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Gary Oates

Bowling Green State University - Main Campus, oatesg@bgsu.edu

Carmi Schooler

Mesfin Samuel Mulatu

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Occupational Self-Direction, Intellectual Functioning, and Self-Directed Orientation in Older Workers: Findings and Implications for Individuals and Societies¹

Carmi Schooler and Mesfin Samuel Mulatu
National Institute of Mental Health

Gary Oates
Bowling Green University

Using data from 1994–95 third-wave interviews, this study tests whether Kohn and Schooler’s findings (based on 1964 and 1974 interviews) that self-directed occupational conditions increase intellectual functioning and self-directed orientations hold when the respondents are 20 years older. Results confirm that even late in life self-directedness of work continues to affect intellectual functioning and self-directedness of orientation. These psychological characteristics, in turn, affect social-structural position in ways that increase disparities between the advantaged and disadvantaged. From a historical and societal perspective, the findings suggest that the occupational self-directedness of a society’s workers may affect its social norms, values, and modes of production.

This article examines the endurance, as people grow older, of the social-psychological processes underlying the findings that “jobs that facilitate occupational self-direction increase . . . intellectual flexibility and promote a self-directed orientation to self and to society; jobs that limit

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occupational self-direction decrease . . . intellectual flexibility and promote a conformist orientation to self and to society” (Kohn and Schooler 1983, p. 152). Establishing such continuing psychological effects of occupational conditions is clearly of direct interest to those concerned with understanding how the environment affects psychological functioning. From a more clearly sociological perspective, because individuals’ positions in the social structures of their societies are central determinants of the environmental conditions they face and choose (Kohn and Schooler 1983; Kohn and Slomczynski 1990; Merton 1957), the psychological effects of such social-structurally determined environmental conditions are of direct theoretical relevance. Confirming the existence and endurance of these psychological effects of occupational conditions would provide an important clue to understanding the origins of differences in self-directed orientations and intellectual functioning among individuals located at different social structural locations. Furthermore, there is reason to believe that the pattern of distribution of self-directed orientations and intellectual functioning within a given society may well come to affect both the culture and social structure of that society. Documenting the enduring effects of intellectually demanding, self-directed work on the intellectual functioning and personality attributes of individuals throughout the life course would significantly facilitate understanding of both the effects of social-structurally influenced environmental conditions on individuals and how these effects on individuals may in turn affect their societies. Although the psychological and sociological implications of such findings are densely intertwined, it is probably heuristically simpler to begin by discussing them separately.

THE EFFECTS OF SELF-DIRECTED WORK ON THE INDIVIDUAL: PSYCHOLOGICAL IMPLICATIONS

Besides extending the applicability of empirical conclusions from earlier studies (e.g., Kohn and Schooler 1983), finding that, even well into the life span, doing intellectually demanding, self-directed work increases people’s intellectual functioning would add important further evidence to the large body of research from a wide range of disciplines—including animal-based neurobiology studies (Bennett et al. 1979; Kempermann, Kuhn, and Gage 1997)—that ties exposure to the cognitive demands of complex environments to increased intellectual functioning throughout the life course and across species.

Schooler (1984, 1990*b*) presents both a review of the evidence and a rough-hewn theory of the psychological mechanisms underlying the effects of environmental complexity on psychological functioning. According to

this theory, the complexity of an individual's environment is defined by its stimulus and demand characteristics. The more diverse the stimuli, the greater the number of decisions required and the greater the number of considerations to be taken into account in making these decisions, the more ill defined and apparently contradictory the contingencies, the more complex the environment. To the degree that such an environment rewards cognitive effort, individuals should be motivated to develop their intellectual capacities and to generalize the resulting cognitive processes to other situations. To the extent that such environments reward initiative and independent judgment, they should foster a generalized individualistic orientation favoring self-directedness rather than conformity to external authority. On the other hand, cognitive processes and behaviors that are adaptive in complex environments may not be adaptive in simpler ones. Simple environments may not provide sufficient rewards for the expenditure of effort needed to insure the development or continuance of relatively high levels of cognitive functioning. Consequently, continued exposure to relatively simple environments may result in a decrement in intellectual functioning and self-directed orientation in keeping with the low level of environmental demand.

Demonstrating that environmental conditions continue to affect people's intellectual functioning throughout their lives also provides evidence against those who argue that levels of such functioning are basically determined by biological factors (e.g., Herrnstein and Murray 1994). Finding that self-directed occupational conditions continue to have a positive effect on intellectual functioning in older individuals despite neuropsychobiological effects of aging (Schooler, Caplan, and Oates 1998) would also be important for our understanding of the human aging process.

It is possible that older individuals may be more adversely affected than younger ones by the greater intellectual demands associated with relatively higher levels of occupational self-direction (Kohn and Schooler 1983). If cognitive speed (Salthouse 1991) and/or working memory (Baddeley 1986) decline with age, one might predict that older workers would react particularly poorly to such intellectually demanding environmental conditions. Still, it could be argued that the very existence of such deficits might make it more important for older rather than younger individuals to be in environments that demand that they continue to practice and develop their intellectual skills.

Finding that occupational conditions similarly continue to affect core beliefs about self and society would argue against the views of those who hold that such values and beliefs are pretty firmly set early in life by some combination of biological predisposition (e.g., Martin and Jardine 1986; Rowe 1994) and/or early experience (e.g., Kasser, Koestner, and Lekes 2002).

As for how occupational self-direction might affect self-directed orientations in later stages of the life course, prior empirical findings and theoretical discussions led to often contradictory hypotheses (see Schooler and Oates 2001). There is the possibility that age brings an increase in wisdom, defined as including relativism of values and priorities and the recognition and management of uncertainty (Baltes and Staudinger 2000). There is the contention that adherence to traditional values generally increases with age (Blanchard-Fields et al. 2001). There is the “aging stability” hypothesis suggesting that as individuals age their orientations toward themselves and others become progressively less volatile and responsive to social structural factors such as job conditions (Glenn 1980; Mortimer and Finch 1986).

One argument for the aging stability thesis hinges on the assumption that the more recent the role acquisition, the more susceptible the role’s incumbent to the effects of environmental forces (Van Mannen and Schien 1979). This perspective implies that the dimensions of occupational self-direction should have a more pronounced effect on self-directed orientations at earlier stages of workers’ careers, when they are younger. Alternatively, “encountering the same job conditions over time” might “engender an increasing and cumulative psychological effect” (Mortimer and Finch 1986, p. 230). This view is consistent with an increase in the psychological centrality of work as individuals age. It implies a concomitant strengthening of the effect of occupational self-directedness on self-directed orientations over time. Set against all of these theoretical positions that posit changing effects of occupational self-direction on self-directed orientations as people age is the possibility that such effects do not change with age. Such a possibility implies that the “lessons” people learn from the work that they do are unaffected by how old they are.

THE EFFECTS OF SELF-DIRECTED WORK ON THE INDIVIDUAL: SOCIOLOGICAL IMPLICATIONS

Establishing that occupational self-direction has a positive effect on intellectual functioning would raise the possibility of the development over time of a feedback loop between a society’s modes of production and socioeconomic operation, on the one hand, and the intellectual functioning of its members, on the other. Societies whose modes of production and socioeconomic operation increase the degree to which their members do self-directed work might be expected to have a relatively high portion of their members functioning at high intellectual levels. Such an increased level of individual intellectual functioning might well lead to more effective modes of production.

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Finding that the experience of occupational self-direction leads to self-directed orientations to self and society would raise the possibility that the degree to which the modes of production within a society promote occupational self-direction may come to affect the level of individualism of that society's cultural norms. Here too, there may develop, over time, a feedback loop between the individualistic values of a society's members and that society's modes of production and socioeconomic operation.

There has been a wide range of sociological theorizing that individualism, through one process or another, encourages economic development. This notion, of course, is core to Weber's argument in the debate about the importance of the Protestant ethic to the growth of Western capitalism (Tawney 1963; Weber 1958). Goldstone (1987) argued that technical and economic progress is dependent on individuals' being open to innovation, pluralism, and risk taking. He attributed the historical economic stagnation of a wide range of countries to the intolerance of innovation resulting from a "suppression of alternatives and emphasis on internal cultural orthodoxy" (Goldstone 1987, p. 132). To the degree that self-directed orientations loosen one's ties to and concerns about the social groups to which one belongs (Macfarlane 1978; Schooler 1990*a*), individuals strongly interested in their own success may also be more willing to engage in potentially lucrative risky ventures than would those constrained by concerns over the repercussions of their actions to the social groups with which they identify. In addition, such persons may be freer to act without concern for the constraints that such group ties impose, providing for greater flexibility in both the geographical movement and occupational behavior of workers.

