A method is presented whereby discrete occupational titles can be represented along a multidimensional continuum reflecting a population's shared perceptions. The spatial locations are then used to operationalize significant others' influence and vocational preferences enabling a test of the applicability of the Wisconsin model of status attainment to the process of occupational choice. Data from a sample of high school students were used to demonstrate the procedure. This model was shown to be useful for explicating the processes by which specific occupational choices are made.

The Wisconsin Model of Status Attainment and the Occupational Choice Process

APPLYING A CONTINUOUS-CHOICE MODEL TO A DISCRETE-CHOICE SITUATION

JOHN SALTIEL
Montana State University

In the short period of less than two decades, understanding of the status attainment process has advanced remarkably. Building on the seminal work of Blau and Duncan (1967) and the social psychological elaboration of Sewell et al. (1969), researchers have explicated the processes affecting young persons' occupational attainment. The result of numerous applications and extensions of the widely used Wisconsin model has been a body of research characterized by what Alexander et al. (1975: 324) have accurately termed "an unusual degree of coherence and cumulativeness."

While there are often differences in how the model is specified, a general consensus has emerged on the basic processes in occupational attainment. In the widely used Wisconsin model, social psychological

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mechanisms are viewed as mediating the effects of socioeconomic background and ability on attainment. In its most general form, the theory postulates that an individual's location in the social structure constrains the range of alternative occupations and exerts influence over the set of persons who serve as significant others and the expectations those others hold for him or her. Individuals' occupational aspirations are formed out of the expectations of their significant others and their own self-reflections (Haller and Portes, 1973). These aspirations, in turn, influence attainments insofar as circumstances and capacity permit. To date, research has provided strong support for the theory (Sewell et al., 1969; Alexander et al., 1975; Otto and Haller, 1979; Jencks et al., 1983). However, a sizable agenda for further research remains (see Haller, 1982; Campbell, 1983).

THE PROBLEM

The utility of attainment research has been limited by viewing occupations as differentiated along a prestige or socioeconomic hierarchy. The complexity of occupational choice is thus reduced to a single continuous variable (Hodge, 1981). There is, of course, solid empirical justification for this approach. A great deal of research has shown that as substantial amount of intergenerational mobility occurs along the socioeconomic dimension (Blau and Duncan, 1967; Featherman et al., 1975), and that prestige plays a central role in people's perceptions of the occupational structure (Kraus et al., 1978).

Despite the importance of the socioeconomic dimension, sociologists have long recognized that occupations can be differentiated on the basis of a number of characteristics that are relevant to the choice process. For example, Spenner (1981) and Mortimer (1974) have clearly shown that there are several aspects of occupation that influence intergenerational occupational mobility. Unfortunately, their work does not examine the processes through which parental occupations affect the vocational choices of their children. In general, research on specific job choices has not been as successful as the work on level of status aspiration and attainment.

Since there is little reason to believe that the basic social psychological processes involved in forming job choices differ in a meaningful way from those involved in setting status aspiration levels, it seems reasonable to apply the Wisconsin model to the former. To do so, however, would require resolving a problem related to the measurement of the key variables. As Woelfel (1975) has pointed out, both processes involve an individual faced with a choice among alternative behaviors. In the case of aspiration level research, the individual chooses an appropriate point or segment along a status or socioeconomic continuum. In occupational choice research, however, a choice is made among discrete categorical alternatives (such as being a doctor or a lawyer). The key variables—such as aspirations, attainments, and significant other expectations—are themselves discrete and thus do not lend themselves well to the use of a variety of powerful multivariate techniques such as path analysis.[1]

The contrast between continuous and discrete-choice models is highlighted by the problem of measuring significant other influence (SOI). The Wisconsin model of status attainment, consistent with social psychological theory, assumes that preferences are formed and modified largely on the basis of information from others about the occupational structure and the self. Such a model poses little problem as long as there is consensus among the sources of information. Empirically, however, this is not very likely. Typically, the individual is faced with several significant others, whose expectations differ. This situation poses the problem of how individuals integrate such information.

In continuous-choice models, such as in aspiration level research, the problem of aggregation can easily be resolved. A single composite measure of SOI can be computed by any number of algebraic operations, such as averaging the expectations (Woelfel and Haller, 1971; Anderson, 1974). Regardless of the method, the aggregate measure will represent some point along the status continuum.

In contrast, in cases in which the individual is faced with categorically distinct expectations, it is not possible to aggregate these influences into a single composite variable. Unlike the continuous-choice model, in which the individual can adopt a compromise position relative to the expectations of others, in a discrete-choice situation no such solution seems possible. How, for example, would the individual respond when faced with expectations such as carpenter and game warden? What occupation is between those two?

It would appear, then, that to utilize an approach comparable to the Wisconsin model to explain vocational preferences, the key variables (job choices and significant other influence) must be recast into continuous ratio-level terms. While attempts to quantify various attributes of occupation are a start, such conceptualizations rest on the theorist's a priori determination of the dimensions thought to be significant in differentiating among occupations. These attributes, however, may differ considerably from the criteria employed in the larger society (Kraus et al., 1978). It is, after all, these criteria that are of relevance in the interaction process that leads to occupational choices.

