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# **Co-speech gestures reflect non-linguistic thinking: evidence from mental abacus**

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## **Abstract**

Why do people gesture when they speak? On one proposal, people gesture because they speak: Gestures reflect speech production processes. Alternatively, people gesture because they think: Gestures reflect non-linguistic thinking processes. If gestures during speech grow out of thinking, not simply speaking, then co-speech gestures should look similar to the gestures that are produced during silent thinking without speech. Here, we looked at spontaneous gestures during mental abacus, a non-linguistic technique for rapid arithmetic operations via imagining moving beads on an abacus. We compared how expert mental abacus users spontaneously gesture during silent thinking (no-speech) and during explaining how they solved the arithmetic problems (speech). In both the speech and the no-speech condition, gestures reflected operations on a mental abacus in the same way (e.g. depicting the trajectory of beads). These results suggest that at least some co-speech gestures grow out of thinking processes that are independent of speaking.