



Hand and finger movement strategies for single-shot tactile search

Sasha Reschechtko^{1,2}, Wyllianne Pangan¹, J. Andrew Pruszynski²

1. School of Exercise & Nutritional Sciences, San Diego State University, San Diego CA, USA

2. Department of Physiology & Pharmacology, University of Western Ontario, London, ON, CAN



What movement strategies do we employ to maximize sensory acuity?

To detect very small surface features with a finger, we need to produce relative motion between the fingertip and surface¹

We investigated the effects of *finger used* and *movement direction* when human participants searched for very small features on a silica wafer

Acuity could differ between fingers due to differing neurophysiological factors² including innervation density, which may be related to fingertip size³

Acuity could also be affected by the precision of control afforded to different fingers, which might be reflected in contact kinetics and kinematics

Methods

We presented participants (n = 33) with two silica wafers. One was smooth while the other had a microscopic feature (2, 6, or 10 μm tall x 500 μm diameter)

Participants performed a Two-alternative forced choice task to indicate which surface had the feature^{3,4}

Exploratory movements constrained by an aperture

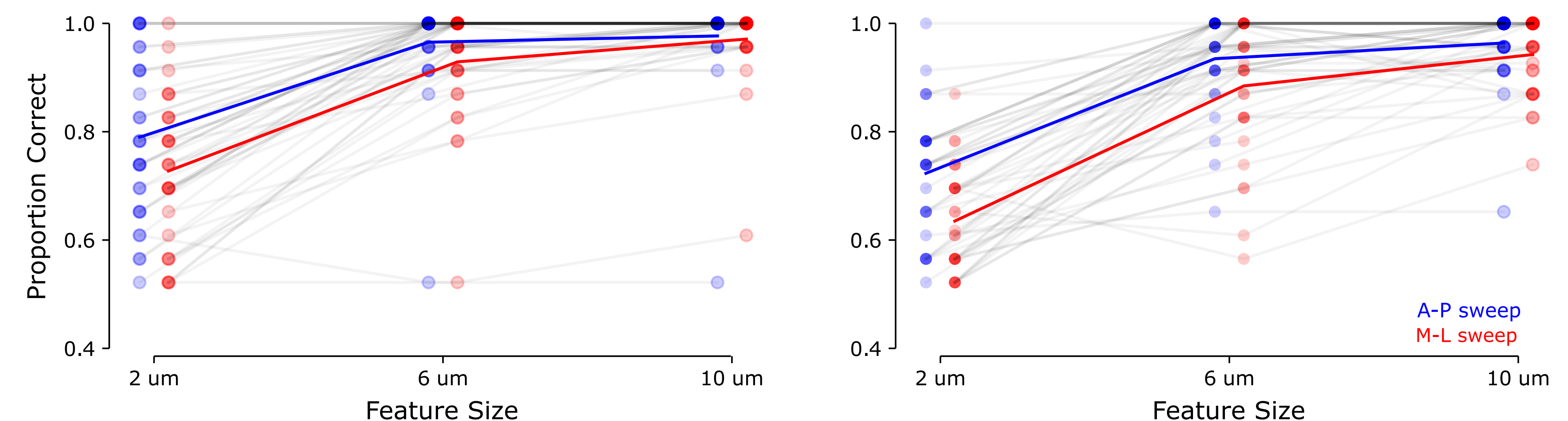
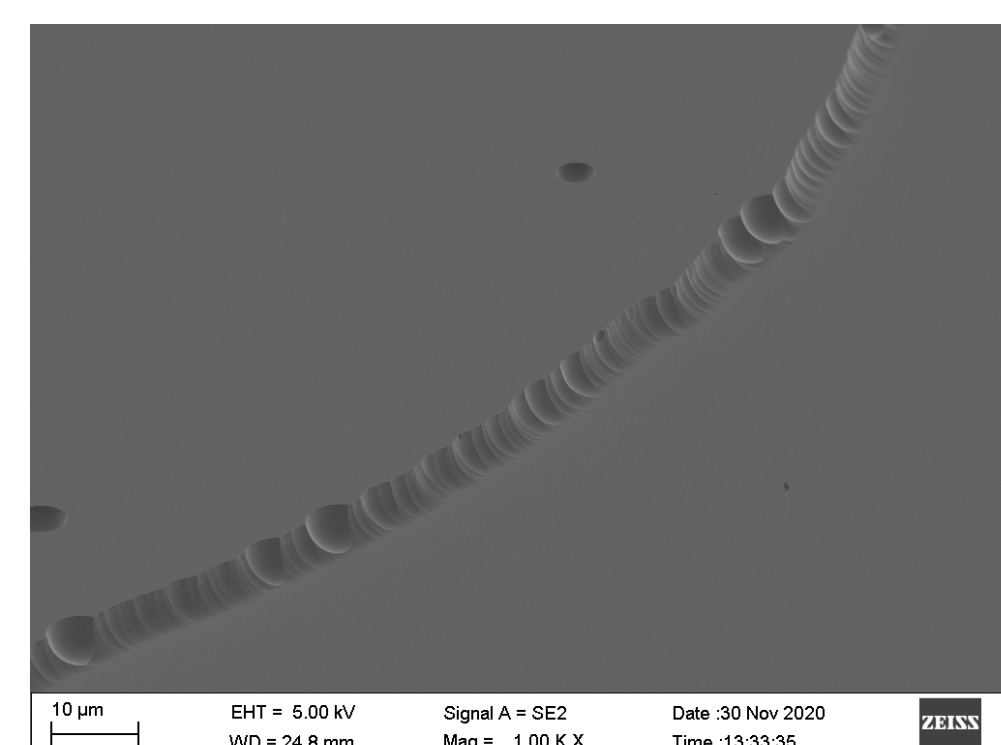
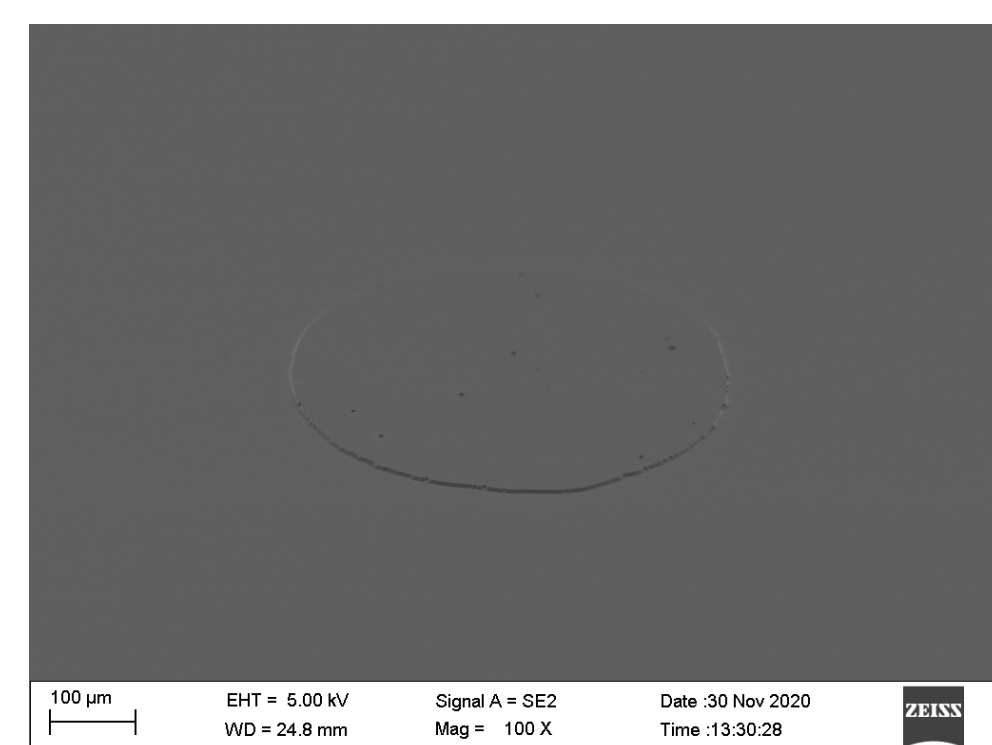
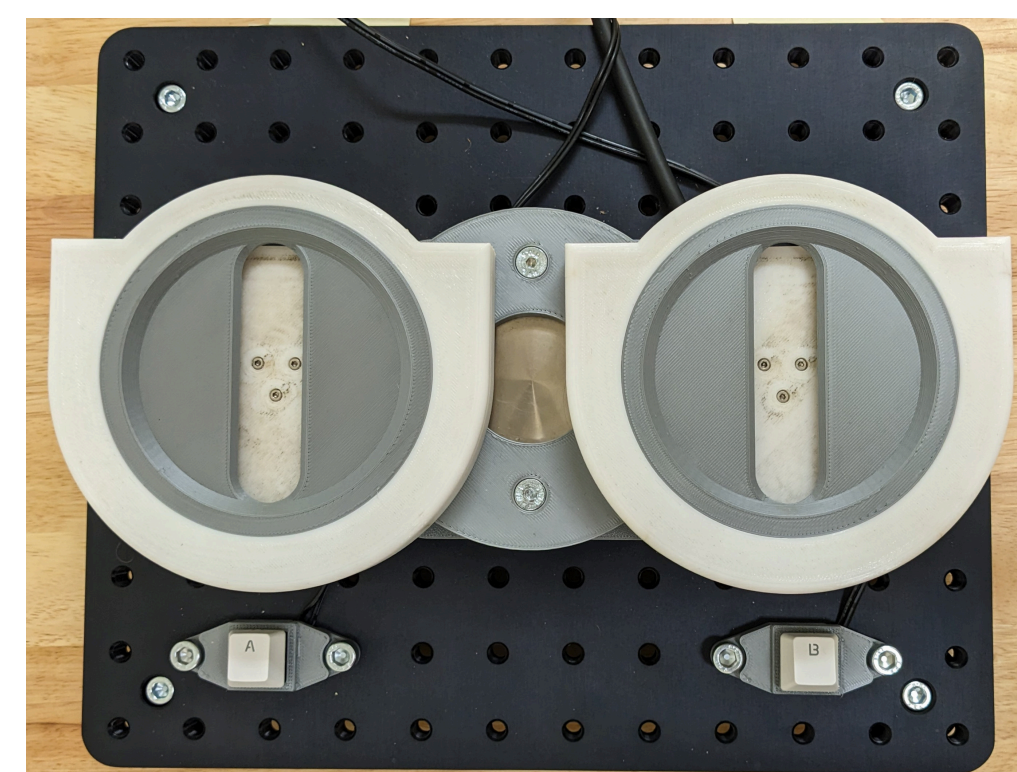
Participants make only one sweep per surface per trial

