Psychological Changes in the Elderly: Implications for Societal Participation

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Introduction

This presentation has two distinct but related purposes. The first is to consider some of the normal psychological changes that occur from late middle age into old age. The second is to discuss how these changes may affect the ability of older persons to continue independent living in the community, as well as to participate in the work place and other meaningful societal pursuits. To do so I will begin by briefly summarizing some of the facts regarding physiological age changes that may limit behavioral competence. Next, as a case study, I will present some data from my own work on longitudinal ability changes to illustrate some detailed findings from the research literature. In this context I will also try to deal with the problem that many older persons may not have experienced adverse psychological changes, but may still be at disadvantage compared to younger persons because they started out at a lower level. This will lead into a brief discussion of personal and professional obsolescence. Some findings will then be presented on what can be done to remediate age-related psychological losses and/or raise performance levels in the well-functioning elderly. Finally, I will consider the implications of this knowledge base for the maintenance and enhancement of societal participation in the elderly.

A balanced discussion of adult age changes always must distinguish between those events that occur to individuals because of our biological characteristics as members of the human species, other events that are programmed by a particular culture to occur at a given life stage, and the personal accidents and ailments that may seem to be signs of premature aging, but whose permanence or reversibility are basically unrelated to chronological age. The first two types of events are generally considered to be normative. But note that culturally determined life-stage specific events are subject to historical variation, such as increased longevity or changes in social structure. The third type, non-normative events that are unrelated to age, may at times appear to occur with increased frequency as people get older. Nevertheless, the frequency of such events is primarily influenced by environmental factors as well as changes in our knowledge with respect to the prevention or treatment of illness, accidents and the modification of unfavorable environments (Baltes & Willis, 1978; Schaie, 1981).

Biological Age Changes that Affect Behavior

I will begin my discussion of normal psychological aging by calling attention to some of the biological changes that impose constraints on the level of optimal psychological functioning and consequently require compensatory responses on the part of the well-functioning older person. Age changes of primary interest here involve sensory and perceptual capabilities and some general health

factors. The latter include specifically changes in energy level, autonomic nervous system arousal level, and cardio-vascular functioning.

Visual acuity. Beginning with the fourth decade of life, structural changes occur in the eye that lead to a lessening of light transmission and accommodation power. Yellowing of the lens decreases sensitivity to the shorter wave length of the visible spectrum leading to increased difficulty in discriminating blue, blue-green and violet. Reduced accommodative power affects accuracy of distance vision, sensitivity to glare, depth perception and color sensitivity. Beginning with the sixth decade there is also a reduction in the size of the visual field (cf. Kline & Schieber, 1985). Many of these deficits can be compensated for, however, by corrective lenses or environmental modifications that increase contrast between visual objects and their surrounding fields, and by increasing the level of overall illumination.

Auditory acuity. Age-related loss in auditory acuity has been reported as early as the late 30s. Losses in pure-tone thresholds, however, are of relatively little consequence by themselves. The most significant age-related decline involves increasing difficulty in the understanding of connected speech under difficult listening conditions (Olsho, Harkins, & Lenhardt, 1985). By the time the seventies are reached, some hearing loss is experienced by most persons. Of importance also are sex differences, with men experiencing greater loss at higher frequencies do women and vice

versa for lower frequencies. It is again possible to compensate for much hearing loss occurring with normal aging by properly fitted hearing aids and attention to the acoustic properties of the older person's work and living environment. Adaptive failures due to paranoid ideations may be seen as behavioral consequence of inadequately compensated auditory loss.

Perceptual speed. Age-related slowing in behavior has typically been attributed to slowed mediation processes in the central nervous system (Birren, Woods, & Williams, 1980). But the changes in the peripheral perceptual system may have equally important behavioral consequences. The phenomenon of *perceptual masking* involves the failure to perceive a visual or auditory stimulus if the sound or display is followed too quickly by a second competing stimulus. Adults over 60 have been found to require substantially greater intervals between successive stimuli to be able to discriminate them as well as to require longer scanning time when complex information is to be digested (cf. Walsh, Till, & Williams, 1978). Again environmental manipulations of the interval between successive signals may suffice to compensate for the changes occurring with normal aging.

