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Altern -
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The Influence of Social-Environment Factors in the Maintenance and Decline of Adult Intelligence

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Introduction

The basic corpus of research conducted by the senior author and his associates over the past 30 years has dealt with describing the course of the development of intelligence from young adulthood into old age, and determining the factors that lead to the vast individual differences occurring in this process. The work of Professor Ursula Lehr has had an important impact on our efforts by sensitizing us to the need of more carefully assessing the impact made by the manifold social-environmental factors upon the course of adult intellectual development. This chapter represents a systematic effort to review the relevant theoretical and empirical literature that may inform our future research directions.

Questions of adult intellectual aging have progressed from the description of basic age-related patterns of change toward the identification of why these different patterns exist. No longer do inquiries focus solely on whether intellectual functions decline with aging, a query that still generates remarkable controversy. Instead, our questions have been refocused toward understanding individual differences and the possibilities for altering the course of intellectual change (22, 43, 45, 46, 48).

As a mechanism for understanding individual differences, developmental psychologists have increasingly recognized the importance of context in the study of intellectual change (22, 43, 45, 46, 48). The recoginition of the importance of context has influenced theorists of all approaches, whether they were psychometrically inclined, neo-Piagetians, neo-functionalists, or those who emphasize elements of information processing (4, 5, 22, 23, 43, 45, 59).

Despite the widespread agreement concerning the need to link social-environment factors to intellectual performance, the literature that actually attempts this task remains relatively sparse [cf. (47, 59)]. The purpose of this chapter is to review this literature and to offer some directions for future research.

Historical Background

Extensive research on adult intellectual development has provided some answers to questions about the existence and magnitude of age-related intellectual change and the description of patterns of generational differences (42). Longitudinal studies such as the Boon Longitudinal Study, the Duke Longitudinal Study, and the Seattle Longitudinal Study have laid to rest notions of intellectual decline occurring in early adulthood, beliefs that resulted from cross-sectional research [cf. (12, 42, 57)]. These longitudinal studies have further pointed to the multi-dimensionality and multi-directionality of intellectual change (3) and introduced the concepts of time of

measurement and cohort into the design of intelligence studies (40). The original questions regarding the magnitude and rate of adult intellectual development were addressed largely by estimating parameters of average age changes for groups; little attention was given to the wide range of inter-individual differences. As a consequence, the age trends identified by all of the classical studies do not necessarily represent the patterns of change for all or even most individuals. More recent research, however, is beginning to identify those factors that are likely to account for individual differences intellectual aging (45, 47).

In order to understand the variations in patterns of aging, researchers have begun to examine contextual parameters, usually defined as social macro and micro-structures, as related to psychological development (47). The macro-level, some reviews have linked demographic structures to psychological development (2) and others have focused on identifying the differences among successive birth cohorts in patterns of intellectual ability change (59). While this review focuses specifically on individual and micro-level factors, implicit across all levels is the belief that structural variables have direct causal impact on the direction and the rate of behavioral development (47).

As ecological researchers have cautioned, the term environment lacks a specific definition and is often based on the idiosyncracies of particular researchers (7, 25). As such, we have chosen aspects of the environment that we believe have direct impact on cognitive aging. Because of our focus, we were less interested in the structural aspects of environments (i.e., housing, neighborhood composition) that often characterize ecological research [cf. (24, 25, 49)] and have focused instead on micro-environmental aspects including work, leisure-time activities, the potential changes in environment resulting from retirement, and research that examines multiple aspects of the environment.

Empirical Studies

Work-Related Studies

The longitudinal research program of Kohn and Schooler (20) provides, perhaps, the best description of the contemporaneous and lingitudinal effects of the work environment on intellectual flexibility. Although ideational flexibility has typically been considered a personality measure, the requirements of the task arguably measure components of intelligence as well. In the study, a representative sample of men responded to an interview questioning the conditions of their work place and their ideational flexibility, the ability to respond to complex situations, first in 1964 and again 10 years later. Longitudinal models testing the reciprocal effects of job conditions and ideational flexibility determined that substantive complexity of the current job positively affected ideational flexibility, whereas the ideational flexibility was influential for future job complexity (21).

