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Experimental Aging Research

An International Journal Devoted to the Scientific Study of the Aging Process

ISSN: 0361-073X (Print) 1096-4657 (Online) Journal homepage: http://www.tandfonline.com/loi/uear20

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To cite this article: Alan Hartley, Lucie Angel, Alan Castel, André Didierjean, Lisa Geraci, Joellen Hartley, Eliot Hazeltine, Patrick Lemaire, François Maquestiaux, Eric Ruthruff, Laurence Taconnat, Catherine Thevenot & Dayna Touron (2018) Successful aging: The role of cognitive gerontology, Experimental Aging Research, 44:1, 82-93, DOI: 10.1080/0361073X.2017.1398849

To link to this article: https://doi.org/10.1080/0361073X.2017.1398849

EXPERIMENTAL AGING RESEARCH
2018, VOL. 44, NO. 1, 82–93
https://doi.org/10.1080/0361073X.2017.1398849

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Successful aging: The role of cognitive gerontology

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ABSTRACT

This commentary explores the relationships between the construct of successful aging and the experimental psychology of human aging—cognitive gerontology. What can or should cognitive gerontology contribute to understanding, defining, and assessing successful aging? Standards for successful aging reflect value judgments that are culturally and historically situated. Fundamentally, they address social policy; they are prescriptive. If individuals or groups are deemed to be aging successfully, then their characteristics or situations can be emulated. If an individual or a group is deemed to be aging unsuccessfully, then intervention should be considered. Although science is never culture-free or ahistorical, cognitive gerontology is primarily descriptive of age-related change. It is not prescriptive. It is argue that cognitive gerontology has little to contribute to setting standards for successful aging. If, however, better cognitive function is taken as a marker of more successful aging—something not universally accepted—then cognitive gerontology can play an important assessment role. It has a great deal to contribute in determining whether an individual or a group evidences better cognitive function than another. More importantly, cognitive gerontology can provide tools to evaluate the effects of interventions. It can provide targeted measures of perception, attention, memory, executive function, and other facets of cognition that are more sensitive to change than most clinical measures. From a deep understanding of factors affecting cognitive function, cognitive gerontology can also suggest possible interventions. A brief narrative review of interventions that have and have not led to improved cognitive function in older adults. Finally, the enormous range is addressed in the estimates of the proportion of the population that meets a standard for aging successfully, from less than 10% to more than 90%. For research purposes, it would be better to replace absolute cutoffs with correlational approaches (e.g., Freund & Baltes, 1998, *Psychology and Aging, 13*, 531–543). For policy purposes, cutoffs are necessary, but we propose that assessments of successful aging be

ARTICLE HISTORY
Received 20 September 2017
Accepted 22 September 2017

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based not on absolute cutoffs but on population proportions. An example of one possible standard is this: Those more than 1 standard deviation above the mean are aging *successfully*; those more than 1 standard deviation below the mean are aging *unsuccessfully*; those in between are aging *usually*. Adoption of such a standard may reduce the wide discrepancies in the incidence of successful aging reported in the literature.

In many ways, the central philosophical and theoretical concern in the field of gerontology is successful aging—what is it and are we achieving it? As evidence, the February 2015 issue of the journal *The Gerontologist* was devoted to the theme of successful aging, reflecting the importance of this concept to the field of gerontology (Pruchno, 2015). The 15 articles explored the contentious but productive debate that developed in reaction to the 1987 article by Rowe and Kahn that distinguished *successful aging* from *usual aging*. This exploration exposed the various, often inconsistent, ways in which successful aging has been conceptualized and measured. As Pruchno noted, this entailed questioning whether it should be defined objectively or subjectively, examining the role of society and culture versus the individual, and arguing whether successful aging is a process or an outcome. Left largely unexplored was the role that the scientific study of human aging can or should play. The question addressed here is what the contributions of the experimental psychology of human aging are or could be—which we will call cognitive gerontology for reasons to be explained—to understanding and assessing successful aging.

Successful aging

As Peterson and Martin (2015) note, Havighurst (1961) focused attention on the concept of successful aging in the first edition of the first volume of *The Gerontologist*, suggesting that it is defined by "conditions of individual and social life under which the individual person gets a maximum of satisfaction and happiness" (p. 8). Rowe and Kahn (1987) emphasized the heterogeneity of the aging population and proposed that, within the range of normal aging, a conceptual distinction should be made between those who are aging *successfully* with minimal physiologic loss relative to younger adults and the remaining individuals who are aging *usually*. Describing what they called the MacArthur model of successful aging, Rowe and Kahn (1997) later elaborated that successful aging encompasses the avoidance of disease and disability, the maintenance of high physical and cognitive function, and sustained engagement in social and productive activities.

