

# The Life and Times of Working Memory

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It used to be called short-term memory. But as the modern label implies, working memory is a dynamic system that involves processing current information. The change in name reflects the evolution of a large body of research focusing on the nature and capacity of this critical and interesting component of individual cognition.

Unfortunately, as we track the emergence, expansion, and eventual decline of working memory across the lifespan, we also find that working memory is many things to many people.

This was one of the themes of a symposium, “The Life-Long Development of Working Memory,” chaired by APS Fellow and Charter Member J. Steven Reznick, University of North Carolina at Chapel Hill, at the APS Annual Convention in Atlanta. In addition to Reznick, symposium presenters included APS Fellow Robert Kail, Purdue University; APS Fellow Randall Engle, Georgia Institute of Technology; and APS Fellow Timothy Salthouse, University of Virginia.

Reznick, who is director of the developmental program in the Department of Psychology at UNC, noted that there are many methodological difficulties to investigating working memory in babies. This has given rise to inventive approaches. For example, because infants cannot give verbal responses, techniques such as measuring eye movement have been used to test their working memory. Ongoing research in his laboratory investigates infants’ working memory capacity using a “peekaboo” game and inferring from the infant’s ability to look where the face should be. This research has revealed that working memory emerges at about five to six months of age. He said much remains to be understood about working memory in infants, particularly auditory working memory. “Working memory is assessed poorly by any single procedure,” he added.

Looking at working memory into childhood, Kail said researchers often mistakenly link young children’s undeveloped cognitive abilities to limited working memory. Kail’s research, which has been supported by the National Institute on Child Health and Human Development and the National Science Foundation, has shown that the speed and capacity of working memory tend to increase throughout childhood. This has major implications for increased cognitive functioning as we progress through childhood, he said, including enhanced reading, math, and problem-solving capabilities.

“These are substantive consequences that are pervasive,” he said.

Discussing research on working memory in adulthood, Engle underscored the lack of agreement on exactly what working memory is. Engle, who is chair of the Department of Psychology at Georgia Tech, sees working memory as a number of short-term memory systems in combination with the ability to control attention. But, he says, many think of working memory only in terms of capacity. And there even seems to be confusion regarding that construct. “Working memory capacity isn’t seven plus or minus two, it’s not four plus or minus two, it’s nothing plus or minus two. Rather, it reflects a limitation in the

system,” he said.

Researchers even disagree on the relative importance of working memory. Unlike many of his colleagues, Engle said, “we don’t need working memory most of the time” because we can simply retrieve most information directly from long-term memory. However, Engle argued that working memory becomes vital when we deal with situations that involve proactive memory interference, such as when an American crosses the street in Britain. In such a situation, working memory is important because it allows us to keep novel information (such remembering to look right before looking left when crossing the British street) easily accessible. Engle also made the case that working memory is important in that individuals regulate their own working memory systems differently. Some of us have high working memory spans and can hold and process more information for longer periods than those with low working memory spans.

Completing the lifespan look at working memory, Salthouse discussed the effects of aging on working memory. Echoing other panelists’ observations about the variety of conceptual approaches to working memory, Salthouse, who is Brown-Forman Professor of Psychology at the University of Virginia and an APS William James Fellow, recalled a recent conference at which 10 cognitive psychologists offered 10 different definitions of the concept.

Still, Salthouse argued that important changes take place in working memory by the time we reach older adulthood. Specifically, the number of items that can be held in working memory decreases significantly between the ages of 20 and 80. However, because many additional cognitive changes have been noted in later adulthood, it is difficult to know if these changes affect working memory or are affected by changes in working memory. Salthouse’s work has been supported by the National Institute on Aging since 1978. He is director of the Salthouse Cognitive Aging Lab at Virginia.

Like other cognitive functions, it appears that across the lifespan the capacity of working memory expands as we grow from childhood to adulthood and then decreases once we reach older adulthood. However, as the panelists pointed out, when interpreting research on working memory, it is important to note that there is a general lack of consensus on the meaning of the concept itself. Indeed, “it is one of the most overused and poorly understood constructs that cognitive developmental psychologists use,” Kail said.