Canonical Specular and Velvety Material Modes Form a Basic Feature in Visual Search

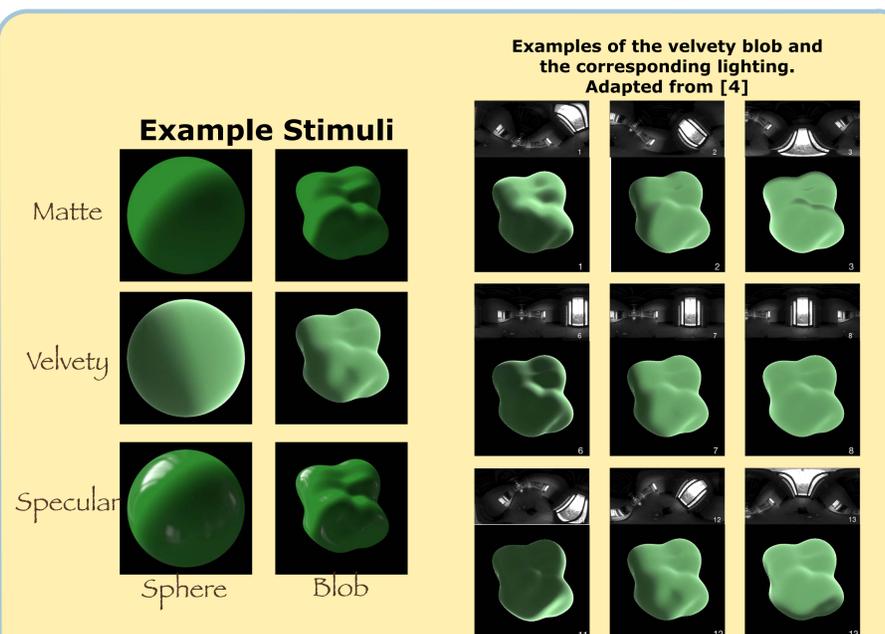Fan Zhang, Dietmar Heinke
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Introduction

- **Question:** Can materials guide our search in visual scenes?
- Wolfe and Myers [1] :
  - No efficient search for material "type" (e.g. fur v.s. stone, Flickr Material Database [2])
  - **Problem**: in-homogenousness of the material qualities (e.g. glossy, hard, natural [3]) per "type"
- Our study:
  - Three canonical material modes [4]: "matte", "velvety", "specular"
  - Per "mode": appearances varied as lighting oriented differently but homogenous in perceived material qualities
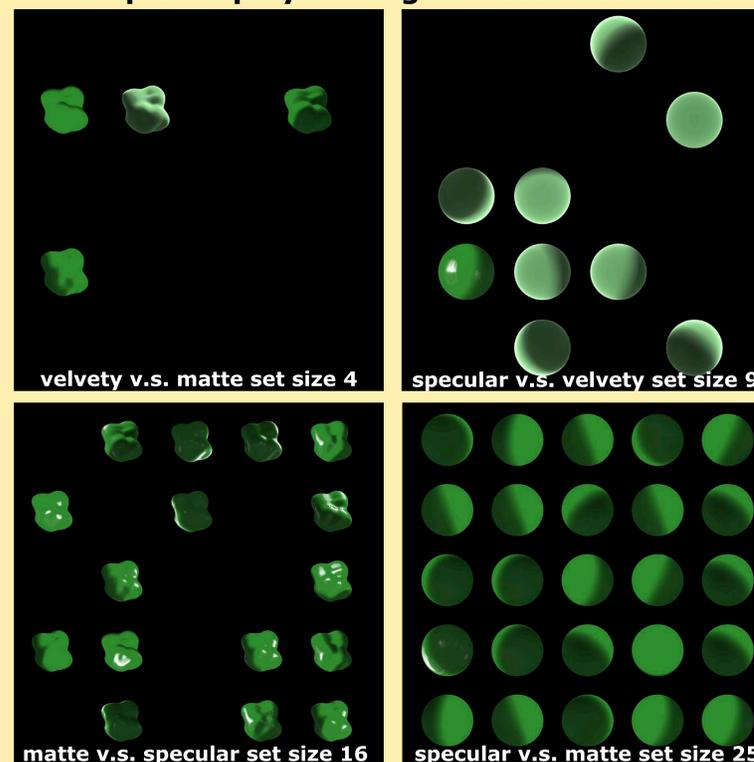 - Participants are expected to use material perception instead of sole perceptual features in searches

