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## Cognitive Aging

Cognitive aging is concerned with age-related changes in adulthood in the basic processes of learning and memory, as well as the complex higher order processes of language and intellectual competence or executive functioning. Although most of the literature has been concerned with explaining the mechanism of cognitive decline, there is also a substantial interest in issues such as compensation and the role of external support, including collaborative problem solving.

### 1. Definition of Cognitive Aging

There have been two distinct traditions in the study of cognitive aging. The first grew out of experimental child psychology while the second derives from psychometric roots.

#### 1.1 Experimental Study of Memory Functions and Language

The concern in this literature is to explicate possible causal variables that would explain why many adults suffer memory loss and decline in the complex manipulation of language variables such as text processing. The typical approach here is to design experiments testing for the effects of single variables in carefully controlled laboratory settings requiring only limited numbers of subjects. Because there is often little interest in individual differences, or population parameters, study participants are typically drawn from convenience samples (McKay and Abrams 1996).

#### 1.2 Descriptive Study of Adult Intellectual Development

Descriptive studies of adult intellectual development often stem from the longitudinal follow up of samples first assessed in childhood or adolescence. Other such studies may represent carefully stratified samples from

defined populations, first assessed at a particular life stage, whether in early adulthood or in early old age. Although descriptive studies often begin as cross-sectional inquiries, they are most frequently conducted as longitudinal analyses since the interest is often in individual differences in intraindividual change, or in the elucidation of typologies of individuals who follow different growth trajectories. These are frequently large-sample studies, and the use of correlational or quasi-experimental approaches is typical (Baltes et al. 1999, Schaie 1996b).

## 2. Methodological Issues

### 2.1 Age-comparative vs. Age Change Designs

Much of the experimental cognitive aging literature is based on age-comparative studies, which typically contrast a group of young adults (typically college students) with convenience samples of community-dwelling older adults in their sixties and seventies. It should be recognized that such comparisons are fraught by the problem that it is often unreasonable to assume that the two age groups can be adequately matched for other status variables that might provide a rival explanation for any observed age difference on the dependent variable. This creates particular problems for identifying the mechanisms that may be implicated in age-related decline from young adulthood into old age. Age-comparative designs are also inadequate in explaining individual differences in age changes. The latter can only be investigated by means of longitudinal paradigms (Schaie 1965).

### 2.2 The Role of Response Speed

A number of theorists have argued that changes in the central nervous system are the primary common cause for the observed age-related declines in cognitive performance. In fact, there have been many published analyses that show a substantial reduction in age differences, if some measure or measures of reaction time or perceptual speed is partialled out of the relation between a given cognitive process and chronological age (Salthouse 1999). This issue is of particular concern because it is not clear whether the observed average increase in reaction time (generally assumed to be of the magnitude of approximately 1.6 from the early twenties to the late sixties), while reliably demonstrable in the laboratory, is of significance in many or most tasks of daily living.

## 3. Basic Findings from the Experimental Literature on Cognitive Aging

Most of this literature is cross-sectional in nature and usually consists of a comparison of convenience samples of young adults (often sophomore psychology

students) and of community-dwelling older adults (often participants in adult education programs). The major findings regarding age differences in cognitive performance include the following.

### 3.1 Memory

It is currently thought that older persons are at a disadvantage in retrieving information from memory when the information to be retrieved is complex and when there are few cues or other environmental support. Hence, age differences are far greater in recall than in recognition of information. It is also thought that the magnitude of age difference in memory is far greater when a task involves effortful processing than when automatic processing is involved. Hence, greater age differences have been found for explicit than implicit memory. Older persons are also thought to have greater difficulty in integrating the context of information they are trying to remember. It is also thought that working memory capacity (i.e., the information kept in immediately accessible store) becomes reduced with increasing age. On the other hand there is little evidence for age differences in long-term storage. Memory deficits occurring with age include nonverbal tasks such as memory for spatial location, memory for faces, and for actions and activities. Studies of prospective memory (i.e., remembering something to be done in the future) suggest that older people do well in remembering simple and event-based tasks, but are at a disadvantage when tasks become complex or are time-based. In sum, it appears that age differences are known to increase in magnitude as a function of the processing requirement of a given task (Salthouse 1999, Smith 1996).

### 3.2 Language

Age-related differences in language behavior are closely related to the processes of encoding and retrieving verbal materials discussed above. But in addition there appear to be greater age differences in textual tasks that involve recent connections than in those that involve recollection of older connections.

