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Utilization deficiency and working memory capacity in adult memory performance: not just for children anymore[☆]

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Abstract

In acquiring mnemonic strategies, children may demonstrate a utilization deficiency phase in which they successfully execute a strategy but it does not facilitate memory performance. The present experiment suggests that utilization deficiencies are not a developmental phenomenon per se, but rather a byproduct of diminished working memory capacity for any reason (i.e., maturation, knowledge base, context, individual differences, etc.). Adults performing a series of study-test memory trials using nonsense words exhibited characteristics of utilization deficiencies, with increased strategy use not contributing to increased memory performance. Furthermore, adults' working memory capacity modified the effect. Implications of these findings for developmental models of strategy acquisition are discussed.

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Mnemonic strategies are effortful, capacity-consuming processes that are at least potentially available to consciousness (Bjorklund & Harnishfeger, 1990). These operations typically facilitate memory performance. However, they have costs as well as benefits. For example, Miller and Seier (1994) identified a phase in strategy development that they labeled *utilization deficiency*, in which children use a strategy spontaneously but they do not benefit, in terms of improved recall performance, from its use. As a result, when children of different ages use the same strategy to the same degree, older children often experience greater cognitive gain than younger (utilization deficient) children.

Utilization deficiencies have been demonstrated for a variety of cognitive strategies, including selective-attention strategies (e.g., Miller, 1994), organizational strategies in free- and sort-recall tasks (e.g., Bjorklund, Coyle, & Gaultney, 1992), and reading comprehension strategies (e.g., Gaultney, 1995). Utilization deficiencies have been demonstrated in preschoolers and children through middle-childhood in studies of both spontaneous and trained strategy use.

However, not all agree that the utilization deficiency is a theoretically useful construct or that utilization deficiencies are empirically very common. Waters (2000) questioned the need for a “new” deficiency construct. Schneider and colleagues reported studies in which utilization deficiencies were seldom found (Hasselhorn, Richter, & Lingen, unpublished manuscript; Schlagmüller & Schneider, 2002; Schneider, Kron, Hünnerkopf, & Krajewski, 2003; Schneider & Sodian, 1997). Some argue that utilization deficiencies are a sign of less than optimal cognition or strategy use. For example, Schneider and co-workers suggest that utilization deficiencies are most likely to be found among children with poorer memory skills in general or among those with smaller working memory capacity (Schlagmüller & Schneider, 2002; Schneider et al., 2003). It remains unclear, therefore, whether the utilization deficiency is a predictable phase in the development of successful strategy use, or an artifact of methodology (e.g., the use of cross-sectional rather than longitudinal designs; see Schneider et al., 2003; Schneider & Sodian, 1997).

If utilization deficiencies *are* a typical component of developing strategy use, what underlies the phenomenon? Several explanations have been proposed, such as inefficient inhibition, knowledge-base deficits, inaccurate metacognition, or limited resource effects. Young children’s relatively poor metamemory capabilities may play a role if the children are unaware that the strategy they are using does not benefit performance (Hasselhorn, 1995). Alternatively, young children’s relatively poor inhibitory abilities may play a role if they are less able to inhibit the use of less mature strategies in order to execute the more mature strategy effectively (Harnishfeger, 1995; Miller, 1994). Another possibility is that the execution of unfamiliar strategies may be so effortful when first applied that there are insufficient resources remaining to devote to enhanced task performance (e.g., Bjorklund & Harnishfeger, 1987; Miller, 2000; Miller, Seier, Probert, & Aloise, 1991). Finally, greater knowledge of the to-be-remembered materials may influence strategy execution or efficiency, with more knowledgeable participants being less likely to demonstrate utilization deficiencies (Gaultney, Bjorklund, & Goldstein, 1996).

In children, maturation and increasing knowledge are confounded, making it difficult to disentangle the effects of these possible sources of utilization deficiencies. Adults, however, are typically assumed to be mature, effective strategists, and therefore examining their performance may eliminate some of the potential confounding. Utilization deficiencies

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