Muscle memory creation: is tactile feedback alone enough?

Surgeons optimize their performance during a procedure based on multiple information received via eyesight, hearing or tactile feedback.

The question remains of how much information can a surgeon take through tactile feedback? This research was motivated by the desire to understand the role of tactile feedback, and how this type of information is utilized to create muscle memory and build motor skills.

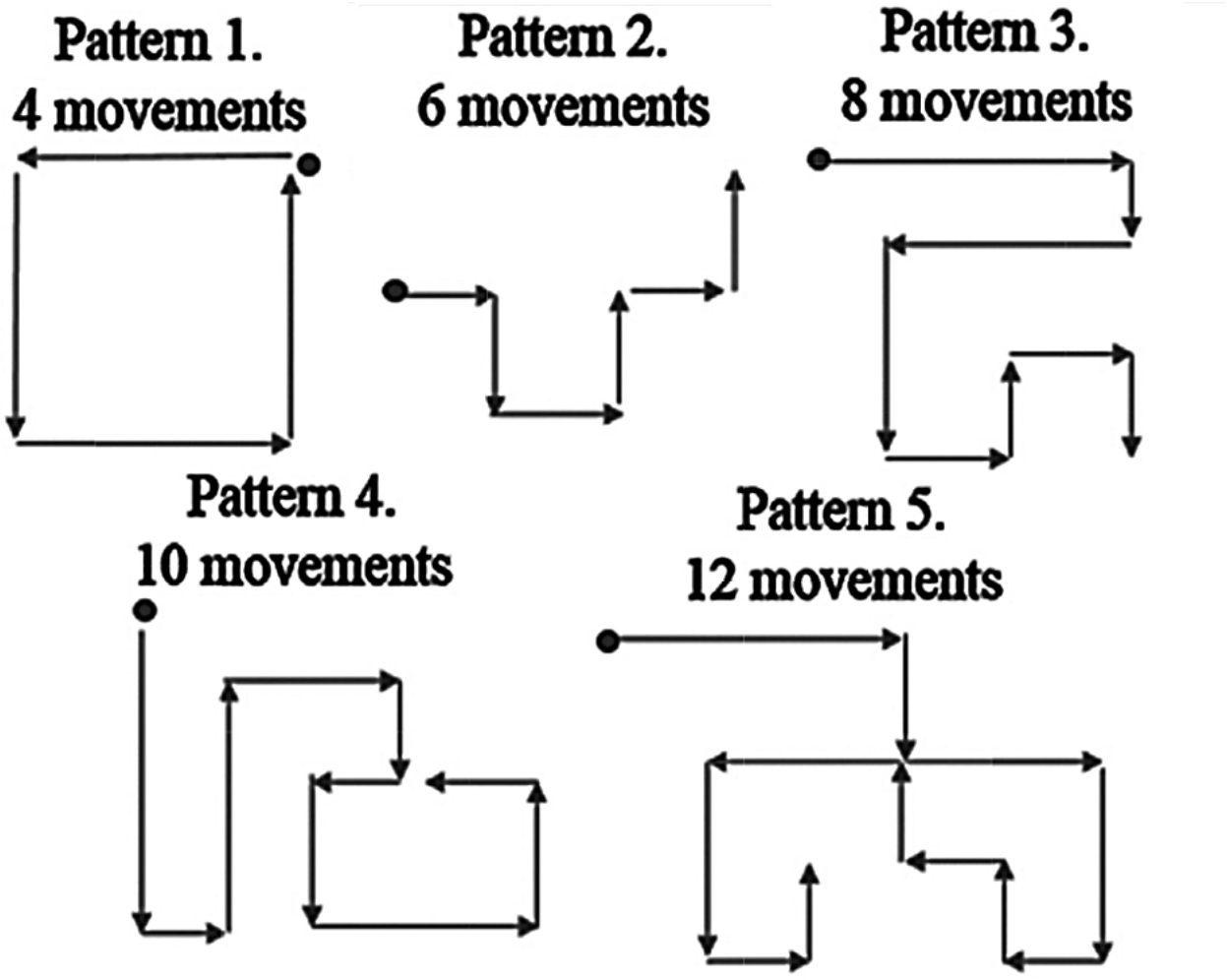

Fig. 1. Participants had significantly less difficulty remembering patterns 1 to 3, as opposed to patterns 4 and 5.

In order to examine the tactile feedback, we perform a two-stage study in a 2D platform. The first

stage tested the accuracy of muscle memory developed purely by tactile feedback, and the second stage evaluated the retention of this muscle memory after several weeks. On the first stage, each of 20 of participants had a chance to perceive the movement of a performer while drawing a pattern with a set number of movements and later replicate them. All subjects were blindfolded to ensure participants exclusively received tactile feedback. On the second stage of the experiment, the participants had the numbers of movements increased to receive training over nine sessions. The accuracy of pattern replication was analyzed over each training session.

Overall, participants were able to remember up to 6-8 steps of movements before they began making mistakes when replicating the patterns. Moreover, participants dramatically decreased their errors after six training sessions. A strategy participants utilized for remembering these movements was to group them in chunks of kinesthetic information.

These important findings demonstrate how the human operators gather kinesthetic information, create muscle memory, and then build motor skills.

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