

How Does Maintenance of Intellectual Competence Contribute to Quality of Life and Successful Aging?

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Introduction

My presentation today is designed to reflect upon current discussions in the United States on how changes in the demographic composition of the American population interact with demonstrated changes in those characteristics of older persons that are particularly relevant to the maintenance of the quality of life in the older years or what by some has been called "successful aging." Although what I have to say applies directly only to present circumstances in the United States, these circumstances are very similar in all Western industrial nations. If anything, the time line of the changes I will discuss proceeds at an even faster pace in those countries that exceed the United States in the proportion of older people in their population.

To help you place what I have to say in an appropriate context, I should make it clear what my response would be when some of my colleagues describe me as a "Gerontologist." My life-long research career has been that of a cognitive developmental psychologist. Even more specifically, the core of my work has been to try to understand the differential patterns of intellectual abilities over the adult life span. In that context, I have tried to determine why it is that some persons reach a peak of competence early in life, others do not reach their peak until late middle-age while some show declines in competence in that life stage, and yet many others retain their intellectual competence well into advanced old age.

Perhaps even more relevant for the topic of this talk, I have also investigated the question whether there are changes in level of intellectual competence in successive generations as well as the question whether the rate of intellectual aging had changed across generations. Most of these questions have been investigated as part of what is known as the Seattle Longitudinal Study, an inquiry that was begun in 1956, and which has assessed the intellectual competence and many background variables over the adult life span, and which has also compared the cognitive similarity of successive generations of biologically related individuals. In contrast to some other cognitive psychologists interested in human aging, I have always tried to embed my work within an understanding of the social context as provided by many colleagues in neighboring disciplines, and to try to interpret the implications of my research findings for the broader social context. I suppose that is what qualifies me to speak more broadly as a "Gerontologist."

Demographic changes over this century have brought a dramatic increase in the proportion of older persons in the American population. This trend is paralleled in all industrial nations and has begun to accelerate even in the less developed countries. In America this is a trend which will be markedly exacerbated by the greying of the baby boomers, and is leading to a serious questioning whether the current ways of intergenerational support can be sustained into the next century. However, in this talk I will only be concerned indirectly with the resulting economic consequences, but

instead will take a more psychological approach and begin my discussion by reviewing some basic requirements for optimal aging from the point of view of a developmental psychologist. Next I will briefly review the evidence on creative productivity and aging. I will then try to address the question whether there is evidence that there have been generational changes in levels of competence and rate of aging that make it possible for older persons to participate longer and more fully in productive activities within our society. I will illustrate some of the points to be made with some relevant data from my own work that bears upon this question. Finally I will reflect on the question whether the generational changes that I describe have already resulted in altered patterns of societal participation by older persons in the United States, will briefly note certain relevant policy options that are currently being considered, and indicate those additional policy options which perhaps should be considered taking into account our present scientific knowledge.

Some Perspectives on Optimal Aging

Gerontologists often distinguish between normal, pathological, and optimal aging. Although the frequency of disease increases with advancing age, physical and mental decline is clearly not a necessary concomitant of normal aging, and many if not most older individuals are well able to compensate for the minor dysfunctions that accompany the normal aging process.

The aged are not a homogeneous population and we must therefore distinguish several substages of old age. At any stage of life, of course, people differ, often radically. Nowhere else in the life span does a single stage provide so inadequate a fit for all those in it as is true in the case of old age.. To compare someone who is 95 to someone who is 65 is not unlike comparing people 30 years different in age at other points in the life span: a 5-year-old to a 35-year-old, or a 20-year-old to a 50-year-old. Indeed, the physical and mental changes in the 30 years toward the end of life are, in most respects, far greater than the changes in the same time span at other ages. The probability of physical disease, for example, is much greater for someone over 80 than for someone between 65 and 80. On many characteristics of mental and physical performance, the young-old (those between 65 and 75) resemble the middle-aged more than they do the old-old. For bright and well-educated people who continue to do at least some work or maintain fulfilling retirement roles, the decade of the seventies can be a rewarding and active period of life, particularly if we were to succeed in transforming our age-differentiated society gives into a more age-integrated one. By contrast, the 25,000 or so centenarians are the remnants of an earlier generation who differ from the young-old in virtually all their demographic and personal characteristics.

Many studies have been conducted of psychological well-being in older adults, but we have learned only recently about older persons' perceptions of

how the important dimensions of well-being change from middle age into old age. For example, Ryff found that continued well-being as people aged was related to being a caring, compassionate person and having good relationships with others. While middle-aged persons stressed self-confidence, self-acceptance, and self-knowledge as criteria of successful aging, older persons emphasized acceptance of change, a sense of humor, and enjoying life.

A significant accomplishment of old age is an increase in altruism and humanitarian concerns during the last part of life. This may to some degree be a compensatory development. It may be that the majority of older people hold so little power and are sufficiently aware of the limits of their existence that economic and control-related motives become less influential. At the same time, however, many people have a strong need to leave a psychological legacy, and may therefore often channel their energies into contributing to the welfare of others for intrinsic reasons alone. Empirical data do show that social responsible attitudes in the United States remain virtually constant across age among women but increase markedly in men (see Figure 1). By participating in volunteer and community efforts, older persons (and men in particular), may often avoid the emotional problems that result from perceived dependency and helplessness. Helping others may provide a sense that one's life is meaningful, leading to a feeling of competence and increased self-esteem.

Figure 1 here

Why do some persons age gracefully, experiencing many rewarding retirement years and maintain full intellectual competence, independence, and good health almost until the end of their life, while other persons decline early and live out their last years in misery and as burdens to their families?

Baltes has argued that optimal aging involves a general strategy of being selective in one's efforts and using alternative strategies and activities to compensate for the losses that the aging processes bring with them. An important reason why some older people do so much better than others is the fact that there is substantial behavioral plasticity at all ages. Throughout life many people function well below the limits of their "reserve" capacities. This failure to apply all of one's capabilities may not matter greatly in young adulthood. In old age, by contrast, it is clear those individuals who manage to function closer to their limits and who are able to maximize the supportive qualities of their environment are going to do much better and to appear more competent than those who do not.

Successful aging obviously does not begin in the 60s. The foundations are laid by life styles that maintain a healthy body and a healthy mind through good habits of nutrition, exercise, and involvement in interesting activities that challenge the mind. The development of habits that support

favorable life styles, of course, is influenced by education and the attitudes and encouragement of family and friends who value a healthful and productive life. Optimal aging is also encouraged in midlife by learning techniques for stress reduction, developing techniques for coping with change, and acquiring leisure skills that do not require substantial physical strength and endurance). Another important strategy is the maintenance of a social support system and the substitution of new relationships for those lost by the death or departure of friends and relatives.