The hundreds of citations of the articles by Rowe and Kahn testify to the ferment they created. The 2015 special issue of *The Gerontologist* was an attempt to pull together the issues, criticisms, and developments of the intervening decades. The themes of the articles in the special issue were captured in the systematic review of the field by Martinson and Berridge (2015). These included (a) that the criteria for successful aging should be expanded and loosened; (b) that the subjective experience of older people be included (something Havighurst, 1961, had argued from the start); (c) that it was too focused on the individual, failed to take into account political and social constraints on the individual,

encouraged ageism, and reflected neoliberal values; and (d) that the field was exclusionary and failed to incorporate approaches that emphasized aging with dignity and embracing loss (Pruchno, 2015).

The conceptualizations of successful aging of Rowe and Kahn and the reactions to them are often characterized as models. They are not models in the usual scientific sense of the term. Rather they are external criteria—value judgments—imposed on the phenomena of human aging. Successful aging is a historically and culturally situated judgment that reflects the values of a particular culture at a particular point in history. We believe much of the apparent confusion comes from failing to acknowledge this or, more often, acknowledging it but then failing to accept its implications. At the broad, conceptual level, these value judgments provide criteria for choosing the phenomena on which we should focus, for example, disease, disability, physical function, cognitive function, or social engagement (Rowe & Kahn, 1997). Fundamentally, the judgments are policy-oriented and prescriptive. Much of the reaction to Rowe and Kahn has concerned whether additional dimensions of aging merit central attention. At the narrow, operational level, the value judgments about successful aging drive decisions about what measures should be used for each dimension and how a cutoff should be selected that dichotomizes individuals into successful and not successful. Effectively, then, successful aging is defined as meeting a specified level of performance or status on one or more specified dimensions. A recent review found 84 unique and different operational definitions of successful aging (Cosco, Prina, Perales, Stephan, & Brayne, 2013). Under those definitions, the percentage of the participants who were aging successfully ranged from less than 1 to more than 90. Given that the choices of dimensions, measures, and cutoffs are all value judgments reflecting policy goals, some range is to be expected. What may be surprising is the extent of the range in definitions from essentially the same culture at essentially the same historical time. Some would argue that the range underscores the need for more rigorous operationalizations of the construct. In our view, equally rigorous operationalizations of the construct could lead to quite different classifications if the underlying values differ.

What is the purpose of a construct of successful aging? A definition of—or more correctly, a criterion for—successful aging serves a critical role. Presuming that successful aging is something to be aspired to and unsuccessful aging, something to be avoided, it provides a criterion for deciding whether intervention is called for. Moreover, if we identify a group of individuals as aging successfully (or unsuccessfully), we can explore the features they share (for example presence of a gene or a common nutritional history). Those shared features can suggest interventions and how they might be targeted. If we do intervene, the criterion allows us to judge whether the intervention increased successful aging or decreased unsuccessful aging. This is what Pruchno (2015) meant when she concluded that "with an enhanced understanding of what successful aging is, we will be in a stronger position to develop interventions that enable more people to age successfully" (p. 3). A more precise conclusion is that with an enhanced consensus about what successful aging is, we will be better able to implement policy to achieve it.

The experimental psychology of human aging: Cognitive gerontology

The central question we wish to address is this: What is or could be or should be the contribution of the experimental psychology of human aging to successful aging? The

term "cognitive aging" is often used to characterize the phenomena under study, and here we use the term *cognitive gerontology* to refer to the scientific study of those phenomena. For cognitive gerontology to have a role, the prerequisite is that successful cognitive functioning should be a central component of a general definition of successful aging. Better cognitive function might be a component per se, or it might be an antecedent of other components of successful aging. An example of the latter is seen in Cahn-Weiner, Malloy, Boyle, Marran, and Salloway (2000), who adopted a composite of scores on executive function tests as a measure of cognitive function and the Instrumental Activities of Daily Living (IADL) as a measure of quality of experience. The IADL examines everyday functioning in four areas, including Safety, Medication Administration, Meal Planning and Preparation, and Money Management. They found that executive function accounted for 19% of the variance in IADL over and above that accounted for by medical risk factors, depression, age, and education. We note that Depp and Jeste (2006) found that 13 of 29 operational definitions of successful aging included cognitive function. Conversely, this makes it clear that many proposed standards for successful aging do not include better cognitive function. Arguing that cognitive function should be included in a definition of successful aging in no way diminishes the importance of other components such as disability and physical function.

