

Adults Count Too

Subitizing and Arithmetic Fluency in Adults

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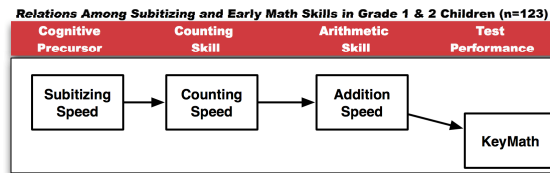
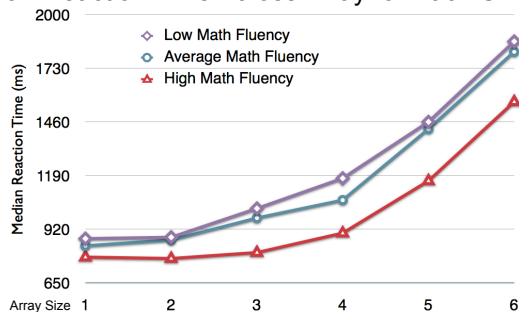
Is evidence of subitizing's foundational role in arithmetic seen in adults?

A number of studies have shown a relation between children's ability to subitize (quickly quantify 1-3 items) and the development of number words, of arithmetic skills, and dyscalculia. This predictive relationship appears to be comparable to the relation between phonemic awareness and reading. Phonemic awareness is a foundation skill underlying reading fluency across all stages of literacy development.

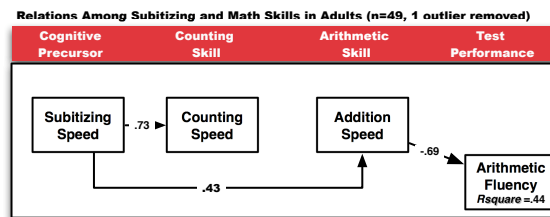
We wondered whether the patterns seen in literacy would be replicated in the relation between subitizing and addition. Fifty adults completed the same computerized dot counting, visual-spatial memory (Corsi), single-digit addition and processing speed tasks as children in the Count Me In study. The KeyMath™ Numeration and French Kit arithmetic fluency tests were completed by children and adults respectively.

Children in the study with poor math skills appear to count 2 and 3 dots rather than subitize them. Below, in the adult data, we see those with relatively* high math skills performing significantly faster and more consistently within the subitizing range.

Median Reaction Time Across Array for Each Skill Group



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* Significant Beta values shown on model lines. The visual-spatial memory task did not contribute significant variance in any of the regressions, so it is not pictured in the diagram above.

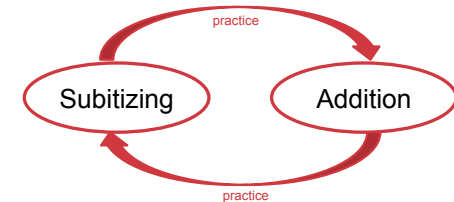
When exploring this kind of reaction time data, it is important to control for processing speed and we did so. However, processing speed has been linked to arithmetic skill in children. In contrast, we found that processing speed did not contribute significant unique variance in a regression with subitizing latency.

Consistent with the pattern seen in the children's data, regression analyses above show that single-digit addition latency predicts a significant unique portion of the variance in arithmetic fluency. Just like in the children's data, the contribution of subitizing is mediated by addition latency.

Note that counting speed no longer contributes to addition variability in the adults. This is consistent with the progression from count-on addition strategies used by young children to direct retrieval by adults.

Subitizing & Addition – a Reciprocal Effect?

The results of this study suggest that subitizing and basic arithmetic, particularly addition, may work in a reciprocal fashion. A similar pattern is seen in reading development. Phonological awareness forms the foundation for reading in young children. As the child learns and practices reading, their phonemic awareness improves, increasing the correlation. By adulthood, the relation is completely mediated by word reading, just as the regressions at left show that subitizing is mediated by single-digit addition.



Subitizing appears to play a foundational role in arithmetic across development. We have shown that in both children and adults, subitizing skill is related to arithmetic fluency, above and beyond any role of general processing speed.

The adult evidence may reflect a reciprocal practice effect similar to that seen between phonemic awareness and word reading skills.