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ABSTRACT

This report is an exploratory application of a dynamic mathematical model to express a theory of changes in youth's career expectations over time. Main content is divided into two focuses: (1) theoretical interpretations of the differential equations which embody the mathematical model and (2) reporting and discussion of the results of preliminary data analyses. Following an introduction (chapter 1), chapter 2 presents several interpretations of the differential equations. It reviews and relates the status-attainment and differential equation models. Chapter 3 describes sampling procedures, methods of data collection, and data coding; gives operational definitions for all variables used in the report; and discusses analytic methods. Chapter 4 contains numerical estimates of the fundamental parameters of the differential-equation model. It presents the specific form of the model used to generate the data and then discusses empirical results for white males and offers race and sex comparisons. Chapter 5 summarizes findings and sets forth conclusions. Appendixes, amounting to over one-half of the report, include questionnaires used during data collection for wave two; detailed explication of instrumentation, data collection procedures, and data coding and correction procedures used during the first and second measurement points of the study; and means, standard deviations, and correlations for variables used in the report. (YLB)

PRELIMINARY FINDINGS FROM THE FIRST TWO WAVES OF A PANEL STUDY OF DEVELOPING CAREER EXPECTATIONS

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

FOREWORD

Understanding of the process by which youth formulate career plans is important to career and vocational education. The National Center for Research in Vocational Education therefore is pleased to conduct this unique longitudinal study of developing career expectations of youth. This publication reports on the first two waves of the study. It contains interesting empirical findings and useful theoretical interpretations of the mathematical model used to express the dynamics of career planning.

The Columbus public school system has lent continuing support to the field work associated with this project. For this support, we express strong appreciation. Dr. Richard Beck of the Columbus Board of Education has been particularly helpful coordinating project activities.

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Robert E. Taylor
Executive Director
The National Center for Research
in Vocational Education

SUMMARY

This volume analyzes empirical data from the first two time points in a longitudinal study of the process by which career expectations of youth develop. A total of three measurement points are planned over the course of the study.

A fairly simple static model of career expectations is taken as a starting point; this model is drawn from sociological path models of status attainment processes. The static model is recast by use of simultaneous differential equations to express the dynamics of career expectations as they develop over time. The dynamic quality of the differential-equation model expresses the developmental nature of career expectations emphasized in the vocational psychology literature.

Three interpretations of the differential equations are advanced. First, it is shown that the differential equations can be viewed as a cross-lagged path model with lag time approaching zero. This interpretation reveals that the differential equations imply a lag time between cause and effect that approaches zero. The second interpretation depends on deriving the differential equations from a distributed-lag model. This derivation shows how the differential equations are consistent with the postulate of a memory effect. The third interpretation postulates that each career expectation variable changes toward equilibrium at every point in time, speed and direction of change depending on other variables in the model.

The concepts of total effect, direct effect, and indirect effect are given explicit definition with reference to specified time interval over which the effects operate. The different types of effects help to form a unified interpretation of the parameters of the differential-equation model and parameters of cross-lagged path models over varying lengths of time between measurements. The definitions are used to address important substantive issues related to status attainment.

All data analyses are carried out separately within sex-race specific subsamples. These analyses reveal several noteworthy findings. First, for all four race-sex subgroups, the numerical estimates reveal a trend toward stable equilibrium with little or no oscillation. Further, the multiple coefficients of determination are quite large for all equations and all subgroups, especially male whites. For male whites, the career-expectation variables exhibit interesting feedback loops, most notably, the reciprocal effects of parental occupational expectations and youth's own occupational expectation on each other, and the feedback effects between parents' educational and occupational

expectations of the youth. Also, parental educational expectation of youth exercises the strongest immediate effect on the youth's own educational expectation, and parental occupational expectation of the youth has the strongest immediate effect on the youth's own occupational expectation. The immediate effects of socioeconomic background (SEB) and mental ability (MA) on the career expectation variables are negligible. In sharp contrast, the equilibrium effects of SEB on the career expectation variables are quite strong, exceeding that of mental ability by several magnitudes.

Among females and blacks, results vary. In all cases, the short-run effects of SEB and MA are small. The long-run effects of SEB are fairly large in all four subgroups and tend to dominate the effects of mental ability. There is one important exception to this generalization, however, among male blacks; MA shows a pronounced long-run impact on the educational and occupational expectations of the youth. The specific pattern of feedback effects among male blacks is fairly sensible, but those effects among females contradict theoretical preconceptions because of negative coefficients where positive values are expected. No theoretical interpretations of these patterns are offered, pending further exploration of the data.

The long-run effects of the endogenous variables on each other approaches zero in every race-sex subsample. This observation suggests that the effectiveness of career counseling programs depends strongly on maintaining the counseling activities over an extended time period. The problem suggested by the theoretical model is that, once the activity ceases, career plans gravitate back to an equilibrium determined mostly by socioeconomic background. Further study of this issue certainly is warranted before firm conclusions can be offered, however.

CHAPTER 1

INTRODUCTION

This volume is the third in a sequence of four reports on a longitudinal study of the process by which high-school age youth form educational and occupational expectations. The first of these four reports is a small text explicating the analytic method to be used in the study (Hotchkiss, 1979a). The second report contains an analysis of the time-one data collected for the study (Hotchkiss and Chiteji, 1979). The present report contains a preliminary examination of data from time-one and time-two combined. The fourth report will contain analyses of all three measurement points of the study.

The theoretical model underlying the study is drawn from sociological work on the "status-attainment process." The main question motivating the status-attainment work is: What are the mechanisms by which statuses such as occupational level, education, and income are passed between generations? Particular attention is focused on occupational achievement of males. For example, it is observed universally that there is a direct association between the status of father's occupation and the occupational status of the son. The question is: Why? To achieve an empirical answer to this question, the status-attainment model proposes that a set of intervening variables "interpret", or account for the pervasive relationship between parental status and status of offspring. The basic hypotheses are that parental status affects school grades, career expectations that offspring hold for themselves, the expectations that others have for the offspring, and the educational attainment of the offspring. These variables, in turn, affect the occupational level achieved, thus generating a correlation between parental status and one's own occupational status, by a chain of effects. These hypotheses are expressed by path models that facilitate multivariate empirical tests. An impressive volume of empirical research lends support to the main ideas in the status attainment model (see Otto and Haller [1979] or Hotchkiss, et al [1979] for recent reviews).

The status-attainment model marks important advancements in the study of social stratification. Prior to development of the model, study of the relationship between achievements of parents and those of their offspring was confined largely to inspection of tables cross-classifying status groupings of occupation of father and occupation of son (e.g., Jackson and Crockett, 1964). Introduction of path models to describe the status-attainment (mobility) process led directly to multivariate analyses in which

the importance of numerous variables in the intergenerational transmission of status could be identified. Further, path analysis offers a quantification of the concept of indirect effect, permitting careful empirical analyses of the main hypotheses regarding indirect transmission of status from one generation to the next.

The status-attainment model describes important aspects of an entire life history, the "socioeconomic life cycle" (Duncan, Featherman, and Duncan, 1972). In contrast, the present study focuses on a short segment of one's socioeconomic life: the teenage years. In particular, the present study draws on the status-attainment model as a beginning point for studying the process by which youth form career expectations.

In spite of the important contributions of the status-attainment model to the study of career expectations much room for improvement remains. First, the continuous nature of the formation of career expectations is not expressed in the structural-equation models of career expectations.[1] Secondly, most existing models do not permit two-directional cause-and-effect relations (feedback) among the career-expectation variables. Thirdly, appropriate criteria for choosing among competing hypotheses do not exist. Fourthly, nonstatus content of occupations generally is ignored. Fifthly, important descriptions of the process of forming expectations, such as the role of uncertainty, are ignored. Finally, almost no attention is devoted to the central concept: occupation.[2]

The present study introduces a continuous-time model of developing career expectations that addresses the first three problems listed in the preceding paragraph. A simultaneous differential-equation model is used to express the theory. The model contributes to the solution of these three problems as follows:

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1. In this report, path analysis and structural-equations are used interchangeably. The subtle differences between the two terms contribute nothing to the exposition herein.

2. Some attention has been given to discerning different dimensions of occupations (e.g., Spaeth 1979; Hope 1972; Klatzky and Hodge 1971; Mortimer 1974); however, little attention is given to the definition of the fundamental unit, occupation. Differences between the census and DOT definitions illustrate the lack of agreement about the definition of occupation.

- Expression of the continuous nature of the process of forming career expectations is achieved by using continuous-time mathematics to state the model.

- The feedback among important career expectation variables is stated by the simultaneous feature of the differential equations.

- Comparatively rigorous criteria for choosing among competing specifications of the theory are implicit in the differential-equation model. The model can be used to generate forecasts of all career-expectation variables and the accuracy of the forecasts used to evaluate competing models.

This report addresses the first two items, and the sequel evaluates forecast accuracy.

The authors of this report are acutely aware of the limitations of the status-attainment model due to factors such as omission of nonstatus dimensions of occupations, inability to account for uncertainty of career expectations, and the imprecise nature of the concept occupation. Although it is hoped that some initial developments including specification of the role of uncertainty can be carried out during the study, limited resources curtail the extent of such expansion of the theory.

[illegible] sequential-equation model [illegible] section of the chapter reviews [illegible] accounts for career [illegible] the status-attainment theory is [illegible] well disseminated outside of [illegible] readers a [illegible] present research and the present study, [illegible] status-attainment model is rela- [illegible] of this chapter describes the dif- [illegible] it to the status- [illegible] presents alternative theoretical [illegible] A fourth section develops explicit [illegible] effect, direct effect, and [illegible] to the differential [illegible] summarizes the chapter.

The Status Attainment Model

[illegible] summary of the status-attainment [illegible] the variables of the model into [illegible] background (SES), mental abil- [illegible] performance variables (E-P), [illegible] (SEA). Socioeconomic-background [illegible] variables describing one's [illegible] father's occupational status, mother's [illegible] educational achievement of one's parents, [illegible] ability, in practice, refers [illegible] written tests of intellectual per- [illegible] performance variables include occu- [illegible] expectations that youth hold for them- [illegible] that others hold of the youth, grades in [illegible] high school athletics, and par- [illegible] extracurricular activities during high [illegible] attainment variables include primarily [illegible] occupational status, and

[illegible] the main features of the status- [illegible] can be presented succinctly in the [illegible] diagram.

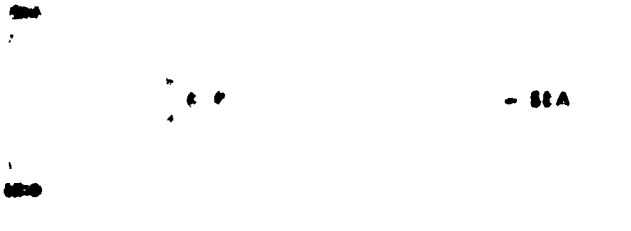

FIGURE 1 Simplified version of the status attainment model

The curved, double-headed arrow connecting MA and SEB indicates a correlation between MA and SEB, but the model does not account for the cause-and-effect mechanisms that generate the correlation. The straight, single-headed arrows indicate effects running in the direction of the arrows.

The following chain: SEB $\longrightarrow$ E-P $\longrightarrow$ SEA comprises the theoretical account of how socioeconomic variables are transmitted between generations. The fundamental hypothesis is that background (SEB) affects expectation and performance variables (E-P), and E-P variables, in turn, affect attainment (SEA). The analogous chain originating with mental ability (MA $\longrightarrow$ E-P $\longrightarrow$ SEA) describes the theoretical effect of ability on attainment; according to the theory, MA also affects attainment indirectly, operating through its effect on expectation and performance variables. The simple chain model shown in Figure 1 generates the empirical prediction that the relationships between background and attainment, and between mental ability and attainment, are reduced to zero when the expectation and performance variables are constant. Empirical research supports the theory in broad outline, but not in every detail (see as examples: Sewell, Haller, and Ohlendorf, 1970; Sewell and Hauser, 1975; Alexander and Eckland, 1975; Otto and Haller, 1979; Rehberg and Rosenthal, 1978).

Numerous variations on the basic model depicted in Figure 1 appear in the research literature. The original statement of the model by Blau and Duncan (1967) omitted mental ability and the expectation-performance variables. Numerous studies omit the attainment variables (SEA), and focus instead on the process by which career expectations develop during the teen-age years (e.g., Hout and Morgan, 1975; Picou and Carter 1976; Curry, et al., 1976; 1978; Kerckhoff and Huff, 1974). The present study is among those that concentrate on the development of career expectations among youth.

Although study of the process by which career expectations develop is of intrinsic interest, that interest is reinforced by the fact that expectations expressed during youth exhibit substantial correlation with adult achievements. Table 1 documents this point; it displays correlations between youth expectations and adult attainments. Each correlation is drawn from a longitudinal study in which a sample of high-school age youth was queried about career plans prior to leaving high school then questioned again about attainments after leaving high school. As indicated in the table, all correlations are of substantial magnitude. The correlations between educational expectation and educational attainment tend to be somewhat larger than the

corresponding values for occupation; however, the combined impact of educational and occupational expectations on educational attainment and subsequent effect of educational attainment on occupational attainment reinforces the link between high-school career planning and adult occupational attainments. The importance of college plans of high school seniors in determining college attendance prompted the following evaluation in one important empirical study:

> What the presence of such a relatively high causal component in the relationship between decision and college entry suggests is that, within limits, ample latitude remains up to almost the end of the twelfth grade for the individual to decide whether or not to continue formal education beyond high school (Rehberg and Rosenthal, 1978: 221).

Models of Career Expectations

The major impetus to application of path models to the study of career expectations derives from the "Wisconsin Model" of status attainment. Sewell, Haller, and Portes (1969) and Sewell, Haller, and Ohlendorf (1970) proposed the germinal model in which career expectations were depicted as intervening between SEB and SEA. Figure 2 shows a path diagram of this model.[3] The socio-economic background (SEB) variable is an index of parental-status characteristics composed of father's education, mother's education, father's occupation, and family income. The significant-other variable for education (ESO) is an index composed of three items as reported by the youth during his senior year in high school: parental "encouragement" to attend college, teacher "encouragement" to attend college, and friends' college plans. The other variables in the model require no explication here. The data are for male Wisconsin residents surveyed first during their senior year in high school in 1957. More recent publications based on the Wisconsin data reveal evolution of the

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3. Figure 2 displays a formal path diagram. The straight lines with one arrowhead denote a "causal effect." The numbers attached to these lines indicate standardized path coefficients. The curved line with two arrowheads indicates a correlation that is not analyzed into its causal components; numbers attached to the curved lines are correlations.

TABLE 1

CORRELATIONS OF EDUCATIONAL AND OCCUPATIONAL EXPECTATIONS WITH EDUCATIONAL AND OCCUPATIONAL ATTAINMENTS FOR MALES

	Sewell & Hauser 1975 p. 93		Alexander & Eckland 1975 (Reported in Otto & Haller 1979)		Rehberg & Rosenthal 1978 p. 206		Wilson & Portes 1975 p. 351		Lenawee Co. Data Otto & Haller 1979	
	EE	CE	EE	OE	EE	OE	EE	OE	EE	OE
EA	.656	.580	.485	.393	.63	--	.51	.41	.700	.639
OA	.473	.476	.386	.364	--	--	--	--	.554	.570

NOTES: EE = Educational expectation as a youth
OE = Occupational expectation as a youth
EA = Educational attainment as an adult
OA = Occupational attainment as an adult

model shown in Figure 2, most importantly by treating the items defining the SEB index and those forming the ESO index as separate variables (Sewell and Hauser, 1975; Hauser, 1972). For current purposes the more parsimonious version shown by Figure 2 is sufficient.

There are four features of the model that are particularly pertinent to the present study. First, although both SEB and MA correlate to a moderate degree with the attainment variables (EA and OA)[4], neither SEB nor MA exhert very much direct effect on the attainment variables; this observation matches the parsimonious version of the model shown in Figure 1. Secondly, the significant-other variable is an aggregate of three types of perceptions of ego:[5] ego's perception of parents' college encouragement, ego's perception of teachers' college encouragement, and ego's perception of the college plans of his/her peers. The important facts here are that the significant-other variable refers only to education, omitting reference to occupation; and the significant-other variable depends on ego's report of others' attitudes. Thirdly, no two-directional effects occur in the model. For example, academic performance (AP) is shown affecting the SO variable, but the SO variable is not shown to have an effect on AP. Finally, the path diagram does not express the dynamics of the process by which the expectation-performance variables develop over time.

The theory of career expectations and performance variables expressed by the Wisconsin Model appears to the left of the vertical dashed line in Figure 2. Numerous refinements and extensions of that model of career expectations have appeared in publication; notable examples include Hauser (1972), Sewell and Hauser (1975), Hout and Morgan (1975), Williams (1975; 1972), and

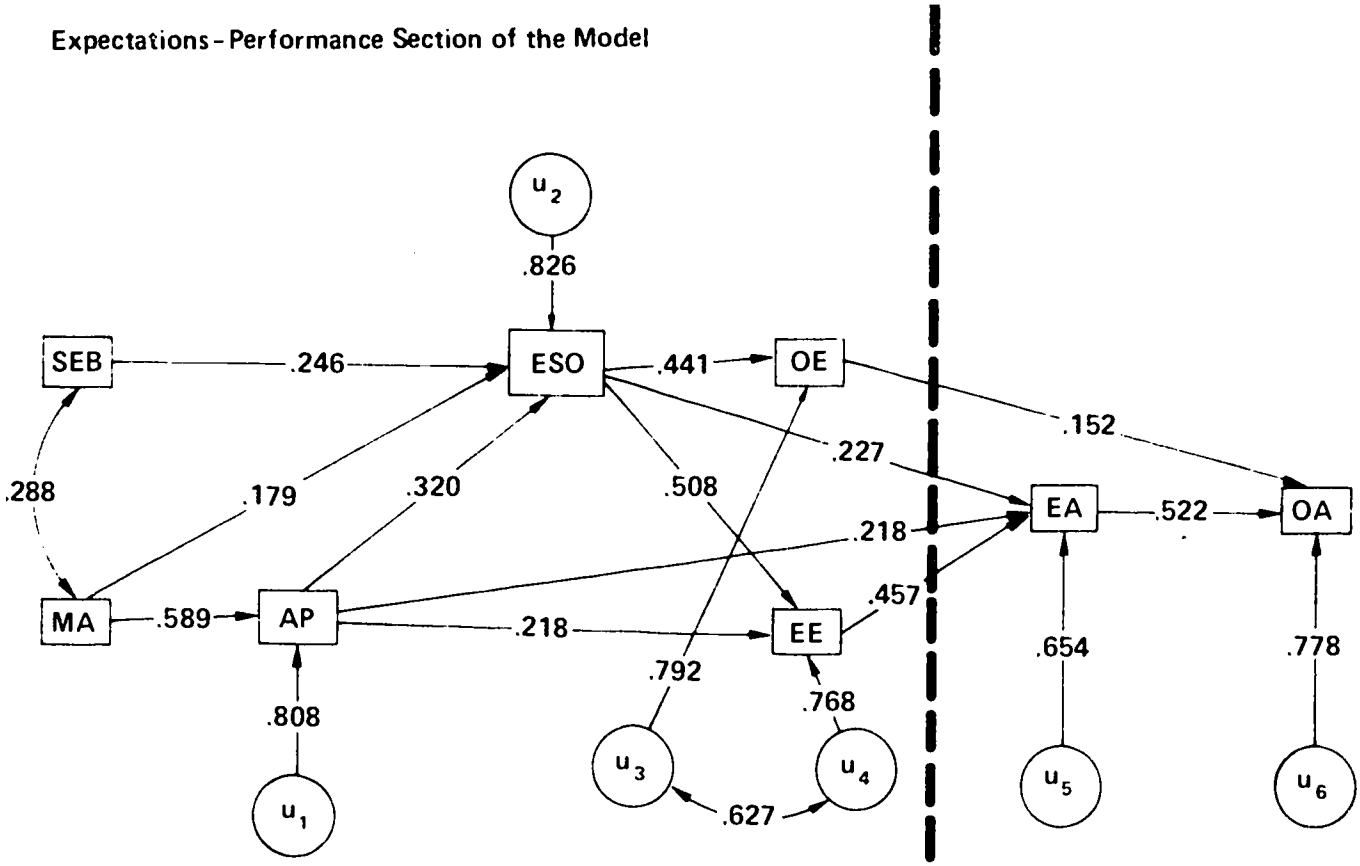
---

4. The correlations in question are tabulated below:

	MA	SEB
EA	.486	.417
OA	.363	.331

Source: Sewell, Haller, and Ohlendorf (1970: 1018, total sample)

5. The term ego refers to the individual on whom a "significant other" exerts influence; it serves a function similar to, but not precisely the same as, the function of "S" to reference the subject in a laboratory experiment with human subjects.



SOURCE: Sewell, Haller, and Ohlendorf (1970: 1023)

VARIABLES:

- SEB = Socioeconomic background
- MA = Measured mental ability
- AP = Academic performance (school grades)
- ESO = Significant other variable for education
- EE = Educational expectation of respondent when a senior in high school
- OE = Occupational expectation of respondent when a senior in high school
- EA = Educational attainment of respondent seven years after the senior year in high school
- OA = Occupational status attainment of respondent seven years after the senior year in high school
- u_i = Unmeasured residual variables

FIGURE 2. Early "Wisconsin Model" of status attainment.

Curry and associates (1976; 1978). The model developed by Curry and his associates is especially important to this report, because, in important respects, it is the intellectual percursor of the present research. Additionally, the sample studied in the reports by Curry and colleagues is comparable to the sample on which the present study is based (Hotchkiss and Chiteji, 1979). Figure 3 reproduces the path diagram from the Curry work which is closest to the dynamic model of the present study. To preserve comparability with the Wisconsin data, Figure 3 shows the results for white males, although the Curry data do contain race-sex comparisons.[6]

In broad outline, the model of career expectations proposed by Curry and his associates resembles the career-expectation part of the Wisconsin Model. There are four important differences in the significant-other variables, however. First, the significant-other variables refer only to parents. Teachers and peers are omitted. Secondly, parents' attitudes about their child's career were measured from responses provided by the parents rather than from the youth's perception of parental attitudes. Thirdly, parents were asked to provide a realistic expectation rather than encouragement. Finally, parents were asked to provide separate responses to questions about educational expectation of their child and occupational expectation of their child, thus generating separate significant-other variables for occupation and education.

One of the important findings of the studies by Curry and associates is that, for the Columbus sample, the parental SO variables measured by asking parents for information yields more satisfactory results than the significant-other variables available in the Wisconsin data. The multiple correlations with EE and OE were higher in the Columbus data when EEP and OEP were the significant-other variables than when the ESO index used in the Wisconsin model were used.[7] This result was replicated by Hotchkiss and Chiteji (1979). Moreover, the degree to which the SO variables "interpret" the correlations between SEB and the EE

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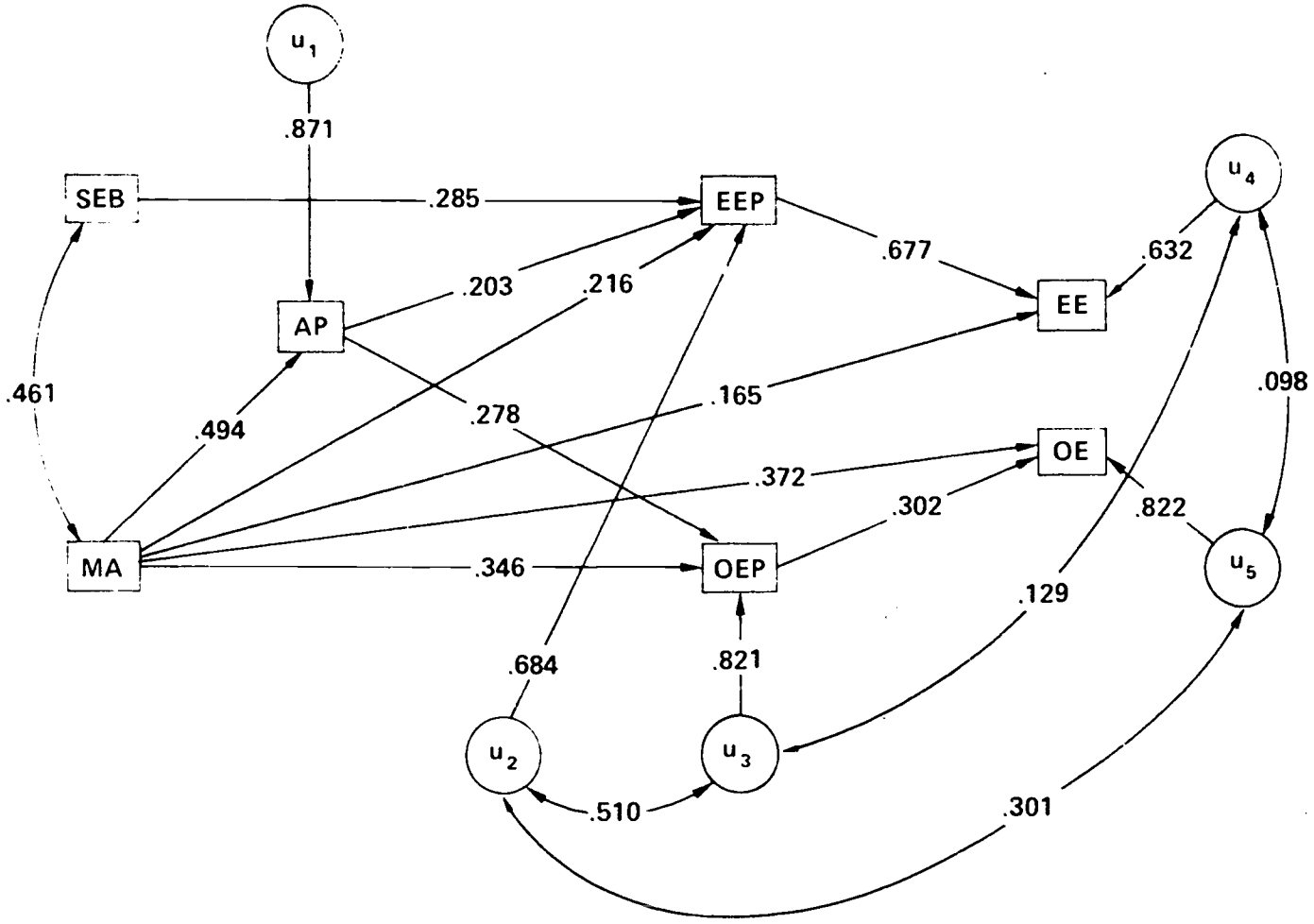
6. Curry and associates (1978) also present a model in which mother's and father's educational and occupational expectations of their child are entered separately in the equations in which EE and OE are dependent variables.

7. Using the disaggregated SO variable in later publications from the Wisconsin data does not change this conclusion.



SOURCE: Curry, *et al.* (1978: 38-40)

VARIABLES:
- SEB = Socioeconomic background
- MA = Measured mental ability
- AP = Academic performance (school grades)
- EEP = Educational expectation of parents for their child
- OEP = Occupational expectation of parents for their child
- EE = Educational expectation of youth for self
- OE = Occupational expectation of youth for self
- u_i = Unmeasured residual variables

NOTE: Nonsignificant paths omitted.

FIGURE 3. Model of career expectations for sophomore males, Columbus sample.

or OE is improved if EEP and OEP are the significant-other variables rather than the index used in the Wisconsin model (see footnote 5).

Two important features are shared by the Wisconsin model and the model proposed by Curry and associates: (a) neither model allows two-directional effects, and (b) both models are static in conception and in data analysis. The next section of this chapter proposes a differential-equation model of developing expectation and performance variables. The model contains two-directional effects, or causal feedback, and is expressed to describe change over time.

A Dynamic Model of Career Expectations

This section proposes a dynamic model of career expectations which includes causal feedback among the expectation and performance variables. For expository purposes, the model is developed with the variables in Figure 3. This selection of variables permits a reasonably parsimonious presentation.

The structural equations associated with the model in Figure 3 are reproduced here as equation-system (1).

$$
\begin{aligned}
&(1a) \quad AP = a_{10} + a_{11}SEB + a_{12}MA + u_1 \\
&(1b) \quad EEP = a_{20} + a_{21}SEB + a_{22}MA + b_{21}AP + u_2 \\
&(1c) \quad OEP = a_{30} + a_{31}SEB + a_{32}MA + b_{31}AP + u_3 \\
&(1d) \quad EE = a_{40} + a_{41}SEB + a_{42}MA + b_{41}AP + b_{42}EEP + u_4 \\
&(1e) \quad OE = a_{50} + a_{51}SEB + a_{52}MA + b_{51}AP + b_{52}OEP + u_5
\end{aligned}
$$

where the variables (SEB, MA, AP, ..., OE, u_j) are defined as in Figure 3, and the a_{ij} and b_{ij} are constants. The fact that equations (1) contain some coefficients for which arrows are missing in Figure 3 is due to omission of statistically non-significant paths from Figure 3.

The usual procedure for empirical analysis with structural equations such as (1) is to apply regression methods to a cross-sectional sample of respondents. Viewed in this light, equations (1) express hypotheses about differences between individuals at a given point in time. Nothing explicit is contained in equations

(1) about the over-time development of career expectations and performance variables. In contrast, theoretical accounts are quite explicit about changes over time in the expectation and performance variables. Donald Super is, perhaps, the most prominent theoretition emphasizing the developmental nature of career expectations. Super and associates write:

> Vocational development is an ongoing continuous, and generally irreversible process. Vocational preferences and competencies ... change with time and experience, making choice and adjustment a continuous process (Super, et al., 1957: 89; emphasis in the original).

From a review of theoretical literature, Picou, Curry, and Hotchkiss conclude:

> ... all of the above theorists have implicitly or explicitly noted the developmental character of occupational choice and placement (Picou, Curry, and Hotchkiss, 1976: 12).

Other theoretical discussions noting the dynamic character of career expectations include Ginzberg, et al (1951), Tiedeman (1961), Rodgers (1966), Beilin (1955), and Blau and associates (1956).

The causal feedback among important expectation and performance variables also has been noted in theoretical discourse. The feedback between educational and occupational expectations is quite explicit in a theoretical-empirical paper by Woelfel and Haller:

> Since there are two principal dependent attitudes in this research (educational and occupational aspirations) and since these two attitudes are known to be related to each other ..., we assume that each attitude exerts reciprocal influence on the other ... (Woelfel and Haller, 1971: 79).

The fact that the methodology used by Woelfel and Haller to assess the reciprocal effects has been criticized (Land, 1971; Henry and Hummons, 1971) has no bearing on the quality of the theoretical argument.[8]

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8. See Hotchkiss and Chiteji (1979 chapter 4) for methodological argument that tends to support Woelfel and Haller's procedures.

Reciprocal effects among other variables here classified as expectation-performance variables also have been posited in theoretical writing. Concerning feedback between significant others' attitudes and those of ego, Falk (1975) constructs a convenient diagram: SO⟶ ego⟶SO. Hout and Morgan (1975) also raise the possibility of feedback between career expectations of youth and parental attitudes toward their children's careers, but find no empirical support for the hypothesis. Bell (1968) raises the general question of reciprocal cause-and-effect relationships in socialization of children within the family. Certainly, informal observation suggests that formation of career expectations of youth and the expectations that parents hold for their children is a give-and-take process that occurs gradually over time. Concerning the relationship between school grades (AP) and SO behaviors and attitudes, Hout and Morgan write:

> Parental encouragement is caused by the three family-of-origin variables and grades; grades are caused by intelligence and parental encouragement (Hout and Morgan, 1975: 366).

This idea certainly is reasonable. Significant others such as parents judge the capacity of youth to achieve educational and occupational outcomes partly on the basis of the youth's academic performance. On the other hand, the effort youth exert in academic work probably is affected by expectations others have for the youth. An analogous argument applies to suggest a reciprocal relationship between academic performance and youth's career expectations for themselves.

The dynamic quality of the process of forming career expectations can be expressed by writing the structural equations as a system of differential equations. Dependent variables in the differential-equation system are rates of change with respect to time.[9] Since, in theory, causal feedback may occur in each pair of the expectation-performance variables, the differential equations should permit these feedbacks. A dynamic version of equations (1) containing all the hypothesized feedback loops is written in equation-system (2) below.

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9. This is not always true with differential equations, but this interpretation is useful in the present context.

$$(2a)\quad dAP/dt = a_{10}+a_{11}SEB + a_{12}MA + b_{11}AP + b_{12}EEP + b_{13}OEP + b_{14}EE + b_{15}OE + u_1$$

$$(2b)\quad dEEP/dt = a_{20}+a_{21}SEB + a_{22}MA + b_{21}AP + b_{22}EEP + b_{23}OEP + b_{24}EE + b_{25}OE + u_2$$

$$(2c)\quad dOEP/dt = a_{30}+a_{31}SEB + a_{32}MA + b_{31}AP + b_{32}EEP + b_{33}OEP + b_{34}EE + b_{35}OE + u_3$$

$$(2d)\quad dEE/dt = a_{40}+a_{41}SEB + a_{42}MA + b_{41}AP + b_{42}EEP + b_{43}OEP + b_{44}EE + b_{45}OE + u_4$$

$$(2e)\quad dOE/dt = a_{50}+a_{51}SEB + a_{52}MA + b_{51}AP + b_{52}EEP + b_{53}OEP + b_{54}EE + b_{55}OE + u_5$$

where the a_{ij} and b_{ij} are constants over time. Each equation in (2) has a rate of change with respect to time as the dependent variable. For example in (2d) the rate of change in the youth's educational expectation with respect to time (dEE/dt) is the dependent variable. The term dEE refers to change in EE and the term dt refers to an infinitesimal change in time. Since the change in time can be taken as small as desired, the hypothesis, in effect, accounts for every instant along a continuous time scale. The idea of feedback is expressed by the fact that the current level of each expectation-performance variable affects the rate of change in every other expectation-performance variable.

The differential-equation system (2) applies to change over time in a single individual. Since the dependent variables in the system are infinitesimal change rates, they are not observable. The fundamental hypotheses, therefore, are not testable directly. Integration of (2) between two time points that are a finite distance apart yields predictions that are amenable to empirical test. (See Platt [1971], Coleman [1968], Doreian and Hummon [1976], or Hotchkiss [1979]. The latter work presents the mathematics by reference to developing career expectations). If it is assumed that all individuals follow the same process, then a cross-lagged path analysis applied to two panels of data is sufficient to estimate the unknown constants in equations (2).

It is important to recognize, however, that the relationship between the cross-lagged coefficients and the fundamental parameters of the differential equation system is complex (Hotchkiss, 1979; Doreian and Hummon, 1974). Let $\underline{A} = [a_{ij}]$ be a matrix of coefficients of the exogenous variables (MA and SEB) and the intercept, and let $\underline{B} = [b_{ij}]$ be the analogous

matrix for the endogenous variables (AP, EEP, OEP, EE, and OE). Let $\underline{x}$ be a column vector with first element equal to 1.0 and remaining elements equal to values of the exogenous variables, $\underline{y}$ be a vector of current values on the endogenous variables, $\dot{\underline{y}}$ be the derivative vector, and $\underline{u}$ be the vector of unmeasured disturbances. System (2) can now be expressed as follows:

$$(3) \quad \dot{\underline{y}} = \underline{A}\underline{x} + \underline{B}\underline{y} + \underline{u}$$

After integration, a vector of endogenous variables at time t, $\underline{y}_t$ can be expressed as a set of linear functions of the exogenous variables and the endogenous variables at time O:

$$(4) \quad \underline{y}_t = \underline{A}^*\underline{x} + \underline{B}^*\underline{y}_o + \underline{u}^*$$

where $\underline{A}^*$ and $\underline{B}^*$ are matrices of constants that can be estimated by regression, and $\underline{u}^*$ is a vector of residuals. The regression constants, $\underline{A}^*$ and $\underline{B}^*$, are connected to the parameters of the differential equation by the following formulas:

$$(5a) \quad \underline{B} = (\ln \underline{B}^*)/t$$

$$(5b) \quad \underline{A} = \underline{B}(e^{\underline{B}t} - I)^{-1}\underline{A}^*$$

(see, e.g., Hotchkiss [1979] for thorough development of these formulas). The logarithm (ln) in equation (5a) is a matrix log.

It is clear from equations (5) that the cross-lagged regression constants ($\underline{A}^*$ and $\underline{B}^*$) should not be interpreted as direct causal parameters if the fundamental process is described by the differential equation (3). One of the most disconcerting aspects of such an interpretation is the fact that the cross-lagged coefficients depend on the length of the measurement interval between observations, t. It can be shown that the relative magnitudes and even the signs of the $\underline{A}^*$ and $\underline{B}^*$ coefficients change with the length of the measurement interval; whereas, the coefficients of the differential equation remain fixed, assuming the hypotheses expressed by (2) are correct (see Hotchkiss [1979]). Subsequent development in this chapter shows that $\underline{A}^*$ and $\underline{B}^*$ can be interpreted as accumulated total effects over a time interval of finite length.

Theoretical Interpretations of the Dynamic Model

The dynamic model expressed by equations (2) was presented by analogy with the typical cross-sectional model such as equations (1). The differential-equation system is highly abstract, however, and there are theoretically more satisfying ways

to arrive at the differential-equation formulation. This section presents three ways to generate the differential-equation system and discusses the description of the development of career expectations contained in each derivation.