Successful aging also requires a positive self-concept which may be maintained by being able to evaluate one's performance in proper relation to the remaining levels of physical and mental capacity. Many older individuals influence their own aging in a positive manner, by not expecting to pursue all possible options, as was possible in their youth, but instead selecting priorities to make maximum use of their motivation, and remaining strength, and the increased leisure time now available to them.

As the majority of our population can now expect to reach old age, there have been significant changes in our society to accommodate this fact, which in turn have had significant impact on the lives and psychological development of individuals. As old age becomes an expected life stage, different social norms develop for this stage and people engage in new age-typical patterns, thus actually changing the way in which the aging process occurs. These new behaviors become commonplace, are reinforced by the news media and other authorities, and become part and parcel of our

institutions (e.g., the role of older persons as the new leisure class). Finally, the changed age norms and their expression in changed social structures alter many age-related behaviors, with further impact on our society.

Creativity Productivity in Late Life

The years of young adulthood and middle age are frequently considered to be those of the greatest creativity and productivity. Many people in centuries past never reached the age of 60 or 70, so of course their greatest works had to be accomplished at an earlier age. Nowadays, people often retire during their 60s and at that time put a deliberate end to striving for creative or productive goals. Illness, correlated with aging but different from it, can slow and inhibit creative urges. Nevertheless, old age can be a time of significant accomplishments. Many people over 60 or 70, and even over 80, have made important contributions to art, science, education, and politics.

To explore the relationship between age and creativity, psychologists have examined the creative products of scientists, philosophers, artists, business people, politicians, chess players, and other people whose achievements can be said to be important and notable. Major creative works -- the one or two accomplishments for which the person is best known -- tend to occur relatively early in life, but there are impressive individual exceptions (e.g., Goethe completed *Faust* after the age of 80). As shown in Figure 2, most scientists do produce their most remarkable works in their

thirties and early forties. However, as also shown in this Figure, the best work of a scientist can occur in the teens as well as quite late in life.

Figure 2 here

Although the major works of creative people tend to occur early in life, their total output is spread more evenly across the span of life. In a study of 738 persons who lived to age 79 or beyond, the sixties were the most productive years for historians, philosophers, botanists, and inventors. Scientists were most productive in their forties, fifties, and sixties. Artists were most productive slightly earlier, in their thirties and forties. Some would argue that continued creative productivity in late life in the United States may be a function of our society providing opportunity structures that allow for continuation of productive work, rather than severely limiting opportunities for professional participation for older scientists as is currently the case in Western European settings. But some productive older persons create their own opportunity structures. An interesting study of American architects suggested that the characteristics of those architects who continued to be productive past age 65 were characterized by commitment and drive, overlearned skills, aesthetic sensitivity, ability to be a good salesperson, and ability to delegate responsibility. Older scholars also express their generativity by facilitating the career paths of their students and serving as mentors to the next generation of scientists.

Older adults are known for wise and mature works that integrate disparate themes and also for works that depict or elucidate the particular conflicts and problems of old age. Qualitative changes have been observed in the work of authors in the direction of greater attention to spiritual issues, and some evidence of a "swan song" phenomenon has been found in an analysis of the last works of classical composers. These last compositions were brief but full of aesthetic significance and reflected a creative wisdom that might have been a function of some kind of "life review" conducted by the composer in proximity of expected death. Although some have argued that the products of older persons might be of lesser importance than those of the young, it has nevertheless been shown that the probability of impact of any particular contribution is equally great for the creations of older and younger persons.

Generational Differences in Individual Competence

I now turn to the issue whether there has been an increase in the level of competence and a reduction in the rate of decline in the older population over successive generations. This is an important issue, because one of the basic assumptions that underlies discussions of the changing role of the old in modern society holds that today's older persons differ markedly from older members of previous generations. The data that I will show you next come from the Seattle Longitudinal Study that I already mentioned earlier.

Let me first show you some data on average longitudinal age gradients for the relationship between age and performance on some basic intellectual abilities (see Figure 3). *Verbal Meaning* represents the ability to understand ideas expressed in words. It indicates the range of a person's passive vocabulary. *Inductive Reasoning* is the ability to recognize and understand novel concepts or relationships; it involves the solution of logical problems--to foresee and plan. *Spatial Orientation* is the ability to visualize and mentally manipulate spatial configurations in two or three dimensions. It is important in determining one's physical orientation from a map or in visualizing what objects would look like when assembled from separate pieces. *Number* is the ability to understand numerical relationships, to work with figures, and to solve simple quantitative problems rapidly and accurately. Finally, *Word fluency* is the ability concerned with verbal recall involved in writing and talking easily.

These data clearly show that most abilities reach a peak in early middle age and then plateau until the 60s are reached. Only modest average decline, probably representing the increased presence of persons with sensory deficits and chronic disease in our samples, occurs during the seventies, while substantial average decline is reached by the eighties.

Figure 3 here

What these data do not tell us however, is whether there has been any change in the rate and timing of changes in competence across generations. To answer these questions we need to compare successive birth cohorts measured at the same ages.

Although many of the advantages of today's older generation comes from improvement in their health status as compared to earlier cohorts, we think that in the United States one of the major factors has been a dramatic increase in the average level of time spent in the formal educational system. Figure 4 shows that for cohorts born over a 70-year range, virtually all those alive today, there has been an average increase in formal education that amounts to approximately 5 years. The increase has been approximately one year greater for men than for women.

Figure 4 here

The increase in duration of educational exposure as well as the elimination of childhood diseases, healthier life styles and better management of many slightly disabling chronic diseases have resulted in an upward trend across generations in a number of intellectual abilities that are basic to competent performance in work situations as well as any other responsible societal roles. However, this trend has not been uniformly positive for all abilities. Figure 5 compares changes in performance across generations in the five abilities I described earlier.

Figure 5 here

The form of these generational trends are uniformly positive for Verbal Meaning, Space and Reasoning, but it should be noted that there is flattening of the cohort gradients for the last groups, which represent the early baby boom cohorts. These abilities seem to be affected by additional years of education but also by the adoption of more "discovery-based" instructional strategies in American schools. Notice, however, that the cohort gradients are concave for Number (with peak performance for the 1924 cohort and decline thereafter) and convex for Word Fluency. The decline in numerical skill is particularly interesting, and leads to the observation that on this particular ability the current elderly are actually at an advantage compared to their younger peers.

Comparable generational differences were also found in our studies of biologically related adult parent-offspring pairs. However, the general population estimates shown in the last figure actually underestimated the advantage of the offspring cohort for Spatial Orientation (see Figure 6).