The connection between self-directed individualistic orientations and economic development is, however, far from seamless. Such orientations apparently characterize both preliterate immediate-return hunter-gatherer societies (Woodburn 1982) and subarctic hunting societies (Ridington 1988). In neither case did self-directed individualistic orientations lead to economic development. Nor do the orientations and values that individuals within a society derive from their work experiences necessarily have a relatively immediate effect on their society's norms. Many factors, including the effectiveness of the institutions shielding a given society's established norms from change, can affect the degree and speed of this process. That said, the possibility that a society's norms might be influenced by orientations and by values that individuals derive from their work remains distinctly plausible (see Cohen [2001] for an extensive review of such hypotheses). For more elaborated discussions of the nature of the processes that may be involved, see Schooler (1990*a*, 1998*b*).

THE 1994–95 FOLLOW-UP STUDY

Although the Kohn-Schooler findings that occupational self-direction increases self-directedness of orientation and intellectual functioning are consistent when tested across gender and industrialized societies, there were several interrelated reasons for testing the continued validity of these findings on the Kohn-Schooler 1974 sample after the passage of 20 years. The primary reason was to ascertain whether the effects of occupational self-direction on intellectual functioning and self-directed orientations to self and society remain relatively consistent over a more extended period of time than had been previously established—a period during which the sample moved to later stages of their work careers and life courses. As discussed above, there are plausible reasons to hypothesize that each of the three possible relationships with age might occur—the effects of occupational self-direction on intellectual functioning and self-directed orientations to self and society might increase, decrease, or remain the same with age. In order to evaluate these possibilities we use structural equation modeling (SEM) in analyses that include the 1994–95 wave of interview data to examine whether and how the relevant parameters may change in the younger and older segments of our sample.

Other findings from two earlier articles (Schooler, Mulatu, and Oates 1999; Schooler and Mulatu 2001) using data from the 1994–95 survey are relevant to the present article's concern with the socioenvironmental determinants of intellectual functioning. Using longitudinal data and full-information reciprocal effects SEM (in which the measurement and causal parameters of the model are estimated simultaneously), Schooler and Mulatu (2001) found that carrying out complex, intellectually demanding leisure time activities improves intellectual functioning among older adults, whether or not they are employed. Using longitudinal data and two-step reciprocal effects SEM modeling, in which the measurement and causal parameters are estimated separately, Schooler et al. (1999) found evidence that intellectual functioning and substantively complex paid work continue to reciprocally affect each other even in older workers.

In the present article we expand these earlier findings in a number of important ways. Substantively, we enlarge the set of psychological variables beyond intellectual functioning to include self-directed orientation. In doing so, we broaden the scope of our psychological variables to test the continuing validity as people age of both aspects of the central Kohn-Schooler hypothesis about the effects of occupational self-direction—that it increases intellectual functioning and self-directed orientations.

As in earlier articles from this research program (Kohn and Schooler 1983; Schooler et al. 1999), our causal assessments involve the use of nonrecursive reciprocal effects models to estimate the degree to which a

correlation found between an occupational condition and a psychological characteristic reflects the effect of the job on that psychological characteristic—as compared to the degree to which having that characteristic affects the likelihood of getting or keeping the job in question (see Farkas et al. 1997).

The present article differs markedly from our earlier examination of the causal connections between substantively complex paid work and intellectual functioning both in content and methodology (Schooler et al. 1999). In terms of content, we use the second-order latent factor *occupational self-direction* to assess the causal connection between self-directed work and intellectual functioning. This factor represents a distinctly broader concept than *substantive complexity*, the measure of complex work we examined earlier. Occupational self-direction not only includes the job's substantive complexity, but also its routinization and closeness of supervision. The present article thus more fully matches the conceptualization of self-directed work that underlies the Kohn and Schooler (1983) theoretical conceptualization. Although, as Kohn and Schooler (1983) note, substantive complexity is a centrally important condition for occupational self-direction, workers cannot exercise occupational self-direction if they are closely supervised. Similarly if the work is so routinized that “it does not allow a variety of approaches, the possibilities for exercising initiative, thought and judgment are seriously limited. . . . No one of these conditions is definitional of occupational self-direction. Together, though, the three job conditions largely determine how much self-direction men [and women] can exercise in their work” (Kohn and Schooler 1983, p. 22).

Methodologically, the SEM approach we employ here is also technically different from what we used earlier (Schooler et al. 1999) to evaluate the potential reciprocal effects between the substantive complexity of work and intellectual functioning. In the latter we used two-step reciprocal effects modeling exclusively. In the present article, in order to confirm our central hypotheses about the continued existence of reciprocal effects between occupational self-direction, on the one hand, and intellectual functioning and self-directed orientations on the other, we first used a one-step full-information approach, which some see as more rigorous and appropriate (e.g., Fornell and Yi 1992; but see also Joreskog et al. 2000; Schumacker and Lomax 1996). Subsequently, as discussed more fully in the methodology section, we followed these analyses by two-stage, age-based multigroup reciprocal effects models to test the specific generalizability of our findings to the younger and older segments of our sample.

METHOD

Respondents

The male respondents are a subsample, interviewed in 1974, of a nationally representative sample of employed men first interviewed in 1964 for the Kohn and Schooler (1983) study of the psychological effects of occupational conditions. The 1964 sample was an area probability sample drawn by the National Opinion Research Center (NORC) of males over 16 years of age then currently employed in the United States at least 25 hours per week in nonmilitary occupations. From an initial selection of 4,105 men, 3,101 (76%) gave reasonably complete interviews. A series of analyses, including comparisons with relevant census data, indicated that the only notable difference between the sample and the target population was that the rate of nonresponse varied proportionately with community size (Kohn and Schooler 1983, pp. 315–18).

In 1974, NORC, in carrying out the follow-up survey for Kohn and Schooler (1983), interviewed a representative sample of approximately one-fourth of the 1964 respondents who were then less than 65 years old. Of the 883 men who were randomly selected for the follow-up study, NORC succeeded in locating 820 (93%). Of the 785 men who were still alive, NORC actually interviewed 687 (88%). As a means of assessing the representativeness of the men interviewed in 1974, a series of analyses were carried out comparing their 1964 social and psychological characteristics with those of the men who were randomly excepted from the follow-up study. Differences were few and small in magnitude. At the time of the original 1964 interview, the men who were interviewed in 1974 were a little more intellectually flexible, somewhat more trustful, slightly lower in self-confidence, and somewhat more liberal in their religious backgrounds. The two groups did not differ significantly in education, social stratification position, major occupational characteristics, age, and even urbanness (Kohn and Schooler 1983, p. 320). As a further test of the representativeness of the sample of men interviewed in 1974, the major analyses of the interrelationship among social stratification, occupational conditions, and psychological functioning that had been carried out with the full 1964 sample were replicated on the 1964 data of the 1974 sample (Kohn and Schooler 1983, p. 320). Despite the smaller size of the 1974 subsample the main findings of the original analyses of the 1964 data held up uniformly well.

In 1974, an attempt was made to interview the wife of every male respondent who was then married. Interviews were conducted with 555 women, 90% of the 617 eligible. They ranged in age from 21 to 65 years. At the time of the interview, approximately half of these women (269) were formally employed at least 10 hours per week. Generalizations about

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women based on the 1974 sample can most confidently be made about those who were married at the time to men between 26 and 65 years of age who had been employed in 1964 and quite plausibly about other employed women in the same cohort.

Sample of Interest and Effects of Attrition

In preparation for the 1994–95 follow-up, we succeeded in locating 95% (650) of the 687 households that took part in the 1974 survey. The present analysis centers on those men and women who were employed in both 1974 and 1994–95. Unless they were known to be dead or disabled, we had to interview respondents in 1994–95 in order to establish whether they were still employed. Of the 626 men employed in 1974, 590 (94.2%) were located in 1994–95; of these, 159 (26.9%) had died and 14 (2.4%) were disabled. Of the remaining 417 cases who might have been employed in 1994–95, 334 (80.0%) were interviewed. The other 83 (19.9%) were not interviewed because they refused outright or proved to be unavailable after three contacts. Of the 334 who were interviewed, 166 (49.7%) were still employed. The parallel numbers for the 269 women who were employed in 1974 were: 248 (92.2%) found; of these 26 (10.5%) had died and 2 (0.8%) were disabled. Of the 220 women who might have still been employed, 182 (82.7%) were interviewed; of these, 78 (42.9%) were still employed. Consequently, the total sample for the present analyses is 244, of which 166 are men and 78 are women. The respondents ranged in age from 41 to 83. Fourteen respondents were African-Americans and the rest were European-Americans. Their median level of education was high school graduate with some technical schooling.

In order to determine how our current sample might differ from the 1974 sample of working men and women from which it was derived, we performed a series of logistic regression analyses. The sociodemographic characteristics (age, gender, race, education) and factor scores of 1974 occupational conditions (substantive complexity, closeness of supervision, and routinization) and personality characteristics (authoritarian conservatism, personally responsible morality, fatalism, and intellectual flexibility) were used to predict whether there were differences (1) between the subjects who were or were not located, (2) among those located, interviewed versus not interviewed, and (3) among the interviewed, working versus not working in 1994–95. There were only two significant predictors of whether or not 1974 participants were located: African-Americans and those with higher scores on fatalism were less likely to have been found. In terms of who was interviewed, participants who were interviewed in 1994–95 were more likely to be male and younger than those who were not interviewed. Finally, among those who were interviewed, those who

were working in 1994–95 were more likely to be younger and to score higher on the fatalism factor than those who were not working.