Energy level. One of the more obvious aspects of physiological aging that affects many behaviors is the experience of lowered energy level. Some of this decline may simply be a consequence of increasingly sedentary and less active life styles and may be reversible at least in part by suitable fitness programs (cf. Buskirk, 1985; Harris & Frankel, 1977). Nevertheless, perceived drops in

energy often are instrumental in reducing behaviors such as the initiation of sexual activity, participation in physically invigorating and intellectually stimulating activities, or the actions required to replace friendships and establish new interests.

Arousal level. Not unrelated to the drop in energy level may be the progressive destabilization of the autonomic nervous system. Although there are conflicting opinions as to whether the aging ANS becomes over- or under-aroused, it seems clear that maintenance of optimal arousal level becomes more difficult with advancing age (Marsh & Thompson, 1977; Woodruff, 1985). Since optimal arousal level is critical for successful performance in many problem-solving situations, this physiological change may contribute to generate increased susceptibility to stress (Eisdorfer & Wilkie, 1977). Some would argue further that destabilization in arousal level with age may in part be accounted for by adverse drug interactions caused by the marked increase in the use of prescribed and non-prescription drugs as people get older.

Behavioral effects of cardiovascular disease. Effective voluntary behavior also requires the close interaction of the brain and the cardiac system. It is know, for example, that heart rate is lowered as part of attending to and perceiving visual displays or auditory stimuli. Less than perfect synchrony between the cardiac cycle and central nervous system processing will therefore result in lowering optimal function. Even small changes in efficient blood-flow and cardiac output might therefore effect behavioral competence. Some

evidence is beginning to accumulate that part of the cognitive deficit previously thought to be inevitable in old age may be linkable to specific cardiovascular problems (Hertzog, Schaie, & Gribbin, 1978). Of course, life styles that have been implicated in the early development of heart disease may also be directly responsible for lowered behavioral functions (Schaie, 1984b).

Normal Psychological Development in Adulthood

The terms *development* and *aging* are often used interchangeably as indicators of a developmental process that, throughout life, can take various directions, intensity and range of occurrence (cf. Baltes & Willis, 1977) As the investigator's concern shifts from the study of emergent behaviors to the apparent plateau of adult behavioral stability, and beyond to the eventual period of decline and deficit different aspects of development may become more or less salient.

Early development is characterized by a remarkable degree of isomorphism between the physiological structures that appear to be essential to the development of a given behavior and the actual observation of that behavior's emergence (Flavell & Wohlwill, 1969). The variability in the emergence of adaptive behaviors is relatively small, and in particular, the time interval between the occurrence of a given behavior in the least and most advanced child is usually brief. The relation between structure and function is severed, however, for the most part, as adulthood is reached (Flavell, 1970; Schaie, 1977/78). Behavioral decrement in the elderly is only in rare

instances (e.g. Alzheimer's disease) tied to specific physiological deficits (Birren & Renner, 1977; Hertzog, Schaie, & Gribbin, 1978).

The finding that adult development is characterized by somewhat different progressions for the physiological and behavioral domains immediately calls attention to the increased range of individual differences that occurs through the course of adulthood. Such increased variability is observed both in the maintenance of adaptive functions and in the ability to modify undesirable behaviors or relearn lost skills (Baltes & Schaie, 1976; Baltes & Willis, 1977). It is important to note that the *range* of observed behavior increases markedly throughout most of adulthood, to the extent that many elderly adults may perform well above the average level of young adults (Schaie, 1984b). Individual differences in adulthood are maximized by differential life styles that may markedly affect the maintenance or decline of cognitive functions (Gribbin, Schaie, & Parham, 1980). Unlike most children, adults typically have sufficient control over their lives to determine or change their life styles in adaptive or maladaptive ways. As will be discussed later, the increasing number of instances of quite elderly persons who do not show substantial decline with age, further suggests that interventions directed towards the remediation of presumed age deficits may be quite feasible (cf. Baltes & Willis, 1982; Stern & Sanders, 1979; Willis, 1985).