Index and little finger, A-P and M-L movement directions

3 feature heights: 2, 6, 10 μm

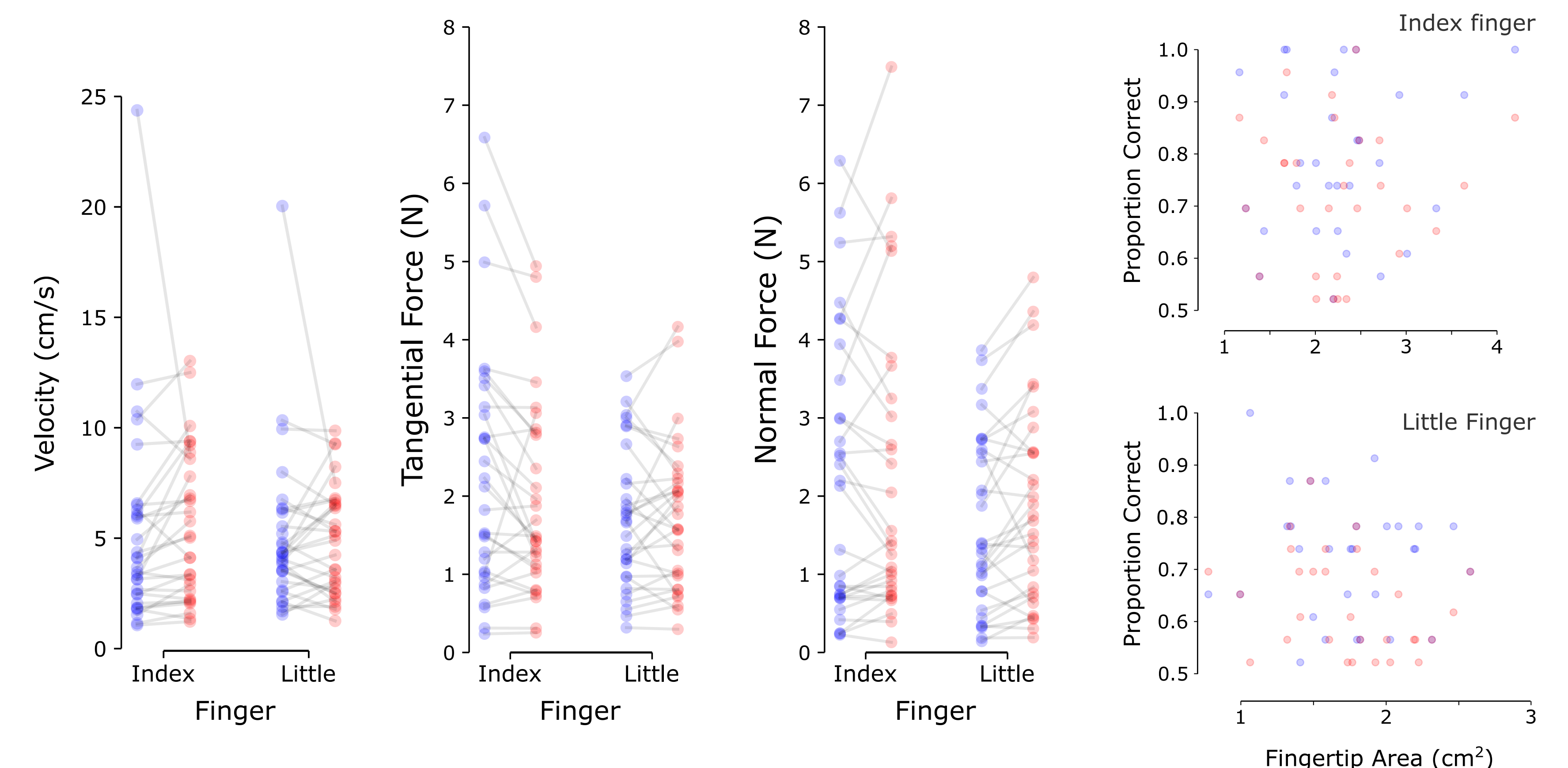
23 repetitions per height x finger x direction

Kinematics reconstructed from Force/Torque data



Index finger detection performance was better than little finger

Anterior-Posterior sweep performance was better for small features



No consistent difference in sweep velocity across directions or fingers

Index finger normal forces were consistently higher than little finger

Index finger tangential forces were higher than little finger in A-P sweeps

We did not observe any relationship between finger size and success rate

References

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4. Kennedy et al. *Neurology* 76, 2011 - use of microscopic stimuli to test tactile acuity
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