Figure 6 here

The positive generational trends in certain abilities are quite encouraging, and initially may lead us to believe that at least on the basis of

their levels of competence many more persons might be likely to continue productive lives to later ages. However, we must also ask whether or not there has been a shift across successive generations in the rate of decline of intellectual competencies. We have investigated this question for the age range from 60 to 81 years for two abilities (Inductive Reasoning and Spatial Orientation) for three cohorts born seven years apart (see Figure 7). While for both abilities there is a clear increase in level across the three cohorts that we studied at age 60, the rate of aging (i.e., the slope of the age gradients) has as indeed slowed for Inductive Reasoning, but has remained approximately the same for Spatial Orientation. What this means is that today's older persons may indeed be experiencing slower aging on some intellectual abilities, but that the rate of aging may not have changed on others. I will later on discuss the societal implications of these findings.

Figure 7 here

Another question that must be addressed is whether retirement from the world of work, whether voluntary or mandated by law or custom, is supportive of continued maintenance of intellectual competence. The data shown in Figure 8, interestingly enough, suggest a very differentiated answer to this question. When we examined persons of the same age (in their 60s) who had either retired or remained at work over a seven year period, we found that the effect of retirement on the maintenance of intellectual

competence was better for those individuals who had worked in a routine and uninteresting job. On the other hand, it was clearly unfavorable for those persons who had retired from a complex and challenging job. I interpret these findings to mean that persons who retired from a routine job were probably able to substitute a more stimulating environment in retirement. But those who retired from complex and challenging jobs apparently were unable in retirement to replace the intellectual stimulation previously provided by their challenging jobs.

Figure 8 here

Implications for Social Policy

I will now try to draw some inferences from the data I have presented to you with regard to the quality of life of our older population and their implications for social policy. Let me first summarize a number of facts. First of all, it is clear that successful aging requires both a supportive environment as well as the maintenance of individual competencies that allow maintenance of an independent and productive existence for older persons. Second, there have been rather dramatic shifts, at least in the United States, in the level of competence attained by successive generations, implying that today's older persons are at an advantage when they are compared to persons at the same age in earlier generations. Many

of these gains have been due to medical advances and increases in educational exposure. These developments, however, have begun to level out, particularly for the "baby boom" cohorts. It may therefore be expected that the differences in performance levels between young adults and healthy older persons will shrink even further over the coming decades. Third, it has become clear that the substitution of leisure roles in retirement for the work role may have desirable outcomes among blue collar workers, but may be disadvantageous for healthy older persons who have experienced stimulating and challenging work roles over much of their adult lives.

The recognition that many older persons can continue to perform well in many work situations has informed American policy that eventually led to the almost complete abandonment of mandatory retirement as a public policy. Ample evidence has accumulated to show that there is virtually no correlation between industrial productivity and chronological age. Other personal characteristics, such as health, individual motivation, and willingness to continue educational activities which counteract personal obsolescence have been shown to be far more importance predictors of job performance.

In spite of the abandonment of forced retirement, the average age of retirement in the United States has actually declined markedly during the past two decades. However, early retirement in America typically means retirement because of pension eligibility from one's primary employer, but not necessarily the person's complete or permanent retirement from the

work force. That is, most early retirees who are in good health tend to reenter the work force, although frequently at lower levels of compensation, working in part-time or temporary employment settings, or by being self-employed.

The demographic facts of the aging of the baby boomers, has already led American legislators to postpone public pension eligibility for these cohorts from age 65 to age 67, and there are current discussions that may lead to the postponement of pension eligibility even further for those who are physically and mentally capable of continuing to work. The research data that I presented earlier, however, do suggest that it may be naive to raise the initial age of pension eligibility indiscriminately. Our data on differential generational changes for different competencies suggest that many persons could well work longer in some but not in all occupations. Moreover, given the increasing frequency of chronic disease, raising the age of retirement eligibility may decrease the number of persons retiring by attaining a given chronological age, but instead increase the number of persons who will leave the work force because of physical and mental disabilities.

Given the higher levels of education and greater productivity of today's older persons, retirement roles increasingly include participation in significant voluntary programs, many of which in the United States are essential for the provision of certain services that in Europe would be provided by city or regional governments. These include providing personnel for information and referral services in hospitals, home health

care agencies, staffing public libraries, as well as many other educational and community facilities.

In the past the majority of these community volunteer has typically consisted of female full-time homemakers. But economic changes in the United States have made two-earner families the rule rather than the exception. The larger share of volunteers is therefore now found among the retired population. Educational institutions have become more sensitive to the fact that volunteer roles may require additional training. In the past programs for older persons, such as elder hostels, or institutes for lifelong education have provided opportunities primarily for self-improvement and leisure-oriented subjects. Programs are now being added to include subjects such as computer training, understanding the working of government, or counseling skills. These programs are specifically designed to contribute directly to the important social roles of older volunteers.

Although the proportion of older individuals who can continue to lead productive independent lives in old age has markedly increased, we must also recognize that the proportion of elders who will experience modest declines in competence will increase as the life span is expanded for many. One of the major policy objectives for achieving a high quality of life will therefore involve interventions that compensate for some of the losses in competence that may be associated with the reduced need to engage in complex decision making and organized activity after retirement. The research literature suggests that many older persons can be successfully

trained to return their intellectual competence to previously experienced levels. The laboratory studies demonstrating these findings will soon be expanded further by a formal multi-site field trial of cognitive training that is about to begin in the United States under the auspices of our National Institute on Aging with techniques pioneered in our laboratory under the leadership of Professor Sherry Willis.

Let me now summarize: Our studies and comparable studies in other countries have shown that there has been a systematic increase in the level of intellectual competence in the elderly during this century. There have also been favorable changes in the rate of decline from early old age into advanced old age, but this change in rate is occurring for some but not all aspects of intellectual competence. It is my belief that in the future many more older persons will continue to be productive members of society whether as full- or part-time workers or as volunteers. The economic forces being unleashed by the aging of the baby boomers will require a longer period of societal participation for all if we are to continue to provide adequately for the needs of our young as well as for those of the frail and disabled portion of the elderly. Given the demographic changes it is unlikely that we will much longer be able to afford the maintenance of an elderly leisure class. It is fortunate therefore that the generational shifts in competence and productivity will make the necessary societal adaptation possible.

General References

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Figure Captions

Figure 1. Longitudinal age changes in Social Responsibility. Source: Schaie, K. W. (1996). *Adult intellectual development: The Seattle Longitudinal Study* (p. 282), New York: Cambridge University Press.

Figure 2. Age at which scientists produced their best work. Source: Adapted from Simonton, D. K. (1991). Career landmarks in science: Individual differences and interdisciplinary contrasts. *Developmental Psychology*, 27, 119-130.

Figure 3. Longitudinal age changes for five primary mental abilities. Source: Schaie, K. W. (1996). *Adult intellectual development: The Seattle Longitudinal Study* (p. 112), New York: Cambridge University Press.

Figure 4. Cumulative cohort differences in number of years of education. Source: Schaie, K. W. (1996). *Adult intellectual development: The Seattle Longitudinal Study* (p. 157), New York: Cambridge University Press.

