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ABSTRACT

The relative influence of selected life history experiences on the development of three vocational types (investigative, social, and enterprising) proposed by J. L. Holland is studied using causal modeling procedures. The lack of explicitness in the developmental postulates of Holland's theory is seen as a major deficiency. Among the principal postulates of the theory is that most persons can be characterized by their resemblance to each of six personality types (realistic, investigative, artistic, social, enterprising, and conventional). A recent study using a biographical questionnaire demonstrates wide variations in the life histories of men and women in the six vocational types. Subjects for this study were obtained from respondents to the 1971 Cooperative Institutional Research Programs survey (completed on entering college in 1971) which obtained a broad array of personal information. Subjects also completed a follow-up survey in 1980 that gathered data on college experiences and educational and occupational achievements in the 9-year period. Findings support Holand's general premise that vocational type development is a function of a complex series of events resulting from family backgrounds, initial personal orientations and occupational preferences, and interactions with alternative environmental settings. The relative importance of life history experiences varies among the three types. Where one goes to college and what one does have important consequences for the development of Holland vocational types. Tables are included. Contains 29 references. (Author/SM)

LIFE HISTORY INFLUENCES ON HOLLAND VOCATIONAL TYPE DEVELOPMENT

(Revised Draft)

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ASHE paper

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LIFE HISTORY INFLUENCES ON HOLLAND VOCATIONAL TYPE DEVELOPMENT

Abstract

The lack of explicitness in the developmental postulates of Holland's (1973; 1985) theory is regarded as one of its primary deficiencies (Osipow, 1973; Eberhardt and Muchinsky, 1982). The primary purpose of this study is to determine the relative influence of selected life history experiences on the development of three vocational types proposed by Holland through the use of causal modeling procedures. The overall findings clearly support Holland's general premise that vocational type development is a function of a complex series of events resulting from family backgrounds, initial personal orientations and occupational preferences, and interactions with alternative environmental settings (i.e., kinds of college and universities attended and experiences in those institutions). At the same time, the relative importance of life history experiences varies among the three vocational types (e.g., family background is most important for Social types, congruent personal orientations. occupational aspirations, and educational preparation are most important for Investigative types). The validity of earlier findings is questioned due to their failure to consider the indirect influences of life history experiences.

LIFE HISTORY INFLUENCES ON HOLLAND VOCATIONAL TYPE DEVELOPMENT

Holland's (1966, 1973, 1985) theory of careers is well established in the research literature on the basis of its favorable comparison with comparable theories (Walsh, 1973) and its high citation frequency in the articles of over 4,000 journals included in the Science Citation Index and the Social Science Citation Index (Institute for Scientific Information, 1980). Among the principal postulates of the theory is that most persons can be characterized by their resemblance to each of six personality types: Realistic, Investigative, Artistic, Social, Enterprising, and Conventional (R, I, A, S, E, C). Holland (1985) suggests that the development of vocational types results from several genetic, cultural, personal, and environmental forces. For example, he suggests that "types produce types" through parental endowment of physical and psychological potential and provision of environmental opportunities. These influences lead individuals to acquire preferences for some kinds of activities and aversions to others at an early stage in their vocational development. These initial preferences are subsequently reevaluated as a result of participation in environmental settings (e.g., schools, colleges, employment), and the interaction among these multiple sources presumably creates a "characteristic disposition or personality type that is predisposed to exhibit characteristic behavior and to develop characteristic personality traits, attitudes, and behaviors that in turn form repertories or collections of skills and coping mechanisms" (Holland, 1985, p.16).

The rather vague process by which vocational types develop is in marked contrast to specific hypotheses in the theory regarding the educational and vocational consequences (e.g., stability, satisfaction, success) of the congruence or fit between persons and their environments (see Spokane, 1985 for a review of these hypotheses and research findings). This vagueness is regarded as one of the primary deficiencies of the theory (Eberhardt and Muchinsky, 1982; Osipow, 1983). Until recently, there have been few systematic efforts to assess the developmental patterns of the six vocational types included in the theory.

Recent efforts using the Biographical Questionnaire (BQ) developed by Owens and Schoenfeldt (1979) have demonstrated wide variations in the life histories of men and women in the six vocational types. For example, Eberhardt and Muchinsky (1982) found that as much as 35 percent of the variance in vocational interests can be explained by life history experiences measured in the BQ and that the nature of these differences were generally consistent with the logic underlying Holland's theory. While the Eberhardt and Muchinsky (1982) results were based on the vocational interests of college students, similarly supportive evidence based on the actual jobs of employed adults was found by Neiner and Owens (1985). Finally, using multiple discriminant analysis procedures, Eberhardt and Muchinsky (1984) found strong support for the structure of Holland's theory (i.e., the hexagonal configuration that reflects the psychological resemblances among the six vocational types) in that "classification errors were not distributed randomly throughout the model. Misses were most common for adjacent (one step removed) types, followed by types two steps removed, and least common for opposite (three steps removed) types" (p. 180).

