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Source: *American Journal of Sociology*, Vol. 85, No. 4 (Jan., 1980), pp. 815-839
Published by: The University of Chicago Press
Stable URL: https://www.jstor.org/stable/2778708

Indianapolis and Beyond: A Structural Model of Occupational Mobility across Generations[1]

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Several aspects of Rogoff's classic mobility study (1953) which have influenced subsequent research are reviewed. Recently developed log-linear techniques are used to estimate the "densities" associated with intergenerational occupational moves. A structural model derived empirically from Rogoff's data for Marion County, Indiana, from 1910 to 1940, is applied to an intergenerational mobility matrix from a 1973 national sample, accounting for five-sixths of the baseline association. The results confirm the fundamental invariance of mobility trends documented by previous research. Net mobility patterns apparently reflect a mental-manual division among occupations, with the more "traditional" service sectors and farming falling in between, rather than a hierarchical status dimension.

Numerous studies have documented a fundamental temporal invariance in the transmission of occupations and social status across "generations." Notwithstanding an overall "upgrading" of the occupational distribution over time, the limited evidence bearing on changes in the dependence of occupational destinations on social/occupational origins in the United States indicates no systematic trend over the past 60–70 years (e.g., Rogoff 1953; Blau and Duncan 1967, pp. 67–113; Duncan 1965, 1966, 1968; Tully, Jackson, and Curtis 1970; Hauser and Featherman 1973, 1974; Hauser, Koffel, Travis, and Dickinson 1975; Baron 1977; cf. Featherman and Hauser 1976; Hauser, Featherman, and Hogan 1977).[2] These results have

[1] This is a revised version of a paper presented at the 1978 annual meeting of the American Sociological Association, San Francisco. I was supported in part by a NRSA Training Grant (HD-07014), and computing was funded through a Center for Population Research grant (HD-05876). Both grants were to the Center for Demography and Ecology of the University of Wisconsin—Madison from the Center for Population Research of the National Institute for Child Health and Human Development. I benefited immeasurably from the diverse criticisms and suggestions of William Bielby, Peter Dickinson, David Featherman, Robert Hauser, Yossi Shavit, and Hal Winsborough, and from several thoughtful comments from the editors and referees. David Featherman and Robert Hauser generously made the 1973 OCG data accessible, and Peter Dickinson and Yossi Shavit provided invaluable computational assistance.

[2] However, a recent replication and extension of Blau and Duncan's (1967) study concludes that "with minor exceptions the evidence consistently shows a temporal decline in the strength of association between occupational origins and destinations. . . . Thus, among American men a reduction of obstacles to occupational change appeared to be a long-term and continuing tendency" (Featherman and Hauser 1978, p. 136).

focused attention on the salience of *continuity* in mobility patterns—rather than change—as a concomitant of industrial development (Hauser, Dickinson, Travis, and Koffel 1975; Burawoy 1977).

Natalie Rogoff's *Recent Trends in Occupational Mobility* (1953) was the first major empirical study to report this finding and to explore its substantive implications. Rogoff collected data on fathers' and sons' occupations for residents of Marion County, Indiana, who applied for marriage licenses there between 1905 and 1912, or between 1938 and 1941 (see Rogoff 1953, chap. 2). Her analysis and conclusions have profoundly influenced subsequent developments in conceptualizing and measuring mobility (Tyree and Hodge 1978). The Indianapolis mobility study is thus an extremely appropriate benchmark against which to examine what advances have been made in studying the structure of intergenerational occupational mobility since Rogoff's seminal analysis. This paper first reviews Rogoff's study and outlines a strategy for measuring intergenerational mobility flows among occupations. The analysis then proceeds in three steps. First, the results of a reanalysis of Rogoff's Indianapolis data (Baron 1977) are summarized. Next, the correspondence between these findings and contemporary mobility trends at the national level is examined. Finally, the dimensions of "mobility space" revealed by these analyses are considered—that is, the relationships among occupational groups as indexed by intergenerational movement among them.

ROGOFF'S ANALYSIS: CONCEPTS AND MEASURES

As Rogoff notes in her preface, the primary focus of her inquiry was methodological (1953, p. 17). Her major concern is that "if movement within the occupational structure is more restricted for some social groups than for others, this can be seen only by controlling the effect of mobility changes due to changes in the occupational structure" (Rogoff 1953, p. 30).

She constructs a set of measures which purport to separate contributions made to total mobility by the marginal distributions of origins and destinations from the "social distance" mobility which reveals "barriers, restrictions, and rigidity in the social structure" (Rogoff 1953, p. 30).

Rogoff's analysis assumes that her "social distance mobility ratio" (R_{ij}) provides a standard metric for comparing actual and expected mobility which is not confounded by the marginal distributions. However, many investigators have demonstrated that R_{ij} does not furnish such a metric and confounds "main" and "interaction" effects (Blau and Duncan 1967, pp. 93–97; Duncan 1966; Hauser 1978; Pullum 1975; Tyree 1973; White 1963; Yasuda 1964). Moreover, R_{ij} is merely a "residual" from the independence model; the "effect" associated with net (im)mobility should be determined from the parameters of a model designed to measure that effect, not from the failure of the model to do so.

According to Rogoff, "Occupational mobility is studied as an index of the relative 'openness' of a social structure" (1953, p. 19). However, operationalizing societal "openness" in terms of the amount of intergenerational mobility focuses attention on the attainment of *individuals* (rather than on the structure of occupational *positions*) and prompts dubious extrapolations from the observed distribution of intergenerational occupational movement to multifaceted conclusions regarding "social mobility and social justice" (Goldthorpe and Hope 1972, p. 37).[3]

This paper approaches the mobility table as a "map" of occupational regions whose "distances" and contours are to be described in terms of the patterns of movement among them.[4] In addition to the effects associated with social origins and occupational destinations, the "predisposition" toward intergenerational movement between (or persistence within) situses is an important feature of the occupational and social structure (as well as of the material and psychological experiences of individuals). Accordingly, this map is drawn by measuring the "density" or net (im)permeability of intergenerational moves. Our concern with the so-called structural effects of origins and destinations is thus contingent on our attempt to model simultaneously the underlying structure of mobility flows. "Structural" effects should be conditioned on the assignment of cells to various homogeneous regions of the mobility table, instead of treating the table as a conceptual and statistical whole by equating the structural *effects* with the row and column *marginals* (for a similar argument, see Hope [1978], p. 33).