What then are some of the psychological changes that do occur for many if not all individuals as we move from middle into old age? The literature on this topic is vast and it would not be possible in the

time available to summarize even briefly the vast array of behaviors that have been studied (cf. Birren & Schaie, 1985; Schaie & Willis, 1986). Rather than attempt to overwhelm you with a mass of unconnected fact I will instead exercise you through a case study based on my own work on the decline and remediation of intellectual abilities.

The Sample Case of Intellectual Abilities

When dealing with an elderly population it soon becomes apparent that a person's intellectual competence often attains paramount importance in determining that person's societal status. For example, questions such as who shall be retired for cause (in the absence of mandatory retirement at an early age), whether individuals retain sufficient competence for independent living, or whether individuals can continue to conserve and dispose of their property, all involve the assessment of intellectual functioning. Given that these issues are of societal importance, it then becomes necessary to address a number of factual issues involved in the development of intelligence beyond mid-life. Intellectual decrement within individuals needs to be differentiated from differences between groups of individuals at different ages that have resulted from different life experiences. Such differential life experiences may express themselves in the obsolescent functioning of older cohorts when compared to younger peers. We must know at what age developmental peaks occur and assess generational differences as well as within-generation age changes.

We must further learn why some individuals show intellectual decrement in early adulthood while others maintain or increase their level of functioning on some ability variables well into old age.

In the elderly, selective changes in ability levels appear to be experientially determined rather than governed by changes in physiological substrates, and given appropriate changes in environmental pressures or opportunities may well be reversible. That is why later on I shall discuss some of our efforts with regard to cognitive intervention research. But reversals may also occur as a function of unplanned environmental interventions. For example, the advent of the computer revolution may lead to an environmental pressure reinforcing the acquisition or reacquisition of certain relevant reasoning abilities in old age.

While it has been argued, that the qualitative nature of intelligence may change in adulthood (cf. Labouvie-Vief, 1985; Schaie, 1977/78; Sternberg & Berg, in press), it is certain, nevertheless, that some of the basic concepts of intelligence found useful in understanding the behavior of children do remain relevant in adulthood and old age as well. Skills involving self-care, social interaction, problem solving, and language functions obviously remain important throughout life. It thus becomes of considerable interest to conduct an examination of changes for some basic ability measures over much of the entire life course. In the following section I will therefore review some of our longitudinal data on adult age changes for a selected set of variables.

Some Data on Cognitive Development from Middle Adulthood into Old Age

Developmental issues of interest beyond the stage of skill acquisition can generally be addressed by asking the following broad questions:

1. Does intelligence change uniformly or in different ability patterns?
2. At what age can age decrements be detected reliably and what is the magnitude of such decrements?
3. What are the patterns of cohort (generational) differences, and what is their magnitude?
4. What accounts for the differences in intraindividual change in intellectual abilities across the life span?

As some of you may know, I have tried to address these questions as part of a series of studies, now known as the *Seattle Longitudinal Study*, that began as a cross-sectional inquiry into the relationship between intelligence and rigidity-flexibility across the adult life span, and has been expanded into a longitudinal-sequential study in which data has now been collected for some individuals over as long as 28 years. Substantively, this work began with the description of age changes and age differences in intelligence, and was then extended to the identification of causal variables for individual differences as well as to the question of the reversibility of measured decline.

The measurement variables

The PMA test battery used by us was derived from a series of factor-analytic studies of some 56 mental tests (Thurstone & Thurstone, 1941). The test form used in our studies consists of five subtests designed to measure the abilities accounting for the greatest proportion of variance determined in the original factor analysis. I shall briefly describe these variables so that the data which I will then show will make sense to you:

Verbal Meaning. This is the ability to understand ideas expressed in words. The test measures the range of a person's passive vocabulary in activities where information is obtained by reading or listening to words.

Space. This ability, sometimes called "spatial orientation" involves thinking about objects in two or three dimensions of space. It may be described as the ability to imagine how an object or figure would look when it is rotated in two or three dimensional space, and to see the relations of an arrangement of objects in space.

Reasoning. This ability, more precisely defined as "inductive reasoning," involves the solution of logical problems. Persons with good reasoning ability can solve problems, foresee consequences and analyze a situation on the basis of past experience.