Language production also seems to be adversely affected in older persons under intense time pressure. The interesting tip-of-the-tongue phenomenon involving word-finding difficulty, however, seems to be more likely with infrequently used words. Significant age differences have also been found in language planning, that is, in planning what one intends to say and how to say it during language production. Hence, older persons are more likely to engage in hesitations, false starts, and repetitions. Age-linked deficits in story recall is thought to be more of a general deficit in connection formation than in specific communication ability. Older persons tend to benefit from textual

material that provides priming of association because it contains learned semantically linked information (McKay and Abrams 1996).

### 4. Basic Findings from the Descriptive Literature on Age Changes in Intellectual Competence

Changes in intellectual competence over the adult life span have been studied primarily with either the Wechsler Intelligence Scale or with ability batteries derived from the Thurstonian Primary Mental Ability framework.

Distinctions are made between fluid abilities thought to be innate and crystallized abilities which involve the utilization of culturally acquired knowledge (Cattell 1963). More recently further distinctions have been introduced between the mechanics (or basic processes) of intellectual competence and the pragmatics that involve cultural mediation (Baltes et al. 1984).

What has been found in most longitudinal studies is that the adult life course of mental abilities is not uniform. The so-called fluid abilities (sometimes defined as cognitive mechanics or primitives) peak in early midlife and begin to decline in the early sixties. By contrast, crystallized abilities, or the pragmatics of intellectual competence that represent abilities acquired in a given cultural context (particularly verbal abilities), do not usually peak until the fifties are reached and begin to show significant decline only in the seventies and often show only minimal decline even in the eighties (Schaie 1996a). However, recent work in advanced old age suggests increasing convergence and steeper decline for both aspects of intellectual competence, probably caused by the increasing decline of sensory and central nervous system functions (Baltes and Lindenberger 1997, Baltes and Mayer 1999).

However, at any particular time, a cross-sectional snapshot may yield very different ability profiles because of the fact that subsequent population cohorts reach different asymptotes in midlife. For example, there has been a positive linear cohort trend in the twentieth century for inductive reasoning, the basic component of most problem-solving tasks, while there has been a negative trend in numeric skills. The magnitude of cohort differences in abilities since the 1950s has been comparable to the average age changes observed from young adulthood into the seventies. Hence, many older persons may appear to have declined markedly in comparison to young peers, even though the age difference may be primarily due to what might be called the obsolescence of earlier cohorts (Schaie 1996b).

Studies of individual differences suggest that while most persons have declined on some aspect of intellectual functioning from their own peak as the sixties are reached, that specific patterns of decline

may well depend on complex patterns of individual life experience. Most healthy community-dwelling persons are able to maintain a high level of function until advanced old age (but see Baltes and Mayer 1999 for the consequences of sensory dysfunctions). Because most tasks of daily living represent complex combinations of basic cognitive processes, many individuals can maintain their abilities above the minimally necessary threshold level for independent functioning by often rather complex compensatory processes (cf. Baltes et al. 1984, Baltes et al. 1999).

### 5. Can Cognitive Aging be Slowed or Reversed?

Once the course of adult intellectual development had been described and a number of antecedents of individual differences had been identified, it then became useful for researchers to think about ways in which normal intellectual aging might be slowed or reversed.

In a number of laboratories (primarily in the USA and in Germany) cognitive training programs have been developed that have been applied in the laboratory, and more recently in cooperative multisite intervention trials. In contrast to training young children, where it can be assumed that new skills are conveyed, older adults are likely to have access to the skills being trained, but through disuse have lost their proficiency. Information from longitudinal studies is therefore particularly useful in distinguishing individuals who have declined from those who have remained stable. In the former, training is directed towards remediation of loss, while in the latter the enhancement of previous levels of functioning are sought with the intention of compensating for possibly cohort-based disadvantage of older persons.

Results from such cognitive interventions allow the conclusion that cognitive decline in old age, for many older persons, is likely to be a function of disuse rather than of the deterioration of the physiological or neural substrates of cognitive behavior. For example, a brief five-hour training program for persons over 65 resulted in average training gains of about one half SD on the abilities of spatial orientation and inductive reasoning. Of those for whom significant decrement could be documented over a 14-year period, roughly 40 percent were returned to the level at which they had functioned when first studied. The analyses of structural relationships among the ability measures prior to and after training further allow the conclusion that training does not result in qualitative changes in ability structures, and is thus highly specific to the targeted abilities. A seven-year follow up further demonstrated that those subjects who showed significant decline at initial training do remain at substantial advantage over untrained comparison groups (Willis and Schaie 1994). It should be noted, however, that while cognitive training may improve performance in the elderly and may function to reduce effects of age decrement,

such training will also be effective in enhancing the performance of young adults such that age differences tend to remain robust (cf. Baltes and Kliegl 1992).

