Subitizing Latency—But Not Approximate Number System Acuity—Correlates With Arithmetic Fluency In Adults

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Introduction

Purpose: To examine individual differences in subitizing latency and approximate number system acuity as predictors of arithmetic fluency in adults.

- *Subitizing:* quick and exact enumeration of small quantities without counting.

Figure 1: Subitizing allows you to quickly determine that there are 3 dots on the left. To determine the exact number of dots on the right, you have to count (or use some other procedure).

- The *approximate number system* is approximate rather than exact; it detects relative differences between large quantities.

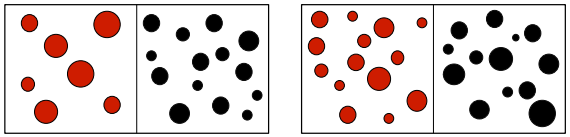


Figure 2: In Example 1, the approximate number system allows you to determine there are more black dots than red; the ratio of red to black dots is 1:2. As the ratio approaches 1:1, it becomes more difficult to determine which group has more, as is demonstrated in Example 2.

Methods

Participants: Undergraduate students (*N* = 109; Mode age = 19 years; 61% female).

Measures:

- ***Subitizing Latency***: Participants quickly named quantities (1, 2 or 3 dots) while being timed. Score is items per second (corrected for errors).
- ***Approximate Number System Acuity***: Participants completed the Panamath task (www.panamath.org; Halberda, Mazzocco & Feigenson, 2008); this task consists of multiple comparisons of large quantities, like those in Figure 2. Scores are Weber fractions.
- ***Arithmetic Fluency***: Participants were given a minute each to complete addition, subtraction and multiplication problems. Scores are overall total correct
- ***Math Background Survey***

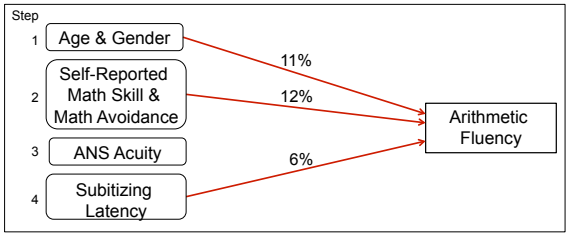
Results

Table 1: Intercorrelations among subitizing latency, approximate number system acuity and arithmetic fluency

	Subitizing Latency	ANS Acuity
Subitizing Latency	--	
ANS Acuity	-.01	--
Arithmetic Fluency	.28**	-.12

Note. $^{**}p < .01$.

Figure 3: Hierarchical regression analyses predicting arithmetic fluency



Discussion

- Contrary to Lyons and Beilock's (2011) findings, approximate number system acuity was not correlated with arithmetic fluency. Lyons and Beilock used quantities 1-9, which mixes subitizable and non-subitizable quantities and may account for their findings.

Conclusions

- It is not clear that individual differences in approximate number system acuity are predictive of math fluency in adults; more research is necessary.
- Subitizing latency is a quantitative skill that appears to be important to mathematical fluency, since it correlates with math skills in children and adults.

References

Halberda, J., Mazzocco, M., & Feigenson, L. (2008). Individual differences in nonverbal number acuity predict maths achievement. *Nature*, *455*, 665-668.

Lyons, I. M., & Beilock, S. L. (2011). Numerical ordering ability mediates the relation between number-sense and arithmetic competence. *Cognition*, *121(2)*, 256-261. doi:10.1016/j.cognition.2011.07.009

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