The authors interpret the results according to a learning generalization model wherein the information learned in the work setting is translated directly to the non-work setting. Thus, in their terms, a self-directed approach in work leads to ideational flexibility and a more self-directed approach to society. Kohn and Schooler have tested the validity of these findings for women and work (31), women and housework (55), and the influence of work conditions on the intellectuality of leisure activities (32).

Based on the results of their research program, Schooler (52, 53) has proposed a general theory of the effects of complex environments on psychological functioning. He theorizes that a complex environment, defined by diversity of stimuli, numerous decisions, ill-defined contingencies, produces conditions which reward cognitive effort and encourage the person to develop his/her intellectual capabilities. Simple environments, on the other hand, may fail to reward this effort sufficiently and thus over time, cognitive functioning may decline. Although Schooler (53) admits the theory is "rough-hewn," he suggests that propositions drawn from the theory have been successfully tested and that the theory is heuristically useful in linking the research findings of different life stages and levels of analysis [cf. (56)].

Based upon the concepts identified by Kohn and Schooler (20), another study assessed the hypothesis that social environmental variables can be related to the complexity of work (i.e., organizational level, substantive nature of the job responsiblitities) and would yield better predictors of job performance for managers than would age (35). Managers were selected as an ideal sample of individuals who function in a complex, somewhat ambiguous environment. The older managers in the study were more likely than younger managers to report perceived intellectual decline, however, the two groups did not differ in their perceived job competency. In this study time-management strategies were identified that were effective in meeting environmental demands and that could be linked to reports of lessened decline in intellectual abilities.

Leisure-Related Studies

Leisure research has typically focused on determining the types of activities people engange in, but some studies have investigated the relationship of leisure to successful aging (10, 34). However, much of this research has examined the predictive value of leisure activities for life satisfaction (18, 19, 37), rather than specific behavioral outcomes.

One notable exception in De Carlo's (10) work in the context of the Aging Twin Study (17). In that study 60 elderly twins were followed over 20 years. The twins were evaluated on their physical health, mental health, and their intellectual performance using five subtests of the Wechsler-Bellevuetest and the vocabulary portion of the Stanford-Binet test. Recreational participation was defined by number of different activities and frequency of participation over the lifespan. The activities were grouped into three dimensions: sensory-motor, cognitive, and affective. These activities were reaated to a three-category index of successful aging based on the subjects' ability to carry on daily activities and the presence or absence of illness. Successful aging was significantly correlated with total activity. Furthermore, a positive correlation (0.58) was found between the cognitive dimension of leisure activities and intellectual performance on the Wechsler-Bellevue test. This finding supports the contention that cognitive activity is important for the maintenance of intellectual abilities. It is also noteworthy that of the three leisure dimensions it was the cognitive dimension that correlated most highly with the index of successful aging, indicative of the importance of cognitive skills in later life functioning.

Further support for the importance of cognitive aspects of leisure are provided by Miller and Kohn (32) who studied the relationship between the intellectual nature of leisure behaviors and the substantive complexity of work. Using structural equation

modeling to estimate regression coefficients over time, these investigators found that intellectual pursuits during non-work time were positively influenced by the complexity of their subjects' work, while intellectual activities positively influenced future substantive complexity of the work and potentiated the maintenance of cognitive abilities into later life.

In other research, Perlmutter and Nyquist (33) identified everyday activities as a possible age-correlated mediating variable useful in explaining age-related declines. Toward this goal, 127 people in four age ranges (20's, 40's, 60's, and 80's) were tested on standard memory, fluid, and crystallized measures from the Wechsler Adult Intelligence Scale (WAIS), as well as being questioned concerning everyday activities. Performance on memory tasks had no correlation with age, whereas performance on fluid tasks was negatively correlated with age (−0.77) and crystallized performance was slightly positively correlated with age (0.11). With regard to everyday activities, the older adults reported fewer mental and physical activities than the younger subjects, although within activity categories (games, media, being creative) the older subjects reported a greater amount of time spent on these activities than did younger subjects.