The experimental psychology of human aging is a very young field. In the very first volume of the *Journal of Gerontology*, arguing for a science of gerontology, Hinman (1946) said,

> The pathologic conditions, or the diseases of old age, are covered by geriatrics, a branch of medicine. But the aging process of healthy people is a much more important problem, demanding study of the social aspects, industrial adjustments, and educational needs of normal older people. There has been practically no scientific research in gerontology. Now the time has come for an intensive study of the biologic processes of aging and the interrelation of these processes with changing social conditions. (p. 416)

What is missing here is any mention of psychology. And, indeed, the first volume of the *Journal of Gerontology* (1946) did not contain a single article concerning the psychology of aging (out of 36 total). But by 1986, a separate section of the journal had been created for Psychological Sciences (along with Medical Sciences, Biological Sciences, and Social Sciences) and 67% of the 49 articles in that section concerned experimental psychology.

This expansion occurred at much the same time as the field of cognitive psychology emerged as the dominant school of experimental psychology. The publication of Ulric Neisser's enormously influential book, *Cognitive Psychology* (1967), is often given as the birth date of the field. The term "cognitive" was not intended to be limiting—the field comprises perception, attention, memory, and higher functions—but rather to make a sharp distinction from the earlier behaviorist focus that viewed much of cognition as epiphenomenal. Since then, the choice of topics in the experimental psychology of human aging has been strongly influenced by the zeitgeist of mainstream cognitive psychology. So research in cognitive gerontology has been primarily concerned with characterizing loss with age—or occasionally stability or even growth—in terms of phenomena borrowed from cognitive psychology.

What does cognitive gerontology have to say about successful aging?

What does or could cognitive gerontology say about successful aging? To foreshadow our conclusion, the answer is relatively little. We will argue that cognitive gerontology has important contributions to make, but they are not in providing a definition of successful aging.

When cognitive gerontologists are asked about successful aging, five themes recur. The first is that longitudinal studies show that the extent of *cognitive decline is overestimated* and the age of onset of decline underestimated by cross-sectional studies (e.g., Lindenberger, 2014; Schaie, 2013). The second is that *some abilities are spared*. For example, verbal abilities such as vocabulary are preserved (e.g., Schaie, 2013), as is expertise gained earlier (e.g., Charness & Krampe, 2008). The third is that in some instances, there is *compensation* for age-related changes, for example, use of two brain hemispheres by older adults for tasks localized to one hemisphere in younger adults (e.g., Reuter-Lorenz & Stanczak, 2000). The fourth is that there are *preserving characteristics* such as a reliance on memory to provide effective strategies in some older adults whereas others avoid relying on memory (Touron, 2015). The fifth is *cognitive reserve*, the idea that "individual differences in the cognitive processes or neural networks underlying task performance allow some people to cope better than others" with loss (Stern, 2009, p. 2016). We do note that there is dissent on each of these assertions. The first two themes say that functioning is higher, and therefore loss is less, than is widely believed. This is important to the public understanding of aging, but it has little to say about successful aging. The last three themes say that some individuals show higher functioning, and therefore less loss, than the typical peer. This assumes that relatively higher function reflects relatively more successful aging. This is important for assessing the effectiveness of intervention but is not particularly helpful in defining successful aging.

To oversimplify the matter, successful aging is a pure value judgment—it is prescriptive—whereas cognitive gerontology is a relatively value-free body of knowledge and set of procedures for acquiring that knowledge—it is descriptive. Science is never value free, as Kuhn's *The Structure of Scientific Revolutions* (1962) made clear. Nevertheless, the principal value judgments in cognitive gerontology have come from the zeitgeist of mainstream cognitive psychology and mostly have to do with the way cognitive function is parsed or fractionated. In the 1960s and 1970s, concepts such as fluid versus crystallized intelligence (e.g., Horn & Cattell, 1967) sprang from the contemporary focus on intelligence testing. In the 1980s and 1990s, concepts such as age-related declines in fundamental operations such as speed of processing (e.g., Salthouse, 1996), working memory (e.g., Salthouse, 1994), and inhibitory function (e.g., Hasher & Zacks, 1988) derived from the focus in mainstream cognitive psychology on humans as information processors. Now, notions such as impaired dopaminergic function (Bäckman, Nyberg, Lindenberger, Li, & Farde, 2006) and the scaffold theory of aging and cognition (STAC; Reuter-Lorenz & Park, 2014) reflect the recent neuroscience revolution in cognitive psychology. Value judgments about research directions provide little or no guidance for value judgments about successful aging.

