Investigating the Building Blocks of Numerical Representations: Subitizing and Finger Gnosia

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What precursor abilities form the building blocks of numerical representations?

Both *subitizing*, the ability to mentally represent small numerosities, and *finger gnosia*, the ability to mentally represent one's fingers, have been found to predict mathematical skill (Penner-Wilger, et al., 2007). Mathematical skill, however, involves a complex set of cognitive abilities, so why this relation exists is an open question.

We posit that subitizing and finger gnosia predict mathematical skill because these abilities form the building blocks of numerical representations (Penner-Wilger et al., 2007; also Butterworth, 1996). Here we examined the concurrent relation between subitizing, finger gnosia, and a task assessing numerical representation—number-line estimation (Siegler & Booth, 2004). Siegler and colleagues assert that the linearity of children's estimates is an index of their numerical representations, with more linear estimates reflecting better representations.

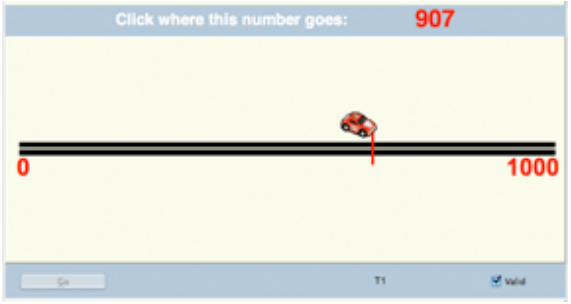
Canadian children in Grades 1-5 (*N*=222) participated as part of the Count Me In longitudinal study.

The tasks: Subitizing, finger gnosia, and estimation

Subitizing. The child was shown a set of dots (1-6) on a screen and asked, "How many are there?" The dependent measure was median latency for trials of set size 1-3 items. Six trials were performed per set size.

Finger gnosia. The experimenter shielded the child's view of their hand, and touched two fingers simultaneously. The shield was removed, and the child was asked to point to the fingers touched. Ten trials were performed for each hand.

Estimation. The child was shown a target number on a screen and asked to click "where it goes" on a line from 0 to 1000. The dependent measure was the R^2 of the linear regression between the 25 targets and answers.



Are subitizing and finger gnosia related to children's estimation skill?

Correlations and regressions were performed, controlling for grade and processing speed.

Subitizing (r = -27) and finger gnosia (r = .21) were both significantly correlated with the linearity of children's number-line estimates (p < .005).

Subitizing and finger gnosia each predicted significant unique variance in children's estimates (semi-partials rs .21 and .15, respectively; R^2 = .28).

We found that both subitizing and finger gnosia are related to children's estimation skill.

Our results are consistent with the view that the ability to mentally represent both small numerosities and one's fingers are building blocks for numerical representations.

Cognitive Science, Washington DC, July 2008

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