Interpretation as Cross-Lagged Path Model

To those familiar with path analysis, perhaps the most satisfying justification of the differential equations relies on a special case of a cross-lagged path model in which all endogenous variables at time $t + \Delta t$ are written as linear functions of the exogenous variables and the endogenous variables at time t. Let α and β be matrices of coefficients of the exogenous and lagged endogenous variables, respectively. Then a cross-lagged path model can be written as follows:

$$(6) \quad \underline{y}(t+\Delta t) = \underline{\alpha x} + \underline{\beta y}(t) + \underline{w}(t)$$

where $y(t+\Delta t)$ and $y(t)$ are vectors of the endogenous variables at time $t+\Delta t$ and t, respectively and $w(t)$ is a vector of disturbances at time t. Without any loss of generality, one may simply define the following correspondences:

$$\underline{\alpha} = \Delta t\underline{A}$$

$$\underline{\beta} = \underline{I}+\Delta t\underline{B}$$

$$\underline{w}(t) = \Delta t\underline{u}(t)$$

Inserting these definitions in (6) produces the following form:

$$(6a) \quad \underline{y}(t+\Delta t) = \Delta t\underline{Ax} + (\underline{I}+\Delta t\underline{B})\underline{y}(t) + \Delta t\underline{u}(t)$$

Subtracting $\underline{y}(t)$ from both sides produces a difference equation:

$$(6b) \quad \underline{y}(t+\Delta t)-\underline{y}(t) = \Delta t\underline{Ax} + \Delta t\underline{By}(t) + \Delta t\underline{u}(t)$$

Dividing by Δt and letting $\Delta t \rightarrow 0$ generates the differential-equation system (3).

[illegible] has revealed an interesting interpretation of [illegible] equations. They are a rearrangement of a [illegible] (all models) in which the lag time between cause and [illegible] approaches (but never reaches) the limiting value of zero. [illegible] for example, this means that the effect of one's [illegible] educational expectation on his/her occupational expectation occurs [illegible] for all practical purposes the effect is [illegible] The same interpretation applies to the effect of [illegible] educational expectation on educational expectation. Yet there [illegible] cases, the briefest instant of delay between cause [illegible], so that the term simultaneous effect is a misnomer. [illegible] effect or feedback is much more descriptive. Extending the same argument to the reciprocal effects between ego [illegible] significant others, Falk's (1975) hypothesis of feedback between ego and SO is contained in the differential [illegible] of the cross-lagged path model with lag time approaching zero reveals this fact more clearly.

[illegible] the differential-equation system as a special case [illegible] lagged path model shows that the differential [illegible] does not really avoid the issue raised by Heise (1970) [illegible] importance of knowing the lag time between cause [illegible], as implied by Hannan and Tuma (1979: 320). Although [illegible] differential equations do solve the practical problem of determining the appropriate length of time between measurements [illegible] comparison of findings from studies with varying [illegible] of time between measurements, they do so precisely because [illegible] certain hypotheses asserting that the causal-lag time [illegible] zero. Once this fact is recognized, one may question [illegible] effects of short lag, thereby reviving the issue raised by [illegible]

[illegible] number of potential hypotheses about causal-lag time [illegible] infinite. This can be seen by deriving the integral [illegible] directly from (6a) without recourse to theorems in [illegible] calculus. This derivation can be carried out by [illegible] application of (6a) to $y(t+2\Delta t)$, $y(t+3\Delta t)$, ... and letting Δt approach zero.[10] The same algebraic form as formula [illegible] from (6a), however, even if Δt is a finite quantity. [illegible] differential equation (4) is consistent with an infinite

[illegible] repeated application of (6a) one finds:

$$\underline{y}(t+n\Delta t) = [(\underline{I}+\Delta t\underline{B})^n - \underline{I}]\underline{B}^{-1}\underline{A}\underline{x} + (\underline{I}+\Delta t\underline{B})^n\underline{y}(t)+\underline{u}^*$$

[illegible] a function of $\underline{u}(t)$, $\underline{u}(t+\Delta t)$, ... Setting $\underline{B}^* = [illegible]$ yields:

(continued next page)

number of hypotheses about the length of the causal-lag time. The equations connecting the coefficients of the cross-lagged path analysis ($\underline{A}^*$ and $\underline{B}^*$), to be fundamental causal parameters ($\underline{A}$ and $\underline{B}$), on the other hand, do depend on the length of the causal lag. As the causal-lag time becomes small relative to the time between measurements, however, the differential equations give an increasingly closer approximation.

The presumption of this study is that the causal lag is short. This does seem like a reasonable assumption for the career expectation variables. For example, the effect of parental educational expectation of a youth on the youth's own educational expectation probably occurs within a relatively short time, say a few minutes; whereas, the time between measurements is several months.

Derivation from a Distributed-Lag Model

The preceding discussion derives from the assumption that, even when there is a lag between cause and effect, the effect occurs at an isolated point in time, in a manner quite analogous to the impact of a hammer on a nail. In theory a nail could be driven the same distance that it moves from one hammer blow by a persistent pressure. Similarly, it is possible that the effects of the career-expectation variables on each other persist over an indefinite period, perhaps due to the memory capability of individuals. An appealing formulation of the memory hypothesis is that effects of the expectation-performance variables on each other are strongest over a short time lag and taper off gradually over time. This idea can be expressed as a distributed-lag model. For expository purposes, take as an example a simultaneous distributed-lag model in which educational expectation (y_1) and occupational expectation (y_2) are two endogenous variables, and SEB (x) is an exogenous variable. Form the hypotheses:

Now, $\underline{A}^*$ can be defined by: $\underline{A}^* = (\underline{B}^* - \underline{I})\underline{B}^{-1}\underline{A}$. This is consistent with the relation for the differential equations given by equation (5). The relation over a finite time can now be written:

$$\underline{y}(t+n\Delta t) = \underline{A}^*\underline{x} + \underline{B}^*\underline{y}(t)$$

which has the identical form to equation (4).

$$(7a)\quad y_1(t) = a_{10}+a_{11}x+b_{12}y_2(t-\Delta t)+\lambda_1 b_{12}y_2(t-2\Delta t)+\lambda_1^2 b_{12}y_2(t-3\Delta t)+\ldots+u_1(t)$$

$$(7b)\quad y_2(t) = a_{20}+a_{21}x+b_{21}y_1(t-\Delta t)+\lambda_2 b_{21}y_1(t-2\Delta t)+\lambda_2^2 b_{21}y_1(t-3\Delta t)+\ldots+u_2(t)$$

$$0 \leq \lambda_1 < 1$$
$$0 \leq \lambda_2 < 1$$

Since the λ's fall between zero and one, the first equation states the hypothesis that educational expectation (EE) is a linear function of all past levels of occupational expectation (OE), but the impact of past OE on current EE declines monotonically with elapsed time. The second equation states the analogous hypothesis for the effect of EE on OE.

Besides the built-in "memory", the distributed-lag model in (7) has another appealing feature. Past values of educational expectation are not "causes" of current values of educational expectation, and likewise for occupational expectation. In contrast, reference to (6a) shows that past values of each endogenous variable are important factors in directing current values. An important element in the differential equations can be interpreted as follows: for each career-expectation variable, the past projects into the present according to a simple (curved) trend line. To the extent that this description characterizes the differential equations, the differential-equation model does not express very satisfactory theory.

In view of the preceding considerations, the fact that the differential-equation system can be derived from a distributed-lag model such as (7) gives an interesting theoretical interpretation to the differential-equation model. By a straightforward algebraic argument, (7) can be converted into the following form:

$$(8a)\quad y_1(t) = a_{10}(1-\lambda_1)+a_{11}(1-\lambda_1)x+\lambda_1 y_1(t-\Delta t)+b_{12}y_2(t-\Delta t)+u_1^*(t)$$

$$(8b)\quad y_2(t) = a_{20}(1-\lambda_2)+a_{21}(1-\lambda_2)x+b_{21}y_1(t-\Delta t)+\lambda_2 y_2(t-\Delta t)+u_2^*(t)$$

where $u_j^*(t)$ are disturbance variables. Subtracting $y_1(t-\Delta t)$ from (8a), $y_2(t-\Delta t)$ from (8b), dividing both equations by Δt and letting t approach zero generates a two-variable simultaneous linear differential equation system with the coefficient matrices defined by:[11]

$$\underline{A} = \begin{pmatrix} a_{10}\frac{(1-\lambda_1)}{\Delta t} & a_{11}\frac{(1-\lambda_1)}{\Delta t} \\ a_{20}\frac{(1-\lambda_2)}{\Delta t} & a_{21}\frac{(1-\lambda_2)}{\Delta t} \end{pmatrix} \quad \underline{B} = \begin{pmatrix} \frac{\lambda_1-1}{\Delta t} & \frac{b_{12}}{\Delta t} \\ \frac{b_{21}}{\Delta t} & \frac{\lambda_2-1}{\Delta t} \end{pmatrix}$$

Because of the connection between the differential equations and a continuous-time version of the distributed-lag model, two useful interpretations of the differential equations are warranted:

- The differential equations (3) are consistent with the idea that effects of career expectations and performance on each other persist over time due to "memory."
- The reason for the effect of past values of a given variable on its current value may be an accumulation of "memory-effects" of the other variables in the system. That is, the diagonals of $\underline{B}$ in equation (3) may be nonzero because they contain cumulated effects of memory.

It should be emphasized that these are permisable interpretations, not necessary ones. While the differential equations can be derived from a continuous-time version of a distributed-lag model, the reverse is not true. Unfortunately, from two

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11. Of course, this result is nonsense unless the b_{ij} approach zero as Δt approaches zero, and the λ_j approach one as Δt goes to zero. This is not a problem, however, since no other behavior of the bs and λs makes any theoretical sense.

measurement points in a panel study, one cannot submit the distributed-lag model to empirical test. The cross-lagged path coefficients to be reported in Chapter 4 are equally consistent with the differential equations generated with or without distributed lag.

It should be noted that if the process followed the distributed-lag model, OLS estimation would be biased and inconsistent. Consequently, examination of the distributed-lag hypothesis is of methodological as well as theoretical interest.

Interpretation as Equilibrium-Seeking Behavior

The cross-lagged path model and distributed-lag model depend on hypotheses about how the past determines the present. While change is implicit in these formulations, it is not an explicit part of the generating equations. There is heuristic value in formulating the hypotheses about determinants of change (Doreian and Hummon [1976] present useful examples of this approach). Consider the following completely general model of continuous-time change for a single variable, say OE:

$$(9) \quad dy_5/dt = k(y_5 - y_5^*); \; k < 0$$

where k is a constant less than zero, and y_5^* is an equilibrium value of y_5 (y_5 = OE). Equation (9) stipulates that y_5 always changes in the direction of its equilibrium value of y_5^*, and the magnitude of k determines the rate of that change. If, for example, y_5 were larger than equilibrium ($y_5 - y_5^*$ is positive) multiplying the positive discrepancy by the negative constant k yields a negative change rate, dy_5/dt, so that y_5 declines in value toward y_5^*. Conversely, by analogous reasoning, if y_5 were below y_5^*, then the change rate would be positive thus moving y_5 toward its equilibrium.

If y_5^* is written as a linear function of SEB, MA, AP, EEP, OEP, and EE one states the hypothesis that the equilibrium for occupational expectation is determined by these other variables which, therefore, affect the rate of change in occupational expectation. The linear function for y_5 can be expressed as follows:

$$y_5^* = \alpha_0 + \alpha_1 x_1 + \alpha_2 x_2 + \beta_1 y_1 + \beta_2 y_2 + \beta_3 y_3 + \beta_4 y_4 + u_5$$

Inserting this hypothesis into (9) gives

$$dy_5/dt = -k\alpha_0 - k\alpha_1 x_1 - k\alpha_2 x_2 - k\beta_1 y_1 - k\beta_2 y_2 - k\beta_3 y_3 - k\beta_4 y_4 + k y_5 - k u_5$$

$$dy_5/dt = a_{50} + a_{51} x_1 + a_{52} x_2 + b_{51} y_1 + b_{52} y_2 + b_{53} y_3 + b_{54} y_4 + b_{55} y_5 + v_5$$

with

$$a_{5j} = -k\alpha_j$$

$$b_{5j} = -k\beta_j \ , \ j = 1, \ldots, 4$$

$$b_{55} = k$$

$$v_5 = -k u_5$$

Analogous procedures produce linear hypotheses for the rate of change in the remaining endogenous variables, thus generating the complete system of linear differential equations. It should be noted that y_5^* at any given time is not the equilibrium value of y_5 that ultimately would occur if the system were permitted to operate indefinitely. Since y_5^* is a partial function of other endogenous variables which are, themselves, subject to change, y_5^* is a moving equilibrium. The value of y_5^* may or may not stabilize depending on the characteristics of the system of equations of which it is a part.

Equation (9) is a very general formulation. It accommodates a wide variety of hypotheses about determinants of y_5^*. Of particular interest is the fact that postulating a distributed-lag model for y_5^* with lag time approaching zero can be used to generate the linear differential equations.

Direct Effects, Indirect Effects and Total Effects

The matrices $\underline{A}^*$ and $\underline{B}^*$ in equation (4) may be estimated from a cross-lagged path analysis. The connection between the fundamental parameters of the model, $\underline{A}$ and $\underline{B}$, and the cross-lagged path coefficients can be found by rearranging equations (5); one thereby finds the manner in which $\underline{A}^*$ and $\underline{B}^*$ are generated by the fundamental parameters $\underline{A}$ and $\underline{B}$:

$$(10a) \quad \underline{A}^* = (e^{\underline{B}t} - \underline{I})\underline{B}^{-1}\underline{A}$$

$$(10b) \quad \underline{B}^* = e^{\underline{B}t}$$

From (10) it is clear that the cross-lagged path coefficients,[12] $\underline{A}^*$ and $\underline{B}^*$, depend in a complex way on the length of time between observations, t.

Since $\underline{A}^*$ and $\underline{B}^*$ do depend on the length of the measurement interval, their interpretation as effect parameters requires careful explication. To illustrate this point, compare the following two $\underline{B}^*$ matrices for three endogenous variables:

$$\underline{B}_1^* = \begin{pmatrix} .6 & .2 & .1 \\ -.1 & .5 & .44 \\ .5 & -.25 & .7 \end{pmatrix} \qquad \underline{B}_2^* = \begin{pmatrix} .39 & .195 & .218 \\ .11 & .12 & .518 \\ .675 & -.2 & .43 \end{pmatrix}$$

12. Note that the exponentiation is a matrix exponential.

Interpretations of these two matrices as cross-lagged path matrices (independent variables across columns and dependent variables across rows) would give different results if $\underline{B}_1^*$ were used than if $\underline{B}_2^*$ were used. In $\underline{B}_1^*$ one observes, for example, that the magnitude of the diagonal entries equals or exceeds the magnitude of all other entries, thus indicating the strong effect of the lagged value of each variable on its current value. In $\underline{B}_2^*$, no such dominance of the diagonal entries occurs, especially for $b^*_{(2)22} = .12$. Additionally, in $\underline{B}_1^*$, the effect of variable 1 on variable 2 is negative: $b^*_{(1)21} = -.1$, but in $\underline{B}_2^*$ it is positive: $b^*_{(2)21} = .11$. In samples of medium to large size, both coefficients would be statistically significant. In spite of these discrepancies between $\underline{B}_1^*$ and $\underline{B}_2^*$, both were generated from the same differential-equation system. For this differential-equation system, $\underline{B}_1^*$ would be observed if measurements were taken after a lag time of one unit, and $\underline{B}_2^*$ would be observed after a lag time of two units.[13]

As shown by the illustration, two investigators studying the same career-expectation variables, one over a one-year interval and one over a two-year interval, might propose discrepant interpretations even though the fundamental processes generating the observations were identical. One of the merits of continuous-time theoretical models is that appropriate methods of comparisons between studies with different lag times between measurements follow directly from the theory (see Hotchkiss [1979]; Hannan and Tuma [1978]).

The concepts total effect, direct effect, and indirect effect can be used to develop a unified interpretation of the instantaneous effect coefficients in $\underline{A}$ and $\underline{B}$, and the matrices of cross-lagged coefficients, $\underline{A}^*$ and $\underline{B}^*$. Since classification of effects into direct and indirect components is important in status-attainment research (e.g., Otto and Haller 1979; Sewell and Hauser 1975), and this study is one of the first applications of differential equations to status-attainment processes, the following paragraphs explicate interpretations of $\underline{A}$, $\underline{B}$, $\underline{A}^*$ and $\underline{B}^*$ by reference to the different types of effect. The discussion is organized into four parts. Part one defines the concepts: total effect, direct effect, and indirect effect. Part two applies the definitions to the differential-equation model. The third part shows the connection between the classification of total effects into direct and indirect components for differential equations to

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13. In fact $\underline{B}_2 = (\underline{B}_1)^2$. See Hotchkiss (1979) for explication of this result and Doreian and Hummon (1974) for a similar observation applied to a single differential equation in status-attainment processes.

the same classification for cross-sectional structural equations. The final part briefly summarizes the main results.

Definitions

Explicit definition of total effect, direct effect, and indirect effect is essential to the interpretations of the differential equations advanced here. In the definitions proposed below, x and y signify two variables; the intent is to specify the conditions defining different types of effect of x on y.

Direct effect. The direct effect of x on y over a time interval of length $n\Delta t$ (where Δt is a segment of time, and n is a positive integer) is the change in y during the interval starting at time t and ending at time $t + n\Delta t$, given the following conditions: (a) x changes during the interval prior to t $(t-\Delta t, \Delta t)$, (b) no variable other than x changes during the interval prior to t, and (c) no variable except y changes during the interval from t to $t+ n\Delta t$. Let $y_D(t+n\Delta t)$ give the value of y at time $t+n\Delta t$ under these conditions. If y_D is differentiable, then for purposes of this paper, the measure of the direct effect of x on y over $n\Delta t$ is the partial derivative with respect to x at time t: $\partial y_D(t+n\Delta t)/\partial x(t)$.

Total effect. The total effect of x on y over a time interval of length $n\Delta t$ is the change in y during the interval from t to $t+n\Delta t$, given the following conditions: (a) x changes during the interval prior to t $(t-\Delta t, t)$, (b) no variable other than x changes during the prior time interval, and (c) no exogenous variable changes during the interval from t to $t+n\Delta t$. Let $y_T(t+n\Delta t)$ give the value of y at $t+n\Delta t$ under the stated conditions. If y_T is differentiable, then the measure of total effect of x on y over n t is $y_T(t+n\Delta t)/\partial x(t)$.

Indirect effect. The indirect effect of x on y over a time interval of length $n\Delta t$ is the complement of the direct effect over the same interval. The measure of the indirect effect is the difference between the total effect and the direct effect: indirect effect=(total effect)-(direct effect).

The definition of total effect given here is somewhat less than satisfactory. The reason is that it depends on the term exogenous variable, but no explicit definition of exogenous variable is included. Several attempts to formulate a definition of exogenous variable led to inadequate results; hence, exogenous variable remains a "primitive term" in the present discussion.

To promote the clarity required to use these definitions in mathematical analyses, they are stated in formal terms.

Informally, a change only in x followed by a change only in y indicates a direct effect of x on y. Holding everything but x constant during the initial time interval is a standard part of the concept of effect. Holding everything but y constant during the subsequent intervals is not the usual stipulation. It is required here to eliminate effects that generally are thought of as indirect effect, viz changes in y due to changes in a third variable that changed in response to the initial change in x. Figure 4 displays a schematic view of the different types of effect, assuming x is constant over the interval. In the figure, all routes from x to z_5 consisting exclusively of paths represented by solid lines are included as direct effect of x on z over five time segments. The lines connecting directly from x to $z_1,\ldots,z_5$ can be interpreted as the influence of continued pressure of the new value of x, as of time t and lasting to t+5t. The arrows from z_1 to z_2 to z_3 ... can be interpreted as the transfer of inertia in z from one time point to the next.

All routes from x to z_5 tracing over one or more dashed lines are defined as indirect effects of x on z operating through y. Note that each such route passes through y at least once. The accumulation of all routes from x to z_5 comprises the total effect of x on z over five time segments.

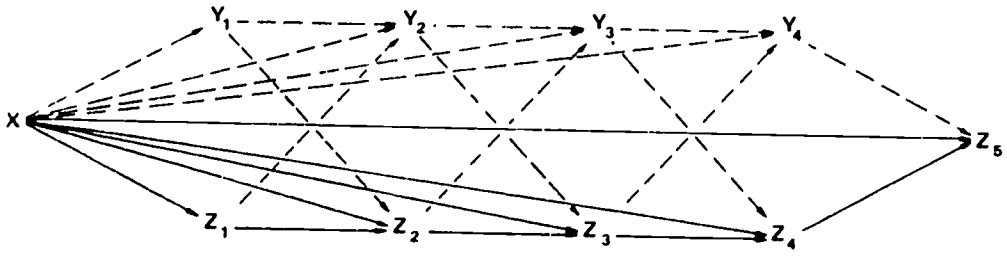
The importance of specifying n is particularly apparent by examining the special case where n = 1. Note that when n = 1, only the single arrow from x to z_1, occurs. This arrow represents the direct and the total effect of x on z. There is no indirect effect.

Application to Differential Equations

When Δt approaches its limiting value of zero, these definitions apply to the differential-equation model. This can be seen most readily by letting $\Delta t \rightarrow 0$ and inspecting equation (6a), reproduced below for easy reference.

$$\underline{y}(t+\Delta t) = \Delta t\underline{A}\underline{x} + (\underline{I}+\Delta t\underline{B})\underline{y}(t) + \Delta t\underline{u}(t)$$

$$\lim \quad \Delta t \rightarrow 0$$



NOTES Subscripts on Y and Z indicate the number of time segments from time t.

All routes from X to Z_5 in which only solid paths appear comprise the direct effect of X on Z over 5 Δ t.

All routes from X to Z_5 in which one or more broken paths appear comprise the indirect effect of X on Y over 5 Δ t.

All possible routes from X to Z_5 comprise the total effect of X on Z over 5 Δ t.

FIGURE 4. Path Diagram depicting direct, indirect, and total effects.

Certainly, as Δt approaches zero so does $\Delta t\underline{A}$ and the off-diagonal values of $(\underline{I}+\Delta t\underline{B})$. Thus, $\underline{A}$ and the off-diagonal entries of $\underline{B}$ are seen to be proportional to the direct effect of x on y and of lagged y on current y in the limiting case as lag time (Δt) approaches zero. Reference to equation (3) shows $\underline{A}$ and $\underline{B}$ to be the fundamental parameters of the differential-equation system. As parameters of the differential equations, they also give the direct effect of x and y on the rate of change in y over time, in the limiting case as the increment in time goes to zero.

In the present context it is useful to attach time subscripts to $\underline{A}^*$ and $\underline{B}^*$; the time subscript makes explicit the fact that these matrices of cross-lagged coefficients depend on the length of the lag time between observations. With the time subscripts on the coefficient matrices, the integral equation (4) is written:

$$(11) \quad \underline{y}_t = \underline{A}^*_t\underline{x} + \underline{B}^*_t\underline{y}_o + \underline{u}_t$$

with

$$\underline{A}^*_t = (e^{\underline{B}t} - \underline{I})\underline{B}^{-1}\underline{A}$$
$$\underline{B}^*_t = e^{\underline{B}t}$$

Applying the definition of (the measure of) total effect by differentiating (11) with respect to $\underline{x}$ gives the total effect of $\underline{x}$ on $\underline{y}$ over an interval of length t:

$$(12a) \quad [\partial \underline{y}_t/\partial \underline{x}]^T = \underline{A}^*_t = (e^{\underline{B}t} - \underline{I})\underline{B}^{-1}\underline{A}$$

where the superscript T stands for transpose of the matrix of partial derivatives.[14] A similar result gives the total effect of each y on every y over a finite interval:

$$(12b) \quad [\partial \underline{y}_t/\partial \underline{y}_o]^T = \underline{B}^*_t = e^{\underline{B}t}$$

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14. The definition of differentiation of one vector by another indicates that dependent variables cross rows and independent variables cross columns, hence the necessity of the transpose notation.

The interpretation of the matrices of cross-lagged coefficients is clear from these results: $\underline{A}^*_t$ gives the accumulation of total effects of $\underline{x}$ on $\underline{y}$ over a finite time interval of length t, and $\underline{B}^*_t$ gives the accumulation of total effects of the endogenous variables on each other over a finite time interval.

The (measure of the) direct effects of $\underline{x}$ on $\underline{y}$ and of $\underline{y}$ on each other can be found by applying the definition to each equation in the system; for example, take the first equation in the system represented by (3):

$$dy/_1dt = a_{10}+a_{11}x_1+\ldots+a_{1L}x_L+b_{11}y_1+\ldots+b_{1K}y_K+ u_1$$

where there are L exogenous and K endogenous variables in the system. To find $\underline{y}_D$, integrate this expression while holding all variables except y_1 constant. The result is

$$y_1(T) = (e^{b_{11}T}-1)\frac{a_{10}}{b_{11}} + (e^{b_{11}T}-1)\frac{a_{11}}{b_{11}}x_1+\ldots+(e^{b_{11}T}-1)\frac{a_{1L}}{b_{11}}x_L$$

$$+ e^{b_{11}T}y_1(0) + (e^{b_{11}T}-1)\frac{b_{12}}{b_{11}}y_2+\ldots+(e^{b_{11}T}-1)\frac{b_{1K}}{b_{11}}y_K$$

Applying the definition of the measure of the direct effect of x_1 on y_1 over a time interval of length T, by differentiating with respect to x_1 gives:

$$(13a)\quad \partial y_1(T)/\partial x_1 = (e^{b_{11}T}-1)\frac{a_{11}}{b_{11}}$$

Similarly, the direct effect of y_2 on y_1 over the interval is:

$$(13b)\quad \partial y_1(T)/\partial y_2(0) = (e^{b_{11}T}-1)\frac{b_{12}}{b_{11}}$$

Matrices containing the direct effects of $\underline{x}$ on $\underline{y}$ and the direct effects of the $\underline{y}$ on each other can be expressed by letting $\underline{\not{B}}$ represent a diagonal matrix containing the diagonal entries of $\underline{B}$ as diagonal elements.

(14a) $(e^{\underline{\beta}T}-I)\underline{\beta}^{-1}\underline{A}$ = direct effects of $\underline{x}$ on $\underline{y}$ over T

(14b) $[(e^{\underline{\beta}T}-I)\underline{\beta}^{-1}\underline{B}+I]$ = direct effects of $\underline{y}$ on each other over T

The indirect effects can be found by subtracting direct effects from total effects:

(15a) $[(e^{\underline{B}T}-\underline{I})\underline{B}^{-1} - (e^{\underline{\beta}T}-I)\underline{\beta}^{-1}]\underline{A}$ = indirect effect of $\underline{x}$ on $\underline{y}$ over T

(15b) $[(e^{\underline{B}T}-\underline{I})\underline{B}^{-1}-(e^{\underline{\beta}T}-\underline{I})\underline{\beta}^{-1}]\underline{B}$ = indirect effect of $\underline{y}$ on each other over T

These expressions for total, direct, and indirect effects over finite time interval of length T present a cumbersome appearance, but the indicated calculations are straightforward. Thus, for a given T one could calculate numerical tables of total, direct, and indirect effects; these tables could be inspected and interpreted. Since there are an infinite number of values of T, however, selection of T poses a practical difficulty. In practical applications, selection of T may be implicit in the particular circumstance, but for theoretical interpretation two values of T are particularly useful. The first of these two is the limiting value: $T \to 0$. Here, it has been noted that the fundamental matrices of the differential equation, $\underline{A}$ and $\underline{B}$, are proportional to the direct effects of $\underline{x}$ on $\underline{y}$ and of the $\underline{y}$ on each other, respectively. When T approaches zero, there is no indirect effect.

The second value of T with particular theoretical interest is the limiting value: $T \to \infty$. Here one asks: What are the "long run" implications of accumulated effects over very short time intervals? Under fairly general conditions of equilibrium,[15] the total, direct, and indirect effects of $\underline{x}$ on $\underline{y}$ are:

(16a) $TE(y,x) = -\underline{B}^{-1}\underline{A}$

(16b) $DE(y,x) = -\underline{\beta}^{-1}\underline{A}$

(16c) $IE(y,x) = (\underline{\beta}^{-1} - \underline{B}^{-1})\underline{A}$

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15. The required equilibrium conditions are: (a) all diagonal entries of $\underline{B}$ are negative, and (b) all eigenvalues of $\underline{B}$ are negative.

... TE(y,x), DE(y,x), and IE(y,x) denote total, direct, and ... effect, respectively of $\underline{x}$ on $\underline{y}$. The analogous results ... the effects of the $\underline{y}$ on each other are:

... TE(y,y) = 0

... DE(y,y) = $(\underline{B}^{-1}-\underline{B}^{-1})\underline{B}$

... IE(y,y) = $-(B^{-1} - \underline{B}^{-1})\underline{B}$

... 0 is a K x K null matrix, TE(y,y), DE(y,y), and IE(y,y) ... total, direct, and indirect effects, respectively, of the ... each other.

The fact that the total effect of the $\underline{y}$ on each other is ..., $\lim T \to \infty$, implies that short-term intervention to change ... of the endogenous variables will not be an effective way to ... about permanent change in any of the endogenous variables, ... it, in some instances, the short-term effects of ... manipulating specific endogenous variables is greater than the ... short-term effects of ... pulating exogenous variables. The ... policy implications o ... feature of the theory are clear: The theory supports the frequently heard assessment that attempts to change youth in school have little impact because the youth must return to their home environments after school. The speed with which manipulations of $\underline{y}$ variables are lost as the system operates over time depends on the numerical entries in $\underline{A}$ and $\underline{B}$. Since schools cannot control the exogenous variables (SEB, MA), and their impact on the endogenous variables (such as EE) is of limited duration, analysis of the numerical results of this study will give useful insights pertaining to potential impact of school programs to assist with developing career expectations.

Relationship to Structural Equations

By assuming equilibrium exists, these results for dynamic ... can be related to the concepts of total, direct, and ... effect as they often are used with cross-sectional ... equations. In equilibrium, all change has ceased; ... the basic differential equation system (3) simplifies to

... $\underline{0} = \underline{Ax} + \underline{By} + \underline{u}$

... 0 is a K x 1 null vector; $\dot{\underline{y}} = d\underline{y}/dt = \underline{0}$. Note that (18) ... the standard algebraic form of simultaneous structural

equations. Solving for $\underline{y}$ yields the reduced form, and differentiating with respect to $\underline{x}$ gives:

$$\underline{y} = -\underline{B}^{-1}\underline{A}\underline{x} - \underline{B}^{-1}\underline{u} \quad \text{(reduced form)}$$

$$[\partial \underline{y}/\partial \underline{x}]^T = -\underline{B}^{-1}\underline{A}$$

Comparing this result to the total effect of $\underline{x}$ ($\lim T \to \infty$) given in (16a), one finds that the total effect is contained in the matrix of reduced-form coefficients, $-\underline{B}^{-1}\underline{A}$.

Recursive path models in cross-sectional data are encountered so frequently in empirical work on status attainment and expectation-formation processes that it seems worthwhile to specialize the above results for a small recursive system. Suppose there are one exogenous variable and two endogenous variables and that the following recursive system applies:

$$y_1 = a_{10} + a_{11}x$$

$$y_2 = a_{20} + a_{21}x + b_{21}y_1$$

These two equations can be rewritten and set in matrix notation matching the form of 18:

$$0 = a_{10} + a_{11}\,x - y_1$$

$$0 = a_{20} + a_{21}\,x + b_{21}y_1 - y_2$$

$$\begin{pmatrix} 0 \\ 0 \end{pmatrix} = \begin{pmatrix} a_{10} & a_{11} \\ a_{20} & a_{21} \end{pmatrix} \begin{pmatrix} 1 \\ x \end{pmatrix} + \begin{pmatrix} -1 & 0 \\ b_{21} & -1 \end{pmatrix} \begin{pmatrix} y_1 \\ y_2 \end{pmatrix}$$

Applying formula (16a) to this equation system, one finds the usual formula for total effect given by decomposition of bivariate correlations (see, e.g., Duncan [1966]):

$$-\begin{pmatrix} -1 & 0 \\ b_{21} & -1 \end{pmatrix}^{-1}\begin{pmatrix} a_{10} & a_{11} \\ a_{20} & a_{21} \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ b_{21} & 1 \end{pmatrix}\begin{pmatrix} a_{10} & a_{11} \\ a_{20} & a_{21} \end{pmatrix}$$

Performing the indicated row into column operation, the total effect of x on y_2 is found to be

$$TE(y_2,x) = b_{21}a_{11} + a_{21}$$

Similarly, the total effect of x on y_1 is

$$TE(y_1,x) = a_{11}$$

since y_2 does not intervene between x and y_1.

The indirect effects can be found in similar fashion by use of equation (16c);

$$-\left[\begin{pmatrix} -1 & 0 \\ b_{21} & -1 \end{pmatrix}^{-1} - \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}^{-1}\right]\begin{pmatrix} a_{10} & a_{11} \\ a_{20} & a_{21} \end{pmatrix}$$

$$= \left[\begin{pmatrix} 1 & 0 \\ b_{21} & 1 \end{pmatrix} - \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}\right]\begin{pmatrix} a_{10} & a_{11} \\ a_{20} & a_{21} \end{pmatrix}$$

$$= \begin{bmatrix} 0 & 0 \\ b_{21} & 0 \end{bmatrix}\begin{pmatrix} a_{10} & a_{11} \\ a_{20} & a_{21} \end{pmatrix}$$

The indirect effect of x on y_2 thus is found to be: $IE(y_2,x) = b_{21}a_{11}$. This is the standard result for a system of three recursive equations.

Recapitulation

The above development accomplishes several important results. First, the concept of effect in a system of equations is defined with explicit reference to change over time. Secondly, the magnitude of effect is found to depend on the length of the time interval over which it operates. Thirdly, distinctions between total effect, direct effect, and indirect effect are defined by explicit reference to change over time under specified conditions of control. This foundation differs markedly from usual procedures that rely on decomposition of bivariate correlations. Finally, the correspondence is derived between direct, indirect, and total effects defined by reference to change over time and the same concepts defined in cross-sectional path analysis by reference to correlational decompositions.

The discussion of effects is limited, however. There are numerous conditions under which effects might occur that are not distinguished above. For example, one might wish to assess the effect of x on y, given that x exhibits a predetermined pattern of change during the time the effect is to be determined. Also, one might be interested in the effects of an endogenous variable on y given the feedback from y to that variable is eliminated.

Commentary

A central theme of this chapter and, indeed, of the remainder of this volume, is that differential equations offer important advantages for expression of theory not shared by conventional structural equations. The chief advantages stem from the fact that the differential equations state a hypothesis about the level of each variable at every instant along a continuous time scale. Advantages of this feature have been noted in this chapter and will be illustrated in detail in Chapter 4.

Although this is not a review article purporting to present a carefully balanced summary of the advantages and disadvantages of differential equations, a brief summary of important restrictions seems worthwhile. First, all functions in the model must be differentiable with respect to time. This means that there is no easy way to accommodate endogenous categorical variables such as participation in interscholastic sports or academic curriculum. Categorical exogenous variables could be included, however. A second shortcoming of the differential equations is that social scientists have little experience with their application. Consequently, technical development of the methodology lags behind developments related to well-known techniques such as multiple regression, factor analysis, or

canonical correlation. Thus, for example, sampling theory for parameters of differential equations is not available, ability to estimate complicated nonlinear (including nonadditive) models is limited, and efficient programs such as LISREL are not available to carry out "theory triming." While these restrictions cannot be overlooked, the advantages of differential equations for a variety of applications to social phenomena seem attractive enough to merit channeling substantial energy into improving the technology of applying differential equations.

CHAPTER 3

METHODOLOGY

This chapter is divided into five sections. The first section describes the sampling procedures. Section two describes methods of data collection. Section three deals with data coding. The fourth section gives operational definitions for all variables used in the present report. Appendix B contains thorough explication of data collection, instrumentation, and coding. Finally, section five discusses analytic methods. Since the differential-equation model and related statistical issues have been examined elsewhere (Hotchkiss 1979), the discussion of analytic methods is brief.

Sample

The sample for this report consists of all youth and their parents who responded both to wave one and wave two of the study. The population from which the sample was drawn includes all sophomores in public high schools in Columbus, Ohio for the 1978-1979 school year. Data collection began with sophomores to assure that the third and last wave of the survey will occur during the youths' very important last year of high school. Data collection for time-one occurred during January, February and March of 1979, and time-two data collection occurred about seven to eight months later, in October and November. The sample is balanced by race (blacks and whites only) and sex. Approximately 155 youth in each race-sex group are included. Table 2 displays the race-sex breakdown of the sample. Exact sample sizes are shown for those completing both panels of the study. Numbers shown in parentheses give the proportion of respondents at time-one who are included at time-two. The table reveals that between 85 and 92 percent of the original sample remained in the study for time-two.

TABLE 2
SAMPLE SIZE AND RETENTION RATE BY RACE AND SEX, TIME 2

	Race		
Sex	Black	White	Total
Female	159 (.850)	163 (.921)	322 (.885)
Male	148 (.860)	156 (.876)	304 (.869)
Total	307 (.855)	319 (.899)	626 (.877)

NOTE: Numbers in parentheses are retention rates from time one to time two.