Data Collection

The data to be presented here are derived from a subset of questions from a much larger interview. This interview was based not only on the earlier Kohn and Schooler research on the psychological effects of occupational conditions, but also on earlier research on coping mechanisms (Pearlin and Schooler 1978), the National Institute on Aging (NIA)–sponsored University of Michigan Health and Retirement Survey, and a general review of other relevant research including interview-based assessments of cognitive functioning in older individuals.

The interviews were carried out by NORC and the Cygnus Corporation, all of the interviewers being trained and supervised by NORC. It took an average of 3.5 hours to complete an interview. Respondents were paid \$50.

Measures

Occupational Self-Direction

As in the earlier analysis by Kohn and Schooler (1983), occupational self-direction is measured as a second-order factor based on three first-order factors: (1) substantive complexity of work, (2) closeness of supervision, and (3) routinization.

Substantive complexity.—Substantively complex work is defined as work that in its very substance requires thought and independent judgment. By its very nature, it requires making many decisions involving ill-defined or apparently contradictory contingencies (Kohn and Schooler 1983, p. 106). Our measures of substantive complexity are derived from detailed open- and closed-ended questions about the respondents' work with things, data, or ideas and people. For 1974 and 1994–95 jobs, these questions provided the basis for seven ratings: appraisals of complexity of work with things, with data, and with people derived from rating scales in the *Dictionary of Occupational Titles (DOT)*; U.S. Department of Labor 1965), the respondents' estimates of the amount of time they spent working at each type of activity, and an appraisal of the overall complexity of work. For analytical reasons described in the data analysis section below, we used five of the highest loading items in previous analyses (Kohn and Schooler 1983; Schooler et al. 1999): complexity of working with data, complexity of working with people, overall complexity of work, hours of work with data, and hours of work with people. *Data* are defined as

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information, knowledge, and conceptions obtained by observation, investigation, interpretation, visualization, and mental creation (e.g., numbers, symbols, and words). Complexity of work with data was rated on a nine-point scale (1 = no significant work with data to 9 = synthesizing data). Complexity of work with *people* was rated on a 10-point scale (1 = no significant work with people to 10 = mentoring others). *Overall complexity* of work was rated on a seven-point scale (1 = not at all complex to 7 = setting up a complex system of analysis, synthesis, or both). Full descriptions of these scales are given in Kohn and Schooler (1983) and Schooler et al. (1999). Hours of work per week with people and data ranged from 0 to 90 both in 1974 and 1994–95.

Closeness of supervision.—In both 1974 and 1994–95 closeness of supervision was measured by four indicators: (1) degree of closeness of supervision rated on a four-point scale similarly in 1974 and 1994–95 (1 = I am my own boss within general policies to 4 = boss decides what I do and how I do it); (2) freedom to disagree with supervisor rated on a five-point scale in 1974 and a seven-point scale in 1994–95 (1 = not at all free to 5 or 7 = completely free); (3) supervisors' style of assigning tasks rated on a four-point scale in both 1974 and 1994–95 (1 = usually discusses to 4 = usually tells); and (4) importance of doing tasks as told by supervisor rated on a five-point agreement scale in 1974 and on a seven-point scale in 1994–95 (1 = not at all important and 5 or 7 = extremely important). Respondents who were self-employed or those who were not supervised were given the lowest supervision scores.

Routinization.—In 1974 and 1994–95, routinization of work was indexed by one item that was based on the self-ratings of work repetitiveness and predictability. It was coded on a five-point scale (1 = different and unpredictable tasks to 5 = same and exactly predictable tasks).

Self-Directed Orientation to Self and Others

Following closely the previous analysis by Kohn and Schooler (1983), self-directed orientation is measured as a second-order factor. The three first-order factors on which it is based are (1) authoritarian conservatism, (2) personally responsible morality, and (3) fatalism. The individual items making up these first-order factors were rated on a five-point scale in 1974 and on a seven-point agreement scale in 1994–95 (i.e., 1 = strongly disagree to 5 or 7 = strongly agree).

Authoritarian conservatism.—This personality dimension is defined by an extreme and rigid conformance to the dictates of authority and intolerance to nonconformity. Kohn and Schooler (1983) adapted the individual items from an earlier study by Adorno et al. (1950) and derived an 11-

item authoritarian conservatism latent factor. The five highest loading items were selected to index this factor in the present study.

Personally responsible morality.—This latent factor is characterized as a continuum of moral positions from defining and holding oneself personally responsible for maintaining one's own moral standards to believing that morality consists of strict adherence to the letter of the law and keeping out of trouble. The four items upon which it is based are the same as those used by Kohn and Schooler (1983).

Fatalism.—This factor measures the degree to which the respondent believes that his or her life is controlled by outside forces as opposed to his or her own efforts. The three items upon which it is based are the same as those used by Kohn and Schooler (1983).

Intellectual Flexibility

Intellectual flexibility, the intellectual functioning measure used in most of our analyses, is defined as flexibility in coping with the intellectual demands of a complex situation (see Kohn and Schooler 1983, p. 112). Its measurement is based on a model with five indicators: (1) a summary score for performance on a portion of the Embedded Figures Test (Witkin et al. 1962); (2) the interviewer's appraisal of the participant's intelligence, made on the basis of the interviewer's impression during the interview session rated on a five-point scale (1 = dull, uncomprehending to 5 = much above average intelligence); (3) the frequency with which the respondent agreed when asked the many agree-disagree questions included in the interview (because some of the questions included in the battery were stated positively and others negatively, an overall tendency to agree suggested that the participant was not thinking carefully about and was less differentiating among the questions); (4) a rating of the degree to which the answer to the question "What are all of the arguments you can think of for or against allowing cigarette commercials on TV?" provided reasons for both sides of the argument; and (5) a rating of the adequacy of the answer to a hypothetical question about how the respondent would decide between two alternative locations for a hamburger stand (adequacy being judged by a concern with potential costs, with potential sales, and with the understanding that profits result from the relationship between the two). Earlier analyses (Schooler et al. 1999; Schooler and Mulatu 2001) have demonstrated that this measure correlated highly ($R = .87$) with an SEM-based latent factor indexed by standard psychometric measures of intellectual functioning.

Sociodemographic Characteristics

Measures of age, gender (1 = male, 2 = female), race (1 = European-American, 2 = African-American), and level of educational attainment (1 = grade school to 9 = advanced degree) were also included.

Data-Analytic Procedures

We estimated our models on covariance matrices using the recently released Mplus version 2 modeling program (Muthén and Muthén 2001). Our data were 97% complete. In order to use all observations, including cases with missing data, we used Mplus's full information maximum likelihood (FIML) estimation approach—a procedure that iteratively estimates a likelihood function for each individual based on the variables that are present so that all the available data are used. FIML is recognized to produce unbiased parameter estimates and standard errors when data are missing at random.

Figure 1 presents our general model and the hypothetical relationships that were expected. We postulated reciprocal relationships between 1994–95 occupational self-direction and two sets of psychological characteristics measured in 1994–95, namely self-directed orientation and intellectual flexibility. In addition, all of these 1994–95 latent concepts were influenced by their corresponding 1974 latent concepts. Background sociodemographic characteristics were also posited to directly influence latent concepts of interest in 1974 but were assumed to have indirect effects on corresponding 1994–95 latent concepts. In all our models, residuals between endogenous concepts that were reciprocally connected and errors between similar indicators across time (e.g., between 1974 and 1994–95 ratings of complexity of work with data) were allowed to correlate. In addition, other error correlations were also allowed if the modification indices suggested that model fitness would improve and if such correlations are theoretically plausible and meaningful.

We identified these nonrecursive models by estimating the reciprocal effects only “concurrently” and by not simultaneously testing for cross-lagged effects (shown in dashed lines in fig. 1). The exclusion of these cross-lagged effects provides instruments to identify the model. This approach follows that of Kohn and Schooler (1983, chap. 6) and Schooler et al. (1999); for general discussions of it, see Heise (1975) and Kohn and Slomczynski (1990). The consequence of this modeling procedure is that for each pair of variables involved in a reciprocal relationship, the observed concurrent effect of one variable on the other is actually the sum of the true contemporaneous effect and the omitted cross-lagged effect. Thus, when we test a model that only examines “concurrent” effects,

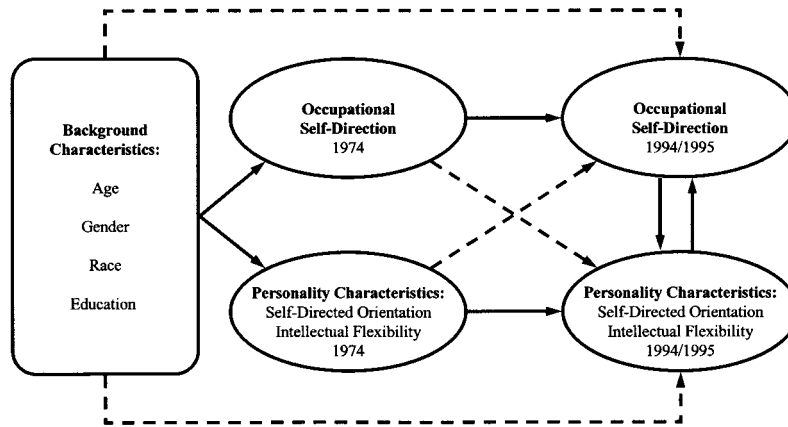


FIG 1.—The general reciprocal effects model of occupational self-direction and personality characteristics.

without modeling lagged effects, we can reasonably assume that the effects we find significant are real, although we cannot assess how much of the effect is actually contemporaneous and how much is actually lagged. What is certain is that any significant reciprocal paths between our measures of the complexity of paid work and cognitive functioning represent the *total* effect of each type of measure on the other over the two time periods.