This article presents a method whereby occupational titles can be portrayed along a multidimensional continuum that reflects a population's shared conceptions of how these objects are differentiated. Illustrative data from an exploratory study on vocational preferences are incorporated within the well-developed Wisconsin model of status attainment.

THEORY

The approach taken here borrows from a proposal made by Woelfel (1975). The starting point is the assumption that the process of occupational choice and status attainment are identical with respect to underlying variables and the relationships among them. Consequently, emphasis is placed on the role of social psychological variables and particularly on the role of significant others in influencing the individual's perception of the occupational structure and the self. These perceptions then influence job preferences and attainment.

From this perspective, development of a theory of occupational choice depends on the investigator's ability to determine how respondents differentiate among occupations. Since occupations can be discriminated by a number of attributes (e.g., prestige, indoor-outdoor, etc.), it seems logical to build a model of occupational choice on an attribute-by-attribute basis. But in practice this is not feasible, since no one knows the complete set of attributes that individuals use to differentiate among occupations. Also, since many occupational characteristics are correlated, the resulting models would be much more complex than is proposed here.

Fortunately, there is a model of cognitive and cultural processes that can serve as the basis for measuring perceptions of the occupational world in such a way that the specifications of the theory are precisely met and the pitfalls mentioned above are avoided. This approach is based on a spatial model of attitudes and beliefs in which the definition of objects of cognition, for individuals or cultures, are given by their location relative to other objects in a multidimensional space (Woelfel and Fink, 1980). In this model, stimuli are viewed as differentiated on the basis of perceived dissimilarities or distances from other stimuli. It is the pattern of distance relationships among objects that determines the geometry of the space.

Multidimensional scaling techniques (MDS), in which respondents estimate the differences between pairs of stimuli without reference to specific criteria, are typically employed in such models. Given the requirements made here on the data, the appropriate method is some variant of metric MDS.

For occupational perceptions, respondents estimate the dissimilarities between all pairs in the domain as a ratio of some criterion pair. These responses are then averaged to yield a matrix of distances that represents a population's view of the occupational structure. Although averaging obscures individual differences, it is appropriate with aggregate phenomena. Furthermore, the random component of such scaling can be substantially reduced by averaging more cases into the means.

The underlying vector space is obtained by transforming the mean distance matrix into a scaler products matrix and then factoring (Torgerson, 1958). The resulting eigen vectors are represented in a matrix, C, where any entry c_{ij} represents the projection of the i^{th} occupation of the j^{th} dimension. Each occupation is then defined as a vector beginning at the origin the end point of which is given by its coordinates in the multidimensional space. This process is equivalent to converting a matrix of distances among cities into a geographic representation such as a map.[2]

In interpreting the data, it is important to keep in mind that the eigenvectors do not necessarily correspond to attributes. The dimensions of the MDS solution are the result of mathematical operations and have no substantive significance (Kruskal and Wish, 1978). They represent only the orthogonal axes of a Cartesian coordinate system. Attribute lines may take any orientation within this grid, and in fact the attributes are often intercorrelated and their number may exceed the number of dimensions (Rosenberg and Sedlak, 1972). In any event, it is the spatial location of the occupations and not their projections on attribute vectors that are of primary importance in this research. It is the spatial coordinates that are used to operationalize occupational choice and significant other expectations.

Evidence of the feasibility of these procedures for scaling occupations has recently been presented by Woelfel et al. (1980) and Saltiel (1986). Based on evidence from four samples of college students in diverse regions of the United States, it has been demonstrated that (1) respondents had little difficulty in completing the questionnaires, (2) the resulting spaces were precise and reliable over time, (3) the structures of the spaces were extremely similar across samples, and (4) the spaces contained attributes known to discriminate among occupations, particularly socioeconomic status and gender.

One of the major advantages of this procedure is the mathematical operations that are possible. The most important feature is the

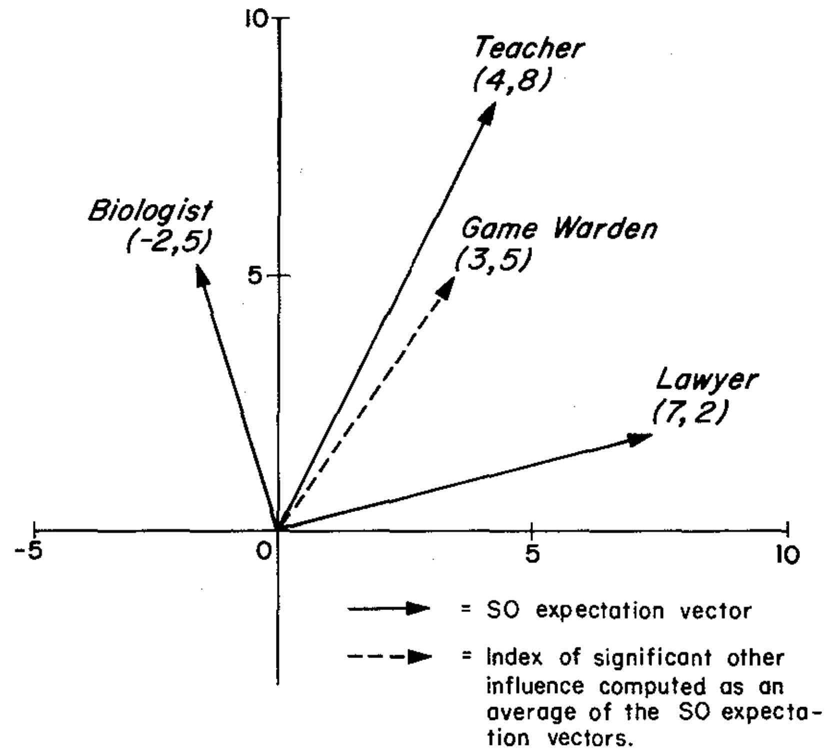

Figure 1: Hypothetical Example of Aggregating the Expectations of Three Significant Others into a Composite Index