While the ability of life history data to explain variance in preferred or actual types and to classify types correctly varied considerably in each of the three studies noted above, these collective findings clearly demonstrate that the six vocational types included in Holland's theory have different life histories, and that those differences are generally consistent with tne underlying logic of the theory. Since all three studies used BQ data, however, they are limited obviously to aspects of life histories measured by that instrument. Differences in other aspects of life histories among the six vocational types would further strengthen the current understanding of the relationship between life experiences and vocational development, as well as add further understanding of the distinctive personal, cultural, and environmental conditions that characterize the development of the vocational types proposed in Holland's theory.

The purpose of this study was to determine the relative influence of several life history experiences on the development of three of the vocational types proposed by Holland (1985). While this purpose has much in common with the earlier efforts of Eberhardt and Muchinsky (1982; 1984) and Neiner and Owen (1985), it differs considerably in two respects. First, the study was based on another measurement instrument and, while containing some overlap in variables, examines several aspects of subjects' life history experiences that have not been investigated previously. The selection of these new life history experiences was guided by the premises in Holland's (1985) theory and extant research findings from studies of college effects on students' personal and vocational development (Weidman, 1984; Pascarella, 1985; Smart, 1986). Second, the present study uses causal modeling procedures to examine the influence of

life history experiences on the development of vocational types. Neiner and Owens (1985) note that a common theme in most vocational choice theories "is that an individual's life experiences either have a direct effect [italics added] on the decision to pursue a certain vocation or an indirect effect [italics added] through postulated precursors and determinants" (p. 127).

Prior studies on the use of life history experiences (i.e., biodata) to understand differences in vocational choice (e.g., Eberhardt and Muchinsky, 1982) have not used analytical procedures that would permit investigators to determine the direct and indirect influences of life history experiences. This failure may be one reason why the use of biodata is often viewed as "being long on prediction but relatively short on understanding" (Neiner and Owens, 1985, p. 130).

The use of causal modeling procedures has two specific advantages in this regard. First, it is necessary to array the various life history experiences in a causal sequence based upon their temporal order and consistency with theoretical postulates. This requirement could contribute to greater theoretical insights from empirical findings that emerge from the use of life history experiences. Second, the procedures permit the determination of the direct as opposed to the indirect influences of variables in the model, thus revealing the dynamics by which the experiences exert their influences through direct and indirect effects. Direct causal effects "are estimated by the magnitude of partial regression coefficients," while indirect causal effects "are estimated by the magnitude of the sum of products of causal effects through intervening variables" (Wolfle, 1985, p. 386). For example, while a variable may not have a

significant direct effect on the dependent variable, it may have a significant indirect effect through its cumulative effects on intervening variables in the model.

The logic of the causal model estimated in this study (see Figure 1) is based on the temporal order of variables included, the general premises advanced by Holland (1985, pp. 15-19), and extant research findings that demonstrate differences in the life histories of the vocational types included in Holland's theory (e.g., Eberhardt and Muchinsky, 1982; 1984; Neiner and Owens, 1985) and the influence of college and university environments on students' occupational activities (Astin and Panos, 1969; Richards, Seligman, and Jones, 1970; Smart 1975; 1985).

(Insert Figure 1 about here)

The model proposes that subjects are influenced initially by sex and family background characteristics. These exogenous variables in the model lead subjects to develop distinctive personal orientations that reflect their preferences for and aversions to selected attitudes and activities. The combined influence of these measures contribute to subjects' precollege (1971) occupational aspirations. These collective precollege characteristics influence their entry into different types of colleges and universities which, in turn, influence the nature of their undergraduate experiences. These measures of subjects' precollege and collegiate life history experiences influence their educational attainment, while their vocational type is a function of all preceding variables

in the model. The relative influence of these variables is assumed to differ among the three vocational types given established differences in their life histories (e.g., Eberhardt and Muchinsky, 1982) and the differential influence of alternative college environments and their experiences in those environments (e.g., Astin and Panos, 1969; Smart, 1985)

Method

Subjects

Subjects for this study were obtained from respondents to the 1971 and 1980 Cooperative Institutional Research Program (CIRP) surveys. All respondents completed the initial CIRP survey on entering college in 1971. This survey obtained a broad array of information on their family backgrounds, high school experiences, personal characteristics, and precollege occupational aspirations. The same respondents completed a follow-up survey in 1980 that collected information on their actual collegiate experiences and their educational and occupational achievements in the intervening nine year period. Astin (1982) has provided a full description of the sampling design for both CIRP surveys. Subjects for this study were all respondents (1,452 men and 1,166 women) who were employed full-time in 1980, whose current and most recent prior jobs since completion of their undergraduate education were included in the Investigative (n=490), Social (n=1,421), and Enterprising (n=707) occupational titles based upon Holland's (1985) most recent classification scheme, and for whom complete data were available. The study was limited to these three vocational types because they comprise the majority of occupations that college students typically enter and because the CIRP survey did not contain adequate measures to assess Realistic, Artistic, and Conventional personal orientations in 1971.

Variables

Three criteria governed the selection of variables for this study; their logical consistency with the tenets of Holland's (1985, pp.15-19) theory, their use in prior research on this topic (e.g., Eberhardt and Muchinsky, 1982; 1984; Neiner and Owens, 1985), and their demonstrated relationship in studies of the effect of colleges and universities on students' career development (e.g., Astin and Panos, 1969; Smart, 1986; Weidman, 1984). Full operational definitions of all variables included in the model, as well as their reliability estimates where appropriate, are presented in Table 1.