A set of log-linear techniques developed recently by Hauser (1978) involves precisely such a partitioning of the mobility table. Thus, in addition to overcoming certain methodological inadequacies of the "independence" model, this class of models also suits a conceptualization of intergenerational mobility "regimes" as indices of the relations among occupational positions.

[3] Perhaps this individualistic bias is symbolized by references to structural mobility as "forced" (Broom and Jones 1969). Moreover, marked increases in "circulation" might occur which substantially equalize access to occupations across all categories of social origins, but which are at odds wtih the preferences and aspirations of individuals (e.g., the case of post–World War II Hungary as documented by Simkus [1977]). It is not clear how one would evaluate societal "openness" in this instance from the above perspective. (For an explicit attempt to model mobility tables in a manner analogous to regression models of status attainment, see Duncan [1979].)

[4] Similar imagery is employed by Carlsson (1969, chap. 8). As he notes, to the extent that occupational mobility indexes "social" mobility, the "space" of interest is actually hierarchical.

THE MODEL

The modeling procedures extend log-linear techniques for analyzing multidimensional contingency tables (e.g., Bishop, Fienberg, and Holland 1975; Fienberg 1970; Goodman 1969, 1972). Quasi-independence models are specified which impose a third latent "dimension" on a two-dimensional mobility table by aggregating cells into the levels (mobility regimes) which constitute this design matrix. For a full exposition of these techniques, see Baron [1977]; Hauser [1978].)

Denote the observed frequency in the (i,j)th cell of the intergenerational mobility matrix (with dimension $I \times J$) by X_{ij}. Each such (i,j) pair is assigned to one of K subsets of the mobility table. Let this partition be represented by H_k $(k = 1,2, \ldots, K)$. Then

$$E[X_{ij}] = m_{ijk} = \alpha\beta_i\gamma_j\delta_{ij} = \alpha\beta_i\gamma_j\delta_k \quad \text{for } (i,j) \in H_k \qquad (1)$$
$$= 0 \text{ otherwise},$$

subject to the normalization constraints that

$$\prod_i \beta_i = \prod_j \gamma_j = \prod_k \delta_k^{n_k} = 1 ,$$

where n_k is the number of cells allocated to the kth level.

Here, α corresponds to a "grand mean" effect, β_i is the effect of the ith row (origin status), γ_j is the jth column (destination) effect, and δ_k is a "level" effect. A common interaction parameter (δ_k) is therefore shared by all cells assigned to the kth level of the design. The δ_k correspond to the "relative densities" associated with the cells in the table. Note that the model embodies no assumptions about ordinality in the occupational categories.[5]

Frequencies under the model may be estimated using Fay and Goodman's (1973) ECTA computer program (Everyman's Contingency Table Analyzer). The likelihood ratio test statistic has a χ^2 distribution with, in general, $(K - 1)$ fewer degrees of freedom than the simple independence model. For convenience, if the logarithms of the quantities in equation (1) are denoted with asterisks, the model may be rewritten

$$m_{ijk}^* = \alpha^* + \beta_i^* + \gamma_j^* + \delta_k^* \quad \text{for } (i,j) \in H_k , \qquad (2)$$

with the constraint that

$$\sum_i \beta_i^* = \sum_j \gamma_j^* = \sum_k n_k\delta_k^* = 0 .$$

Adopting the notation of Goodman (1970), the model of interest may be labeled (P) (S) (H), where $P =$ father's occupation, $S =$ son's occupation,

[5] However, the techniques applied here are based on Goodman's (1972) elaboration of various models of "quasi-independence" which usually *does* assume ordered row and column classifications (cf. Goodman 1979, p. 806).

and $H =$ the levels to which the cells in the table are assigned under the model. Thus, this is a model of statistical independence, conditional on the allocation of all cells to levels of H_k.[6]

Two quantities derived from this model are of particular interest. Let the expected frequencies obtained from the model in equation (1) be denoted by

$$\hat{m}_{ij} = \hat{\alpha}\hat{\beta}_i\hat{\gamma}_j\hat{\delta}_{ij} . \quad (3)$$

Then the "errors," expressed as natural logs of the ratios of observed to expected frequencies, may be defined as

$$\ln (e_{ij}) = \ln (X_{ij}/\hat{m}_{ij}) = \ln X_{ij} - \ln \hat{m}_{ij} . \quad (4)$$

From equations (3) and (4) it follows that

$$X_{ij} = \hat{\alpha}\hat{\beta}_i\hat{\gamma}_j\hat{\delta}_k e_{ij} .$$

Rearranging terms yields

$$R_{ij}{}^* = X_{ij}/(\hat{\alpha}\hat{\beta}_i\hat{\gamma}_j) = \hat{\delta}_k e_{ij} . \quad (5)$$

$R_{ij}{}^*$ denotes the "mobility ratio" for the model. The $R_{ij}{}^*$ may also be expressed conveniently in additive form:

$$\ln (R_{ij}{}^*) = \ln X_{ij} - \ln \hat{\alpha} - \ln \hat{\beta}_i - \ln \hat{\gamma}_j = \ln \hat{\delta}_k + \ln e_{ij} . \quad (6)$$

Thus, ln $(R_{ij}{}^*)$ is composed of two quantities: the common interaction or "level" effect associated with all cells in the kth level of the design matrix, and the within-level error associated with each cell.[7]

ROGOFF REVISITED: A SUMMARY

In reanalyzing Rogoff's Indianapolis data, mobility "maps" were drawn inductively. Supplemented by certain "priors" (e.g., the expectation of high "density" along the main diagonal), the statistical apparatus described above was applied in an iterative search procedure of the sort frequently employed in mobility studies and exploratory data analyses in general. Given this exploratory strategy, one must resist the temptation to "overfit" the data by attending to insignificant details, and one should control the urge to ascribe great importance to test statistics (and their nominal significance levels), since numerous implicit tests have been per-

[6] The parameters from this model can be estimated by calculating the (log) expected frequencies under the (P) (S) (H) model, which are then regressed on three vectors of dummy variables denoting the row, column, and level of the cell to which each expected frequency corresponds. The resultant coefficients may then be deviated from the grand mean (rather than omitted categories) for ease of presentation and interpretation.

[7] Hence, by definition ln $e_{ij} = 0$ if a cell is the only element in a level of the design matrix.

formed.[8] A model was adopted when major modifications clearly threatened substantive validity, parsimony, or goodness of fit, and where minor revisions did not appreciably affect the portrait of mobility structure obtained.

