Speed of Material vs. Object Recognition Depends Upon Viewing Conditions

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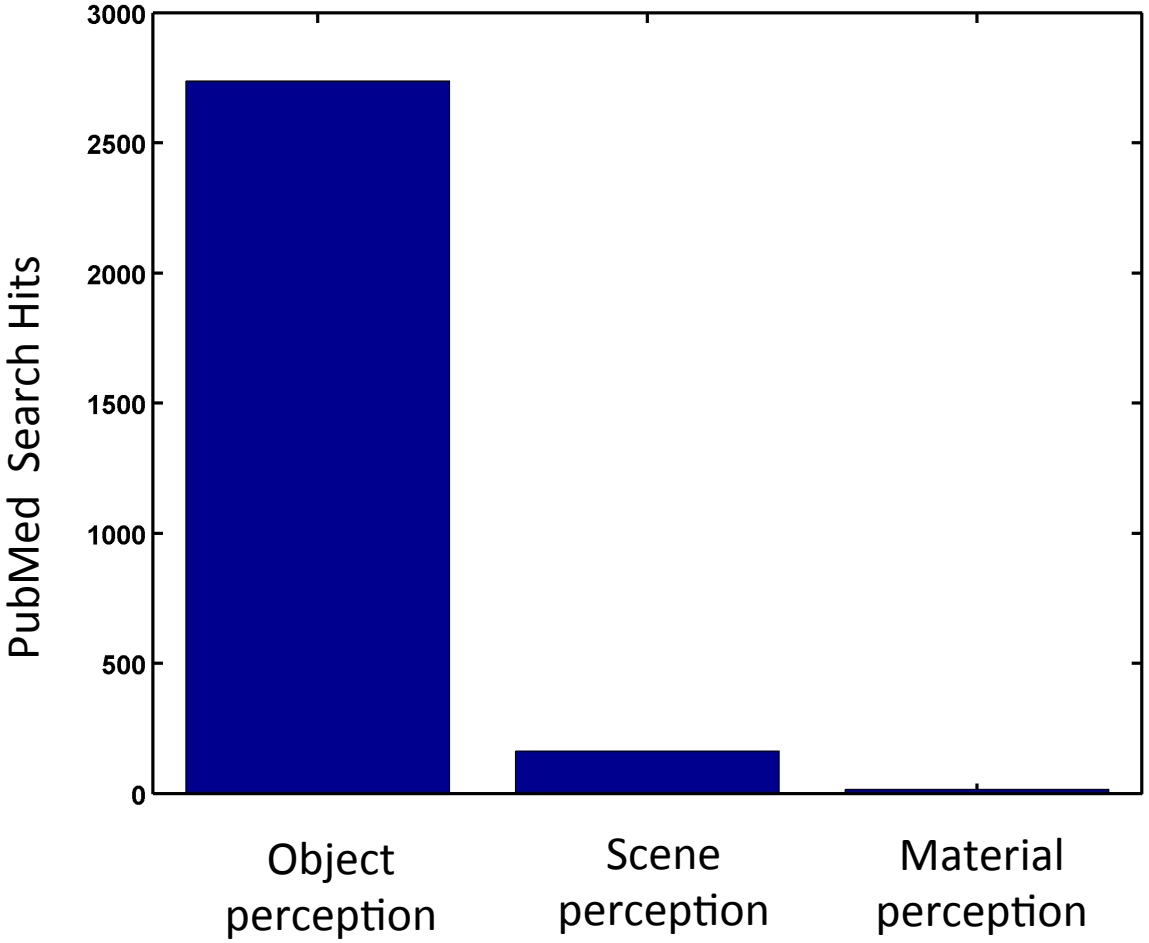
Material recognition is important for selecting donuts!

Courtesy Aude Oliva

We know very little about material perception



Material recognition is different from object recognition!

http://www.thehazelbloom.com/2010/08/vanilla-apricot-jam/

Questions

1. How fast is material recognition?

Object and scene recognition is very fast (Biderman et al. 1974; Porter, 1975, 1976; Thorpe et al, 1996, Greene 2008).

Sharan et al. 2011 find that material recognition is fast, but slower than object recognition.

Questions

2. Does the speed of material recognition depend on viewing conditions?

Object recognition might be view-point invariant (Poggio, 1999; Ullman 1999; Biederman 1987, Wallis 1997; Yuille 2006, Dicarlo 2000; See review Dicarlo 2007)

Little is known about the invariance of material recognition.

This is a sleeveless cardigan!

http://www.calvinklein.com/

This is a sleeveless cardigan made with linen blend!

http://www.calvinklein.com/

This is a sleeveless cardigan made with linen blend!

Linen blend

?