By means of multiple regression analyses, it was determined that everyday activity was positively correlated with cognitive performance, however, the pattern of this relationship differed across age and cognitive task. In both younger and older subsamples everyday activity accounted for most of the variance in digit-span memory. Everyday activity had a direct positive effect on crystallized intelligence and accounted for most of the variance in the older, but not the younger subsample. Daily activity also had a direct effect on fluid intelligence, but age accounted for most of the individual differences variance. Despite the simplistic categorization of leisure activities recorded in this study, everyday activity seemed to have an important effect on cognitive functioning; however, the effect appears to vary by ability and age group.

The influence of time spent in reading-related activities were examined by Rice et al. (36) by means of a time diary on a prose recall task. In addition to age, education, and verbal ability, total time spent reading was found to be a significant predictor of prose recall. The measures of reading activities when entered into a regression equation predicted 30% of the variance in prose recall. Interestingly, the variance predicted by reading activity increased with increasing age, reaching 55% in the oldest group. The older subjects who did word games (primarily crossword puzzles) remembered more of the prose, while individuals who played games of chance (Bingo) did not do as well.

The studies of leisure activities, despite simplistic categorization, have been able to demonstrate some significant relationships between daily activity and cognitive performance. These studies seem to support the "use it, or lose it" approach to cognitive aging, but further longitudinal research is needed to determine the nature of the causal relationship between the activities and maintained intellectual performance.

Retirement

Our discussion of the effects of work and leisure suggests the important role that these facets of life tend to exert upon the continued intellectual performance of

aging individuals. Leisure is often considered a complement to work, but in the case of retirement the interplay between work and leisure ends and leisure assumes the more primary role.

Rosow (38) has argued that as individuals age they lose important roles, such as the work role, and these losses may have far-reaching effects on their abilities to cope and function effectively. Rosow suggests that role loss may decrease social participation and devalue a person's sense of identity and that people are often not well socialized to the inevitable facts of aging and the losses that occur with increasing age. Although role losses are likely to cause psychological changes at any age, the role losses occurring at older ages may also lead to potential decreases in intellectual performance as the environment becomes less complex and may provide fewer challenges that require high levels of practice on cognitive skills (41). These consequences are by no means inevitable. However, because of the loss of work-related roles, the importance of leisure-time activities does increase in old age. This is because leisure roles now need to fill some of the instrumental functions of previous work-roles (30) and thus become a more integral part of an individual's self-definition.

Further longitudinal research is needed to examine the potential complexities of environment and lifestyle changes after retirement. Some previous work has shown that the impact of work can be felt long after retirement through the "busy ethic" (14). Retirees are often found to continue patterns established on the job by keeping busy and industrious. Eckerdt argues that many individuals legitimize their retirement every day by adherence to this busy ethic in order to provide an acceptable definition to the retirement role both for the retiree and those of their observers whose perception is valued by the retiree. But the "busy ethic" is not simply a mild form of self-deception designed to maintain the retiree's self esteem. It has the important instrumental property of helping the individual to maintain high levels of cognitive functioning through encouraging cognitively stimulating activities in retirement.

The interactions between prior work environment and retirement may turn out to be exceedingly complex. For example, analyses from the Seattle Longitudinal Study have shown that people retiring from occupations of high complexity appear to have accelerated decrement over the 7 years following their retirement as compared to individuals of the same age who continue to work during that period. However, those retiring from a routinized job showed no decrement during the 7 years following their retirement, while their working comparison group did show decline (13). It seems to follow that retirement can have the effect of either providing lesser or greater stimulation than does a person's work life, depending upon the cognitive complexity of work and retirement roles.

Differences in individual patterns of aging may also depend upon differential forms of personality organization. Early work by Havighurst et al. (16) identified eight different personality types based on cognitive, affective, personality, role activity, and life satisfaction. These forms of personality organization included types such as "reorganizers" who were competent people engaged in a variety of activities, and the "disengaged," a pattern describing individuals who had high life satisfaction but low activity and who had voluntarily withdrawn from role commitments.

