A Life-Span Approach to Adult Intellectual Development

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The series of West Virginia life-span conferences being memorialized here, were actually preceded by an earlier conference sponsored by Division 20 and the National Institute of Child and Human Development held at West Virginia University in the spring of 1967 (Schaie, 1968). That conference actually set the tone for what was to come later by pairing scientists representing the child and the adult literatures to survey the state of aging research and comment on the relevant life-span methodologies. Not surprising, intelligence turned out to be a rather important topic both substantively as well as providing a vehicle to debate critical theoretical and methodological issues.

In this paper we would like to reflect on the historical prominence of the study of intellectual development within the life-span developmental psychology movement. In this context we will show that the topic of intellectual development has perhaps been better articulated in a life-span framework than many other content areas. As part of this discussion we contrast a life-span approach to the study of intelligence to the perhaps more common age-comparative framework that has dominated cognitive experimental psychology. Finally, we will call attention to the impact of the life-span approach to sensitizing research on intelligence to contextual influences.

Intellectual development in adulthood more often than not has been considered by contrasting the normative performance characteristics of young adults and the elderly, emphasizing the occurrence and magnitudes of intellectual age differences. By contrast, a life-span approach sees adult intellectual development as a continuous process that is characterized by periods of growth, stability and decline, a process that will not necessarily map upon calendar age in a monotonic fashion. Moreover, at least those of us who pursue adult intellectual development in the psychometric traditions (e.g., Horn, 1982, Schaie, 1994; Sternberg, 1977), have good reason to consider intellectual development to be a life-long enterprise that is firmly grounded in the structure of intellectual products and their underlying componential processes that are established in childhood. This is much different from other topics in the psychology of aging, where a linkage with early experience may be much more tenuous. Indeed, it could be argued that there are some psychological processes that are quite life stage specific: For example, many behaviors important in infancy may be solely designed to allow the infant to survive that life stage without any implication for later life (cf. Kagan, 1980), Likewise, courtship behaviors developed in adolescence and young adulthood may retain little significance beyond adolescence.

With respect to intellectual development, moreover, there is a fairly unique line of empirical research that grows functionally out of our understanding of the acquisition of cognitive skills and moves on to an understanding of how these skills are maintained and applied throughout adulthood (Schaie, 1977-78). Thus there is much concern about the relative importance and course of development of specific components of intelligence across the life span, but there is never any doubt that intelligence in adults, no matter how complex its applications or target, involves some necessary building block components that have already been identified as being important early in life.

Another unifying theme for the study of intellectual development across the entire life span is methodological in nature. Development is often understood to have both quantitative aspects that involve shifts in levels of competence or response intensity as well as qualitative aspects that involve transformations from the way in which behavior is expressed at a particular life stage to alternate forms at the next stage. The critical early developments in factor analysis occurred in the substantive context of the study of intelligence in children (e.g. Thurstone & Thurstone, 1941). Factor analysis has not only been important in the quantitative description of the relation of observed variables to theoretical construct defining the nature of intelligence. It has also allowed us to operationalize qualitative change as shifts in the number of factors describing a particular domain or by indicating changes in the regression of the latent constructs upon the observed variables. The advent of restricted factor analysis provided appropriate methods to test factorial invariance and consequently further established the major impact of factor analysis in the study of adult intelligence (cf. Schaie, 1992).

A number of theoretical underpinnings for the life-span approach to intellectual development arose early on and continue to influence the field. These theoretical models are both quantitative and qualitative (read structural) in emphasis. As early as 1916, while standardizing the Binet tests for American use, Lewis Terman became aware of the fact that the mental age concept of linear growth of intellectual skills required modification in slope and direction if theses tests were to be applied beyond childhood. Wechsler (1939) recognized the need for a more differentiated approach to the life-long measurement of intelligence by introducing his deviation IQ concept. He also attempted to include in his tests tasks that would seem to have greater face validity (or what we would call ecological validity today!), but he did not really tamper with the conceptual context advanced by Binet and by Terman, nor did he quarrel in any way with Binet's original definition of intelligence. Again, it has turned out that the work of Thurstone on the primary mental abilities originally done on children, has proven to be quite applicable to the study of adult intelligence.

At one time there was reason to believe that if more ecologically valid measures to describe intelligence in adults were developed age difference pattern seen on the laboratory tests of basic intelligence might be attenuated for such measures (Schaie, 1978). The outcome of a decade of relevant empirical work suggests two major conclusions: First. more appropriate measures can certainly be built and such measures may indeed be more useful in describing directly how adults function on everyday problems related to competent functioning within the community (cf. Willis & Schaie, 1993). Second, it is clear that substantial inter-individual differences variance on such measures is predicted by the basic laboratory measures.

When it comes to describing average growth and decline, however, there is little convincing evidence that the basic components of adult intelligence can profitably be dimensioned differently for adults than for children. Nor do special adult or elderly-oriented measures produce age gradients that differ markedly from those earlier demonstrated for the laboratory tests. Indeed, no matter what the precise measurement variables turn out to be, there is evidence of average growth for many components of intelligence into midlife, a plateau then seems to prevail until the early sixties are reached, followed by decline which is slow at first, but becomes fairly precipitous once the eighties are reached. Nevertheless, deviations from this pattern become exceeding common in adulthood, with biological linkages stronger during childhood and advanced old age, while secular trends and social norms being more influential in accounting for individual differences during the middle half of life.