(Insert Table 1 about here)

The influence of family background on vocational type development is a component of Holland's theory and specific influences of this construct have been documented by Eberhardt and Muchinsky (1982), Neiner and Owens (1985), and others. The socioeconomic status of subjects' families and the number of their parents who have the same vocational type as the subjects in 1980 are two measures of family background included in this study. The sex of subjects was included given sex differences reported by Eberhardt and Muchinsky (1982).

There are three measures of subjects' personal orientations in 1971 given Holland's premise that family background influences the development of preferences for and aversions to selected activities, and the differences in precollege life history experiences reported by Eberhardt and Muchinsky (1982)

and Neiner and Owens (1985). The three personal orientations included in this study represent subjects' preferences for values and their self-ratings of abilities that are consistent with the postulated characteristics of Investigative, Social, and Enterprising types (Holland, 1985, pp. 19-23; Smart, 1986b). These variables lead to the formulation of occupational preferences prior to college attendance. The degree to which these precollege occupational aspirations are congruent with subjects' current (1980) vocational types is included because prior research has consistently found that initial career intentions are strong predictors of later achievements (Astin and Panos, 1969; Weidman, 1984).

The selection of college and university characteristics and subjects' experiences in those institutions was guided by Holland's premise that initial orientations and aspirations may be reinforced or revised based on interactions with environmental settings and extant research findings of the differential influence of college environments on students' later occupational achievements (Astin, 1977; Weidman, 1984; Smart and Pascarella, 1986; Smart, 1986). Specifically, the selectivity/quality of the undergraduate institution and the proportion of students majoring in subject matter areas similar to students' vocational types have been shown to have a positive relationship to students' career attainment. The selectivity of the undergraduate institution was included, as well as the proportion of degrees conferred in science (Investigative), social science (Social), and business (Enterprising) fields. College grades and educational attainment were included because academic achievement and educational attainment levels have been shown to vary among Investigative, Social, and Enterprising types (Gottfredson, 1980). The

congruence between subjects' undergraduate majors and their vocational types was included because of extant research findings that academic disciplines tend to reinforce the prevailing norms and values of their respective fields (Smart, 1985) and that the likelihood of students entering various vocations and fields of graduate study is highly associated with their undergraduate major (Smart, 1987).

Holland (1985, p. 3) notes that several methods may be used to estimate the vocational type of individuals, including their work history and choice of a particular vocation. The vocational type of subjects was determined by their first and most recent full-time vocations following completion of their undergraduate education. Vocations were classified by the author using Holland's (1985, pp. 182-188) most recent classification scheme, and only those whose two most recent jobs were in the Investigative, Social, or Enterprising categories were included to obtain the most reliable possible estimate of subjects' vocational type.

Statistical Analyses

Three separate analyses were run, each contrasting one of the three vocational types against the other two. In each analysis, the vocational type under consideration (e.g., Investigative) was coded "2", while the two other vocational types (Social and Enterprising) were coded "1". The three exogenous variables and the first eleven endogenous variables were common to all three analyses. Thus, there were 12 structural equations defining the model in each analysis, with the first eleven equations being common across the three analyses.

Ordinary least-squares regression was used to estimate the coefficients in the 12 structural equations defining the modal in each analysis. Each endogenous variable was regressed on all exogenous variables and causally antecedent endogenous variables. This produced 12 sets of regression coefficients representing the direct effects of the causal factors on each of the 12 endogenous/dependent measures. GEMINI (Wolfle and Ethington, 1985), a FORTRAN program based on the work of Sobel (1982), was used to estimate and test the statistical significance of the indirect effects. The .001 confidence level was used because of the rather large sample size (n=2,618).

Results

Table 2 presents the structural equations for the eleven endogenous, intervening variables in the model. The direct, indirect, and total effects of all fourteen predictor variables on vocational type in the three equations are presented in Table 3. Inspection of the final row in Table 3 indicates that variables in the model explain 33%, 40%, and 27% of the variance for Investigative, Social, and Enterprising types, respectively.

(Insert Tables 2 and 3 about here)

The following discussion of the results is structured according to the six sets of predictor variables in the model, with attention given to similarities and differences in the separate equations for Investigative, Social, and Enterprising vocational types.

Sex and Family Background

While all three variables in this set exert a significant direct effect in each of the three equations, the sign and magnitude of the direct effects vary considerably (see Table 3). Sex has a negative direct effect in the Investigative and Enterprising equations and a positive direct effect in the Social equation, meaning that men are more likely to become Investigative and Enterprising types and women are more likely to become Social types. The direct effect of sex is further magnified in the Social and Enterprising equations by its significant indirect effect (positive in the former and negative in the latter). Family socioeconomic status exerts a significant positive direct and indirect influence in the equations for Investigative and Enterprising types and a significant negative direct and indirect influence in the Social equation. Parents' occupations exerts a significant positive direct and indirect effect for the Social equation, a significant negative direct influence only in the Enterprising equation, and a significant negative direct and indirect influence in the Investigative equation. In sum, the development of all three vocational types is strongly influenced by sex and family background variables. While Social types tend to be predominantly women from less affluent backgrounds and whose parents tend to be employed in Social occupations, Investigative and Enterprising types tend to be men from more affluent backgrounds whose parents are not as likely to be employed in these respective occupational groups.