possibility of aggregating the disparate expectations of influential others and assessing the impact of this information on occupational choice.

In this model, the individual's job choice is represented as a vector in the multidimensional space, as are each of the expectations of his or her others. To understand how significant other influence can be aggregated, consider first the relatively simple case in which the individual has two SOs, each with different expectations. In contrast to the discrete-choice models discussed above, in which the person is faced with making a choice among alternatives, in this spatial model the individual can select an occupation along the line segment connecting the two expectations.

The logic of this procedure can easily be generalized to the situation in which there are n significant others holding differing expectations. One simple index of influence could be constructed by taking the arithmetic mean of the expectations. Computationally, this amounts to summing the coordinates on each dimension over the expectations and dividing by n. SOI can thus be expressed as a vector, the endpoint of which is represented by the set of average coordinates. Although such an averaging procedure has been used in status attainment research (Woelfel and Haller, 1971) and meets the balance properties postulated by cognitive consistency theorists (Osgood and Tannenbaum, 1955), it is not required. Any number of more complicated indices could be constructed.

This procedure is illustrated in the hypothetical example presented in Figure 1. In this case, three SOs with the following expectations are postulated: lawyer, biologist, and teacher. Presuming that the occupations are located in a two-dimensional space as pictured, the significant other influence vector (the dashed line) is readily computed by averaging the coordinates of the three expectations. It is this point—or, alternatively, the occupations that lie on or near it—toward which the individual might be expected to aspire, all other factors being equal.

As status attainment theory has shown, however, influence from the expectations of others is not the only operative factor. A more reasonable model would include those variables already shown to be effective in status attainment research, for example, socioeconomic status, measured mental ability, levels of educational aspiration, and so forth.

Since the purpose of the theory is to account for occupational choices, operationally this is equivalent to employing the spatial location of the individual's job preference as the dependent variable. Given the orthogonality of the reference axes, this can be accomplished by a set of r ordinary regression equations of the form

(1) $\hat{y}_i = b_{i1x1} + b_{i2x2} \ldots\ldots\ldots + b_{iqxq}$

where: $\hat{y}_i$ = the predicted coordinate value for the individual's job choice on the i^{th} dimension

b_{ij} = empirically derived regression coefficients

x_j = the value of the independent variables. In the case of significant other influence, x is the average coordinate value on the i^{th} dimension.

What is basically involved is an extension of ordinary multiple regression techniques. It does, however, present some unique features of interpretation discussed below.

DATA AND METHODS

Data to test the theory were taken from a larger study on the educational and occupational decision-making processes of rural high school youth. The research procedure employed a multistage design in which data were collected from the entire high school population in a rural Montana town (population, 1,200) and from those identified by the students as occupational significant others. In the first stage, all of the students present in school on the day of the administration (142, with normal absentee rates) completed a modified form of the Wisconsin Significant Other Battery (WISOB). This instrument elicited data on student's background characteristics and their educational aspirations and occupational preferences, and identified the significant others for each individual. Each SO was then contacted and his or her expectations for ego were measured. (For a thorough discussion of the WISOB, see Haller and Woelfel, 1972).

The students and their SOs also provided pairwise distance estimates for 34 occupations. The 34 occupational titles were selected from those occupations most frequently listed by the students as potential job choices. The 34 titles largely reflect the opportunity structure of this particular community. Housewife was included because it remains a significant future status for a large number of females. While there is some debate on the issue, students of the occupational structure have increasingly come to view housewife as an occupation (Hall, 1975).

Using these titles, respondents were asked to estimate the distances between all possible pairs using as a standard that mail carrier and bank teller were 50 units apart. Given the large number of potential paired comparisons (561), each respondent was asked to provide distance estimates on a randomly selected subset. This yielded an average of 60.1 estimates for each pair of occupations.[3]

A three-dimensional plot of the occupations generated by these procedures is presented in Figure 2. Although the particular configuration reflects the range of occupations scaled, as well as any uniqueness in the sample, it is interesting that two attributes already shown to be of importance in differentiating among occupations are identifiable. By correlating the Duncan SEI scores and percent female in each occupation with the coordinate values on each axis, we calculate that a prestige vector lies at an angle of about 32 degrees to the first dimension and a sex-typing vector at about 20 degrees to the second. While it is clear that these axes (especially the first) are characterized by other (unknown) attributes, these data are in accord with other research that shows that socioeconomic status is central to respondents' conceptual organization