http://www.calvinklein.com/

Questions

1. How fast is material recognition?

2. Does the speed of material recognition depend on viewing conditions?

We use a 2×2 design to study material and object discrimination

Material

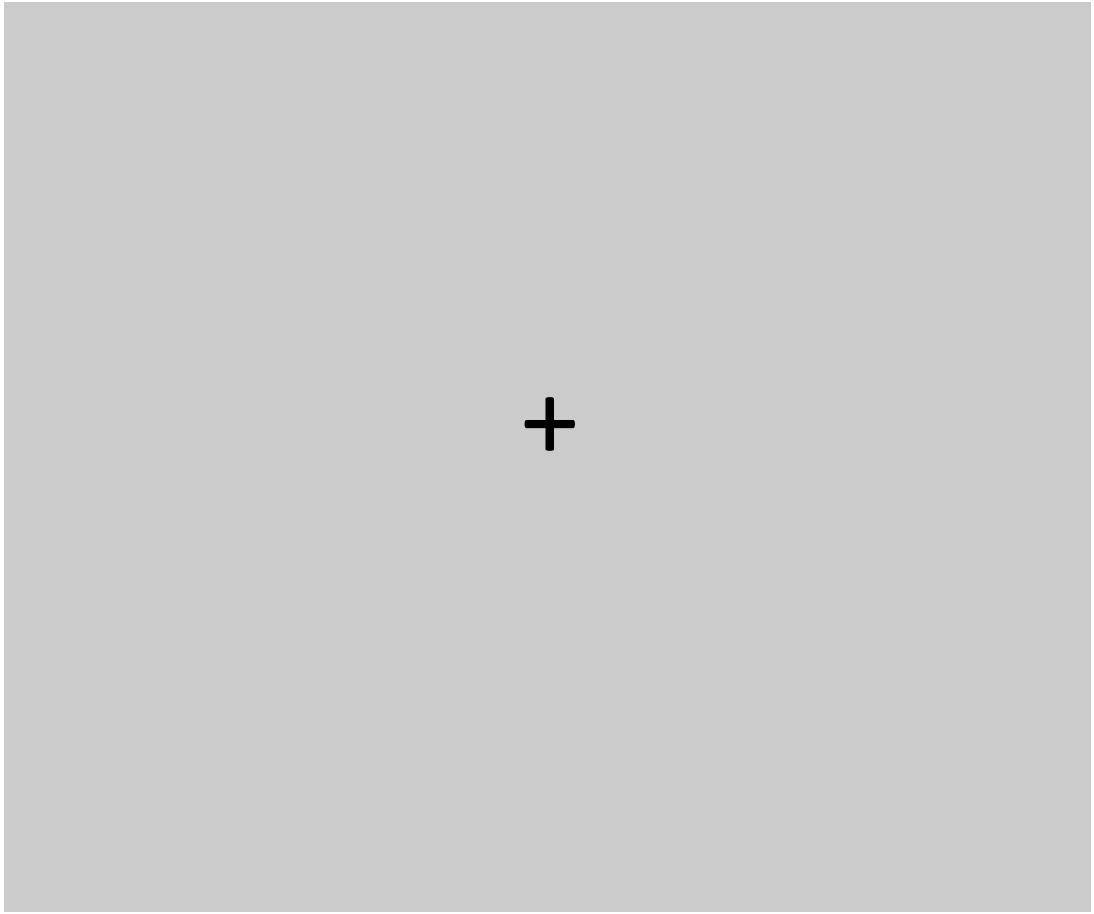
Object	Fabric	Leather
Gloves		
Hand-bags		