Personal Orientations

All three measures of subjects' personal orientations in 1971 exert significant direct effects in each of the three equations. In each instance,

the development of a corresponding personal orientation in 1971 has a significant positive direct effect on the vocational type of subjects in 1980; that is, a higher Investigative orientation in 1971 has a significant positive direct influence on being an Investigative type in 1980, while a higher Enterprising orientation in 1971 has a similar effect on being an Enterprising type in 1980. This condition is enhanced in the Investigative and Social equations by the significant indirect effects of their respective personal orientations in 1971.

Initial Occupational Aspiration

The congruence between the occupations preferred by subjects in 1971 and their occupations in 1980 has a significant positive direct and indirect effect in the Investigative equation, a significant negative direct and indirect effect in the Enterprising equation, and a significant positive indirect effect only in the Social equation. Thus, initial occupational aspirations are most important for the development of Investigative and Enterprising types; Investigative types are more likely to aspire to investigative occupations nine years earlier, while Enterprising types were likely to aspire to careers in other vocational types (i.e., Social or Investigative).

College and University Characteristics

The selectivity of the undergraduate institution attended has a significant negative direct and indirect effect in the Social equation, a significant positive direct effect in the Enterprising equation, and does not have a significant direct or indirect effect in the Investigative equation. Thus, the

"quality" of the undergraduate institution has a positive influence on the development of Enterprising types, a negative influence on the development of Social types, and no substantive influence on the development of Investigative types. The distribution of majors at the undergraduate institution exerts significant direct effects in all three equations. In each instance, the distribution of "similar" types at the undergraduate institution has a significant positive direct effect on the development of each vocational type. That is, attendance at a college with a high proportion of science majors has a positive influence on becoming an Investigative type, while attendance at a college with a high proportion of business majors has a positive influence on becoming an Enterprising type. The positive direct effect of the percent of social science majors in the equation for Social types is reduced somewhat, however, by the significant negative indirect effect of this measure.

College and University Experiences

The undergraduate grades of subjects does not have a significant direct effect in any of the equations. But this variable does have a significant positive indirect effect in the Investigative equation and a significant negative indirect effect in the Social equation. The congruence between subjects' undergraduate major and current vocational type is a much stronger influence than college grades in each of the three equations. This congruence has a significant positive direct effect in the Investigative and Social equations and a significant negative direct effect in the Enterprising equation. Thus, congruence between undergraduate major and current vocational type (like congruence between initial job aspirations and current vocational type) has a

positive influence in the development of Investigative and Social types, and a negative influence on the development of Enterprising types.

Educational Attainment

The level of educational attainment exerts a significant positive direct effect in the Investigative equation, a significant negative direct effect in the Social equation, and is not statistically significant in the Enterprising equation. In general, educational attainment is not an important influence in the development of Enterprising types, but has a positive influence on the development of Investigative types, and a negative influence on the development of Social types.

Discussion

Prior studies of the developmental antecedents of Holland's vocational types (e.g., Eberhardt and Muchinsky, 1982; 1984; Neiner and Owens, 1985) have not used analytical procedures that permit identification of the direct and indirect influences of life history experiences. This neglect results not only in the failure to examine the indirect influence of life history experiences, but further may result in the misspecification of the total effect of these measures. A principal advantage of the causal modeling procedures used in this study is that they permit identification of the indirect influences of life history experiences, the manner by which these indirect influences are exerted through intervening variables in the model, and a more appropriate estimate of the total influence of each variable in the model (Wolfle, 1985).

The findings of this study clearly demonstrate that life history experiences frequently exert their influence in an indirect manner as suggested by Meiner and Owens (1985). The frequency with which these measures exert their influence in this manner varies among the three vocational types included in this study (see indirect effects in Table 3). Five, eight, and three of the predictor variables in the equations for Investigative, Social, and Enterprising types, respectively, exert a statistically significant indirect influence. Both family socioeconomic status and initial occupation aspiration exert significant indirect effects in all three equations, and in each instance, these indirect effects account for a sizable proportion of the total effect of these two variables. For example, the indirect effect of socioeconomic status accounts for 47%, 41%, and 38% of the total effect of this variable in the Investigative, Social, and Enterprising equations; the comparable percentages for initial occupational aspiration are 43%, 53%, and 47%.

The positive indirect effect of socioeconomic status on the development of Investigative types is mediated primarily through Investigative Orientation, Percent of Science Degrees, and Educational Attainment (see Table 2). Thus, family affluence has a permeating influence throughout the model for Investigative types. That is to say, affluent families tend to instill an Investigative Orientation in their children prior to college, to promote their attendance at institutions that confer a larger proportion of their total degrees in scientific fields, and to encourage higher educational attainment levels in their children. All these attributes have a significant positive direct effect on the development of Investigative types. At the same time, family affluence contributes to the development of attributes that inhibit the

development of Social types (thus, its significant negative indirect effect in this equation). That is to say, family affluence tends to promote higher levels of Investigative and Enterprising orientations and attendance at higher quality/more selective undergraduate institutions, all being factors with a significant negative direct effect on the development of Social types.

