational Aspiration Scale. Cambridge: Schenkman.

Haller, A.O. & A. Portes (1973) "Status attainment processes." Sociology of Education 46, 51-92.

Haller, A.O. & J. Woelfel (1969) The Wisconsin Significant Other Battery. Madison: University of Wisconsin, Final Report to U.S. Office of Education, Project N. 5-1170.

Hodge, R.W., P.M. Siegel & P.H. Rossi (1964) "Occupational prestige in the United States, 1925-63." American Journal of Sociology 70, 286-302.

Holland, J.L. (1966) The Psychology of Vocational Choice. Toronto: Blaisdell.

Horan, P.M. (1974) "The structure of occupational mobility: conceptualization and analysis." Social Forces 53, 33-45.

Kohn, M.L. (1969) Class and Conformity. Homewood,IL: Dorsey Press.

Kruskal, J.B. (1964) "Nonmetric multidimensional scaling: A numerical method." Psychometrika 29, 115-129.

Klatzky, S.R. & R.W. Hodge (1971) "A canonical correlation analysis of occupational mobility." Journal of the American Statistical Association 66, 16-22.

Laumann, E.O. & L. Guttman (1966) "The relative associational contiguity of occupations in an urban setting." American Sociological Review 31, 169-178.

Marshall, K.P. & B. Gorman (1975) "Occupational prestige from preference orientations via the Markov Chain: An alternative to respondent ranking techniques." Social Science Research 4, 41-64.

Morris, R.T. & R.J. Murphy (1959) "The situs dimension in occupational structure." American Sociological Review 24, 231-239.

Mortimer, J.T. (1974) "Patterns of intergenerational occupational movements: A smallest-space analysis." American Journal of Sociology 79, 1278-1299.

Osipow, S.H. (1968) Theories of Career Development. New York: Appleton-Century- Crofts.

Reiss, A.J. (1961) Occupations and Social Status. New York: Free Press.

Roe, A. (1956) The Psychology of Occupations. New York: Wiley.

Sewell, W.H., A.O. Haller & A. Portes (1969) The educational and early occupational attainment process." American Sociological Review 34, 82-97.

Schmidt, C.F. (1972) "Multidimensional scaling analysis of the printed media's explanations of the riots of the Summer of 1967." Journal of Personality and Social Psychology 24, 59-67.

Shaycroft, M.F. (1971) "The project TALENT approach to the career-grouping problem." Pp. 50-64 in Career Education and the Technology of Career Development. Washington, D.C.: American Psychological Association.

Shepard, R.N., A.K. Romney & S.B. Nerlove (1972) Multidimensional Scaling: Theory and Applications in the Behavioral Sciences. New York: Seminar.

Siegel, P.M. (1971) Prestige in the American Occupational Structure. Unpublished Ph.D. dissertation. Chicago: University of Chicago.

Slocum, W.L. (1974) Occupational careers. 2nd edition. Chicago: Aldine.

Temme, L.V. (1975) Occupation: Meanings and Measures. Washington: Bureau of Social Science Research.

Torgerson, W.S. (1958) Theory and Methods of Scaling. New York: Wiley.

Woelfel, J. (1972) "Significant others and their role relationships to students in a high school population." Rural Sociology 37, 86-97.

Woelfel, J. (1975) "A theory of occupational choice." Pp. 41-61, in J.S. Picou & R.E. Campbell (eds.) Career Behavior of Special Groups. Cloumbus: Merrill.

Woelfel, J. & A.O. Haller (1971) "Significant others, the self-reflexive act and the attitude formation process." American Sociological Review 36, 74-87.