While a regional or national sample would be preferable to the Columbus sample, past experience has shown that local samples do provide usable results. The type of analyses proposed here have been carried out on a Fort Wayne, Indiana sample (Kerckhoff, 1971), a small Wisconsin city sample (Woelfel and Haller, 1971), a Binghamton, N.Y. sample (Rehberg and Rosenthal, 1978), and a Columbus, Ohio sample (Curry, et al., 1976) with results that do not differ markedly from reports based on national samples. Curry and associates (1976; 1978) present an appendix comparing the distributions of several demographic variables collected in the sample of Columbus public schools to similar variables reported in the 1970 Census. Comparisons were made to Columbus (city and SMSA), the region and the nation. The results showed that the sample data were similar to the Census data, although scattered differences were noted.

Also, the present sample has been compared to the Census and to the sample collected by Curry and associates (Hotchkiss and Chiteji 1979; Chapter 3). These comparisons reveal a fairly close correspondence between the present sample and the Curry sample. Statistically significant differences between the present sample and the 1970 census were observed for percentage of parents completing high school and proportion of intact families. A lower percentage of parents in the sample than in the census graduated from high school, and the sample contains a lower percentage of intact families than the census. No significant difference in parental age distributions in the sample and comparable adults in the census were observed, however. The magnitude of the percentage differences between the sample and the census on high school graduation is not large, but the differences in proportion of intact families is substantial. Since a similar discrepancy between the census proportions of intact families and those for the Curry study exists, it was concluded tentatively that the differences reflect, at least in part, a real trend since the 1970 Census. While no local sample can be used to make precise generalizations to the entire nation, it does appear that a Columbus sample can be used with reasonable confidence to provide an approximation.

An official roster of all sophomores in Columbus public schools was secured from the Columbus Board of Education. Names were drawn from this list within race and sex categories at random. As it turned out, the master list was not current so that an oversampling of approximately three to one was necessary in order to obtain the target number of respondents. This fact may have biased the sample somewhat against families who change address frequently. If so, the unrepresentative nature of the sample should be compensated partially by relatively low rates of attrition for time-two and time-three.

Table 3 presents a percentage breakdown of students originally designated to be part of the study. Percentages are shown according to the reasons for nonparticipation. The first column of percentages are calculated as the percent of participants plus nonparticipants, and the second column shows percentages of nonparticipants. By far the largest category of nonparticipants is comprised of families who could not be contacted by interviewers. The reasons for failure to contact cannot be determined definitely, but inaccurate telephone number is the most immediate cause. Inaccurate numbers could be due to families moving, changed numbers, or mistakes in the records. Although refusals constitute the second largest category of nonparticipants, the percentage of the total number of students selected who refused

TABLE 3
DISPOSITION OF STUDENTS DRAWN FROM THE SAMPLE FRAME TO BE PART OF THE STUDY

Disposition	Percentage of Total	Percentage of Nonparticipants
No contact made with family	33.9%	51.1%
Family refused	19.8	29.9
Student not eligible	9.6	14.6
Other nonparticipant	2.9	4.4
Family participated	33.8	---
Total	100.0 (N=2115)	100.0 (N=1401)

is not high, twenty percent. Ineligible youth comprise the next largest group of nonrespondents. Ineligible youth include those who were not in school at the time of contact, those who were not first-year high school students, and students with learning disabilities. The residual category of nonparticipants includes cases for which one or more prospective respondents repeatedly failed to keep appointments for home visits by the interviewer, and interviews that were terminated by the interviewer or the respondents.

Data Collection Procedures

Interviewers were hired to hand carry self-administered questionnaires to respondents' homes. At time-one, interviewers made telepnone contacts with the mother or female guardian, in most cases, to gain verbal agreement to participate in the study and set an appointment when all respondents would be available together in the home. The interviewer then called on the family at the appointed time with questionnaires for each respondent member of the family -- usually the sophomore youth, his/her mother and father. No youth participated unless at least one parent also participated. These procedures were duplicated as closely as possible at time-two.

Interviewers remained in the home until all respondents completed their questionnaires. During the home visits, interviewers were responsible for (1) clarifying instructions on the questionnaires, (2) requesting signatures on a respondent consent form (time-one only) and a pay form, (3) checking questionnaires for completeness after respondents were finished, and (4) editing completed questionnaires for usable occupational information. Each respondent family was paid ten dollars in return for participation; it was for this reason that pay forms had to be signed in respondent homes. Upon completion of the home visit, interviewers returned all materials to the field-site headquarters.

The management of the field operation for time-one was done jointly by project staff and a local survey firm, Appropriate Solutions, Incorporated (ASI). Interviewers were recruited from the interviewer roster of ASI and through an open publicity campaign. Interviewers with no experience were given one four-hour training session, and all interviewers were given a four-hour briefing session informing them of the procedures specific to the study. Time-two data collection was subcontracted to ASI.

In addition to the home visit, the Thurstone Test of Mental Alertness was administered to each student in his/her high school. Arrangements for this administration were made through the local school board, but the administration was carried out by project staff.

Data Coding and Quality Checks

College students were hired to code questionnaire responses into numeric scores. The numeric scores were transferred to a specially designed coding form in preparation for keypunching.

Most of the coding was fairly routine and needs little explanation here. A ten-percent quality check by permanent staff supervisors was conducted routinely. Two members of the project staff assumed responsibility for coder supervision and management during most of time-one coding, one staff member during time-two. Coders worked under continual supervision of the coding supervisor.

Two aspects of coding require some explanation. As described later in this chapter, the data set contains subjective probabilities for a list of some 90 occupation categories, 12 income ranges, nine schooling levels, and several categories of vocational training, as described in part in the section on definitions of variables. Respondents placed checkmarks on continuous lines to indicate their judgments about the chance of entering each occupation, completing each schooling level, etc. These checks were measured on a one-hundred point scale with a specially constructed ruler, to permit empirical analysis of the maximum degree of precision obtainable from respondents.

Occupational coding is the second important type of operation requiring special explanation. Several questions in the surveys requested respondents to name an occuption and list the duties. For example, parents were asked to name their current occupations, and youth were asked for occupational aspirations and expectations. The format of these questions approximates that of the 1970 Census, and all these responses were coded into 1970 three-digit census codes. After some trial and error, during time-one coding, census procedures for occupational coding were adopted, and a few coders were selected on merit to specialize in occupational coding. The occupational coding was monitored carefully during the early stages of time-one to assure agreement between the coding supervisor, project director and coders. Standard ten-percent quality checks were maintained throughout, and an error rate of less than one percent was found.

After coding was completed and the data were keypunched, a new group of student coders was hired to assist in checking accuracy. A computer program was written to check each variable on each case for numerical values beyond the valid range. The student workers corrected values found to be out of range by the computer program. Also, all variables were checked for coding accuracy on five percent of the sample. The error rate was found to be one percent per variable.

The reader is referred to Appendix B for complete description of data collection, instrumentation, and coding.

Definitions of Variables

A total of nine variables are used in this report. All variables except measured mental ability were measured by questionnaires administered as described earlier. The questionnaires are contained in Appendix A. This section describes each of the nine variables, referencing the questionnaire item(s) used to construct each variable.

A mnemonic abbreviation is associated with most of the variables. To provide a quick reference, the mnemonic for each variable is listed below, accompanied by a brief definition. More complete definitions and presentation of operational procedures are given in later paragraphs. The nine variables used in this report are:

1. SEB -- socioeconomic background, (parental socioeconomic status)
2. MA -- measured mental ability
3. AP -- academic performance of youth
4. EEP -- educational expectation of parents for their child, (measured by subjective probability)
5. OEP -- occupational expectation of parents for their child, (measured by subjective probability)
6. EE -- educational expectation of youth, (measured by subjective probability)
7. OE -- occupational expectation of youth, (measured by subjective probability)
8. RACE -- race of student, black or white
9. SEX -- sex of student

The remaining paragraphs of this section contain full definitions and description of operational procedures used to generate numerical values for each of the above variables. In these definitions, the term data-present average is used to describe procedures. Data-present average means to calculate the arithmetic mean of all values not coded as missing data. References to form and question numbers indicate the questionnaire form number and item number. Exact wording of items can be found by reference to the indicated form and question in Appendix A.

SEB stands for socioeconomic status of the youth's parents (socioeconomic background). It was calculated as a data-present

average of the standard scores for father's occupational status, mother's education, and father's education, averaged across time-one and time-two.[16] Standard scores rather than raw scores were used, to adjust for differences of metric between education and occupation. The primary data source for determining father's occupation, mother's education, and father's education is the mother's or father's report, time-one and time-two. When parent's report was missing, the youth's report on the parent was substituted. The occupational question for the father is form 6, question 31. The educational question of the mother and father is form 4 and 6, respectively, question 29. The youth's report of father's occupation is form 2, question 44. The youth's report of mother's and father's education was recorded in form 2, question 43. All open-ended occupational data were coded to three digit 1970 census codes and then translated into Duncan SEI codes by reference to Appendix B in Hauser and Featherman (1977).

MA denotes measured mental ability. It was measured by the Thurstone Test of Mental Alertness in a special administration in each students' high school. The Thurstone Test generates three scores, a verbal, quantitative, and total score. The total score was used to define MA. Unfortunately, due to the fact that the tests were administered in late spring of 1979, the school year ended before all make-up sessions could be completed. As a consequence, there is a substantial quantity of missing data for MA: 102 out of 159 (64.2%) of the black females took the test, 118 of 163 (72.4%) white females, 107 of 148 (72.3%) black males, and 103 of 156 (66.0%) white males took the test. Make-up sessions administered this school year have decreased the percentage of missing data to less than 20, but the additional data were not available in time for inclusion in this report. The Thurstone Test was selected primarily because it requires a short period to take, 20 minutes. The short administration time facilitated scheduling.

AP stands for academic performance. The measure used in this report is derived from students' responses to a question about how good a student they felt they were. Responses were converted to a four-point scale equivalent (with a maximum of 4 and minimum of 0). It should be emphasized that the operational definition of AP used here involves the concept of academic self concept; it is not a self-report estimating the calculated grade-point average. Also, the question refers to major subjects, thus excluding by implication courses such as music,

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16. One could argue that mother's occupation ought to be included in the SEB index Haug (1973). Omission of mother's occupation does avoid the conceptual difficulty regarding proper treatment of mothers who are homemakers. Moreover, calculations carried out in preparation for this report but excluded here for brevity show inclusion of mother's occupation changes substantive conclusions very little.

art, and physical education. Although there is some room for differences of interpretation among respondents on this question, such differences probably are not substantial due to the fact that three major subjects are listed as examples in the question (see form 2, item 40).

The next four variables are based on subjective-probability measurements. Since the four variables based on subjective probabilities share basic procedures, an account of the operations is given prior to defining each specific variable. Respondents were asked to indicate their subjective judgment of the chance they would enter each of over 90 occupational groups and each nonvocational schooling level from tenth grade through doctorate degree (see forms 1, 3, and 6, questions 2 and 4). It is assumed that the occupations form a mutually exclusive, exhaustive list of occupations, and that the educational levels are mutually exclusive and exhaustive of the highest level of "regular" schooling. Respondents indicated subjective probabilities by placing a checkmark on a number line beside each response alternative. The number line was marked off in units from zero to 100. Checkmarks were transformed to numbers by measuring the distance of the check from the origin, as described in the section on coding procedures. For each respondent and each variable, the numeric values of subjective probabilities were normed so that they add to 1.0, thus converting responses to legitimate probability scores. The norming is justified by the assumption that occupational and educational categories are mutually exclusive and exhaustive. That the norming can be justified is one of the useful features of the subjective probabilities. Frequently respondents are asked to indicate responses of the type "very low" to "very high," leaving the metric for each respondent to define subjectively. The norming operation converts to a standard metric between respondents.

The educational and occupational expectation variables based on subjective probabilities are defined by the sum of products of the subjective probabilities with the scale values of education or occupation. Suppose y_j is the scale value for education (e.g., 10 indicating tenth grade) or for occupation (e.g., the Duncan SEI for lawyer). Denote the subjective probability of respondent i for response alternative j by p_{ij}, and assume there are J educational or occupational levels. The score for respondent i for educational or occupational expectation is then defined by

$$x_i = \sum_j^J p_{ij} y_j$$

where x_i is the score for respondent i. Note that this is an expected value as defined in statistics. For more complete

discussion of this procedure and its relationship to theory of forming career expectations, see Hotchkiss (1979b).

EEP is the parents' educational expectation of their child based on subjective probability. It is a data-present average of mother's and father's educational expectation of the youth based on subjective probability, as reported by the parents. There are nine values of y--10 for tenth grade through 18 for Ph.D. or professional degree (see forms 3 and 5, question 4).

OEP is the parents' occupational expectation of their child based on subjective probability. It is a data-present average of mother's and father's occupational expectation of the youth based on subjective probability, as reported by the parents. There are 93 values of y for the occupation variables at time-one; the number of occupational categories was expanded to 97 for time-two. Each occupation on the list represents one or more of the occupations contained in the three-digit 1970 census categories. Duncan SEI scores were assigned to each occupation category by averaging Duncan SEI's associated with census categories represented by each occupation category. Due to an oversight, a few of the three-digit census categories are not represented in the question for time-one. Strictly speaking therefore, the assumption of exhaustiveness is not met, but it was assumed that the violation is not serious. Also, the assumption of mutual exclusivity of the occupation groups for time-one was violated in one instance because the stimulus "engineer" appears once in isolation and once in a group of technical occupations. A correction for this error was carried out by subtracting each respondents' subjective probability for engineer from the subjective probability for the second category including engineer and other occupations. This difference is treated as the subjective probability of entry into the nonengineering occupations listed in the category including engineers and other occupations. If the difference were negative, it was set to zero. (See forms 4 and 6, question 1.)

EE stands for educational expectation of youth based on subjective probability. It is the youth's expectation for self; otherwise, it is defined in the same manner as the educational expectation based on subjective probability of each parent for the youth (see form 1, question 4).

OE stands for occupational expectation of youth based on subjective probability. It is the youth's expectation for self; otherwise, it is defined just as is each parent's occupational expectation of the youth based on subjective probability (see form 1, question 1).

RACE stands for the race of the youth. The primary data source for RACE was an item completed by the student at time-one. This response was checked against the records on the school roster used to define the population. Discrepant cases were determined by asking interviewers to state the race of the student.

SEX stands for the sex of the youth. The primary data source for SEX was an item completed by the youth at time-one. Accuracy of sex codes were checked in the same way those for race were checked.

In recent publications related to status attainment it is unusual to find aggregate measures of SEB. For this report, there are several reasons why the aggregate measure is preferable to separate study of the SEB components. First, the aggregate variable is more parsimonious than separate variables; fewer coefficients must be examined. The purposes at hand are not to investigate the relative importance of the different components on career expectations. Secondly, sampling accuracy is higher because fewer degrees of freedom are lost than when SEB components are studied separately. Thirdly, past experience indicates that the magnitude of path coefficients not involving SEB variables is changed little by disaggregation of SEB into its components (Curry, et al., 1978). Finally, the SEB components are intercorrelated to a fairly high degree, thus studying separate SEB components introduces collinearity into the matrix of correlations among regressors, thereby increasing sampling instability.

The aggregate parental significant-other variables (e.g., FEP) can be justified on similar grounds. The educational and occupational expectations of the mother for her child are highly correlated with those of the father. Thus, disaggregation of mother's and father's career expectations of their child would produce multicollinearity. Secondly, disaggregation of parents' career expectations implies that analyses be confined to intact families in which both parents participated in the survey, thus substantially reducing sample size. Finally, the parsimony of the aggregate parental expectation variables is appealing.

The use of the term expectation in this report deserves some comment. Generally, expectation is used here to indicate a realistic assessment of future outcomes rather than a hope. This usage follows closely that suggested by Kuvlesky and Bealer (1966) but departs from Haller's (1968) suggestion that expectation refers to significant others and aspiration refers to ego.

The operational definitions of occupational variables make it clear that all occupation variables measure socioeconomic

components of occupations. Other content of occupations is ignored. This is a potentially serious shortcoming of sociological theory of occupational attainment, but it is one which this report is not designed to address. (See Spaeth [1979] for a recent review of these issues and theoretical proposal regarding occupational dimensions.)

Data Analysis

Detailed expositions of the data analysis method for this study are already in print (Hotchkiss 1979; Hotchkiss and Chiteji, 1979: chapter 4); hence, this section is fairly brief. It summarizes the earlier work.

The main statistical strategy used in this report is to apply ordinary least squares (OLS) to equation (4), and use equations (5) to calculate estimates of the fundamental parameters of the differential-equation system. For the reader's convenience, equation (4) is reproduced here as (19) and equations (5) written as equations (20):

(19) $\underline{Y}_t = \underline{A}^*\underline{x} + \underline{B}^*\underline{Y}_o + \underline{u}_t$

where

$\underline{Y}_t$ = a column vector of endogenous variables measured at time t, in this case, time 2 measurements

$\underline{Y}_o$ = a column vector of endogenous variables at time 0.

$\underline{x}$ = a vector of exogenous variables

$\underline{u}_t$ = a vector of unmeasured disturbances at time t

$\underline{A}^*$ = a coefficient matrix associated with the exogenous variables

$\underline{B}^*$ = a coefficient matrix associated with the time-zero endogenous variables

To find the coefficients of the differential equation (3) [$d\underline{y}/dt = \underline{A}\underline{x} + \underline{B}\underline{y} + \underline{u}$], the following formulae apply:

(20a) $\underline{A} = \underline{B}(e^{\underline{B}t} - \underline{I})^{-1}\underline{A}^*$

(20b) $\underline{B} = (\ln \underline{B}^*)/t$

The matrix $\underline{A}^*$ gives the accumulation of effects of the exogenous variables on the endogenous variables over the finite time interval from time-one to time-two. The matrix $\underline{B}^*$ is the matrix of cross-lagged regression coefficients and contains estimates of the total effects of the endogenous variables on each other over the same finite time interval (see Chapter 2). The magnitude of the entries in the matrices of instantaneous effects, $\underline{A}$ and $\underline{B}$ can be adjusted by choice of time scale. The relative magnitudes are independent of the time scale, however. Dependence of $\underline{A}$ and $\underline{B}$ on the time unit can be seen readily by inspection of formulae (20). For this report, six months is the unit-length time interval. This selection was made because it generates entries in $\underline{A}$ and $\underline{B}$ that approximate the magnitudes of the familiar standardized regression coefficients.

To facilitate comparisons among coefficients in the model, a somewhat unorthodox standardization procedure was applied to the variables. The exogenous variables were standardized by subtracting a population estimate of the combined mean of all four subgroups from each raw numerical score and dividing the result by a sample estimate of the overall standard deviation. In path analysis this procedure, when applied to all variables, produces "standardized path-regression coefficients." These coefficients can be compared between subgroups and between variables (Hotchkiss, 1976). A similar procedure was applied to the endogenous variables, except that the time-one means and standard deviations were used to standardize both time-one and time-two measurements. Use of time-one values as standardization constant for time-two avoids removal of changes in mean and variability from the data (see Hotchkiss [1979a]. The usefulness of the standardized coefficients is clear, but it is important to avoid the temptation to overinterpret them, especially in a preliminary report such as the present work.

The literature on structural equations is replete with warnings against indiscriminant application of OLS, especially when time series or panel data are to be analyzed (e.g., Fisher, 1976; Koopmans, Rubin, and Leipnik 1950; Koopmans 1953; Goldberger 1964). Two key points emerge from this literature. First, consistent estimation with OLS demands that all regressors be uncorrelated with the disturbance variables. In the present case, this means that $\underline{x}$ and $\underline{y}_o$ are uncorrelated with $\underline{u}_t$. Secondly, use of statistics depending on the variance of $\underline{u}^*$, such as statistical tests and R-squares, require that $\underline{u}_t$ be distributed independently of $\underline{x}$ and $\underline{y}_o$.

The major threat to these assumptions in the analysis of panel data consisting of two time points is the likely presence of autocorrelation among the disturbances (see Markus [1979], Johnston [1972], or Hannan and Tuma [1979]). Tests for

autocorrelation in time-series data are available, but such tests do not apply to panel data with only two time points. Consequently, the statistical analysis for this report rests on the untested assumption that autocorrelation is negligible. While this assumption may seem implausible, it is no more implausible than alternatives required by methods such as two-stage least squares, three-stage least squares, or full-information maximum likelihood. In essence, all these methodsrequire location of "instrumental variables" that (a) are distributed independently of the disturbance variables and (b) exhibit very specific patterns of zero effects. The assumptions about patterns of zero effects often strain credibility at least as much as the assumption of zero autocorrelation. Furthermore, Hotchkiss and Chiteji (1979: chapter 4) show that specification error in the use of instrumental variables generates serious bias and inconsistency, and the large-sample bias is likely to be larger for misspecification with instrumental variables than with OLS. This point has been neglected in most of the literature on structural-equation estimation.

Empirical check on the hypothesis of autocorrelation will be possible after time-three measurement of this study is available for analysis. Although the Durbin-Watson d statistic does not apply, it will be possible to correlate disturbances with regressors, across individuals. The estimates of the disturbances for each case and each variable can be defined by the deviation between time-three observation and the forecasted value derived from estimates of $\underline{A}$ and $\underline{B}$ calculated from time-one and time-two data.

There is one exception in this report to the use of OLS to estimate $\underline{A}^*$ and $\underline{B}^*$. High correlations between time one and time two variables among female whites generated apparent instability in the estimates. The instability was evidenced by unusually large absolute magnitudes of some coefficients in the $\underline{B}$ matrix. Slight nonzero covariances between selected regressors and disturbances were introduced to help counter the apparent instability. The values of these nonzero covariances are reported in the next chapter, Table 9.

Statistical tests of significance are not reported in this volume. The main focus of interest is on statistics such as the matrices of the differential equation, $\underline{A}$ and $\underline{B}$, or on equilibrium effects. Standard output of statistical packages do not produce standard error estimates for such matrices, though standard errors of $\underline{A}$ and $\underline{B}$ would be extremely useful in view of circumstantial evidence in the authors' experience that sample estimates exhibit rather high sampling variability (see also Doreian and Hummon 1979). Although large-sample estimates of standard errors could probably be derived by application of the Slutsky theorem (Goldberger 1964), the time schedule for this report precluded such work.

CHAPTER 4

EMPIRICAL FINDINGS

This chapter contains numerical estimates of the fundamental parameters of the differential-equation model. The focus is on the theoretical processes over time and the adequacy with which the model describes those processes. The numerical estimates and theoretical commentary necessarily are tentative. Organization of the presentation is shaped by this focus. Theoretical discussion of the basic procedures is much simplified by concentrating on a single set of numerical estimates. Hence, as a pedagogic device, results for male whites are presented first, and comparisons to the other three groups are drawn subsequently. This organization permits concentration on basic theoretical issues without the awkward necessity of detailed comparisons of coefficients specific to different subsamples. The chapter is divided into four sections. The first section presents the specific form of the model used to generate the data presented in the chapter. The second section discusses the empirical results for male whites. The third section presents race and sex comparisons. The final section contains a summary and commentary.

The Specific Model

The specific model to be estimated in this chapter is stated mathematically in equation-system (2). This equation system is reproduced here for the reader's convenience.

$$(2a)\quad dAP/dt = a_{10}+a_{11}SEB + a_{12}MA + b_{11}AP + b_{12}EEP + b_{13}OEP + b_{14}EE + b_{15}OE + u_1$$

$$(2b)\quad dEEP/dt = a_{20}+a_{21}SEB + a_{22}MA + b_{21}AP + b_{22}EEP + b_{23}OEP + b_{24}EE + b_{25}OE + u_2$$

$$(2c)\quad dOEP/dt = a_{30}+a_{31}SEB + a_{32}MA + b_{31}AP + b_{32}EEP + b_{33}OEP + b_{34}EE + b_{35}OE + u_3$$

$$(2d)\quad dEE/dt = a_{40}+a_{41}SEB + a_{42}MA + b_{41}AP + b_{42}EEP + b_{43}OEP + b_{44}EE + b_{45}OE + u_4$$

$$(2e)\quad dOE/dt = a_{50}+a_{51}SEB + a_{52}MA + b_{51}AP + b_{52}EEP + b_{53}OEP + b_{54}EE + b_{55}OE + u_5$$

where

SEB = socioeconomic background

MA = mental ability

AP = academic performance

EEP = educational expectation of parents for their child

OEP = occupational expectation of parents for their child

EE = youth's educational expectation for self

OE = youth's occupational expectation for self

There are two exogenous variables and five endogenous variables in the model. The exogenous variables are SEB and MA, and the endogenous variables are AP, EEP, OEP, EE and OE. In summary, the model states that the instantaneous rates of change over time in the five endogenous variables depend linearly on the exogenous variables and on the current numerical value of the endogenous variables. The model permits all possible feedback loops among the endogenous variables. Thorough examination of alternative theoretical interpretations of the model are contained in Chapter 2.

Most path models of career expectations contain more variables than do equations (2). In most empirical studies, the SEB variable is disaggregated into its components, in this case, father's occupational status, father's educational achievement, and mother's educational achievement. Also, investigation of the separate influence of the mother and the father demands disaggregation of the parental-expectation variables (EEP, OEP). Finally, nonparental significant-other variables, such as peer expectations, counselors' advice, and teachers' expectations frequently are of interest.

The simplicity of the model can be justified in part by the fact that this is the first investigation applying a continuous-time dynamic model to development of career expectation. The parsimonious model presented here can serve as a starting point for expansion at a later date. Additionally, the OLS estimation procedure described in the previous chapter appears to be sensitive to sampling variability. Since sampling stability declines with each additional independent variable, it is best to keep the number of independent variables to a minimum until further investigation of statistical methods can be carried out.[17]

Calculations including disaggregate socioeconomic background were carried out, but are not reported in detail here. In summary, the disaggregation had little effect on the pattern of coeefficients associated with the endogenous variables, but the coefficients associated with the separate SEB variables were difficult to interpret theoretically. Additionally, computer runs including measures of peer educational and occupational expectations were completed in preparation for this volume. The

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17. The difficulties with various econometric methods are summarized in Chapter 3 and developed in detail in Hotchkiss and Chiteji (1979: Chapter 4).

results were that peer variables exercise little impact on the other variables in the model; hence, for simplicity, the peer variables were eliminated.

No calculations were done with mother's educational expectation and occupational expectation treated as distinct from those of the father. There are two reasons. First, such calculations should be carried out separately for youth with both parents living at home and youth living in one-parent households. The sample size within each race-sex subgroup for this study will not support such calculations. Further, in most cases, data were not collected from parents not living in the home. Secondly, mother's expectations of the youth are highly correlated with father's expectations; hence, disaggregating parental expectations would introduce additional multicollinearity among the regressors and thereby decrease sampling stability. The method by which mother's and father's expectations are combined to create EEP and OEP conforms closely to the "additive model" for combining information from significant others (see Webster, Roberts, and Sobieszek, 1972).

The career expectation variables (EEP, OEP, EE and OEP) used in statistical estimation rely on the subjective-probability (SP) method of measurement, described in Chapter 3. The decision to rely on the subjective-probability measurements was made empirically. Several variations were tried and pondered. The main alternative method of measuring occupational expectation (aspiration) was the Occupational Aspiration Scale (OAS), and the alternative for educational expectation was a close-ended question requesting respondents to check the highest level of education they expected to achieve. In addition to estimation using SP measurements, parallel calculations were carried out with the following measurements: (a) All expectation variables were measured with non-SP measures. (b) Educational expectations (EEP, EE) were measured by the non-SP method, and occupational expectations were measured with SP methods. (c) The average of the SP and non-SP measurements were used for each expectation variable (EEP, OEP, EE, OE). In all cases, high multiple correlations were observed, the highest occurring when the average of the SP and non-SP measures were used. The pattern of coefficients indexing instantaneous effects on change rate ($\underline{A}$ and $\underline{B}$), however, exhibitd signs of instability. In several instances, negative values of the coefficients occurred where theory suggests positive coefficients. Also, standardized coefficients of

excessive magnitude occurred in some instances.[18] Reliance on the SP measures seemed to offer the best compromise until further investigation of estimation methods can be completed.

Observations for Male Whites

This section reports results for the dominant economic subgroup in American society, male whites. The instantaneous effects or "fundamental parameters" of the differential-equation model are examined first, along with their auxilliary data such as the cross-lagged (OLS) regression coefficients. The intermediate and long-term effects are discussed next. The reader is reminded that all exogenous variables are standardized to zero mean and unit variance using sample estimates of the corresponding population parameters, and all endogenous variables are standardized using time-one sample estimates of population means and standard deviations. Justification of this procedure is summarized in Chapter 3 and laid out in detail in Hotchkiss (1979a).

Table 4 displays the sample estimates of the coefficients of the differential equations ($\underline{A}$ and $\underline{B}$), the corresponding cross-lagged regression coefficients ($\underline{A}^*$ and $\underline{B}^*$), multiple R-squares for each equation, and the eigenvalues of $\underline{B}$. The unit time interval is defined as six months, because six months produced easily interpretable estimates. Readers unfamiliar with differential-equation systems might take exception to the fact that all the entries in the diagonal cells are negative and relatively large in absolute magnitude. This is a normal pattern, however; substantively, it indicates that, ceteris paribus, extremely high or extremely low levels of each endogenous variable generate rapid change back toward an intermediate level.

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18. One of the more extreme examples of this phenomenon is contained in the instantaneous effects of the endogenous variables on parents educational expectation of the youth for female blacks (second row of $\underline{B}$). These coefficients for effects of AP, EEP, OEP, EE, OE, respectively, were .084,-1.049, .513, .850, -.277. Five additional negative coefficients too large to ignore occurred in the same matrix. While more reasonable results might have been achieved by arbitrarily designating nonzero covariances between regressors and disturbances, the extent of such adjustment necessary using SP measures was smaller. It should be emphasized that most results with non-SP measures were fairly reasonable.

TABLE 4

COEFFICIENTS OF THE DIFFERENTIAL EQUATIONS, CROSS-LAGGED REGRESSION COEFFICIENTS, EIGENVALUES AND MULTIPLE R-SQUARES: MALE WHITES

Statistics for the Differential Equations

Independent Variables

Dependent Variable	A: Exogenous Variables			B: Endogenous Variables				Eigenvalues	
	Intercept	SEB	MA	AP	EEP	OEP	EE	OE	Real Part	Imaginary Part
dAP/dt	-.317	-.085	.038	-.488	.037	0	.030	.150	- .157	0
dEEP/dt	.067	.062	.003	.125	-.594	.316	.035	.022	-1.305	0
dOEP/dt	-.101	.103	.025	.150	.308	-.709	-.108	.247	- .630	.044
dEE/dt	.077	.059	.104	.253	.625	-.116	-.988	.331	- .630	-.044
dOE/dt	-.024	.082	-.006	.016	.003	.305	.116	-.617	- .672	0

Statistics for the Cross-Lagged Regressions

Independent Variables

Dependent Variables (Time two Endogenous Variable)	A*: Exogenous Variables			B*: Lagged Endogenous Variables					R-squares	
	Intercept	SEB	MA	AP_1	EEP_1	OEP_1	EE_1	OE_1	Multiple	Bivariate
AP_2	-.298	-.073	.034	.551	.035	.022	.021	.101	.558	.532
EEP_2	.022	.068	.008	.103	.519	.187	.011	.053	.704	.657
OEP_2	-.108	.098	.028	.101	.164	.473	-.036	.143	.747	.699
EE_2	.030	.061	-.071	.159	.304	.041	.310	.176	.656	.528
OE_2	-.037	.090	-.006	.040	.057	.176	.047	.504	.733	.675

NOTES: SEB = Socioeconomic background
MA = Measured mental ability
AP = Academic performance
EEP = Educational expectation of parents for child
OEP = Occupational expectation of parents for child
EE = Youth's own educational expectation
OE = Youth's own occupational expectation

dAP/dt . . . dOE/dt indicate instantaneous rate of chance in AP . . . OE over time

The subscripts attached to AP . . . OE indicate measurements at panel 1 or panel 2.

There are several interesting observations in the table. In view of the continuing concern for equality of opportunity in the United States, perhaps the most compelling observation is that SEB exercises very little immediate impact on the rate of change in any of the endogenous variables. Furthermore, the accumulated total effects over the seven to eight months between panels also are negligible, as shown by observing the cross-lagged regression coefficients under the column labeled SEB. In so far as expectations translate into attainment, then, the small magnitude of these coefficients appear to support those who deemphasize the impact of family background on attainment (e.g., Featherman and Hauser, 1978; Rehberg and Rosenthal 1978). On the other hand, the effects of mental ability also are uniformly small, thus appearing to contradict the view that merit dominates class background in determining achievement. As will be seen in a moment, however, the accumulated total effects over the long run reveal a different pattern. To anticipate briefly, the long-run effects of SEB on all four expectation variables far exceed the effects of mental ability and mental ability exercises a somewhat greater effect on AP than does SEB.

There are several noteworthy patterns among the coefficients of the endogenous variables ($\underline{B}$). First, parental occupational expectation (OEP) exercises the dominant influence on rate of change in youth's occupational expectation (OE) ($b_{53} = .305$), but the reciprocal effect of the youth's own occupational expectation on the parents' occupational expectation of the youth is nearly as large ($b_{35} = .247$). This produces an interesting feedback loop:

$$\text{OEP} \underset{.247}{\overset{.305}{\rightleftharpoons}} \text{OE}$$

This pattern is not repeated for educational expectation. The educational expectation of parents (EEP) on the youth's educational expectation (EE) exercises a pronounced effect on the rate of change in youth's educational expectation, but the reverse effect is nearly absent. The accumulated total effect of EEP on EE between time-one and time-two is more modest than its effect on the rate of change in EE, however (compare b_{42} to b^{*}_{42}).

Parental educational and occupational expectations of their child exercise substantial reciprocal effects on each other ($b_{32} = .308$, and $b_{23} = .316$). In contrast, the effect of the youth's occupational expectation on the youth's educational expectation is approximately three times larger than the reverse effect ($b_{45} = .331$, and $b_{54} = .116$). A similar observation applies to the accumulated total effects between time-one and time-two.

The R-squares in Table 4 are substantial, the smallest being that for AP; its value is .558. Three of the four remaining R-squares exceed .70, and the fourth is .656. Such high correlations seldom are observed in social research in which individuals are the unit of analysis. Although most of the large multiple correlations is due to the high bivariate correlations between time-one and time-two endogenous variables, the table shows that multiple R-squares are larger than the corresponding bivariate squared correlations between time-one and time-two measures of the endogenous variables. In view of the emphasis in this research on forecasting accuracy as a method of theory testing, the high correlations should not be emphasized. They indicate how accurately one could have forecast time-two data from time-one data given, a priori, the precise numerical values of each coefficient in $\underline{A}^*$ and $\underline{B}^*$. It is important to distinguish between this hypothetical case and the actual case. In fact, the elements of $\underline{A}^*$ and $\underline{B}^*$ were calculated post facto according to the explicit criterion of maximizing R-squares.

One of the outstanding advantages of the differential-equation model is that forecasting to any point along a continuous time scale is built into the theoretical model. Thus, one is permitted to compare the short-run effects of the endogenous variables (SEB, MA) to their long-run effects. This comparison is, indeed, instructive. Table 5 shows the long-run

TABLE 5

LONG-RUN AND TWO-YEAR TOTAL EFFECTS OF SEB AND MA ON CAREER EXPECTATIONS AND AP: MALE WHITES

Dependent Variable	Long-Run Effects			Two-Year Effects		
	Intercept	SEB	MA	Intercept	SEB	MA
AP	-.848	-.019	.095	-.584	-.101	.063
EEP	-.423	.328	.084	-.088	.166	.033
OEP	-.586	.363	.112	-.272	.208	.064
EE	-.487	.347	-.026	-.090	.157	-.081
OE	-.445	.379	.043	-.144	.213	.000

NOTES: SEB = Socioeconomic background
MA = Measured mental ability
AP = Academic performance
EEP = Educational expectation of parents for child
OEP = Occupational expectation of parents for child
EE = Youth's own educational expectation
OE = Youth's own occupational expectation

(equilibrium) effects of SEB and MA on each of the endogenous variables; the table also shows the accumulated effects over a two-year period. The negligible effects of SEB and MA in the short run have already been observed. In contrast, the long-run effects of SEB on all four career-expectation variables (EEP, OEP, EE, and OE) are pronounced. In each of these four cases, standardized coefficients exceed .32, the impact on the youth's own ocupational-expectation level being the largest (.379). In contrast, mental ability exercises only small long-run effects on any of the five endogenous variables. Though less pronounced, the same pattern is evident for the two-year effects.

The information in Table 5 refers to accumulated total effects over the long run and over a two-year time interval. Table 6 displays the corresponding indirect effects. The indirect effect of x on y over a given time interval is the change in y produced by a change in x that traces through at least one endogenous variable other than y. (See Chapter 2.) The indirect effect of SEB on the four career-expectation variables are substantial; in each case they are about two-thirds the magnitude of the total effect. If one imagines that the projected long-run expectations of youth ultimately are realized (or approximated), then the data here lend support to the view expressed in the Wisconsin model, viz, that socioeconomic background is translated into career attainments in part through a socialization process whereby significant others mold the career goals of youth (Sewell, Haller, and Portes 1969; Haller and Portes 1973).