Regular View vs Close-up View

Regular view

Close-up view

2AFC task of material discrimination

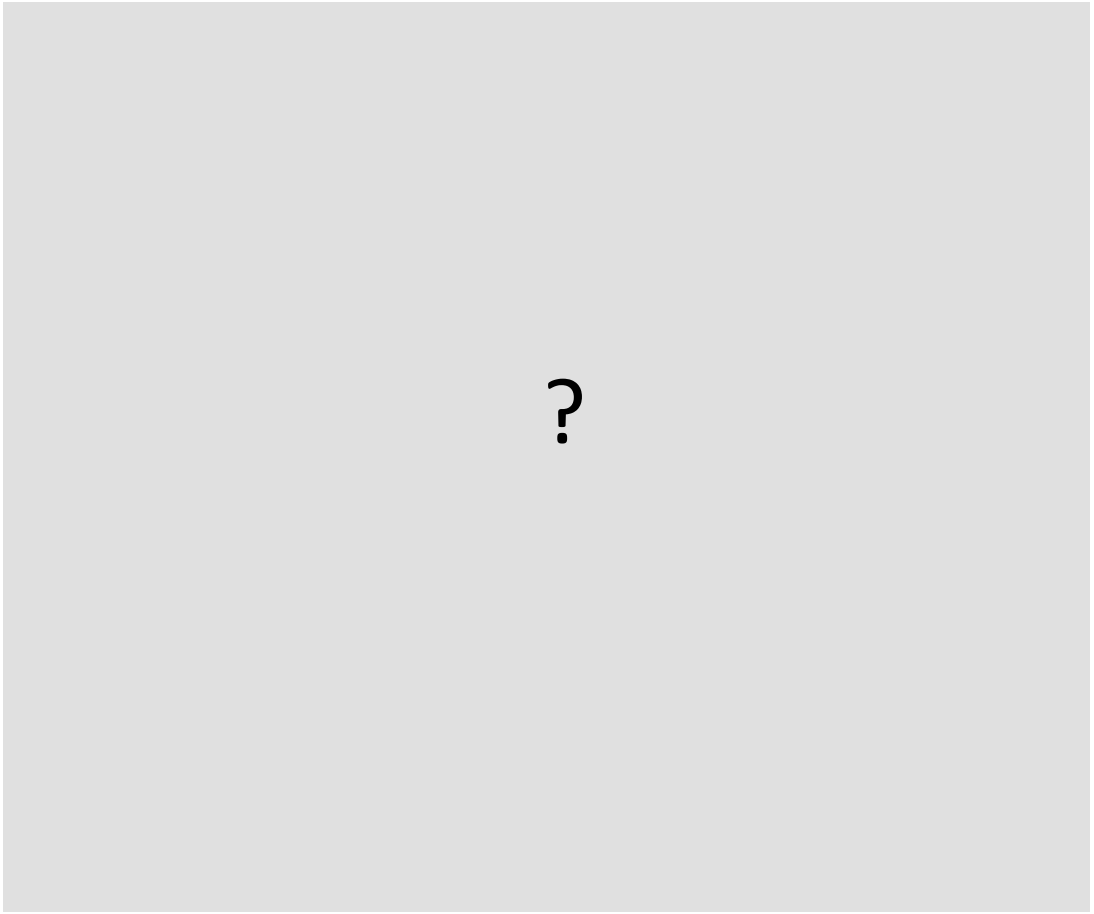


2AFC task of material discrimination

500ms

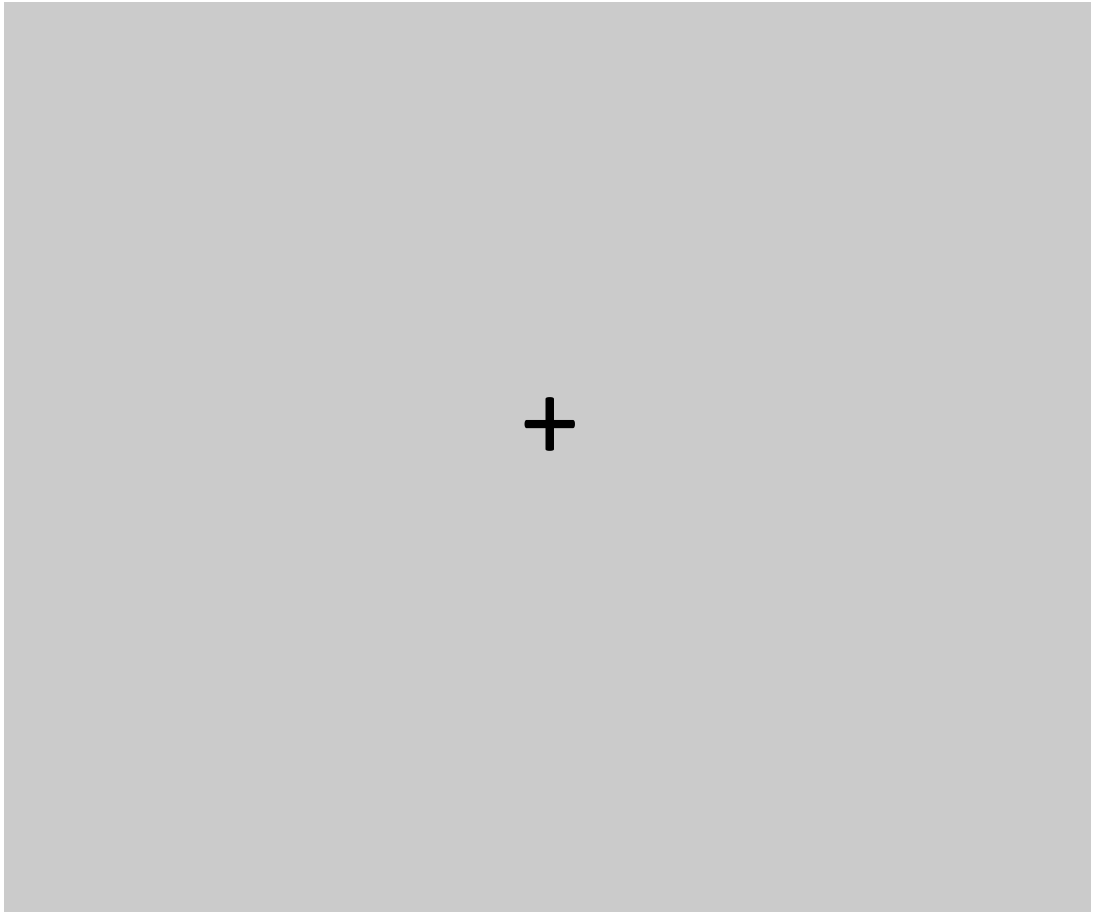
2AFC task of material discrimination

Response