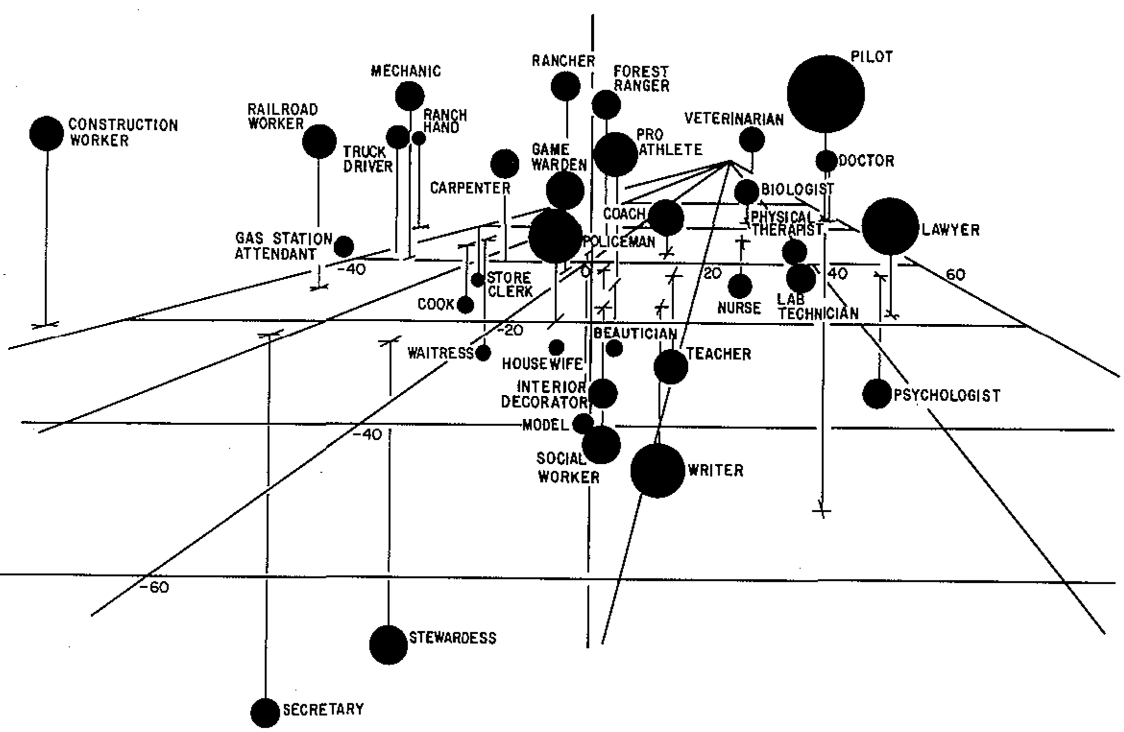

Figure 2: Three-Dimensional Perspective Plot of 34 Occupations

of the occupational structure (Kraus et al., 1978), and that sex-role stereotyping is important in differentiating among occupations (Woelfel et al., 1981).[4]

Because the scaled occupations omitted some choices students listed, we included only those students who listed an occupational preference from among the 34 listed. Similarly, we excluded students who had a large proportion of SOs holding expectations different from the scaled occupations. The result was a sample size of 98. This group generated 811 SOs, of whom 66% returned their questionnaires.

OPERATIONALIZATION OF THE VARIABLES

THE DEPENDENT VARIABLES

Occupational choice (OC1-OC3). The dependent variable is the individual's vocational preference. As previously discussed, this is operationalized by the spatial location of the desired occupation. In this research, however, only the coordinate values along the first three axes are used. As discussed later, use of a larger dimensional space is dependent on identifying the attributes that are relevant to occupational differentiation. Lacking such knowledge, and because the primary purpose of the research is to demonstrate the feasibility of these procedures, this approach is justified.[5]

Occupational choice was measured by students' responses to four open-ended questions patterned after the Haller and Miller Occupational Aspiration Scale (1971). Students were asked to list the job(s) they were sure they could get (realistic) and those they would most like to have (idealistic), on a short-range time span (after schooling is over) and a long-range basis (when you are 30 years old). The coordinates of the job choices were then averaged over the four responses to produce a composite measure.

Significant other influence (SO1-SO3). This was measured by the responses of each other to the same four questions asked of the student, except that the wording was changed to tap the expectations for a particular student. In this research, each other is viewed as a separate source of information. An index of influence was calculated by averaging the expectations over the number of SOs. This is also represented as a set of coordinates in three-dimensional space.

Father's occupation (X). This was determined from the Duncan SEI scale (1961).

Father's and mother's education (V and M). This was determined by student's responses to questions on highest grade level competed by each parent. Scores ranged from 1 for less than grade school to 7 for an advanced degree.

Parents' income (I). This was measured by the respondent's estimate of family income relative to that of others.

Sex of subject (S). Sex was entered as a dummy variable with males coded 0 and females 1.

Mental ability (VN, SCA, MCH). Jencks et al. (1983) have demonstrated the advantages of disaggregating aptitude measures in attainment research. Measures of diverse abilities would be even more useful in explaining occupational choice. Fortunately, this school had data from a multiaptitude battery, Form L of the Differential Aptitude Test (DAT) (Buros, 1978). For our analysis, three test scores were used. A composite of verbal and numerical ability (VN) was employed because it is a good global measure and is the best predictor of grades. And measures of mechanical ability (MCH) and clerical speed and accuracy (CSA) were included because evidence suggests that they tap distinct abilities.