On the basis of tests utilizing hierarchical log-linear models (Baron 1977, p. 42), the Indianapolis data were found to have an essentially symmetric and temporally homogeneous interaction structure. An initial nine-level symmetric design matrix was derived from iterative specifications fit to data "smoothed" over time and across the main diagonal (i.e., expected frequencies under a model which constrained the interactions between fathers' and sons' occupations to be symmetric and temporally invariant). The resultant model (not, incidentally, the best-fitting one) was accepted because of its interpretability, parsimony, and close fit.

Relaxing the assumption of symmetry revealed several conspicuous asymmetries in mobility flows which warranted minor modifications of the initial model. The final nine-level design matrix (with three asymmetries) is presented in figure 1. For convenience, the levels have been ranked from relatively "most dense" (i.e., those cells into which net inflow, as measured by the R_{ij}^*, is the greatest) to "least dense," labeling them from 1 to 9, respectively; the lowest numbers represent the "easiest" moves, while the

Occupational category	Sons									
Fathers	1	2	3	4	5	6	7	8	9	10
1] Professional	1	3	3	4	8	7	9	7	7	6
2] Semi-professional	3	1	4	5	8	6	9	7	5	7
3] Proprietors, managers and officials (PMO)	3	4	2	4	8	6	8	5	6	5
4] Clerical and sales	3	4	4	3	8	6	8	6	6	7
5] Skilled labor	8	8	8	8	7	7	9	9	8	8
6] Semi-skilled labor	7	6	6	6	7	4	6	6	5	6
7] Unskilled labor	9	9	8	8	9	6	3	6	6	8
8] Protective service	7	7	5	6	9	6	6	3	7	5
9] Personal service	7	5	6	6	8	5	6	7	3	5
10] Farming	6	7	5	7	8	6	5	5	5	1

High density (levels 1-4)
Medium density (levels 5-7)
Low density (levels 8-9)

FIG. 1.—Nine-level model of the structure of intergenerational mobility in Marion County, Indiana, 1910–40. The model contains three asymmetries: the (4,1), (2,4) and (7,10) cells.

[8] For a discussion of simultaneous test procedures for a series of hypotheses pertaining to quasi-independence in contingency tables, see Goodman (1971).

highest depict relatively large distances between the origin and destination categories.

Figure 1 also graphically portrays the important structural features of the model by grouping the nine levels into three broad classes—cells which are of relatively high density (levels 1–4), moderate density (5–7), and low density (8–9). The table reveals four basic rectangular "provinces": a domain of high density within the white-collar sector; two regions of moderate density pertaining to movement between service and farm occupations on the one hand and white-collar occupations on the other; and a large territory characterizing movement among semiskilled and unskilled laborers, service workers, and farmers as "moderate" and persistence in those sectors as "high," relative to exogenous influences. These provinces are separated by several "gullies" indicating blockages to intergenerational movement (*a*) between skilled occupations and all others except semiskilled labor and (*b*) between white-collar employment and unskilled labor.[9]

The global results of various reanalyses of Rogoff's data utilizing the model in figure 1 are summarized in table 1. For each influence on the mobility process analyzed (time, race, nativity, and/or age), table 1 shows the proportion of the G^2 under the conditional independence (baseline) model[10] accounted for by various models including "mobility parameters" for each region of figure 1 which (*a*) are invariant across subtables or (*b*) depend on the time period, race, nativity status, and/or age cohort involved.

These results underscore the virtual lack of variation in mobility regimes over time and by race, nativity status, and age, after having fit a model to the data which specifies the relative "distances" among occupational situses. The results show mobility patterns to be fundamentally invariant—a single configuration of relationships among origin and destination statuses accounts for virtually all of the baseline association between fathers' and sons' occupations. Moreover, once this interoccupational nexus has been specified, the so-called structural effects which have received substantial attention in recent studies (e.g., Hauser, Dickinson, Travis, and Koffel 1975) are found to be less consequential: relative to the parameterization

[9] Under the model of figure 1 movement of unskilled laborers' sons to the farm is also "blocked"; however, there are few observations in this cell in either time period.

[10] That is, in which the marginal distributions of fathers' and sons' occupations vary by each variable but are independent of one another. For example, let $P =$ father's occupation, $S =$ son's occupation, $T =$ time, $A =$ age, and $H =$ design matrix of figure 1. Then in the analysis of Rogoff's table disaggregated by age and time, the baseline model is (PAT) (SAT), and the model with invariant densities is (PAT) (SAT) (H). The models (PAT) (SAT) (HT), (PAT) (SAT) (HA), (PAT) (SAT) (HA) (HT), and (PAT) (SAT) (HAT) correspond to variation in densities by (1) time, (2) age, (3) main effects of time and age, and (4) main effects for time and age, plus an age $\times$ time interaction, respectively.

TABLE 1

PROPORTIONS OF BASELINE ASSOCIATION (under Hypothesis of Conditional Independence) ACCOUNTED FOR BY "MOBILITY DENSITY" PARAMETERS OF FIGURE 1* FIT TO ROGOFF'S (1953) INDIANAPOLIS DATA
(N = 20,145)

	VARIABLE			
	Time†	Race	Nativity‡	Age§
Baseline G^2	4,796.02 (162)	47,965.43 (98)	93,555.17 (324)	93,609.45 (486)
Invariant set of level parameters ("densities") (%)	95.91 (154)	99.68 (91)	99.51 (316)	99.36 (478)
Densities allowed to vary by (%)	Time: 96.38 (146)	Race: 99.76 (84)	Time: 99.53 (308)	Time: 99.39 (470)
			Nativity: 99.55 (308)	Age: 99.38 (462)
			Time, nativity: 99.57 (300)	Time, age: 99.42 (454)
			Time×nativity: 99.59 (292)	Time×age: 99.46 (438)

SOURCE.—Adapted from Baron (1977, pp. 81, 103, 113, 126).

NOTE.—Numbers in parentheses are degrees of freedom.

* In the analysis of mobility by race (whites vs. blacks, 1940), Rogoff's tables are categorized differently. The model employed in this analysis is an eight-level version of figure 1 adapted slightly to the coarser scheme of occupational classification in these tables.

† 1910 vs. 1940.

‡ Sons of native fathers vs. sons of foreign-born fathers.

§ Under 24, 24–30, or over 30 years of age.

of figure 1, changes in the occupational distributions of fathers and sons by time, race, nativity status, and/or age exercise extremely small net effects (see Baron 1977, pp. 81, 103, 113, 126).[11]

To what extent are these relationships characteristic of present-day national mobility trends? The remainder of this paper examines the correspondence between the Indianapolis results and mobility trends among the 1973 Occupational Changes in a Generation II (OCG II) sample of the U.S. male civilian labor force.

