Cognitive Facets of Aging Well

By Timothy A. Salthouse

Aging well or successfully with respect to cognitive functioning is a difficult concept to define in a precise manner. At a minimum, the phrase undoubtedly refers to the avoidance of such grossly debilitating diseases as dementia. In addition, however, it presumably also refers to the preservation or growth of one's cognitive abilities in order to allow old activities to be continued and new interests to be pursued.

Even this second, more limited interpretation of successful aging is sometimes assumed to present a formidable challenge because research concerned with aging and cognition has revealed age-related declines in many cognitive abilities. Indeed, the research literature concerned with age-associated declines in ability has grown so extensive that researchers in the field have been criticized for focusing exclusively on cognitive declines, thereby contributing to negative stereotypes of elderly adults as forgetful, and perhaps even mentally incompetent, individuals. Although it is probably true that a majority of the empirical research has concentrated on age-related declines, it is unlikely that the reasons for this imbalance are nefarious. That is, of the three possible outcomes of age-related behavioral comparisons—stability, increases, and decreases—only decreases are a cause for concern. Therefore, if one is interested in eventually doing something that might prevent those declines in the future, or possibly in remediating those that already exist, it is important to understand as much as possible about the causes of age-related declines. Information about cognitive abilities that remain stable or increase with age, although perhaps desirable to provide a more balanced portrayal of the true capabilities of older adults, has had a lower priority among many researchers because it has been presumed to be of less value in contributing to the ultimate elimination of age-related cognitive problems.

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Regardless of the justification for past research in the field of cognitive aging, it is indisputable that the research has contributed considerable information about the relations between aging and cognitive functioning. Because some familiarity with the major research results is desirable in order to present an informed discussion of what it means to age well in a cognitive sense,

several of the most important findings from research on aging and cognition will be briefly reviewed.

Findings Reviewed

Cognitive functioning is generally assessed by means of short tests requiring the examinee either to provide specified information, such as the meaning of words or the significance of historical events, or to perform brief activities, such as arranging blocks to match a design or determining which item provides the best continuation of a series. Past research has revealed two fairly distinct patterns of age relations on measures of cognitive functioning. One pattern, evident in measures assumed to reflect the efficiency of processing at the time of testing, is for performance to decline with increased age. The other pattern, characteristic of measures hypothesized to represent the accumulated products of processing from earlier periods in one's life, is for performance to remain stable across the adult years.

These two patterns have been interpreted as reflecting a reduction with increased age in the ability to acquire or manipulate information, sometimes referred to as fluid intelligence, but with little or no influence of advancing age on access to the products of prior processing, sometimes referred to as crystallized intelligence. The magnitude of the age trends for fluid or processing-efficiency measures has also been found to vary across the specific measures employed, but for measures of the type used in the assessment of cognitive abilities in adults (for example, the subtests in the Performance Scale of the Wechsler Adult Intelligence Scale –Revised), the declines appear to be nearly continuous beginning in about the late 20s or early 30s. There is still little agreement about the causes of these age relations, but it is noteworthy that the age differences seem to be largely independent of both the amount of education and the self-reported health status of the research participants. Age-related declines have also been reported in many cognitive measures without any systematic age-related increases in the variability of the scores.

The results just mentioned have been derived from cross-sectional comparisons of different people tested at the same point in time. Only a few longitudinal studies, in which the cognitive abilities of the same people are tested at different periods in their life, are available with intervals extending over 20 years or more. Furthermore, virtually all these studies suffer from problems of selective attrition (because more low-performing than high-performing people fail to return for subsequent testing), and differential practice (because increased age is associated with more prior experience with the tests). Finally, in some longitudinal studies the measures of cognition reflect crystallized intelligence or the accumulated products of earlier processing instead of fluid intelligence or current processing efficiency. Because there are very few age-related differences in crystallized or product measures in cross-sectional investigations, there is no reason to expect pronounced age differences in them in longitudinal studies.

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One of the few studies in which the same cognitive measures were administered to adults from a wide range of ages in both cross-sectional and longitudinal comparisons is the Seattle Longitudinal Study conducted by Warner Schaie. Although it is sometimes claimed that the results from longitudinal comparisons of cognitive abilities and those from cross-sectional comparisons are quite different, several reanalyses of data from this particular project (e.g., Botwinick, 1977; Salthouse, 1991) indicate that the age trends from both cross-sectional and longitudinal comparisons were qualitatively similar. The cognitive declines were somewhat smaller in magnitude, and occurred a little later in life, in the longitudinal comparisons relative to the cross-sectional comparisons. However, these slight discrepancies may be attributable to the confoundings of age with selective attrition and with practice in longitudinal studies, and consequently the discrepancies do not necessarily indicate that what is being assessed in cross-sectional and longitudinal comparisons is fundamentally different.