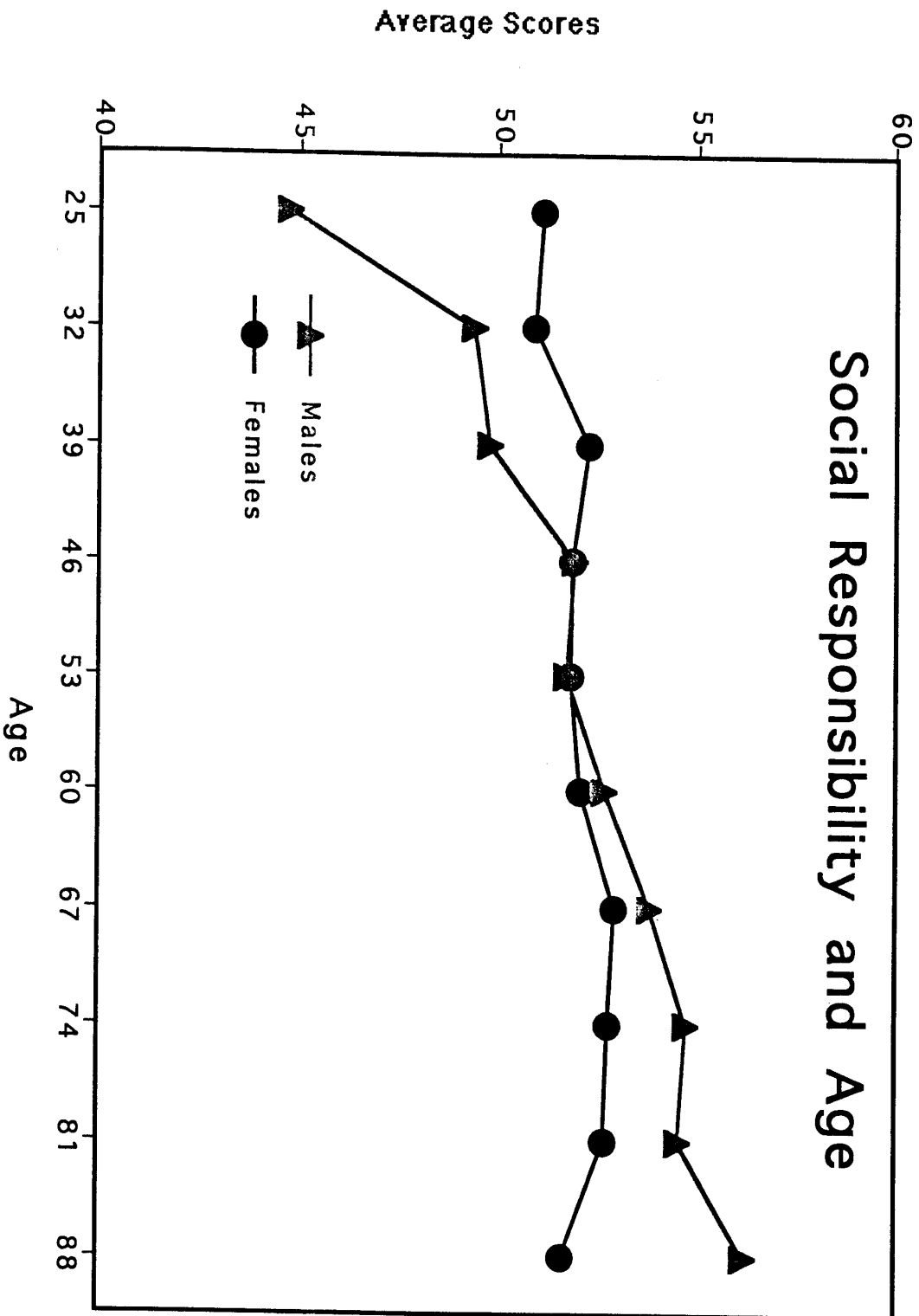
Figure 5. Cohort differences for five primary mental abilities, Source: Schaie, K. W. (1994). The course of adult intellectual development (p. 308). *American Psychologist*, 49, 304-312.

Figure 6. Generational differences between parents and offspring on five primary mental abilities. Source: Adapted from Schaie, K. W. Plomin R. L., Willis, S.L., Gruber-Baldini, A., & Dutta, R. (1992). Natural cohorts: Family similarity in adult cognition. In T. Sonderegger (Ed.), *Psychology and aging: Nebraska Symposium on Motivation, 1991* (Vol. 38, pp. 205-243).

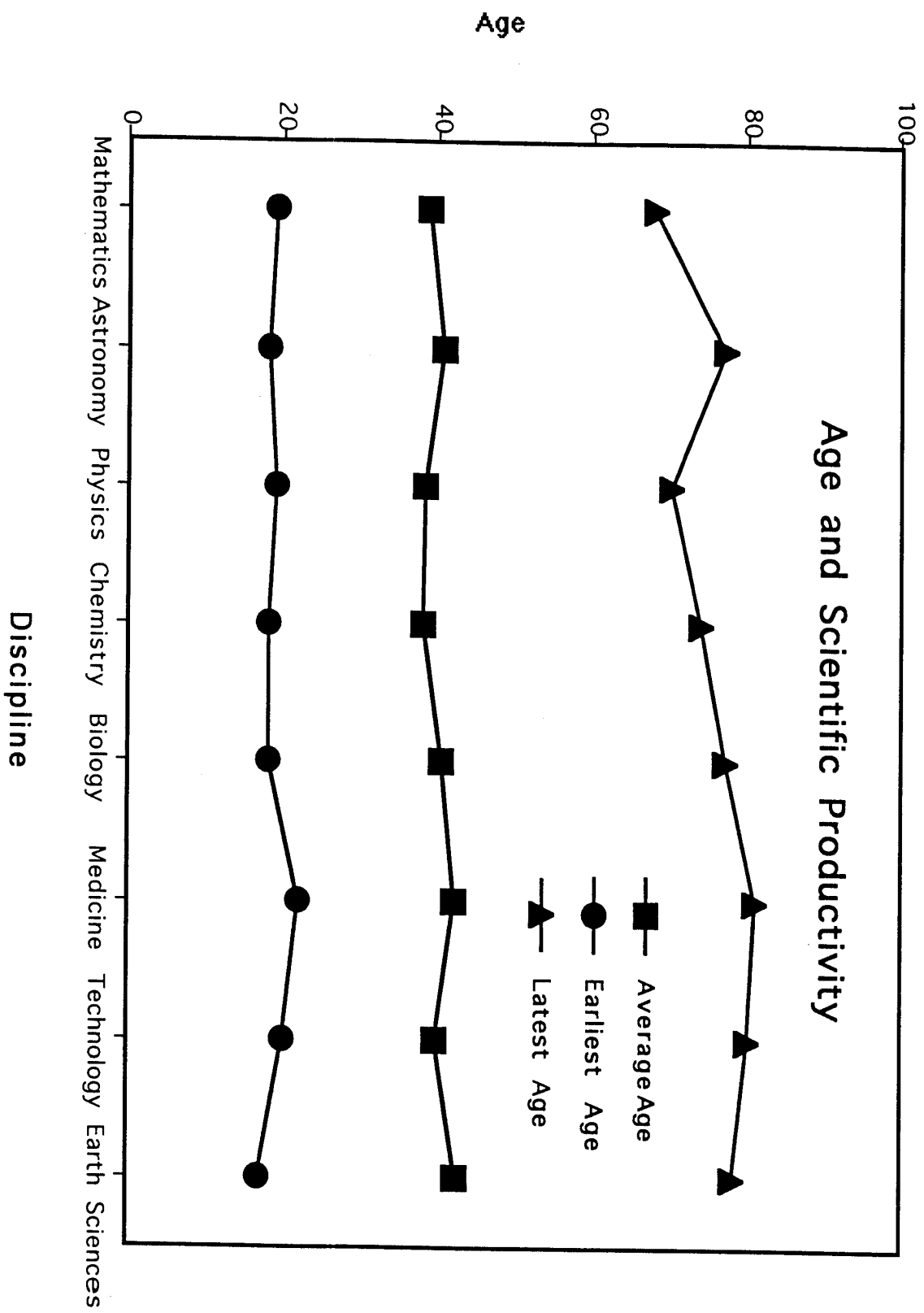
Figure 7. Rate of aging from age 60 to 81 on Inductive Reasoning and Spatial Orientation for three successive cohorts. Source: Seattle Longitudinal Study,

