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Cognitive aging: New directions for old theories

Denise Park and Meredith Minear

in *New Frontiers in Cognitive Aging*

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This chapter describes the current state of knowledge with respect to what happens to our cognitive systems with age, including theoretical, behavioural, and neurobiological perspectives, as well as new directions and questions that have resulted from an integration of the three. It then considers how the context and culture in which one ages can affect cognitive aging and assesses the universality of cognitive aging theories. This is followed by a brief discussion of how theories of aging can be used as a model for understanding the mechanisms underlying cognitive symptoms associated with medical disorders. The chapter concludes by considering the challenges for cognitive aging researchers for the future.

New Frontiers in Cognitive Aging

Roger Dixon, Lars Backman, and Lars-Goran Nilsson (eds)

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With an ever increasing population of aging people in the western world, it is more crucial than ever that we try to understand how and why cognitive competence breaks down with advancing age; why do some people follow normal patterns of cognitive change, while others follow a path of progressive decline, with neurodegenerative diseases such as Alzheimer's. What can be done to prevent cognitive decline or — to avoid neurodegenerative diseases? The answers, if they come, will not emerge from research within one discipline, but from work being done across a range of scientific and medical specialities. This book delves into the subjects of cognitive aging, neuroscience, pharmacology, health, genetics, sensory biology, and epidemiology. This book is

about new frontiers rather than past research and accomplishments. Recently cognitive aging research has taken several new directions, linking with, and benefiting from, rapid technological and theoretical advances in these neighbouring disciplines. This book provides unique interdisciplinary coverage of the topic.

Relations between Age and Cognitive Functioning

Timothy A. Salthouse

in Major Issues in Cognitive Aging

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This chapter begins with a brief discussion of the purpose of this book, which is to summarize some of the robust and replicated research findings concerned with the effects of aging on cognitive abilities, and to discuss potential causes and consequences of these effects. It presents a comparison of cognitive aging with physical aging, and discusses tests used to assess cognitive ability. The chapter then discusses the two broad themes about cognitive aging that have been apparent from the beginning of research on this topic. The first theme is that different cognitive variables have different patterns of relations with age; and the second is that there is large variation in cognitive performance across people at any given age, such that the differences associated with age correspond to only a small proportion of the total variation which exists across people.

Within-Person and Across-Time Comparisons

Timothy A. Salthouse

in Major Issues in Cognitive Aging

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One of the important questions in the field of cognitive aging is what is responsible for the different age relations found in cross-sectional and longitudinal comparisons of cognitive functioning. This chapter discusses the major factors that have been postulated to contribute to different age trends in cross-sectional and longitudinal comparisons. Two important observations are relevant to the interpretation of cognitive aging phenomena. First, similar relative age trends have been reported

from the earliest systematic studies dating from the 1920s; and second, patterns of cognitive aging in nonhuman animals closely resemble those found in humans. These findings indicate that the phenomenon of cognitive aging can be inferred to be at least somewhat generalizable across specific historical contexts and different species.

Approaches to Investigating Cognitive Aging

Timothy A. Salthouse

in Major Issues in Cognitive Aging

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This chapter considers how sources of hypotheses for the locus of age differences in cognition have often been based on models and metaphors in cognitive psychology. It considers the primary ways in which cognitive aging research has been conducted and the implications these practices have for what needs to be explained in cognitive aging.

Mediators and Moderators of Cognitive Aging

Timothy A. Salthouse

in Major Issues in Cognitive Aging

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This chapter discusses two analytical procedures — mediation and moderation — which can be informative about potential causes of age-cognition relations. Both are based on the principle that although correlation does not imply causation, in many cases causation does imply correlation. Results from mediation and moderation analyses with cross-sectional data have been informative in suggesting that some hypothesized causes — such as amount of education, health status, sensory ability, amount of physical or cognitive exercise, and level of personality or mood — do not appear plausible as major determinants of the relations between age and cognitive functioning. Some variables, such as amount of education, health status, and sensory ability have been found to influence the age—cognition relations, but they do not appear to be primary causes because substantial relations between age and measures of cognitive functioning are still evident at every level of these variables. Longitudinal research investigating moderation

or mediation of age—cognition relations has been very limited, and primarily restricted to the period of late adulthood.

Normal and Pathological Cognitive Aging in Late Adulthood

Timothy A. Salthouse

in Major Issues in Cognitive Aging

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This chapter focuses on cognitive functioning in late adulthood. It discusses three related topics: dementia, the preclinical phase of dementia, and the risk factors for cognitive decline and dementia. Dementia, and Alzheimer's disease in particular, is characterized by severe impairment in cognitive functioning. It is a particularly devastating disease because it destroys one's sense of self, and there are currently no effective treatments to prevent or even delay the disease. Research has revealed differences in cognitive performance between individuals who will and will not develop the disease several years prior to the eventual diagnosis. However, what is responsible for these relations and whether it is meaningful to refer to a distinct diagnostic category are still controversial issues.