Many people have been quite skeptical of results that suggest the existence of age-related declines in cognitive abilities because these results seem inconsistent with observations of the functioning of many people in their daily lives. Although it is clearly possible that further research may lead to the modification or qualification of some of the conclusions summarized above, it is important to note that they are not necessarily inconsistent with observations of older adults functioning at high levels in many daily activities.

One possible reason for the apparent discrepancy between the research results and everyday observations is that the effects noted above are relatively small, and hence there is considerable overlap in the distributions of performance at each age range. The average adult in his or her 70s would therefore be well within the normal range of functioning for adults in their 20s or 30s, and it would not even be surprising to find that many people in their 70s perform at higher levels than the average 25-year-old.

A second reason that the consequences of age-related declines in cognition may not be very large in everyday activities is that the relevance of psychometric measures of cognition to real-world activities outside the academic environment is still not known. Most cognitive tests were initially validated against a criterion of school performance, and a comparable criterion of competent functioning for adults no longer in school is not yet available. However, it should be emphasized that

there is currently a lack of knowledge as to whether the existing tests are invalid or irrelevant for the functioning of adults, rather than knowledge that such is indeed the case. In fact, there is some evidence that the tests may be valid for older adults. Willis and Schaie (1986) have found that performance on standard tests of cognitive ability is moderately successful in predicting performance on special tests designed to measure practical or real-world skills such as interpreting bus schedules, comprehending legal documents, and reading maps.

It is also likely that daily functioning provides a very insensitive index of an individual's true capabilities because the activities performed in one's normal environment are typically very familiar and highly practiced, and hence the age-related effects on those activities may be smaller than the effects evident in unfamiliar or novel tasks. Furthermore, most activities of daily life have undergone a great deal of adaptation and selective survival because those that have been found to be stressful or difficult for many people have generally been eliminated or modified to allow them to be performed by the largest possible percentage of the relevant population. An example is automobile driving in which modifications of the automobile (in the form of automatic transmissions, power-assisted steering and brakes, and the like) and alterations of the environment (in the form of, say, smoother roads and better illumination and signs) are continuously introduced to reduce the difficulty of driving and, presumably, also the likelihood of accidents.

Several of the preceding assertions about aging and cognition are still controversial, but each has been documented in a number of large-scale studies (see Salthouse, 1991, for a comprehensive review). It therefore seems reasonable to consider the implications of these findings for understanding cognitive aging and for strategies of coping with possible cognitive deficits in order to age successfully. One implication of the empirical results is that cognitive aging is apparently not merely a late life phenomenon; if the declines are truly continuous, then the differences between people in their 70s and people in their 50s may be no greater than the differences between people in their 50s and those in their 30s. Moreover, if age-related influences actually begin in early and midadulthood, then effective strategies for successful aging should presumably begin at that point as well.

A second implication of the earlier-mentioned results is that the age-related declines are apparently not simply an artifact of changing educational patterns or declining health status; similar age trends are evident when the comparisons are restricted to those with the same amount of education or to those reporting themselves to be in excellent health. This does not mean that factors related to education and health do not influence cognitive performance, particularly among individuals with a greater range of variation in health and education than that typically found in volunteer samples, but it does suggest that age-related declines are not limited to individuals with low levels of education or in poor health.

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The third implication is related to the second because the discovery that variability for many measures remains stable from the 20s through the 70s implies that the declines are not attributable to large losses in only a few people, with most people unaffected by age-related influences. If this selective impairment interpretation were correct, then the variances would be expected to increase with age because a growing percentage of people would be in a lower-performing portion of the distribution while the other, unaffected, people would continue in the portion of the distribution that remains stable. The lack of an increase in variance observed in several analyses of cognitive performance instead appears more consistent with roughly constant age-related declines among most members of the population, although this speculation obviously must be considered quite tentative in the absence of definitive longitudinal data.

To recapitulate, the results and implications discussed above indicate that although there are few or no age-related influences on measures of accumulated knowledge, declines with increased age on measures reflecting current processing efficiency are well documented. Furthermore, the declines do not appear to be limited to certain segments of the population, because the entire distribution is shifted and the declines are not restricted to people in poor health or with low levels of education, and the declines seem to begin relatively early in adulthood. The issue to be considered in light of these findings is how one can age well in the face of probable declines in the level of certain cognitive abilities.

An initial step in attempting to understand successful aging is to consider how success is achieved in a variety of different activities. Two important ingredients of success in virtually all endeavors seem to be establishing priorities and capitalizing on one's strengths. Priorities are needed to allow one's limited time and energies to be channeled in the directions considered most productive or important. Thus, strengths as well as weaknesses need to be identified to maximize opportunities to employ one's strengths and to minimize reliance on one's weaknesses. Both of these aspects can be applied to dealing with declines in one's cognitive abilities, as illustrated by considering

three specific strategies or models for successful cognitive aging.