The indirect effect of initial occupational aspirations in all three equations is mediated through the congruence between subjects' undergraduate major and their current jobs. The higher the congruence between subjects' desired occupations in 1971 and their current jobs, the more likely they are to major in subject matter areas as undergraduates that are congruent with their current jobs. This relationship is the primary contributor to the positive indirect effect of initial occupational aspirations in the Investigative and Social equations and its negative indirect effect in the Enterprising equation.

There is one instance in which both the direct and indirect effects of variables are statistically significant, but they exert their influences in an opposite manner. This occurs in the influence of the percent of social science degrees on the development of Social types where the direct effect is positive and the indirect effect is negative. Failure to examine the indirect effect of this measure would result in an overestimation of its total effect. Such instances clearly demonstrate the need to assess the indirect effects of life history measures to understand how they exert their influence and to obtain a better estimate of their total effect on vocational development.

The causal sequence of variables in this study conforms to the general pattern of vocational development advanced by Holland (1973, 1985) and the

findings obtained clearly support his general premise that vocational type development is a function of a complex series of events resulting from initial personal orientations and vocational preferences that are subsequently reexamined as a result of interactions in alternative environmental settings. With a single exception (i.e., the lack of influence of educational attainment on the development of Enterprising types), at least one measure in each of the six sets of predictor variables included in the causal model exerts a significant direct or indirect influence on the development of the three vocational types included in this study. This clearly demonstrates that vocational type development is a function of a long series of life history experiences that extend from individuals' family backgrounds through their experiences at different kinds of colleges and universities.

What is equally clear, however, is that the magnitude, direction, and method by which these influences are exerted (i.e., direct versus indirect effects) differ dramtically among the three vocational types. Variations in the overall magnitude and direction of these influences may be seen in the total effects of the predictor variables shown in the last column for each vocational type in Table 3. These total effects are the sum of the direct and indirect effects.

Inspection of these total effects clearly indicates that sex and family background characteristics have a decidedly larger and a unique total effect on the development of Social vocational types. The total effect for the three life history measures in this variable set are larger and exert their influence in a different direction for Social types than for either Investigative or

Enterprising types. While the finding that being a women has a greater influence on Social type development is not surprising, tne stronger influence of the two family measures has potentially important implications for Holland's (1985) general premise that "types produce types" (p. 15) through biological endowments of physical and psychological potential and through attitudes shaped by alternative child-rearing styles (Grotevant, Scarr, and Weinberg, 1977; Roberts and Johansson, 1974). The relative affluence of the family and the number of parents employed in the occupation (vocational type) subsequently chosen by the child appears to have a decidedly stronger influence on the vocational development of Social types. Further research might examine the premise that Social type parents "produce" Social type offspring more than either Investigative or Enterprising parental types.

Socioeconomic status was not found to be an important discriminating variable in the studies conducted by Eberhardt and Muchinsky (1982) or Neiner and Owens (1985). Yet the findings of this study suggest that it exerts an important influence for all three vocational types, and is especially significant for Social types. This discrepancy in findings may be attributed to a number of factors, for example, the manner in which socioeconomic status was measured in the respective studies, its correlation with other measures in the various studies, and differences in the samples of the studies. Another possibility, however, may be that neither Eberhardt and and Muchinsky (1982) or Neiner and Owens (1985) examined the indirect effects of variables in their analyses, and approximately forty percent of the total effect of socioeconomic status in this study is exerted in an indirect manner. Thus, earlier studies may have underestimated the influence of this variable through their failure to examine its indirect influences on vocational type development.

While the backgound variables exert similar influences on the development of Investigative and Enterprising types, these two vocational types differ on other variables in the model. For example, the congruence between initial occupational aspirations in 1971 and current job and the congruence between undergraduate major and current job exert strong negative influences on the development of Enterprising types and a similarly strong positive influence on the development of Investigative (and Social) types. Thus, the development of Enterprising types appears to be less constrained by congruent vocational aspirations and educational training during adolescent years than is the case for the development of Investigative and Social types.

In contrast to these distinctive developmental patterns, there are two general sets of life history experiences that exert their influence in a similar manner across the three vocational types. The first set is the personal orientations of subjects prior to college entry. For each vocational type, the acquisition of preferences for the corresponding personal orientation and aversions to the noncorresponding personal orientations during the adolescent years have significant direct or indirect influences on subjects' vocational type in early adulthood. The second set is the distribution of majors in the undergraduate institutions attended by subjects. For each vocational type, attendance at institutions with proportionately more majors in similar fields of study exerts a positive direct or indirect influence on the development of that type. That is, attendance at institutions with proportionately more science majors has a positive influence on the development of Investigative types (and a negative influence on the development of Social and Enterprising types), while attendance at an institution with proportionately more business majors has a

positive influence on the development of Enterprising types (and a negative influence on the development of Social and Investigative types). These influences are consistent with the premise in Holland's theory that vocational development is a function of both individual characteristics (i.e., personal orientations) and environmental settings (i.e., distribution of majors), and with extant findings that subject matter areas, classified according to the six Holland categories, tend to socialize college students to their distinctive norms and values (Smart, 1987). The influence of the collegiate environment seems somewhat more important to the development of Investigative types where the strength of the percent of science degrees measure (.517) is considerably stronger than the percent of social science (.192) and business (.270) degrees for Social and Enterprising types, respectively. This may suggest that the strength of the college environment influence is greater in subject matter areas with a higher level of paradigm development (e.g., sciences) than "softer" fields (Kuhn, 1970).