Grade point average (GPA). This was obtained from school records. Grades from all courses except physical education were included.

Level of educational aspiration (LEA). This was measured by a two-item scale tapping the realistic and idealistic dimensions of aspiration. Each item offered five responses, from quitting school to getting an advanced degree. The scores were summed to yield a metric from 0 to 10.

RESULTS

The means, standard deviations, and correlations among the variables are provided in Table 1. Of much greater interest are the coefficients for the structural and reduced form equations in Table 2. Although these were computed by standard regression techniques, interpretation of the data presents some unusual problems due to the multidimensional nature of the dependent variable.

The typical attainment study examines the effects of the causally prior variables on a unidimensional continuous attainment variable, such as the amount of education or the level of income or occupational prestige. In the research presented here, however, the dependent variable, occupational preference, is operationalized as a location in a multidimensional space. The goal is to examine the effects of the

TABLE 1
Means, Standard Deviations, and Correlations for Occupational Choice Variables

	S	V	M	I	X	VN	CSA	MCH	GPA	SO1	SO2	SO3	LEA	OC1	OC2	OC3
S	1.0															
V	-.021	1.0														
M	.048	.355	1.0													
I	-.059	.091	.120	1.0												
X	.072	.519	.161	.235	1.0											
VN	.047	.167	.274	-.033	.167	1.0										
CSA	.465	.049	.072	.065	.111	.158	1.0									
MCH	-.558	-.013	.062	-.057	-.037	.270	-.240	1.0								
GPA	.378	.173	.292	.075	.161	.725	.497	-.096	1.0							
SO1	.321	.240	.203	.283	.119	.205	.209	-.193	.377	1.0						
SO2	-.893	-.064	-.009	.059	-.193	-.062	-.466	.602	-.346	--	1.0					
SO3	.027	.243	.086	.166	-.028	.113	-.184	.084	.121	--	--	1.0				
LEA	.108	.324	.290	.089	.118	.218	.152	-.132	.331	.350	-.182	-.018	1.0			
OC1	.113	.146	.202	.191	-.005	.260	.060	-.151	.290	.650	--	--	.393	1.0		
OC2	-.890	-.027	.016	.135	-.144	-.044	-.403	.560	-.327	--	.902	--	-.171	--	1.0	
OC3	.119	.135	.043	.095	-.125	.097	.008	.143	.171	--	--	.534	.087	--	--	1.0
Mean	.545	4.17	4.40	3.16	62.90	49.05	49.45	44.17	2.59	-2.37	-2.57	-.204	6.53	-9.27	-.80	-.95
SD	.500	1.36	.93	.60	11.39	14.95	9.38	8.23	.79	18.18	20.91	9.68	1.64	18.24	22.71	12.63

NOTE: S = sex; V = father's education; M = mother's occupation; I = family relative income; X = father's occupation (Duncan score); VN = verbal and numerical ability (composite); CSA = clerical ability; MCH = mechanical ability; GPA = grade point average; SOI = significant other influence (1, 2, and 3 refer to location on first, second, and third dimension); LEA = level of education aspiration; OCC = occupational choice (1, 2, and 3 refer to location on first, second, and third axis).

TABLE 2
Standardized Coefficients of Structural and Reduced Form Equations

Dependent Variables	Predetermined Variables: S	V	M	I	X	VN	CSA	MCH	GPA	SOI	LEA	R^2
VN	.019	.011	.257*	-.097	.142							.100
CLR	.466*	.019	.027	.077	.045							.230
MCH	-.577*	-.090	.126	-.111	.057							.335
GPA	.367*	.066	.237*	.050	.050							.231
GPA	.144	.041	.068	.081	-.054	.697*	.280*	-.138*				.736
SO1	.349*	.256*	.080	.299*	-.123							.259
SO1	.312*	.249*	.038	.311*	-.147	.188	.002	-.056				.286
SO1	.278*	.239*	.022	.292*	-.133	.022	-.065	-.023	.238			.303
SO2	-.886*	-.045	.066	.032	-.124							.819
SO2	-.760*	-.027	.059	.050	-.123*	-.054	-.055	.173*				.839
SO2	-.775*	-.032	.052	.042	-.118*	-.126	-.084	.188*	.104			.842
SO3	.068	.378*	-.032	.204*	-.271*							.132
SO3	.300*	.397*	-.074	.256*	-.283*	.113	-.302*	.162				.230
SO3	.261*	.386*	-.092	.234*	-.268	-.074	-.377*	.199	.268			.249
SOI	.955*	.459*	.109	.363*	.322*							.529
SOI	.875*	.469*	.102	.406*	.342*	.266	.307*	.244*				.561
SOI	.864*	.455*	.108	.377*	.321*	.148	.392*	.275*	.373			.571
LEA	.116	.304*	.183	.068	-.093							.159
LEA	.033	.283*	.156	.060	-.113	.190	.075	-.191				.204
LEA	-.071	.273*	.139	.038	-.099	.007	.001	-.155	.263			.222
LEA	-.344	.275*	.132	.022	-.154	-.054	-.082	-.049	.287	(.259* -.325 -.193)		.305
OC1	.135	.171	.138	.208*	-.174							.109
OC1	.018	.147	.085	.218*	-.204	.328*	-.063	-.243				.201
OC1	.008	.144	.080	.211*	-.200	.277	-.084	-.233	.073			.203
OC1	-.171	-.010	.066	.024	-.114	.263	-.042	-.217*	-.080	.644*		.492
OC1	-.149	-.048	.043	.028	-.102	.263*	-.044	-.192	-.116	.607*	.172*	.514