Although there may be a certain methodological elegance or purity in using a full-information approach to SEM, doing so is not without cost. This is particularly true in longitudinal studies such as ours where the size of the sample upon which analyses can be performed is limited by the size of the original sample, attrition, and the requirements of the particular analysis (e.g., that the respondents be working in 1974 and 1994–95). In the present case, as detailed above in the section describing our sample, only 244 interviewed respondents met the criteria for inclusion in our analyses. Especially in studies such as ours where both the measurement and causal aspects of the models are fairly complex, simultaneously estimating measurement and causal parameters means that the number of open parameters to be estimated is relatively high compared to the size of the sample. Consequently, matrices involved in the estimations are sometimes not as well conditioned as they might be and the standard errors of the parameters may become so high as to preclude all but fairly substantial parameters from reaching significance. Furthermore, when full-information estimation procedures are used on relatively limited samples, the possibility of reaching subtle conclusions that might be based

on the significance of less strong but theoretically interesting parameters is reduced.

We took steps in both the measurement and causal components of our modeling to maximize the ratio of observations to open parameters. As indicated above, in the measurement component, we reduced from nine to five the number of indicators used to measure authoritarian conservatism and from seven to five those measuring substantive complexity of work. In both cases, we chose the five indicators that had the highest loadings in the measurement models based on previous analyses (Kohn and Schooler 1983; Schooler et al. 1999). In addition, based again on these previous studies, we constrained factor loadings of the same constructs to be equal over time (e.g., factor loadings of the indicators of 1974 were set to be equal to corresponding indicators of 1994–95) unless the modification indices indicated that removing the equality constraints would significantly improve the model fit.

We estimated the causal models in two sets. In the first set, the reciprocal relationships between occupational self-direction and self-directed orientation or intellectual flexibility were tested with the total sample in single group full-information models. In the second set, the same models were estimated using the two-stage multigroup approach. Here, we first split our sample at the median age of 57 years, with the younger group ($N = 119$) ages 41–57 years and the older group ($N = 125$) ages 58–83 years. We estimated the measurement models involving the variables of interest and saved the model-generated covariances between the first-order factors. We used these covariance matrices as input in our causal modeling. Thus, in these models 1994–95 occupational self-direction, for instance, became a first-order factor with three “observed” indicators: substantive complexity, closeness of supervision, and routinization. Likewise, demographic factors and intellectual flexibility were assumed to be single-indicator variables with no measurement error. With the exception of residual and error correlations, the two groups were assumed to have equal causal parameters.

In estimating the causal models, the following analytical strategies were adopted. First, residual or error correlations were excluded if they turned out to be nonsignificant or added if including them would significantly improve the model fit and meaningfulness. Second, paths from demographic variables to 1994–95 substantive latent factors were added based on suggestions of the modification indices. Third, in two-group models equality constraints were relaxed when modification indices indicated that the parameters are statistically different between the two groups. Finally, in the case of the nonsignificant reciprocal effect between 1994–95 occupational self-direction and 1994–95 self-directed orientation or 1994–95 intellectual flexibility, the nonsignificant path was excluded and then

the cross-lagged effect between the comparable 1974 and 1994–95 latent variables was tested. No other nonsignificant causal path was excluded in these models.

Three indices of model goodness of fit available in Mplus were used. First, the χ^2 statistic divided by the degrees of freedom was used to evaluate how closely the expected covariance matrix derived from the estimated model fits the actually observed matrix. A $\chi^2/df \leq 2$ ratio indicates a very good fit, although some have considered values less than five as acceptable (Bollen and Long 1993; Hayduk 1987). Second, the comparative fit index (CFI), which is a measure of how much better the proposed model fits the observed data compared to a baseline, usually a null, model (Bentler 1990) was also used. The CFI is considered particularly appropriate for small samples and multiple-group models (Bentler 1990; Hu and Bentler 1995). Scores of above .90 on this index are considered desirable (Hu and Bentler 1995). Finally, the root mean square error of approximation (RMSEA), a fit index that seems to have recently become the generally accepted standard, was also included. The RMSEA is a measure of the mean of the squared discrepancies between observed and predicted matrices per degrees of freedom (Steiger 1990), and a score of less than .05 on this index is considered to represent a good fit, although values less than .08 are also taken as indicative of an appropriate model (Browne and Cudeck 1993).

RESULTS

Properties of the Preliminary Measurement Models

Our causal models include latent concepts measured by multiple indicators (i.e., occupational self-direction, intellectual flexibility, self-directed orientation), as well as single-indicator based factors (i.e., age, race, gender, education). The latter variables, for which we could not use SEM to adjust for measurement error, were assumed to be measured error free. On the other hand, for latent factors indexed by multiple indicators, SEM could be used to develop measurement models so that the effects of the measurement errors could be accounted for. For ease of presentation, in this section we describe the development and properties of the measurement models for each set of multiple indicator-based latent factors separately, although all of our final measurement parameters were estimated as part of structural equation models in which all of the measurement and causal parameters are estimated simultaneously.

Occupational self-direction.—As indicated earlier, based on previous work (Kohn and Schooler 1983), occupational self-direction was conceptualized as a second-order factor influencing three first-order factors,

namely (1) substantive complexity, (2) closeness of supervision, and (3) routinization of work. Initially, we estimated a model that constrained all 1974 factor loadings to be equal to their corresponding factor loadings in 1994–95. The model provided a modestly good fit to the data ($\chi^2 [df = 164, N = 244] = 360.90, P < .001; \chi^2/df = 2.20; CFI = .87; RMSEA = .070$). Despite the fact that all factor loadings were significant, inspection of the modification indices suggested that model fitness would improve if four equality constraints (hours of work with data, hours of work with people, importance of doing as told by boss, and freedom to disagree with supervisor) were removed. This slightly modified model fit the data well ($\chi^2 [df = 160, N = 244] = 249.73, P < .001; \chi^2/df = 1.56; CFI = .94; RMSEA = .048$) and also showed significantly improved goodness of fit compared to the previous model. Table 1 presents the standardized coefficients of the indicators of the first-order factors from subsequent full-information models. The loadings of these first-order factors on the second-order 1974 and 1994–95 occupational self-direction factors are shown in figures 2 and 3.

Self-directed orientation.—Similarly, based on Kohn and Schooler's (1983) earlier work, self-directed orientation was conceptualized as a second-order factor influencing three first-order factors, namely (1) authoritarian conservatism, (2) personally responsible morality, and (3) fatalism. Our initial estimate of a measurement model that set all 1974 factor loadings to be equal to their corresponding factor loadings in 1994–95 showed acceptable goodness of fit to the data ($\chi^2 [df = 236, N = 244] = 284.56, P = .017; \chi^2/df = 1.20; CFI = .96; RMSEA = .029$). All indicators loaded significantly on their respective factors and inspection of the modification indices suggested that not much improvement in model fitness would be achieved by relaxing the equality of the parameters. Table 2 presents the standardized coefficients of the indicators of the first-order factors from subsequent full-information models. Figure 2 shows the loadings of the first-order factors on the respective second-order self-directed orientation factor in 1974 and 1994–95.

Intellectual flexibility.—Initial estimation of the measurement model that sets equal the indicators of 1974 and 1994–95 intellectual flexibility showed a reasonably well fitting model ($\chi^2 [df = 31, N = 244] = 62.40, P < .001; \chi^2/df = 2.01; CFI = .90; RMSEA = .064$) but indicated that model fitness would significantly improve if the over time equality constraint on one of the items (Embedded Figures Test) was relaxed. A reestimation of the model removing the over time equality constraint on this indicator resulted in very good fit to the data ($\chi^2 [df = 30, N = 244] = 39.67, P = .11; \chi^2/df = 1.32; CFI = .97; RMSEA = .036$). The loadings of all indicators as well as the improvement in model fitness compared to the initial estimation were statistically significant. Table 2 presents

TABLE 1
STANDARDIZED LOADINGS OF OCCUPATIONAL SELF-DIRECTION INDICATORS

Variable	1974	1994-95
Substantive complexity:		
Complexity of work with data .....	.68*	.77*
Complexity of work with people .....	.60*	.60*
Hours of work with data .....	.43*	.26*
Hours of work with people .....	.37*	.25*
Overall complexity of work .....	.72*	.74*
Closeness of supervision:		
Freedom to disagree with supervisor	-.67*	-.75*
Self-rated assessment of the closeness of supervision .....	.78*	.76*
Supervisor tells respondent what to do .....	.77*	.75*
Importance of doing what one is told .....	.89*	.91*
Routinization of work:		
Routineness of work	1.00	1.00

NOTE.—Unstandardized estimates for corresponding indexes of 1974 and 1994-95 factors were set to be equal with the exception of those that are noted in the text.