Three Models

One possible strategy for dealing with cognitive decline is *accommodation*, in which deficit-revealing situations are avoided by altering the nature of the activities one performs. The field of sports provides many excellent examples of accommodation. The aging athlete often tries to adjust to his or her declining physical abilities by changing to a less-demanding position in team sports or by reducing the frequency or difficulty of the tasks attempted in both team and individual sports. Eventually the athlete may shift into a coaching or managerial position where his or her accumulated knowledge can be shared with younger athletes. Many parallels may exist in the cognitive domain because, while the ability to execute certain novel tasks might decline with age, there is still tremendous value in the wealth of knowledge that has accumulated with experience. People following the accommodation model of successful aging might therefore gradually disengage from activities stressing the fluid or processing efficiency abilities that may be declining with age and shift to activities that place a premium on the crystallized or cumulative knowledge abilities that appear to be either preserved or even increase with age.

A second possible model for successful aging is *compensation*, in which there is an active or deliberate substitution of processes so that the same overall level of functioning is maintained through a modification in the way in which the activities are performed. For example, an individual experiencing difficulties in memory might attempt to minimize the consequences of this impairment by means of compensation in the form of greater reliance on written notes and shopping lists, developing regular habits for the placement of keys, glasses, and the like, or perhaps even always trying to park the car in the same position in a parking lot. These actions are compensatory because a loss in one aspect (reliability of memory) is presumably balanced or offset by a gain in another aspect (reliance on external memory aids). Compensatory strategies may be quite effective in maintaining high levels of functioning if the problem areas can be accurately identified and if there is sufficient motivation to search for, and implement, alternative methods of performing the activity or accomplishing the goal.

A third possible model for successful aging is *remediation*, in which some type of intervention is introduced to restore one's ability to a prior level by improving the critical or deficient processes. The most common analogy for remediation is the restoration through exercise of a muscle atrophied as a consequence of disuse.

The idea that age-related cognitive deficits might be remediated through various types of interventions is currently quite controversial among researchers interested in aging and cognition. There is no doubt that, in general, performance on many cognitive tests can be substantially improved with various types of practice or training, and it is now well established that older adults also experience these benefits. The difficulty, however, is that many researchers have failed to distinguish between demonstrations of cognitive plasticity and demonstrations of the modifiability of age relations in cognition. Plasticity is inferred by the gains in performance associated with an intervention such as practice or training. Modifiability, in contrast, refers to an alteration of the initial age relations and hence requires that the observed plasticity be greater among older adults than among young adults. In other words, because remediation implies that the defective process has been restored to its prior level, in order for an intervention to remediate an age-related deficit the intervention should be found to affect modifiability and not just plasticity.

Unfortunately, although there is now considerable research demonstrating that adults of all ages can benefit from interventions designed to improve performance on cognitive tests, in none of this research has it been found that the initially poorer-performing older adults benefited more than the better-performing young adults so that the age relations were actually modified as a consequence of the intervention. This does not mean that remediation is an uninteresting possibility, or that the demonstrations of cognitive plasticity in older adults are of no value, but merely that there does not yet appear to be any convincing evidence for the true remediation of age-related cognitive deficits.

The three models just discussed indicate that there are many opportunities for successful cognitive aging even if one accepts the potentially controversial characterization of the cognitive aging research literature summarized above. Cognitive declines with age have been clearly documented, but they are limited in scope (because accumulated knowledge seems to remain relatively unaffected), and they are limited in magnitude (because functioning generally remains in the normal range except for the small percentage of pathological cases with dementia). High levels of cognitive functioning can therefore presumably be achieved at any age by determining what activities are important and by capitalizing on one's strengths and minimizing one's weaknesses through techniques like accommodation, compensation, and possibly remediation. Optimum use of one's cognitive abilities may require some changes as one grows older, but for most people there seem to be relatively few cognitive limits on what can be accomplished at any stage of life.

Timothy Salthouse, Ph.D., is a professor of psychology at the Georgia Institute of Technology, Atlanta.

References

Botwinick, J., 1977. "Intellectual Abilities." In J. E. Birren and K. W. Schaie, eds., *Handbook of the Psychology of Aging.* New York: Van Nostrand Reinhold.

Salthouse, T. A., 1991. *Theoretical Perspectives in Cognitive Aging.* Hillsdale, N.J.: Erlbaum.

Willis, S. L. and Schaie, K. W., 1986. "Practical Intelligence in Later Adulthood." In R. J. Sternberg and R. K. Wagner, eds., *Practical Intelligence.* New York: Cambridge University Press.