In more recent research, Lehr (27) readdressed the theories of disengagement (9) and activity (29) by combining changes in role activity and satisfaction. Lehr (27) found that the individuals characterized by each pattern differed most on such

"central" roles as spouse, parent, grandparent, or friend; they differed less on more "peripheral" roles, such as kin, club member, or citizen. Because these differences were role specific, Lehr questions the explanatory value of global theories such as disengagement and activity theory. Depending upon the individual's personal, health, and economic situation, adaptations in old age can be consistent with the predictions from activity theory in some roles and with disengagement theory in other roles for the same individual. These observations argue for an individual differences or differential approach to examine changes in adaptive behavior.

Multi-Faceted Descriptions of the Environment

We have thus far considered primarily those empirical studies that have examined the interface between social-environmental influences and the maintenance of intellectual competence for specific domains. There are a number of studies that have taken a broader contextual approach. For example, Arbuckle et al. (1) examined performance differences on memory tasks with respect to 12 social, personality, adjustment, and lifestyle measures. These measures included the Eysenck Personality Inventory (which measures introversion-extroversion, neuroticism, and a "lie" score), psychological well-being, locus of control, everyday activities (divided into social and mental dimensions), stressful life events, as well as self-ratings of memory, financial situation, and health for everyday functioning. The cognitive measures included a test of forward digit span, test of free recall, and a prose memory task. Their sample included 285 men and women aged 65–95 years, of middle-class and working-class backgrounds. In this study a large portion of the age differences and almost all of the social class differences in memory performance could be accounted for by personality and contextual variables. In particular, education, intellectual activity, extroversion, neuroticism, and lie scores accounted for more variance in memory performance than did age.

Craik et al. (8) also examined the influence of contextual variables and task presentation on memory performance in three elderly samples. The elderly groups differed on social-economic status, verbal scores, and participation in an active life style. In this study task presentation was varied (free or cued recall) with the result that memory performance was influenced both by task presentation and the contextual characteristics of the individuals. Individuals coming from the less stimulating environments performed significantly worse on some of the memory tasks. The authors argued that age changes in memory should be examined in multiple-level groups and suggested that theories of congitive-performance must model the interactions between mental processes and relevant aspects of the environment.

By contrast, in an earlier study, Denney and Thissen (11) failed to find any predictive value for environmental context upon two factors of intellectual abilities, a non-verbal factor and a verbal factor resulting from the analyses of six tests: three Piagetian tasks, verbal and non-verbal tests, and a problem-solving task. The environmental variables included occupation, years since retirement, health status, activity level, and marital status. In this study only age significantly predicted performance on the non-verbal factor, while education predicted performance on the verbal factor. Denney and Thissen suggest that performance on the two factors may have alternate antecedents and they express some surprise that education was a stronger predictor for the sample of older men than was occupation and years from retirement.

Research from the Bonn Longitudinal Study has also linked environmental variables with cognitive performance (50). Study participants with higher intelligence scores were more likely to have higher incomes, to live with more people, to be seldom alone, and to read newspapers more often (28). Using path-analytical techniques, Rudinger and Lantermann (39) attempted to identify primary, secondary, and tertiary socialization factors of cognitive performance in old age. Predictive factors included aducation of mother and father, occupational status of parents, and subject's education explained 38% of the variance. Home environment, described by its different capacities for stimulation, was also a significant predictor.

In a somewhat different approach to the study of environment influences, other researchers have taken a more global approach to environment and have identified patterns of lifestyles, instead of simply entering contextual variables as predictors in a regression equation. Schoenfeldt (51) analyzed cognitive data in relation to five life-style factors: socioeconomic success, sensitive intelligence, physical vigor, introversion, and egocentric independence. After computing the subjects' factor scores on each of the five dimensions, Schoenfeldt clustered his 84 subjects into seven subgroups. Two of these groups performed at a significant lower level than the other life style groups.

The influence of numerous micro-level environmental factors upon intellectual performance has also been investigated in the Seattle Longitudinal Study. In 1974, a Life Complexity Inventory (LCI) was constructed to obtain additional information on 140 subjects who had participated in the first three waves of the SLS. This 26-page inventory was designed to collect data on many aspects of the interpersonal, work, social, structural, and cultural aspects of the SLS participants' microenvironment. Questions asked in this inventory cover, for example, basic demographic information, home environment, frequency of leisure activities, characteristics of the work and home-making environment, neighborhood composition, travel, mobility, reading activities, continued educational pursuits, and social network data.