Number. This is the ability to work with figures and to handle simple quantitative problems rapidly and

accurately. It is measured by asking subjects to check simple addition problems.

Word Fluency. This ability is concerned with verbal recall involved in writing and talking easily. It differs from verbal meaning in that it focuses on the speed and ease with which words are used, rather than the degree of understanding of verbal concepts.

Data from the Seattle Longitudinal Study

One of the major questions in this study was concerned with identifying the ages at which statistically significant decline could be noted for the five different abilities just described, as well as to determine patterns of individual decline (cf. Schaie, 1979; Schaie & Hertzog, 1983; Schaie & Labouvie-Vief, 1973; Schaie & Parham, 1977).

Our findings immediately confirmed that the steep age decrement curves suggested by earlier cross-sectional data were an artifact of the confounded cohort effects. Figure 1 provides an example that contrasts findings from cross-sectional and longitudinal data for the variable of Verbal Meaning based on our 1956 and 1963 data collections. The cross-sectional data were obtained by averaging comparable ages at both times of measurement, while the longitudinal gradient was estimated by linking average age changes within groups of individuals between the two times of measurement (e.g., for the 25 year-olds to age 30, for the 30 year-olds to age 35, and so on). What appears to be substantial age decrement in the cross-sectional data,

turns out to be the effect of measuring at one point in time groups of individuals who differed in the level of performance they had attained as young adults. When we follow the same individuals we control for generational differences in performance level, and consequently find that decline within individuals does not begin until a much later point in the life span.

Substantive results from the longitudinal data that we have now collected for some subjects over as long as twenty-eight years can best be conveyed by estimates of cumulative age changes from within-subject data (cf. Schaie, 1983). Figure 2 presents longitudinal estimates obtained by averaging over all 7-year longitudinal data for each 7-year age range, adjusted for cohort differences and time-of-measurement effects. What the averaged 7-year data consistently suggest is the attainment of a plateau in the thirties, one that is generally maintained to age 60 (albeit with almost trivial decline for some abilities in the 50s). Thereafter we note significant and accelerating average decrement, that occurs at different rates by gender and ability. This decline seems to occur faster for women on Space than it does for men and the opposite holds for Word Fluency. It is important to note though, that the absolute magnitude of decline remains low until the eighties are reached.

Our cross-sectional age-difference data are not directly relevant to testing propositions about ontogenetic change. Having such data at several points in time, however, makes it possible to obtain estimates of the magnitude of differences between successive cohorts (Schaie,

1983). We can do so by averaging differences over successive measurement points for the different cohorts, and likewise averaging differences across cohorts (at the same ages) over times of measurement. When this is done, it becomes clear from our data that there are systematic advances in cohort level for Space and Reasoning: a significant disadvantage is noted for the older cohorts up to that born in 1931. A similar pattern prevails for Verbal Meaning, although here only cohorts born in 1917 or earlier are significantly disadvantaged. Very different findings, however, occur for Number and Word Fluency. The former shows positive cohort changes up to about 1910. Then there is a plateau and a shift to successively lowering of performance level: the 1924 cohort exceeds both earlier and later born cohorts, and both oldest and youngest cohorts are now at a disadvantage compared to the middle-aged! For Word Fluency finally, we found successive lowering of cohort levels (the younger cohorts thus being disadvantaged) until 1938, but improvement for our two youngest cohorts.

I am often asked as to the meaning of these cohort differences. While there are many different ways of approaching this problem (cf. Schaie, 1984a), it seems most straightforward to argue that they are a function of differential early life experiences (be they of an educational, nutritional or other quality of life nature) that are characteristic of a rapidly changing society. If this is the case, we must conclude that in certain aspects the older person who maintains his or her level of functioning from young adulthood into old age will

still be at a disadvantage. Increases in the complexity of modern life require ever higher levels of psychological competence. Maintenance of a constant level of function will therefore not suffice but instead assure obsolescence. We may conclude then that some older individuals are at disadvantage because they have suffered intellectual decrements, others because they are beset by personal obsolescence, and some obviously are disadvantaged for both reasons. But neither disadvantage is true of all persons, nor as we shall see is it impossible to provide suitable remediations. .