The findings of this study, like those obtained by Eberhardt and Muchinsky (1982; 1984) and Heiner and Owens (1985), show that life history experiences may be used to understand the differential development of vocational types proposed by Holland (1973; 1985), and that these differential patterns a generally consistent with the tenets of his theory. The present findings are distinctive, however, in at least two respects.

It is clear that where one goes to college and what one does in college have important consequences for the development of Holland vocational types. The measures of undergraduate institutions included in this study only begin to tap

the potential influence of the collegiate experience on subsequent vocational development of Holland types. There is a clear need to explore other dimensions of the undergraduate experience. The pervasive influence of faculty members on students' subsequent development, especially informal, nonclassroom interactions (Pascarella, 1980), appears to be one dimension of the collegiate experience that warrants greater attention in subsequent studies.

The other distinctive contribution of this study is the use of causal modeling procedures to understand how life history experiences influence vocational development. Such procedures appear to have the potential to reveal more clearly the dynamics by which these influences are exerted in direct and indirect manners, to get a more appropriate estimate of their total influence on vocational development, and to link more closely the findings from empirical studies to the theoretical postulates in which they are grounded. The accumulated findings from the use of causal modeling procedures may dimish the view of life history experience data as "being long on prediction but relatively short on understanding" (Neiner and Owens, 1985, p. 130).

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TABLE 1

Definitions of Variables Included in the Casual Model

Symbols	Variable Names	Definitions
SEX	Sex	Sex of student coded: 1 = male, 2 = female.
SES	Socioeconomic Status	Mother and fathers' educational levels and annual family income. Educational level was a six level measure (from 1 = "grammar school or less" to 6 = "postgraduate degree"). Family income was a twelve level measure (from 1 = "less than $4,000" to 12 = $40,000 or more"). Alpha = 0.81.
PAR71	Parents' Occupations	The number of parents with the same vocational type as subjects in the study. There were 47 specific occupations listed. These occupations were then classified as vocational types on the basis of Holland's (1985, pp. 182-188) most recent classification system "The Occupational Finder." The values of this measure ranged from 0 (none) to 2 (both parents having the same vocational type as the subject in 1980).
INV71	Investigative Orientation (1971)	Subjects' self ratings of their academic and mathematical abilities and their intellectual self-confidence. These items had a five point scale (from 1 = "lowest 10%" to 5 = "highest 10%"). Alpha = 0.82.
SOC71	Social Orientation (1971)	The relative importance of the following life goals to subjects: "influencing social values," becoming a community leader," "participate in community programs," "help others in difficulty," "become involved in environment." Subjects rated the importance of these goals on a four point scale (1 = "not important" to 4 = "essential"). Alpha = 0.76.
ENT71	Enterprising Orientation (1971)	Subjects' self ratings of their "drive to achieve," "leadership ability," "popularity," and "public speaking ability," and the relative importance of the following life goals: "influencing political structure," "be very well off financially," and "be successful in own business." The ability self-ratings and the importance of goals items were measured as noted on the two preceding scales. Alpha = 0.80.
OCC71	Initial Occupational Aspiration (1971)	The congruence between subjects' desired occupation (i.e., vocational type) in 1971 and their actual vocational type in 1980. "The Occupational Finder" (Holland, 1985, pp. 182-188) was used to estimate subjects' vocational types in 1971 and 1980. There were four congruence levels based on the "psychological resemblances" among the six personality types as defined by Holland's hexagonal configuration (Holland, 1985, p. 29). Those whose 1971 and 1980 vocational types were the same were assigned a value of 4, those whose vocational types were in adjacent categories on the hexagon were given a value of 3, those whose vocational types were two steps removed on the hexagon were given a value of 2, and those whose vocational types in 1971 and 1980 were at opposite ends of the hexagon were assigned value of 1.
SELECT	College Selectivity	The mean SAT or ACT score of the undergraduate student body.
PERSCI	Percent of Degrees in Science	The percent of total undergraduate degrees conferred in science and engineering fields.
PERSOC	Percent of Degrees in Social Science	The percent of total undergraduate degrees conferred in social science disciplines.
PERBUS	Percent of Degrees in Business	The percent of total undergraduate degrees conferred in business fields.

Table 1 cont'd.