Figure 8. Seven-year age change for Inductive Reasoning for individuals who retired prior to or who continued working throughout the period, classified by job complexity (challenging or routine). Source: Seattle Longitudinal Study.

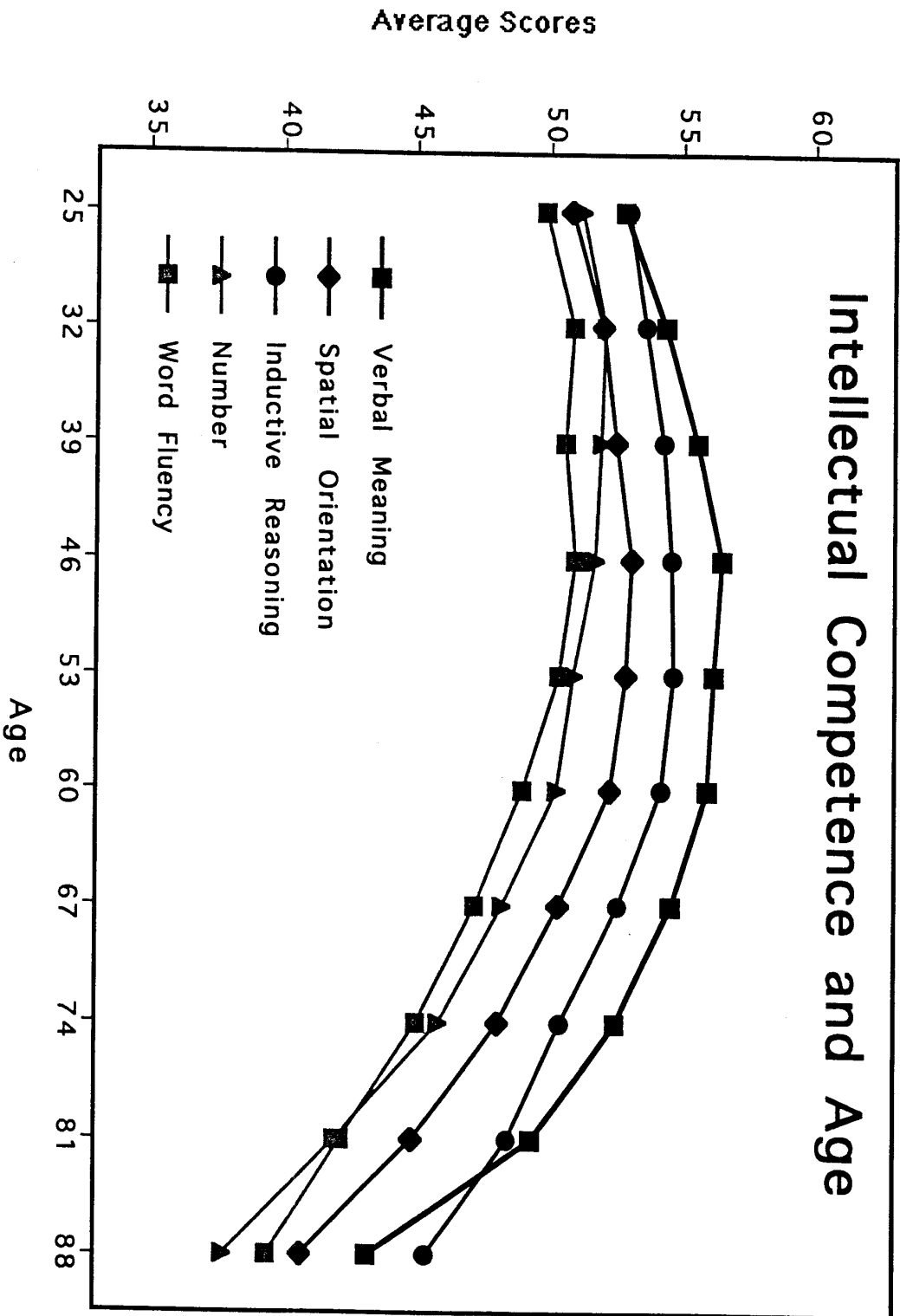