TABLE 6

LONG-RUN AND TWO-YEAR INDIRECT EFFECTS OF SEB AND MA ON CAREER EXPECTATIONS AND AP: MALE WHITES

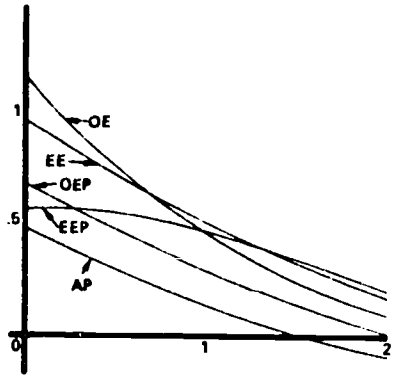
Dependent Variable	Long-Run Effects			Two-Year Effects		
	Intercept	SEB	MA	Intercept	SEB	MA
AP	-.198	.162	.018	-.027	.054	-.004
EEP	-.536	.224	.080	-.190	.071	.029
OEP	-.444	.218	.076	-.139	.071	.030
EE	-.565	.287	.079	-.166	.098	.022
OE	-.406	.246	.053	-.108	.091	.010

NOTES: SEB = Socioeconomic background
MA = Measured mental ability
AP = Academic performance
EEP = Educational expectation of parents for child
OEP = Occupational expectation of parents for child
EE = Youth's own educational expectation
OE = Youth's own occupational expectation

The indirect effects of mental ability are uniformly small, never exceeding the small total effects by more than a marginal amount. In contrast, the indirect effect of SEB on AP is fairly large and exceeds the total effect by a substantial amount. The direct effect of SEB is, therefore, negative. This result is counterintuitive and should not be taken seriously unless it is replicated.

The eigenvalues displayed in Table 4 reveal important information about the behavior of the system of career-expectation variables over time. The important observation in the present context is the fact that the real part of each eigenvalue of $\underline{B}$ is negative. These negative values imply that the long-run total effect of the endogenous variables on each other approaches zero.[19] Thus, the ultimate career expectations of youth are determined by the exogenous variables irrespective of where those expectations stand during the sophomore year in high school.

Again, it is useful to imagine that the long-run expectations of youth are approximated by adult attainments. In this circumstance, since mental ability has little impact on long-run caree expectations, the implication is that ultimate achievements are determined by socioeconomic background, operating indirectly through a socialization process. Figure 5 illustrates the operation of SEB over time. The graph shows the



NOTE AP = Academic performance
EEP = Educational expectation of parents for child
OEP = Occupational expectation of parents for child
EE = Youth's own educational expectation
OE = Youth's own occupational expectation

For these plots, socioeconomic background is set to one standard deviation below the mean and measured mental ability is set to 1 3 standard deviations above the mean

FIGURE 5. Time path of career expectations and academic performance for a hypothetical individual over a two-year time span: Male whites.

19. This is a standard result of the mathematics of differential equations (see Hotchkiss 1979; Doreian and Hummon 1976).

theoretical course for each of the five endogenous variables for a hypothetical youth over a two-year time interval. This hypothetical youth comes from a family with a composit status index one standard deviation below the mean; he is 1.3 standard deviations above average in mental ability. As shown by the graph, this youth has high expectations as a sophomore, and his parents have high expectations for him. His perception of academic performance is also high. Over the two-year interval shown on the graph, all these variables decline to just about the average, or just a little above. If left to operate indefinitely, all five variables would decline to about three-quarters of a standard deviation below their respective means.

Of course, given the lack of attainment data for this report and the tentative nature of the differential-equation model of career expectations, these comments necessarily are highly speculative. At the very least, however, they do illustrate the powerful capability gained by explicit expression of theory by a dynamic model.

It is of interest to compare the estimates of total effect derived from the differential-equation model to those obtained by the standard regression method. The usual method of estimating total effects of the exogenous variables is to regress each endogenous variable against the exogenous variables without controlling for any endogenous variables (Alwin and Hauser, 1975). The regression statistics needed for the comparisons are shown in Table 7. Clearly, the regression estimates indicate a much more

TABLE 7

COMPARISON OF LONG-RUN TOTAL EFFECTS OF SEB AND MA ESTIMATED BY THE DIFFERENTIAL EQUATIONS TO THE REDUCED-FORM REGRESSION ESTIMATES OF TOTAL EFFECT: MALE WHITES

Dependent Variable	Long-Run Total Effects Estimated by Differential Equations			Reduced Form Regression Estimates		
	Intercept	SEB	MA	Intercept	SEB	MA
AP	-.848	-.019	.095	-.102	.039	.530
EEP	-.423	.328	.084	.026	.276	.407
OEP	-.586	.363	.112	-.209	.464	.521
EE	-.487	.347	-.026	-.118	.218	.374
OE	-.445	.379	.043	-.292	.394	.470

NOTES: SEB = Socioeconomic background
MA = Measured mental ability
AP = Academic performance
EEP = Educational expectation of parents for child
OEP = Occupational expectation of parents for child
EE = Youth's own educational expectation
OE = Youth's own occupational expectation

important role of mental ability than do estimates of long-run effects generated from the differential equations. The regression estimates of effects of SEB are somewhat smaller than the corresponding differential-equation estimates. The most straightforward explanation of these results is that the regression calculations were applied to a system which had not reached equilibrium, for it can be shown mathematically that the regression method yields the long-run effects of the differential equation model if the system has reached equilibrium (see Hotchkiss and Chiteji [1979: Chapter 4], and Chapter 2 of this volume).

The point here is not to demonstrate a "flaw" in the regression estimates of total effects. The differential-equation model has received insufficient empirical support to permit such a demonstration. Rather, the conflicting results of the two sets of estimates show that much research remains before the relative impact of SEB and MA on career development can be determined confidently. Certainly, such determination requires a dynamic theoretical model of the process of job mobility. Few such models are available, and none have been subjected to thorough empirical test.[20]

If the differential-equation model were an accurate description of the process of developing career expectations, the long-run effectiveness of career counseling would be negligible, irrespective of the short-run impact. The model implies that whatever perturbation in career plans that are introduced in the short run "wash out" eventually. This conclusion presumes that changes are induced for a short time period (e.g., one six-weeks term), and that the full system is allowed to operate naturally after the stimulus inducing the changes is removed. Obviously, this implies that the stimulus must be maintained indefinitely in order to be effective. For example, the effects of accurate occupational information on the level of occupational expectation could be maintained only by indefinite repetition of the occupational information.

The forecasting capability of the differential-equation model carries with it the ability to forecast cross-lagged regression matrices for any desired lag time between observations. Although no firm conclusions can be drawn from such matrices, some interesting speculations are suggested. Table 8

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20. Sörensen (1979) offers a differential-equation model of intragenerational job changes and reports empirical tests from the census public use sample. Sorensen's model has not been submitted to the intense empirical scrutiny that the status-attainment model has received, however.

TABLE 8

PREDICTED CROSS-LAGGED PATH MATRICES FOR ONE-YEAR AND TWO-YEAR INTERVALS BETWEEN PANELS: MALE WHITES

Predicted Path Matrix for One-Year Interval

Dependent Variable	A*(1) Exogenous Variables			B*(1) Lagged Endogenous Variables				
	Intercept	SEB	MA	AP_1	EEP_1	OEP_1	EE_1	OE_1
AP_2	-.410	-.092	.045	.393	.047	.039	.023	.115
EEP_2	.001	.101	.015	.127	.375	.202	.008	.081
OEP_2	-.160	.137	.041	.117	.170	.338	-.025	.155
EE_2	.009	.090	-.083	.179	.297	.098	.163	.185
OE_2	-.065	.133	-.006	.062	.089	.189	.039	.359

Predicted Path Matrix for Two-Year Interval

Dependent Variable	A*(2) Exogenous Variables			B*(2) Lagged Endogenous Variables				
	Intercept	SEB	MA	AP_1	EEP_1	OEP_1	EE_1	OE_1
AP_3	-.584	-.101	.063	.176	.060	.062	.017	.100
EEP_3	-.087	.166	.033	.127	.191	.165	.005	.107
OEP_3	-.272	.208	.064	.112	.133	.180	-.003	.130
EE_3	-.090	.157	-.081	.160	.202	.151	.038	.156
OE_3	-.144	.213	.008	.087	.112	.156	.018	.180

NOTES: SEB = Socioeconomic background
MA = Measured mental ability
AP_i = Academic performance at time i
EEP_i = Educational expectation of parents for youth at time i
OEP_i = Occupational expectation of parents for youth at time i
EE_i = Youth's own educational expectation at time i
OE_i = Youth's own occupational expectation at time i
$\underline{A}^*(i)$ = Estimated regression coefficients of exogenous variables over a time interval of length i
$\underline{B}^*(i)$ = Estimated regression coefficients of lagged endogenous variables over a time interval of length i

displays the predicted cross-lagged path matrices for time intervals of one year and two years. The results suggest the following general characterization: The diagonal entries in the projected one-year and two year matrices associated with the endogenous variables ($\underline{B}^*(1)$ and $\underline{B}^*(2)$ seem too small. It does not seem reasonable, for example, to suppose that the effect of OE on itself would decline from .504 over seven to eight months to .359 over twelve months. It seems even less likely that this effect over two years would be only .180. Yet these results are implied by the model. It is impossible to test this speculation without data from time-three of the study, but it is interesting to note that if the speculation were confirmed, it would show affinity between the continuous process of changing career expectations and the discrete changes to which Markov chains are applied. Blumen, Kogan, and McCarthy (1955) showed that job shifts fail to follow a stationary Markov process due to excessively large entries in the diagonals of multiple-period transition matrices. They proposed the "mover-stayer" model to account for the observation. The mover-stayer model was generalized in an ingenious fashion by Spilerman (1972). The mover-stayer model and Spilerman's generalization posit population heterogeneity regarding propensity to move. A similar strategy could be adopted for the career-expectation system. The first step would be to postulate time dependence in the coefficients of the model. An obvious hypothesis is that the responsiveness of each variable to the other variables slows down with time. This idea reflects roughly the idea of "crystallization" given prominent attention in the vocational psychology literature (e.g., Super 1957). Once the basic model of time dependence is established, one may posit variation among individuals regarding the degree of time dependence. The degree of time dependence may be associated with demographic variables such as race and sex or with career planning variables such as degree of certainty of career expectation. The idea that the time dependence is associated with characteristics of individuals is an obvious analogy with the population heterogeneity proposed in the mover-stayer model.

A useful beginning for developing a theory incorporating time dependence is contained in the following generalization of the basic model:

$$(21)\quad d\underline{y}/dt = f(t)[\underline{A}\underline{x} + \underline{B}\underline{y}] + \underline{u}$$

where $f(t)$ is a scalar function of time. To reflect population heterogeneity, of course, one must postulate that some parameters of the function $f(t)$ vary from person to person. To express the idea that the diagonals of $\underline{B}^*$ should decline more slowly than implied by the original model, one can require that $f(t)$ increase more slowly than the time units ($0 \leq df(t)/dt \leq 1$). The definite integral associated with (21) is:

$$(22)\quad y_1 = (e^{\underline{B}[F(t_1)-F(t_o)]}-I)\underline{B}^{-1}\underline{Ax} + e^{\underline{B}[F(t_1)-F(t_o)]}y_o$$

where $F(t) = \int f(t)dt$. This result provides a prediction and estimation equation. It can be viewed as a generalization of the stationary model in which the time scale is transformed. Presumably, f(t) and F(t) would contain parameters; these parameters might be viewed as dependent on individual characteristics, such as race, sex, or uncertainty.

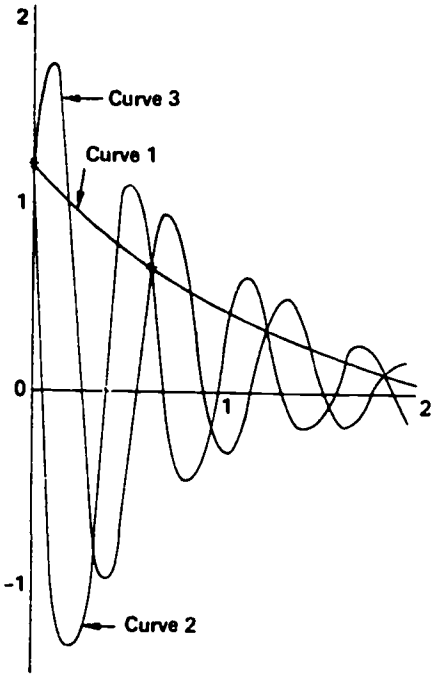
The fact that two of the eigenvalues of $\underline{B}$ are complex numbers (see Table 4) indicates some degree of oscillation in the time path of the endogenous variables. Little oscillation is apparent in any time paths graphed in Figure 5, however. Absence of apparent oscillation is due to the small magnitude of the imaginary parts of the two complex eigenvalues (imaginary part = $\pm$ .0436). However, the estimate of the imaginary part of the eigenvalues of $\underline{B}$ depends on taking the principal branch of the logarithm of the corresponding eigenvalue of $\underline{B}^*$ (the matrix of cross-lagged regression coefficients). If γ_R, γ_I are the real and imaginary parts of γ, with γ an eigenvalue of $\underline{B}$, and λ_R, and λ_I are the corresponding eigenvalue, real and imaginary parts for $\underline{B}^*$, then the following relations hold:

$$\gamma = \gamma_R + \gamma_I = \ln \lambda \qquad \text{(eigenvalue of } \underline{B}\text{)}$$

$$\gamma_R = \tfrac{1}{2}[\ln (\gamma_R^2 + \gamma_I^2)]/t \qquad \text{(real part)}$$

$$\gamma_I = [\tan^{-1}(\lambda_I/\lambda_R) + k\Pi]/t \qquad \text{(imaginary part)}$$

where $i^2 = -1$, k is any integer, and t is the length of the time interval between measurements. The principal branch of $\ln \lambda$ is found by setting k to zero. Other solutions are just as valid mathematically, however, and lead to eratic oscillation of the endogenous variables over time. To illustrate, Figure 6 plots alternative time paths of occupational expectation for the same hypothetical youth shown in Figure 5. Three assumptions about the value of k are included. The first assumption is that k = 0 for both complex eigenvalues. This curve is the same time path as that plotted for OE in Figure 5. The second assumption is



NOTE: Curve 1 – k = 0 for all eigenvalues (same as Figure 5)
Curve 2 – k = 1, -1, respectively, for the first and second complex eigenvalues
Curve 3 – k = -1, 1, respectively, for the first and second complex eigenvalues.
Initial values of all variables are the same as those given in Figure 5.

FIGURE 6. Three possible time paths over two years of occupational expectations for a hypothetical individual: Male whites.

that k = 1 for the first complex eigenvalue (γ = -.630 + .043), and k = -1 for the second complex eigenvalue (γ = -.630 - .043). The third assumption reverses the signs of k (k = -1 for the first complex eigenvalue, and k = 1 for the second). The value of k is zero for all real eigenvalues.

The two time paths for nonzero k exhibit erratic fluctuations, but note that all three curves pass through the same point at time-one and at time-two, marked by asterisks on Figure 6. This fact emphasizes the inability to distinguish between the three alternatives with only two time points. Although no empirical distinction between the curves can be made with measurements at two time points, inspection of the $\underline{B}$ matrices implied by the nonzero k reveals uninterpretable entries. For example, the entries in the first row of $\underline{B}$ for curve 3

are: -7.821, 8.254, 10.978, -5.364, -7.398. Thus, common sense suggests that the nonzero k are not good expressions of the process under study. Two points should be made, however, before dismissing the idea of oscillation. First, common sense is frequently wrong. On the other hand, common sense does suggest that youth vacillate about their career expectations, though usually not as erratically as shown in Figure 6. Further, it seems likely that the degree of vacillation differs among individuals. Thus, an attractive elaboration of the basic model would be to incorporate individual variability in degree of vacillation. Such variability might be tied to cross-sectional measures of uncertainty. One way to introduce oscillation into the model would be to posit that f(t) in equation (21) is sinusoidal with parameters depending on individual characteristics. This sort of revision in the model would mark a useful beginning to incorporation of the verbal formulations of process in the vocational psychology literature into a formal model that has been extrapolated from status-attainment theory in sociology.

Race and Sex Comparisons

Although the specific patterns of effect parameters differ among race-sex subsamples, there are important similarities among the four groups. First, since the real part of all eigenvalues in each subsample is negative, a stable long-run equilibrium exists for the model in each group. Secondly, the numerical estimates reveal little evidence of oscillation. This is because the eigenvalues are either all real, in the case of female blacks, or the magnitude of the imaginary parts of complex eigenvalues is such that oscillation is negligible, in the case of all subgroups except female blacks. These results are reported in Table 9. The table also reveals fairly high R-squares for all race-sex subsamples, the lowest being for female blacks. As with white males, a substantial part of the multiple R-squares can be attributed to the bivariate correlation for each endogenous variable between time-one and time-two measures. But, in no case can all the multiple R-squares be attributed to this source.

Table 10 shows the long-run total and indirect effects of the exogenous variables. Although there is some variation by subgroup, the tendency among white males for SEB to dominate the long-run equilibrium of the career expectation variables is present. Mental ability shows the dominant effect on academic performance in all four subsamples. The most important exceptions to these general similarities occur among male blacks. Here, MA exercises the strongest impact on educational and occupational expectations of the youth.

TABLE 9

COEFFICIENTS OF THE DIFFERENTIAL EQUATIONS, CROSS-LAGGED REGRESSION COEFFICIENTS, EIGENVALUES AND MULTIPLE R-SQUARES: MALE BLACKS, FEMALE BLACKS, FEMALE WHITES

Statistics for the Differential Equations

	Dependent Variable	Independent Variables: A Exogenous Variables: Intercept	SEB	MA	B Endogenous Variables: AP	EEP	OEP	EE	OE	Eigenvalues: Real Part	Imaginary Part
Male Blacks	dAP/dt	-.360	.103	.170	-.653	-.186	.253	.210	-.055	-.193	0
	dEEP/dt	-.131	-.020	-.257	.164	-.514	-.027	.254	.156	-1.379	0
	dOEP/dt	-.150	.014	.070	.048	.371	-.765	-.086	.236	-.684	.214
	dEE/dt	.411	.022	.092	.422	.396	-.037	-1.011	.216	-.684	-.214
	dOE/dt	.201	.094	.162	.149	-.057	.130	.311	-.747	-.751	0
Female Blacks	dAP/dt	-.246	-.042	.162	-.718	-.067	.278	.293	-.155	-1.247	0
	dEEP/dt	.022	.048	.099	-.002	-.963	.481	.182	.264	-1.175	0
	dOEP/dt	-.157	-.029	-.090	.013	.280	-.896	.063	.258	-.405	0
	dEE/dt	.053	.055	-.019	.084	-.218	.208	-.731	.588	-.6	[illegible]
	dOE/dt	.217	.079	.055	-.052	-.007	.081	.154	-.775	-.64[illegible]	0
Female Whites	dAP/dt	-.330	.023	.129	-.615	-.180	.253	.187	.052	64	
	dEEP/dt	-.146	.128	-.025	.226	-.575	-.049	.115	.255	-.729	.54
	dOEP/dt	-.069	.050	.110	.163	-.039	-.627	.060	.162	-.729	-.54
	dEEP/dt	.137	.034	-.076	.107	.342	.010	-.436	-.116	-.42	0
	dOE/dt	.146	.070	.059	.015	.192	-.151	.095	-.431	-.[illegible]	0

Table 9 (continued) Statistics for the Cross-Lagged Regressions

	Dependent Variable	Independent Variables: A* Exogenous Variables: Intercept	SEB	MA	B* Endogenous Variables: AP_1	EEP_1	OEP_1	EE_1	OE_1	Correlations: Multiple	Bivariate
Male Blacks	AP_2	-.292	.092	.176	.460	-.058	.131	.077	-.005	.497	.420
	EEP_2	-.092	.002	-.197	.149	.546	.008	.15[illegible]	.105	.494	.436
	OEP_2	-.136	.022	.037	.057	.200	.398	.01[illegible]	133	.629	.532
	EE_2	.235	.042	-.077	.231	.176	.023	.35[illegible]	.108	.445	.337
	OE_2	.177	.091	.166	.121	.011	.078	.1[illegible]	.419	.592	.477
Female Blacks	AP_2	-.223	-.035	.117	.417	-.026	.137	.[illegible]	-.007	.425	.365
	EEP_2	.021	.046	.063	.001	.322	.213	.10[illegible]	.185	.376	.308
	OEP_2	-.092	-.006	-.053	.004	.108	.373	.058	.155	.394	.323
	EE_2	.076	.058	-.012	.035	-.085	.090	.4[illegible]	.290	.357	.319
	OE_2	.181	.068	.037	-.022	-.005	.041	074	.41[illegible]	.328	.302
Female Whites	AP_2	-.270	.022	.122	.474	-.082	.147	.12[illegible]	.0[illegible]6	.571	.511
	EEP_2	-.138	.129	-.008	.142	.511	-.022	.[illegible]04	[illegible]68	.578	.499
	OEP_2	-.067	.050	.108	.096	-.011	.463	.056	.1[illegible]2	.567	.505
	EE_2	.078	.054	-.071	.101	.214	.019	.604	-.045	.575	.536
	OE_2	.135	.080	.044	.023	.144	-.099	.078	.591	.487	.409

NOTES: SEB = Socioeconomic background
MA = Measured mental ability
AP = Academic performance
EEP = Educational expectation of parent for child
OEP = Occupational expectation of parent for child
EE = Youth's own educational expectation
OE = Youth's own occupational expectation
dAP/dt...dOE/dt indicate instantaneous rate of change in AP...OE overtime

The subscripts attached to AP...OE indicate measurement at panel 1 or panel 2.

For female whites OLS estimation was not used. The following nonzero covariances between lagged endogeous variables and the disturbance variable were assumed arbitrarily: .10, .10, .10 and -.08 for the (2,3), (2,4), (3,2) and (5,5) entries, respectively, of the matrix of covariances: Euy'_o. The R-squares in the table are adjusted to account for nonOLS estimation. The corresponding OLS R-squares are: .571, .624, .593, .575, and .500. Three of these match those in the tabulation because the corresponding equations were not changed by the nonzero Euy'_o.

TABLE 10

LONG-RUN AND TWO-YEAR TOTAL EFFECTS OF SEB AND MA ON CAREER EXPECTATIONS AND ACADEMIC PERFORMANCE: MALE BLACKS, FEMALE BLACKS AND FEMALE WHITES

	Dependent Variable	Long-Run Effects			Two-Year Effects		
		Intercept	SEB	MA	Intercept	SEB	MA
Male Blacks	AP	-.582	.233	.424	-.494	.171	.340
	EEP	-.339	.252	-.061	-.170	.079	-.238
	OEP	-.360	.218	.199	-.234	.083	.063
	EE	.075	.275	.340	.218	.136	.180
	OE	.147	.306	.482	.243	.193	.340
Female Blacks	AP	-.327	-.011	.182	-.352	-.038	.171
	EEP	.167	.152	.088	.087	.106	.083
	OEP	-.008	.066	-.055	-.069	.030	-.059
	EE	.267	.160	-.006	.198	.125	-.010
	OE	.353	.140	.051	.308	.120	.050
Female Whites	AP	-.543	.142	.282	-.444	.055	.231
	EEP	-.416	.525	.063	-.267	.289	.017
	OEP	-.202	.230	.257	-.289	.117	.210
	EE	-.195	.421	-.069	.010	.178	-.113
	OE	.163	.411	.070	.231	.207	.056

NOTES: SEB = Socioeconomic background
MA = Measured mental ability
AP = Academic performance
EEP = Educational expectation of parents for child
OEP = Occupational expectation of parents for child
EE = Youth's own educational expectation
OE = Youth's own occupational expectation

The estimates of instantaneous effect coefficients (B) among the endogenous variables exhibit considerable variation among subgroups. Among male blacks, the numbers mostly are sensible, with the exception of the negative coefficient of moderate magnitude associated with the effect of EEP on MA. The pattern, nevertheless, differs from that for male whites. Among black males educational expectation (EE) has a larger impact on occupational expectation (OE) than the opposite effect (.311 vs .216). This pattern reverses the relative magnitude among male whites (.116 vs .331). Also, among black males, EE has a larger impact on OE than does either parental expectation variable (OEP, EEP).

Some of the effects among the endogenous variables in the B matrices for females are difficult to reconcile with theoretical preconceptions. A salient discrepancy between theory and data is the supposed negative impact of parental occupational expectation (OEP) on the youth's own occupational expectations (OE) among female whites. Further, neither parental-expectation variable has a strong effect on the occupational expectation of female blacks. It should be noted, however, that the matrices of cross-lagged regression coefficients (B*) jibe with theory better than do the instantaneous effect estimates (B).

Numerous empirical studies report comparisons between race and/or sex groups (Featherman and Hauser 1976; McClendon 1976; Tyree and Treas 1974; Sutter and Miller 1973; Curry et al 1976; 1978; Treiman and Terrell 1975; Hout and Morgan 1975; Portes and Wilson 1976; Porter 1974). A bewildering array of statistical interactions have been reported in these studies, whether they apply to attainment or expectation. Treiman and Terrell offer a succinct summary: "... as usual, everything interacts with race." (Treiman and Terrell 1975: 198.) To a somewhat lesser extent this comment also applies to sex. The results here are no exception. Everything interacts with race, and with sex. In fact, in the present data, interaction by sex is more pronounced than that by race.

Curry and associates (1978) tested several theoretically based hypotheses concerning sex differences in development of educational and occupational expectations. Several hypotheses involved presumed influence of the female's attitude toward homemaking and motherhood, but few were supported by the data. Porter (1974) interprets his data on race differences as supporting racial differences on Turner's dimension of "content" vs "sponsored" mobility. In spite of isolated theoretical ties to data such as these, nothing approaching an adequate theory of race-sex differences in developing career expectations exists.

The importance of such a development is clear, however. Important advantages could be expected from an adequate theoretical model accounting for race and sex differences. First, the parsimony achieved by such an integrated theory would be impressive. No longer would it be necessary to duplicate all numerical calculations within each race-sex subgroup. Secondly, a substantial gain in statistical efficiency could be expected if calculations were conducted on total samples rather than race-sex subsamples. Finally, the substantive contribution to understanding race-sex differences in career expectations and attainments would be the most important contribution of an integrated model. Some of the suggestions of the previous section of this chapter regarding population heterogeneity might provide a useful starting point for theory development. The time-dependence, uncertainty, and vacillation of career expectations may differ between subgroups. If a model can be developed incorporating these features, then it is possible that the model would also explain, at least in part, race and sex differences. Also, attention to nonstatus dimensions of occupations, such as sex and race segregation, might offer important avenues of research.

Summary and Commentary

This chapter presents numerical estimates of a relatively simple differential-equation model describing change over time in career expectations of youth. The tentative nature of the findings is emphasized. For the continuing debate on status mobility processes in the United States, the most interesting observation relates to effects of socioeconomic background (SEB) and mental ability (MA) on development of career expectation variables. The immediate and short-run effects of these exogenous variables are negligible in the present data for all four race-sex subsamples. Long-run effects reveal a different picture, however. Socioeconomic background exercises a substantial impact on the equilibrium levels of career expectations among male whites, far exceeding the impact of mental ability. This pattern is repeated in the other three subsamples, except that both SEB and MA have strong effects on the equilibrium levels of occupational and educational expectations of male blacks. In most cases the data are consistent with the view that the longrun effects of SEB are transmitted indirectly through a socialization process.

Among males, the pattern of reciprocal effects among the endogenous variables (career expectations and academic performance) is interesting and does not violate theoretical expectations. Parental expectations generally show

substantial impact on the youth's expectations, but effects of youth on the parents also are evident. For male whites, occupational expectation (OE) shows a stronger impact on educational expectation (EE) than the reciprocal effect (EE$\longrightarrow$ OE). This relative magnitude is reversed for male blacks.

The coefficients indexing effects of the endogenous variables on their rates of change for females in some cases contradict common sense, though the cross-lagged regression statistics are easier to interpret. Much work remains before an adequate model for females is achieved.

The differential-equation model was used to generate a predicted matrix of cross-lagged regression coefficients for one-year and two-year intervals between measurements. The results led to speculation that the diagonals of the generated matrices are much smaller than would be observed by direct empirical estimation. This speculation suggests the advisability of incorporating time dependence into the basic model. In analogy with the "mover-stayer" model of transition matrices for Markov processes, the time dependence might be viewed as related to features of individuals such as race and sex, or degree of certainty about career expectations. This type of theoretical strategy is one way to approach development of a model that would account for race and sex differences. The parsimony of a single model accounting for race-sex differences is an appealing enticement.

The analysis in this chapter is highly exploratory. There are numerous extensions that might be pursued; these are listed below, not necessarily in order of importance:

- A simultaneous model of measurement and effects among latent constructs could be estimated using a method such as developed by Heise (1969), Wiley and Wiley (1970) or Joreskog (1973).

- More extensive exploration of non-OLS estimation techniques should be carried out. In particular, an explicit model of the behavior of the disturbance variables over time would be interesting. Random shocks of disturbance variables might be postulated, with the wait time between shocks described by a poisson probability function. Such a model almost surely would generate autocorrelation of disturbances and, thereby, predict nonzero covariances between

disturbances and lagged endogenous variables. Hopefully, an estimation technique accounting for the autocorrelation would emerge from the model.[21]

- Investigation of the separate effects of the SEB variables, and of mother's and father's expectations of youth should be carried out. Also, examination of the role of peers in influencing career expectations demands further attention.

- The suggestions in this chapter regarding relationships between time-dependence of the effect coefficients, uncertainty of career expectations, and race and sex differences should be pursued.

- This report has concentrated exclusively on the effects parental significant others (SO) have because of attitudes that they communiate to their children (SO definer). But parents (and others) also influence youth by example (SO model). The influence of SO's as models deserves attention in future research.

It would be desirable to follow all the extensions, but as a practical matter and, perhaps, as a matter of theoretical strategy, it is advisable to concentrate efforts on a few possibilities, gradually expanding as the evidence warrants. The sociological path models of career expectations on which the current model is based fail to grapple with important aspects of the process by which expectations develop. The path models omit reference to obvious empirical facts, including vacillation, uncertainty, impact of occupational knowledge, and race and sex differences. The present authors prefer to work on theoretical expansions of the model to account for such processes before attending to statistical issues such as the appropriateness of OLS for parameter estimation. Of course, it is impossible to separate estimation from theory, since empirical test of theory demands some method of estimation. It seems advisable, however, to create the theory first in order to direct the work on statistical methods. Initial work on theory will be facilitated by concentration on a small number of basic variables. Expansion by disaggregation of indices such as SEB, addition of variables

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21. Generalized least squares (GLS) usually are referenced in this connetion, but they apply in an obvious way to time-series data. Application of GLS to panel data is not so straightforward.

such as peers' college plans and the study of SO models can be carried out gradually.

In conclusion, much can be learned by reference to a dynamic model of career expectations, as illustrated in this chapter. But the main lesson of this chapter is some appreciation for the magnitude of the task before us.

CHAPTER 5

SUMMARY AND CONCLUSIONS

This report is an exploratory application of a dynamic mathematical model to express a theory of changes in youth's career expectations over time. The main content of the volume divides into two foci. First, considerable attention is devoted to theoretical interpretations of the differential equations which embody the mathematical model. Secondly, the results of preliminary data analyses are reported and discussed.

Several interesting interpretations of the differential equations are given in Chapter 2. The model of career expectations first is presented by analogy with linear path models of the same variables. Two important contrasts are evident, however: the differential equations explicitly account for change over time and therefore can be used to test theory by assessing the accuracy of forecasts that the theory generates. Also, the differential-equation model contains all possible feedback loops among the endogenous variables--youth's occupational expectation, youth's educational expectation, parental occupational expectation of the youth, parental educational expectation of the youth, and the youth's idea of his or her academic performance.

Following the initial presentation of the differential equations, three additional interpretations are offered. One interpretation is that each endogenous variable exhibits continual change toward an equilibrium, but, in this context, the equilibrium is defined by current levels of all endogenous and exogenous variables. Thus, the equilibrium can be viewed as a moving equilibrium. A second interpretation is that of a cross-lagged path model. The differential equations are consistent with a path model in which all endogenous variables at time two are linear functions of the endogenous variables at time-one and of the exogenous variables. To be interpreted as a variant of the differential-equation model, the path model must be stated for the case when lag time between measurements approaches, but never reaches, zero.

Perhaps the most interesting substantive interpretation of the differential equations is that associated with a distributed-lag model. In the distributed-lag model given in this document simultaneous equations are written in which each endogenous variable is a linear function of exogenous variables and of all past values of every other endogenous variable. The coefficients on the past values of endogenous variables decline monotonically with distance from the present, according to a specified function. If the lag time between cause and effect approaches

the limiting value of zero, then algebraic operations show the distributed-lag model to be consistent with the differential-equation model. The diagonal entry of the effects of endogenous variables, under this interpretation, contains the accumulated effects of memory. This is a particularly satisfying interpretation because it shows that the model does not necessarily imply lack of memory, as one might expect by noting the fact that only current values of the endogenous variables are included.

Considerable attention is devoted to defining effects with explicit reference to time lag. Distinctions between total, direct, and indirect effect over specified time periods are drawn. The definitions are used to derive expressions for the three types of effect in a differential-equation model. In the empirical chapter these results assist in the interpretations, the most interesting interpretations being those of the long-run effects of socioeconomic background and mental ability on career expectations.

Several observations in the data are noteworthy. First, for all four race-sex subgroups, the numerical estimates reveal a trend toward stable equilibrium with little or no oscillation. Further, the multiple coefficients of determination are quite large for all equations and all subgroups, especially male whites. For male whites, the career-expectation variables exhibit interesting feedback loops, most notably, the reciprocal effects of parental occupational expectations and youth's own occupational expectation on each other, and the feedback effects between parents' educational and occupational expectations of the youth. Also, parental educational expectation of youth exercises the strongest immediate effect on the youth's own educational expectation, and parental occupational expectation of the youth has the strongest immediate effect on the youth's own occupational expectation. The immediate effects of socioeconomic background (SEB) and mental ability (MA) on the career expectation variables are negligible. In sharp contrast, the equilibrium effects of SEB on the career expectation variables are quite strong, exceeding that of mental ability by several magnitudes.

Among females and blacks, results vary. In all cases, the short-run effects of SEB and MA are small. The long-run effects of SEB are fairly large in all four subgroups and tend to dominate the effects of mental ability. There is one important exception to this generalization, however, among male blacks; MA shows a pronounced long-run impact on the educational and occupational expectations of the youth. The specific pattern of feedback effects among male blacks is fairly sensible, but those effects among females contradict theoretical preconceptions because of negative coefficients where positive values are

expected. No theoretical interpretations of these patterns are offered, pending further exploration of the data. The difficulties interpreting the numerical estimates of parameters for females and blacks may be due to inadequate modeling of the process of forming career expectations, as well as to inadequate method of statistical estimation.

The long-run effects of the endogenous variables on each other approaches zero in every race-sex subsample. This observation suggests that the effectiveness of career counseling programs depends strongly on maintaining the counseling activities over an extended time period. The problem suggested by the theoretical model is that, once the activity ceases, career plans gravitate back to an equilibrium determined mostly by socioeconomc background. Further study of this issue certainly is warranted before firm conclusions can be offered, however.

Numerous extensions of the present work are needed. In the authors' view the most pressing needs pertain to modification of the formal theory to accommodate mechanisms that informal observation strongly suggest operate in the formation of career expectations. Although methodological work on sampling and estimation methods is important, it will be more fruitful if guided by theory.

Some strategies for extension of the theory have been suggested in this report. These strategies depend on relaxation of the assumption of constant coefficients in the differential-equation model. By examining the projected one-year and two-year path matrices, it was surmised that the model with constant coefficients predicts too rapid change. A gradual decline in the magnitudes of the parameters of the differential-equation model could counteract this phenomenon. Alternatively, decline in magnitude of parameters could be interpreted as a nonlinear transformation of the time scale. The speed of change probably varies according to individual characteristics such as race, sex, and uncertainty of expectations. Linking individual characteristics to speed of change may be a useful strategy for expanding the theoretical model to accommodate some complexities of the process not expressed by the simple linear model with constant coefficients. It might be particularly interesting to allow the speed of change to oscillate over time, thus expressing the idea that some people vacillate about their career expectations. Uncertainty of expectations seem particularly relevant to speed of change. On the one hand, highly uncertain youth probably vacillate more than others, thus exhibiting very fast short-run changes. The movement of the average of these fluctuations toward equilibrium, on the other hand, may proceed more slowly for youth with high uncertainty. Allowing f(t) in equation (21) to

be a sine curve with parameters depending on uncertainty is one way to express these ideas in a formal model.

There are numerous additional complexities of the process of forming career expectations that are difficult to ignore, even allowing for the goal of expressing theory parsimoniously. The idea, expressed so elegantly in neoclassical economic theory, that people make decisions to maximize "utility" subject to resource constraints probably applies to occupational choice in some form (e.g., Annable and Fruitman, 1976). The subjective probability measurements collected for this study make it possible to explore the way in which different factors influence reactions of respondents to occupational titles. Since the subjective probabilities are associated with census occupational categories, it would be possible to examine empirically what features of occupations lead to high expectation of entry. Status is certainly one important feature; it might be viewed as utility producing. Other utility-producing features of occupations include income, freedom from supervision (self direction), benefits, and job security. But to express the economic idea of maximizing subject to constraints, these utility-producing features must be connected by a "constraint function." It would be possible, for example, to do a multiple regression for each respondent in which subjective probabilities for occupational categories comprise the dependent variable, and job features such as status and self direction were independent variables. The results would not be meaningful, however, due to failure to account for constraints. Certain constraining variables, such as required level of training, might also be included as independent variables, but this is an ad hoc strategy.

