Students Who Gesture during Learning 'Grasp' Concepts Better

Hand movement appears to help in teaching about statistical models

By Matthew Hutson on April 13, 2021

Credit: Dmitri Dikushin *Alamy*

When we talk, we naturally gesture—we open our palms, we point, we chop the air for emphasis. Such movement may be more than superfluous hand flapping. It helps communicate ideas to listeners and even appears to help speakers think and learn.

A growing field of psychological research is exploring the potential of having students or teachers gesture as pupils learn. Studies have shown that people remember material better when they make spontaneous gestures, watch a teacher's movements or use their hands and arms to imitate the instructor. More recent work suggests that telling learners to move in specific ways can help them learn—even when they are unaware of why they are making the motions.

One study involved people who were asked to swing their arms or to stretch them—both groups were told the motion was to get blood flowing. The researchers found that those who swung their arms were more likely to solve a puzzle that required a specific insight: to connect two strings hanging from the ceiling that were too far apart to reach at the same time, they needed to attach a weight to one to turn it into a pendulum. The blood-flow ruse worked: only three participants suspected a relationship between swinging or stretching their arms and solving the task. Apparently, this type of instructed movement helps thought even without any conscious connection to what a person is doing.

New work by researchers at the University of California, Los Angeles, and California State University, Los Angeles, extends this finding. "We're trying to test 'Where is the boundary of the power of gesture?'" says Icy (Yunyi) Zhang, a psychology graduate student at U.C.L.A. and the paper's lead author. The researchers set about doing this by testing instructed hand movements' subconscious effects on learning an abstract concept in statistics.
In the first of two experiments, reported in the February issue of *Cognitive Science,* 60 undergraduates came to a laboratory to stand and watch a brief narrated video. The video explained the idea of a statistical model, a function that generates predictions. It depicted data as the bars of histograms and models as the means, or averages, of the data. (The simplest model of a collection of numbers is its mean.) Study participants were divided into three groups. A control group simply watched the video. A "match" group watched the same video overlaid with an animation. For the latter group, when the narrator said, for example, that one data set had more variation than another—represented by histograms with more bars placed along their *x* axis—

two vertical red bars (unrelated to the histogram bars) moved away from each other. Those participants were asked to imitate the movement of the red bars with their hands, holding them vertically and moving them apart. A "mismatch" group was instructed to imitate red bars that moved in ways incongruous to the lesson. During the description of variation, for example, they were horizontal and moved vertically.

After watching the video three times, all participants took a short quiz. The match group outperformed the mismatch group, 16.3 to 12.6 (out of a maximum score of 23) on average, and the control group registered an in-between score. A second experiment reproduced the results with 130 college students, this time sitting at laptops. Match participants scored 4.4 out of five points on average, outperforming both the control group (four points) and the mismatch group (3.8).

"It's a nice, clean demonstration" of movement's benefits, says Martha Alibali, a psychologist at the University of Wisconsin–Madison, who studies gesture in education and was not involved in the study. A model, she says, is "a super important concept, a really foundational statistical concept."

"I like the fact that [the field] is moving into this new domain of statistics," says Susan Goldin-Meadow, a psychologist at the University of Chicago, who has done extensive work on gestures but was also not involved in the study. ADVERTISEMENT

One question that was not tested is whether simply watching the matched animation could help performance as much as imitating it. Zhang doesn't believe so, citing previous work showing that gesturing holds benefits over watching animations.

The researchers had not revealed the goal of the experiment to the students. They hid their intent by telling the subjects a cover story, saying the study focused on multitasking. Afterward they asked the students to guess its real purpose. Of those who gestured, only about a third in the match group and a fifth of those in the mismatch group surmised the study had something to do with enhancing learning through gestures. Even when excluding the students who caught on to the purpose of the study, those in the group that performed matched movements were still helped by the exercise. Goldin-Meadow calls this aspect of the study "a really nice, interesting result."

The instructed movements' unconscious effects impressed Zhang. "It definitely convinced me of the power of embodied cognition," the idea that physical interaction with our surroundings influences even abstract thinking in ways we don't always recognize, she says.

There is one more benefit to gesturing: keeping learners engaged. The students rated how well they understood the video after each of the three viewings. Those in the two hand-movement groups gave higher ratings each time. The control group's ratings, however, declined about 20 percent from the second to the third viewing—possibly because of frustration at having to watch the video again rather than reduced understanding. The movement required of the other groups may have kept them absorbed.

Some teachers in the classroom have already been using movement as a learning tool. Alibali notes that in students her daughter's algebra class did "slope aerobics," getting out of their seats and moving their arms to represent various functions. Zhang says her work has the potential to be applied in teaching any lesson that includes a spatial component and that it could be adapted to classrooms or online learning. "I think gesture is used in the classroom all the time," Goldin-Meadow says, "so we might as well be using it well."