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Exploring the Generality of Retest Effects: Commentary on "When Does Age-Related Cognitive

Decline Begin?"

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Abstract

With respect to age differences in cognitive functioning, longitudinal and cross-sectional analyses have typically revealed differential patterns of results. Longitudinal comparisons show little or no age-related declines, whereas cross-sectional comparisons typically demonstrate poorer performance with increasing age. Salthouse presents evidence suggesting that longitudinal comparisons fail to detect age declines because the effects of prior test experience are not taken into account and that age-related declines in cognition begin in early adulthood. The present paper discusses some implications of these findings, such as their generalizability to other cognitive tasks, and highlights some additional findings in his paper that are worthy of discussion.

Keywords: cognitive aging; retest effects; old-old adults; longitudinal vs. cross-sectional

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The idea of delaying or preventing age-related cognitive decline has become an area of increasing interest in recent years. Numerous releases have appeared in the media (e.g., Hamilton, 2007), showcasing the possibility of cognitive improvement for people of all ages via training programs. For example, recent research (e.g., Zelinski, Yaffe, Ruff, Kennison, & Smith, 2007) trained adults 65 and older using the Posit Science's Brain Fitness Program, which consists of six auditory exercises focusing on auditory processing and memory. After 40 hours of training, older adults showed better performance on generalized memory and speed of processing measures, relative to people who received educational training. Video game systems like the Nintendo DS or Wii have taken a similar yet non-empirical approach through games like Brain Age and Brain Age 2, promising to lower one's brain "age", where lower numbers indicate more optimal cognitive functioning. These programs promote brain training through various cognitive exercises thought to increase blood flow to the brain, especially the prefrontal cortex (e.g., Brain Age). Along with many others, I (reluctantly) admit to buying these games in the hopes of improving my brain's efficiency and preventing further cognitive declines. Thus, the issue raised by Salthouse regarding the age at which cognitive decline begins is very timely and relevant to people of all ages.

Previous research has left this issue unresolved because of differential findings for cross-sectional and longitudinal comparisons. Whereas longitudinal comparisons often reveal cognitive declines occurring later in adulthood, cross-sectional comparisons suggest that declines may begin earlier (e.g., Lövdén, Ghisletta, & Lindenberger, 2004; Schaie, 2005). In his paper, Salthouse proposed that longitudinal comparisons may be less sensitive in detecting the onset of

age-related declines in cognitive functioning because the effects of prior test experience are not taken into account. A similar claim about the need to control for retest effects in longitudinal studies has been made by Rönnlund, Lövdén, and Nilsson (2008) using the Tower of Hanoi task of problem solving (see also Rönnlund & Nilsson, 2006, who used the WAIS-R Block Design Test). Salthouse compared four cognitive abilities (inductive reasoning, spatial visualization, episodic memory, and perceptual speed), each assessed through three tests, and first demonstrated negative cross-sectional differences for all measures, with some declines already emerging by the mid 20s, e.g., reasoning. It is worth noting that early age-related declines can occur in other domains besides those tested, such as language production. Compared to college students, older adults consistently show an increase in tip-of-the-tongue (TOT) states, a word retrieval failure that reflects the temporary inability to retrieve a known word (e.g., Burke, MacKay, Worthley, & Wade, 1991; Evrard, 2002; James & Burke, 2000; Maylor, 1990). However, even adults in their 30s and 40s show an increase in the frequency of naturally-occurring TOT states compared to adults in their 20s (Burke et al., 1991).

Despite the generality of these early age-related declines in cognition, Figure 2 in the paper suggests some interesting differences that are worthy of discussion. First, it seems that there may be differences between the four cognitive abilities tested in the extent of decline. The age declines observed in the cross-sectional comparisons seem to be smallest for the episodic memory measures, which is somewhat surprising given that memory is one of the most notorious cognitive abilities to change with age. Second, within a particular ability, the three tests do not show equivalent patterns of decline. For example, within reasoning, age-related declines from age 20 to 30 are much more pronounced for the matrix reasoning test than the letter sets test. Similar discrepancies occur for spatial reasoning, where declines are greater for the form boards

test relative to the spatial relations test. Third, the patterns of decline vary across different age intervals. For example, whereas the slope of the declines in memory and speed seem to be relatively constant starting at age 30, reasoning and spatial visualization performance seem relatively stable between the ages of 35 and 45. A greater understanding of the cause of these differences and whether there is a neurobiological basis for them deserve exploration.

A related issue of interest pertains to the magnitude of age-related decline that progresses throughout old age, resulting in greater declines for adults aged 61 to 95 compared to adults under age 60 in Salthouse's study. This finding is consistent with research within the older adult group, where adults in their 70s and 80s show greater declines than adults in their 60s in a variety of cognitive tasks, including implicit memory (e.g., Davis et al., 1990; Hultsch, Masson, & Small, 1991; Jelicic, Craik, & Moscovitch, 1996; Maylor, 1998), written spelling (e.g., MacKay & Abrams, 1998; Stuart-Hamilton & Rabbitt, 1997), word naming (e.g., Au et al., 1995), TOT states (e.g., Abrams, Trunk, & Merrill, 2007; Heine et al., 1999; White & Abrams, 2002), and even vocabulary (e.g., Lindenberger & Baltes, 1997). Thus, even though some age-related declines begin in early adulthood, the rate of decline increases as we age. Given the broad nature of these age-related declines, Salthouse's findings emphasize the importance of determining the cause of these changes in advanced old age. One possibility is that these accelerated declines may be confounded by these age groups having a higher incidence of people in the preclinical stages of dementia, which are characterized by impairments in memory and abstract reasoning (e.g., Jacobs, Sano, Dooneief, & Marder, 1995), cognitive abilities that were tested in Salthouse's paper.

One of the most interesting aspects of Salthouse's research is the use of three methods for estimating retest efforts and generally finding positive retest effects across all of the methods.

However, his focus on general patterns regarding retest effects, such as positive short-term retest effects being greater than 1-year longitudinal changes, obscures some interesting findings, namely that five out of the 12 tests did *not* exhibit this pattern. Similarly, the length of the retest interval influenced the magnitude of longitudinal change on only four of the tests. An equally interesting question is why so many tests did not show a reduction in benefits of prior test experience or significant interval effects. If longitudinal comparisons are underestimating age-related changes because of retest effects, then longitudinal comparisons should be more accurate for variables where retest effects decay more quickly or where the length of the retest interval is less influential. In any case, the retest effect findings suggest some broad implications that researchers should consider more closely. One is the impact of inadvertent retesting that can occur for researchers using an established set of older adult volunteers, who participate in various studies. Researchers should be cautious about interpreting older adults' performance on cognitive tests that are given repeatedly. A second implication is at an individual level, i.e., whether the degree of positive effects from retesting at an early age (and the rate at which those benefits decay) has any relationship to the rate of decline in old age. In any case, Salthouse's use of retest effects to synthesize findings from neurobiological, behavioral, and animal studies is a novel approach upon which future research should expand.

Statement of Disclosure

There are no actual or potential conflicts of interest to report.

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