Several concepts are associated with study of developing career orientations. These include self concept, aspiration, expectation, preference, valence, maturity, realism, crystallization, occupational information, and uncertainty. Each concept carries implicit hypotheses related to the process of developing career orientations. Some of the concepts are related closely. For example, expectation, aspiration, preference, and valence may be points along a continuum of realism. Crystallization and information are related to uncertainty. A model of developing orientations ought to account for these concepts or show why it is unnecessary to do so. Additionally, the theoretical model does not account for differences between significant-other "definers" and significant-other "models," nor does it distinguish between significant others who influence ego's perception of self and those who influence perceptions of objects (Woelfel and Haller, 1971). Clearly, a great deal of work remains.

The preceding discussion relates to the process of change, addressing only briefly determination of what variables must be included in the model. Potentially, a large number of variables are important, including participation in sports in high school, nonathletic extracurricular activities in high school, peer attitudes, high school context, academic track in school, attitudes of nonparental relatives, and family size. If all these variables were included as linear factors in the differential-equation model the loss of parsimony would be substantial and the increase in predictive accuracy probably would be small. Further, sampling variability would increase substantially. For the present, at least, it appears that more insight can be gained by concentrating on more adequate specification of the process for a small number of variables.

The model of expectation development should be coupled with a model of adult attainment (mobility). Two points of intersection seem important. First, modeling the process of transition from school to work would provide a dynamic framework within which to use expectations of youth to predict adult attainments. Secondly, adults as well as youth hold occupational expectations. The reciprocal influences of adult job shifts and expectations on each other probably comprise important elements of a theory of intragenerational occupational mobility. The discrepancy between current job status of adults and current expectation should predict dissatisfaction with job status. Dissatisfaction, in turn, probably predicts propensity to change jobs. The idea of "vacancy competiton" proposed by Sorensen (1979) might be linked to the propensity to change jobs. Such a linkage would relax the fairly strict assumption in the Sorensen model that job changes depend only on resources and vacancies.

Expression of the theory of adult attainment as a dynamic model offers numerous advantages (Doreian and Hummon, 1974). In particular, such expression coupled with a dynamic model of youths' expectations would provide a theoretical tie between longitudinal studies with varying time lags between measurement of expectations of youth and follow-up studies of the same individuals as adults. For example, the theory should predict the differences between the Wisconsin findings (Sewell and Hauser, 1975), based on a seven-year lag time between measurements, and findings from the Lenawee County data (Otto and Haller, 1979) or those from Explorations in Equal Opportunity data (Alexander and Eckland, 1975) both of which are based on a fifteen-year lag time. Also, such a theory should predict the decline with age in correlations between father's occupational status and status of son's current job, thus helping to resolve the issue raised by Blau and Duncan (1967) regarding change over time in the association between status background and status destination.

Although this report proposes that theoretical work take precedence over methodological study, this is not to say that methodology can be ignored until a complete theory is worked out. Rather, a sort of iterative process seems necessary: theory ⟶ method ⟶ theory, reminiscent of Merton's famous essay on the relationships between theory and method. Important methodological questions must be investigated. Sampling stability of estimates of the parameters for the differential equation merits attention. The impact of different measurement methods on those estimates deserves systematic study. The Occupational Aspiration Scale should be compared to the subjective probability measures of occupational expectation, and similar comparisons carried out for education. These comparisons would yield estimates of the degree to which the differential equation parameters are affected by variation in measurement. Availability of multiple measurements of the key concepts at different time points makes it feasible to apply the Joreskog methodology to estimate a model combining measurement theory and substantive theory.

In conclusion, much work remains before achieving a convincing theory of development of career expectations. The importance of applying dynamic models to represent such theory has been argued and illustrated in this document. Carrying through with some of the suggestions for revision of the theory offers exciting prospects for future research.

APPENDIX A

WAVE-TWO QUESTIONNAIRES

Introduction

This appendix reproduces the questionnaires used during data collection for wave two. These questionnaires are very similar to those used for wave one. Most questions in wave two were taken verbatim from the wave-one questionnaires. A copy of the wave-one questionnaires can be found in Hotchkiss and Chiteji (1979).

One pair of questionnaires was completed by each respondent. Form number by type of respondent is shown below:

Form 1--Estimating the chances: Sophomore's Form (completed by youth)

Form 2--Survey of youth, Part II: Career Aspirations

Form 3/5--Estimating the chances: Parents' Form (Form 3 completed by mother; Form 5 completed by fathers)

Form 4/6--Survey of Mothers: Career Aspirations (Form 4 completed by mothers; Form 6 completed by fathers)

Form 3 is identical to form 5, and form 4 is nearly identical to form 6; hence only one reproduction of these pairs is included.

Protocol No. 78 B 191
Form 1
Panel 2

OSU

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ESTIMATING THE CHANCES
YOUTH'S FORM

This survey continues the research on career aspirations in which you participated last winter. That initial phase of the study has been very successful, due in large part to your cooperation. To accomplish our major goal of studying changes in career aspirations, however, your continued participation is critical. We thank you for agreeing to this second home visit.

Please recall that when these questionnaires leave your home, no one will be allowed to see how you answered any question -- your answers are strictly confidential. DO NOT put your name on any questionnaire.

Again, thank you for helping us.

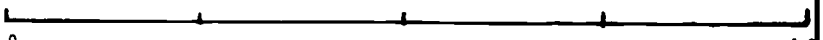
We recognize that it is hard for high school students to be sure about their future careers. In this questionnaire, therefore, we ask you to estimate your chance of obtaining different occupational, educational and income options. Of course, you may not be sure about your chances either, but please give us your best guess for every question.

OCCUPATIONS

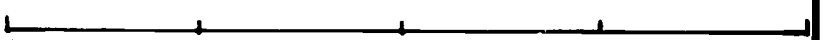
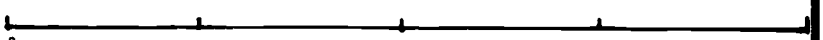
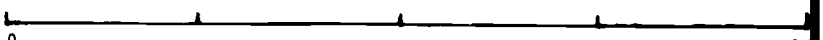
1. The next few pages contain a list of jobs with a line to the right of each job. We want you to use the line to guess the chance that each job will be your main job for most of your life.

   Look at some of the questions to see how they are laid out, then read the directions below:

   a. Put one check on each line
   b. Place the check so that the farther to the right it is, the higher the chance this occupation will be your main job.
   c. Don't worry if most of your checks are near zero, this is normal

NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Military officer [1:08]	
Military enlisted person, not an officer [1:11]	

NOTE: The remaining are civilian jobs only.

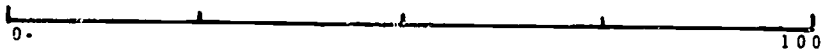
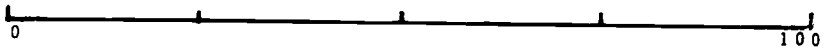
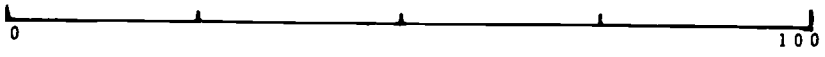
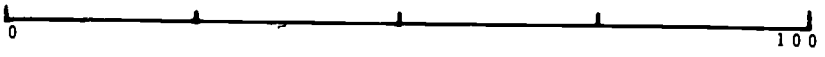
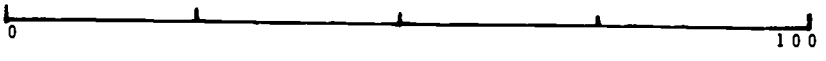
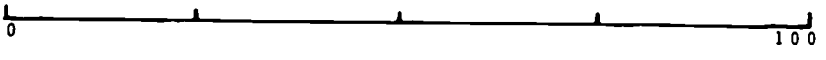
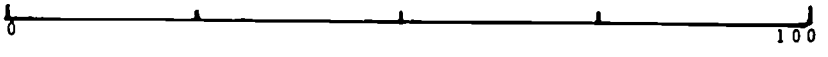
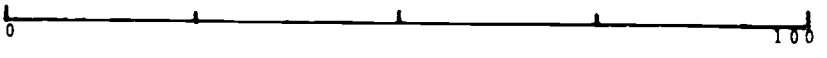
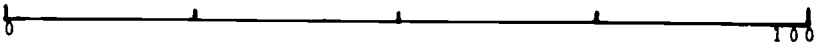
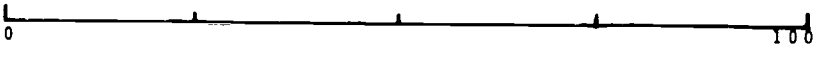
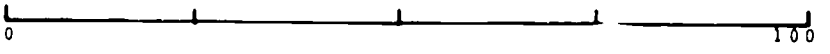
Accountant [1:14]	
Architect [1:17]	
Computer specialist (such as programmer) [1:20]	

NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Forester or conservationist [1:23]	0 — 100
Judge [1:26]	0 — 100
Librarian or curator [1:29]	0 — 100
Physical scientist such as geologist or astronomer, but not an engineer, or a college professor [1:32]	0 — 100
Engineer such as chemical engineer or electrical engineer, but not a college professor [1:35]	0 — 100
Social scientist, such as psychologist, economist, or sociologist, but not a college professor [1:38]	0 — 100
Biological or agricultural scientist, but not a college professor [1:41]	0 — 100
Lawyer (but not a college professor) [1:44]	0 — 100
Physical, speech, or occupational therapist [1:47]	0 — 100

NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Airplane pilot [1:50]	0 — 10
Air traffic controller or radio operator [1:53]	0 — 10
Flight engineer [1:56]	0 — 10
Designer, including designer of clothes, pottery, rugs, interior decorating, glassware [1:59]	0 — 10
Bank officer or financial manager [1:62]	0 — 10
Funeral director or embalmer [1:65]	0 — 10
Inspector such as building safety inspector or bank examiner [1:68]	0 — 10
Writer or author (fiction or nonfiction), journalist, reporter, editor, public relations person or publicity writer [1:71]	0 — 10
Postmaster or mail superintendent, sales manager, or health administrator [1:74]	0 — 10

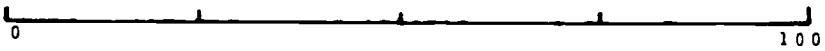
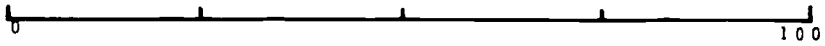
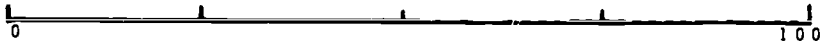
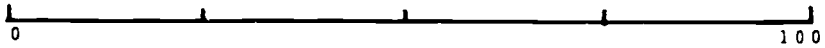
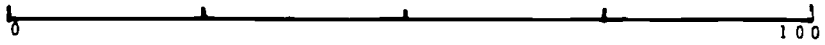
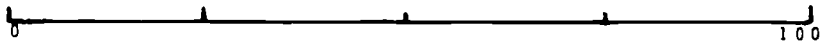
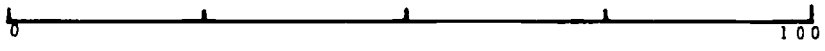
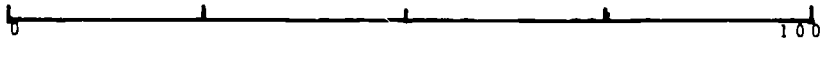
NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Railroad conductor, officer, or pilot of a ship, building manager or superintendent [1:77]	0 — 100
Storekeeper or restaurant, cafeteria, or bar manager *[2:08]	0 — 100
Corporation executive or college administrator such as college dean [2:11]	0 — 100
Receptionist or office machine operator such as computer, keypunch or telephone operator [2:14]	0 — 100
Clerical work such as file clerk, postal clerk, or stock clerk [2:17]	0 — 100
Blacksmith or boilermaker [2:20]	0 — 100
Operator of earth moving machinery and other heavy machinery such as bulldozer, grader, or crane [2:23]	0 — 100
Carpentry work such as cabinet maker or housebuilder [2:26]	0 — 100

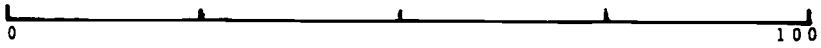
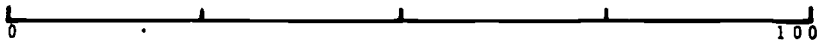
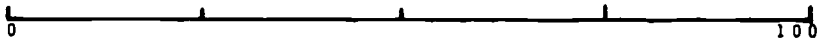
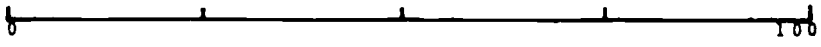
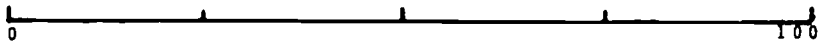
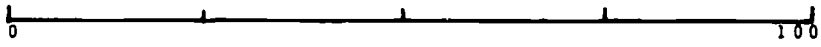
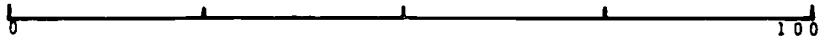
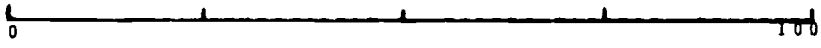
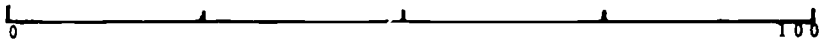
NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Bookbinder or typesetter in a print shop or related work [2:29]	0 — 100
Jeweler, watchmaker, machinist, optician, grinder, or polisher [2:32]	0 — 100
Tailor or upholsterer [2:35]	0 — 100
Tool and die maker [2:38]	0 — 100
Garage worker or gas station attendant [2:41]	0 — 100
Meatcutter, butcher, baker, or related work [2:44]	0 — 100
Operator of a precision machine such as lathe, drillpress, milling machine, or grinder [2:47]	0 — 100
Textile worker such as weaver [2:50]	0 — 100
High school or grade school administrator such as principal or superintendent [2:53]	0 — 100
Other administrator or manager such as union officer, office manager [2:56]	0 — 100
Labor negotiator (but not a union officer) [2:59]	0 — 100

NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Bank teller, cashier in a store, or bookkeeper [2:62]	
Vehicle dispatcher, such as taxicabs or police cars [2:65]	
Insurance adjuster, examiner, or investigator [2:68]	
Mail carrier, deliveryman, routeman or reader of gas or electric meters [2:71]	
Auctioneer [2:74]	
Insurance agent or underwriter [2:77]	
Real estate agent or appraiser *[3:08]	
Stock and bond salesman [3:11]	
Sales clerk in a store or other salesperson [3:14]	
Medical secretary [3:17]	
Secretary or stenographer (except medical secretary) [3:20]	

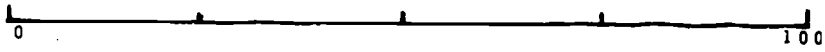
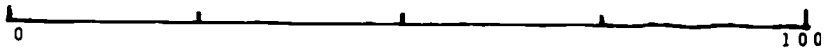
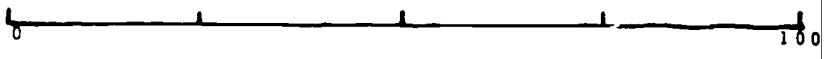
NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Railroad brakeman or railroad switchman [3:23]	0 — 100
Garbage collector [3:26]	0 — 100
Longshoreman, stevedore, sailor, or deckhand [3:29]	0 — 100
Lumberman or related work such as working in a sawmill or miner, such as coal miner or other mine work [3:32]	0 — 100
Operator of a machine such as riviter, photo developer, welder or other type of worker [3:35]	0 — 100
Farmer or farm manager, farm foreman [3:38]	0 — 100
Farm laborer or self-employed farm service worker such as sheep shearer or combine operator [3:41]	0 — 100
Cleaning service worker in a business such as a hotel but not a private home -- such as janitor, cleaning woman, maid [3:44]	0 — 100
Office messenger, telegraph messenger, newsboy or newsgirl, or peddler [3:47]	0 — 100

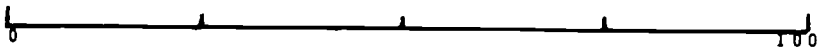
100

NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Food service worker such as bartender, busboy in a hotel, dishwasher, food counter or fountain worker or waiter or waitress [3:50]	
Protective service worker such as fireman, policeman, detective, sheriff, or bailiff [3:53]	
Worker in a family home -- such as cook, child care worker, housekeeper, maid, or butler [3:56]	
Personal service worker such as airline stewardess baggage porter or bellhop, barber, boarding and lodging housekeeper, elevator operator, hairdresser or cosmetologist, usher [3:59]	
Medical doctor or dentist [3:62]	
Registered nurse or dietitian [3:65]	
Optometrist (eye doctor) [3:68]	
Pharmicist or druggist [3:71]	
Veterinarian [3:74]	

NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Technical work related to health care, such as radiologic assistant, dental hygienist, therapy assistant, or laboratory technician [3:77]	
Chiropractor, podiatrist (foot doctor) *[4:08]	
Minister, priest, or rabbi (or other clergyman) [4:11]	
Other religious worker [4:14]	
Social worker or recreation worker [4:17]	
Elementary school teacher (including Kindergarten and preschool) [4:20]	
High school teacher, vocational or educational counselor [4:23]	
Teacher aide [4:26]	
Other type of teacher [4:29]	
Science technician, surveyor, or draftsman [4:32]	

NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Health service worker with no college training such as practical nurse, medical technician, or dental assistant [4:35]	0 — 100
Locomotive engineer or fireman [4:38]	0 — 100
Auto mechanic or repairman of heavy equipment [4:41]	0 — 100
Household appliance, radio, television, or other mechanic or repairman [4:44]	0 — 100
Motion picture projectionist [4:47]	0 — 100
House painter or plasterer [4:50]	0 — 100
Piano or organ tuner or repairman [4:53]	0 — 100
Brick layer, electrician, plumber or related work [4:56]	0 — 100
Sheetmetal worker or tinsmith [4:59]	0 — 100
Shoe repairman or shoemaking machine operator [4:62]	0 — 100

NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Sign painter or letterer [4:65]	
College teacher or professor of sciences such as: physics, chemistry, astronomy, mathematics, geology, biology, agriculture, medicine, dentistry, pharmacy, or veterinary medicine [4:68]	
College teacher or professor of nonsciences such as: psychology, economics, sociology, political science, law, history, English, language, education, business, commerce, industrial arts, sport coach or physical education, art, drama, music [4:71]	
Entertainer or artist such as actor, dancer, musician, composer, painter, sculptor, photographer, radio or TV announcer, professional athlete [4:74]	
Skilled or semiskilled craftsman, such as carpet installer, wallpaper hanger, foreman, telephone installer, repairman or lineman [4:77]	

NAME OF JOB	CHANCE YOU WILL BE IN THIS JOB (Place one check on each line)
Transport equipment operator such as parking attendant, bus driver, conductor or motorman on mass rail transport, taxicab driver, chauffer, or truck driver *[5:08]	

SECTION II

INCOME

3. Different income ranges are listed below next to lines. Please rate the chance that each of the income ranges includes the highest total yearly income (not just take-home pay) you will ever make. Assume the VALUE OF THE DOLLAR DOESN'T CHANGE.

Use the same method you did for jobs.

a. Put one check on each line

b. Place the check so that the farther to the right it is, the higher your chance that this will be the most you will ever make.

c. Since only one income range can include the highest income you will ever make, if you check very high on one, the rest necessarily must be low

IF YOU HAVE ANY QUESTIONS, PLEASE ASK

$ PER YEAR	CHANCE THIS WILL BE THE HIGHEST INCOME YOU WILL EVER MAKE (Place one check on each line)	
Under $4,000	0 — 100	[5:11]
4,000 - 5,999	0 — 100	[5:14]
6,000 - 7,999	0 — 100	[5:17]
8,000 - 9,999	0 — 100	[5:20]
10,000 - 11,999	0 — 100	[5:23]
12,000 - 14,999	0 — 100	[5:26]
15,000 - 19,999	0 — 100	[5:29]
20,000 - 24,999	0 — 100	[5:32]
25,000 - 29,999	0 — 100	[5:35]
30,000 - 34,999	0 — 100	[5:38]
35,000 - 39,999	0 — 100	[5:41]
40,000 - or more	0 — 100	[5:44]

SECTION III

EDUCATION

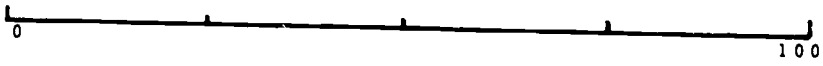
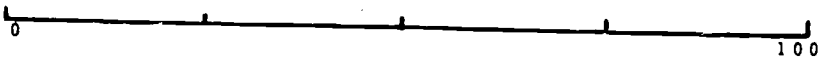
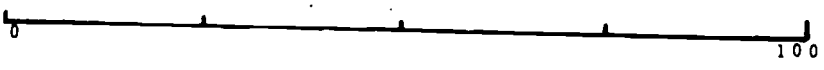
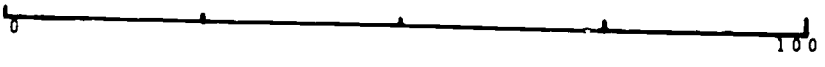
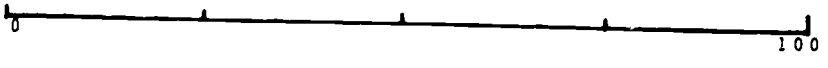
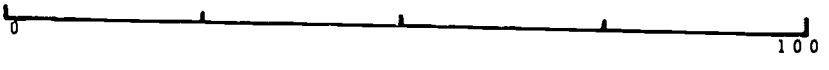
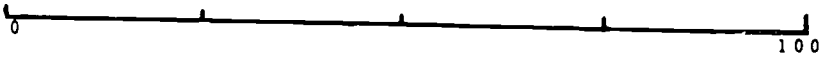
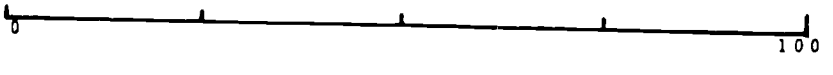
4. Different levels of schooling are listed below next to measuring lines. Please rate the chance that you will stop your regular schooling after completing each level. (Regular school excludes specialized training such as those listed in the next question.)

   Use the same method you used for jobs and income.

   a. Place one check on each line

   b. Place the check so that the farther to the right it is, the higher you think your chance that this is the most education you will get

   c. Since only one grade can be the highest you will ever attend, if you check very high on one, the rest must necessarily be low

REGULAR SCHOOL LEVEL	CHANCE THIS WILL BE HIGHEST LEVEL ATTENDED (Place one check on each line)
High school sophomore	 [5:47]
High school junior	 [5:50]
High school senior	 [5:53]
College freshman	 [5:56]
College sophomore	 [5:59]
College junior	 [5:62]
College senior	 [5:65]
Master's degree	 [5:68]
Ph.D. or professional degree	 [5:71]

5. Different types of special training are listed below next to measuring lines. Please rate the chance that you will complete each one.

   a. Place one check on each line

   b. Place the check so that the farther to the right it is, the higher you think your chance is

   c. Since it is possible that you may complete more than one kind of special educational training, you can have more than one high check

IF YOU HAVE ANY QUESTIONS, PLEASE ASK

TYPE OF SPECIAL SCHOOLING	CHANCE OF COMPLETION (Place one check on each line)
Nursing school (for RN's only)	0 — 100 *[6:08]
Trade or craft such as mechanic, electrician, beautician, etc.	0 — 100 [6:11]
Business or office work	0 — 100 [6:14]
Science or engineering technology such as draftsman	0 — 100 [6:17]
Agricultural school	0 — 100 [6:20]
Home economics school	0 — 100 [6:23]
Real estate	0 — 100 [6:26]
Other, please specify _____ _____	0 — 100 [6:29]

Protocol No. 78B 191
Form 2
Panel 2

The Ohio State University

THE NATIONAL CENTER
FOR RESEARCH IN VOCATIONAL EDUCATION

1960 Kenny Road
Columbus, Ohio 43210

Phone: 614—486-3655
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SURVEY OF YOUTH

PART II

CAREER ASPIRATIONS

SECTION I

QUESTIONS ABOUT YOUR FUTURE CAREER

The questions in this section are about your hopes and expectations for your future career. Please answer every question to the best of your ability, even if you aren't sure.

1. Do you want to go to college? (Please check one.) [1:08]

   [ ] 1. Yes, very much

   [ ] 2. Yes, somewhat

   [ ] 3. Not sure

   [ ] 4. No, prefer not to go

   [ ] 5. No, definitely not

2. What is the highest level of regular school you want to finish? (Please check one.) [1:09-10]

   Level of Regular School

   [ ] 10. High school sophomore

   [ ] 11. High school junior

   [ ] 12. High school graduate

   [ ] 13. College freshman

   [ ] 14. College sophomore

   [ ] 15. College junior

   [ ] 16. College graduate (Bachelor's degree)

   [ ] 17. Master's degree

   [ ] 18. Ph.D. or professional degree such as medicine, law, or dentistry

3. Disregarding what you want, what is the highest level of school you realistically think you will finish? (Please check one.)

[1:11-12]

Level of Regular School

[ ] 10. High school sophomore

[ ] 11. High school junior

[ ] 12. High school graduate

[ ] 13. College freshman

[ ] 14. College sophomore

[ ] 15. College junior

[ ] 16. College graduate (Bachelor's degree)

[ ] 17. Master's degree

[ ] 18. Ph.D. or professional degree such as medicine, law, or dentistry

If you do not expect to continue regular schooling after high school (checked 10, 11, or 12 on the last question), skip to question 5.

4. What subject do you think you most likely will study for your highest level of regular schooling? (Please check one.)

[1:13-14]

[ ] 1. Business and administration
[ ] 2. Agriculture
[ ] 3. Home economics
[ ] 4. Art (painting, sculpture, theater)
[ ] 5. Music
[ ] 6. Biology
[ ] 7. Black studies
[ ] 8. English
[ ] 9. Foreign language
[ ] 10. History
[ ] 11. Philosophy
[ ] 12. Astronomy
[ ] 13. Chemistry
[ ] 14. Mathematics
[ ] 15. Physics
[ ] 16. Statistics
[ ] 17. Anthropology
[ ] 18. Economics
[ ] 19. Political science
[ ] 20. Psychology
[ ] 21. Sociology
[ ] 22. Journalism
[ ] 23. Engineering
[ ] 24. Architecture
[ ] 25. Law
[ ] 26. Medicine
[ ] 27. Dentistry
[ ] 28. Veterinary medicine
[ ] 29. Seminary (preachers, priests, rabbis)
[ ] 30. Pharmacy
[ ] 31. Social work
[ ] 32. Elementary education
[ ] 33. Secondary education
[ ] 34. Other, please specify _____

5. Besides regular schooling, what other type of schooling, if any, do you think you most likely will finish? (Please check one or more.)

Type of Special Schooling

[ ]	0.	None	[1:15]
[ ]	1.	Nursing school (for RN's only)	[1:16]
[ ]	2.	Trade or craft such as mechanic, electrician, beautician, etc.	[1:17]
[ ]	3.	Business or office work	[1:18]
[ ]	4.	Science or engineering technology such as draftsman	[1:19]
[ ]	5.	Agriculture school	[1:20]
[ ]	6.	Home economics school	[1:21]
[ ]	7.	Real estate	[1:22]
[ ]	8.	Other, please specify _____	[1:23]

6. Please list the name and some of the duties of the job that you now think you would most like to have for your main occupation over most of your life.

Name of Occupation	Duties or Tasks of Occupation
_____	_____
_____	_____

[1:24-26]

7. Disregarding what you would like, please list the name and some duties of the job that you think you are most likely to end up in for your main occupation over most of your life.

Name of Occupation	Duties or Tasks of Occupation
_____	_____
_____	_____

[1:27-29]

The next several questions ask about what kind of life-style you think you will follow as you get older.

8. Do you expect that you will get married someday? (Please check one.) [1:30]

[ ] 1. Yes, quite sure I will marry

[ ] 2. Yes, I probably will marry

[ ] 3. Don't know

[ ] 4. No, I probably won't marry

[ ] 5. No, quite sure I won't marry

9. If you do get married, what is the youngest age you think you would be when you marry? [1:31-32]

_____ youngest age

10. What is the oldest age you think you would be when you get married (if you get married)? [1:33-34]

_____ oldest age

11. What is the fewest number of children you think you are likely to have? (If none, write 0.) [1:35-36]

_____ fewest number of children

12. What is the most number of children you think you are likely to have? [1:37-38]

_____ most number of children

13. What relative amount of energy do you expect to devote to your home life and to your work? (Please check one.)

[1:39]

Relative energy devoted to home and to job

[ ] 1. Much more energy devoted to home than to job

[ ] 2. Somewhat more energy devoted to home than to job

[ ] 3. About the same energy devoted to home as to job

[ ] 4. Somewhat less energy devoted to home than to job

[ ] 5. Much less energy devoted to home than to job

The next three questions concern your ideas about your future income. For all these questions, answer as if the VALUE OF THE DOLLAR STAYS THE SAME AS IT IS NOW. All three questions refer to the time in your life when you will make your highest income -- your peak earning years.

14. Assuming you work for pay after leaving home, what is the total income per year you realistically expect to make?

For convenience, each income level is listed as a yearly, monthly, and weekly amount. The figures on each row all give the same amount per year.

[1:40-41]

INCOME RANGES

	$ Per Year	Is the same as:	$ Per Month	$ Per Week
[ ] (1)	Under $4,000		Under $333	Under $77
[ ] (2)	4,000 to 5,999		333 to 499	77 to 114
[ ] (3)	6,000 to 7,999		500 to 666	115 to 152
[ ] (4)	8,000 to 9,999		667 to 832	153 to 191
[ ] (5)	10,000 to 11,999		833 to 999	192 to 229
[ ] (6)	12,000 to 14,999		1,000 to 1,249	230 to 286
[ ] (7)	15,000 to 19,999		1,250 to 1,666	287 to 382
[ ] (8)	20,000 to 24,999		1,667 to 2,082	383 to 479
[ ] (9)	25,000 to 29,999		2,083 to 2,499	480 to 575
[ ] (10)	30,000 to 34,999		2,500 to 2,916	576 to 670
[ ] (11)	35,000 to 39,999		2,917 to 3,332	671 to 766
[ ] (12)	40,000 or more		3,333 or more	767 or more

15. What about your future family income, including possible income of your husband or wife, or income from any other source? What is the highest income per year you realistically expect for your future family income.

For convenience, each income level is listed as a yearly, monthly, and weekly amount. The figures on each row all give the same amount per year.

[1:42-43]

INCOME RANGES

	$ Per Year	Is the same as:	$ Per Month	$ Per Week
[ ] (1)	Under $4,000		Under $333	Under $77
[ ] (2)	4,000 to 5,999		333 to 499	77 to 114
[ ] (3)	6,000 to 7,999		500 to 666	115 to 152
[ ] (4)	8,000 to 9,999		667 to 832	153 to 191
[ ] (5)	10,000 to 11,999		833 to 999	192 to 229
[ ] (6)	12,000 to 14,999		1,000 to 1,249	230 to 286
[ ] (7)	15,000 to 19,999		1,250 to 1,666	287 to 382
[ ] (8)	20,000 to 24,999		1,667 to 2,082	383 to 479
[ ] (9)	25,000 to 29,999		2,083 to 2,499	480 to 575
[ ] (10)	30,000 to 34,999		2,500 to 2,916	576 to 670
[ ] (11)	35,000 to 39,999		2,917 to 3,332	671 to 766
[ ] (12)	40,000 or more		3,333 or more	767 or more

16. Compared to your parents, about how much income do you think you personally will make?

[1:44]

[ ] 1. Much more than my parents

[ ] 2. Somewhat more than my parents

[ ] 3. About the same as my parents

[ ] 4. Somewhat less than my parents

[ ] 5. Much less than my parents

17. What about your future family income including money your wife or husband makes? Compared to your parents, about how much do you think your future family income will be?

[1:45]

[ ] 1. Much more than my parents

[ ] 2. Somewhat more than my parents

[ ] 3. About the same as my parents

[ ] 4. Somewhat less than my parents

[ ] 5. Much less than my parents

18. At the time when you are earning your highest income, would you most likely think of yourself as: (check one)

[1:46]

[ ] 1. Rich

[ ] 2. Well-to-do

[ ] 3. Middle income

[ ] 4. Low-middle income

[ ] 5. Low income

[ ] 6. In poverty, or close to it

INSTRUCTIONS: This set of questions concerns your interest in different kinds of jobs. There are eight questions. You are to check ONE job in EACH question. Make sure it is the BEST ANSWER you can give to this question. Read each question carefully. They are all different. Do not omit any, EVEN IF YOU MUST GUESS.

19. Of the jobs listed in this question, which is the BEST ONE you are REALLY SURE YOU CAN GET when your SCHOOLING IS OVER?

[1:47-48]

[ ] 1. Lawyer

[ ] 2. Welfare worker for a city government

[ ] 3. United Stated Representative in Congress

[ ] 4. Corporal in the Army

[ ] 5. U.S. Supreme Court Justice

[ ] 6. Night watchman

[ ] 7. Sociologist

[ ] 8. Policeman

[ ] 9. County agricultural agent

[ ] 10. Filling station attendant

20. Of the jobs listed in this question, which ONE would you choose if you were FREE TO CHOOSE ANY of them you wished when your SCHOOLING IS OVER? [1:49-50]

[ ] 1. Member of the board of directors of a large corporation

[ ] 2. Undertaker

[ ] 3. Banker

[ ] 4. Machine operator in a factory

[ ] 5. Physician (doctor)

[ ] 6. Clothes presser in a laundry

[ ] 7. Accountant for a large business

[ ] 8. Railroad conductor

[ ] 9. Railroad engineer

[ ] 10. Singer in a night club

21. Of the jobs listed in this question, which is the BEST ONE you are REALLY SURE YOU CAN GET when your SCHOOLING IS OVER?

[1:51-52]

[ ] 1. Nuclear physicist

[ ] 2. Reporter for a daily newspaper

[ ] 3. County judge

[ ] 4. Barber

[ ] 5. State Governor

[ ] 6. Soda fountain clerk

[ ] 7. Biologist

[ ] 8. Mail carrier

[ ] 9. Official of an international labor union

[ ] 10. Farm hand

22. Of the jobs listed in this question, which ONE would you choose if you were FREE TO CHOOSE ANY of them you wished when your SCHOOLING IS OVER? [1:53-54]

[ ] 1. Psychologist

[ ] 2. Manager of a small [illegible] n a city

[ ] 3. Head of a departmen[illegible] state government

[ ] 4. Clerk in a store

[ ] 5. Cabinet member in the federal government

[ ] 6. Janitor

[ ] 7. Musician in a symphony orchestra

[ ] 8. Carpenter

[ ] 9. Radio announcer

[ ] 10. Coal miner

23. Of the jobs listed in this question, which is the BEST ONE you are REALLY SURE YOU CAN HAVE by the time you are 30 YEARS OLD? [1:55-56]

[ ] 1. Civil engineer

[ ] 2. Bookkeeper

[ ] 3. Minister or priest

[ ] 4. Streetcar motor man or city bus driver

[ ] 5. Diplomat in the United States Foreign Service

[ ] 6. Sharecropper (one who owns no livestock or farm machinery and does not manage the farm)

[ ] 7. Author of novels

[ ] 8. Plumber

[ ] 9. Newspaper columnist

[ ] 10. Taxi driver

24. Of the jobs listed in this question, which ONE would you choose to have when you are 30 YEARS OLD, if you were FREE TO HAVE ANY of them you wished?

[1:57-58]

[ ] 1. Airline pilot

[ ] 2. Insurance agent

[ ] 3. Architect

[ ] 4. Milk route man

[ ] 5. Mayor of a large city

[ ] 6. Garbage collector

[ ] 7. Captain in the army

[ ] 8. Garage mechanic

[ ] 9. Owner-operator of a printing shop

[ ] 10. Railroad section hand

25. Of the jobs listed in this question, which is the BEST ONE you are REALLY SURE YOU CAN HAVE by the time you are 30 YEARS OLD?

[1:59-60]

[ ] 1. Artist who paints pictures that are exhibited in galleries

[ ] 2. Traveling salesman for a wholesale concern

[ ] 3. Chemist

[ ] 4. Truck driver

[ ] 5. College professor

[ ] 6. Street sweeper

[ ] 7. Building contractor

[ ] 8. Local official of a labor union

[ ] 9. Electrician

[ ] 10. Restaurant waiter

26. Of the jobs listed in this question, which ONE would you choose to have when you are 30 YEARS OLD, if you were FREE TO CHOOSE ANY of them you wished?

[1:61-62]

[ ] 1. Owner of a factory that employs about 100 people

[ ] 2. Playground director

[ ] 3. Dentist

[ ] 4. Lumberjack

[ ] 5. Scientist

[ ] 6. Shoe shiner

[ ] 7. Public school teacher

[ ] 8. Owner-operator of a lunch stand

[ ] 9. Trained machinist

[ ] 10. Dock worker

27. Last year at school, did you participate on a <u>regular basis</u> in any of the activities listed below? Please check all those you participated in.