Individual Differences in Adult Age Changes

The data just presented on average age changes tend to conceal a most important item of information. That is, they might indicate to the casual observer that intellectual decrement in old age is universal and unavoidable. Our data argue to the contrary. Figure 3 depicts proportions of individuals who have either gained, remained stable, or declined reliably over the past seven years. These data are given for seven-year intervals beginning with ages 60, 67 and 74. While it is true that, on average, intellectual abilities decline as the sixties are reached, it remains equally true that by the early sixties only about a third of our subjects, individually, showed reliable evidence of decline over the previous seven years. That figure went up somewhat as the mid-seventies were reached, but it is noteworthy that even by age 81, about half of the members of our longitudinal panels maintained their functional level over a seven year period (Schaie, 1984b,.

What accounts for these vast individual differences in intellectual change over time? In addition to factors which might be genetic in nature we have thus far implicated as major attributes for those of our subjects who fail to decline in old age that they are free of cardio-vascular disease (Hertzog, Schaie, & Gribbin, 1978), that they have at least average socio-economic status and exhibit a stimulating and engaged life style (Gribbin, Schaie, & Parham, 1980), and that they described themselves as having flexible attitudes and behaviors at mid-life (Schaie, 1984b). It was further observed that the relationship between ability maintenance and cardio-vascular disease may just be reflective of the fact that persons who are in good physiological health may also be those who lead life-styles that are conducive to the maintenance of mental abilities. Our studies of the relation of life styles and ability maintenance into old age suggest a pattern shown in Figure 4. What this figure tells us basically is that an affluent life style that permits maximum environmental stimulation, in the absence of family dissolution is highly predictive of successful intellectual aging. Combine this with the propensity of such persons to show high levels of attitudinal flexibility and you have a clear recipe for what it takes to remain at a high level of mental function (Schaie, 1984b).

Can Intellectual Decrement be Reversed?

During the past decade there has been an increased focus in the study of adult intelligence on issues related to optimal or adaptive

intellectual functioning. It has been recognized that even well functioning older adults can be disadvantaged in at least two different ways: First, some age-related decline may occur through disuse, whether by personal choice or environmental restrictions. Second, even older adults who have not declined may be disadvantaged because of rapid sociocultural and technological change. Prior cross-sectional cognitive training research has strongly suggested the modifiability of older adults' performance on a number of intelligence dimensions (Baltes & Willis, 1982; Willis, 1985). However, the cross-sectional nature of this research made it impossible to examine one of the most fundamental questions. That is, to what extent did training procedures result in remediation of age-related decline vs the acquisition of new performance levels in subjects experiencing no decline? This issue must be addressed within the context of a longitudinal study, such that training improvement can be assessed for subjects with known intellectual histories. Recently completed work conducted together with my wife and colleague Professor Sherry Willis has obtained the data needed to answer this question (Schaie & Willis, 1985; Willis & Schaie, 1985).

Subjects from the five oldest cohorts of the Seattle Longitudinal Study ranging in age from 64 to 94 years (mean age 72.4) were classified on the basis of prior longitudinal data and pretest scores as having either remained stable or shown significant decline in performance on two of Thurstone's Primary Mental Abilities, Spatial Orientation and Inductive Reasoning. 229 study participants were pre-

and posttested on an extensive battery of primary ability measures. Training was provided on one of the two abilities by means of five one-hour training sessions conducted in the subjects' homes. Training procedures focused on strategies and skills shown in previous research to facilitate performance on the target ability. A primary concern in this study was to determine the proportion of subjects showing significant training improvement. A second objective was to determine how successful training might be in returning perf

It appears that training procedures are particularly effective for those individuals subjects who exhibited prior decline. Our data suggest that significant training gains are achieved by somewhat fewer of the subjects who had not suffered prior decline on the ability on which they were trained. Nevertheless, significant training gains occurred for one-third of the stable women and 40 percent of the stable men trained on Space. And for Reasoning, more than half of both stable men and women showed significant training improvement at posttest.