Intervention research in cognitive gerontology

The often implicit assertion that any meaningful improvement in cognitive function means more successful aging is minimal, but it has led to the most important contribution of cognitive gerontology: intervention research. Interventions that might lead to improved

cognitive function have been extensively explored by cognitive gerontologists. In practice, the goal has primarily been to bring about improvement with a program of training that is relatively short, relatively focused, and relatively low in the cost of resources. The interventions fall into four categories. Some interventions simply ask, "Can the performance of older adults at this task be improved?" Or, in other words, can older adults *learn*? Others explore the possibility of transfer, either *near transfer* to other tasks in the same domain (such as training on one speeded task benefitting other, different speeded tasks) or *far transfer* to tasks in different domains (such as training in speed benefitting performance on memory tasks). Finally, there are interventions that explore benefits to cognitive function from training such as physical exercise that does not involve cognitive tasks. This might be called *very far transfer*. Although we will not provide an extensive review, we will give examples in each of these categories.

Older adults can learn; they improve with practice on even demanding tasks. For example, older adults showed a significant improvement in the ability to multitask—to carry out two separate tasks simultaneously or nearly simultaneously—after thousands of trials of practice (Bherer et al., 2005; Maquestiaux, Hartley, & Bertsch, 2004), although they did not achieve the levels of performance of younger adults. Charness and Campbell (1988) showed that six sessions of training led to significant improvement in older adults in the time to square numbers between 1 and 99, narrowing the age differences. There is also good evidence for near transfer, that is, transfer from training in one task in a domain, such as memory, to other tasks in the same domain. For example, in a systematic review and meta-analysis of 35 studies of training in memory strategies in older adults, Gross et al. (2012) found the overall improvement in memory performance across studies was significant (0.43 standard deviation). In a randomized, controlled study of 2832 older adults, Ball et al. (2002) found that training in speed of processing, memory, or reasoning led to significant improvements in the targeted ability.

Far transfer—transfer from training in one domain such as memory to another domain such as reasoning—has been much more difficult to demonstrate. For example, Ball et al. found no evidence for improvements other than in the domain trained. From a meta-analysis not specific to older adults Au et al. (2015) concluded that training on working memory tasks generally improved measured fluid intelligence, yet Borella et al. (2014) found little or no evidence in young-old or old-old adults that working memory training had an effect beyond working memory measures. Perhaps surprisingly, there is good evidence for very far transfer, improvement in cognitive function as a result of noncognitive training. For example Park et al. (2014) trained older adults in quilting or in digital photography or both and found significant improvement in episodic memory (although not in processing speed, mental control, or visuospatial processing). The most striking finding is that even relatively short interventions involving aerobic exercise lead to significant general improvements in cognition. In a meta-analysis of 29 studies with exercise interventions 1 month or longer, Smith et al. (2010) found significant improvements in attention and processing speed, episodic memory, and executive function (but not working memory).

We have limited ourselves here to improvements with training in cognitive function, making the tacit assumption that cognitive improvement, per se, represents more successful aging. We have not addressed whether improvements in cognitive function transfer in turn to improvements in everyday functioning and perceived well-being, dimensions that

are often central to conceptions of successful aging (but see, e.g., Cahn-Weiner et al., 2000; Willis et al., 2006; Wolinsky et al., 2006). We also want to mention that Simons et al. (2016) have provided detailed and well-justified guidelines for how intervention research should be carried out.

It is clear from these examples that cognitive gerontology can play two roles: (a) it can suggest and form the basis for some interventions and (b) it can provide the measures to determine whether interventions were successful. In the case of learning and of near and far transfer, it provided both the basis and assessment, successful with learning and near transfer, unsuccessful with far transfer. In the case of very far transfer, it provided the assessment tools but not the intervention. The success of exercise interventions at improving cognitive function in a number of domains raises the important question of the appropriate level at which to intervene. Even though the goal is to improve cognitive function, interventions that target underlying substrates—such as physiology or pharmacology—may be more broadly effective than interventions at an explicitly cognitive level.

A clear contribution that cognitive gerontology can make is to provide targeted measures for assessments of change. Of the 13 definitions of successful cognitive aging mentioned earlier (Depp & Jeste, 2006), 8 used a criterion involving a clinical assessment tool such as the Mini-Mental Status Examination (MMSE; Folstein, Folstein, & McHugh, 1975) or the Short Portable Mental Status Questionnaire (SPMSQ; Pfeiffer, 1975). Three others used self-assessment of memory; only one used cognitive measures: in that case, of executive function.