OC2	-.881*	-.027	.072	.101*	-.102							.814
OC2	-.821*	-.017	.066	.109*	-.104	-.032	.011	.111				.821
OC2	-.823*	-.017	.065	.108*	-.103	-.042	.007	.113	.014			.821
OC2	-.440*	-.002	.039	.087*	-.045	.021	.049	.020	-.037	.494*		.860
OC2	-.462*	.013	.049	.090*	-.053	.019	.047	.016	-.020	.472*	-.058	.862
OC3	.160	.308*	-.040	.158	-.327*							.115
OC3	.397*	.340*	-.089	.206*	-.347*	.031	-.084	.345*				.203
OC3	.352*	.328*	-.110	.181	-.330*	-.183	-.170	-.387*	.307			.228
OC3	.236	.155	-.069	.076	-.211	-.150	-.001	.298*	.187	.446*		.378
OC3	.239*	.125	-.080	.069	-.198	-.149	.004	.309*	.159	.461*	.089	.384
OCC	.906*	.353*	.161	.280*	.384*							.0471
OCC	.912*	.371*	.140	.319*	.416*	.331*	.106	.436*				.516
OCC	.895*	.359*	.151	.298*	.399*	.355	.190	.466*	.316			.523
OCC	.528*	.155	.103	.118	.244	.304	.065	.369*	.207	.927*		.622
OCC	.541*	.135	.103	.117	.229	.303	.065	.364*	.198	.897*	.202	.672

NOTE: S = sex; V = father's education; M = mother's occupation; I = family relative income; X = father's occupation (Duncan score); VN = verbal and numerical ability (composite); CSA = clerical ability; MCH = mechanical ability; GPA = grade point average; SOI = significant other influence (1, 2, and 3 refer to location on first, second, and third dimension); LEA = level of education aspiration; OCC = occupational choice (1, 2, and 3 refer to location on first, second, and third axis).
*Coefficient significant at .05 level.

causally prior variables on that location given by its projections along the orthogonal axes.

Following the procedure outlined in equation 1 above, the effects of the predetermined variables on occupational preference are computed by first regressing the coordinate value for each dimension on the appropriate set of variables. These coefficients can be found on lines 22-36 of Table 2. We then employ the fact that the dimensions are orthogonal to compute the effects of the independent variables on the spatial location. This is accomplished in the following manner.

Assuming p dependent variables and q independent variables, the regression equations expressed in 1, above, can be stated in vector form as

(2) $\hat{y}_i = b_{1x1} = b_{2x2} + \ldots\ldots + b_{qxq}$, where each b_j is a vector of regression weights. The dependent choice vector is now portrayed as a sum of vectors.

The effect of each independent variable x_j can now be estimated from the regression weights in the vector b_j in a straightforward manner. First recall that each element in b_j represents the effect of x_j projected on each of the p reference axes. Since these axes are orthogonal, the effect of x_j in the p dimensional space can be expressed as a resultant vector of length of $1_j = (b_j b_j)^{1/2}$. This vector has direction cosines that can be represented as follows:

$$k_j = \begin{pmatrix} b_{1j/1j} \\ b_{2j/1j} \\ \cdots \\ \cdots \\ b_{pj/1j} \end{pmatrix}$$

where: $b_{ij/1j}$ = the cosine of the angle of the vector b_j to the i^{th} axis.

The value of 1_j can now be interpreted as any other regression coefficient except that its direction also needs to be taken into account. That is, each unit of change in x_j produces a change of magnitude 1_j along a vector in p dimensional space the location of which is determined by the direction cosines given in k_j. One can test whether this vector length is significantly different from 0 by testing the hypothesis that all the elements of b_j are different from 0. This is done by taking the sum of the ratios of the squared elements of b_j their variance that is distributed approximately as chi-squared with p degrees of freedom.

The direction cosines, as well as the value of l_j, are important for interpreting the effects of each independent variable. To use them, however, requires knowledge of what occupations are in each region of the space. Since only a limited number of occupations were scaled in this study, such interpretations warrant extreme caution at this time. The importance of this for future research is discussed below.

The orthogonality feature can be used advantageously to compute a multidimensional R^2. Since the total variance around the spatial locations of the measured job choices is equal to the sum of the variances along each of the references axes, the multidimensional R^2 can be expressed as

$$R^2 = \sum_{i=1}^{P} \sigma_i^2 R_i^2 \Big/ \sum_{i=1}^{P} \sigma_i^2$$

The regression and correlation coefficients are shown in lines 37-41 of Table 2. Perhaps the most useful way to understand the meaning of these coefficients is to consider the independent variables as forces acting on the dependent occupational choice variable. Each force "pulls" the individual along a vector in a direction given by the direction cosine. The magnitude of this force is the product of the value of the independent variable and the regression coefficient (l_j). The predicted job choice, as a spatial location, can be understood as the resultant of all the forces (independent variables) that are believed to be operative.