ROGOFF REPLICATED: INTERGENERATIONAL MOBILITY IN THE UNITED STATES, 1973

In order to extend and validate these reanalyses of the Indianapolis data, mobility from father's occupation to son's current occupation was examined in the OCG II survey, a stratified, multistage cluster sample of males in the U.S. civilian noninstitutional population and aged 20–64 as of March 1973 (see Featherman and Hauser 1975).

Perhaps the major impediment to a satisfactory replication of Rogoff's survey is the inescapable fact that the Indianapolis data "do not constitute a probability sample from a well-defined actual universe" (Duncan 1966, p. 69). Selecting some subsample of the OCG survey which might be valid for comparisons with the Indianapolis survey (from the standpoint of sampling) would virtually guarantee that any conclusions for the national sample would be substantively meaningless. Accordingly, no such subsample has been selected.

Certain discrepancies arise in comparing the Indianapolis and the OCG II data bases. For example, fathers' occupations in the OCG data were determined from reports by sons recalling (approximately) their sixteenth birthdays, while Rogoff utilized marriage license applications. Moreover, somewhat different criteria were used to exclude cases from each sample. Perhaps it is overly optimistic to suppose that the various discrepancies "cancel" one another; nonetheless, I have not gerrymandered the contemporary American mobility experience, as represented by the OCG sample, by attempting to duplicate certain unfortunate idiosyncracies of Rogoff's sample design.

The detailed procedures used to replicate Rogoff's 10-category scheme of occupational classification are described in the Appendix. Sons' current occupations and fathers' occupations were assigned to one of Rogoff's 10 occupational categories using three-digit 1960 census occupation codes (U.S. Bu-

[11] The largest structural effects are associated with temporal variation in fathers' and sons' occupations in the gross comparison between the 1910 and 1940 tables. Even in this instance, variation in the net effects of origins and destinations by time accounts for only 18% of the baseline association.

reau of the Census 1960). All occupations allocated explicitly by Rogoff to one of her 10 categories were assigned to that category. Otherwise, occupational titles appearing within one of the broad census categories corresponding to Rogoff's situses (e.g., "clerical and sales workers") were assigned to that group. However, certain titles could not be mapped on this basis. For example, since there is no distinction between "professional" and "semiprofessional" categories in the 1960 census codes, white-collar occupations that did not appear in Rogoff's sample had to be labeled (semi)professional on an ad hoc basis. These decisions were made by mapping the ambiguous title to some "functionally equivalent" occupation occurring in Rogoff's categorization.

RESULTS

Table 2 presents the marginal distributions for fathers' and sons' occupations in the OCG data, along with the corresponding marginals from the temporally smoothed Indianapolis data. The two data sets are strikingly similar in the distribution of fathers across occupational categories. The most notable exceptions are skilled and semiskilled labor—the former apparently constitutes a smaller proportion in the OCG than in the Rogoff sample, while the opposite is true for semiskilled employment. One would expect the two distributions of social origins to summarize approximately the same set of occupational experiences pertaining to fathers between 1910 and 1940.[12] Thus, their strong correspondence indirectly validates the scheme of occupational classification used to replicate Rogoff's analysis.

Unfortunately, there is no way to determine the extent to which differences in the distribution of sons' occupations reflect (*a*) idiosyncracies of the Indianapolis labor force, (*b*) "structural change" between the 1910–40 period and the present, or (*c*) discrepancies in the methodologies of the two studies. According to the 1970 census, Indianapolis currently mirrors the national labor force (as depicted by the OCG survey) fairly well.[13] Nonetheless, some differences between Indianapolis and the American occupational structure remain—such as the smaller proportion of proprietors and the larger amount of clerical and sales employment in Marion County—which may illustrate certain unique features of Indianapolis's economic and social structure.

12 Admittedly, there is some disparity. Men in the OCG sample were born between 1909 and 1953 and thus celebrated their sixteenth birthdays between 1925 and 1969.

13 The distribution of males employed in Marion County, 1969, by occupational category is: professional and semiprofessional, 15.09%; proprietors, managers, and officials, 11.58%; clerical and sales, 16.89%; skilled labor, 20.91%; semiskilled labor, 21.23%; unskilled labor, 5.73%; protective service, 1.94%; personal service, 6.28%; farming, 0.36% (U.S. Bureau of the Census 1973, table 122).

TABLE 2

ROW AND COLUMN PERCENTAGES: OCG II AND TEMPORALLY SMOOTHED INDIANAPOLIS MOBILITY DATA

	Category of Row or Column*									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Indianapolis:										
Rows (fathers)	4.22	.93	12.19	8.69	27.05	12.21	9.81	1.99	1.46	21.44
Columns (sons)	4.65	2.47	6.89	20.14	27.02	21.99	9.48	1.62	3.52	2.23
OCG II:										
Rows (fathers)	5.23	1.61	11.41	8.89	19.83	17.10	6.53	2.09	4.61	22.71
Columns (sons)	10.79	4.25	15.06	12.53	21.65	19.36	6.09	2.23	3.87	4.19

* (1) Professional; (2) semiprofessional; (3) proprietors, managers, and officials; (4) clerical and sales; (5) skilled labor; (6) semiskilled labor; (7) unskilled labor; (8) protective service; (9) personal service; (10) farming.

Table 3 presents observed frequencies, multiplicative "mobility ratios" (see equation [5]), and additive cell "errors" (see equation [4]) under the model of figure 1 applied to the OCG data.[14] Under the hypothesis of statistical independence, $G^2 = 3855.44$ (df $= 81$), while the value of G^2 under the structural model is 636.55 (df $= 73$). While a significant proportion of the baseline association remains unexplained, the eight additional parameters estimated under this specification capture 83.5% of the "variance" under independence. Although the independence model is admittedly a dubious baseline against which to compare the design matrix, there is no clear alternative. The amounts of "explained" and "residual" variation are both substantial. Given the disparities between the sample from which the model was derived and that to which it has been applied, and the multiplicity of factors which militate against a close fit, these results seem to provide extremely persuasive evidence of the relevance of the Indianapolis mobility experience to contemporary trends in the national labor force.[15]

The values of R_{ij}^* generated from this replication must not be taken too seriously, however, as there is appreciable error associated with the model's fit. Thus it is perhaps most instructive to examine the instances in which net (im)mobility among the OCG men is poorly estimated by the Indianapolis model. Ignoring very small cells, the largest contributions to the value of our residual G^2 are, with few exceptions, concentrated in three locations: along the main diagonal; in the white-collar sector; and in the farm categories.[16] Inheritance among members of the PMO category warranted its own level in the Indianapolis sample but not in the OCG replicate, in which the relevant value of R_{ij}^* is almost identical with the densities associated with moves from PMO and semiprofessional origins to the professions.