A reasonable question, then, is why tasks drawn from cognitive gerontology would be preferable to tools such as the MMSE or SPMSQ. One answer is that the cognitive tasks are targeted. Cognitive function is multifaceted—speed, attention, visuospatial functioning, working memory, episodic memory, semantic memory, prospective memory, reasoning, and executive functions—and tests can be chosen to tap particular dimensions of functioning. Best practices from confirmatory factor analysis are now frequently adopted. These call for the use of three or more measures of a dimension and extracting a latent factor to reduce the effects of measure-specific variance. In the intervention studies reviewed, improvement was found in some dimensions but not others. The clinical tools provide an assessment of the general level of functioning but do not isolate particular abilities. A second answer is that cognitive tasks can be sensitive to relatively small differences or changes in normal individuals whereas clinical tools are designed to detect exceptional functioning and most individuals score at ceiling. Substantial change could occur as a result of an intervention, yet it would be below the resolution of the clinical tools.

A possibility for choice of measures is a hierarchy, based on the goals. One goal for assessing cognitive function might simply be answering the question: Is the individual showing signs of dementia (with no goal of making more than broad distinctions)? Here the clinical measures would be perfectly appropriate. A second goal might be to assess general cognitive function but to make finer distinctions. From the norms by Crum, Anthony, Bassett, and Folstein (1993) for the MMSE, for adults aged 60–70, the 25th percentile is a score of about 25, the 50th, 27, and the 75th, 29. That does not allow fine distinctions, and modest gains as a result of interventions could be swamped by noise. A third goal would be to distinguish among different cognitive functions in

level of observed function. For both the second and third goals, a battery of more specific tests is called for.

We see assessment of interventions as the central role of cognitive gerontology in addressing successful aging. There are many issues surrounding intervention that are important, but we are not able to address here. We mention two. In the same way that conceptions of successful aging are culturally and historically situated, so are conceptions of intervention. The way we have discussed intervention reflects a Western, positivist, secular set of values that focuses more on the worth and experience of the individual than it does on societal-level concerns. Consider a society that adopts a fatalistic philosophy ("It is God's will.") or a society that practices ritual senicide such as *ubasute*, in which elderly individuals were allegedly taken to a remote place and left to die in ancient Japan. It would appear that these customs are inconsistent with intervention. In the first society, however, it would not be uncommon to pray for the individual (either for relief or forbearance). That is, in fact, an intervention, although of a very different sort than we envision. Similarly, senicide is an intervention, although hardly one that benefits the individual. A second important point that we do not address here is who makes the decision that intervention is warranted. Is it the individual, who may fail to see change where it has occurred or who may see change where none has occurred objectively? Is it the observer, whose perceptions may also be fallible?

Operational standards from cognitive gerontology for successful cognitive aging

Any attempt to set an absolute standard or cutoff beyond which an individual is judged to be aging successfully (rather than relatively more or less successfully) is arbitrary and reflects sociocultural values rather than the science. For research purposes, correlational approaches are preferable to arbitrary cutoffs (e.g., Freund & Baltes, 1998). For purposes of social policy, cutoffs seem to be unavoidable. There may be a way around this dilemma. Consider standards for who is successfully aging in the domain of cognitive functioning. Depp and Jeste (2006) found standards ranging from "no cognitive impairment" using the MMSE (where impairment was otherwise undefined; Andrews, Clark, & Luszcz, 2002), to MMSE scores of 18 or higher (Von Faber et al., 2001), to MMSE scores at or above the 80th percentile from a sample of 5875 older adults (Newman, Arnold, & Naydeck et al., 2003). In our view, the last of these provides an opening to how we might set appropriate standards for successful cognitive aging and avoid unacceptably large differences in the numbers judged to be successful from one study to another. We do so by setting the standard at a particular proportion. In the case of Newman et al. (2003), it was a proportion of a very large sample, but using population norms such as those provided by Crum et al. (1993) would be even better. The choice of a particular proportion is still an arbitrary value judgment, but it is an open and public choice and makes clear that successful aging is always relative. One example of an accessible and useful standard would be this: More than 1 standard deviation above average (i.e., 16%) is labeled "successful"; beyond 1 standard deviation below (again, 16%) is "unsuccessful"; and between plus and minus 1 standard deviation (68%) is "usual." With such a standard, any complaint that the proportion of older adults labeled successful is too large or too small would be moot. This standard may seem inadequate for certain political or policy considerations, but it would allow a consensus on how successful and unsuccessful aging

should be operationally defined for the purposes of exploring sequelae that may lead to productive interventions.