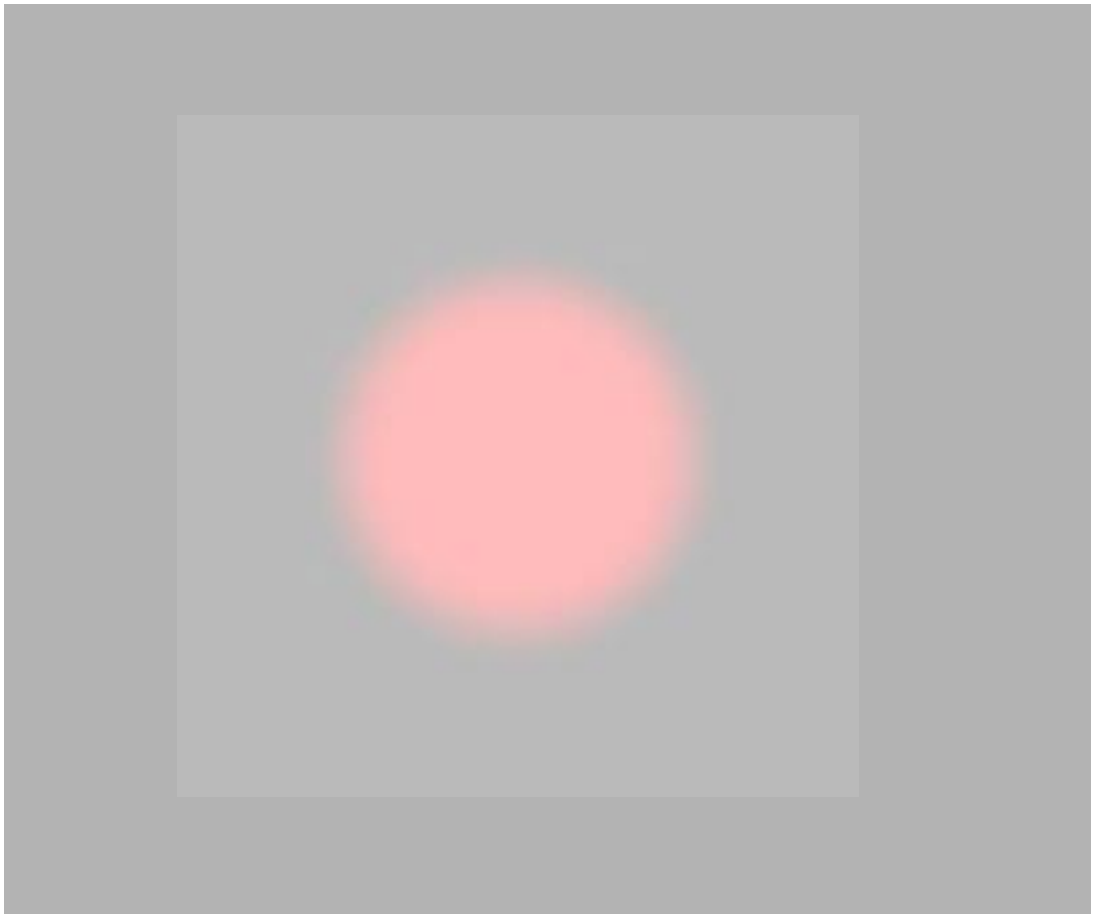
ISI = 500ms

Baseline task: color discrimination

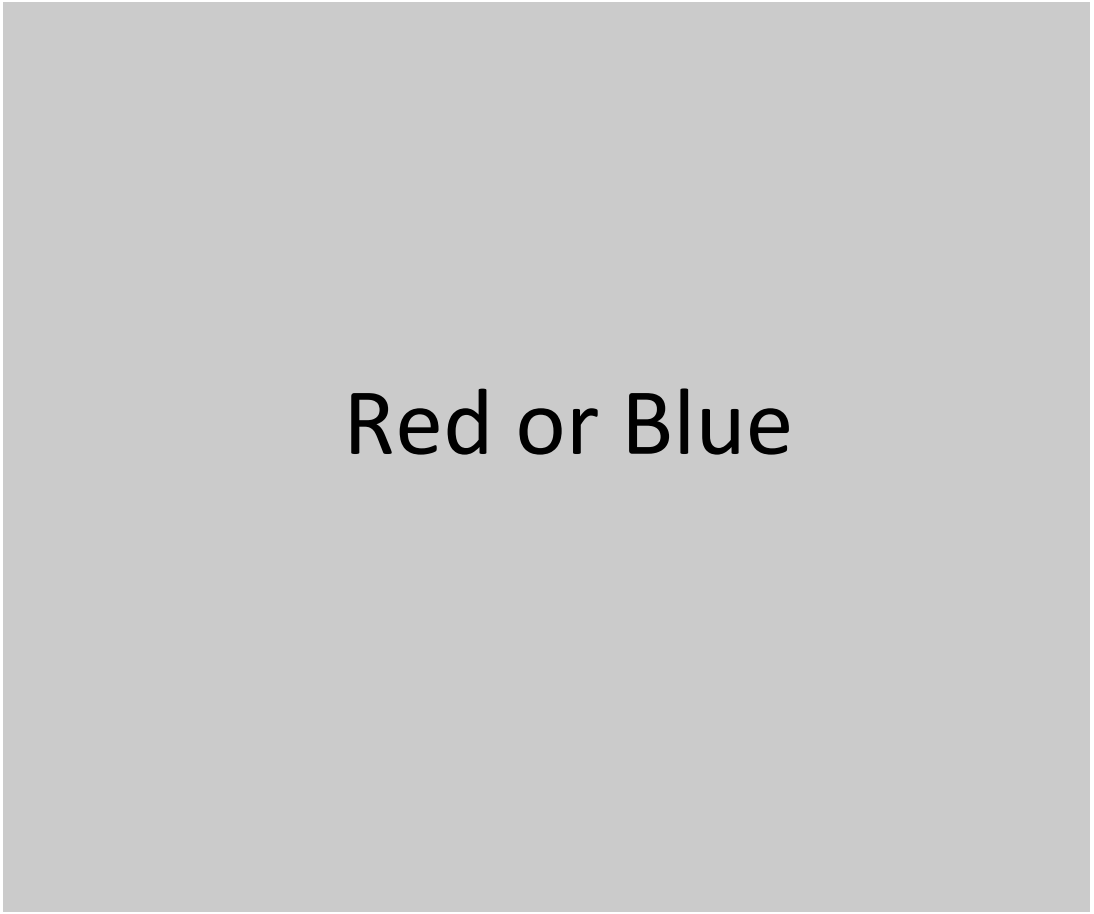


Baseline task: color discrimination

500 ms

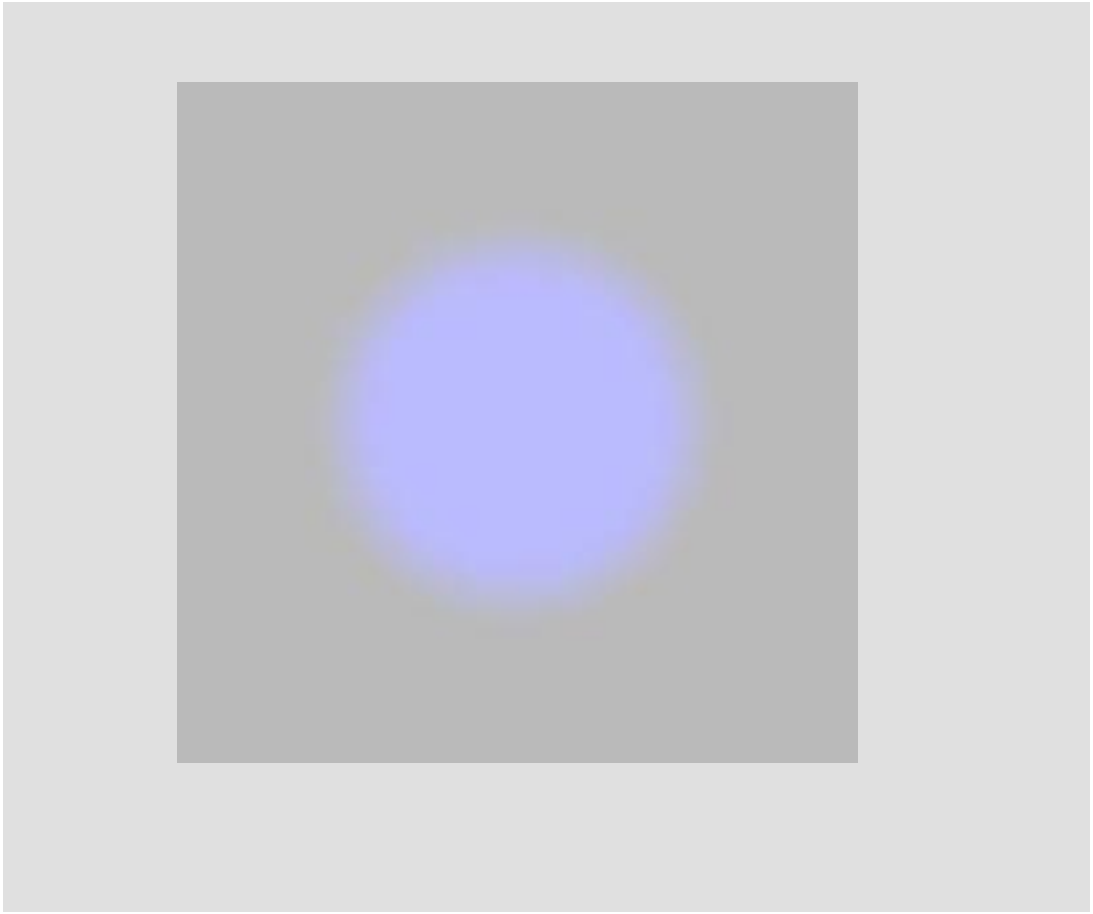


Baseline task: color discrimination