The model considerably overestimates inheritance, especially in the professional, semiprofessional, semiskilled, and unskilled categories; persistence in farming is substantially underestimated. Except for moves from the professional to the PMO situs, white-collar mobility is consistently and appreciably underestimated by the parameterization derived from Rogoff's

[14] Observed frequencies in table 2 have been weighted to reflect underlying population counts and scaled downward to compensate for sampling variability and departures from simple random sampling in the OCG II survey.

[15] Under the symmetric nine-level model (Baron 1977, p. 50), $G^2 = 652.58$ (df $= 73$). The three major asymmetries in mobility flows in Indianapolis thus appear to characterize recent national trends as well. Since these asymmetries isolated originally for Indianapolis could have been irrelevant to the current national experience, the superior fit of the asymmetric version further substantiates the model's generality.

[16] The most important exceptions are: (*a*) moves from protective service to professional occupations, from the latter to personal service, from unskilled to semiskilled labor, and from personal to protective service; and (*b*) moves from the "proprietors, managers, and officials" (PMO) to semiskilled category. In the case of *a*, the model substantially underestimates mobility, while the opposite is true of *b*.

TABLE 3

OBSERVED FREQUENCIES, "MOBILITY RATIOS," AND CELL "ERRORS" UNDER MODEL OF FIGURE 1 FIT TO OCG II MOBILITY DATA

	Sons									
Fathers	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Professional	358.96	93.07	186.13	153.83	137.54	85.04	26.57	16.11	36.48	12.04
	6.05	3.41	2.10	1.84	.69	.67	.60	.95	1.33	.97
	(−.13)	(.46)	(−.03)	(.11)	(−.04)	(−.08)	(−.03)	(.27)	(.61)	(.02)
2. Semiprofessional	63.25	39.46	61.27	45.62	55.44	45.67	14.51	5.84	9.01	.86
	2.75	3.73	1.78	1.41	.72	.93	.84	.89	.85	.18
	(.24)	(−.62)	(.07)	(.42)	(0)	(−.02)	(.32)	(.20)	(−.09)	(−1.40)
3. Proprietors, managers, and officials	416.92	130.37	659.63	409.38	341.98	240.86	71.70	38.20	74.26	28.82
	2.65	1.80	2.81	1.85	.65	.71	.61	.85	1.02	.87
	(.20)	(.09)	(0*)	(.11)	(−.11)	(−.28)	(−.17)	(−.09)	(.07)	(−.06)
4. Clerical and sales	303.02	112.49	385.49	366.78	287.10	229.26	74.18	45.17	61.89	15.06
	2.30	1.86	1.96	1.98	.65	.81	.75	1.21	1.02	.55
	(.06)	(.12)	(.17)	(−.09)	(−.10)	(−.15)	(.04)	(.24)	(.07)	(−.28)
5. Skilled labor	420.50	194.29	617.55	536.37	1,161.20	771.38	210.46	92.47	139.54	49.09
	.83	.83	.81	.75	.68	.71	.55	.64	.59	.46
	(.14)	(.14)	(.12)	(.04)	(−.06)	(−.02)	(−.10)	(.04)	(−.19)	(−.44)
6. Semiskilled labor	261.63	142.99	419.11	436.70	890.32	970.46	235.08	100.02	123.63	36.29
	.83	.99	.89	.99	.84	1.44	1.00	1.12	.85	.55
	(.14)	(.04)	(−.06)	(.04)	(.15)	(−.14)	(.05)	(.16)	(−.09)	(−.54)
7. Unskilled labor	76.11	29.27	151.22	133.10	339.54	383.29	151.59	37.89	60.36	18.56
	.53	.44	.70	.65	.70	1.24	1.40	.92	.90	.61
	(−.15)	(−.33)	(−.03)	(−.09)	(.13)	(.27)	(−.44)	(−.03)	(−.05)	(−.16)
8. Protective service	64.19	15.29	66.50	61.60	91.42	77.83	25.34	21.12	16.80	1.32
	1.42	.73	.98	.96	.60	.80	.75	1.63	.80	.14
	(.67)	(.01)	(.06)	(.02)	(−.02)	(−.17)	(−.24)	(−.28)	(.10)	(−1.90)
9. Personal service	76.57	46.96	129.52	132.21	186.24	205.23	78.45	32.93	79.98	7.18
	.82	1.09	.93	1.00	.59	1.02	1.12	1.23	1.85	.37
	(.12)	(.16)	(−.02)	(.06)	(−.19)	(.10)	(.16)	(.53)	(−.16)	(−.93)
10. Farming	240.48	94.28	507.39	373.46	1,086.86	1,084.79	399.91	80.71	217.25	717.63
	.55	.47	.78	.61	.74	1.16	1.22	.65	1.08	7.83
	(−.55)	(−.44)	(−.18)	(−.18)	(.03)	(.20)	(.27)	(−.36)	(.15)	(.13)

NOTE.—Top entry for each cell is its observed value. Intermediate numbers are "mobility ratios" (i.e., R_{ij}^* in eq. [5]), expressed in multiplicative (antilog) form. Additive errors (residuals from scale row, col., and level effects) are shown in parentheses; see eq. (4). Dividing each observed value by the antilog of the corresponding cell error will reproduce the expected frequency (within rounding error).

* Fitted exactly under model.

data. Finally, actual mobility to and from the farm is below that predicted by the model, although errors associated with farm destinations are probably inflated because of the sparsity of several cells.

Table 4 shows the row, column, and level parameters for the model of figure 1 applied to the OCG data, along with the corresponding parameters for Rogoff's data smoothed over time. The findings here, as throughout, reveal a fundamental congruence in the effects of origins, destinations, and densities between the two samples but also highlight some significant and interesting differences. While there are several large discrepancies in the absolute magnitude of effects, the relative "pushes" and "pulls" associated with each category of "supply" and "demand" are extremely similar across data sets. The row effects in the OCG and Rogoff data exhibit a zero-order correlation of .935; the correlation between sets of column parameters is .913. Thus the relative influences of categories of origin and destination are markedly comparable between the two data sets.

Table 4 reveals some major differences between the OCG and Indianapolis data regarding intergenerational "shifts" in the effects associated with each occupational category.[17] These are indicated by the ratios of column to row effects. (Large positive [negative] values indicate substantial "growth" ["decline"] in an occupational situs.) Both data sets imply essentially identical patterns in semiprofessional employment, skilled and unskilled labor, protective service, and farming: the semiprofessions evince the same large amount of expansion; farming is characterized by precipitous contraction; and skilled and unskilled labor and protective service are shown to be relatively stable across "generations" in both sets of parameters.

