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## Tapping out affects the count

The brain links together action, space and number perception.



Humans and many other animals have the ability to make spontaneous and rapid estimates of the approximate number of items that they can see. This sense of number, or “numbersense”, is particularly important in humans, as evidence suggests that it lays the groundwork for acquiring mathematical skills.

Researchers have many questions about numbersense. Is it a kind of perception? Or does it require more active thought, like counting? Do people have the same sense of number when they view, hear or touch items that depict the same number? Having a sense of number is essential for carrying out certain actions, like the following the steps in a dance, but the connection between action and numbersense is not entirely clear.

A process called adaptation means that viewing specific stimuli for a period of time can affect what people think they see subsequently. For example, viewing large numbers of dots makes subsequent smaller groups of dots seem like they contain fewer dots than they actually do. Giovanni Anobile, Roberto Arrighi and co-workers have now investigated the link between action and numbersense by asking volunteers to tap one hand either rapidly or slowly in one spot for a short time. The volunteers were then shown a series flashes or a cloud of dots in the region where they had been tapping and asked to estimate the number of flashes or dots.

After fast tapping, the volunteers greatly underestimated the numbers of flashes or dots that they saw; after slow tapping, they overestimated the numbers. However, if the images were shown far away from where the volunteers had been tapping, their estimates were more accurate.

Overall, the results suggest that adaptation is controlled by space-specific sensory mechanisms rather than some kind of active counting. Furthermore, numbersense appears to have a generalized form that is shared by the brain regions responsible for perception and action. Because numbersense and mathematical ability are linked, this strong connection between action and number perception may have important implications for understanding and treating math-related learning disabilities. Anobile, Arrighi and colleagues next plan to study how movement-driven adaptation affects numbersense in children and adults with these conditions.

**To find out more**

Read the *eLife* research paper on which this eLife digest is based: **“A shared numerical representation for action and perception”** (August 9, 2016).



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