

The Role of Cohort Analysis in Psychological Research:  
The Case of Intellectual Abilities, Obsolescence and Retraining<sup>1</sup>

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Abstract

This paper examines how psychologists have used the concept of cohort in attempting to understand the complex interaction of socio-cultural change and psychological maturation in the study of adult intellectual development. Cohort differences in intelligence are described and it is shown how research on cohort effects has modified our thinking regarding intellectual functioning in adulthood. The concept of obsolescence is then placed within the context of cohort differences and consideration is given to the interplay of cohort differences and maturational change as they effect the behavior of older individuals. Finally, suggestions are given regarding the importance of cohort analysis in facilitating our understanding of intervention efforts to alleviate cohort related obsolescence and remediation of age-related decline in intellectual functioning.

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<sup>1</sup>Paper presented as part of a symposium on age stratification, M. W. Riley, Chair, at the annual meeting of the American Sociological Association, San Antonio, Texas, August 29, 1984.

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Introduction

It is frequently observed that concepts and methods common to one scientific discipline may by virtue of our professional myopia be re-invented by another discipline in very similar form, but often with a somewhat different twist. An interesting case in point is the application of cohort analysis to issues in adult developmental psychology. The senior author began to introduce the concept of cohort into theoretical formulation and empirical practice in that field of inquiry at about the same point in time (Schaie, 1965) but in total ignorance, for example, of Norman Ryder's (1965) seminal paper.

The purpose of this presentation is to provide some examples of how cohort analysis has effected research in the psychology of adult development. Some of the notions to be expressed here have been well-enunciated in the sociological literature (cf. Elder, 1979; Riley, in press). Our particular intention, however, is to examine how psychologists have found the concept of cohort useful in attempting to understand the complex interaction of socio-cultural change and psychological maturation in the study of adult intellectual development.

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<sup>1</sup>More extensive discussions of the material covered in this paper may be found in Schaie (1983a) and Willis (in press).

We will begin by examining cohort differences in intelligence, and how the research on cohort effects has modified our thinking regarding intellectual functioning in adulthood. The concept of obsolescence will next be placed within the context of cohort differences, and we will consider how the interplay of cohort differences and maturational change affects the behavior of older individuals. Finally, we will make some suggestions regarding the importance of cohort analysis in facilitating our understanding of intervention efforts to alleviate cohort related obsolescence or the remediation of age-related decline in intellectual functioning.

#### Cohort Differences in Intellectual Function

The past two decades have seen considerable discussion among psychologists interested in adult development with regard to the role of cohort effects as a major source of interindividual differences in intraindividual change (Botwinick and Arenberg, 1976; Horn and Donaldson, 1976; Schaie and Baltes, 1977). Some psychologists (Botwinick, 1977; Salthouse, 1982) have sought to dismiss cohort differences as little more than variations in the so-called "classical" pattern of intellectual aging. The fact remains, however, that cohort differences in intellectual functioning appear to have some distinctly different implications from those associated with age-related change, and indeed, for much of the adult life course cohort effects may be of greater practical significance than age changes in terms of social policy implications.

The most comprehensive study of cohort differences in adult intellectual functioning has probably been Schaie's (1979, 1983a)

21-year cohort-sequential research. Data from that study suggest that differences between cohorts in intellectual performance equal or exceed the magnitude of intraindividual change when such effects are examined over comparable time periods. Figure 1 indicates the magnitude of cohort effects on five intellectual abilities by comparing performance differences between birth cohorts as the proportion of performance of the cohort born in 1952, whose performance is set at 100%.

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Insert Figure 1 about here  
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The modal pattern in Figure 1 is that of a positive cohort trend; that is, the level of performance of earlier born cohorts is below that of later born cohorts when comparison is made at the same chronological age. The current cohorts of elderly are therefore significantly disadvantaged with regard to the abilities of inductive reasoning and verbal meaning, with a similar trend shown for spatial orientation. By contrast, word fluency shows a reverse cohort trend. Here the oldest cohorts performed above the mean level of the youngest cohort. Finally a curvilinear cohort trend prevails for numerical ability with birth cohorts 1910 to 1924 performing above earlier or later cohorts.

Cohort effects are dynamic and thus vary from cohort to cohort. Cohort effects as reflections of multidirectional patterns of change represent varying impacts of critical life experiences for a given cohort. Most recently there is suggestive evidence (Schaie and Hertzog, 1983) that there may be a partial reversal in the positive

cohort trend for verbal ability in current young adult cohorts, a trend also implied by recent reports of decline in college entrance examinations.