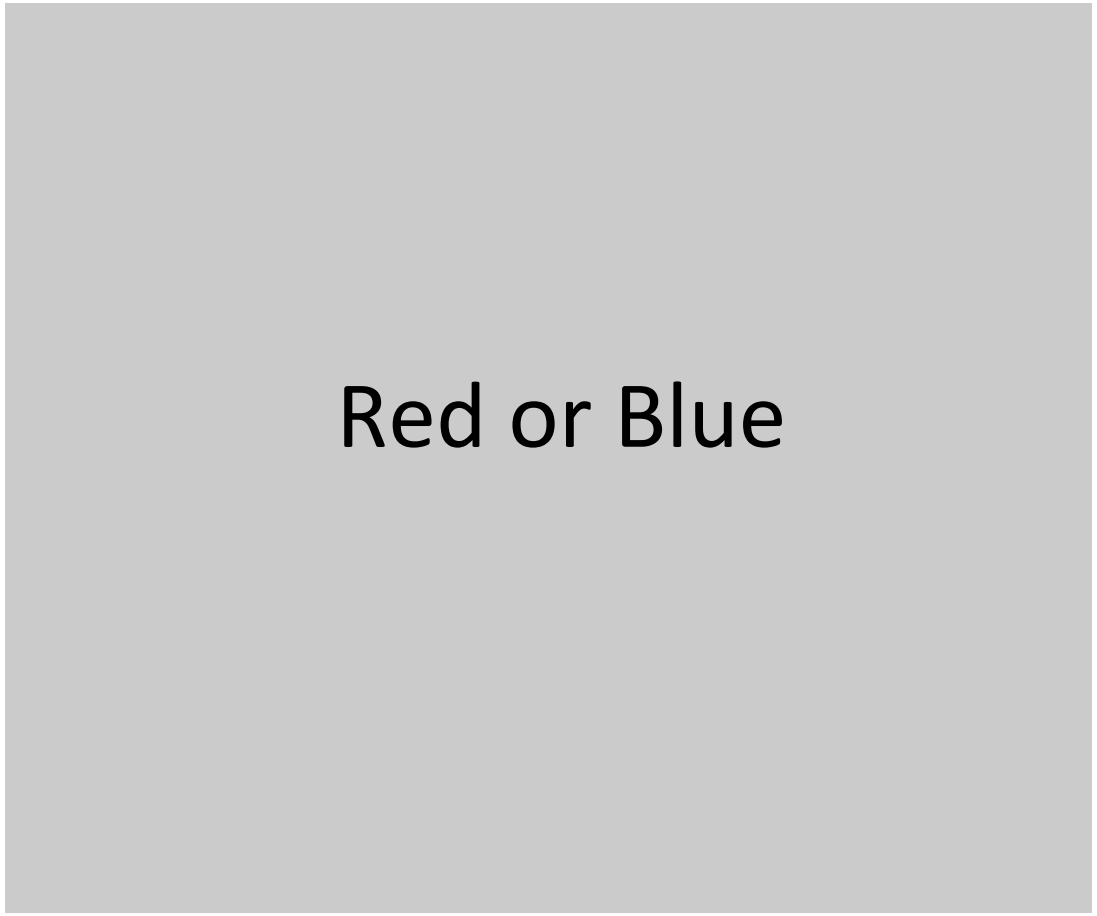


Baseline task: color discrimination

500 ms



Baseline task: color discrimination



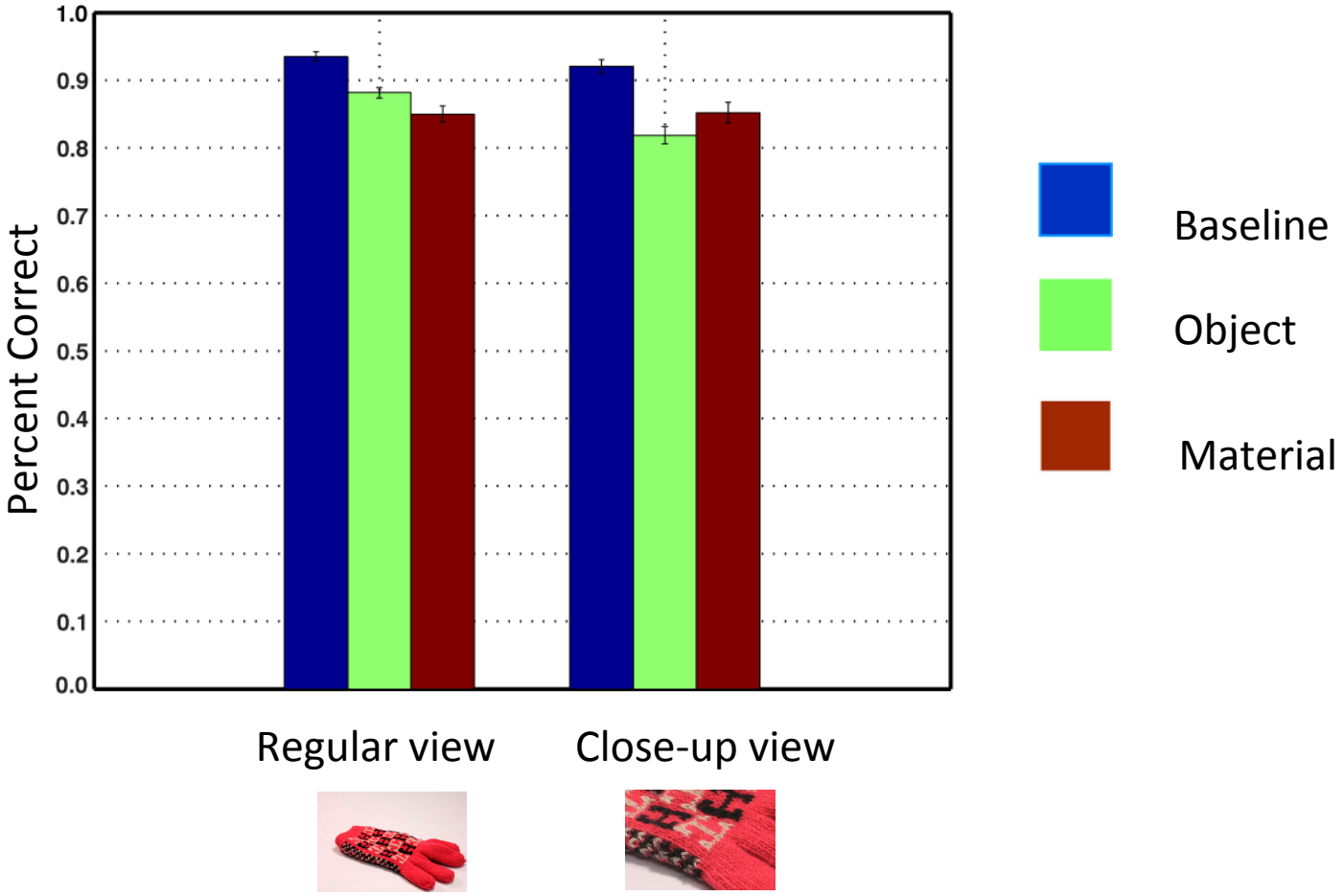
Summary of conditions

- Two tasks : material and object discrimination

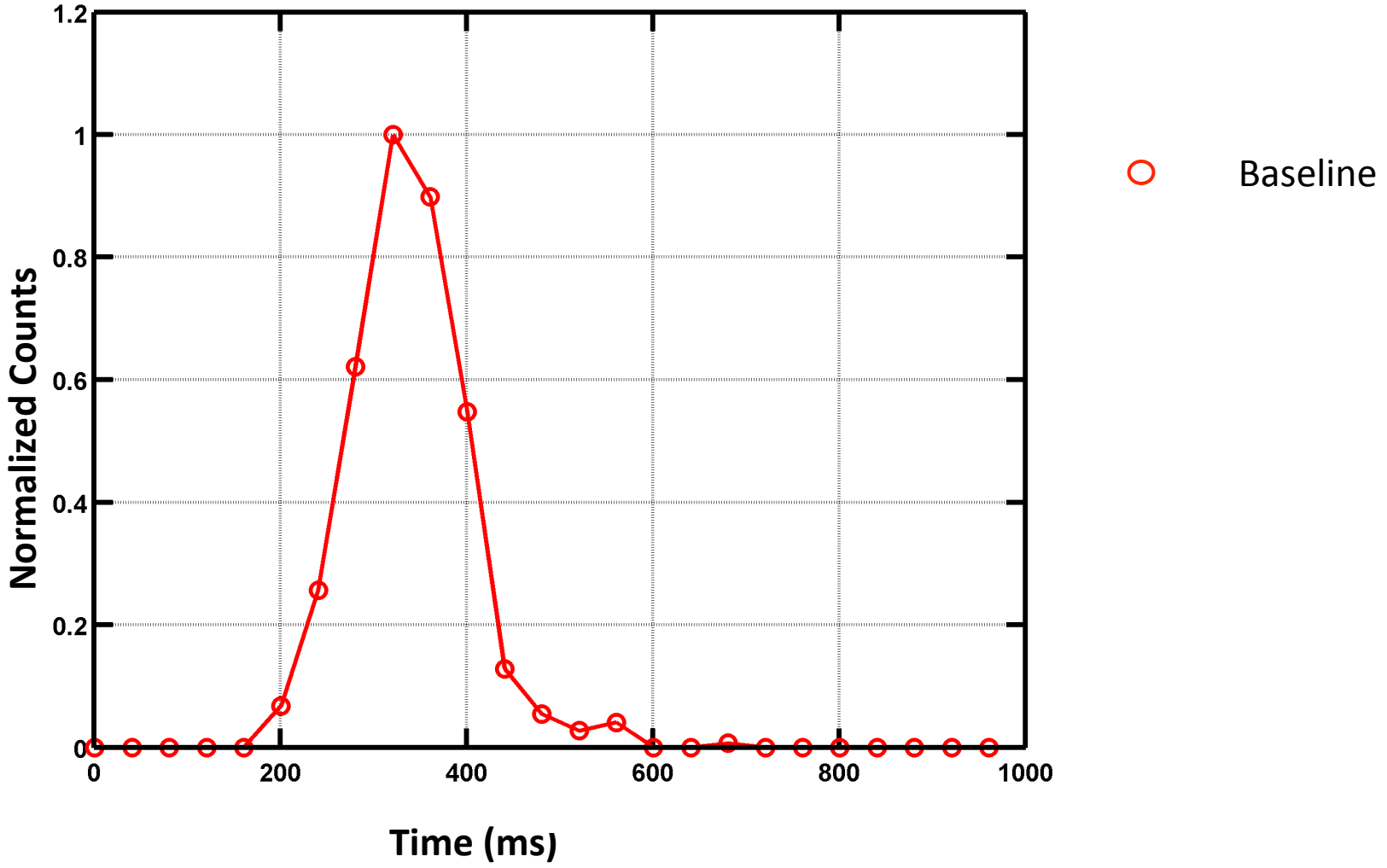