[ ] None [1:63]

[ ] Band or orchestra [1:64]

[ ] Choir or chorus [1:65]

[ ] Drama (school plays, etc.) [1:66]

[ ] School paper or yearbook [1:67]

[ ] Language club (such as French, Spanish, German) [1:68]

[ ] Hobby or interest club (such as photography, chess, radio) [1:69]

[ ] Service activities (such as stage hand, band manager, athletic manager) [1:70]

[ ] Member of student government or class officer [1:71]

[ ] Academic honor club [1:72]

[ ] Intramural athletics [1:73]

Interschool athletics:

[ ] Basketball [1:74]

[ ] Football [1:75]

[ ] Baseball [1:76]

[ ] Track [1:77]

[ ] Soccer [1:78]

[ ] Swimming [2:08]

[ ] Wrestling [2:09]

[ ] Other interschool athletics [2:10]

[ ] Other activities, Please list: [2:11]

1. _____

2. _____

3. _____

SECTION II

QUESTIONS ABOUT OTHER PEOPLE'S ATTITUDES TOWARD YOUR CAREER

28. Do you think your parents want you to go to college? Please check one for your mother on the left and one for your father on the right.

[2:12] [2:13]

Mother	Father		
[ ]	[ ]	1.	Yes, very much
[ ]	[ ]	2.	Yes, somewhat
[ ]	[ ]	3.	Neither yes nor no
[ ]	[ ]	4.	No, prefer I not go
[ ]	[ ]	5.	No, strongly opposed

29. Have your parents shared their desires with you by encouraging or discouraging you from going to college? Please check one for your mother on the left and one for your father on the right.

[2:14] [2:15]

Mother	Father		
[ ]	[ ]	1.	Strongly discouraged
[ ]	[ ]	2.	Discouraged somewhat
[ ]	[ ]	3.	Neither discouraged nor encouraged
[ ]	[ ]	4.	Encouraged somewhat
[ ]	[ ]	5.	Strongly encouraged

30. Would you say that in your home it is just taken for granted that you will go to college? Please check one.

[2:16]

[ ] 1. Yes

[ ] 2. Not sure

[ ] 3. No

31. During the past year, about how often would you say you have discussed going to college with your parents? Please check one on the left for your mother and one on the right for your father.

[2:17] [2:18]

Mother	Father		
[ ]	[ ]	(1)	Hardly at all, if ever
[ ]	[ ]	(2)	2 or 3 times
[ ]	[ ]	(3)	4 to 6 times
[ ]	[ ]	(4)	at least 7 times, but less than once a month
[ ]	[ ]	(5)	average once a month or more

32. What is the highest grade of regular school that you think each of your parents expects you to finish? Please check one on the left for your mother and one on the right for your father.

[2:19-20] [2:21-22]

Mother	Father		Level of Regular School
[ ]	[ ]	10.	High school sophomore
[ ]	[ ]	11.	High school junior
[ ]	[ ]	12.	High school graduate
[ ]	[ ]	13.	College freshman
[ ]	[ ]	14.	College sophomore
[ ]	[ ]	15.	College junior
[ ]	[ ]	16.	College graduate (Bachelor's degree)
[ ]	[ ]	17.	Master's degree
[ ]	[ ]	18.	Ph.D. or professional degree such as medicine, law, or dentistry

33. If you had to guess, what would you say is the highest grade in regular school most of your high school friends might think you will finish? (Please check one.)

[2:23-24]

Level of Regular School

[ ] 10. High school sophomore

[ ] 11. High school junior

[ ] 12. High school graduate

[ ] 13. College freshman

[ ] 14. College sophomore

[ ] 15. College junior

[ ] 16. College graduate (Bachelor's degree)

[ ] 17. Master's degree

[ ] 18. Ph.D. or professional degree such as medicine, law, or dentistry

34. Referring to jobs that you might have as your main occupation over most of your life, please list the name and duties of one occupation for each of the following cases. Don't leave any blank, even if you have to guess.

a. Occupation your mother expects is the most likely one you will end up in

_____ _____
name of occupation duties or tasks of occupation

[2:25-27]

b. Occupation your father expects is the most likely one you will end up in

_____ _____
name of occupation duties or tasks of occuaption

[2:28-30]

c. Occupation you think most of your high school friends would be least surprised to find you in

_____ _____
name of occupation duties or tasks of occupation

[2:31-33]

35. If you had to guess, what would you say is the highest yearly income each of your parents thinks you will ever make? Please check one on the left for your mother and one on the right for your father.

For convenience, each income level is listed as a yearly, monthly, and weekly amount. The figures on each row all give the same amount per year.

[2:34-35] [2:36-37]

INCOME RANGES

Mother	Father		$ Per Year	Is same as: $ Per Month	$ Per Week
[ ]	[ ]	(1)	Under $4,000	Under $333	Under $77
[ ]	[ ]	(2)	4,000 to 5,999	333 to 499	77 to 114
[ ]	[ ]	(3)	6,000 to 7,999	500 to 666	115 to 152
[ ]	[ ]	(4)	8,000 to 9,999	667 to 832	153 to 191
[ ]	[ ]	(5)	10,000 to 11,999	833 to 999	192 to 229
[ ]	[ ]	(6)	12,000 to 14,999	1,000 to 1,249	230 to 286
[ ]	[ ]	(7)	15,000 to 19,999	1,250 to 1,666	287 to 382
[ ]	[ ]	(8)	20,000 to 24,999	1,667 to 2,082	383 to 479
[ ]	[ ]	(9)	25,000 to 29,999	2,083 to 2,499	480 to 575
[ ]	[ ]	(10)	30,000 to 34,999	2,500 to 2,916	576 to 670
[ ]	[ ]	(11)	35,000 to 39,999	2,917 to 3,332	671 to 766
[ ]	[ ]	(12)	40,000 or more	3,333 or more	767 or more

SECTION III

WHAT YOU THINK OTHERS YOUR AGE ARE PLANNING

36. Referring to the people your own age who are your friends, which of the statements below best describes your guess about how many of them plan to go to college? (Check one only.)

[2:38]

[ ] (1) 75% or more

[ ] (2) 50% to 75%

[ ] (3) 25% to 50%

[ ] (4) less than 25%

37. What is the highest level of regular school that you think most of your teenage friends will complete? Please check one. We realize you can't be sure about this; we just want whatever ideas you have.

[2:39-40]

Level of Regular School

[ ] 10. High school sophomore

[ ] 11. High school junior

[ ] 12. High school graduate

[ ] 13. College freshman

[ ] 14. College sophomore

[ ] 15. College junior

[ ] 16. College graduate (Bachelor's degree)

[ ] 17. Master's degree

[ ] 18. Ph.D. or professional degree such as medicine, law, or dentistry

38. Please list the name of an occupation that you would not be surprised to see some of your friends have as their main occupation over most of their lives. Also, please describe the main duties or tasks that people do in this occupation. Again, we realize that you cannot be sure about this; we just want whatever ideas you have.

	Name of Occupation	Duties of Tasks of this Occupation
1.	_____	_____
	_____	_____

[2:41-43]

39. Do you think most of your high school friends will be (check one):
[2:44]

[ ] 1. Rich

[ ] 2. Well-to-do

[ ] 3. Middle income

[ ] 4. Low-middle income

[ ] 5. Low income

[ ] 6. Poverty stricken or close to it

40. In your major subjects (like English, math, or history) at school, how good a student would you say you are? (Check one.)

[2:45-46]

[ ] 1. A+

[ ] 2. A

[ ] 3. A-

[ ] 4. B+

[ ] 5. B

[ ] 6. B-

[ ] 7. C+

[ ] 8. C

[ ] 9. C-

[ ] 10. D+

[ ] 11. D

[ ] 12. D-

[ ] 13. Below D-

41. What type of school curriculum do you consider yourself to be in? Please check one.

[2:47]

[ ] Vocational education

[ ] College preparation

[ ] General education (or other)

SECTION IV

BACKGROUND INFORMATION

Although the questions in this section are not directly related to your future career, they are vitally important to us. Please answer every question, even if you are not sure.

For all questions about your mother and father, please answer for the persons who are most like parents to you whether or not they are your real mother and father.

42. Please list your age in the blank.

_____

[2:48-49]

43. To the best of your knowledge, what is the highest grade of regular school your mother and your father each finished and got credit for? Please check one on the left for your mother and one on the right for your father.

Mother	Father		Level of Regular School
[ ]	[ ]	0.	Less than 1st grade
[ ]	[ ]	1.	1st grade
[ ]	[ ]	2.	2nd grade
[ ]	[ ]	3.	3rd grade
[ ]	[ ]	4.	4th grade
[ ]	[ ]	5.	5th grade
[ ]	[ ]	6.	6th grade
[ ]	[ ]	7.	7th grade
[ ]	[ ]	8.	8th grade
[ ]	[ ]	9.	High school freshman
[ ]	[ ]	10.	High school sophomore
[ ]	[ ]	11.	High school junior
[ ]	[ ]	12.	High school graduate
[ ]	[ ]	13.	College freshman
[ ]	[ ]	14.	College sophomore
[ ]	[ ]	15.	College junior
[ ]	[ ]	16.	College graduate (Bachelor's degree)
[ ]	[ ]	17.	Master's degree
[ ]	[ ]	18.	Ph.D. or professional degree such as medicine, law, or dentistry

[2:50-51] [2:52-53]

44. What is the name of your father's main occupation or job? (If he is not working now, write the name of his last job.)

[2:54-56]

Describe a little about what your father does (did) on this job. That is, what are some of his main duties?

45. What is the name of your mother's main occupation or job? (If she is not working now, write the name of her last job.)

[2:57-59]

Describe a little about what your mother does (did) on this job. That is what are some of her main duties?

46. To the best of your knowledge, what will be your total family income this year? Please check one box beside the appropriate income range. For convenience, each income level is listed as a yearly, monthly, and weekly amount. The figures on each line all give the same income for a year.

NOTE: Total family income includes all income made by any family member living in your home. It includes not only wages and salaries, but also income from any other place, such as rent, interest, business profits, child support, or welfare payments.

[2:60-61]

INCOME RANGES

		$ Per Year	Is the same as:	$ Per Month	$ Per Week
[ ]	(1)	Under $4,000		Under $333	Under $77
[ ]	(2)	4,000 to 5,999		333 to 499	77 to 114
[ ]	(3)	6,000 to 7,999		500 to 666	115 to 152
[ ]	(4)	8,000 to 9,999		667 to 832	153 to 191
[ ]	(5)	10,000 to 11,999		833 to 999	192 to 229
[ ]	(6)	12,000 to 14,999		1,000 to 1,249	230 to 286
[ ]	(7)	15,000 to 19,999		1,250 to 1,666	287 to 382
[ ]	(8)	20,000 to 24,999		1,667 to 2,082	383 to 479
[ ]	(9)	25,000 to 29,999		2,083 to 2,499	480 to 575
[ ]	(10)	30,000 to 34,999		2,500 to 2,916	576 to 670
[ ]	(11)	35,000 to 39,999		2,917 to 3,332	671 to 766
[ ]	(12)	40,000 or more		3,333 or more	767 or more

47. Please estimate your parents' ability to help pay for your college or other education after high school if you decide to go. (Check one.) [2:62]

[ ] 1. They can easily afford it

[ ] 2. They can afford it, but would have to sacrifice

[ ] 3. They cannot afford it at all

48. Please list the age of each of your brothers in the space below. If you're not sure, take a guess. (Include half brothers and anyone living with you who is like a brother to you.)

Age of each brother:

____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

[3:09-10] [3:11-43]

49. Please list the age of each of your sisters in the space below. If you're not sure, take a guess. (Include half sisters and anyone living with you who is like a sister to you.)

Age of each sister:

____ ____ ____ ____ ____ ____ ____ ____ ____ ____ ____

[3:44-45] [3:46-78]

50. Go back to the previous two questions and circle the ages of brothers and sisters who have not lived with you over the past year. If none, check here [ ].

Your time and effort in filling out this survey is invaluable to us. Thank you very much.

Protocol No. 78B 191
Forms, 3, 5
Panel 2

OSU

The Ohio State University

THE NATIONAL CENTER
FOR RESEARCH IN VOCATIONAL EDUCATION

1960 Kenny Road
Columbus, Ohio 43210

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ESTIMATING THE CHANCES

PARENT'S FORM

This survey continues the research on career aspirations in which you participated last winter. That initial phase of the study has been very successful, due in large part to your cooperation. To accomplish our major goal of studying changes in career aspirations, however, your continued participation is critical. We thank you for agreeing to this second home visit.

Please recall that when these questionnaires leave your home, no one will be allowed to see how you answered any question -- your answers are strictly confidential. DO NOT put your name on any questionnaire.

Again, thank you for helping us.

We recognize that it is hard for you to be sure about your child's future career. In this questionnaire, therefore, we ask you to estimate the chance that your son or daughter will obtain different occupational, educational and income options. Of course, you may not be sure about the chances either, but please give us your best guess for every question.

OCCUPATIONS

1. The next few pages contain a list of jobs with a line to the right of each job. We want you to use the line to guess the chance that each job will be your son's or daughter's main job for most of his or her life.

   Look at some of the questions to see how they are laid out, then read the directions below:

   a. Put one check on each line
   b. Place the check so that the farther to the right it is, the higher the chance that this occupation will be his or her main job
   c. Don't worry if most of your checks are near zero, this is normal

NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Military officer [1:08]	0 — 100
Military enlisted person, not an officer [1:11]	0 — 100

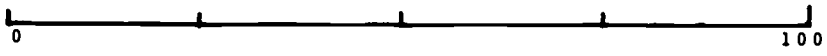
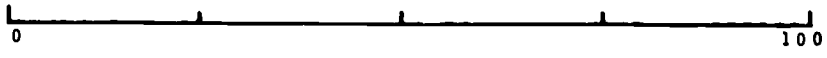
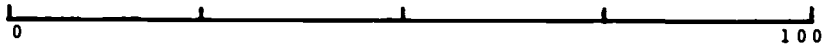
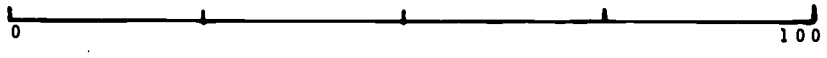
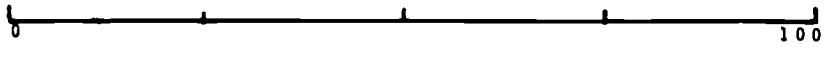
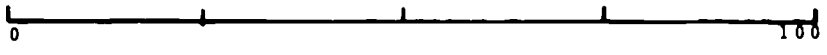
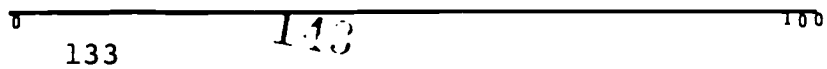
NOTE: The remaining are civilian jobs only.

Accountant [1:14]	0 — 100
Architect [1:17]	0 — 100
Computer specialist (such as programmer) [1:20]	0 — 100

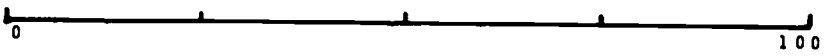
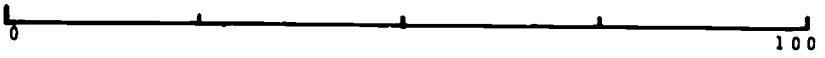
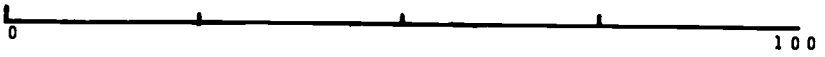
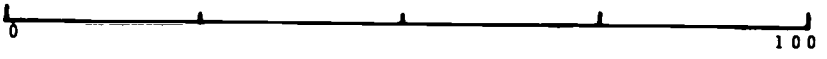
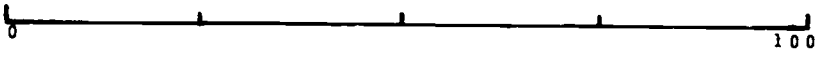
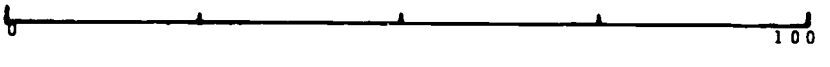
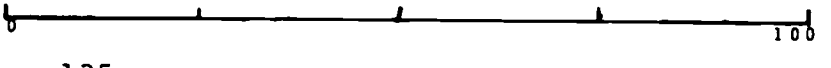
NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Forester or conservationist [1:23]	0 — 100
Judge [1:26]	0 — 100
Librarian or curator [1:29]	0 — 100
Physical scientist such as geologist or astronomer, but not an engineer, or a college professor [1:32]	0 — 100
Engineer such as chemical engineer or electrical engineer, but not a college professor [1:35]	0 — 100
Social scientist, such as psychologist, economist, or sociologist, but not a college professor [1:38]	0 — 100
Biological or agricultural scientist, but not a college professor [1:41]	0 — 100
Lawyer (but not a college professor) [1:44]	0 — 100
Physical, speech, or occupational therapist [1:47]	0 — 100

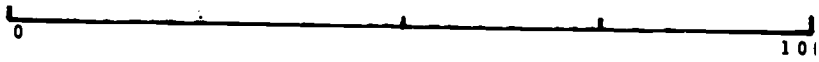
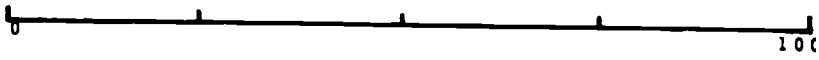
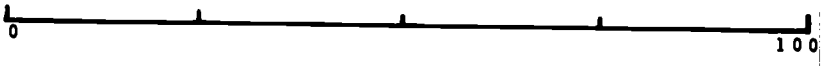
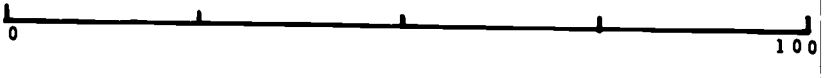
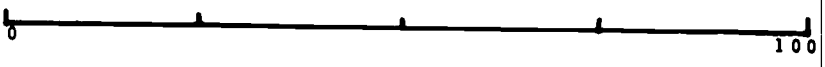
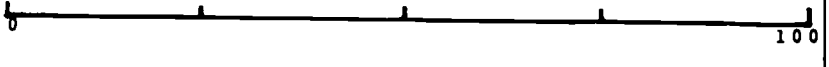
NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Airplane pilot [1:50]	0 — 100
Air traffic controller or radio operator [1:53]	0 — 100
Flight engineer [1:56]	0 — 100
Designer, including designer of clothes, pottery, rugs, interior decorating, glassware [1:59]	0 — 100
Bank officer or financial manager [1:62]	0 — 100
Funeral director or embalmer [1:65]	0 — 100
Inspector such as building safety inspector or bank examiner [1:68]	0 — 100
Writer or author (fiction or nonfiction), journalist, reporter, editor, public relations person or publicity writer [1:71]	0 — 100
Postmaster or mail superintendent, sales manager, or health administrator [1:74]	0 — 100

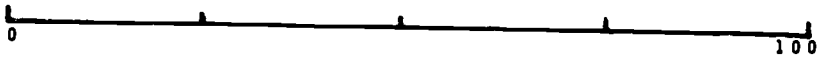
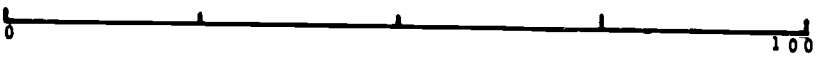
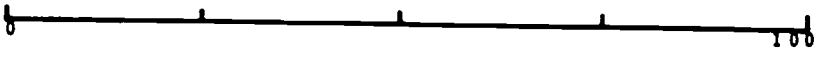
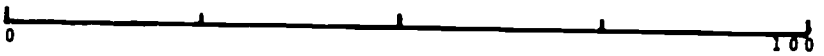
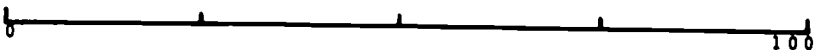
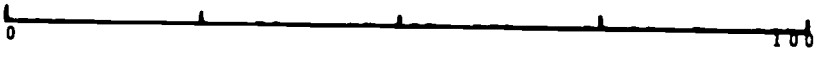
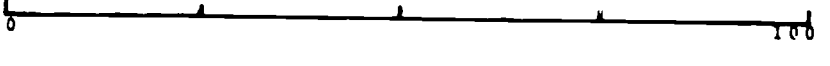
NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Railroad conductor, officer, or pilot of a ship, building manager or superintendent [1:77]	0 — 100
Storekeeper or restaurant, cafeteria, or bar manager *[2:08]	0 — 100
Corporation executive or college administrator such as college dean [2:11]	0 — 100
Receptionist or office machine operator such as computer, keypunch or telephone operator [2:14]	0 — 100
Clerical work such as file clerk, postal clerk, or stock clerk [2:17]	0 — 100
Blacksmith or boilermaker [2:20]	0 — 100
Operator of earth moving machinery and other heavy machinery such as bulldozer, grader, or crane [2:23]	0 — 100
Carpentry work such as cabinet maker or housebuilder [2:26]	0 — 100

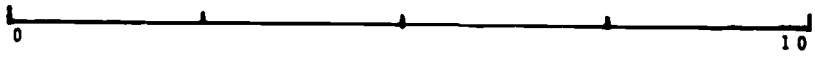
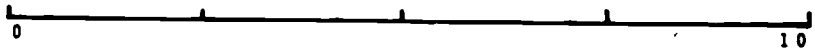
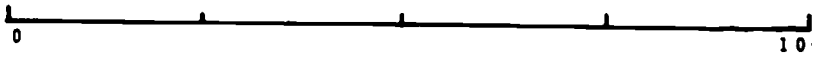
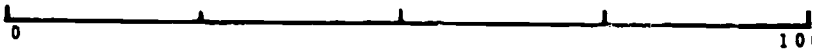
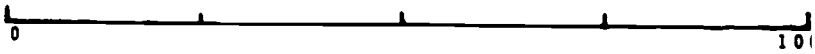
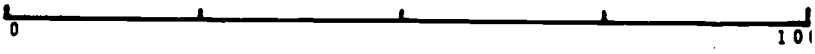
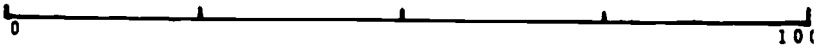
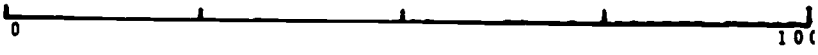
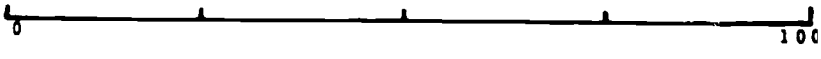
NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Bookbinder or typesetter in a print shop or related work [2:29]	
Jeweler, watchmaker, machinist, optician, grinder, or polisher [2:32]	
Tailor or upholsterer [2:35]	
Tool and die maker [2:38]	
Garage worker or gas station attendant [2:41]	
Meatcutter, butcher, baker, or related work [2:44]	
Operator of a precision machine such as lathe, drillpress, milling machine, or grinder [2:47]	
Textile worker such as weaver [2:50]	
High school or grade school administrator such as principal or superintendent [2:53]	
Other administrator or manager such as union officer, office manager [2:56]	
Labor negotiator (but not a union officer) [2:59]	

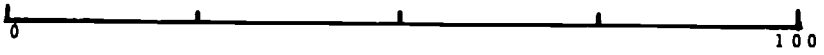
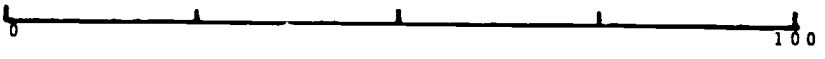
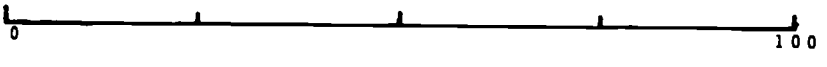
NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Bank teller, cashier in a store, or bookkeeper [2:62]	0 — 100
Vehicle dispatcher, such as taxicabs or police cars [2:65]	0 — 100
Insurance adjuster, examiner, or investigator [2:68]	0 — 100
Mail carrier, deliveryman, routeman or reader of gas or electric meters [2:71]	0 — 100
Auctioneer [2:74]	0 — 100
Insurance agent or underwriter [2:77]	0 — 100
Real estate agent or appraiser *[3:08]	0 — 100
Stock and bond salesman [3:11]	0 — 100
Sales clerk in a store or other salesperson [3:14]	0 — 100
Medical secretary [3:17]	0 — 100
Secretary or stenographer (except medical secretary) [3:20]	0 — 100

NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Railroad brakeman or railroad switchman [3:23]	
Garbage collector [3:26]	
Longshoreman, stevedore, sailor, or deckhand [3:29]	
Lumberman or related work such as working in a sawmill or miner, such as coal miner or other mine work [3:32]	
Operator of a machine such as riviter, photo developer, welder or other type of worker [3:35]	
Farmer or farm manager, farm foreman [3:38]	
Farm laborer or self-employed farm service worker such as sheep shearer or combine operator [3:41]	
Cleaning service worker in a business such as a hotel but not a private home -- such as janitor, cleaning woman, maid [3:44]	
Office messenger, telegraph messenger, newsboy or newsgirl, or peddler [3:47]	

NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Food service worker such as bartender, busboy in a hotel, dishwasher, food counter or fountain worker or waiter or waitress [3:50]	
Protective service worker such as fireman, policeman, detective, sheriff, or bailiff [3:53]	
Worker in a family home -- such as cook, child care worker, housekeeper, maid, or butler [3:56]	
Personal service worker such as airline stewardess baggage porter or bellhop, barber, boarding and lodging housekeeper, elevator operator, hairdresser or cosmetologist, usher [3:59]	
Medical doctor or dentist [3:62]	
Registered nurse or dietitian [3:65]	
Optometrist (eye doctor) [3:68]	
Pharmicist or druggist [3:71]	
Veterinarian [3:74]	

NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Technical work related to health care, such as radiologic assistant, dental hygienist, therapy assistant, or laboratory technician [3:77]	
Chiropractor, podiatrist (foot doctor) *[4:08]	
Minister, priest, or rabbi (or other clergyman) [4:11]	
Other religious worker [4:14]	
Social worker or recreation worker [4:17]	
Elementary school teacher (including Kindergarten and preschool) [4:20]	
High school teacher, vocational or educational counselor [4:23]	
Teacher aide [4:26]	
Other type of teacher [4:29]	
Science technician, surveyor, or draftsman [4:32]	

NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Health service worker with no college training such as practical nurse, medical technician, or dental assistant [4:35]	
Locomotive engineer or fireman [4:38]	
Auto mechanic or repairman of heavy equipment [4:41]	
Household appliance, radio, television, or other mechanic or repairman [4:44]	
Motion picture projectionist [4:47]	
House painter or plasterer [4:50]	
Piano or organ tuner or repairman [4:53]	
Brick layer, electrician, plumber or related work [4:56]	
Sheetmetal worker or tinsmith [4:59]	
Shoe repairman or shoemaking machine operator [4:62]	

NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Sign painter or letterer [4:65]	
College teacher or professor of sciences such as: physics, chemistry, astronomy, mathematics, geology, biology, agriculture, medicine, dentistry, pharmacy, or veterinary medicine [4:68]	
College teacher or professor of nonsciences such as: psychology, economics, sociology, political science, law, history, English, language, education, business, commerce, industrial arts, sport coach or physical education, art, drama, music [4:71]	
Entertainer or artist such as actor, dancer, musician, composer, painter, sculptor, photographer, radio or TV announcer, professional athlete [4:74]	
Skilled or semiskilled craftsman, such as carpet installer, wallpaper hanger, foreman, telephone installer, repairman or lineman [4:77]	

NAME OF JOB	CHANCE YOUR CHILD WILL BE IN THIS JOB (Place one check on each line)
Transport equipment operator such as parking attendant, bus driver, conductor or motorman on mass rail transport, taxicab driver, chauffer, or truck driver *[5:08]	0 100

SECTION II

INCOME

3. Different income ranges are listed below next to lines. Please rate the chance that each of the income ranges includes the highest total yearly income (not just take-home pay) your child will ever make. Assume the VALUE OF THE DOLLAR DOESN'T CHANGE.

Use the same method you did for jobs.

a. Put one check on each line

b. Place the check so that the farther to the right it is, the higher your child's chance that this will be the most he or she will ever make

c. Since only one income range can include the highest income your child will ever make, if you check very high on one, the rest necessarily must be low

IF YOU HAVE ANY QUESTIONS, PLEASE ASK

$ PER YEAR	CHANCE THIS IS THE HIGHEST INCOME YOUR CHILD WILL EVER MAKE (Place one check on each line)	
Under $4,000	0 — 100	[5:11]
4,000 - 5,999	0 — 100	[5:14]
6,000 - 7,999	0 — 100	[5:17]
8,000 - 9,999	0 — 100	[5:20]
10,000 - 11,999	0 — 100	[5:23]
12,000 - 14,999	0 — 100	[5:26]
15,000 - 19,999	0 — 100	[5:29]
20,000 - 24,999	0 — 100	[5:32]
25,000 - 29,999	0 — 100	[5:35]
30,000 - 34,999	0 — 100	[5:38]
35,000 - 39,999	0 — 100	[5:41]
40,000 - or more	0 — 100	[5:44]

SECTION III

EDUCATION

4. Different levels of schooling are listed below next to measuring lines. Please rate the chance that your child will stop regular schooling after completing each level. (Regular school excludes specialized training such as those listed in the next question.)

   Use the same method you used for jobs and income.

   a. Place <u>one</u> check on <u>each</u> line

   b. Place the check so that the farther to the right it is, the <u>higher</u> you think your chance that this is the most education your child will get

   c. Since only one grade can be the highest your child will ever attend, if you check very high on one, the rest must necessarily be low

REGULAR SCHOOL LEVEL	CHANCE THIS WILL BE HIGHEST LEVEL ATTENDED (Place <u>one</u> check on <u>each</u> line)	
High school sophomore	0 — 100	[5:47]
High school junior	0 — 100	[5:50]
High school senior	0 — 100	[5:53]
College freshman	0 — 100	[5:56]
College sophomore	0 — 100	[5:59]
College junior	0 — 100	[5:62]
College senior	0 — 100	[5:65]
Master's degree	0 — 100	[5:68]
Ph.D. or professional degree	0 — 100	[5:71]

5. Different types of special training are listed below next to measuring lines. Please rate the chance that your child will complete each one.

   a. Place one check on each line

   b. Place the check so that the farther to the right it is, the higher you think your child's chance is

   c. Since it is possible to complete more than one kind of special educational training, you can have more than one high check

IF YOU HAVE ANY QUESTIONS, PLEASE ASK

TYPE OF SPECIAL SCHOOLING	CHANCE OF COMPLETION (Place one check on each line)
Nursing school (for RN's only)	0 — 100 *[6:08]
Trade or craft such as mechanic, electrician, beautician, etc.	0 — 100 [6:11]
Business or office work	0 — 100 [6:14]
Science or engineering technology such as draftsman	0 — 100 [6:17]
Agricultural school	0 — 100 [6:20]
Home economics school	0 — 100 [6:23]
Real estate	0 — 100 [6:26]
Other, please specify _____ _____	0 — 100 [6:29]

Protocol No. 78B 191
Form 4/6
Panel 2

The Ohio State University

THE NATIONAL CENTER
FOR RESEARCH IN VOCATIONAL EDUCATION

1960 Kenny Road
Columbus, Ohio 43210

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SURVEY OF MOTHERS (FATHERS)
(or female guardians)

CAREER ASPIRATIONS

SECTION I

QUESTIONS ABOUT YOUR SON OR DAUGHTER'S FUTURE

The questions in this section are about your hopes and expectations for the future career of your son or daughter. Please answer every question to the best of your ability, even if you are not sure.

1. Do you want your child to go to college? (Please check one.) [1:08]

   [ ] 1. Yes, very much

   [ ] 2. Yes, somewhat

   [ ] 3. Haven't made up my mind

   [ ] 4. No, prefer he or she didn't go

   [ ] 5. No, strongly opposed

2. Have you mentioned your desires to your child by encouraging or discouraging him/her from going to college? (Please check one.) [1:09]

   [ ] 1. Strongly discouraged

   [ ] 2. Discouraged somewhat

   [ ] 3. Neither discouraged nor encouraged

   [ ] 4. Encouraged somewhat

   [ ] 5. Strongly encouraged

3. Would you say that in your home it is just taken for granted that your child will go to college? (Please check one.) [1:10]

   [ ] 1. Yes

   [ ] 2. Not sure

   [ ] 3. No

4. About how often during the past year would you say you have discussed going to college with your child? (Please check one.)

[1:11]

[ ] (1) Hardly at all, if ever

[ ] (2) 2 or 3 times

[ ] (3) 4 to 6 times

[ ] (4) At least 7 times, but less than once a month

[ ] (5) Average once a month or more

5. What is the highest level of regular school you want your son or daughter to finish? (Please check one.)

[1:12-13]

Level of Regular School

[ ] 10. High school sophomore

[ ] 11. High school junior

[ ] 12. High school graduate

[ ] 13. College freshman

[ ] 14. College sophomore

[ ] 15. College junior

[ ] 16. College graduate (Bachelor's degree)

[ ] 17. Master's degree

[ ] 18. Ph.D. or professional degree such as medicine, law, or dentistry

6. Disregarding what you would like, what is the highest level of school you realistically think your son or daughter will finish? (Please check one.)

[1:14-15]

Level of Regular School

[ ] 10. High school sophomore

[ ] 11. High school junior

[ ] 12. High school graduate

[ ] 13. College freshman

[ ] 14. College sophomore

[ ] 15. College junior

[ ] 16. College graduate (Bachelor's degree)

[ ] 17. Master's degree

[ ] 18. Ph.D. or professional degree such as medicine, law, or dentistry

If you don't expect your son or daughter to attend college (checked 10, 11, or 12), skip to question 8.

7. What subject do you think your son or daughter most likely will study for his or her highest level of schooling. (Please check one.)
[1:16-17]

[ ] 1. Business and Administration
[ ] 2. Agriculture
[ ] 3. Home economics
[ ] 4. Art (painting, sculpture, theater)
[ ] 5. Music
[ ] 6. Biology
[ ] 7. Black studies
[ ] 8. English
[ ] 9. Foreign language
[ ] 10. History
[ ] 11. Philosophy
[ ] 12. Astronomy
[ ] 13. Chemistry
[ ] 14. Mathematics
[ ] 15. Physics
[ ] 16. Statistics
[ ] 17. Anthropology
[ ] 18. Economics
[ ] 19. Political science
[ ] 20. Psychology
[ ] 21. Sociology
[ ] 22. Journalism
[ ] 23. Engineering
[ ] 24. Architecture
[ ] 25. Law
[ ] 26. Medicine
[ ] 27. Dentistry
[ ] 28. Veterinary medicine
[ ] 29. Seminary (preachers, priests, rabbis)
[ ] 30. Pharmacy
[ ] 31. Social work
[ ] 32. Elementary education
[ ] 33. Secondary education
[ ] 34. Other, please specify

_____

8. Besides regular schooling, what other types of schooling, if any, do you think your child most likely will finish? Check as many as apply.

Type of Special Schooling

[ ] 0. None [1:18]

[ ] 1. Nursing school (for RN's only) [1:19]

[ ] 2. Trade or craft such as mechanic, electrician, beautician, etc. [1:20]

[ ] 3. Business or office work [1:21]

[ ] 4. Science or engineering technology such as draftsman [1:22]

[ ] 5. Agriculture school [1:23]

[ ] 6. Home economics school [1:24]

[ ] 7. Real estate [1:25]

[ ] 8. Other, please specify _____ [1:26]

9. Please list the name and some of the duties of the job that you think you would most like to see your son/daughter have as a main occupation of his/her life.

Name of Occupation	Duties of Occupation

[1:27-29]

10. Disregarding what you would like, please list the name and some of the duties of the job that you think your son/daughter is most likely to end up in as a main occupation over most of his/her life.

Name of Occupation	Duties of Occupation

[1:30-32]

11. Do you expect that your son or daughter will get married? (Please check one.)

[1:33]

[ ] 1. Yes, quite sure my child will marry

[ ] 2. Yes, my child probably will marry

[ ] 3. Don't know

[ ] 4. No, my child probably won't marry

[ ] 5. No, quite sure my child won't marry

12. If your son or daughter gets married, what is the youngest age you think he/she will be?

[1:34-35]

_____ youngest age

13. What is the oldest age you think he/she will be.

[1:36-37]

_____ oldest age

14. What is the fewest number of children you expect your son or daughter will have? (If none, write 0.)

[1:38-39]

_____ fewest number of children

15. What is the largest number of children you expect he/she will have?

[1:40-41]

_____ largest number of children

16. What relative amount of energy would you expect your child will devote to home life and to work? (Please check one.)

[1:42]

Relative energy devoted to home and to job

[ ] 1. Much more energy devoted to home than to job

[ ] 2. Somewhat more energy devoted to home than to job

[ ] 3. About the same energy devoted to home as to job

[ ] 4. Somewhat less energy devoted to home than to job

[ ] 5. Much less energy devoted to home than to job

The next three questions concern your ideas about your child's future income. For all these questions, answer as if the VALUE OF THE DOLLAR STAYS THE SAME AS IT IS NOW. All three questions refer to the time in your child's life when he/she will make the most income -- the peak earnings years.

17. Assuming your child works for pay after leaving home, what is the total income per year you think he/she will make? For convenience, each income level is listed as a yearly, monthly, and weekly amount. The figures on each row all give the same income for a year. (Please check one below.)