Gribbin et al. (15) analyzed the information gained from the LCI by initially clustering all variables included in the questionnaire. The results indicated that the variables could be clustered into eight types: 1) subjective dissatisfaction with lifestyle, 2) social status, 3) noisy environment, 4) family dissolution, 5) disengagement from environmental interaction, 6) semi-passive engagement with the environment, 7) maintenance of acculturation, and 8) female homemaker characteristics.

Age was negatively correlated with cluster scores for social status and positive correlations occurred between age and the disengagement and family-dissolution patterns. Regarding the relationship between clusters and intellectual ability, all abilities clustered positively with social status, and negatively with disengagement. The relationships with other clusters were not as pervasive, yet all clusters except semi-engagement showed a positive relationship across time with at least one ability measure. Changes in performance on the Primary Mental Abilities test over a 7-year span were correlated with the cluster scores. In general, disengagement and dissolution were associated with greater cognitive decrement, while dissatisfaction with life style was associated with maintenance or improvement in functioning.

As a further step, Gribbin et al. (15) investigated the differential change in ability for individuals of different life styles. The subjects were clustered based on the lifestyle variables. This clustering produced four different types of individuals who could loosley be labeled as highly engaged, average engaged, semi-engaged, and the

disengaged. Further analyses showed that these types showed different intellectual performance levels over time. The disengaged demonstrated significantly higher decline, while the highly engaged performed consistently well on all abilities.

These results demonstrate that different types of individuals are differentially prone to changes in cognitive variables and further suggest that life-style based typologies may be more useful than the cohort-based independent variables used in past research. A strength of this study is the large number of variables considered. Nevertheless, because of the correlational nature of the study, it is premature to conclude whether changes in life-style preceded or followed changes in intellectual functioning over time. In further work, however, Schaie (42) has demonstrated the predictive utility of these lifestyles in predicting later cognitive performance. For example, the social status cluster predicts high performance at a later time for all abilities, while the disengagement cluster has a systematic negative relationship. These findings provide evidence that a number of contextual factors can be isolated that account for individual differences in the pattern and rate of ability decline in old age [also see (45)].

Conclusions

Progress is being made toward our understanding of the individual difference in maintenance or decrement of intellectual functioning in adulthood and old age. A number of studies have successfully linked complex work environments, more active lifestyles, as well as advantaged environments and lifestyles to the maintenance of high levels of cognitive performance into old age. Some of this research has indicated that the strength of effect of a environmental factor varies depending upon the specific cognitive ability being investigated. Such findings are precisely what would be expected if we except that human intelligence can best be understood within a multidimensional framework. Not all activities of daily living will require the skills underlying all intellectual abilities, nor will every environmental context have a direct impact on each of these abilities [cf. (58, 60)]. This consideration points to the need to better define our environmental factors with greater specificity and sharpen our hypotheses concerning their potential influence upon cognitive functioning.

Social scientists can certainly speculate about the advantages of higher social economic status; however, we have not been able to identify the mechanisms that would link social status to cognitive performance. Similar concerns also must be expressed regarding the complexities of studying the environment as it affects the aging process [cf. (6)]. While researchers have addressed the direct effects of job complexity and the direct effects of leisure activities, we know very little about the combined effect of these or other environmental variables. For example, knowing that someone is or was engaged in a highly complex job throughout adulthood, one might predict that cognitive performance would remain high. Nevertheless, after retirement, it was the workers from complex jobs who demonstrated higher decrement than workers who had been employed in routine jobs (13). In fact, it is only those studies that have examined life styles that have thus far begun to address the complex interactive effects to be found when using environmental data to explain cognitive aging.

Much of the research linking social-environmental contexts and intellectual performance has been static, examining relationship at only one point of time. The

relationships explicated by such study designs are, of course, strictly correlational and one cannot judge either the predictive nature of environmental factors or the reciprocal influences between performance and environment. Future research must, therefore, depend heavily on longitudinal paradigms in order to be able to assess both changes in cognitive performance over time and changes in the environment in a manner that will allow adequate tests of causal models.

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