- Two zoom-levels: normal views and close-up views (30 images of bags; 30 images of gloves)

- 9 observers completed the material task and 9 observers completed the object task.

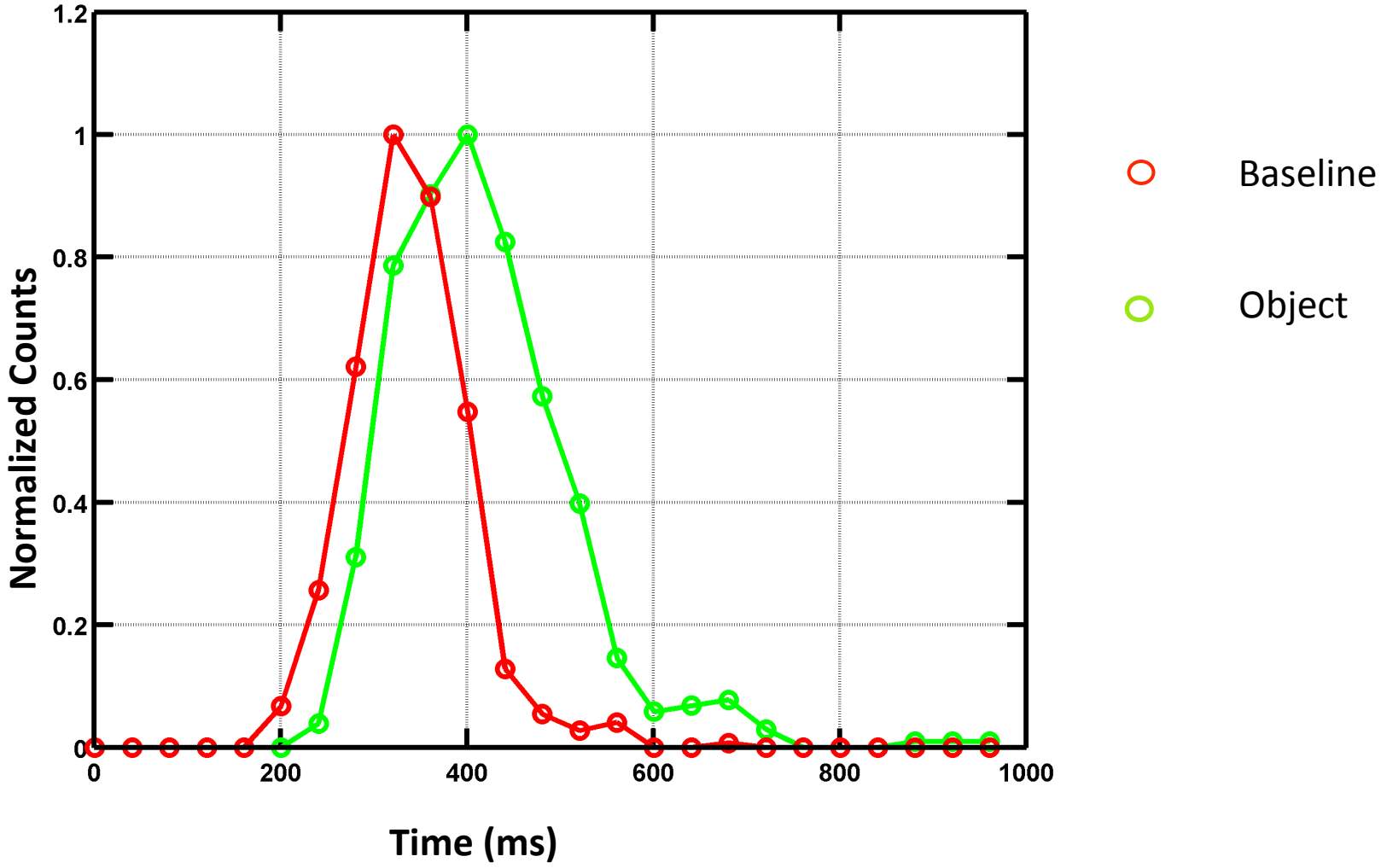
Results: Mean percent correct of two views are similar