A somewhat different situation prevails with respect to the structure of intelligence. Two different approaches characterize the life-span approach. The first, enunciated by Heinz Werner in his monumental *Comparative Psychology of Mental Development* (1948) describes a process of cognitive differentiation in childhood and adolescence and of dedifferentiation in late life. The second reflects the proposition that intelligence may not be a unitary domain, but may represent either a hierarchical or parallel set of multiple domains.

The Wernerian concept of the differentiation and dedifferentiation of intelligence is quite similar to the Lewinian field-theoretical approaches that were influential in early developmental psychology (cf. Schaie, 1962). In empirical terms, development of disparate mental abilities occurs generally in lock step during childhood (given the important physiological constraints during this period). Hence, it has been argued by some that there ought to be fewer factors describing intelligence in childhood and again in old age (cf. Cunningham, 19891; White & Cunningham, 1987). This would be a very strong developmental theory, one that in our opinion is unlikely to prevail. A weaker and more plausible form would argue that the differentiation-dedifferentiation theory ought to predict that different aspects of intelligence will tend to be highly correlated when studied in a populations whose members exhibit rapid growth. As cognitive differentiation occurs throughout adolescence and young adulthood, interindividual differences increase, as individual paths of development diverge. When the physiological infrastructure fails in ever increasing proportions of a population under study in advanced old age dedifferentiation (or reintegration) occurs with some decrease in interindividual variation (since the survivors become more homogenous) and factor correlations tend to increase (cf. Reinert 1970).

Formal tests of the differentiation hypothesis from young adulthood to old age suggest the maintenance of configural invariance (same markers of the latent ability constructs), but changes in interfactor covariances and in the magnitude of regressions of the latent factors on the markers (Schaie, Willis, Jay, & Chipuer, 1989; Schaie, in press). For much of midlife, however, these differences may simply be cohort effects, as they do not appear in longitudinal data sets following the same individuals over seven years (Schaie, 1994).

The second approach suggested by some proponents of a life span approach is that intelligence should be conceived as have several different dimensions that might either operate in parallel (cf. Sternberg & Berg, 1987), or that might form a hierarchical model (cf. Baltes, 1987; Willis & Schaie, 1993). For example, Sternberg talks of the mechanical components of intelligence, academic intelligence and practical intelligence; Baltes, distinguishes between the mechanics and pragmatics of intelligence. We have argued that a hierarchical model of intelligence requires underlying mechanisms (such as those studied in the information processing literature; e.g. perceptual speed, working memory) that are essential components of intelligent behavior. However, proficiency in these processes result in substantive competence with respect to products such as represented by the primary mental abilities. Everyday problem solving involves the application of such skills to environmental challenges posed to each individual. Each higher layer must at least in part be represented by permutations and combinations of the lower level. It is quite plausible, however, that different layers within a hierarchical model of intelligence might have differential importance depending upon the individual's life stage.

Basic mechanisms are thought to develop in childhood and reach maximum levels of efficiency in late adolescence or young adulthood. Although under simple conditions there may be little loss in adulthood, advancing age is thought to have persons function closer to the limits of their reserve capacity on these mechanisms, such that they are at a disadvantage when called upon to respond in complex situations, and when testing the limits (Kliegl & Baltes, 1987). The products represented by the primary mental abilities (sometimes called academic intelligence [cf. Sternberg & Berg, 1987]). combine proficiency in the mechanics with substantive knowledge or specific (perhaps genetically programmed) cognitive skills. To the extent that experience is important in reaching asymptotic performance levels, such levels are most likely to occur in middle age, and for some skills such as verbal ability, decline will occur only very late in life or as a function of specific disabilities. The problem solving skills used in everyday behavior or special areas of expertise (such as in the professions) must represent different combinations and permutations of competence at the other levels depending upon the requirement of a particular task. To the extent that there are broad deficiencies in these levels, there should also be broad deficiencies in problem solving. However, since cognitive aging occurs at different rates for different components, and for different individuals, performance on everyday tasks is likely to be far more idiosyncratic than is the case for the lower levels of the model (cf. Schaie, 1989; Willis, 1991).

The life-span approach conceives intellectual development to be conditional upon the individual impact of biological development, demands of the immediate environment and upon the socio-cultural context. But these influences are not simply to be seen as constraining conditions and their reciprocal interaction with levels of intellectual competence must be understood. Thus, in childhood individual differences in intellectual competence may be largely governed by genetic endowment and the quality of the child's rearing environment. In adulthood, by contrast, level of intellectual functioning may determine the extent to which individuals can obtain favorable life circumstances for themselves and their families. In turn, complexity of the job environment (cf. Schooler, 1987) and appropriate choices as to when and how retirement decisions are pursued may determine maintenance of intellectual competence into old age. Levels of individual competence are also important in the postponement of chronic disease through the exertion of favorable life styles and the better management of such disease through earlier detection and better compliance with remedial or compensatory treatment regimen (Gruber-Baldini, 1991).

A final contribution of the life-span approach to the study of intellectual development has been to call attention to the fact that contextual influences are not stable across time and successive generations. While these facts have been most extensively demonstrated during adulthood (cf. Schaie, in press; Willis, 1989), we have early on called attention to their impact in childhood as well (cf. Schaie, 1972).

We would like to suggest then, that intellectual development represents a prime topic to operationalize a life span approach to empirical work both because of the history of the field as well as the availability of suitable methodologies. While most work has thus far been done from young adulthood to old age, there is no reason why we could not extend work formally into adolescence and childhood, both with respect to more complete tests of construct invariance, as well as with the respect to the development and growth of everyday competence at earlier life stages, to supplement our concern with the aging enterpriseP.

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