

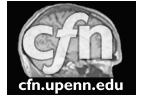
Black and white issues: color perception and object color knowledge

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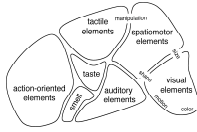


INTRODUCTION

- Are the neural substrates of perception also employed in conceptual knowledge retrieval?

- Evidence for co-localization of conceptual and perceptual processing of color:

- In color perceptual regions, activity during color knowledge > motor knowledge (Simmons et al., 2007)
 - More activity in color perceptual regions when making within-color than between-color category discriminations (Thompson-Schill et al., 2003).



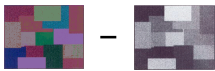
From Thompson-Schill et al., 2006

- Most studies use a chromatic > grayscale contrast to define color-sensitive regions (e.g., Beauchamp et al., 1999; Chao & Martin, 1999) but a similar distinction between chromatic and achromatic knowledge of objects has yet to be made:

Color perception:



Stimuli from Thompson-Schill et al., 2003



Stimuli from Chao & Martin, 1999

Color knowledge:

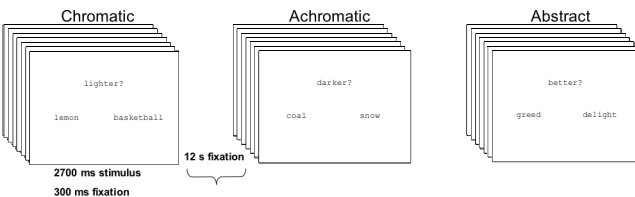
BANANA
 APPLE
 SNOW
 BULLDOZER
 COAL
 LEMON
 FORK

In color perceptual regions that are defined this way, we might expect activity during retrieval of "chromatic color knowledge" (e.g., bananas are yellow) to be greater than "achromatic color knowledge" (e.g., crows are black).

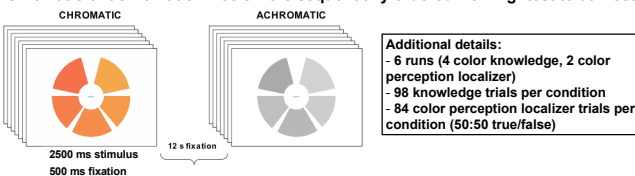
METHODS

Subjects: 18 subjects (8 males, mean age = 23.1) were recruited and scanned on a 3T Siemens Trio system. They performed a practice version of the task 1-2 days prior to the scan and received \$25 for their participation.

COLOR KNOWLEDGE TASK:



COLOR PERCEPTION (LOCALIZER) TASK: Subjects determined whether wedges on chromatic or achromatic wheels were sequentially ordered from lightest to darkest.



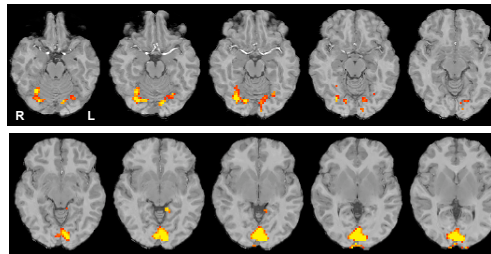
Additional details:
 - 6 runs (4 color knowledge, 2 color perception localizer)
 - 98 knowledge trials per condition
 - 84 color perception localizer trials per condition (50:50 true/false)

QUESTION

Does the retrieval of information about chromatic and achromatic object colors differentially engage cortical regions involved in color perception?

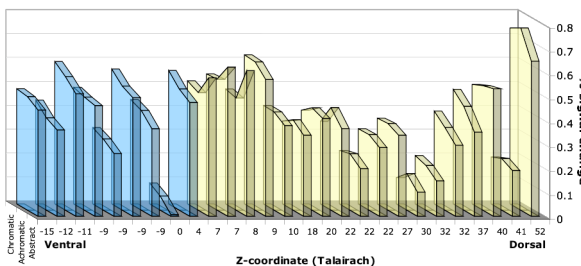
RESULTS

Color Perceptual Localizer ($p < 0.001$, uncorrected) determined across subjects the regions that responded to chromatic > achromatic wheels:



Spherical masks were drawn around all 27 local maxima, identifying voxels that survive the $p < 0.001$ (uncorrected) threshold.

We then tested to see whether activity in these areas was differentially modulated by the retrieval of chromatic, achromatic and abstract knowledge.



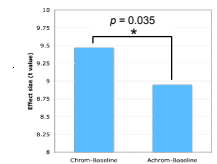
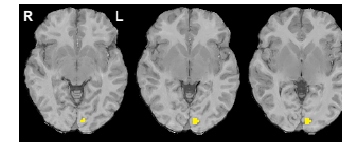
Voxels in all 9 ventral masks demonstrated greater activity during retrieval of chromatic than either achromatic or abstract knowledge.

Binomial test between chromatic and achromatic knowledge retrieval:
 Ventral masks ($p < 0.004$) Dorsal masks ($p = 0.481$)

REFERENCES

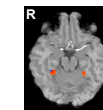
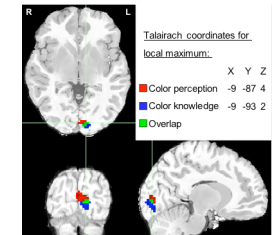
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RESULTS (continued)



Using a permuted threshold of $p < 0.05$ yielded an ROI in the left lingual gyrus, in which there was significantly more activity during chromatic than achromatic knowledge retrieval.

We observed direct overlap between color perception (Chr > Achr) and color knowledge retrieval (Chr > Achr) by identifying the top 50 voxels in ventral occipito-temporal cortices from each task.



	(Chrom + Achrom) - Abstract		Chrom - Achrom	
	t	p	t	p
L FFG	8.051	< 0.0001	0.621	0.542
R FFG	4.322	0.0005	0.499	0.624

Bilateral anterior fusiform gyri were previously shown to be recruited during color knowledge retrieval (e.g., Howard et al., 1998; Simmons et al., 2007). Neither region demonstrated significantly greater activity for chromatic than achromatic knowledge retrieval. All regions were recruited more for object than abstract knowledge.

DISCUSSION

We find that:

- 1) in ventral color perception regions, activity is differentially modulated by the retrieval of chromatic and achromatic knowledge
- 2) there is direct overlap of activity in the left lingual gyrus during both color perception and color knowledge retrieval

These results differ slightly from previous studies of color knowledge retrieval and may reflect our use of a more demanding color knowledge task to modulate activity. Taken with other reports of co-localization, these results may help to characterize resolution of information along the ventral anterior-posterior axis.

ACKNOWLEDGEMENTS

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