In order to visualize this, Figure 3 presents a somewhat oversimplified portrayal of the effects of three variables (sex, family income, and mechanical aptitude) on occupational choice. These "forces" have been located in the multidimensional space used to define the occupational domain. Since the magnitude of the force for each individual can only be determined by both the regression coefficient and the value of the independent variable, these force vectors are presented only in terms of direction. Although only a few occupations are portrayed in this illustration, the utility of this approach is clear.

Beyond these relatively direct extensions of ordinary regression analysis, it is also technically possible to assess direct and indirect effects. Although the Alwin and Hauser (1975) approach can be used, working in a multidimensional space presents some unique problems. This is because the regression coefficients reflect only the magnitude of the effects in the total space and thus may hide much of what is occurring.

Consider the effect of sex on occupational choice (OCC) after adding the mental aptitude variables (lines 22-23, 27-28, 32-33, and 37-38).

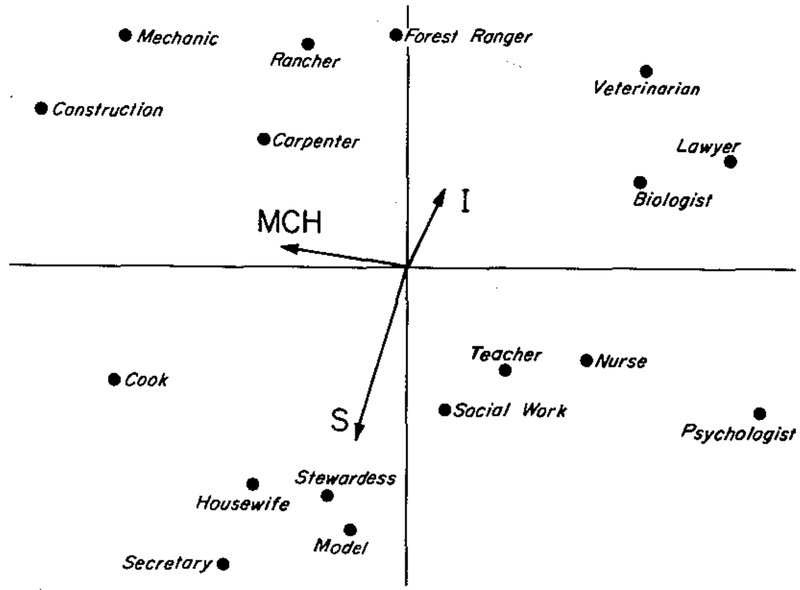

Figure 3: Illustration of the Effects of Sex, Income, and Mechanical Ability as Forces in a Two-Dimensional Space of Selected Occupations

Lines 37-38 show that the direct effect of sex are slightly larger than the total. But if examined along each reference axis, a different picture emerges. It appears that mental aptitude mediates most of the effect of sex on choice along OC1, but acts as a suppressor along OC3. Thus the way aptitude effects the relationship between sex and occupational choice is a complicated product of effects. The interpretation of such data awaits more complete knowledge of the space.

Despite some limitations on interpretation given the present state of development, these data are sufficient to demonstrate utility of these procedures for explaining the occupational choice process. With this in mind, we will first briefly examine the relationships among the antecedent variables, and then turn to the occupational choice variable.

The data show that both sex and SES affect performance on aptitude tests. But there are differences by type of aptitude. Sex seems to have little relationship to scores on the general intelligence measure (VN), but females perform better than males on CSA and worse on the MECH aptitude measure. The effects of SES on aptitude are due largely to the relationship between mother's education and VN.

Not surprisingly, the major effect on grades is the score on VN. And, consistent with previous studies (Hauser et al., 1976), women get higher grades than do men. A good part of the effect of sex (62%), however, is mediated by the aptitude variables. Of these indirect effects, 36% is via CSA, 22% via MECH, and only 4% via VN. Thus girls seem to get better grades because they score better on clerical ability tests. CSA may very well be a proxy for those kinds of behaviors that teachers reward with good grades. The data also show that mother's education has an indirect effect on grades via VN.

Significant other influence (SOI) is a social psychological variable that theoretically plays a key intervening role in the choice process. It is also, like occupational choice, a spatial variable operationalized by its coordinates. Hence interpretation of the causally prior variables warrants the cautions outlined above.

Before examining these data, one further caution needs mention. In this sample, sexual incumbency (percent female) of occupations is closely correlated with the occupations' scale scores on the second dimension. Thus when only the first few dimensions in the space are examined, any variables that have a high correlation with the second dimension will exert very strong effects on the overall spatial location. The data for this sample show clearly that ego's gender has very strong effects on both the SO2 and the aggregate SOI variable. As will be seen momentarily, it also plays a strong role in occupational choice.

What is reflected here is the very important role of sex role stereotyping, not only as a basis for differentiating among occupations, but also in the socialization process by which males and females are directed along lines traditionally considered appropriate for each. These data clearly show that most of the effects of sex on SOI are direct. It appears that in setting expectations, significant others are guided primarily by the individual's gender, regardless of aptitude or ability.