While net "demand" associated with professional employment far outstripped "supply" in the OCG data, the two effects are more nearly equal in the Indianapolis results. The opposite pattern applies to semiskilled labor, which appears relatively stable in the national sample and exhibits much stronger demand than supply forces in Marion County. In the case of the PMO category, the Rogoff data yield a portrait of intergenerational decline, while the OCG findings suggest an increase across generations in the net effect associated with that situs. The reverse is true of personal services, which exhibit a much stronger effect as a destination than as an origin status in the experiences of Rogoff's cohorts of men; the OCG data, however, show a diminution in the marginal effect of this category across generations. Finally, while the column parameters for clerical and sales occupations far exceed those for rows in both sets of results, the

[17] As Duncan (1966) has argued, shifts in the effects associated with "origins" and "destinations" in a mobility table regrettably provide a less than adequate portrait of "labor force transformations."

TABLE 4

PARAMETERS (in Additive Form) FOR THE MODEL OF FIGURE 1: OCG II and TEMPORALLY SMOOTHED INDIANAPOLIS DATA

FACTOR	CATEGORY OF ROW, COLUMN, OR LEVEL									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OCG II Data (Grand Mean = 4.661; N = 21,148)									
Rows (father's occupation)	−.771	−1.719	.204	.025	1.377	.895	.119	−1.040	−.316	1.227
Columns (son's occupation)	.193	−.584	.596	.536	1.406	.956	−.095	−1.060	−.579	−1.370
Levels (density)	1.933	1.031	.772	.504	−.075	−.053	−.322	−.330	−.490	...
Ratio of column to row effect	2.62	3.11	1.48	1.67	1.03	1.06	.81	.98	.77	.07
	Indianapolis Data (Grand Mean = 4.211; N = 20,147)									
Rows	−.682	−2.035	.424	.076	1.909	.607	.643	−.923	−1.387	1.367
Columns	−.503	−.858	−.145	1.273	1.988	1.360	.498	−1.173	−.430	−2.008
Levels	2.303	1.672	1.064	.655	.150	−.088	−.403	−.560	−.749	...
Ratio of column to row effect	1.20	3.24	.57	3.31	1.08	2.12	.87	.78	2.60	.03

excess is substantially smaller in the OCG sample. (The row and column percentages in table 2 reveal essentially similar patterns.)

It is tempting to interpret many of these discrepancies as evidence of "structural changes" in the labor force occasioned by demographic, economic, and social transformations throughout this century. Yet other differences between these "push" and "pull" effects across data sets (e.g., regarding clerical and sales jobs) are not easily explained in this way and suggest that unique aspects of Indianapolis's population, labor force, and social structure may have occasioned idiosyncratic trends in intergenerational occupational distribution.[18] However, one must be mindful of the methodological pitfalls involved in treating these ratios of marginal effects as indices of generational change (Duncan 1966); accordingly, these comparisons should be regarded as speculative.

Variation among row or column parameters provides one additional piece of information which bears indirectly on the differences in "occupational structure" revealed by the marginal effects for each sample. A widely dispersed set of parameters indicates a good deal of differentiation among occupational categories in their relative pushes and pulls. This variability can be assessed by taking the sum of squared row or column parameters (SS) in table 4. For the Indianapolis data, SS(rows) = 13.86 and SS(cols.) = 14.27; in the OCG replicate, SS(rows) = 8.99 and SS(cols.) = 7.26. Thus, while the differentiation among occupations in their net effects appears relatively stable across generations in each data set, there is a considerably more varied set of origin and destination effects in Rogoff's sample than in the 1973 national data. This might manifest (*a*) the greater heterogeneity of the national occupational structure, resulting in a less skewed distribution of fathers and sons among situses in the OCG sample, and/or (*b*) a "leveling" over time in the supply and demand forces associated with various occupational classes as the transition to a service economy has reduced the proportionate marginal effects associated with industrial labor.[19]

[18] For example, this particular anomaly probably reflects Indianapolis's disproportionately large fiduciary, commercial, credit, insurance, and retail trade sectors (see Duncan et al. 1960, pp. 406–7), which endow its labor force with much larger relative "pulls" toward clerical and sales occupations than the OCG's national average.

[19] The variation among level parameters is also considerably narrower in the OCG sample than in Rogoff's, perhaps suggesting a less variegated "mobility regime" in the contemporary American occupational structure. While this may reveal (as one reviewer suggested) a "weakening" in the dependence of destinations on origins, it may also be a methodological or statistical artifact. Recall that the value of δ_k for each level depends on the magnitude of the row and column parameters pertaining to the cells at that level, which are in turn related to the configuration of counts *within* each level. Hence, the distribution of sparse cells in the Rogoff and OCG II data may underlie the discrepant ordering and spacing of density effects in this replication. Finally, these results may merely convey the extent to which certain areas of the Indianapolis mobility tables—especially the sparsest ones—were "overfitted."

SUMMARY AND CONCLUSIONS

This paper has approached intergenerational mobility as one index of the relationships among occupational positions, focusing on the net "exchange" among occupational situses. From this perspective, exchange is a social process of principal substantive importance; thus, it warrants explicit modeling of the sort described herein, instead of being regarded conceptually and statistically as a residual phenomenon.

Our knowledge about mobility across generations obtained by studying Marion County from 1910 to 1940 (Baron 1977) allows us to say considerably more about recent national trends than one might initially expect given the complications of sampling, geography, and temporal change. That a "map" of Indianapolis's occupational "mobility space" accounts for 83.5% of the comparable territory in the 1973 OCG sample suggests that linkages among occupational situses exhibit a striking generality and temporal stability (cf. Hauser, Koffel, Travis, and Dickinson 1975; Tyree and Smith 1978).

Nonetheless, this analysis reveals substantial differences between the earlier Indianapolis experience and present-day national patterns. Mobility to and from the farm, movement among white-collar positions, and net tendencies toward immobility were found to diverge significantly from the results based on Rogoff's data. Moreover, the effect parameters associated with origins and destinations reveal important differences between the two studies in the relative pushes and pulls exerted by occupational groups in the mobility process. In summary, the present findings reaffirm Duncan's observation that "it is well to bear in mind that invariance with regard to some aspects of the mobility process is compatible with variation in other aspects" (1966, pp. 76–77).