This approach would require population norms for the measures used. Many cognitive tests have been normed for clinical use in the domains of executive functioning (e.g., Wisconsin Card Sorting Test, Verbal Fluency), attention (e.g., Continuous Performance Test, Symbol Digit Modalities Test), memory (e.g., California Verbal Learning Test, Rey Auditory Verbal Learning Test), and visuomotor skills (e.g., Embedded Figures Test, Trail Making Test). One problem is that the clinical measures derive from experimental measures with some lag, so they may be less reflective of current thinking in mainstream cognitive psychology. One example is the California Verbal Learning Test (Delis, Kramer, Kaplan, & Ober, 1987), which reflects conceptualizations and procedures that were common in the 1970s and 1980s but that are less current now. The lag is also a consequence of the fact that standardizing and norming is so demanding that there is real inertia to develop new measures. A second problem is that there may be secular shifts in population norms (e.g., Ben-David, Erel, Goy, & Schneider, 2015). Neither trends in cognitive psychology nor population values will shift abruptly, so neither of these is likely to be a constant concern, but it does make sense to periodically reevaluate the measures and norms.

Conclusion

Cognitive gerontology has played and will continue to play a vital role in describing the aging process. In our view, it can and should play only a secondary role in framing a sociocultural definition for successful aging. When standards for successful aging are articulated and those standards involve cognitive function, cognitive gerontology can assess the extent to which those standards are met. Most importantly, when interventions to achieve more successful aging are pursued, cognitive gerontology can provide tools to assess the effectiveness of those interventions.

Postscript

This essay was the result of an international conference in which European and United States researchers were invited to present current work related to successful aging. The research presented was important and timely, but the presentations in fact devoted limited attention to successful aging. In discussion, we specifically explored the relation of the experimental psychology of cognitive aging to the construct of successful aging. The outcome was less than satisfying, resulting only in the five themes mentioned above. Subsequently, we came to the realization that the outcome was the result of a fundamental disconnect between the sociopolitical value judgments of successful aging and the realities of scientific research on aging as it is actually practiced. This essay is a preliminary attempt to recognize and to bridge that disconnect.

Acknowledgments and Funding

This article was the result of an international conference on Cognitive Psychology and the Challenges of Successful Aging, organized by A.H., A.D., and F.M. and sponsored and supported

by the Albert and Elaine Borchard Foundation, held June 14 to 17, 2015, at the Domaine de la Bretesche, Missillac, France.

References

Andrews, G., Clark, M., & Luszcz, M. (2002). Successful aging in the Australian longitudinal study of aging: Applying the MacArthur model cross-nationally. *Journal of Social Issues*, *58*, 749–765. doi: 10.1111/1540-4560.00288

Au, J., Sheehan, E., Tsai, N., Duncan, G. J., Buschkuehl, M., & Jaeggi, S. M. (2015). Improving fluid intelligence with training on working memory: A meta-analysis. *Psychonomic Bulletin & Review*, *22*, 366–377. doi: 10.3758/s13423-014-0699-x

Bäckman, L., Nyberg, L., Lindenberger, U., Li, S., & Farde, L. (2006). The correlative triad among aging, dopamine, and cognition: Current status and future prospects. *Neuroscience and Biobehavioral Reviews*, *30*, 791–807. doi: 10.1016/j.neubiorev.2006.06.005

Ball, K., Berch, D. B., Helmers, K. F., Jobe, J. B., Leveck, M. D., Marsiske, M., … Willis, S. L. (2002). Effects of cognitive training interventions with older adults: A randomized controlled trial. *JAMA: Journal of the American Medical Association*, *288*, 2271–2281. doi: 10.1001/jama.288.18.2271

Ben-David, B. M., Erel, H., Goy, H., & Schneider, B. A. (2015). 'Older is always better': Age-related differences in vocabulary scores across 16 years. *Psychology and Aging*, *30*(4), 856–862. doi: 10.1037/pag0000051

Bherer, L., Kramer, A. F., Peterson, M. S., Colcombe, S., Erickson, K., & Becic, E. (2005). Training effects on dual-task performance: Are there age-related differences in plasticity of attentional control? *Psychology and Aging*, *20*, 695–709. doi: 10.1037/0882-7974.20.4.695