Differential cohort differences in intellectual functioning appear to have their origin during the early portion of the life span, that part where formal education plays a major socialization role (Parsons & Platt, 1968, 1972). For example, if the declines in SAT scores reflect in part cohort differences, then it would follow that cohort differences in certain abilities may be evident at least by age 17 or 18. Although these differences most likely originate in childhood, their effects are cumulative and the consequences are probably most strongly felt in old age.

During the past two decades research on cohort effects has significantly modified our understanding of changes in intellectual functioning across the adult life course. Most research on adult intelligence has been conducted using a cross-sectional design, in which the intellectual performance of an earlier and later cohort was compared at one point in time. The common finding was that the earlier cohort performed at a lower level than the later cohort; these cohort differences in performance were interpreted as age-related decline in intellectual functioning. However, Schaie's cohort sequential study examining longitudinal change in intellectual performance in several cohorts across the same age period indicated that significant age-related decline did not occur for many abilities until the late sixties. Figure 2 illustrates the stability in intellectual functioning across much of the adult life course for several cohorts. Note that while the pattern of developmental change was quite similar

for various cohorts, the mean performance of earlier cohorts remained below that of later cohorts across the age period studied. Thus, much of what was interpreted as age-related decline in earlier cross-sectional research actually were cohort differences. Such cohort differences suggest that today's elderly cohorts may be significantly disadvantaged when compared with more recent cohorts. This leads us to a discussion of the phenomenon known as obsolescence.

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Insert Figure 2 about here  
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#### Obsolescence and Cohort Effects

One form of cohort difference that has particular effects upon adaptive individual functioning and is laden with social policy implication is that more commonly referred to as obsolescence. This term has been used primarily to refer to job-related obsolescence, and particularly with regard to professional obsolescence in high technology industries such as engineering (Ferdinand, 1966; Shearer and Stegar, 1975). However, we will argue that job-related obsolescence is only a subset of a more general obsolescence phenomenon. General obsolescence refers to the impact of rapid socio-cultural change (e.g., the computer revolution) which may effect the type of behavioral competencies needed to function effectively in our our daily life. These competencies may not be specific to any particular job or life role.

It is important to note that obsolescence as it is typically defined does not focus primarily change or intellectual decline within the individual. Currently, obsolescence is seen as largely a problem

of middle age. However, our longitudinal research suggests considerable stability in intellectual functioning during middle age, in fact, verbal ability peaks during middle age. Rather, obsolescence represents primarily a form of interindividual differences. For example, Siefert (1964) in discussing the obsolescence of engineers, defines the term as the difference between the knowledge and skills possessed by a new graduate of a modern engineering curriculum and the knowledge and skills possessed by the practicing engineer who has completed his formal education a number of years ago.

Obsolescence then, does not merely reflect individual decline, but rather represents a difference in early educational or other experiences of different cohorts of professionals. Closer to home, many of you may have or be experiencing the threat of obsolescence with regard to current trends in computer usage. Your level of competence may be below that of your graduate students, or worse your school age child. This does not reflect, hopefully, a decline in your intellectual competence, but rather cohort differences in educational experiences. In discussing obsolescence as a form of cohort differences, it may be useful to consider other definitions of cohort than birth cohort (See Schaie, 1983b, for further discussion). For example, specific educational experiences rather than year of birth may be a more useful criteria for defining cohorts with regard to certain types of professional obsolescence.

Sources of professional cohort differences may be found in the rapid growth of knowledge and change in particular areas of specialization. The term "professional half-life" has been used to refer to the length of time from the completion of professional training until that point in time when at least half of the acquired professional knowledge became obsolete (Dubin, 1972). The half-life measure thus reflects the point at which professional cohort differences reach a level of practical significance. Continuous professional updating, whether by self-directed learning or formal educational procedures, may prevent or reduce such professional cohort differences (Dubin, 1977; Houle, 1981). But the cost of such intervention is high. Dubin's calculations suggest, for example, that given the rapid knowledge growth in psychology, obsolescence avoidance in that field would require approximately 20% of the psychologists's work time to be spent in updating activities!

The phenomenon of professional obsolescence has been used to illustrate some practical implications of cohort effects as a form of interindividual differences in intraindividual change. The longitudinal data referred to earlier suggest both that the magnitude of cohort effects varies by ability, and that the pattern of cohort effects is dynamic and may differ across cohorts that have different life experiences.