If intergenerational movement is one indicator of the relationships among occupational situses—as suggested above—what are the contours of "occupational space" revealed by these analyses? Numerous studies have concluded that occupational status or prestige is the major dimension underlying mobility distances. For example, Klatzky and Hodge's (1971) canonical analysis of the 1962 OCG I intergenerational mobility tables showed SES to be the central factor in the relationship between origins and destinations. Blau and Duncan's (1967, pp. 67–75) smallest space analysis of inflow and outflow indices of dissimilarity from these same tables also revealed a principal dimension corresponding closely to the socioeconomic rank order of occupational groups.

These representative inquiries utilized measures of similarity among occupational situses which reflect (in part) the marginal distributions of fathers' and sons' occupations. Accordingly, it is not altogether surprising that a status dimension emerges as central. Patterns of occupational transformation across generations undoubtedly have effected a real "upgrading" of the labor force, in large measure because of the ever-greater importance of education in the process of allocating individuals to occupational roles (cf. Blau and Duncan 1967, p. 113). It is interesting that education also typically exercises the strongest effect in regression equations relating indices of status and prestige to socioeconomic characteristics of occupations (e.g., Siegel 1971, p. 196). Both as a component of status/prestige scales and as an influence on labor force transformation, the effect of education probably reflects the increasing differentiation of occupations in terms of skill and knowledge, and the existence of an increasingly credential-oriented labor market which operationalizes these attributes in terms of schooling.

Yet some of the status dimension embedded in the marginal trends is probably an artifact of procedures for classifying occupations which were explicitly designed to capture this change toward a hierarchical occupational structure increasingly differentiated in terms of "skill" and "social standing" (Conk 1978; Braverman 1974). Lacking a conception of the *technical* division of labor among occupations, classification schemes came to depend heavily on the sociocultural divisions which occupations were presumed to manifest. The same cultural definitions underlying popular evaluations of occupations (e.g., in status and prestige scales) apparently figured prominently in the evolution of occupational classification schemes. In short, part of the importance of SES documented by previous research may be attributable to a somewhat tautological methodology which grouped occupations in terms of the socioeconomic attributes of their incumbents (rather than by task requirements or skill), thereby virtually guaranteeing a portrait of "structural change" which reflected this presumed status upgrading of occupations (Conk 1978; also see Hope 1978, pp. 23–24).

The present analysis, however, has not focused on structural changes but has sought to determine what relations among occupational groups are revealed when these "marginal" effects are disentangled from net tendencies toward (im)mobility.[20] For this reason, perhaps it is not startling that the R_{ij}* presented here do not confirm the status/prestige interpretation of other investigators. Figure *2a* reproduces the smallest space array derived from the model in figure 1 applied to the temporally smoothed Indianapolis data (see Baron 1977, pp. 64–67), a portrait with which the OCG results (figure *2b*) are overwhelmingly consistent. The triangular matrices of mobility ratios analyzed in these figures are composed of the average of the mobility ratios for each off-diagonal cell and its transpose, weighted by the number of cases in each cell. Note that because the models which generated these mobility ratios fit the data so closely, the patterns of inter-

[20] Indeed, the flawed "Rogoff ratios" (which are not "freed" of the margins) do reveal an underlying status dimension when computed for the Indianapolis and OCG II tables.

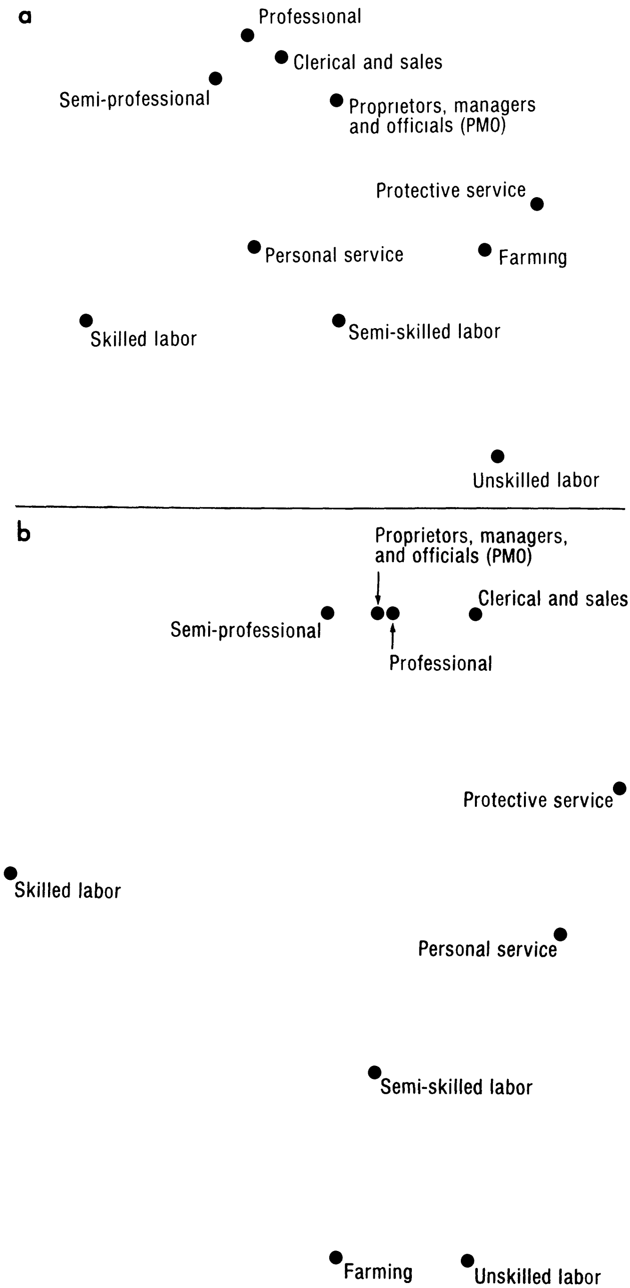

FIG. 2.—*a,* Two-dimensional smallest space plot of mobility ratios under asymmetric model (figure 1) applied to Indianapolis data smoothed over time. *b,* Two-dimensional smallest space plot of mobility ratios under asymmetric model (figure 1) applied to OCG II data.

occupational distance revealed by the smallest space plots are the same as those posited (and obtained) under the structural model (see figure 1 and table 3). Thus the smallest space technique simply provides a convenient alternative way of representing the distances among occupational categories as indicated by the $R_{ij}*$.