The results of the training study clearly show that cognitive intervention techniques can reverse reliably documented decline over a fourteen year period in a substantial number of older subjects for at least two different mental abilities, and can enhance performance in those who have not declined. More importantly these findings suggest that cognitive decline in a substantial proportion of community-dwelling elderly is not irreversible, is likely to be attributable to disuse, and can be subjected to environmental manipulations involving relatively simple and inexpensive educational training techniques.

Some Practical Implications for the Societal Participation of the Elderly

I have tried to build a chain of evidence for you, based on the sample case of intellectual abilities, that while there is reliably documentable behavioral decrement in increasing proportions of the population as the seventh decade of life is reached, many individuals retain unimpaired levels of functioning and many others can be restored to their previous functional levels. Because of the dramatic rise in levels of education, and attention to healthy life styles at earlier ages, however, many old people may be at a disadvantage when compared to their younger peers even when they have suffered no impairment from their own previous levels. Findings such as these are counter-intuitive and conflict with common stereotypes. They suggest, however, that there are a number of efforts in the area of primary prevention in adulthood that might markedly increase the societal participation of the elderly.

I would like to consider here four major areas within which behavioral intervention might be useful to enhance the status of the elderly. The first is concerned with educating the media and the public services sector. Many of the assumed disabilities of early old age are directly related to stereotypes about aging that become self-fulfilling prophecies. It is important therefore to try to convince the media to concentrate upon the 95% of the elderly who are not institutionalized and to report on and show successful older individuals who display full cognitive competence. The public service

sector needs to be educated to be more understanding of the moderate changes occurring with age and to value older clients as being of equal importance and deserving of high quality service and attention.

Applied behavioral gerontologists, secondly, must become increasingly active in the area of health education. Although an increasingly successful effort is being made to convince the public that dietary, smoking and drinking behaviors must be controlled by mid-life at the latest to assure physical fitness in old age, similar efforts still remain to be implemented in other behavioral areas. For example, educational efforts are needed to convince individuals to seek adequate compensation for sensory changes by attending to suitable modifications of their working and living environments. Greater attention in particular must be given also to changes in occupational hazards occurring as a function of slowing reaction times and increased complexity of work environments.

A third concern suggested by the data presented today involves the need for emphasis on the development of obsolescence-reducing educational mechanisms and their wide-spread use. The aging of the work force poses a particular challenge for those interested in adult and continuing education. Occupational and professional updating has frequently been reserved for those at mid-career. A lengthening work life and fast-moving technology mandates that equal attention be paid to those in the last third of their occupational involvement. Because of the data on the effects of disuse of specific intellectual competencies, it would seem that occupation-specific training could

profitably be supplemented by more general programs of intellectual skill training as suggested by the efforts that I described earlier.

A fourth area of interest to applied gerontologists is the transition from the world of work to that of (not infrequently enforced) leisure. In the United States, recent changes in mandatory retirement legislation have made it more and more likely that retirement will become an increasingly complex decision process. The arbitrary guideposts of chronological age now provide constraining time frames rather than specific end points, and much more flexible retirement plans are beginning to be offered by industry. These developments open new options and opportunities for individuals moving into old age but also add much uncertainty. Applied gerontologists will consequently need to become increasingly active in preretirement counseling programs, including formal assessment programs that help workers and their employers to appraise needs and abilities as they relate to reassignment or retirement decisions.

Summary

This presentation began by giving a brief overview on physiological changes from midlife to old age that constrain the maintenance of optimal levels of behavioral functioning. We next examined the evidence on normal psychological age changes by reviewing data for the sample case of intellectual abilities. In that context I presented data from my own work to show how selected intellectual functions change in adulthood and how secular trends and generational

differences impact these changes. Some of the factors that affect individual differences in adult cognitive development were briefly mentioned and new data on the feasibility of remediating cognitive deficit in old age were presented. Finally, I reviewed some practical implications of this work for selected societal issues involving the elderly. Far too much territory has been covered in too brief a time, but I do hope that I have provided some stimulating thoughts for those of you who wish to consider seriously how psychological changes impact the functioning of the elderly in today's society.

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