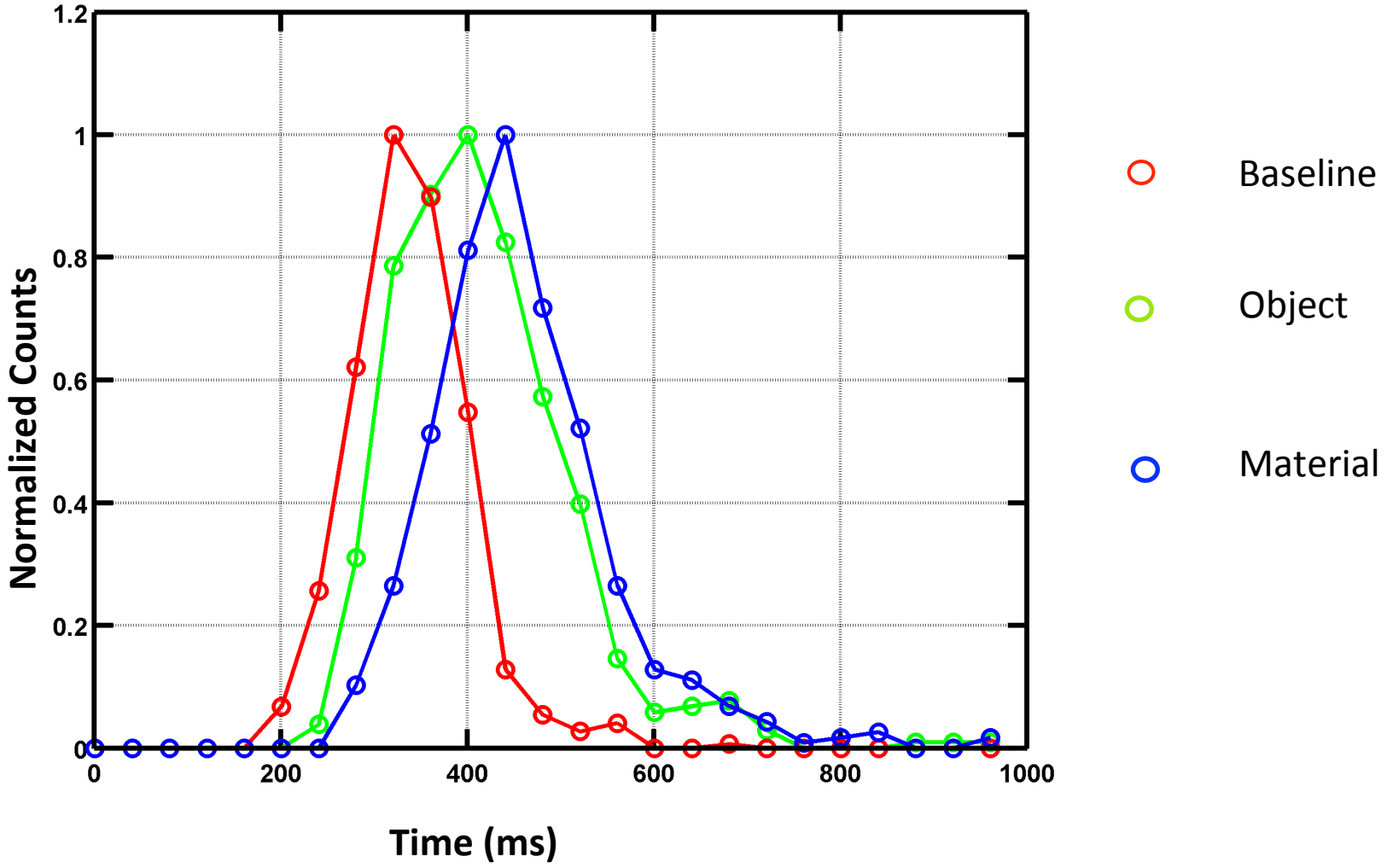
Results: Distribution of Reaction times for two tasks (Regular View)