Practical Consequences and Potential Interventions

Timothy A. Salthouse

in Major Issues in Cognitive Aging

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Assuming that the phenomena described in earlier chapters are accepted as robust and valid, two questions are often asked: (1) Why are there not greater consequences of these cognitive declines in everyday life?; and (2) What can be done to prevent, or remediate, these declines? These are the two major topics addressed in this chapter. Age-related cognitive declines seem well established, but there are a number of factors that might explain why they do not have greater consequences in everyday life. Among these are that few situations require maximum levels of functioning, many activities have minimal cognitive demands, and in most situations there is a benefit of experience which is usually positively associated with age. Furthermore, one manifestation of

increased experience may be accommodations in which activities are performed, and in how they are performed. Although there has been considerable interest in interventions that might prevent or reverse age-related cognitive decline, the currently available research findings are more intriguing than they are definitive.

Role of Dopamine Systems in Cognitive Aging

Lars Bäckman and Lars Farde

in Cognitive Neuroscience of Aging: Linking cognitive and cerebral aging

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This chapter reviews literature on the influence of age-related changes in the nigrostriatal dopamine (DA) system on age-related cognitive changes. The chapter is organized as follows: first, it provides an empirical and theoretical rationale for the cognitive relevance of DA. This is followed by an overview of the organization of DA systems in the brain. It describes the basic principles for imaging of the DA system then discusses evidence for an influence of adult age on various DA markers. The major findings in behavioral research on cognitive aging are reviewed. The sections converge into a review of research examining the correlative triad among age, DA markers, and cognitive performance. The findings from this research are then positioned in relation to other theory and data in the cognitive neuroscience of aging. The chapter concludes by suggesting avenues for future empirical research on DA functions and cognitive aging.

The Cognitive Neuroscience of Working Memory and Aging

Patricia A. Reuter-Lorenz and Ching-Yune C. Sylvester

in Cognitive Neuroscience of Aging: Linking cognitive and cerebral aging

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This chapter reviews current knowledge about the effects of normal aging on working memory and its neural underpinnings. It begins with a general overview of working memory, how it is measured by different tasks, and a controversy regarding theoretical claims about the organization of working memory. It then reviews behavioral evidence indicating how working memory changes because of normal aging.

Following an overview of the working memory circuitry in younger adults, the chapter takes an in-depth look at neuroimaging studies of aging and working memory published to date, and examines how this literature can clarify each of the three issues emerging from the behavioral studies. It concludes by describing what the infusion of neuroimaging has taught us about aging working memory, revisiting the controversy about the organization of working memory, and identifying directions for future research.

Part 2 New theoretical orientations in cognitive aging 2 Cognitive aging: New directions for old theories 19. Denise Park and Meredith Minear 3 Does longitudinal evidence confirm theories of cognitive aging derived from cross-sectional data? 41 Christopher Hertzog 4 Intraindividual variability in performance as a theoretical window onto cognitive aging 65 David F. Hultsch and Stuart W.S. MacDonald 5 Commentary: Measures, constructs, models, and inferences about aging 89 Leah L. Light. Part 3 New directions in the cognitive neuroscience of aging 6 The aging brain: Structural changes and their implications 19. There is currently little consensus regarding what must be explained by theories of cognitive aging. In the present article, four empirical generalizations are presented. New York: Academic Press. Google Scholar. Charness, N., & Campbell, J. I. D. (1988). The information loss model: A mathematical theory of age-related cognitive slowing. *Psychological Review*, 97, 475-487. Article PubMed Google Scholar. Featured Article Behavioral/Systems/Cognitive. Cognitive Aging and the Hippocampus: How Old Rats Represent New Environments. Iain A. Wilson, Sami Ikonen, Irina Gureviciene, Robert W. McMahan, Michela Gallagher, Howard Eichenbaum and Heikki Tanila. For counterbalancing, the direction of rotation alternated each session, either 90° clockwise or counterclockwise. Spatial firing pattern analysis. Previous studies have reported that aging results in weakened control of external cues over hippocampal spatial representations. However, different experiments have described different manifestations of this weakened control (Barnes et al., 1997 ; Tanila et al., 1997b ; Oler and Markus, 2000 ; Rosenzweig et al., 2003 ; Wilson et al., 2003). Panel on New Directions in Social Demography, Social Epidemiology, and the Sociology of Aging; Committee on Population; Division on Behavioral and Social Sciences and Education; National Research Council. Visit the National Academies Press online and register for instant access to free PDF downloads of titles from the. This chapter proposes that institutional theory constitutes an important prism through which to advance understanding of the range and impacts of patterned social arrangements channeling age and aging processes, although its use is underdeveloped in the study of aging.