Borella, E., Carretti, B., Cantarella, A., Riboldi, F., Zavagnin, M., & De Beni, R. (2014). Benefits of training visuospatial working memory in young–Old and old–Old. *Developmental Psychology*, *50*, 714–727. doi: 10.1037/a0034293

Cahn-Weiner, D. A., Malloy, P. F., Boyle, P. A., Marran, M., & Salloway, S. (2000). Prediction of functional status from neuropsychological tests in community-dwelling elderly individuals. *The Clinical Neuropsychologist*, *14*, 187–195. doi: 10.1076/1385-4046(200005)14:2;1-Z;FT187

Charness, N., & Campbell, J. D. (1988). Acquiring skill at mental calculation in adulthood: A task decomposition. *Journal Of Experimental Psychology: General*, *11*(2), 115–129). doi: 10.1037/0096-3445.117.2.115

Charness, N., & Krampe, R. T. (2008). Expertise and knowledge. In S. M. Hofer, D. F. Alwin, S. M. Hofer, & D. F. Alwin (Eds.), *Handbook of cognitive aging: Interdisciplinary perspectives* (pp. 244–258). Thousand Oaks, CA: Sage Publications. doi: 10.4135/9781412976589.n15

Cosco, T. D., Prina, A. M., Perales, J., Stephan, B. C. M., & Brayne, C. (2013). Operational definitions of successful aging: A systematic review. *International Journal of Psychogeriatrics*, *26*, 373–381. doi: 10.1017/S1041610213002287

Crum, R. M., Anthony, J. C., Bassett, S. S., & Folstein, M. F. (1993). Population-based norms for the mini-mental state examination by age and educational level. *JAMA: Journal of the American Medical Association*, *269*, 2386–2391. doi: 10.1001/jama.269.18.2386

Delis, D. C., Kramer, J. H., Kaplan, E., & Ober, B. A. (1987). *CVLT, California verbal learning test: Adult version: Manual*. San Antonio, TX. Psychological Corporation.

Depp, C. A., & Jeste, D. V. (2006). Definitions and predictors of successful aging: A comprehensive review of larger quantitative studies. *The American Journal of Geriatric Psychiatry*, *14*, 6–20. doi: 10.1097/01.JGP.0000192501.03069.bc

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental status". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research*, *12*, 189–198. doi: 10.1016/0022-3956(75)90026-6

Freund, A. M., & Baltes, P. B. (1998). Selection, optimization, and compensation as strategies of life management: Correlations with subjective indicators of successful aging. *Psychology and Aging*, *13*, 531–543. doi: 10.1037/0882-7974.13.4.531

Gross, A. L., Parisi, J. M., Spira, A. P., Kueider, A. M., Ko, J. Y., Saczynski, J. S., … Rebok, G. W. (2012). Memory training interventions for older adults: A meta-analysis. *Aging & Mental Health*, *16*, 722–734. doi: 10.1080/13607863.2012.667783

Hasher, L., & Zacks, R. T. (1988). Working memory, comprehension, and aging: A review and a new view. In G. H. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory* (Vol. 22, pp. 193–225). San Diego, CA: Academic Press. doi: 10.1016/S0079-7421(08)60041-9

Havighurst, T. J. (1961). Successful aging. *The Gerontologist*, *1*, 8–13. doi: 11.1.8/1.1.8

Hinman, F. (1946). The dawn of gerontology. *Journal of Gerontology*, *1*, 411–417. doi: 10.1093/geronj/1.4_Part_1.411

Horn, J. L., & Cattell, R. B. (1967). Age differences in fluid and crystallized intelligence. *Acta Psychologica*, *26*, 107–129. doi: 10.1016/0001-6918(67)90011-X

Kuhn, T. S. (1962). *The structure of scientific revolutions*. Chicago, IL: University of Chicago Press.

Lindenberger, U. (2014). Human cognitive aging: Corriger la fortune? *Science*, *346*, 572–578. doi: 10.1126/science.1254403

Maquestiaux, F., Hartley, A. A., & Bertsch, J. (2004). Can practice overcome age-related differences in the psychological refractory period effect? *Psychology and Aging*, *19*, 649–667. doi: 10.1037/0882-7974.19.4.649

Martinson, M., & Berridge, C. (2015). Successful aging and its discontents: A systematic review of the social gerontology literature. *The Gerontologist*, *55*, 58–69. doi: 10.1093/geront/gnu037

Neisser, U. (1967). *Cognitive psychology*. New York, NY: Meredith.