* $P < .01$.

the standardized coefficients of the indicators from subsequent full-information models.

Single Group Causal Models with the Total Sample

We estimated two sets of full-information causal models that tested the hypotheses that positive and reciprocal effects exist between (1) occupational self-direction and self-directed orientation, and (2) occupational self-direction and intellectual flexibility. The following sections present the findings of these two causal model estimations.

Occupational Self-Direction and Self-Directed Orientation

Our first full-information causal model examined the tenability of the proposed reciprocal relationship between occupational self-direction and self-directed orientation. The model included the following principal parameters: (1) reciprocal paths from 1994-95 occupational self-direction to 1994-95 self-directed orientation; (2) longitudinal paths from 1974 occupational self-direction and 1974 self-directed orientation to the corresponding latent concepts in 1994-95; (3) paths from age, gender, race, and educational attainment to both 1974 occupational self-direction and self-directed orientation factors. Residual correlations between endogenous latent concepts and error correlations identified during the development of the measurement models were also included.

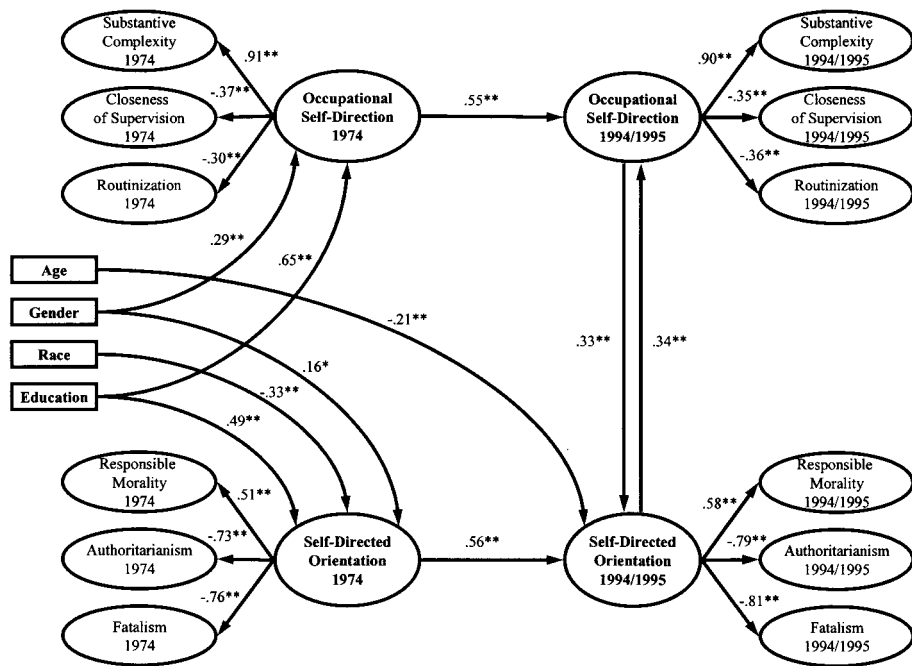


FIG. 2.—The single group reciprocal effects model of occupational self-direction and self-directed orientation. Notes: χ^2 ($df = 1,027$, $N = 244$) = 1,367.23, $P < .001$; $\chi^2/df = 1.33$; CFI = .90; RMSEA = .037; * $P < .05$; ** $P < .01$.

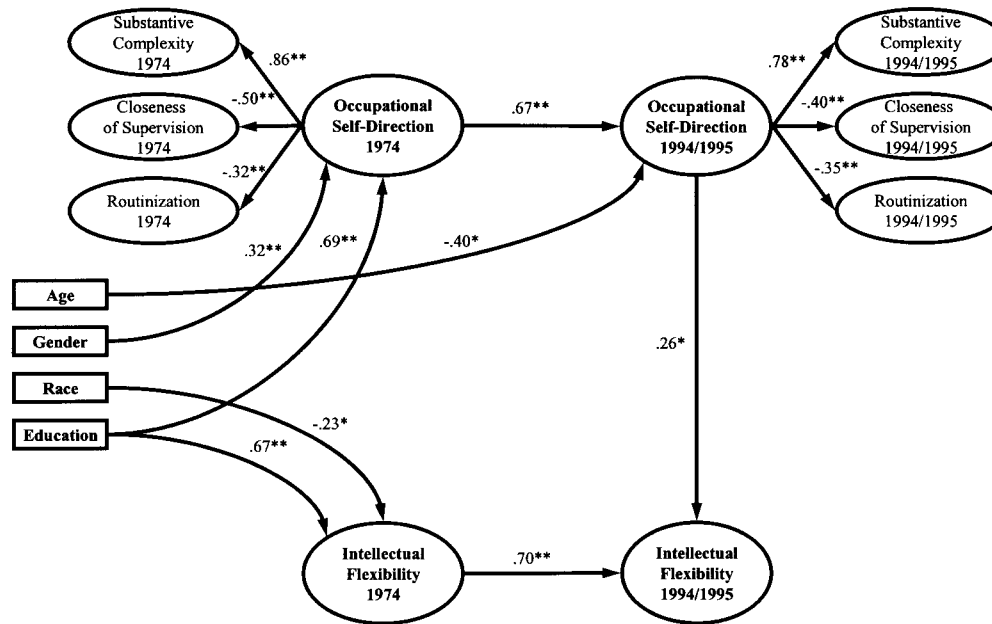


FIG. 3.—The single group reciprocal effects model of occupational self-direction and intellectual flexibility. Notes: χ^2 ($df = 485, N = 244$) = 659.77, $P < .001$; $\chi^2/df = 1.36$; CFI = .92; RMSEA = .038; * $P < .05$; ** $P < .01$.

Occupational Self-Direction

TABLE 2
STANDARDIZED LOADINGS OF SELF-DIRECTED ORIENTATION AND INTELLECTUAL
FLEXIBILITY INDICATORS

Variable	1974	1994–95
Authoritarian conservatism:		
The most important thing to teach children is obedience to parents .....	.75*	.68*
Young people shouldn't be allowed to read books likely to confuse them .....	.56*	.50*
In this complicated world, the only way to know what to do is rely on leaders .....	.63*	.47*
No decent man can respect a woman who has had premarital sex .....	.64*	.56*
Any good leader should be strict with people under him to gain their respect .....	.57*	.50*
Personally responsible morality:		
It is all right to do anything you want if you stay out of trouble	-.69*	-.61*
If something works, it doesn't matter whether it is right or wrong	-.59*	-.48*
It is okay to go around the law as long as you don't break it	-.48*	-.43*
It is all right to do whatever the law allows	-.23*	-.28*
Fatalism:		
Never faults self when things go wrong .....	.54*	.57*
Hardly blames self for one's own problems .....	.76*	.59*
Things that happen are out of personal control .....	.73*	.65*
Intellectual flexibility:		
Embedded Figures Test .....	.54*	.63*
Interviewer's estimate of intelligence .....	.70*	.46*
"Agree" score in agree-disagree questions	-.43*	-.44*
"Hamburger stand" question .....	.18*	.28*
"Cigarette commercial" question .....	.32*	.35*

NOTE.—Unstandardized estimates for corresponding indexes of 1974 and 1994–95 factors were set to be equal with the exception of those that are noted in the text.
* $P < .01$.

Initial estimates of this model indicated a modestly well-fitting model ($\chi^2 [df = 1,032, N = 244] = 1436.48, P < .001; \chi^2/df = 1.39; CFI = .88; RMSEA = .040$). Inspection of the specific parameters estimates and modification indices showed that adding new paths to substantive latent factors could improve model fitness and interpretability. Subsequently, we added paths from age to 1994–95 self-directed orientation, to 1994–95 closeness of supervision, and to 1974 personally responsible morality. In addition, paths from gender to both 1974 and 1994–95 personally responsible morality were included. Our reestimation of the model showed a significant improvement in model fitness and interpretability ($\chi^2 [df =$

1,027, $N = 244$] = 1,367.23, $P < .001$; $\chi^2/df = 1.33$; CFI = .90; RMSEA = .037).

As shown in figure 2, the model demonstrated that occupational self-direction and self-directed orientation affect one another positively and significantly. In addition, being younger led to greater 1994–95 self-directed orientation. Demographic variables also had indirect effects on 1994–95 self-directed orientation and 1994–95 occupational self-direction through their significant effects on corresponding factors in 1974. Relatively high levels of education and being male resulted in higher 1974 occupational self-direction; being male, relatively high level of education, and not being an African-American led to higher levels of 1974 self-directed orientation.

