

Can you see what you feel? Tactile and visual perception of material properties



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Motivation

- How do we demonstrate that people are good at material perception? In the past, material perception was mostly studied with subjects judging visual attributes such as gloss and roughness.
- In the real-life, one example of successful material perception is being able to make visual prediction of how things feel.
- Using fabrics as stimuli and a multimodal task, we compared tactile and visual discrimination of material properties. Specifically, we studied the effect of temporal order of vision and touch on material discrimination.

Stimuli

- Stimuli are 35 common apparel fabrics laid on a bumpy object (size: 13 inch by 13 inch).
- There are 14 broad categories: sateen, silk, linen, broad cloth, corduroy, velveteen, fleece, denim, wool khaki, jersey, shirting, felt, flannel, twill.



Experimental Design



Paired-comparison task: the subject is asked to ONLY look at the two fabrics outside a box and ONLY touch the same fabrics inside the box. The task is to arrange the fabrics inside the box so that they are matched to the ones outside the box.

Experimental Manipulations

Task 1: One person looks and touches at the same time for 6 seconds. (n = 5)

Task 2: One person looks for 6 seconds, followed by tactile arrangements for 6 seconds. (n = 5)

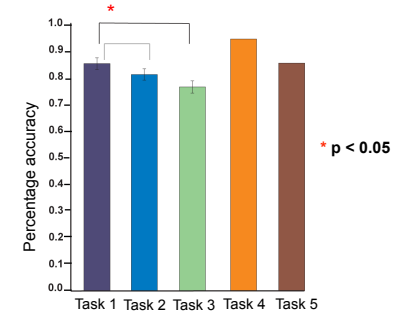
Task 3: One person touches for 6 seconds, followed by looking for 6 seconds and verbal reports of choices. (n=5)

Task 4: Two people perform the task: one looking, one touching and they communicate by words. The person who touches the fabrics also performs the arrangement. Unlimited time. (n = 1)

Task 5: Same as Task 4 except only the person who looks talks and the person who performs the tactile arrangement is not allowed to talk. (n = 1)

Results

Simultaneous looking and touching improves accuracy.



- Look and touch at the same time improves accuracy.
- Look first and touch next is slightly more accurate than touch first and look next.
- Two-way communication is better than one-way communication in the tasks including two people.
- There are 80% shared errors between Task 2 and 3.

Words used in describing visual differences

- **Usability:** t-shirt, jeans, pool-table cover, linen pants.
- **Mechanical:** bendable, movable, solid, firm.
- **Tactile:** soft, light, thick, fuzzy, thin, smooth, coarse, rough, warm, cool, liney, plastic.
- **Optical/texture:** parallel lines, dense, stripy, shinny, grainy, two sides being different.
- **Categories:** linen, felt, satin, denim, silk, cloth, corduroy, woven, burlap, fleece.
- **Shape:** curl-up on the side, has more shape, wrinkled.
- **Color:** iridescent.

Summary

- Matching visual and tactile discrimination of fabrics is fast. Higher accuracy is achieved when looking and touching are performed at the same time.
- Matching visual and tactile discrimination of fabrics through language description achieved high accuracy.
- Across different observers, limited vocabulary of visual differences is sufficient for tactile discrimination of fabrics.

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