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## Education

# A handwaving approach to arithmetic

## Gesticulating helps children to learn

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HUMAN language is the subject of endless scientific investigation, but the gestures that accompany speech are a surprisingly neglected area. It is sometimes jokingly said that the way to render an Italian speechless is to tie his wrists together, but almost everyone moves their hands in meaningful ways when they talk. Susan Goldin-Meadow of the University of Chicago, however, studies gestures carefully—and not out of idle curiosity. Introspection suggests that gesturing not only helps people communicate but also helps them to think. She set out to test this, and specifically to find out whether gestures might be used as an aid to children's learning. It turns out, as she told the AAAS, that they can.

The experiment she conducted involved balancing equations. Presented with an equation of the form  $2 + 3 + 4 = x + 4$ , written on a blackboard, a child is asked to calculate the value of  $x$ . In the equations Dr Goldin-Meadow always made the last number on the left the same as the last on the right; so  $x$  was the sum of the first two numbers. Commonly, however, children who are learning arithmetic will add all three of the numbers on the left to arrive at the value of  $x$ .

In her previous work Dr Goldin-Meadow had noted that children often use spontaneous gestures when explaining how they solve mathematical puzzles so, to see if these hand-movements actually help a child to think, or are merely descriptive, she divided a group of children into two and asked them to balance equations. One group was asked to gesture while doing so. A second was asked not to. Both groups were then given a lesson in how to solve problems of this sort.

As Dr Goldin-Meadow suspected, the first group learnt more from the lesson than the second. By observing their gestures she refined the experiment. Often, a child would touch or point to the first two numbers on the left with the first two fingers of one hand. Dr Goldin-Meadow therefore taught this gesture explicitly to another group of children. Or, rather, she taught a third of them, taught another third to point to the second and third numbers this way, and told the remainder to use no gestures. When all were given the same lesson it was found those gesturing “correctly” learnt the most. But those gesturing “incorrectly” still outperformed the non-gesturers.

Gesturing, therefore, clearly does help thought. Indeed, it is so thought-provoking that even the wrong gestures have some value. Perhaps this helps to explain why the arithmetic-intensive profession of banking was invented in Italy.

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