While explaining educational aspirations (LEA) is not a major concern in this work, the low R^2 and the small path coefficients from SOI are noticeable. Although the literature shows a strong correlation between occupational and educational expectations, the correlation holds when occupational expectation is measured as a status level. The measure of occupational expectation employed in this research gets at a number of characteristics associated with occupation, thus reducing the correlation with educational aspirations.

Turning to the occupational choice variable, the pattern of coefficients presents an interesting picture. Overall, the most important factors affecting choice are sex and SOI. About 60% of the effect of sex is direct, with SOI playing the major mediating role. As discussed above, the role of mental ability cannot be clearly determined with the limitations of these data.

Roughly half of the effect of the SES variables is direct, with virtually all of the indirect effects due to SOI. The most surprising findings here are the small effects of SES on choice. While the weak measure of family income may partially account for this, it appears that the choice variable is not as sensitive to SES variables as are aspiration level-type measures. Certainly, other aspects of family background should be incorporated in choice research. Given the previous research on role transmission (Mortimer, 1974; Spenner, 1981), at a minimum, fathers' and mothers' occupations (considered as a spatial location) ought to be included. The current operationalization probably underestimates the effects of family background to a significant degree.

Finally, it is noted that both grades and LEA have very small effects on occupational choice. It seems plausible that neither of these measures taps the elements of achievement or education that are relevant to the choice process. Grades in particular subject areas might be better measures of achievement. And a measure of the different dimensions of educational aspiration (Kerckhoff et al., 1982) would be quite useful.

DISCUSSION AND CONCLUSIONS

This article presented and tested a procedure for recasting discrete occupational titles into continuous terms and employed the results within the framework of the Wisconsin model of status attainment to explain specific vocational choices. Despite the claims of Horan (1978), it appears that status attainment research is not dependent on representing occupations only as status levels.

In particular, the data show that a student's gender and, to a lesser extent, his or her family socioeconomic status are related to job preference. It is also the case that the young person takes into account different types of abilities in forming a choice. Finally, significant others partially mediate this process by taking into account the gender and abilities of ego when communicating their expectations. Beyond this, however, the data point to a number of problems that must be addressed before further research along these lines can be conducted.

An obvious problem is the small number of occupations that were scaled. In this research, a number of persons were excluded from the data base because their occupational choices did not correspond to those that were scaled. Moreover, it placed serious limitations on the ability to give a substantive interpretation to the effects of the independent variables. If the research reported here is convincing, efforts to map a larger domain of the occupational structure would be worthwhile. Such a mapping could also lead to the development of more precise instruments to measure vocational preference.

Perhaps the most important issue is that of specifying the causally prior variables involved in the occupational choice process. This research began with the assumption that the basic processes involved in forming vocational preferences and setting status aspiration levels were the same. Although there is little reason to doubt this statement, it does appear that measures of the theoretical variables beyond those typically employed in status attainment research are required. Indeed, by using social standing and resource measures to tap family background, and grade point average for the measure of achievement, the depth of this research was necessarily limited. Although these measures have been useful in research dealing with occupational aspiration and attainment levels, it is apparent that other dimensions of the theoretical variables need to be included when explaining specific occupational choices. The identification and inclusion of such variables should lead to substantially more accurate explanations.

The identification of these variables might also be useful for elaborating male-female differences in attainment. Evidence to date shows the typical status attainment model accounts for more variance in male occupational attainments than it does for females. A common argument is that since occupational achievement is more salient for males, most status attainment variables have stronger effects (Sewell et al., 1980). These results may be due in large part to the status level conceptualization of achievement. By focusing on specific job choices, and by including different aspects of family background, ability and achievement that bear on these choices, occupational preference studies may provide more useful information on sexual differences in attainment than will further status level research.

Given the strong theoretical basis, the past success with the Wisconsin model, and the proposed techniques for treating discrete choices in a quantitatively precise way, it seems that conditions are favorable for explicating the processes by which specific occupational choices are made.

NOTES

1. There exist techniques for modeling the processes by which individuals make choices among discrete alternatives, as Manski (1981) has recently shown. In contrast to the continuous case, however, these procedures are cumbersome.

2. One of the major objections to this procedure is that the dissimilarity estimates

frequently violate the triangular inequality axiom of Euclidean geometry. However, there is strong evidence that these violations are not due to unreliability in measurement. Since such outcomes are theoretically explicable, scaling algorithms which eliminate them result in substantial losses of meaningful and useful information (Woelfel and Fink, 1980; Woelfel and Barnett, 1982).

3. This particular standard was chosen so as not to imply that prestige should be used as the only basis for differentiating among occupations. Data on the average distance estimates can be obtained from the author upon request.

4. The significance of sex stereotyping for occupational differentiation varies among population subgroups. For this sample, gender is apparently central to peoples' perceptions. In the Woelfel et al. (1981) study of college students, however, a sex stereotyping vector lies essentially within the subspace generated by the second, third, and fourth dimensions.

5. The basic problem here is that we have employed as independent variables those typically used in research aimed at explaining status level aspirations. While this is a critical aspect of occupational choice, it is safe to presume that there are other variables invovled in this process. Thus use of the independent variables employed in this research in a space of higher dimensionality would be of limited utility.

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