Method

- Standard visual search experiment
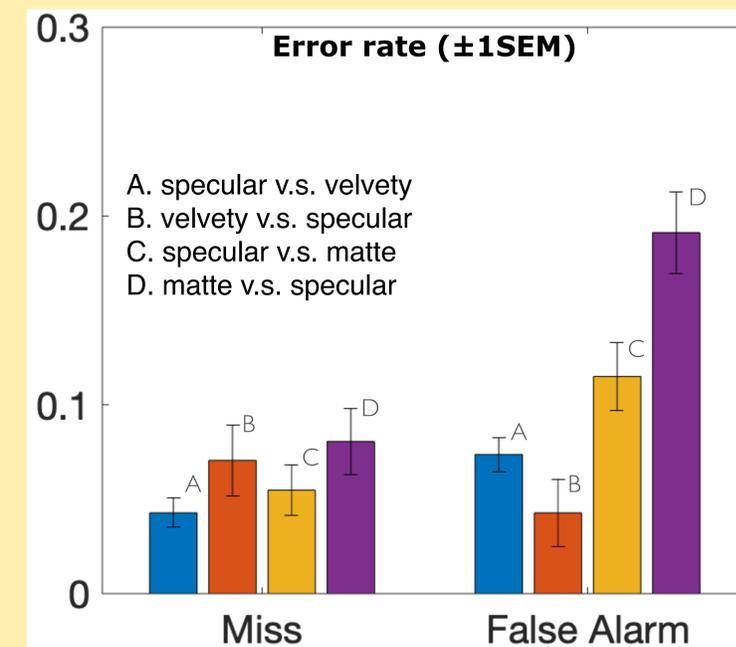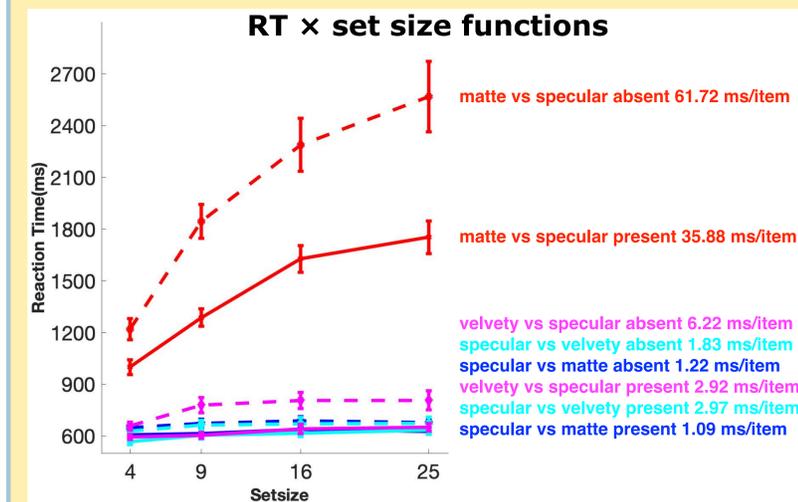- Students (age around 20) recruited as participants
- Setup overview:

	Exp. 1 (N=28)		Exp. 2 (N=20)		Exp. 3 (ongoing)	
Set Size	4, 9, 16, 25					
Materials	Material 1	Material 2	Material 1	Material 2	Material 1	Material 2
	Matte	Specular	Velvety	Specular	Matte	Velvety
Procedure	1st experiment block: search for Material 1 among Material 2					
	2nd experiment block: search for Material 2 among Material 1					
	Counterbalanced within-subjects design					
	Experiment conducted via *Gorilla.sc* & Monitored via *Zoom*					
	First present all images one by one, each 125x125 px					
	Two experiment blocks, each contains 16 practice trials and 384 experiment trials					
	(4 set sizes x 2 presence x 2 target material x 24 repetitions)					
	500ms fixation between trials + max. 50000ms RT per trial					

Example Stimuli

Examples of the velvety blob and the corresponding lighting. Adapted from [4]

Example Displays - Target Present Condition

velvety v.s. matte set size 4

specular v.s. velvety set size 9

matte v.s. specular set size 16

specular v.s. matte set size 25

Results

RT × set size functions

matte vs specular absent 61.72 ms/item

matte vs specular present 35.88 ms/item

velvety vs specular absent 6.22 ms/item
specular vs velvety absent 1.83 ms/item
specular vs matte absent 1.22 ms/item
velvety vs specular present 2.92 ms/item
specular vs velvety present 2.97 ms/item
specular vs matte present 1.09 ms/item

Error rate (±1SEM)

A. specular v.s. velvety
B. velvety v.s. specular
C. specular v.s. matte
D. matte v.s. specular

Summary

- Specular and velvety constitutes a basic feature in the sense of Treisman's Feature integration Theory
- This study presents a first evidence that material perception may extract basic features
- To strengthen our claim further studies will be tested in laboratory environment with more material modes included and controlling for low level features

Reference
[1] Wolfe, J., & Myers, L. (2010). Fur in the midst of the waters: Visual search for material type is inefficient. *Journal of Vision*, *10*(9), 8-8.
[2] Sharan, L., Rosenholtz, R., & Adelson, E. (2009). Material perception: What can you see in a brief glance?. *Journal of Vision*, *9*(8), 784-784.
[3] Fleming, R., Wiebel, C., & Gegenfurtner, K. (2013). Perceptual qualities and material classes. *Journal of vision*, *13*(8), 9-9.
[4] Zhang, F., de Ridder, H., Barla, P., & Pont, S. (2020). Effects of light map orientation and shape on the visual perception of canonical materials. *Journal of vision*, *20*(4), 13-13.