Social Responsibility and Age



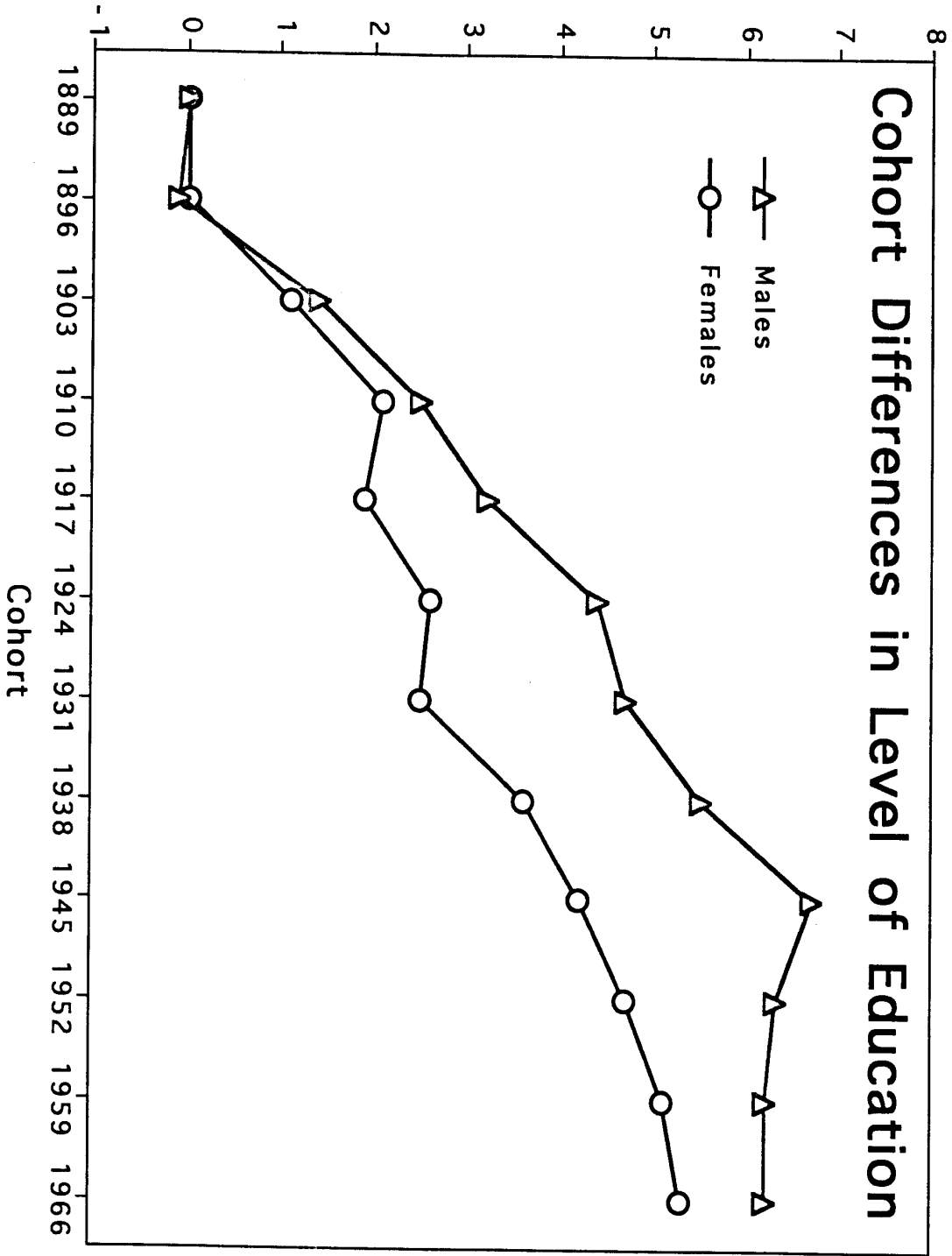
Age and Scientific Productivity



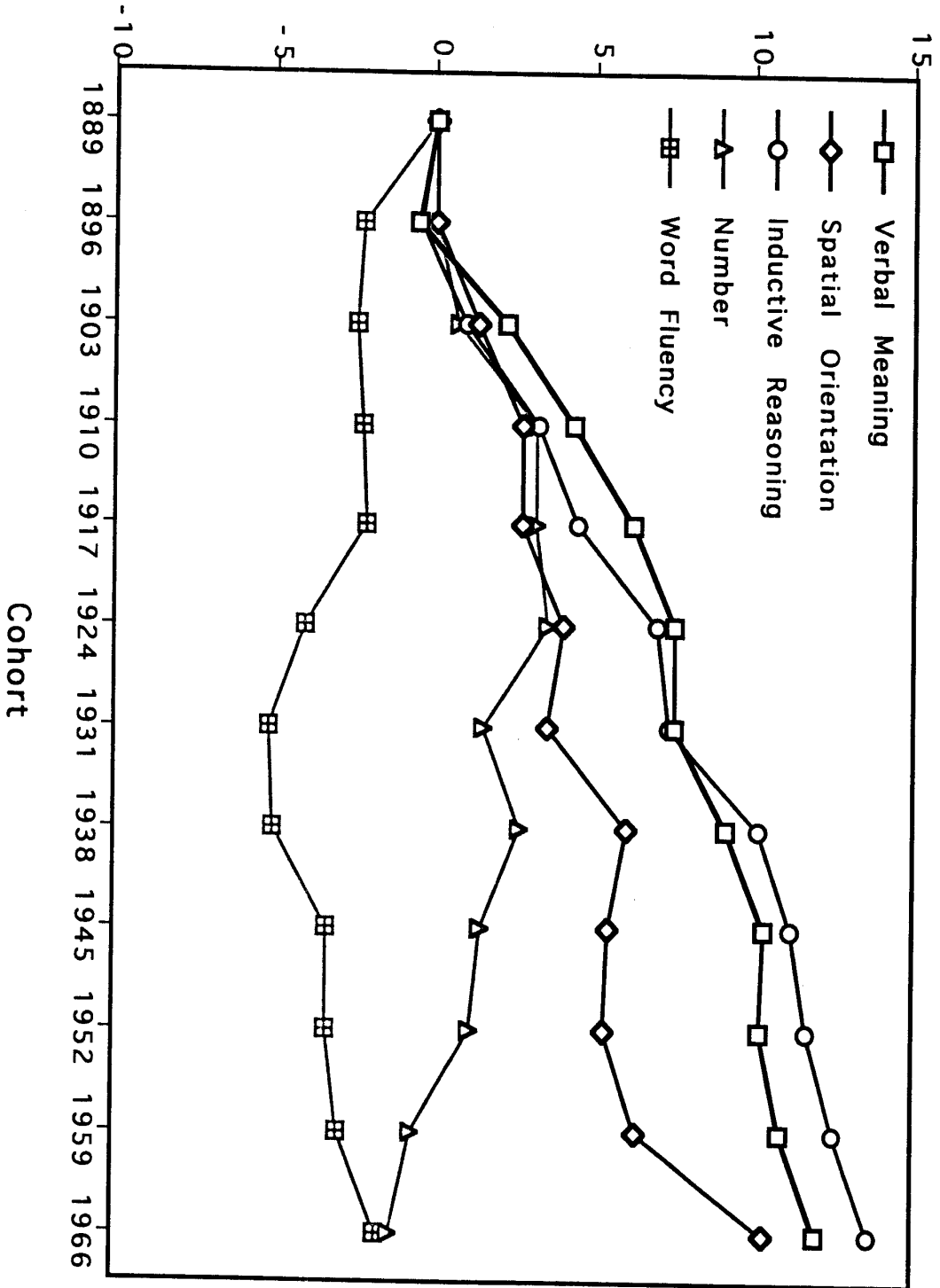
Intellectual Competence and Age



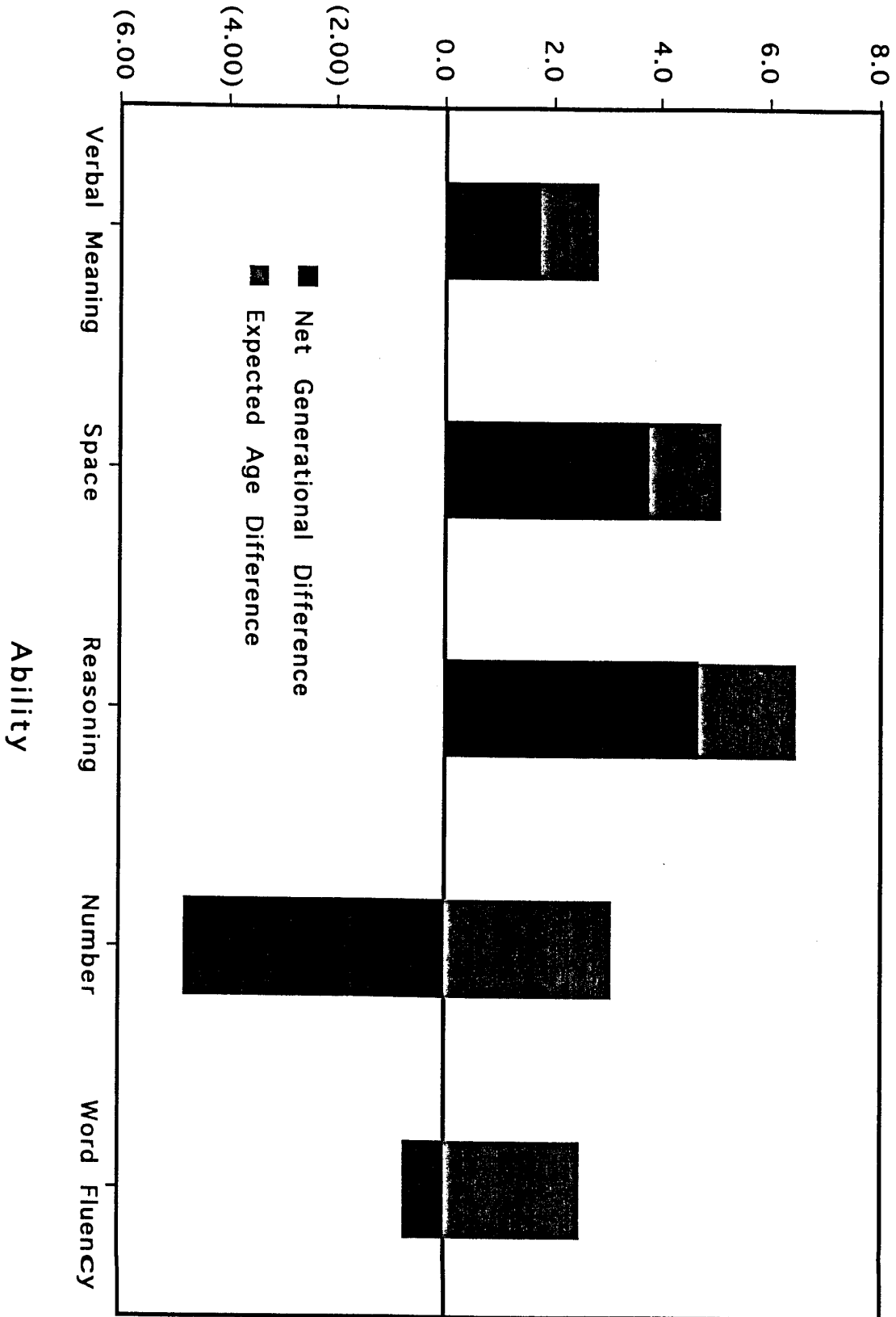
Cumulative Mean Change in Years of Education