[1:43-44]

INCOME RANGES

	$ Per Year	Is the same as:	$ Per Month or	$ Per Week
[ ] (1)	Under $4,000		Under $333	Under $77
[ ] (2)	4,000 to 5,999		333 to 499	77 to 114
[ ] (3)	6,000 to 7,999		500 to 666	115 to 152
[ ] (4)	8,000 to 9,999		667 to 832	153 to 191
[ ] (5)	10,000 to 11,999		833 to 999	192 to 229
[ ] (6)	12,000 to 14,999		1,000 to 1,249	230 to 286
[ ] (7)	15,000 to 19,999		1,250 to 1,666	287 to 382
[ ] (8)	20,000 to 24,999		1,667 to 2,082	383 to 479
[ ] (9)	25,000 to 29,999		2,083 to 2,499	480 to 575
[ ] (10)	30,000 to 34,999		2,500 to 2,916	576 to 670
[ ] (11)	35,000 to 39,999		2,917 to 3,332	671 to 766
[ ] (12)	40,000 or more		3,333 or more	767 or more

18. What about your child's future family income, including possible income from a wife or husband, or income from any other source. What is the highest income per year you think your son or daughter realistically will have? For convenience, each income level is listed as a yearly, monthly, and weekly amount. The figures on each row all give the same income for a year. (Please check one below.)

[1:45-46]

INCOME RANGES

	$ Per Year	Is the same as:	$ Per Month or	$ Per Week
[ ]	(1) Under $4,000		Under $333	Under $77
[ ]	(2) 4,000 to 5,999		333 to 499	77 to 114
[ ]	(3) 6,000 to 7,999		500 to 666	115 to 152
[ ]	(4) 8,000 to 9,999		667 to 832	153 to 191
[ ]	(5) 10,000 to 11,999		833 to 999	192 to 229
[ ]	(6) 12,000 to 14,999		1,000 to 1,249	230 to 286
[ ]	(7) 15,000 to 19,999		1,250 to 1,666	287 to 382
[ ]	(8) 20,000 to 24,999		1,667 to 2,082	383 to 479
[ ]	(9) 25,000 to 29,999		2,083 to 2,499	480 to 575
[ ]	(10) 30,000 to 34,999		2,500 to 2,916	576 to 670
[ ]	(11) 35,000 to 39,999		2,917 to 3,332	671 to 766
[ ]	(12) 40,000 or more		3,333 or more	767 or more

19. At the time when your child is earning his/her highest income, would you think he/she most likely will be: (check one)

[1:47]

[ ] 1. Rich

[ ] 2. Well-to-do

[ ] 3. Middle income

[ ] 4. Low-middle income

[ ] 5. Low income

[ ] 6. In poverty, or close to it

INSTRUCTIONS: This set of questions concerns your interest in different kinds of jobs for your son or daughter.

There are eight questions. You are to check ONE job in EACH question. Make sure it is the BEST ANSWER you can give to this question.

Read each question carefully. They are all different. Do not omit any, EVEN IF YOU MUST GUESS.

20. Of the jobs listed in this question, which is the BEST ONE you are REALLY SURE HE/SHE CAN GET when his/her SCHOOLING IS OVER.

[1:48-49]

[ ] 1. Lawyer

[ ] 2. Welfare worker for a city government

[ ] 3. United States Representative in Congress

[ ] 4. Corporal in the Army

[ ] 5. United States Supreme Court Justice

[ ] 6. Night watchman

[ ] 7. Sociologist

[ ] 8. Policeman

[ ] 9. County agricultural agent

[ ] 10. Filling station attendant

21. Of the jobs listed in this question, which ONE would you most like to see him/her have if he/she were FREE TO CHOOSE ANY of them he/she wished when his/her SCHOOLING IS OVER?

[1:50-51]

[ ] 1. Member of the board of directors of a large corporation

[ ] 2. Undertaker

[ ] 3. Banker

[ ] 4. Machine operator in a factory

[ ] 5. Physician (doctor)

[ ] 6. Clothes presser in a laundry

[ ] 7. Accountant for a large business

[ ] 8. Railroad conductor

[ ] 9. Railroad engineer

[ ] 10. Singer in a night club

22. Of the jobs listed in this question, which is the BEST ONE you are REALLY SURE HE/SHE CAN GET when his/her SCHOOLING IS OVER?

[1:52-53]

[ ] 1. Nuclear physicist

[ ] 2. Reporter for a daily newspaper

[ ] 3. County judge

[ ] 4. Barber

[ ] 5. State governor

[ ] 6. Soda fountain clerk

[ ] 7. Biologist

[ ] 8. Mail carrier

[ ] 9. Official of an international labor union

[ ] 10. Farm hand

23. Of the jobs listed in this question, which ONE would you most like to see him/her have if he/she were FREE TO CHOOSE ANY of them he/she wished when his/her SCHOOLING IS OVER?

[1:54-55]

[ ] 1. Psychologist

[ ] 2. Manager of a small store in a city

[ ] 3. Head of a department in state government

[ ] 4. Clerk in a store

[ ] 5. Cabinet member in the federal government

[ ] 6. Janitor

[ ] 7. Musician in a symphony orchestra

[ ] 8. Carpenter

[ ] 9. Radio announcer

[ ] 10. Coal miner

24. Of the jobs listed in this question, which is the BEST ONE you are REALLY SURE HE/SHE CAN GET by the time he/she is 30 YEARS OLD?

[1:56-57]

[ ] 1. Civil engineer

[ ] 2. Bookkeeper

[ ] 3. Minister or priest

[ ] 4. Streetcar motorman or city bus driver

[ ] 5. Diplomat in the United States Foreign Service

[ ] 6. Sharecropper (one who owns no livestock or farm machinery, and does not manage the farm)

[ ] 7. Author of novels

[ ] 8. Plumber

[ ] 9. Newspaper columnist

[ ] 10. Taxi driver

25. Of the jobs listed in this question, which ONE would you like to see him/her have when he/she is 30 YEARS OLD, if he/she were FREE TO CHOOSE ANY of them he/she wished?

[1:58-59]

[ ] 1. Airline pilot

[ ] 2. Insurance agent

[ ] 3. Architect

[ ] 4. Milk route man

[ ] 5. Mayor of a large city

[ ] 6. Garbage collector

[ ] 7. Captain in the Army

[ ] 8. Garage mechanic

[ ] 9. Owner-operator of a printing shop

[ ] 10. Railroad section hand

26. Of the jobs listed in this question, which is the BEST ONE you are REALLY SURE HE/SHE CAN HAVE by the time he/she is 30 YEARS OLD?

[1:60-61]

[ ] 1. Artist who paints pictures that are exhibited in galleries

[ ] 2. Traveling salesman for a wholesale concern

[ ] 3. Chemist

[ ] 4. Truck driver

[ ] 5. College professor

[ ] 6. Street sweeper

[ ] 7. Building contractor

[ ] 8. Local official of a labor union

[ ] 9. Electrician

[ ] 10. Restaurant waiter

27. Of the jobs listed in this question, which ONE would you like to see him/her have when he/she is 30 YEARS OLD, if he/she were FREE TO HAVE ANY of them he wished?

[1:62-63]

[ ] 1. Owner of a factory that employs about 100 people

[ ] 2. Playground director

[ ] 3. Dentist

[ ] 4. Lumberjack

[ ] 5. Scientist

[ ] 6. Shoeshiner

[ ] 7. Public school teacher

[ ] 8. Owner-operator of a lunch stand

[ ] 9. Trained machinist

[ ] 10. Dock worker

SECTION II

BACKGROUND INFORMATION

Although the questions in this section are not directly related to your child's future, they are vitally important to us. Please answer every question even if you are not sure.

28. Are you now married, widowed, divorced, separated, or have you never been married?

[1:64]

[ ] 1. Now married

[ ] 2. Widowed (husband died and you have not remarried)

[ ] 3. Divorced (and not remarried since)

[ ] 4. Separated (legal)

[ ] 5. Never married (include annulment here)

NOTE: If your husband lives away from home for business reasons, consider yourself "now married" rather than "separated".

29. Please check the highest level of regular school you have finished and gotten credit for?

[1:65-66]

Level of Regular School

[ ] 0. Less than 1st grade

[ ] 1. 1st grade

[ ] 2. 2nd grade

[ ] 3. 3rd grade

[ ] 4. 4th grade

[ ] 5. 5th grade

[ ] 6. 6th grade

[ ] 7. 7th grade

[ ] 8. 8th grade

[ ] 9. High school freshman

[ ] 10. High school sophomore

[ ] 11. High school junior

[ ] 12. High school graduate

[ ] 13. College freshman

[ ] 14. College sophomore

[ ] 15. College junior

[ ] 16. College graduate (Bachelor's degree)

[ ] 17. Master's degree

[ ] 18. Ph.D. or professional degree such as medicine, law, or dentistry

30. Are you now employed, a homemaker, a student, or what? Please check as many as apply to you.

[ ] 1. Working fulltime for pay (either in your home or outside your home) [1:67]

[ ] 2. Working parttime for pay (either in your home or outside your home) [1:68]

[ ] 3. In school (at least half time) [1:69]

[ ] 4. Keeping house [1:70]

[ ] 5. Retired [1:71]

[ ] 6. Other, please specify _____ [1:72]

31. What is your present main occupation or job called? [1:73-75]

_____

_____

Describe a little about what you do in this job. That is, what are some of your main duties or tasks?

_____

_____

32. Do you work for yourself or someone else? (Consider that you work for yourself if you work for a corporation in which you own 15% or more of the stock.) (Please check one.) [1:76]

[ ] 1. Work for someone else

[ ] 2. Work for myself in my own professional practice (such as law or medicine)

[ ] 3. Work for myself in my own business (except professional practice)

If you work for someone else, skip to question 34.

33. If you work for yourself, how many people work for you and are paid by you? If none, write 0.

[2.08-12]

_____ number who work for you

34. How many paid workers do you personally supervise on a regular basis as part of your job? If none, write 0.

[2:13-17]

_____ number of persons you supervise

The next question asks about your family income this year. We only want a range, not an exact amount. Remember, your answers will never be shown to anyone -- they are strictly confidential.

35. To the best of your knowledge, which income range below includes your total family income for 1979? Please check one of the boxes. For convenience, each income level is listed as a yearly, monthly, and weekly amount. The figures on each row all give the same income for a year.

[2:18-19]

NOTE: Total family income includes all income made by any family member living in your home. It includes not only wages and salaries, but also income from any other place, such as rent, interest, business profits, child support, or welfare payments.

INCOME RANGES

	$ Per Year	Is the same as:	$ Per Month or	$ Per Week
[ ] (1)	Under $4,000		Under $333	Under $77
[ ] (2)	4,000 to 5,999		333 to 499	77 to 114
[ ] (3)	6,000 to 7,999		500 to 666	115 to 152
[ ] (4)	8,000 to 9,999		667 to 832	153 to 191
[ ] (5)	10,000 to 11,999		833 to 999	192 to 229
[ ] (6)	12,000 to 14,999		1,000 to 1,249	230 to 286
[ ] (7)	15,000 to 19,999		1,250 to 1,666	287 to 382
[ ] (8)	20,000 to 24,999		1,667 to 2,082	383 to 479
[ ] (9)	25,000 to 29,999		2,083 to 2,499	480 to 575
[ ] (10)	30,000 to 34,999		2,500 to 2,916	576 yo 670
[ ] (11)	35,000 to 39,999		2,917 to 3,332	671 to 766
[ ] (12)	40,000 or more		3,333 or more	767 or more

Your time and care in answering these questions have been invaluable to us. Thank you very much.

APPENDIX B

INSTRUMENTATION, DATA COLLECTION, AND CODING

Introduction

This appendix provides detailed explication of (1) instrumentation, (2) data collection procedures, and (3) data coding and correction procedures used during the first and second measurement points of the study. The discussions are intended as an aid in understanding and evaluating project findings and as a resource to other researchers involved in the collection and coding of occupational data.

Instrumentation

The time-one and two instruments are almost identical; both contain closed-ended and open-ended items, measuring occupational and nonoccupational variables. Some items are borrowed from previous studies and some are original. The items are contained in a total of six questionnaire booklets (forms). One pair each is designed for students, mothers, and fathers. The first booklet of each pair (forms 1, 3, and 5) is entitled "Estimating the Chances" and contains three groups of original items called subjective probability questions. These items measure occupational, educational, and income expectations of the student. The second of each pair, "Survey of Career Aspirations" (forms 2, 4, and 6), contains original and borrowed items providing occupational information concerning the student (e.g., additional expectation and aspiration data, significant other information) and nonoccupational information (e.g., sex, age, and number of siblings).

Instructions for completing booklets are provided in written form. Those for booklets 1, 3, and 5, containing subjective-probability questions, are designed to be read to the respondent by the interviewer. Those for booklets 2, 4, and 6 are designed to be read independently by the respondent. Approximately 15 minutes each is required for completion of booklets 1, 3, and 5; 40 minutes each for booklets 2, 4, and 6. Thus, each respondent in a family spends about 55 minutes at each administration of the instruments.

Time-two instruments are reproduced in Appendix A of this report. Time-one instruments may be found in Appendix A of the interim report (Hotchkiss and Chiteji, 1979). Location information for instrumet items discussed below refers to the time-two instruments.

The following discussion is divided into four sections. The first section explains the types of questionnaire items. Section two describes the reactions of respondents and coders to selected items. Section three deals with procedures and issues related to development of the time-one instruments and their revision for

time-two. Discussions of questionnaire items and respondent and coder development preceed discussion of instrument development due to the fact that knowledge of instrument items and respondent and coder reactions is necessary for understanding of procedures used in developing and revising the instruments. The fourth section comprises a separate discussion devoted to the subjective probability instrument explaining procedures used in developing and revising the instrument as well as respondent and coder reactions. This discussion is separate from the discussions of other items due to the uniqueness and special significance of the subjective probability instrument to the study.

Types of Questionnaire Items

Discussion of closed-ended items (subjective probabilities excluded) is presented first followed by discussion of open-ended items. Each discussion includes a description of item format, instructions to respondents, instructions to coders and a summary of those items in which changes were made for the panel two instruments.

Closed-ended questions. The most prominent sequence of closed-ended questions comprise the Occupational Aspiration Scale (OAS). As explained in the text, the form of the OAS used in this study is the original version developed by Haller (Haller and Miller 1971), validated by nationwide tests for use with both male and female youth. In the OAS [form 2, items 19-26 and forms 4 and 6, items 20-27] eight lists containing ten job titles each are presented to the youth and parents. The youth is asked to select from each list that job which he or she really wants to have ("...if you were free to choose any of them you wished.") or the job he or she feels certain of being able to obtain ("...best one you are really sure you can get"). Similarly, parents are asked to select the jobs they feel their son or daughter would really like to have and the jobs they feel he or she could really get.

Except for the OAS and subjective-probability items, closed-ended questions elicit nonoccupational information. Most consist of a stem followed by a sequence of numbered response alternatives. Respondents place checkmarks in boxes adjacent to the one or more alternatives reflecting their opinion or situation.

Coding procedures for closed-ended questions differ depending on whether one, or more than one, response by respondents is permitted. If only one response is allowed, coders usually record the numerical precode used in numbering the response alternative. In the following discussions, these questions are referred to as precoded questions. Most of the closed-ended questions in the instruments are precoded.

For those questions in which respondents may check more than one alternative, coders record a 1 or 0 for each response alternative, dependent on whether it has been checked or not by the respondent. These questions are referred to (in the following discussions) as binary-code questions. The following items in the time-two instruments are binary code questions: form 2, items 5 and 27; forms 4 and 6; items 8 and 30.

The time-two instruments contain five closed-ended items not included in the time-one instruments. These items measuring youth's own income expectations (form 2, item 14), youth's expectations for future family income (form 2, item 15), youth's perception of his or her parents' expectations for youth's future income (form 2, item 35), and parental income expectations regarding youth and youth's spouse (forms 4 and 6, items 17 and 18), replace open-ended items used to measure the same variables at time one. A reproduction of one of these closed-ended items (item 14, form 2 measuring youth's own income expectations), and the open-ended item (time one) that it replaces are provided below. The formats of all the other income expectations questions for times one and two are identical to the closed-ended and open-ended formats shown below.

Time-Two Youth Income Expectations Question (form 2, Item 14):

Assuming you work for pay after leaving home, what is the total income per year you realistically expect to make?

For convenience, each income level is listed as a yearly, monthly, and weekly amount. The figures on each row all give the same amount per year.

INCOME RANGES

	$ Per Year	Is the same as:	$ Per Month	$ Per Week
[ ]	(1) Under $4,000		Under $333	Under $77
[ ]	(2) 4,000 to 5,999		333 to 499	77 to 114
	.			
	.			
	.			
[ ]	(3) 40,000 or more		3,333 or more	767 or more

Time-One Youth Income Expectations Question:

Assuming you work for pay after you leave home, what is the total income per year you think you will make? Please give us two estimates -- first, the lowest this figure might realistically be; and second, the highest this figure might be.

Between $_____ and $_____
(lowest) (highest)

The time-one version shown above required respondents to write in their lowest and highest income expectations. Coding involved recording the figures. The design of this and the other time-one youth income expectations questions was changed due to difficulties encountered during coding of the time-one items (e.g., entries such as $59,00.000). The same closed-ended, precoded format used for obtaining current family income data was substituted. Coding of the revised item was the same as for other precoded items.

A few closed-ended items are eliminated in the time-two instruments. These items record information assumed to be stable across measurement points (e.g., sex and race).

Open-ended questions. Most of the open-ended questions elicit occupation-related information. Form 2, items 6, 7, 34, and 38; and forms 4 and 6, items 9 and 10 of the time-two instruments elicit occupational expectation and aspiration information concerning the youth and his or her friends. Form 2, items 44 and 45; and forms 4 and 6, item 31 of the time-two instruments elicit parents' current job information (job title and description). Additional open-ended occupational questions contained in the time-one instruments only, concern parents' past (5 years previous) jobs and the industry of parents' current and past jobs. These items are omitted from the time-two instruments.

All of the above open-ended occupation and industry questions contain two parts. In the first, the respondent lists a job title or name of business; in the second, the respondent gives a job or industry description. Items recording parents' current and past jobs constitute a modified version of the U.S. Bureau of the Census occupation/industry questionnaire item.

The remaining open-ended questions elicit nonoccupational information such as ages and dates. In responding to these questions, individuals are asked to write a response, usually a number, on a blank provided.

Although most of the nonoccupational open-ended questions in the time-one instrument were retained in the time-two instruments, two groups were revised or replaced completely. (Reasons for the changes are given in the discussions of respondent reactions and instrument development.) As mentioned previously, a closed-ended format was substituted for time-one open-ended items measuring youth income expectations (see time-one instruments: form 2, items 25, 26, and 44; and forms 4 and 6, items 38 and 39). A second group of questions in the time-one instruments, the open-ended items for enumerating members of the household (forms 4 and 6, item 20) and family (forms 4 and 6, item 21) were also changed in the time-two instruments. The format used for the two time-one items and that used for the time-two replacements (three items) are reproduced below.

Time-One Household Membership Question
(Forms 4 and 6, Item 20)
(same format is used for family membership question, item 21):

We are interested in knowing a little about your family and the people who live in your house.

> Would you tell us the age of each person, including yourself, now living in your home, their sex, and relationship to [name of youth].

Age of each person living in your house	Sex of this person		Relationship to [name of youth]:
	Male	Female	
yourself: _____	_____	_____	_____
_____	_____	_____	_____
.	.	.	
.	.	.	

Time-Two Revision (Household and Family Enumeration Questions)
(form 2 items 48, 49 and 50)

(Form 2, Items 48/49):

Please list the age of each of your brothers (item 48)/sisters (item 49) in the space below. If you're not sure take a guess. (Include half brothers/sisters and anyone living with you who is like a brother/sister to you.)

Age of each brother/sister:

__ ___ ___ ___ ___ ___ ___ ___ ___ ____ ___ ___ ___ ___ ___

Go back to the previous two questions and circle the ages of brothers and sisters who have not lived with you over the past year. If none, check here [ ].

In the time-one items, parents only are asked to list the name, age, sex, and relationship to the high school student of all individuals in the household and family. Interviewers wrote the name of the teen-age respondent on the line where "[name of youth]" appears in the reproduction of the item.[22] In the time-two items, youth only are provided with two sets of blanks on which they write in the ages of all brothers and sisters, respectively. The ages of those siblings not residing with the youth during the previous year are then circled.

Coding of the time-one items required direct transfer of age data and the assignment and recording of codes for sex and relationship. Coding of the wave-two items involved transfer of age data and the recording of codes to indicate whether each age had or had not been circled by the respondent.

Respondent and Coder Reactions to Instrument Items

The following discussions relate the specific comments (verbal and written) and behaviors (response rates, response and coding difficulties) of respondents and coders. Respondent reactions to closed-ended items (subjective probabilities

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22. The term "interviewer" is used throughout this report in referring to those individuals hired to oversee completion of questionnaires in respndents' homes.

excluded) are discussed first, followed by reactions to open-ended items. Specific information reported includes: figures compiled from interviewer statements of respondent reaction (reported in interviewer evaluation forms), selected response rates, verbal comments from interviewers regarding respondent reactions, and comments written by respondents noted in the questionnaire booklets. A final discussion relates coder reaction to items.

Respondent reactions to closed-ended items (subjective probabilities excluded). Tables 11 and 12 list the response rates for all items with lower than a 90 percent response rate during either time one or time two. As evidenced in the tables, the response rate for most OAS items was consistently lower than for other items. Students, mothers, and fathers were all equally as likely not to answer OAS items. Reasons for the lower response rates are suggested in respondent comments found in questionnaire booklets. Respondents of both sexes often commented that they found it hard to answer some OAS questions because the lists contained no jobs that they would consider. Many females expressed specific objection to what they considered the sexist nature of the lists' contents: too few jobs appropriate for females. The fact that the authors of such comments often failed to answer some or all parts of the OAS series suggests evidence that such sentiments may have been a general reason behind the lower OAS response rates. Additional indication of respondent reaction to the OAS came from interviewers. Eighty-four percent of the interviewers completing a study evaluation form at the end of time one called the OAS the most hostilely greeted questions and 38 percent called it the most difficult to answer. At the end of time two, 77 percent reported it the most hostilely greeted and 35 percent, the most difficult to answer.

The closed-ended youth income expectations questions used in the time-two instrument were the second largest group of items with a lower than 90 percent response rate. These items had been substituted for the open-ended youth income expectations questions used in the time-one instrument. In explaining the low response rate [which did not occur with the open-ended items (time one)], it might be speculated that respondents were confused (or intimidated) by the presence of three columns of income figures contained in these items (see page 166). Response rates for two of the three current family income questions employing this same design were also below 90 percent during time two (as indicated in Table 12), although other explanations might be suggested in these cases (e.g., sensitivity of people, in general, regarding questions about current income).

Respondent reactions to open-ended items. There was only one open-ended item for which the response rate was less than 90

percent during either time one or time two: the time-one open-ended household membership question. (A reproduction of this item and the items substituted in time two appear on page 168.) The purpose of the two time-one items and the three time-two items was to obtain information about household membership, family membership, sibling order, and number and ages of brothers and sisters using a minimum of questionnaire items, thereby conserving space and reducing respondent burden.

Respondent behavior, however, indicated a lack of clarity in instructions, in question design, or both. In addition to failing to answer the questions, respondents often gave incorrect data, the most common being parents reporting a household or family member's relationship to themselves instead of the requested relationship to the youth. As reported previously, these two items were revised for the time-two instruments. The revised items (see page 169) were easier for respondents.

Respondent behavior regarding the time-one open-ended youth income expectation questions (see page 167) deserve mention even though their response rates were not low. Typical responses to these open-ended items included figures entered in reverse order, e.g., the higher estimate on the blank provided for the lower estimate; figures in which decimal points or commmas had been misplaed (e.g., $5000,00; $5000.0); and figures representing unusually low yearly income estimates (possibly the result of misplaced decimal points), e.g., 90.00 dollars. Such entries presented problems during coding. The closed-ended items substituted in the time-two instruments successfully eliminated most of the coding problems but resulted in a lower response rate as noted in Table 12 and in the discussion of reactions to closed-ended items.

Although not reflected in response rates, there was some evidence of respondent difficulty with open-ended occupation and industry questions during times one and two. Interviewer comments explaining these difficulties point to the common but hard to remedy problem regarding open-ended questions: the reluctance of respondents to give specific and complete replies.

Coder reaction to closed-ended and open-ended items (subjective probabilities excluded). There was no evidence of coder problems with the OAS nor most other precoded questions. Problems did occur in coding binary code questions. Coders sometimes miscoded these items by following rules designated for coding precoded questions rather than rules for binary-code items. The similarity in format of the two types of questions is believed to be the source of the problem. Both the relatively

small number of binary-code items and the overall low error rate (on all coding) reduce concern about the overall affect of this type of error on the data.

Instrument Development and Revision

Except for subjective-probability items, most questionnaire items were borrowed from or patterned after items used in previous studies. A few items, however, were designed especially for this study. Procedures used for locating borrowed items, in designing original items (subjective probabilities excluded), and in revising items between the first and second waves of the survey, are briefly summarized below. The pilot test used to pretest questionnaire items is described in a later section on data collection procedures.

Procedures used to identify extant items depended on a literature search of more than 62 publications. Through this method, staff obtained the exact wordings of questions and response alternatives used to measure career planning variables in previous research. Approximately 250 questionnaire items from 36 data sets for 60 variables were found. Project staff compiled a 69-page reference book of items and reviewed all items to select the most desirable constructions for inclusion in the current study.

Procedures used in designing original items included the usual deliberations associated with question design and need no elaboration here. Design of the subjective probability instrument is discussed later.

Procedures used in revising time-one items for the time-two instruments were less formal than those used in original instrument development.

In addition to the revision or replacement of extant items, instrument revision prior to time two involved deliberation regarding adding new items to measure additional variables.

Subjective Probability Instrument

This section of the appendix is devoted exclusively to discussion of the subjective probability instrument. Details concerning format and method of responding to and coding responses; respondent and coder reactions; and instrument development are presented. The subjective probability instrument (questionnaire booklets 1, 3, and 5) permits sensitive measurement of

TABLE 11

TIME-ONE ITEMS WITH RESPONSE RATES LOWER THAN 90 PERCENT

Item Description	Item Location (for time-one instrument)	Response Rate
Youth's OAS #3	Form 2, item 30	88.66%
Youth's OAS #4	Form 2, item 31	84.03
Youth's OAS #5	Form 2, item 32	83.75
Youth's OAS #7	Form 2, item 34	85.71
Youth's OAS #8	Form 2, item 35	85.15
Mother's OAS #4	Form 4, item 44	87.11
Mother's OAS #5	Form 4, item 45	85.71
Mother's OAS #6	Form 4, item 46	82.77
Mother's OAS #7	Form 4, item 47	85.01
Mother's OAS #8	Form 4, item 48	84.45
Father's OAS #5	Form 6, item 45	88.80
Father's OAS #6	Form 6, item 46	87.50
Father's OAS #7	Form 6, item 47	86.49
Father's OAS #8	Form 6, item 48	82.07
Household Enumeration Question: age, sex, and relationship to youth of female adult in the home	Form 4, item 20	88.45

TABLE 12

TIME-TWO ITEMS WITH RESPONSE RATES LOWER THAN 90 PERCENT

Item Description	Item Location	Response Rate
Youth's income expectation	Form 2, item 14	87.[illegible]
Youth's income expectation for self plus future spouse	Form 2, item 15	83.23
Youth's OAS #3	Form 2, item 21	86.26
Youth's OAS #4	Form 2, item [illegible]2	84.19
Youth's OAS #5	Form 2, item [illegible]	84.03
Youth's OAS #7	Form 2, item [illegible]	85.30
Youth's OAS #8	Form 2, item 26	85.78
Youth's perception of mother's income expectation for youth	Form 2, item 35	86.26
Youth's perception of pectation for youth	Form 2, item 35	77.64
Youth report of current family income	Form 2, item 46	84.82
Mother's income expectation for youth	Form 4, item 17	88.70
Mother's income expectation for youth and		
Mother's OAS #5	Form 4, item 24	86.84
Mother's OAS #6	Form 4, item 25	87.01
Mother's OAS #7	Form 4, Item 26	88.36
Mother's OAS #8	Form 4, item 27	89.71
Father's expectation for youth's major	Form 6, item 7	81.03
Father's OAS #3	Form 6, item [illegible]2	88.99
Father's OAS #6	Form 6, item 25	88.99
Father's OAS #7	[illegible]rm 6, item 26	87.15
Father's OAS #8	[illegible]orm 6, item 27	89.90
Father's report of current family income	Form 6, item 35	78.89

uncertainty data. In the current study, subjective probability items are used to measure occupational, educational, and income expectations of the youth and of the parents for the youth.

Format and instructions to respondents and coders. For each subjective-probability question, a list of outcomes (school grade levels, types of jobs, or salary ranges) appears on the left side of the page. To the right of each of these items there appears a horizontal line marked 0 percent and 100 percent at the left and right ends of the line, respectively. Respondents are instructed to place a checkmark on each line at the point on the line that indicates what respondents feel their chance is of accomplishing the particular outcome indicated on the left.

In coding subjective probability responses, coders use a 100-point scaled ruler to measure the distance between the checkmark and the 0 point on the line. This two-digit number is recorded on the code sheet in preparation for keypunching. Accuracy of measurement within 2 points is required.

Respondent and coder reaction. Respondent behavior regarding subjective-probability questions merits special attention since this is the first time that this type of question has been used. Although it is not possible to report figures based on a systematic check, unsystematic evidence suggests that some respondents may not have understood instructions to section II (income expectations) and section III (regular education expectations) in the subjective probability booklets (see Appendix A, form 1, pages 13 and 14 for examples).

Section II in the subjective-probability booklets asks each respondent to rate, for each of the income ranges listed, the chance that each range includes the "highest total yearly income" that the youth will ever make. Section III requires each respondent to rate, for each of the school levels listed, the chance that each level of schooling will be the highest level that the youth will complete (that the youth will stop after completing that level). A few cases were noted in which a respondent's checkmarks began at or near 100 percent for the lowest level of education or income ("high school sophomore" or "under $4,000.00"), and descended in value as the education or income level ascended. Although inconclusive as evidence of misunderstanding, such a pattern suggests that some respondents interpreted the question to mean: "What is the chance that you will achieve at least the amount of education or income listed on the left?" A computer adjustment for this pattern, however, produced negligible changes in correlations.

interviewers reported other evidence, too varied to list, of either time-one or two was affected by the problems regarding instructions. Difficulty with instructions to the occupation section of the subjective probability instrument was less evident. Further, the high correlations achieved with the subjective probability items (see Chapter 4 and Appendix C) indicate that such difficulties were not excessive.

The length of the subjective probability occupation checklist (over 90 occupational groups, 11 pages) was the source of some concern during planning (see discussion in section on development of the subjective probability instrument). No negative reactions to the checklist however, were noted. Response time ranged from approximately 10 minutes to approximately 20 minutes for all subjective-probability questions in each set.

Coding of the subjective probabilities was tedious and time consuming; however, no serious problems were observed. Coding time exceeded response time, averaging approximately 30 minutes.

Development of subjective probability instrument. The following discussion focuses on issues involved in planning the subjective-probability questions. The issues presented are those considered most crucial to assuring their quality as effective alternatives to conventionally formated questions; they relate to the following three elements: (1) the number line, (2) the checklist of occupations (occupation subjective-probability question), and (3) design of instructions for answering the subjective-probability questions. Following discussion of the issues, description of three pretest sessions conducted to test subjective-probability items is presented.

(1) Number line. In the final instrument, only two of the percentage points on each number line are labeled (the 0 percent and 100 percent values). In designing the number lines, project staff considered marking each line at several percentage points (such as 0, 10, 20, ...), or, on the other hand, not marking any of the percentage points. Although it was conceded that the former system would create greater ease in response and coding, project staff feared the possibility that numerous percentage-point labels might influence respondents to cluster their responses at the labeled points. The effect would be to destroy the continuous feature of the number line, reducing subjective-probability questions to discrete-category items.

The idea of omitting number lines completely and providing blanks for respondents to write percentage figures for their subjective probabilities was also considered. This idea was

tested during pretest sessions, students preferred the number line.

(2) Occupation checklist. Creating a checklist for the subjective-probability occupation question constituted a major problem during the planning operation. Logic underlying probability theory dictates the need for an exhaustive list; practicalities and concern about respondent fatigue suggest the need for as short a list as possible. The 1970 Census Bureau list of occupations offers important advantages. First, it purports to be comprehensive, and the titles are mutually exclusive. Secondly, much descriptive information, including Duncan SEI scores, is available for the census titles. The list contains over 400 titles, however; project staff had reservations about using such a long list. On the other hand, staff were skeptical of the validity of schemes to shorten the list. Partly as a result of this dilemma staff experimented with the alternative of omitting the checklist and allowing respondents to write in titles for those jobs that they had considered. During pretests conducted with high school students, both systems were tried; students expressed preference for the checklist. Since the checklist requires less coding time and students preferred it, project staff undertook the difficult task of collapsing census titles into a list of usable length. The technique used was to group together in single categories those titles similar in type and in Duncan SEI scores. For the time-one instrument the result was the reduction of the 400-item census list to a list containing 93 occupational groups. In addition, space was provided at the end of the list for respondents to write in titles of any jobs they felt had not been included in the checklist. Prior to the time-two data collection, the list was revised resulting in 97 occupational groups.

(3) Instructions for subjective-probability questions. Another problem was the issue of how to explain to respondents the method of answering these questions. Ideas considered by staff included verbal instructions provided by interviewers, written instructions printed in the text, and combination of both. Alternatives ranged from simple plans involving practice examples to more elaborate plans involving test-like situations or hands-on instructional aids. Project staff experimented with some of these ideas during the pre and pilot tests. The major concerns throughout were the fear of intimidating respondents and concern regarding clarity and uniformity of instructions across all respondents.

Concern for uniformity caused staff to prefer written instructions but pretest and pilot test experiences revealing that respondents do not always read instructions led staff to

consider verbal directions from interviewers. The important concern regarding the possibility of intimidating respondents, however, cautioned staff against allowing the verbal component to assume connotations of a test of respondents' intelligence.

The method of instruction used for time one was restricted in both length and complexity, relying on what is believed to be the intuitive notion that most individuals have about "chances": (1) the interviewer read or explained instructions to respondents based on a written script; (2) respondents completed a practice example provided in the questionnaire booklet; (3) the interviewer examined the respondents' response to practice examples; (4) the interviewer interpreted to respondents the meaning of the responses and asked if the interpretation were correct. If a respondent reported that the interviewer's interpretation were inaccurate, the respondent was asked to explain to the interviewer what he or she meant by the response. The interviewer then explained to the respondent how the question should have been checked. For time-two, instruction procedures were not as rigidly prescribed, as all respondents were familiar with the method.

Subjective-probability pretests. Project staff conducted three pretests on the subjective-probability instrument in local public high schools containing students from a range of backgrounds. All pretests focused on three issues: (1) format and design of the subjective-probability questions, (2) instructions, and (3) response time.

In pretesting instructions, project staff noted a tendency against reading instructions, especially if lengthy. This experience contributed to the decision to simplify and shorten instructions for the instruments.

Each version of the subjective-probability questionnaire was timed during the pretest to assure that response time would be twenty minutes or less.

Data Collection Procedures

Details concerning the fieldwork are presented in the following sections. The first section, planning for data collection, covers procedures used in developing the fieldwork plan, and the pilot test of the original instruments. The second section adds additional details to the text description of the fieldwork system. The final section describes procedures used to monitor field activities. Differences between time-one and time-two fieldwork systems are noted throughout the second and third discussions.

Planning for Data Collection

The skeleton plan for gathering data called for obtaining data from high school students and their parents within the city of Columbus, at three time points within a three year period. Data were to be collected via interviewer visits to respondents' homes.

In the first stage of planning, project staff attempted to identify specific strategies that could be used to implement the plan. Toward this end, project staff discussed their own ideas and sought suggestions from individuals with experience or knowledge of data-collection techniques in general and panel studies in particular. In addition, staff reviewed relevant professional literature. Included in this review were descriptions of the data-collection systems of other studies (especially those related to the same topic), and general discussions of field methods. Examples of discussions consulted include the description of methodology contained in Youth in Transition (Bachman, 1970); and general discussions on methodology contained in various issues of the Public Opinion Quarterly (e.g., Crider, et al., 1971; Dohrenwend, et al., 1968; Schuman, et al., 1971; Taylor, 1976).

In the second stage of planning, project staff discussed ideas obtained from above sources in a formal session with consultants. Next, a tentative plan was developed in consultation with a local research firm (Appropriate Solutions, Inc.). In the final stage, the plan was pilot tested and revised and a manual explaining the plan to interviewers (Interviewer Special Instructions) was composed.

Special concerns. In planning a data collection strategy, numerous concerns arose. Two of the most important were: maximization of participation levels (response rates), and prevention of bias.

Because response rates depend on participation, attention during planning was focused on encouraging family cooperation. This concern was the reason for adoption of the plan to hand deliver and hand collect questionnaires instead of mailing them out. Other strategies adopted included obtaining and mailing to respondents a letter from the superintendent of the school system supporting the research, and offering monetary incentives to families ($10.00).

Because the study was designed to extend over three years, staff was extremely concerned about preventing attrition. Two

types of attrition were addressed during planning: (1) attrition due to a respondent's deliberate decision to withdraw, and (2) attrition caused by external factors such as a respondent's moving outside the area of study, or to an unknown address within the study area.