Background variables also had indirect effects on the second-order factors through their significant effects on first-order factors. Male gender was significantly associated with lower levels of 1974 and 1994–95 personally responsible morality (β s = $-.32$ and $-.39$, respectively; $P < .01$). Age was associated negatively with 1994–95 closeness of supervision ($\beta = -.17$; $P < .05$) and positively with 1974 personally responsible morality ($\beta = .28$; $P < .01$). Clearly, in addition to serving as statistical controls in these models, the background factors have direct and indirect effects on occupational self-direction and self-directed orientation both in 1974 and 1994–95. Overall, in terms of our central concerns here, our full-information SEM analyses provided strong evidence that occupational self-direction and self-directed orientation reciprocally affect each other.

Occupational Self-Direction and Intellectual Flexibility

Our second full-information causal model examined the acceptability of the hypothesized reciprocal relationship between occupational self-direction and intellectual flexibility. The model included the following principal parameters: (1) reciprocal paths from 1994–95 occupational self-direction to 1994–95 intellectual flexibility; (2) longitudinal paths from 1974 occupational self-direction and 1974 intellectual flexibility to the corresponding latent concepts in 1994–95; (3) paths from age, gender, race, and educational attainment to 1974 occupational self-direction and intellectual flexibility factors. Residual correlations between endogenous latent concepts and error correlations identified during the development of the measurement models were also included.

Initial estimates of this model indicated a modestly fitting model ($\chi^2 [df = 486, N = 244] = 684.93, P < .001$; $\chi^2/df = 1.40$; CFI = .91; RMSEA = .041), but they also indicated that at least three new paths could be added to significantly improve the fit and interpretability of the findings. Subsequently, we added paths from age to 1994–95 occupational self-

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direction and to 1994–95 closeness of supervision and another path from education to 1994–95 substantive complexity. We then reestimated the model and found that its fit improved significantly ($\chi^2 [df = 483, N = 244] = 660.47, P < .001; \chi^2/df = 1.36; CFI = .92; RMSEA = .039$). Further inspection of these results showed that while there was a significant effect from 1994–95 occupational self-direction to 1994–95 intellectual flexibility ($\beta = .52; P < .01$) the reverse path, although in the expected direction, was nonsignificant ($\beta = .09; P > .05$). We then excluded the nonsignificant path and added the lagged effect from 1974 to 1994–95 occupational self-direction, which turned out to be nonsignificant ($\beta = .01; P > .05$). The final model, shown in figure 3, excluded the nonsignificant lagged and contemporaneous paths from intellectual flexibility to 1994–95 occupational self-direction. The model fit the data well ($\chi^2 [df = 485, N = 244] = 659.77, P < .001; \chi^2/df = 1.36; CFI = .92; RMSEA = .038$).

As shown in figure 3, the model revealed that occupational self-direction has a significant positive effect on intellectual flexibility. In addition, controlling for all other background factors, being younger led to greater 1994–95 occupational self-direction. Demographic variables also had indirect effects on 1994–95 self-directed orientation and 1994–95 occupational self-direction through their significant effects on corresponding factors in 1974. Relatively high levels of education and being male resulted in higher 1974 occupational self-direction; being male, relatively high level of education, and not being an African-American led to higher levels of 1974 intellectual flexibility. Indirect effects on second-order factors were also found from age by way of its effects on first-order factors. Specifically, age was associated negatively with 1994–95 closeness of supervision ($\beta = -.37; P < .05$) and positively with 1994–95 substantive complexity ($\beta = .18; P < .05$). In sum, our model provided strong evidence that higher levels of occupational self-direction lead to increases in intellectual flexibility.

Multigroup Causal Models Comparing the Younger and Older Workers

In order to tease out the potential effects of age, we estimated the above two models in multigroup analyses. We used the two-stage approach in these analyses primarily because of the low ratio of our sample size compared to the number of estimated parameters. As indicated earlier, factor loadings and causal paths were set to be equal between groups whereas error and residual correlations were estimated for each group separately. Modification indices were then inspected to identify inequalities between the two groups. When significant differences were found, the equality constraints were removed and the models were reestimated.

Occupational Self-Direction and Self-Directed Orientation

Our initial two-group occupational self-direction and self-directed orientation model revealed a well-fitting model ($\chi^2 [df = 196, N = 244] = 265.52, P < .001; \chi^2/df = 1.35; CFI = .95; RMSEA = .054$). Inspection of the parameter estimates and modification indices indicated that model fitness would improve if the following parameters were added: (1) paths from age to 1994–95 occupational self-direction and 1994–95 self-directed orientation for both groups; (2) a path from gender to 1994–95 self-directed orientation for the younger group and another path from race to 1994–95 occupational self-direction for the older group; (3) an error correlation between 1974 closeness of supervision and 1974 substantive complexity for both groups. In addition, the modification indices also suggested that the equality constraint on the path from age to 1974 occupational self-direction be relaxed. When these changes were made, the goodness of fit of the model significantly improved ($\chi^2 [df = 188, N = 244] = 133.85, P = .99; \chi^2/df = .97; CFI = 1.00; RMSEA = .000$). Inspection of the results showed significant reciprocal effects between occupational self-direction and self-directed orientation. As figure 4 shows, controlling for everything else, age was negatively related to both 1994–95 occupational self-direction and 1994–95 self-directed orientation. Similar effects to those found in the full-information single-group model were also found from background variables to 1974 occupational self-direction and 1974 self-directed orientation.

Age group differences were also found in the effects of the background variables on both 1974 and 1994–95 substantive factors. Being male was associated with lower levels of 1994–95 self-directed orientation among the younger group. On the other hand, being African-American was associated with higher levels of occupational self-direction among the older group. The within-group effect of age on 1974 occupational self-direction was significant in the younger but not in the older group. In contrast, the effect of education on 1974 occupational self-direction was stronger among older respondents. Figure 4 presents the results of this analysis. By demonstrating the existence of significant reciprocal effects between occupational self-direction and self-directed orientation, these findings for both the younger and older groups replicate those from the total sample analysis.

Occupational Self-Direction and Intellectual Flexibility

We also examined the reciprocal effects of occupational self-direction and intellectual flexibility in a two-group model. Initial estimation indicated that the model fit the observed data reasonably well ($\chi^2 [df = 92, N =$

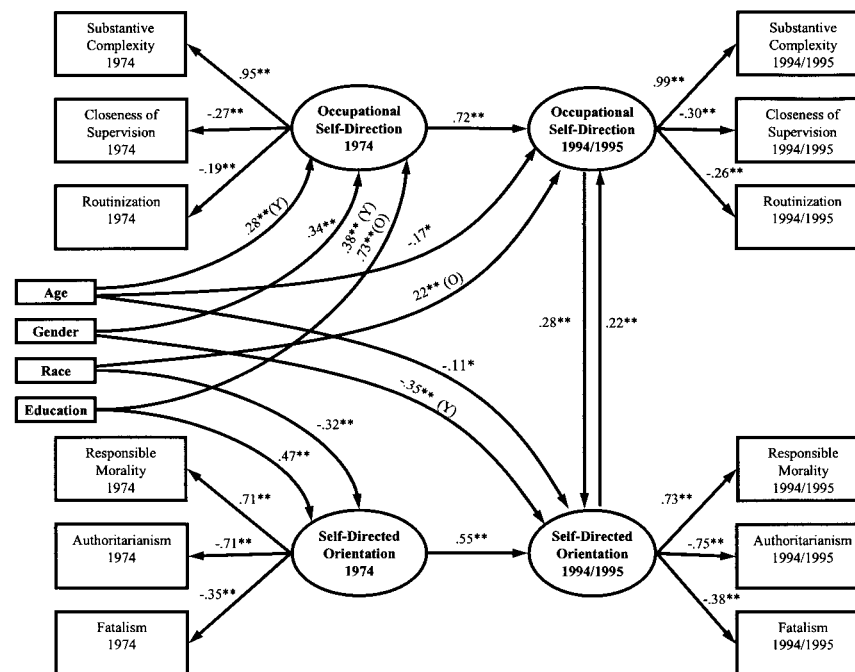


FIG. 4.—The multigroup reciprocal effects model of occupational self-direction and self-directed orientation. Notes: χ^2 ($df = 188$, $N = 244$) = 133.85, $P = .999$; $\chi^2/df = .71$; CFI = 1.00; RMSEA = .000; * $P < .05$; ** $P < .01$. Paths marked by Y or O show significant paths for the younger or older groups, respectively.