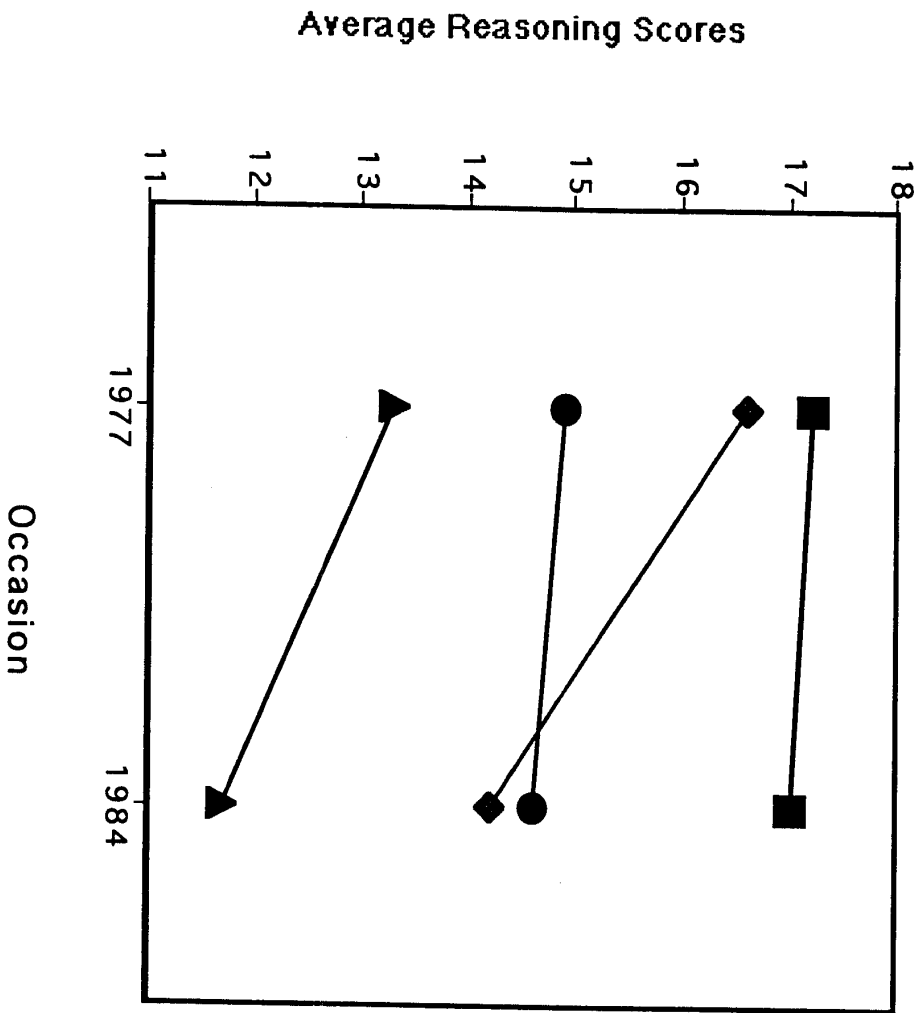
Cumulative Average Cohort Change



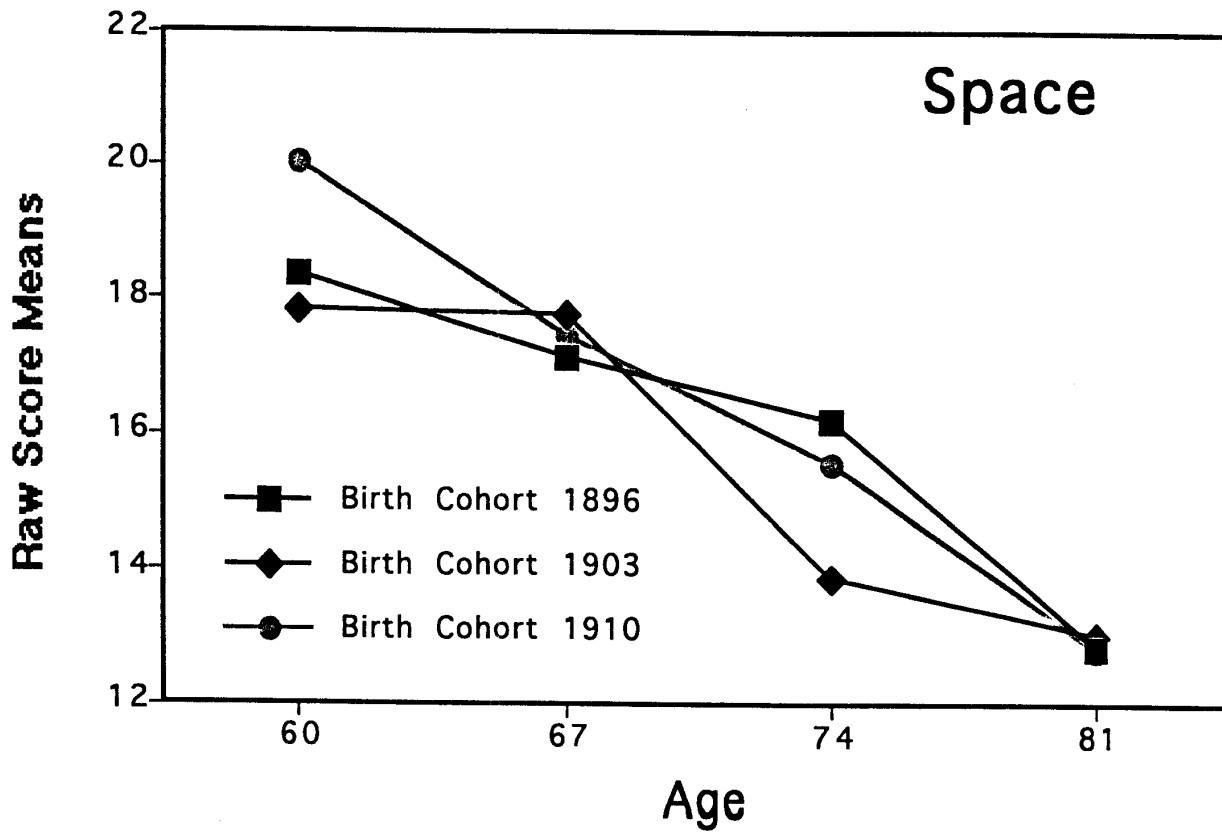
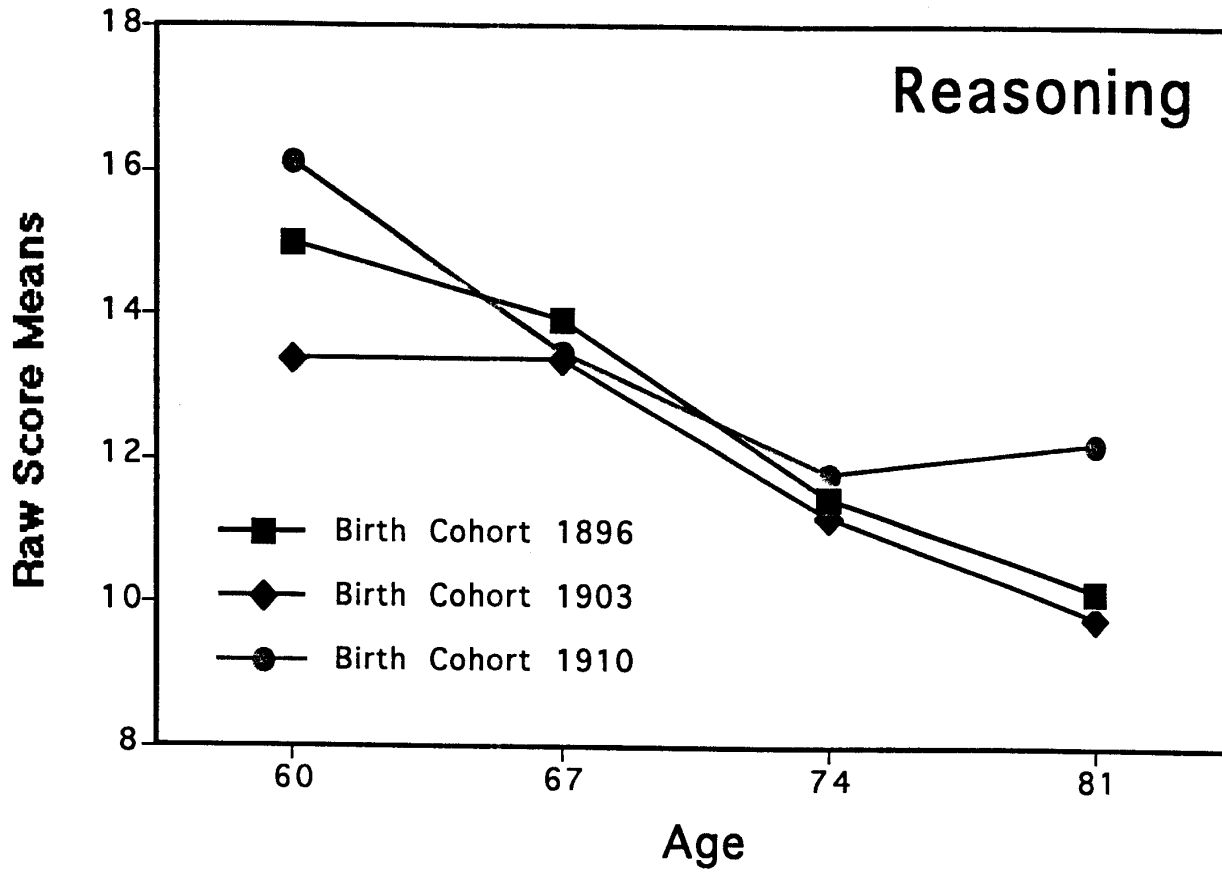
Difference in T-Score



Job Complexity and Retirement



- Complex Job - Retired Late
- Complex Job - Retired Early
- Routine Job - Retired Early
- Routine Job - Retired Late





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