Instead of a graded status hierarchy, this representation suggests an occupational structure divided into two broad sectors, connected by a group of "traditional" situses which are somewhat atypical of the industrial division of labor. The cluster at the top of figure *2a* is composed of white-collar occupations characterized by mental labor and by control over information, capital, others' labor power, and other instruments of production, although some recent analyses (e.g., Braverman 1974; Glenn and Feldberg 1977) have stressed the "proletarianization" of clerical and sales jobs. Protective service might also be included in this cluster insofar as policemen, firemen, and others in this category, in contrast to other service workers, manifest substantial "developed skill, knowledge, and authority in the labor processes of society" (Braverman 1974, p. 367). All categories of industrial labor fall at the bottom of figure *2a* (with wide dispersion among them), suggesting an internally differentiated "underclass" of manual workers.

Two occupational situses—personal service and farming—are situated between these clusters of "head" and "hand" occupations, illustrating the somewhat contradictory and transitional position of these "traditional" forms of employment within the modern occupational structure. As Braverman (1974, chap. 20) suggests, much of the conventional social science wisdom about the unskilled character of employment in these two groups reflects the insensitivity of occupational classification schemes to historical changes in the nature of service and farm employment. Furthermore, both categories are extremely heterogeneous. Some personal service workers merely produce commodities in the form of services to capitalist elites (servants, janitors, chauffeurs, etc.), while others perform jobs that resemble "mental" labor in most respects. Rogoff's "farm" classification is equally heterogeneous, apparently including farm owners and farm workers. Thus the location of farming and personal services in the region between white- and blue-collar occupations may bespeak the admixture of jobs embraced by those categories, as well as the extreme differentiation of skills among farmers and servants. However, in the OCG II data (figure *2b*), farming is located near unskilled labor, suggesting a greater affinity between agrarian and blue-collar labor in the recent national experience than in Rogoff's sample.

Admittedly, this interpretation is a coarse simplification of these figures, which are rather ambiguous (especially for the national data). Others might wish to proffer somewhat different stories about these results, but the moral seems inescapable: there is clearly no graded dimension of status or prestige in these spatial arrays; rather, the major contrast (especially for the national data) appears to involve a tightly woven "mental" or white-collar sector, on the one hand, and all other occupational situses—highly differentiated among themselves—on the other. I have stressed the contrast between mental, manual, and "traditional" situses because it seems to be the most consequential—substantively and empirically.[21] Indeed, Conk (1978) argues that census officials perceived the dichotomy between "head" and "hand" work as fundamental within the modern industrial order, inspiring the bureau's various attempts to classify occupations between 1870 and 1940. The present results substantiate this perception, demonstrating the centrality of the head-hand distinction throughout the period spanned by the Rogoff and OCG II studies.

A variety of mechanisms, structural and social psychological, could operate to produce and maintain such a mobility regime. The father's occupation reflects the material and psychological conditions impinging on the son's development and attainment. The propensity to end up in a mental or manual job may be transmitted by the objective resources and/or by the personal traits, experiences, values, and aspirations the son inherits as a consequence of his socioeconomic background.

These findings could manifest some normative consensus about the nature of work in industrial society, centering on the distinction between white- and blue-collar jobs. Of course, this should not preclude the possibility that this portrait of mobility space reflects more objective features of social organization (cf. Featherman, Jones, and Hauser 1975). Braverman (1974, p. 126) argues that the "separation of hand and brain is the most decisive single step in the division of labor taken by the capitalist mode of production." Indeed, the results of this research are not incompatible with recent analyses stressing the relationship between occupational mobility patterns and the development of class relationships (e.g., Parkin 1971; Giddens 1973). Rather than indicating commonalities across time and space in the

[21] The interpretation offered here is also corroborated by various cluster analyses (single-link and complete-link) which reveal a predominant white-collar cluster in both data sets (cf. Vanneman 1977). These results do suggest, however, that the remaining occupational situses cannot be clustered in an equally reliable and unambiguous fashion. Furthermore, this account of "mobility space" is by no means complete. In fact, the coefficients of alienation corresponding to the one- and two-dimensional solutions for figure 2*a* are .313 and .162, respectively, while for figure 2*b* the values are .331 and .129. Thus a two-dimensional representation apparently provides a less than full account of the spatial relations among occupational categories. While my discussion has not ascribed an interpretation to the second dimension of these arrays, if a line is drawn between the cluster of white-collar categories, on the one hand, and unskilled labor, on the other, the resultant axis might be construed as representing some dimension of "task complexity," "intellectuality," "educational requirements," or the like. Note that this axis is not orthogonal to the head-hand dimension discussed above.

social evaluation of occupational status, enduring patterns of intergenerational movement among occupational situses may reflect structural continuities in the division of labor in terms of which classes may be identified.

APPENDIX

Replicating Rogoff's Occupational Classification in the OCG II Survey

All respondents aged 20–64 in the experienced civilian labor force as of March 1973 were included in the sample (see Featherman and Hauser 1975). Each respondent's current occupation and his father's occupation (as of the son's sixteenth birthday) were cross-classified, after each was allocated to one of Rogoff's 10 categories by mapping three-digit 1960 census codes (U.S. Bureau of the Census 1960, pp. xv–xx) as follows.

1. Professional—all "professional, technical, and kindred workers" except those coded below as "semiprofessional."

2. Semiprofessional—artists and art teachers (014), athletes (015), authors (020), chiropractors (022), dancers and dancing teachers (070), designers (072), dieticians and nutritionists (073), draftsmen (074), editors and reporters (075), entertainers[22] (101), farm and home management advisers (102), foresters and conservationists (103), funeral directors and embalmers (104), librarians (111), musicians and music teachers (120), professional and student professional nurses (150–151), personnel and labor relations workers (154), photographers (161), public relations men and publicity writers (163), radio operators (164), recreation and group workers (165), religious workers (165), social and welfare workers (171), sports officials and instructors (180), surveyors (181), technicians (185–192), therapists and healers[23] (193).

3. Proprietors, managers, and officials—all "managers, officials, and proprietors, except farm" and insurance adjusters, examiners, and investigators (321).

4. Clerical and sales—all "clerical and kindred workers" (except 321) and "sales workers."

5. Skilled labor—all "craftsmen, foremen, and kindred workers" except members of the armed forces (555).

6. Semiskilled labor—all "operatives and kindred workers."

7. Unskilled labor—all "laborers, except farm and mine."

8. Protective service—all "protective service workers" (850–860) and members of the armed forces (555).

[22] Not elsewhere classified.

[23] Not elsewhere classified.

9. Personal service—all "private household workers" and "service workers, except private household" (excluding protective service workers).

10. Farming—all "farmers and farm managers" and "farm laborers and foremen."

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