Definitions of Variables Included in the Casual Model

Symbols	Variable Names	Definitions
GRADES	College Grades:	Undergraduate grades of subjects measured on a six point scale (from 1 = "D or less" to 6 = "A- or more").
CONGRU	Congruence Between Undergraduate Major and Current Job	Both the undergraduate majors and current jobs of subjects were classified according to Holland type (using "The Occupational Finder") and a four level measure of congruence was computed similar to that described above for "initial occupational aspiration." For example, those with common undergraduate majors and jobs (e.g., both Social) were were assigned a value of 4, while those with opposite majors and jobs (e.g., Social and Realistic) were assigned a value of 1.
DEGREE	Highest Earned Degree	Highest educational degree received by subjects measured on a five point scale (from 1 = "HS diploma or equivalent" to 5 = "doctorate or advanced professional degree").
TYPE	Vocational Type	Subjects indicated their first and current full-time jobs following their undergraduate education. The 47 occupational codes for these two jobs were converted to vocational types using "The Occupational Finder" (Holland, 1985, pp. 182-185). Holland (1985, p. 3) notes that vocational type may be estimated in a variety of ways, including individuals "choice of vocation or field of training" and their "work history." Only those subjects whose first and current full-time jobs were both included in the Investigative, Social, and Enterprising occupations as defined by Holland were included in the study in order to obtain the most reliable estimate possible. Representative occupations of each vocational type are: Investigative (physician, scientific researcher), Social (nurse, elementary teacher), and Enterprising (business manager, lawyer)

Note: A two-step procedure was used to develop scores on all measures where individual items were on a different metric (Status). First, all items were standardized; second, the score for each individual was obtained by summing across the standard.

TABLE 2

Structural Equations for the Eleven Common Intervening Endogenous Variables

Independent Variables	INV71	SOC71	ENT71	OCC71	SELECT	PERSCI	PERSOC	PERBUS	GRADES	CONGRU	DEGREE
SEX	-.639* (-.147)	.147 (.021)	-1.733* (-.201)	.203* (.089)	-2.503* (-.084)	-.030* (-.106)	.029 (.064)	-.006 (-.027)	.293* (.167)	.231* (.124)	-.231* (-.122)
SES	.202* (.211)	-.007 (-.005)	.181* (.103)	-.050* (-.108)	2.020* (.333)	.007* (.123)	.011* (.123)	-.002 (-.042)	.029* (.081)	-.001 (-.003)	.023* (.065)
PAR71	-.459* (-.112)	.178 (.030)	.083 (.011)	.024 (.012)	-1.614 (-.062)	-.012 (-.049)	.020 (.052)	.002 (.012)	.013 (.009)	.024 (.015)	-.115 (-.076)
INV71				.022 (.045)	1.786* (.282)	.011* (.177)	.002 (.019)	-.002 (-.056)	.132* (.353)	-.014 (-.035)	.016 (.043)
SOC71				.008 (.025)	.152 (.035)	-.001 (-.019)	.004 (.062)	-.001 (-.035)	.007 (.029)	.005 (.019)	.004 (.017)
ENT71				.006 (.024)	-.220* (-.063)	-.002 (-.054)	.001 (.018)	.001 (.063)	-.012 (-.059)	-.004 (-.019)	.019* (.092)
OCC71					-.612 (-.046)	.000 (.000)	.005 (.027)	.003 (.032)	.014 (.019)	.221* (.269)	.071* (.092)
SELECT									.000 (.001)	-.003 (-.049)	.013* (.225)
PERSCI									-.343 (-.055)	.135 (.021)	.051 (.008)
PERSOC									.184 (.047)	-.261* (-.063)	.375 (.097)
PERBUS									.038 (.004)	.224 (.025)	.108 (.013)
GRADES											.277* (.279)
CONGRU											.054* (.059)
R^2	.077*	.001	.053*	.021*	.238	.072*	.031*	.008	.146*	.108*	.251*

Note: Standardized coefficients are in parentheses.
p<.01

TABLE 3

Direct, Indirect and Total Effects of Variables in the Causal Model

Independent Variables	Investigative			Social			Enterprising		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
SEX	-.158* (-.201)	-.016 (-.020)	-.174 (-.221)	.299* (.298)	098* (098)	.397 (.396)	-.141* (-.158)	-.082* (-.092)	-.223 (-.250)
SES	.010* (.064)	.009* (.053)	.019 (.117)	-.026* (-.129)	-.018* (-.089)	- 044 (- 218)	.016* (.083)	.010* (.053)	.026 (.136)
PAR71	-.154* (-.225)	-.036* (-.053)	-.190 (-.278)	.239* (274)	.034* (.039)	.273 (313)	-.065* (-.110)	.002 (.003)	-.067 (-.113)
INV71	.032* (.193)	.009* (.054)	.041 (.247)	-.019* (-.088)	-.009* (-.040)	-.028 (-.128)	-.014* (-.072)	-.001 (-.003)	-.015 (-.075)
SOC71	-.010* (-.087)	.000 (.000)	-.010 (-.087)	.013* (.087)	.001 (.006)	.014 (.093)	-.003 (-.021)	-.001 (-.008)	-.004 (-.029)
ENT71	-.009* (-.095)	-.001 (-.007)	-.010 (-.102)	-.011* (-.096)	.000 (.003)	-.011 (-.093)	.020* (.191)	.000 (.002)	.020* (.193)
OCC71	.027* (.078)	.020* (059)	.047 (.137)	.014 (032)	.016* (.036)	.030 (.068)	-.041* (-.104)	-.036* (-.092)	-.077 (-.196)
SELECT	.000 (.003)	.001 (018)	.001 (.021)	-.004* (-.125)	-.001* (-.020)	-.005 (-.145)	.004* (.138)	.000 (.006)	.004 (.144)
PERSCI	.508 (.184*)	.009 (.003)	.517 (.187)	-.193 (- 054)	.001 (000)	-.192 (-.054)	-.315* (-.100)	-.010 (-.003)	-.325 (-.103)
PERSOC	-.221* (-.127)	.002 (.001)	-.219 (-.126)	.219* (098)	- 027* .012)	192 (.086)	.002 (.001)	.025 (.013)	.027 (.014)
PERBUS	-.119 (-.031)	.025 (.007)	-.094 (-.024)	- 187 (- 038)	.012 (.002)	-.175 (-.036)	.306* (.070)	-.036 (-.008)	.270 (.062)
GRADES	- 001 (-.002)	.015* (.034)	.014 (.032)	027 (.048)	- 009* (-.017)	.018 (.031)	-.027 (-.052)	-.001 (-.011)	-.028 (-.063)
CONGRU	.079* (.187)	.003 (.007)	.082 (.194)	.068* (.127)	-.001 (-.004)	.067 (.123)	-.147* (-.306)	-.001 (-.002)	-.148 (-.308)
DEGREE	055* (.123)		.055 (.123)	- 036* (-.062)		-.036 (-.062)	-.020 (-.039)		-.020 (.039)
R^2			.325*			.397*			.273*