### 6. Other Related Topics in Cognitive Aging

Much of the work on cognitive aging in the past has been concerned with age-related development in the mechanics and basic processes of cognition. It should be recognized that current attention in the study of cognitive aging is turning to the discovery of how these basic processes operate within more complex domains. Of particular interest here are the study of wisdom (e.g., Baltes and Staudinger 1993, Sternberg 1990), the application of the basic processes to social cognition (e.g., Staudinger 1999), the development of expert systems (e.g. Charness and Bosman 1990), and in everyday problem solving (Willis 1996). The extensive literature on these topics is beyond the scope of this article.

*See also:* Aging and Health in Old Age; Aging, Theories of; Aging Mind: Facets and Levels of Analysis; Brain Aging (Normal): Behavioral, Cognitive, and Personality Consequences; Differential Aging; Ecology of Aging; Lifespan Theories of Cognitive Development; Memory and Aging, Cognitive Psychology of; Memory and Aging, Neural Basis of; Old Age and Centenarians; Social Cognition and Aging; Spatial Memory Loss of Normal Aging; Animal Models and Neural Mechanisms

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## Cognitive and Interpersonal Therapy: Psychiatric Aspects

Cognitive and interpersonal therapies are each structured psychological treatments. They differ considerably in their rationale and therapeutic procedures, but both have been subject to research since their inception. In recent years, each has been demonstrated to offer effective symptomatic help for a range of specific mental disorders. This has facilitated their adoption in publicly or insurance funded health services, where major changes have been taking place in the pattern of therapeutic provision and in the training of mental health professionals. In English-speaking countries, where psychiatrists trained in psychological treatments were, even 10 years ago, more likely to offer psychoanalytic psychotherapy than any other kind, provision of cognitive or interpersonal therapy is increasingly common. Cognitive therapy is also provided frequently by clinical psy-

chologists. This article will provide a brief overview of their respective rationales, methods, and current applications. It concludes with some speculations on future developments.

### 1. Cognitive Psychotherapy

#### 1.1 Overview

All forms of cognitive therapy (CT) work from the premise that common mental disorders are consequent to and/or maintained by faulty thinking (rather than the reverse). Cognitive therapists, therefore, set out to identify cognitions associated with a target problem (such as depressed mood or hypochondriacal behavior) then use this analysis as the basis for an explicit therapeutic plan. Treatments addressing these cognitions can adopt a number of techniques, depending upon the problem addressed, the formulation of an individual case, and the specific form of cognitive psychotherapy favored by individual practitioners.

#### 1.2 Rationale

Although cognitive therapy has only gained currency since 1970, its basic aims are not new. Attempts to restore mental health by arguing sufferers out of their false beliefs underpinned much 'moral therapy' in eighteenth-century asylums. As a modern movement, CT emerged from behavior therapy (qv). This had its theoretical rationale in learning theory (qv), derived from experimental manipulation of contingent responses in laboratory animals. Behavioral treatments had sought behavioral change through functional analysis of target symptoms. Behavioral theory paid little attention to the 'black box' of the mind and any mediating role it played between environmental stimulus and behavioural response. Cognitive therapy developed in reaction to this denial of the importance of thought, but was helped by clinical evidence that thinking could actively obstruct the progress of behavioral treatment unless it was explicitly attended to. The behavioral and cognitive approaches to psychological treatment have retained many common features, including emphasis on explicit formulation, and an empirical and collaborative approach. Behavioral and cognitive techniques may be combined within a treatment, and the close relationship between the two is reflected in the designation of 'cognitive-behavior therapy' or 'CBT' for much work that remains essentially cognitive.

Cognitive therapists have used a variety of models to account for how cognitive processes contribute to psychopathology. While these can be impressive in their orderliness and ingenuity, and can be of great heuristic value in practice, they nearly always derive from clinical experience. At the same time, independent support for such models has been sought from experimental psychology. Few cognitive findings

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