244] = 184.23, $P < .001$; $\chi^2/df = 2.00$; CFI = .92; RMSEA = .091). When the parameter estimates and the modification indices were inspected, significant group differences, new paths, and correlated errors were detected. Subsequently, the following changes in the model were made: (1) the equality constraint on paths from age and education to 1974 occupational self-direction and from gender to 1974 intellectual flexibility were relaxed; (2) new paths from age to 1994–95 occupational self-direction and to 1994–95 intellectual flexibility were added for the younger group, whereas paths from age and race to 1994–95 intellectual flexibility were added for the older group; and (3) an error correlation between 1974 closeness of supervision and 1974 substantive complexity was added for both groups. The reestimated model fit the data very well ($\chi^2 [df = 83, N = 244] = 75.83, P = .699$; $\chi^2/df = .91$; CFI = 1.00; RMSEA = .000). The results show that, although in our parallel single-group analysis the path from 1994–95 intellectual flexibility to 1994–95 occupational self-direction did not quite reach statistical significance, in this model it did. In doing so, the two-stage model provides evidence for significant reciprocal effects between occupational self-direction and intellectual flexibility. Effects of background factors on 1974 occupational self-direction and 1974 intellectual flexibility remained basically similar as in the full-information, single-group model. Significant differences between the two groups were also found. Age was differently related to both 1994–95 occupational self-direction and 1994–95 intellectual flexibility. When differences in background, early job, and psychological characteristics are controlled, age had a negative effect on 1994–95 occupational self-direction for the younger but not for the older group. In addition, increasing age and being African-American were associated with declining 1994–95 intellectual flexibility among the older but not the younger group. In fact, taking into account the other paths in the model and in contrast to its effect among older respondents, age had a positive effect on 1994–95 intellectual flexibility among the younger cohort of our respondents. Results of this analysis are presented in figure 5.

DISCUSSION

Using two waves of longitudinal data collected 20 years apart, the central aim of this study has been to test whether the experience of occupational self-direction continues to increase levels of both intellectual functioning and self-directed orientations even late in individuals' work careers. Our core findings indicate that this is, indeed, the case. These findings are based on the use of both full-information causal models on our total sample and multigroup (younger vs. older respondents), two-stage causal

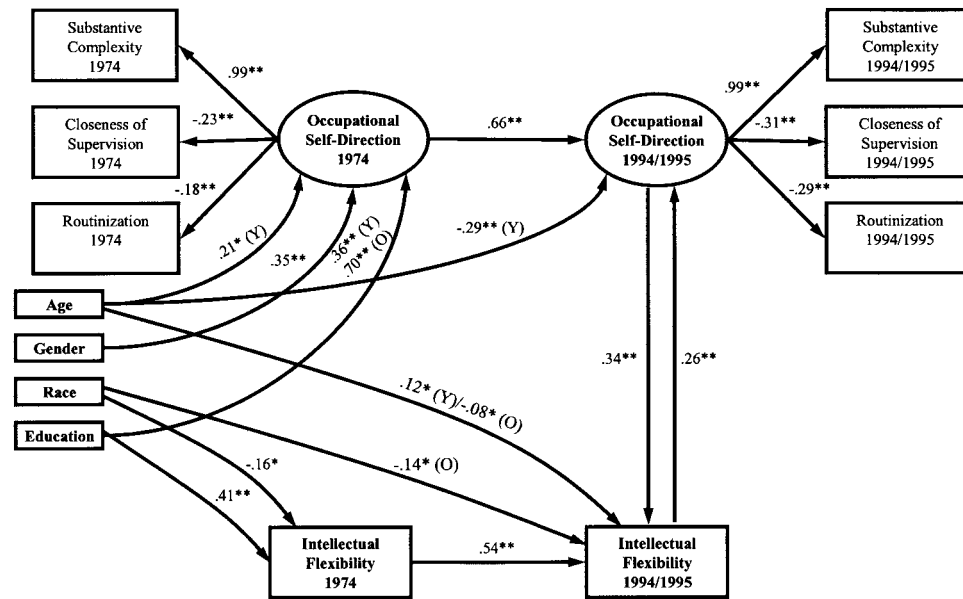


FIG. 5.—The multigroup reciprocal effects model of occupational self-direction and intellectual flexibility. Notes: $\chi^2 (df = 83, N = 244) = 75.83$, $P = .699$; $\chi^2/df = .91$; CFI = 1.00; RMSEA = .000; * $P < .05$; ** $P < .01$. Paths marked by Y or O show significant paths for the younger or older groups, respectively.

models. Both types of analyses also provide evidence that self-directed orientations and intellectual functioning each reciprocally affect occupational self-direction, although in the case of intellectual functioning the reciprocal path to occupational self-direction only reaches significance in the multigroup, two-stage model.

Both statistical- and sampling-based caveats limit our certainty about the full range and exact pattern of our findings. One limitation is that the observed effect of one variable on the other in our reciprocal models is the sum of the true contemporaneous effects and the cross-lagged effects. Our modeling procedures do not permit us to assess how much of any reciprocal effect we find is actually contemporaneous and how much is actually lagged. A second limitation is that, probably because of issues of sample size and multicollinearity, we have not been able to reliably estimate models that include reciprocal effects between intellectual functioning and self-directed orientations or among the two psychological factors and occupational self-direction. We have also not been able to successfully estimate multigroup full-information models. These difficulties may well be due to the relatively small size of our total sample and the even smaller sizes of the relevant subgroups. More generally, because our sample is a comparatively small one, there is a real possibility that we have not been able to demonstrate the existence of theoretically important, but relatively weak, effects that might well have proved significant if our sample had been larger.

In regard to issues of generalization, our focus has been on those respondents who were working in both 1974 and 1994–95. The present sample thus consists of those in the 1974 sample who were located and alive in 1994–95, who agreed to be interviewed, and who were found to be still working. The men in the 1974 sample were part of a representative sample of men working in the U.S. civilian labor force in 1964. As we have noted, previous analyses strongly suggest that, except for the 1974 cohort being more likely to come from a liberal religious background, there were no demographic differences between the 1964 and 1974 men's samples. The women we interviewed were married to the men of the 1974 sample. Ninety-five percent of the 1974 sample was located in 1994. Among those located alive, only being somewhat more likely to be younger or male distinguished those who were interviewed from those who were not. None of the other demographic or psychological variables had an effect on being interviewed in 1994–95. Each of the idiosyncrasies of our present sample places some limits on generalization. At a minimum, our findings are based on respondents who were more likely to have been male, younger, healthier, and more cooperative in 1994–95 than were the other respondents who were working at the time of the 1974 survey. Generalizations about women can most confidently be made to those who

were married in 1974 to men between 26 and 65 years of age who had been working in 1964.

Despite these potential limitations, the general strength and consistency of our findings provide reassuring support for the belief in their relevance to understanding three interrelated issues: (1) how social-structurally determined environmental factors affect important psychological characteristics such as intellectual functioning and self-directedness of orientations, (2) how changes in such psychological characteristics may reciprocally affect individuals' positions in the social structures of their societies, and (3) how such psychological changes may affect the very nature of societies' social structures and cultures. We discuss each of these issues in turn.

Effects of Occupational Self-Direction on Intellectual Functioning

Our findings extend earlier Kohn and Schooler's (1983) findings about the effects of occupational self-direction on intellectual functioning when the sample in question was 20 years younger and Schooler et al. (1999) findings based solely on the substantive complexity of work. All of these conclusions about the cognitive effects of doing self-directed, substantively complex paid work are congruent with other findings that carrying out intellectually demanding leisure time activities has a similar effect (Schooler and Mulatu 2001). Together, they provide consistent, credibly strong evidence that even in old age, carrying out self-directed complex tasks has a positive effect on intellectual processes. They thus afford further support for the generalizability of the hypothesis (Schooler 1984; Schooler 1990*b*) that dealing with cognitively demanding environments increases one's level of intellectual functioning throughout the life span. Within the age range of our sample (41–83 years), the effects of environmental conditions on psychological functioning are at least as strong for older as for younger adults. Indeed, our earlier findings about greater effects of substantive complexity on intellectual functioning in older than younger adults (Schooler et al. 1999) suggest that, if anything, older adults may be psychologically more affected by environmental conditions than younger ones. The findings raise the practical issues of the desirability and possibility of societal interventions to at least maintain the complexity of the environments to which older individuals are exposed.

By showing that, even late in life, social-structurally influenced environmental circumstances can have notable effects on intellectual functioning, these results also provide striking evidence against sociobiological theories, such as put forth by Herrnstein and Murray (1994), that posit strong forms of genetic determinism. Using our findings on the positive cognitive effects of dealing with complex environmental demands in both

work and leisure activities as relevant and important evidence, Dickens and Flynn (2001) have made a strong case that intelligence is a function of environmental and genetic factors and, importantly, the interactions between them.

Our conclusions about the positive effects of doing self-directed, substantively complex work on intellectual functioning also provide a clue to, at least, a partial explanation of what has been termed the “Flynn effect” (Neisser 1998)—the trend in industrial societies, ever since testing began, for scores over a wide range of intelligence tests to rise by about three IQ points per decade (Flynn 1987). If technical and economic development leads to more complex environments and to more intellectually demanding work conditions, our findings imply that such increased environmental complexity should result in higher levels of intellectual functioning. Such an increase in environmental complexity almost certainly occurred in the move from rural to urban settings and from premodern agricultural to commercial and manufacturing occupations. There is also evidence that the substantive complexity of work continues to increase at later levels of development (Attwell 1987; Dickens and Flynn 2001; Form 1987; Penn, Rose, and Rubery 1994). Given this increasing complexity of work demands and other aspects of life and the causal link between levels of environmental complexity and intellectual functioning, the ongoing gains in intelligence test performance that Flynn (1987) found can be seen as due, in some large part, to the way the world has become more complex. For a full discussion of the plausibility of this view of the Flynn effect, see Schooler (1998*a*).