Note: Standardized coefficients are in parentheses.
p<.01

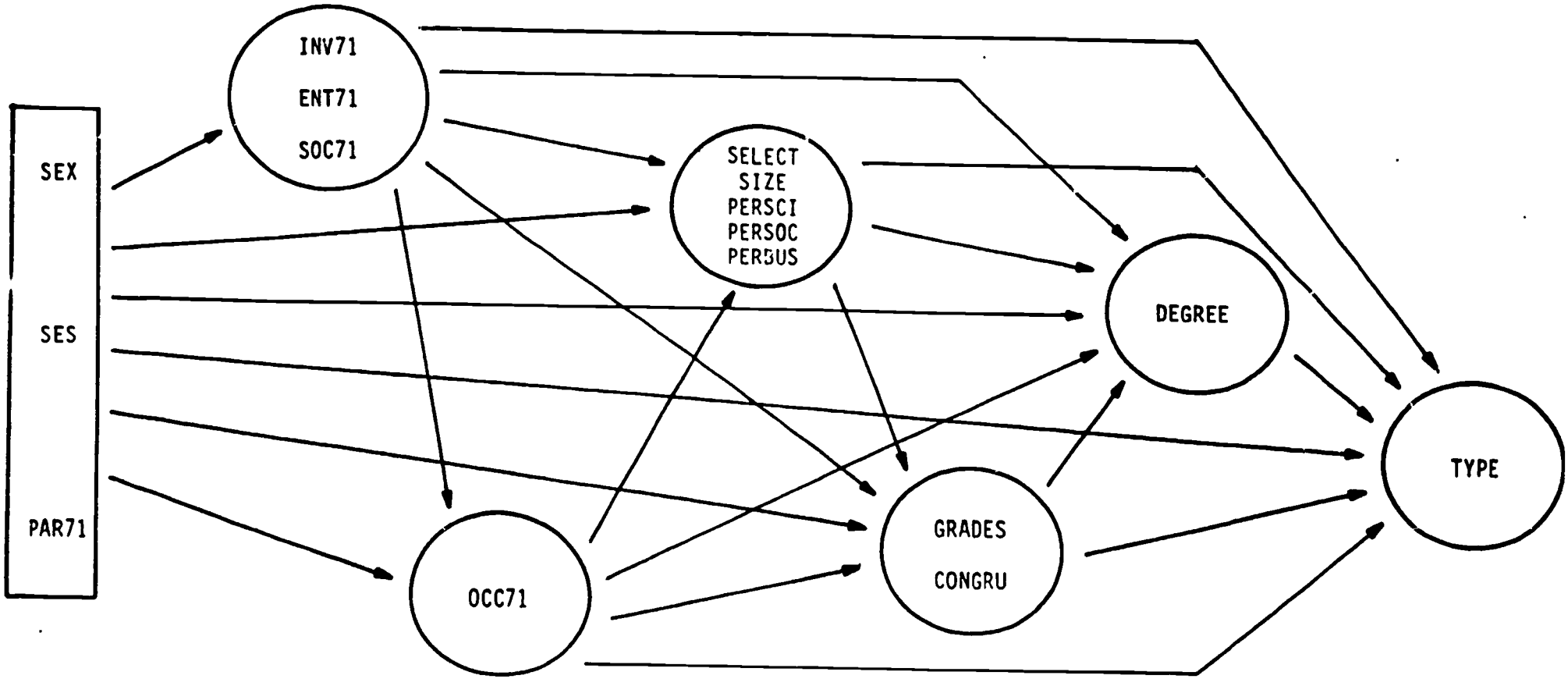
INV71
ENT71
SOC71
SEX
SES
PAR71
SELECT
SIZE
PERSCI
PERSOC
PERBUS
DEGREE
TYPE
GRADES
CONGRU
OCC71

Figure 1

Causal Model of Vocational Type Development

Note: See Table 1 for full names and definitions of variables in the model.