Newman, A. B., Arnold, A. M., Naydeck, B. L., Fried, L. P., Burke, G. L., Enright, P. (2003). "Successful aging": Effects of subclinical cardiovascular disease. *Archives of Internal Medicine*, *163*, 2315–2322. doi: 10.1001/archinte.163.19.2315

Park, D. C., Lodi-Smith, J., Drew, L., Haber, S., Hebrank, A., Bischof, G. N., & Aamodt, W. (2014). The impact of sustained engagement on cognitive function in older adults: The Synapse project. *Psychological Science*, *25*, 103–112. doi: 10.1177/0956797613499592

Peterson, N. M., & Martin, P. (2015). Tracing the origins of success: Implications for successful aging. *The Gerontologist*, *55*, 5–13. doi: 10.1093/geront/gnu054

Pfeiffer, E. (1975). A short portable mental status questionnaire for the assessment of organic brain deficit in elderly patients. *Journal of the American Geriatrics Society*, *23*, 433–441. doi: 10.1111/j.1532-5415.1975.tb00927.x

Pruchno, R. (2015). Successful aging: Contentious past, productive future. *The Gerontologist*, *55*, 1–4. doi: 10.1093/geront/gnv002

Reuter-Lorenz, P. A., & Park, D. C. (2014). How does it STAC up? Revisiting the scaffolding theory of aging and cognition. *Neuropsychology Review*, *24*, 355–370. doi: 10.1007/s11065-014-9270-9

Reuter-Lorenz, P. A., & Stanczak, L. (2000). Differential effects of aging on the functions of the corpus callosum. *Developmental Neuropsychology*, *18*, 113–137. doi: 10.1207/S15326942DN1801_7

Rowe, J. W., & Kahn, R. L. (1987). Human aging: Usual and successful. *Science*, *237*, 143–149. doi: 10.1126/science.3299702

Rowe, J. W., & Kahn, R. L. (1997). Successful aging. *The Gerontologist*, *37*, 433–440. doi: 10.1093/geront/37.4.433

Salthouse, T. A. (1994). The aging of working memory. *Neuropsychology*, *8*, 535–543. doi: 10.1037/0894-4105.8.4.535

Salthouse, T. A. (1996). The processing-speed theory of adult age differences in cognition. *Psychological Review*, *103*, 403–428. doi: 10.1037/0033-295X.103.3.403

Schaie, K. W. (2013). *Developmental influences on adult intelligence: The Seattle Longitudinal Study* (2nd ed.). New York, NY: Oxford University Press.

Simons, D. J., Boot, W. R., Charness, N., Gathercole, S. E., Chabris, C. F., Hambrick, D. Z., & Stine-Morrow, E. A. L. (2016). Do "brain training" programs work? *Psychological Science in the Public Interest*, *17*, 108–191. doi: 10.1177/1529100616661983

Smith, P. J., Blumenthal, J. A., Hoffman, B. M., Cooper, H., Strauman, T. A., Welsh-Bohmer, K. &., … Sherwood, A. (2010). Aerobic exercise and neurocognitive performance: A meta-analytic

review of randomized controlled trials. *Psychosomatic Medicine*, *72*, 239–252. doi: 10.1097/PSY.0b013e3181d1463

Stern, Y. (2009). Cognitive reserve. *Neuropsychologia*, *47*, 2015–2028. doi: 10.1016/j.neuropsychologia.2009.03.004

Touron, D. R. (2015). Memory avoidance by older adults: When 'old dogs' won't perform their 'new tricks'. *Current Directions in Psychological Science*, *24*, 170–176. doi: 10.1177/0963721414563730

Von Faber, M., Bootsma-Van Der Wiel, A., Van Exel, E., Gussekloo, J., Lagaay, A. M., Van Dongen, E., … Westendorp, R. G. J. (2001). Successful aging in the oldest old. *Archives of Internal Medicine*, *161*, 2694–2700. doi: 10.1001/archinte.161.22.2694

Willis, S. L., Tennstedt, S. L., Marsiske, M., Ball, K., Elias, J., Koepke, K. M., … Wright, E. (2006). Long-term effects of cognitive training on everyday functional outcomes in older adults. *JAMA: Journal of the American Medical Association*, *296*, 2805–2814. doi: 10.1001/jama.296.23.2805

Wolinsky, F. D., Unverzagt, F. W., Smith, D. M., Jones, R., Stoddard, A., & Tennstedt, S. L. (2006). The ACTIVE cognitive training trial and health-related quality of life: Protection that lasts for 5 years. *The Journals of Gerontology: Series A: Biological Sciences and Medical Sciences*, *61*, 1324–1329. doi: 10.1093/gerona/61.12.1324