Effects of Occupational Self-Direction on Self-Directed Orientation

The implications for the psychology of the individual of our finding that during the 20-year period since the 1974 survey the experience of occupational self-direction continued to increase the self-directedness of the now middle-aged and older respondents’ orientations toward themselves and others are similar in several respects to those for the parallel findings about intellectual functioning. The self-directedness of orientation findings extend earlier Kohn and Schooler (1983) conclusions about the effects of occupational self-direction when the present sample was 20 years younger. In doing so, they argue against those who believe that such orientations are set early in life by genetic (e.g., Martin and Jardine 1986; Rowe 1994) and/or early environmental influences (e.g., Kasser et al. 2002). The results also provide further support for the hypothesis that the experience of dealing with cognitively demanding complex environments increases not only levels of intellectual functioning but also the value placed on self-direction and autonomy (Schooler 1984; Schooler 1990*a*). The finding that

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there is no reliable difference between the older and younger segments of our sample in the effects of occupational self-direction on self-directed orientation provides further evidence for the hypothesis that the degree to which people learn and generalize from the work that they do is not diminished by how old they are.

Our results also have implications for a number of issues of direct concern to cognitive psychologists. The indication that doing self-directed work on the job leads to self-directed orientations provides further evidence of generalization of what has been learned in a particular setting (the job) to other spheres of life. Despite some progress in recent years, widespread learning-generalization, particularly involving *far transfers*, has not been easy to demonstrate in experimental psychological studies (Barnett and Ceci 2002; Schooler 2001), especially in older individuals (Willis 1989). In fact, the earlier Kohn and Schooler (1983) findings on the effects of occupational self-direction have been cited as among the more convincing evidence that such generalization exists (Ceci 1990). That this ability to generalize takes place among our respondents who are in the latter part of their work careers takes on added meaning in that the nature of the processes through which generalization takes place in cognitive experiments differs between older and younger subjects (Caplan and Schooler 2001; Caplan and Schooler 1990; Myers and Conner 1992).

Effects of Intellectual Functioning on Occupational Self-Direction

Although our full-information, total sample analyses do not provide significant evidence that individuals' levels of intellectual functioning reciprocally affect the self-directedness of the jobs they hold, our multigroup models do provide evidence that this is the case. The finding that having a relatively high level of intellectual functioning increases the likelihood of obtaining and holding a relatively self-directed job supports Farkas and colleagues' (1997) conclusion that "individual cognitive skill level . . . affects access to occupations requiring more cognitive skill" (p. 940). Because of the positive reciprocal relationship between occupational self-direction and intellectual functioning, those with relatively low levels of intellectual functioning are doubly disadvantaged in that the cognitive effects of the jobs they hold tend to decrease their cognitive functioning even further. For example, African-American and lower social status workers are particularly likely to be caught in a negative feedback loop. The relatively low-status, nonself-directed jobs that they are likely to get, in part because of their relatively low levels of cognitive functioning (Farkas et al. 1997), are likely to lead to lower levels of intellectual functioning that further decrease the likelihood of their obtaining higher status jobs.

On the other hand, our finding that the experience of occupational self-

direction increases intellectual functioning qualifies Farkas et al.'s (1997) notion that employers play little role in the exacerbation of inequality. Since being placed in a self-directed job fosters intellectual functioning, which leads to more self-directed, generally higher-status, better-paying jobs, employers intensify existing socioeconomic differences to the extent that they select workers for self-directed jobs on the basis of intellectual functioning or of social characteristics, such as race or social status, that are linked to this psychological characteristic.

Effects of Self-Directed Orientations on Occupational Self-Direction

The evidence that having self-directed orientations leads to having self-directed jobs has several implications. Since education and occupational prestige, characteristics that are generally used to index social status (Schooler and Schoenbach 1994), are linked to holding self-directed orientations, those in higher social status positions and from relatively higher social status backgrounds tend to have higher levels of self-directed orientations (e.g., Kohn and Schooler 1983). Having such self-directed orientations contributes to the likelihood that they will obtain relatively high status, self-directed jobs (Kohn and Schooler 1983). Furthermore, since, as our own and other findings (e.g., Altemeyer 1996) suggest, being African-American tends to further lessen self-directed orientations, African-Americans are placed at an even further disadvantage than results from the direct effects of prejudice alone. This outcome provides clear support for Stinchcombe's (1990) view that "skills acquired by workers . . . on the job are often a function of unequal opportunities flowing to these workers because of their race, social class" (p. 357). In fact, as seems the case for intellectual functioning, the pattern of relationships among self-directed job conditions, self-directed orientations, and social status suggests the existence of a feedback loop. High-status individuals tend to hold self-directed jobs. Such self-directed jobs increase their levels of self-directed orientation. This increase, in turn, serves to further increase the self-directedness of their orientations and hence the social status of future jobs they might obtain.

Broader Effects of Occupational Self-Direction on Societies

In terms of the sociological understanding of societal functioning, our results suggest that there would be a relatively high overall level of intellectual functioning in societies whose modes of production are characterized by high levels of self-directed work. Such an increased level of individual intellectual functioning might in turn reciprocally lead to more effective modes of production.

Occupational Self-Direction

The indication that occupational self-direction leads to self-directed orientations to self and society raises the possibility that the level of occupational self-direction fostered by the modes of production within a society may come to affect the level of individualism of that society's cultural norms. Earlier evidence for such a possibility comes from the finding based on the Kohn-Schooler 1974 survey wave (Schooler 1976) that, even when other relevant variables such as occupational self-direction are controlled, men from ethnic groups with a recent and pervasive history of serfdom tend to show the nonindividualistic, conformist orientation, as well as the intellectual inflexibility, of men working under the environmental conditions characteristic of serfdom. This pattern of ethnic differences suggests that the restrictive social and occupational conditions that prevailed within European societies may have affected those societies' cultures in a manner analogous to the way in which the lack of occupational self-direction affects an individual's orientations to self and others.

Accepting such a possibility does not imply that the level of occupational self-direction characteristic of a society's modes of production is the sole determinant of the individualism of its cultural norms. From an institutional theory perspective, Meyer (1990) has plausibly argued, "Modern cultural systems clearly and explicitly instill and value interpretations of the self as competent, autonomous and causal" (p. 53). On the other hand, some present-day sociocultural systems have also been seen as actively dampening individualistic orientations. A series of reviews of relevant psychological research (Heine et al. 1999; Markus and Kitayama 1991; Nisbett et al. 2001; but see also Oyserman, Coon, and Kimmelmeier 2002) provide convincing evidence that the psychological processes, including orientations toward themselves and others, of members of a number of Asian ethnic groups have been distinctly affected by the Confucian worldview that historically influenced their cultures. In its emphasis on the fundamental interrelatedness among individuals and their harmonious interdependence, this worldview is seen as being in distinct contrast to the modern Western emphasis on the self as an autonomous independent entity (e.g., Markus and Kitayama 1991). Nevertheless, although Japanese culture may be the most frequently investigated example of such a Confucian-influenced culture "a varied body of evidence suggests that there has been an increase in the degree to which Japanese hold individualistic values and orientations" (Schooler 1998*b*, p. 40). This increase occurred during the same period that there was a massive shift of the Japanese workforce from nonindustrial agricultural to substantively more complex commercial and manufacturing occupations (Hayashi et al. 1970; Schooler 1998*b*). The finding that doing substantively complex self-directed work increases self-directed orientations to self and society raises

the strong possibility that the changes in the modes of production that have characterized postwar Japan have played a part in the increase in the levels of individualistic values held by individual Japanese (Schooler 1998b).

The processes and the time frame through which changes in the orientations, values, and even intellectual functioning of individuals, brought about by changes in the nature of their work, in turn affect the institutions, cultural values, and even the economic development of their societies remain important theoretical and empirical issues (Schooler 1996; Schooler 1998b). A full elucidation of these processes, however, is beyond what we presently know or could hope to do. What we have provided is substantial evidence supporting three interrelated hypotheses with important psychological and sociological implications. Our evidence indicates that even late in life, a social-structurally determined characteristic of individuals' environments—the self-directedness of their work—can affect such core psychological characteristics as their intellectual functioning and their views of themselves as being autonomous, personally responsible individuals. These psychological characteristics, in turn, affect individuals' positions in their societies' social structures in ways that increase disparities between the advantaged and disadvantaged. Considered from a historical and societal perspective, the overall pattern of our findings gives credence to the possibility that the level of occupational self-directedness of a society's workers may come to affect its social norms, values, and modes of production.

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