#### **Cohort Effects and the Remediation of Obsolescence Effects**

Efforts to remediate obsolescence must involve a consideration of the interaction between cohort differences and individual maturation. Adults may experience two forms of disadvantage: First, rapid socio-



cultural change may lead to the experience of obsolescence as a function of cohort differences. The threat of cohort-related obsolescence becomes particularly salient in middle age, and becomes cumulative as the individual moves into later adulthood. Secondly, in old age, the individual becomes increasingly susceptible to age-related decline in intellectual functioning. Figure 3 presents in a simplified manner a matrix which may be helpful for understanding the type of intervention that would be required given different combinations of intraindividual change and cohort differences. In particular, this matrix may help us to explicate further the likely outcome of intervention for different age/cohorts.

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Insert Figure 3 about here  
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It was suggested earlier (and documented by Figure 1) that a given cohort may experience both positive and negative cohort effects. The left side of Figure 3 depicts the situation that would pertain if the target of intervention were an ability or skill exhibiting unfavorable cohort differences for current middle aged or elderly populations. For current middle aged populations, recent trends in computer technology are a prime example. In term of more basic intellectual abilities, current elderly populations are particularly disadvantaged with regard to the ability of inductive reasoning. Some of our recent research suggests that inductive reasoning is an important ability in performing many types of every day tasks, such as interpreting medicine bottle labels.

In this instance, training success with adults who had not experienced prior age-related decline, would occur largely because of initially lower levels of functioning associated with the negative cohort effects (upper left-hand cell of the matrix). Given that normative age-related decline does not become substantial until age 67 or later, successful intervention with adults in their fifties or early sixties might thus reflect primarily the modifiability of negative cohort effects. While we typically associate negative cohort differences with earlier born cohorts, this is not always the case. For example, it recent drops in SAT scores do reflect cohort trends, then later cohorts may be disadvantaged with regard to verbal ability when compared with earlier born cohorts.

The lower left-hand cell of our matrix, by contrast, represents that portion of the adult population who are disadvantaged not only with regard to cohort differences, but who have also experienced age-related decline. This, of course, is the portion of the elderly that may be most in need of intervention.

The middle and right-hand cells of the matrix indicate forms of intraindividual change which might be found if the target of intervention would be an ability that showed few significant cohort differences or for which there is a positive cohort effect in favor of earlier born cohorts. In our work such a situation would hold true for the ability of word fluency (or vocabulary recall). Training improvement for persons within the lower middle or right-hand cells would consequently reflect primarily remediation of age-related decline. By contrast, training improvement for those persons falling within the upper middle or right hand cell of the matrix would reflect

increased performance levels, beyond those previously exhibited, since neither cohort differences nor age-related decline would represent prior disadvantaging conditions for these individuals.

Empirical examination of the effectiveness of training programs in remediating age-related decline vs. cohort effects, of course, require subject panels for whom prior longitudinal data are available for the relevant ability dimensions. That is, prior data is required to permit knowledgeable assignment of candidates for intervention to the upper or lower parts of our matrix. We are now in the midst of collecting data of this kind, and our initial analyses of incomplete data (Willis and Schaie, 1983b), suggest partial support for the above model.

### Some Concluding Thoughts

We have briefly suggested how an understanding of cohort effects is essential to the behavioral scientist's efforts to analyze the phenomena of personal and job-related obsolescence, and how such an understanding would assist in formulating predictions about the likelihood of intervention success. It remains to raise some points about future directions which would seem to follow.

One of the important implications for behavioral scientists interested in the use of cohort as an explanatory or organizing variable is the fact that cohort effects are dynamic phenomena. It thus does not suffice to describe cohort effects as they impinge at one period in time upon a dependent variable of interest (such as intelligence) but rather it becomes mandatory to continue the monitoring of cohort trends, as they are continually impacted and modified

by sociocultural change. For the study of lifespan development, it is important to follow specific cohorts over their maturational history. For selected human abilities, this work is being done for present adult cohorts and continues in our longitudinal studies (Schaie, 1983a).

Much remains to be done also in determining the profiles of abilities that underlie certain types of job-related and independence-maintaining skills. A beginning has been made by studying how certain laboratory-defined ability structures relate to everyday tasks (Willis & Schaie, 1983a). But similar efforts are now needed to relate these ability structures to the requirements of various job families.

Knowledge gained from a more detailed description of age and cohort interactions would indeed place us in a better position to plan effective remediation and up-dating efforts. Such research would have implications also for more efficient utilization of the mature adult work force, and for increasing the proportion of the elderly population who remain productive and functional within a rapidly changing society.

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**Figure Captions**

Figure 1. Cohort Differences in Performance on Intellectual Abilities.

Figure 2. Age Changes on Spatial Orientation for the 1903 and 1910 Birth Cohorts from Ages 53 to 67.

Figure 3. Schematic of Age Changes by Cohort Effects.