

Quantification and Arithmetic: How are they related?

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Subitizing and Counting

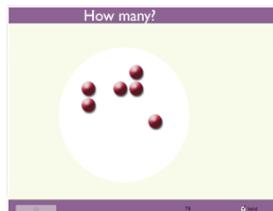
Three different quantification processes have been identified that may be important in the development of mathematical skill: subitizing, counting, and approximation. In this poster, we explore links between the development of symbolic arithmetic and two of quantification these quantification processes: subitizing and counting.

Subitizing; fast, accurate identification of the quantity of small sets (1, 2, 3 or 4)

Counting: slower, sequential enumeration to determine quantities of any set size set (up to counting limit of the individual)

When children learn to solve addition problems such as $2 + 4$ or $6 + 7$, they rely on counting (e.g., Siegler & Shrager, 1985). Solution procedures become more sophisticated with development but even adults claim to count on some problems (LeFevre et al., 1996). On nonsymbolic arithmetic [i.e., presented and solved without using Arabic digits] for 5- and 6-year-olds, subitizing correlates with performance (LeFevre et al., in press).

How are counting and subitizing related to the development of symbolic arithmetic?



Method

Participants – Children in Kindergarten through Grade 5 ($n_s = 53, 36, 53, 61, 35,$ and 31), and adults ($n=48$).

Tasks – count circles (1-6), symbolic arithmetic (sums < 11).

Procedure - stimuli presented on laptop computers. Measured latencies and accuracy on each trial.

Control variables – spatial working memory; processing speed, age in months.

Results

1. Fig. 1: Subitizing range increases with age; counting slopes decrease.
2. Fig 2: Counting latency is a consistent unique predictor of arithmetic latency.
3. Fig 2: Only for adults was subitizing speed a significant unique predictor of addition latency.
4. The total R^2 values of the predictors increased with age from 25% to 50% (K to Adult) largely due to an increase in shared variance.

Figure 1: Subitizing and Counting

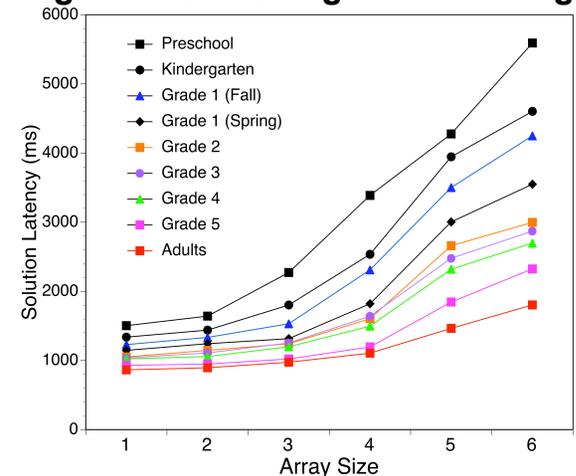
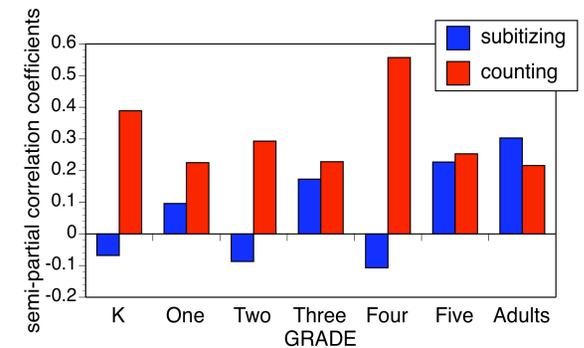


Figure 2: Semi-partial correlation coefficients for addition regression



Our results suggest that counting latency is more closely related to the development of addition latencies than is subitizing. Overall, subitizing, counting, and addition become more closely linked with age. Nevertheless, subitizing predicts nonsymbolic arithmetic in young children. Further research is needed to disentangle the connections among quantification and arithmetic tasks.