Techniques to prevent deliberate withdrawal were adopted. These include: (1) monetary incentives were offered for each completion of the questionnaires. (2) Attempts were made both in the letter announcing the study, and throughout the study, to instill in respondents a sense of the importance of the study, as well as their importance to the success of the study, and (3) a short progress report designed to maximize respndents' identification with the study was mailed to respondents. Because of fear of influencing responses to the questionnaires, however, the progress report refrains from discussing theory or reporting findings.

External sources of attrition such as a family's relocation are not under the control of a research study. Project staff did, attempt, however to address the problem of attrition resulting from such situations. A system of distributing change-of-address-and-telephone-number postcards to respondents throughout the study (in person and through the mail) was adopted. A plan for sending precontact letters in address-correction-requested envelopes (a service available through the postal system) prior to the beginning of each data collection period was also adopted.

Two discussions (Wilcox, 1965 and Bachman 1970) reported statistical evidence of the propensity toward survey attrition on the part of certain groups of people including renters and low income individuals. This information suggested the idea of asking respondents whether they owned or rented their homes. This was done on a supplementary form to the questionnaire called the Follow-Up form. On the form respondents also were asked if they planned to move during the year, and if so, whether they would or would not remain within the Columbus area. In addition, the form elicited the name of a person (close friend or relative) to serve as a contact in case the respondent family moved without notifying the research project. No special effort was required to obtain information about the income status of the family since questions regarding income were already contained in the instruments. The intent of this system was to create a special file of such "high risk" respondents so that they could be monitored more closely than other families.

A second major concern during planning related to prevention of bias. The form of bias considered the greatest threat to

quality of the data was intrafamily contamination of data: i.e., the effects of individual family members on the responses of other family members. This included the possibility that family members might confer with one another in filling out their questionnaire booklets as well as the possibility that the mere presence of other family members in the same room might unconsciously influence a respondent to offer answers acceptable to the other individuals (the group-interview effect). Fear of family collaboration was the main reason behind the a strategy of interviewer supervised, group completion of questionnaires instead of a mail-out or drop-off system. (Drop-offs were allowed only as a last resort during time two in cases when schedule conflicts within a family would otherwise have meant dropping the family from the study.) Project staff found it impossible to address the concern of possible group interview effects.

Pilot test. All data collection procedures were pilot tested prior to the field operation. Twenty-four respondent families and six interviewers participated in the pilot test. Procedures paralleled closely those employed during the field operations except for the method of initial contact with prospective respondents. In the field operations, letters from the Columbus public schools (time-one, only) and the project director were sent to respondents prior to telephone contact by interviewers; these letters were not part of the pilot test.

Following the pilot test, a debriefing session during which interviewers reported their experiences was held. In addition, each interviewer submitted a form for each family interviewed reporting on various aspects of the home visit such as: (1) ability of family members to read the instrument with understanding, (2) specific questionnaire items that created problems for respondents, and (3) duration of home visit.

Data Collection Plan

An overview of the data collection plan is provided in the text chapter on methodology. Details concerning these plans are provided below. The first discussion provides additional details concerning selection, training and management of interviewers. The second discussion provides details concerning selection, management and maintenance of respondents. Differences between time-one and time-two procedures are indicated throughout.

Interviewer Selection, Training and Management

Twenty-eight interviewers (see footnote 1) were employed at the beginning of the time-one data collection operation; 20

completed the operation. For the time-two operation, the range was 25 to 20. The following discussions cover selection, training and management of the interviewer staff.

Selection of interviewers. As explained in the text, interviewers were recruited from the interviewer roster of a local research firm, Appropriate Solutions, Inc. (ASI), and through open publicity campaigns. Most of the individuals selected had had previous interviewing experience.

Training of interviewers. Prior to each wave of data collection, interviewers attended a three hour briefing session covering specific information and instructions regarding the survey. Three important topics covered in the briefing sessions were: (1)underlying logic of the subjective-probability questions, (2) procedures for explaining the subjective-probability questions to respondents, and (3) techniques for obtaining codable responses to open-ended occupation and industry questions. The Special Instructions to Interviewers manual was used as the basis for discussions regarding the first two topics. Discussion regarding obtaining codable responses to open-ended occupation and industry questions consisted of (1) brief explanation of the steps and resources used in census coding, (2) presentation of coding examples to demonstrate the importance of specific and complete information, and (3) practice in coding occupational and industry entries. Both briefing sessions were conducted jointly by project staff and ASI. In addition to the briefings, all interviewers received comprehensive training at the beginning of their employment concerning all types of interviewing.

Management of interviewers. Appropriate Solutions, Inc. held responsibility for managing interviewers' work during both time-one and time-two data collection operations. A fieldwork office, manned by National Center staff and ASI consultants (time one) or by ASI alone (time two) was maintained during all periods of the day and week when interviews were being conducted. At this office, staff members responded to telephone calls regarding problems and questions from the field, including calls from respondents requesting changes in appointment times and dates; distributed additional supplies (e.g., questionnaire booklets) to interviewers when needed; and took turns managing interviewer check-in sessions during which interviewers reported to the office to hand in completed questionnaire booklets. Additional aspects of the time-one and two interviewer management systems are summarized below.

(1) Method of assigning respondents to interviews. Prior to the first-wave of data collection, information contained in school board records (e.g., parents' names, home address, telephone number) was transferred to individual forms called "Call

Records", then grouped together according to the zip code of the respondents' address.

The purpose of the clustering system was to minimize travel distance; it was not always possible, however, to assign interviewers to respondents in or near the formers' neighborhood. During time one, groups of these forms were distributed to interviewers as the latter completed (successfully interviewed) or resolved (definite determination that an interview was impossible) all previously distributed call records.

During time two, interviewers were assigned their entire quota at the beginning of the fieldwork period.

(2) Interviewer check-in system. The interviewer check-in system, in which interviewers reported to the fieldwork office once a week to turn in completed questionnaires, enabled project staff to maintain contact with interviewers and to monitor progress of the research operation. Specific tasks accomplished during each check-in session were as follows: (1) completed questionnaire packets were returned to the fieldwork office, logged into entry files, and routed to the coding division; (2) the status of all nonresolved call records (neither completed or resolved) held by the interviewers was reported to project staff; (3) the numbers of completed cases and nonresolved cases contained in each race and sex category were tallied; (4) new assignments (time one, only) and additional supplies were distributed to interviewers.

(3) Interviewer verification system. Work submitted by interviewers was subject to verification through telephone calls to respondents' homes. Questions asked during verification calls dealt with whether the interviews had taken place and whether all rules and procedures had been followed. During time-one, all interviewers were verified at 19 percent, a total of 139 verification calls. Some irregularities in interviewer performance were uncovered. (The effects of these irregularities on data quality was, however, found to be negligible.) During time-two, old interviewers were verified at the rate of 10 percent, or a minimum of two interviewers; new interviewers were verified at 25 percent. A total of 89 verifications were conducted; no problems were identified. In addition to checking on procedure violations, the verification telephone call also gave respondents a chance to express their thoughts about the survey to project staff. The reactions expressed were overwhelmingly positive.

Selection, Management and Maintenance of Respondents

The first discussion below covers choice of respondents. The second discussion reports respondent management procedures such as record keeping. The third discussion reports techniques used to maintain respondents across panels, including address checks and tracking procedures.

Selection of Respondents

As reported in the text section on sampling, students for the survey were selected from the master list of high school sophomores attending the Columbus public school system. The ratio of oversampling required, as reported in the text discussion of sampling (chapter three), was three to one. Subsequent to identifying the potential sample, parents of each student were contacted to obtain agreement to participate.

There were three requirements for participation during time one: (1) the student had to be enrolled as a regular (nonspecial-education-program) sophomore in a Columbus public high school, (2) at least one parent (or parent substitute) had to be willing to participate, and (3) all participating family members had to be able to read and fill in their own questionnaire booklets (functional literacy). All youth participating during time one were eligible for participation during time two; eligibility of other family members was dependenton the continued participation of the youth.

After letters from the superintendent of Columbus Public Schools (time one only) and the project director were mailed to respondents, interviewers made telephone calls to potential respondents in order to: (1) confirm all conditions of eligibility (it was at this point during time one that attempts were made to eliminate special-education-program students and functional illiterates), (2) obtain agreement for participation, and (3) schedule the home visit. Under no circumstance was a home visit made without prior telephone contact.

Management of Respondents

Throughout the study, staff maintained records concerning respondents. Two files containing respondents' names, addresses and telephone numbers were kept: one arranged alphabetically by students' last name (with cross reference entries for cases in which a parent had a different last name), and one arranged numerically by respondent identification number. In addition, records of respondents by address zip code, and records of all respondents assigned to each interviewer were kept. All

information was continually updated. Procedures used to obtain updated address and telephone information are explained below in the discussion of maintaining respondents.

Maintenance of Respondents

Techniques used to maintain respondents across waves have been mentioned in the discussion of strategies adopted by staff during planning: the continuation of monetary incentives, the attempt to instill in respondents a sense of identification with the study, and the adoption of address monitoring and tracking procedures. Additional details concerning address checks and tracking procedures are reported below.

Prior to time two, respondents were mailed a letter from the project office. This communication served two purposes: it informed respondents of the beginning of the second interview period, and it provided opportunity for project staff to obtain updated addresses and telephone numbers. The Post Office Address Correction Requested System was used to assist with these corrections.

At the commencement of the time two fieldwork, attempts were made to locate additional respondents who had moved. Staff contacted the individuals listed on respondents' follow-up sheets (see discussion of planning, for explanation) for this purpose. Seven families were found to have moved out of the interviewing area. Entire packets of materials were mailed to these families. If no response occurred in three weeks, certified reminder letters were sent. In all, four of the seven families who had moved out of the interviewing area (57%) completed and returned packets.

In addition to tracking respondents who had moved, project staff reviewed all refusal or problem call records returned to the office by interviewers during the time-two data collection operation. In many cases, the decision was made to make a final telephone call from the project office to work out a solution to problems preventing the respondent's continued participation or to encourage the family to remain in the study. Of the 45 calls made, 19 resulted in completed questionnaires for time two (42%), reducing the drop-out rate from a potential 15.1 percent to 12.5 percent.

Attrition statistics and a summary of reasons for attrition have already been presented in the text (chapter three).

Coding

The following sections describe how the data were coded and corrected. The first section summarizes general characteristics of the coding operation. The second section focuses on nonoccupation/industry coding, explaining the planning, training and actual steps involved in coding most of the items in the instruments. The third section focuses on coding of the open-ended, occupation and industry questions contained in the instruments. Procedures adopted for coding these items constitute a modification of procedures used by the U.S. Bureau of the Census in coding employment information collected during the 1970 dicennial census. The extensive planning, training, reference materials, and step-by-step procedures required for this operation are described. A final section explains quality checks performed on the data during coding as well as procedures used to check and correct the coded, keypunched data.

General Characteristics

Questionnaire responses were transferred or transcribed (using codes) to coding forms in preparation for keypunching. The alternative of recording codes in the righthand margin of questionnaire pages was considered but rejected because of concern of increasing chances of keypuncher error. Project staff modified the standard FORTRAN coding form for the coding: heavy vertical lines to identify each number field were drawn in and all skipped columns were blackened out.

As explained in the section on data collection procedures, completed questionnaire booklets arrived from the field in sets of six (in the case of two-parent families) or four (in the case of one-parent families). Each set also contained separate forms indicating facts about preinterview contacts with the family (call records), supplementary information concerning the interview situation (supplementary forms), and information to assist in locating respondents for the second and third data collection periods (follow-up forms). On arrival in the coding office, each set of questionnaires was logged in and a disposition form attached. The disposition form was designed to record each step of the coding operation. Questionnaires were then routed to coders.

Before coding questionnaires, coders logged out each set of booklets. This procedure consisted of listing the family identification number for the set of questionnaires, the coder's

initials and the check-out date in a log specially designed for this purpose.

All coding was done during regularly scheduled shifts. For time one coding, shifts were held over a 14 week period, for a total of approximately 1600 coder hours. For time two, coding lasted nine weeks involving a total of approximately 1100 coder hours.

During most of time-one coding, supervision of shift was shared between two staff members. During time two, one staff member supervised all shifts. During both coding operations, decisions made by supervisor of coding shifts were recorded in a Resolution Log. This system served two purposes. First, it created a permanent record of decisions made. Among other things, this meant that if later developments or decisions dictated a change in a coding rule, all cases coded under the old rule could be identified and changed. Secondly, the resolution log enabled decisions made by the supervisor of one shift to be communicated to supervisors of other shifts (time one, only), thereby contributing to consistency of procedures across coding shifts. Supervisory staff also composed and distributed weekly updates to coders clarifying procedures and informing coders of new rules.

If a coder had difficulty coding any response, he or she was instructed to seek assistance from the coding supervisor. Problem cases that could not be coded using this procedure were referred. The referral system relied upon a form called the referral sheet on which the problem, the resolution, and all steps leading to it were recorded. First, the coder recorded the problem on the referral sheet and inserted the sheet in the questionnaire booklet. Next, the set of questionnaires was routed to supervisors. Initially, all referred cases were read, researched and solved, if possible, by one staff member and then routinely checked by a second staff member. If the second staff member disagreed with the resolution, the case was reviewed by the project director whose decision was considered final. This plan remained in effect throughout the first half (approximately six weeks) of the time-one coding operation. The number of project staff involved in resolving coding problems was reduced during the second half of the time-one coding operation and during time two.

As is typical of coding operations, some responses failed to fit any of the predefined codes. Special codes had to be created for these cases. Two special codes created for coding open-ended occupation and industry data are explained in the discussion of census coding.

Nonoccupation/Industry Coding

Coding of the data was specialized to the extent that some individuals coded occupation and industry questions, and others coded nonoccupational questions. The latter are termed here "general coders." Planning, training of coders, and coding procedures for general coding are described below.

Planning. Since most questions to be coded by general coders were either precoded or binary coded, little planning was required. Special rulers were constructed for coding subjective probability questions (rulers constructed were 4.25 inches long, marked with 100 equal divisions), and rules for coding number responses to the nonoccupation fill-in questions had to be defined. For the time-two operation, codebooks consisting of a set of annotated questionnaires (containing simulated responses and instructions for coding them) were constructed. These were used both as a training tool and as a reference book throughout the time two coding operation.

Training. Training for general coding at the beginning of each coding operation consisted of approximately an hour and a half orientation to the questionnaires, the coding form, the codes, and coding procedures. Coders were taught how to measure and record values for the subjective probabilities, how to distinguish and code precoded and binary code questions and when and how to right-justify numerical entries for the open-ended questions. Much of the training consisted of practice in coding a complete set of questionnaire booklets. For the time-one training, a set of six questionnaires completed in the field were used for this purpose followed by a discussion and correction session. For time two, the specially constructed codebooks were used.

Procedures. During time one, five college students worked as general coders, during time two, nine. After logging out the entire set of booklets for a family, general coders coded all questions assigned to them in order of occurrence. Subjective probability checkmarks were measured and the two-digit values (ranging from zero to 100) indicating the distance between the checkmarks and the zero point of the lines, were recorded. Precoded closed-ended questions were coded by transferring the precode to the coding form. In the case of binary code questions, each response alternative was assigned a code of zero or one depending on whether or not it had been checked by the respondent. For nonoccupational open-ended questions (e.g., fill-in questions eliciting information such as ages, dates, etc.) coding usually took the form of transferring the numeric response to the coding

form. It was sometimes necessary to right-justify digits in this process.

After general coders finished coding all questions assigned to them, they recorded their initials on the disposition form attached to the set of questionnaires and placed them in one of two boxes. If completely coded (containing no nonresolved problems), the questionnaires were routed to occupational/industry coders. If requiring referral (due to the presence of coding problems), the questionnaires were routed to the coding supervisor.

Occupation/Industry (Census) Coding

During most of time one, three college students worked as occupation/industry coders, during time two, five. Occupation/industry coding involved coding of all open-ended occupation and industry questions into U.S. Census codes. These questions include: (1) current occupation and industry; (2) parents' past (5 years previous) occupation and industry (time one, only); (3) students' occupational expectations; (4) students' occupational aspirations; (5) students' perceptions of peers' occupational expectations; (6) students' perceptions of parents' occupational expectations and aspirations for students; and (7) objective parental expectations and aspirations for student. Use of the U.S. Bureau of the Census occupation and industry coding system necessitated a specialized operation in which occupation and industry titles provided by respondents could be looked up in Census Bureau reference books. Planning for this operation was extensive. The plan eventually adopted constitutes a modified version of procedures used by the Census Bureau. [For description of exact procedures used by the Census Bureau, the reader is referred to the 1977 Census of Oakland, California Industry and Occupation Coding Training Manual (U.S. Bureau of the Census, 1977.)]

Planning. Toward developing a system for census coding, project staff investigated coding procedures used by the Census Bureau and other research operations using census codes. The following manuals were studied: Manual for Coding Occupations and Industries into Detailed 1970 Categories and a Listing of 1970-Basis Duncan Socioeconomic and NORC Prestige Scores (Featherman, Sobel and Dickens, 1975); Social Factors in Aspirations and Achievements Occupation-Industry Coding Handbook (Sheehy, Netkin and Grant, 1974); Occupation and Industry Coding Manual of the Minnesota Labor Force Study (Gustafson, 1977); and the introduction sections of the Alphabetical Index of Industries and Occupations (Alphabetical Index) and Classified

Index of Industries and Occupations (Classified Index) (U.S. Bureau of the Census, 1971). In addition, project staff gathered suggestions from consultants and other individuals having experience with similar coding operations.

From these investigations, numerous ideas for coding occupations and industries were considered. Discussion of these is presented below.

In one study (Sheehy, et al., 1974), Census coders were subdivided into three groups coding current job information; job expectations; and allocating census codes to all those occupational cases uncodable through usual procedures. In addition, a system of independent coding of each occupation and industry questionnaire item was used. The expressed aim of this system was to avoid inter-question bias--the tendency of coders to select a census code for one questionnaire item because of knowledge concerning the coding of other questionnaire items. Implementation of this system meant that census coders were permitted to code only one employment-related item per questionnaire at any given time. To accomplish this objective, questionnaires were rotated among census coders. Shelf space was allotted and labeled for each occupation and industry question. All incoming questionnaires were placed in the first slot on the shelf, i.e., that slot reserved for the first job or industry question contained in the questionnaire. A census coder coded the first entry in a questionnaire and then placed the questionnaire in the next slot. Another census coder then coded the second entry. This process continued until all occupation and industry questions in each questionnaire were coded. This system was not adopted for the present study due to the excessive space, time and supervisory efforts necessitated; however, census coders were instructed not to allow previous coding decisions to influence their coding of any particular item.

The Minnesota Labor Force Survey employed a system of industry coding based on a listing of all major companies located in the study area (Gustafson, 1977). Firm names contained in the listing were arranged according to the Standard Industrial Classification coding system developed by the U.S. Government Office of Management and Budget. Although this coding system differs from the census coding system; it is possible to cross-reference these codes to census codes by using a section of the Alphabetical Index of Industries and Occupations. Coders could, therefore, use the listing to locate industry codes for firm names contained in the questionnaires. Although these procedures differ from Census Bureau methods, and have some disadvantages (Sheehy, et al., 1974), they have one important advantage of being easier and more direct, involving less coder interpretation and judgment than the Census Bureau method.

A system analogous to the Minnesota technique was adopted for the time-one operation (industry was not coded during time two). A listing of firm names and codes for the study area was obtained in the form of the membership list of the Columbus Area Chamber of Commerce. This list contains the names and Standard Industrial Codes (SIC) for approximately one-third of all firms located in Columbus, Ohio. Although the list was not a complete one, project staff felt that the ease and uniformity introduced by the system effected greater validity of the coded data. Comparison of codes assigned during a trial period at the beginning of the time-one operation using the Census Bureau system (in which interpretation and judgment were necessary), and codes assigned using this system support this point.

One problem considered during the planning operation was whether to code the industry of the respondent's specific job or the industry of the respondent's employer. For example, which industry code should be used for an auto mechanic working at Sears Department Store? Although opinion in the literature regarding this issue varied (Sheehy, et al., 1974), the industry code which reflected the major activity of the firm was coded for this study. One reason for this decision was that it allowed use of the Chamber of Commerce membership roster for all industry coding. Also, coding the firm rather than the job introduces less overlap with occupation codes.

As a result of preliminary reading about the coding experiences of other operations, project staff anticipated that some respondent entries would be too general or vague for assignment of a single code. One study devised a specialized system to handle this problem (Sheehy, et al., 1974). Table 8 in the 1970 Census of Population Occupation by Industry (U.S. Bureau of the Census, 1972) was used to obtain statistics concerning the number of individuals of each sex working in various occupations. All occupational groups suggested by a respondent's vague entry were looked up in this table. That occupational group containing the greatest number of individuals of the same sex as the respondent was then chosen as the most likely job category for the vague entry. This system was not used in the current study, however. Instead, all possible codes for the general or vague entry were listed on a special form called a Multiple Code Sheet. The most appropriate of the codes was listed as the first entry (in addition to being listed on the coding sheet) with the other codes following. The plan for utilizing the multiple codes during analysis was to average Duncan SEI codes for all the occupational codes listed on the Multiple Code Sheet. No use of this data is included in this report, however.

During planning, staff experimented with two different ways to use Census Bureau reference materials. The Census Bureau's Alphabetical Index and Classified Index contain two types of listings for both industry and occupation titles. The Industrial Classification System (three pages) and the Occupational Classification System (five pages) comprise one type of listing, summarizing all numerical codes and their title headings. (Throughout the remainder of this discussion, these summary lists are referred to as the short list of industries and the short list of occupations.) In addition to the short lists, the Alphabetical and Classified Indexes provide a breakdown of each of the code groups, listing all of the job or industry titles contained within each group, either in alphabetical order (Alpha Index) or numerical order by code group (Classified Index).

Initially, a plan to use the short lists as the only coding reference in census coding was adopted. This was done due to the assumption that coding of the survey data would be less complicated than the U.S. census operation due to the limited geographical area of respondents, and to restrictions imposed by the relatively simpler design of the questionnaire items used to elicit employment information. The decision also was due, in part, to difficulties in obtaining details regarding specific procedures employed by the Census Bureau, and to project staff's initial lack of appreciation of the complexities of occupational coding. Routine quality checks performed on the coded data after the first three weeks of time-one coding, however, revealed difficulties with this system. As a result, procedures were revised (and all previously coded occupation and industry entries were recoded). The revised procedures relied on the Census's longlists as the reference source for all occupation and industry coding. (See procedures section for a complete explanation of this system.)

Training. Training of census coders during the time-one operation consisted of a three hour training session followed by a three-week period of close supervision and checks on coders' work. During time-two coding, training for census coding consisted of five one-and-one-half hour training sessions. Time during each session was divided between discussion of procedures and practice in coding. Training exercises designed by the Census Bureau and examples of actual responses from completed questionnaires were used for the practice sessions.

Coding References. Both Census Bureau references were used in census coding: the Alphabetical Index of Industries and Occupations and the Classified Index of Industries and Occupations. Additionally, the Dictionary of Occupational Titles (D.O.T.) was used for occupational coding, and the 1977-78 Columbus Chamber

of Commerce Membership Roster and Directory was used for industry coding. A description of the content and format of each of these volumes is provided below.

The Alphabetical Index of Industries and Occupations lists industry and occupation titles reported in national censuses and surveys conducted by the U.S. Bureau of the Census. In addition to the eight-page summary of title headings of all industrial and occupational codes (short lists), the text is divided into two sections: the first comprises a listing of industrial titles; the second, a listing of occupational titles. In each of these sections, titles are listed in alphabetical order on the left side of the page and three-digit codes for each are printed on the right-hand side. For a complete description of the text the reader is referred to the introduction of the Alphabetical Index.

The Classified Index of Industries and Occupations is identical to the Alphabetical Index in its contents; differences between the two volumes are organizational only. In this volume job and industry titles are listed by code category, and all code categories are listed in numerical order by code number.

The 1977-78 Columbus Area Chamber of Commerce Membership Roster and Directory includes a forty-five page alphabetical list of the approximately 2,300 businesses belonging to the Columbus Area Chamber of Commerce. For each firm, a code indicating the firm's classification according to the Standard Industrial Classification (SIC) system is given. In the time-one and time-two coding operations, coders cross referenced these SIC codes by consulting the short lists contained in the Alphabetical and Classified Indexes in which both SIC and census codes are listed.

The Dictionary of Occupational Titles (D.O.T.) is published by the U.S. Manpower Administration and contains 35,550 job titles. For each job title, the D.O.T. either describes the job or refers the reader to another (synonomous) title containing a description. The order of job titles is by code group, but the D.O.T. coding system is specific to the Office of Manpower Administration and differs from the U.S. Census Coding System. Project staff were unable to locate a cross-reference source in time for the time-one coding operation; two partial cross-references were located and used in the time-two coding operation (National Occupational Information Coordinating Committee, 1979; U.S. Department of Labor, 1975).

Procedures for Coding Occupations. As evidencd by reference to Appendix A, all of the open-ended occupation questions were composed of two parts. The first section elicited a job title, the second section, a description of duties involved in the job.

After logging out a questionnaire packet, the first step in coding occupation was to decide whether the job title provided by the respondent in the first section of the question was consistent with the description of duties listed in the second section. This step required judgment on the part of the coder. If convinced that the job title constituted an accurate representation of duties performed, the coder looked the job title up in the Alphabetical Index (long list). If an industry restriction appeared between the title and code (see explanation of Alphabetical Index), it was necessary for the coder to make sure that the industry code for the occupational entry being coded was consistent with those listed in the industry restriction. The final step in coding was to record the three-digit code for the job title on the coding form. The most common situations complicating these procedures were: (1) omission of a job title in the questionnaire response, (2) suspected inconsistency between the job title and description, and (3) inability to locate the exact wording used by the respondent in the Alphabetical Index. Additional procedures were required in each of these cases and are explained below.

In cases in which the job title section of the question had not been answered, the coder had to rely on the description of duties provided in the question. In such cases, the coder was required to determine an appropriate job title based on information provided in the description. The coder then proceeded with the other steps in coding.

Whenever a coder suspected that the job title listed might not be an accurate description of duties performed, the D.O.T. or The Encyclopedia of Careers and Vocational Guidance (Hopke, 1977) was consulted. The job title in question was looked up and compared to the description of duties for the title contained in the reference book was compared to the description of duties contained in the questionnaire. If inconsistencies were determined, coders ignored the title and relied on the description of duties provided in the questionnaire to determine an appropriate code. This policy was consistent with policy used in a previous study (Sheehy, et al., 1974) and reflects agreement with the argument that job descriptions are usually more accurate than job titles (reasons include inflation of job titles by employers). Consistent with this policy, coders were instructed to place more weight on the job description in other cases of ambiguity, as well. Whenever there was complete contradiction betwen a job title and description, a special code was used (see section on Special Codes).

If the exact words or particular order of words used in a respondent's job title were not found in the Alphabetical Index, the coder looked up other wordings (e.g., "teacher's assistant" instead of "teacher's aid", or other possible word orders (e.g., "coach, reading" instead of "reading coach"). Coders used their own judgment, the job description section of the question, the [illegible], and other sources such as The Encyclopedia in generating these alternatives.

After locating a code in the Alphabetical Index, it sometimes was judged advisable to double check the code in order to obtain further evidence of the appropriateness of the code in representing the respondent's occupation. The short list of occupations and the Keypunch Index were used for this purpose.

Whenever a respondent's occupation entity was too ambiguous for assigning a unique code, the usual procedure was to list all possible codes on a special form called the Multiple Code Sheet. That code judged to be the best fit for the entity was listed first and was the only code recorded on the coding form. The reference for this procedure and the cases suggested for the additional data for the analysis stage have been mentioned in the preceding few various coding sections. If the entity was judged too general for use of the Multiple Code Sheet, a special code was sometimes used (see section on special codes).

Procedures for coding industry (time one only). The time one questionnaire contains two questions eliciting industry information about parents' current and past jobs. Because of the fact that it was often necessary to know the industry code of a respondent's occupational code could be assigned, industry questions were coded before occupation questions. In the case of multiple pieces of information requiring more than one industry code, the code of industry of the first was coded. This was done even if the code assigned with the specific industry of the respondent's job, for example, a teaching assistant working at State Department Store was assigned the industry code for department stores instead of educational services. The rationale for this procedure has been explained in the preceding few various coding sections.

Exact wording of the coding of the industry questions during time one were as follows. [illegible] the name of the respondent's place of employment was obtained from the questionnaire. (2) This name was coded by the [illegible] Standard Industrial Classification (SIC) code. (3) The short list of the [illegible] was referenced to obtain the correct census industry code. (4) This census code was recorded on the coding form.

For cases in which the employer's name was not found in the Chamber of Commerce Roster, the company name was looked up in the Directory of Ohio Manufacturers (Ohio Department of Economic and Community Development, 1975) which provides SIC codes for major firms in the State of Ohio. If this attempt proved unsuccessful or if the name of business had been omitted on the questionnaire, coders resorted to routine census procedures for coding industry: the industry description was read and interpreted by coders and an industry title was looked up in the industry section (long list) of the Alphabetical Index. If located, the three-digit code indicated in the text was recorded. If the exact title could not be located, synonomous titles or alternative word orders were checked.

If the description was missing from the questionnaire or was inadequate, a street directory (Polk, 1977) was consulted, or a telephone call was made to either the local public library's business section or the Corporation Registration/Licensing Office of the Ohio Department of State. All of these sources provide at least a brief description of firms and companies when the company name is known or, in the case of the State Corporation Registration Office, if the company is incorporated.

For both occupational and industry coding, two additional resources developed before the end of the coding operation proved useful. These were: (1) file boxes containing resolutions of problem cases encountered in two previous studies, and (2) the referral sheet notebook containing a record of resolutions of problems encountered in the current study. Coders could consult either or both of these two resources at any point in the coding operation.

Whenever occupation/industry coders were unable to code entries quickly, they requested supervisor help. As in the case of general coding, resolutions reached through this procedure were always recorded in the Resolution Log for later review.

Special codes. Procedures used in the census coding operation included use of unique codes designated for the coding of unanticipated responses. Project staff either invented these codes or redefined already existing Census Bureau codes for usage in such cases. The main reason for special codes was to preserve as much information as possible, even if the information were somewhat vague or incomplete. Two of the special codes are particularly interesting and, therefore, are described below.

(1) Industry and occupation allocation codes. Whenever possible, either Census Bureau industry codes or occupation allocation codes were used to code those occupational entries that were too vague for the assignment of single or multiple occupation codes. For example, when a respondent provided the nonspecific response of "works in a department store," the Census

Bureau industry code for department store was assigned (instead of attempting to list all possible occupation codes relevant to "department store" on a multiple code sheet, or using the missing data code) thereby preserving this item of information. When a respondent listed "professional job", the Census Bureau occupation allocation code 196 for "professional technical and Kindred Workers" was used. This procedure was used only as a last resort in the coding of occupational entries due to the fact that Census Bureau allocation codes lack Duncan SEI equivalents.

(2) Code for contradictory responses. Previous discussion has explained procedures for coding cases involving partial contradiction between job titles and job description (see section on census coding procedures). For cases in which there was complete contradiction, a special code "-33" was invented. In addition to listing this code on the coding form, coders listed this code on a multiple code sheet followed by appropriate codes to represent both the job title and the job description.

Quality Checks and Correction of the Data

During the time-one coding operation, a special quality check across all coders was completed approximately three weeks after the start of the coding operation. At least one-third of each coder's work was checked on all nonoccupational questions at this time. At a later point a check of coding on all occupation and industry questions was completed. As a result of these two checks, some changes in the time-one coding operation were made. Throughout the remainder of the time-one operation and during the time-two coding operation, 10 percent quality checks on both occupation/industry and general coding were conducted.

After the data were coded and keypunched, a computer program was written to check each variable for numerical values outside of the valid range for the variable. Using this program, accuracy of both the coded and keypunched data was checked and illegal values corrected.

APPENDIX C

MEANS, STANDARD DEVIATIONS AND CORRELATIONS

Introduction

This appendix contains means, standard deviations, and correlations for each variable used in this report except race and sex. All statistics were calculated within race-sex subsamples. Table 13 presents all the statistics.

TABLE 13

SEX-RACE SPECIFIC MEANS, STANDARD DEVIATIONS, AND CORRELATIONS FOR ALL VARIABLES

Female Blacks, N = 159

	SEB	MA	AP_1	EEP_1	OEP_1	EE_1	OE_1	AP_2	EEP_2	OEP_2	EE_2	OE_2
SEB												
MA	.1334											
AP_1	-.0109	.1445										
EEP_1	.2177	.3283	.2839									
OEP_1	.1841	.2785	.3596	.5191								
EE_1	.2903	.2665	.3615	.5879	.4226							
OE_1	.2839	.3429	.3221	.4137	.5115	.6146						
AP_2	.0357	.2423	.6039	.2963	.3669	.4025	.3349					
EEP_2	.2135	.2752	.2320	.5548	.4459	.4667	.4254	.3160				
OEP_2	.1604	.1760	.2647	.4689	.5687	.4603	.4502	.3221	.4928			
EE_2	.2283	.1739	.2529	.3003	.3201	.5646	.4819	.3616	.4700	.3171		
OE_2	.2685	.2420	.1643	.2884	.3261	.4247	.5492	.2851	.3173	.3227	.4250	
MEAN	-.1497	36.6961	2.7363	14.6210	55.7323	14.8800	55.1089	2.5283	14.6382	54.9409	15.0680	56.1284
STD. DEV.	.6876	10.9876	.7865	1.7493	6.8275	1.9191	7.1609	.6649	1.6318	6.7317	1.8207	7.0461

TABLE 13
(continued)

Female Whites, N = 163

	SEB	MA	AP_1	EEP_1	OEP_1	EE_1	OE_1	AP_2	EEP_2	OEP_2	EE_2	OE_2
SEB												
MA	.3878											
AP_1	.3001	.4686										
EEP_1	.4475	.4082	.4078									
OEP_1	.3357	.4255	.3945	.6945								
EE_1	.3392	.3118	.4104	.6356	.5481							
OE_1	.1127	.2843	.3434	.5169	.6939	.5158						
AP_2	.3021	.4778	.7146	.4061	.4565	.4515	.3802					
EEP_2	.4216	.3781	.4494	.7066	.6570	.6603	.4834	.4356				
OEP_2	.3442	.4663	.4560	.6578	.7108	.4949	.5596	.4515	.6912			
EE_2	.3440	.2646	.3969	.5934	.4735	.7323	.3956	.3759	.6807	.4693		
OE_2	.2701	.3390	.3621	.5558	.5641	.5252	.6397	.3736	.5163	.6195	.5294	
MEAN	.2735	50.3812	2.9366	14.6653	56.8977	14.7548	55.5374	2.6667	14.4828	55.2598	14.9167	56.1091
STD. DEV.	.8172	14.3722	.8667	1.6504	8.9038	1.9609	10.4449	.7337	1.7854	8.6405	2.0487	9.9880

TABLE 13
(continued)

Male Blacks, N = 148

	SEB	MA	AP_1	EEP_1	OEP_1	EE_1	OE_1	AP_2	EEP_2	OEP_2	EE_2	OE_2
SEB												
MA	.2163											
AP_1	.1401	.3295										
EEP_1	.2623	.2916	.3399									
OEP_1	.2773	.3014	.4432	.5961								
EE_1	.1893	.2395	.3685	.6454	.5295							
OE_1	.1895	.3519	.4970	.4596	.5342	.4794						
AP_2	.2412	.4163	.6480	.3165	.4442	.3619	.4128					
EEP_2	.1677	.0965	.3528	.6600	.4511	.5376	.4076	.3569				
OEP_2	.2631	.3337	.4467	.6431	.7292	.5308	.5625	.4299	.6423			
EE_2	.2041	.3025	.4559	.5267	.4567	.5308	.4609	.4123	.5675	.5497		
OE_2	.2813	.4499	.5070	.4755	.5309	.5186	.6904	.5673	.4912	.6361	.6015	
MEAN	-.1316	37.7100	2.5828	14.5196	51.5264	14.8847	51.9066	2.2721	14.5727	50.9141	14.9046	52.2008
STD. DEV.	.6518	12.7985	.7401	1.6825	8.9550	1.8346	10.0571	.6724	1.7402	8.2094	2.0050	9.9320

TABLE 13
(continued)

Male Whites, N = 156

	SEB	MA	AP_1	EEP_1	OEP_1	EE_1	OE_1	AP_2	EEP_2	OEP_2	EE_2	OE_2
SEB												
MA	.3243											
AP_1	.2377	.6403										
EEP_1	.3793	.4253	.5810									
OEP_1	.3595	.5189	.5926	.7755								
EE_1	.4270	.4851	.5515	.7100	.6608							
OE_1	.3168	.5186	.5030	.6390	.7248	.6580						
AP_2	.1500	.5093	.7295	.4979	.5170	.4727	.4873					
EEP_2	.3861	.4551	.5781	.8109	.7450	.6405	.6208	.5487				
OEP_2	.4065	.5186	.5938	.7399	.8361	.6288	.7005	.5651	.7626			
EE_2	.3817	.4315	.5689	.7339	.6730	.7269	.6540	.5625	.7579	.7087		
OE_2	.3912	.4926	.5195	.6627	.7386	.6497	.8213	.5179	.6890	.7916	.7046	
MEAN	.2027	50.8155	2.6407	14.3182	51.2023	14.3565	49.0966	2.4103	14.3090	50.7501	14.3305	49.5912
STD. DEV.	.8361	15.6967	.8678	1.8808	13.1146	2.1377	14.0146	.7869	1.8692	11.9635	2.2355	12.6100

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