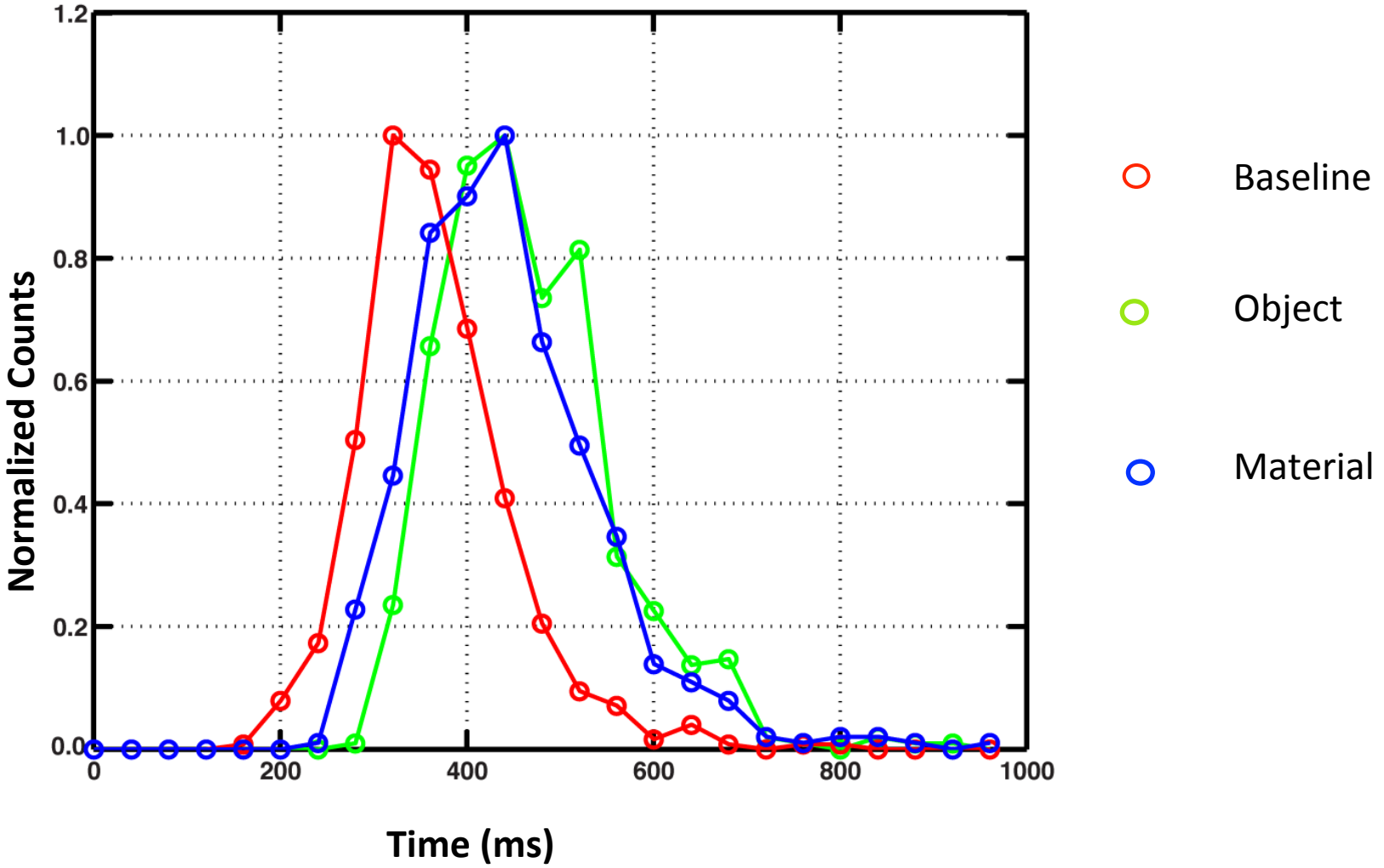
Results: Distribution of Reaction times for two tasks (Regular View)



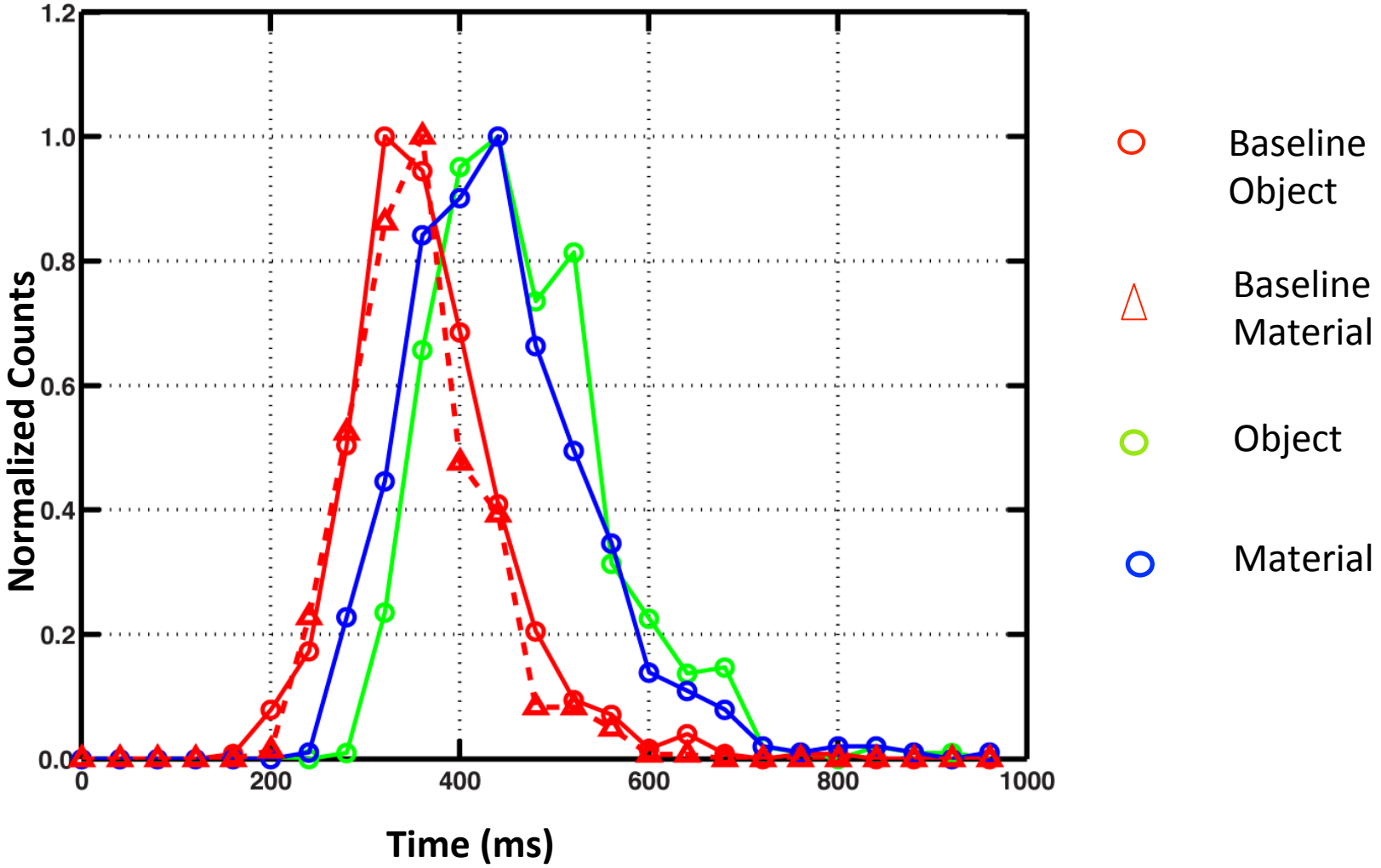
Results: Distribution of Reaction times for two tasks (Regular View)



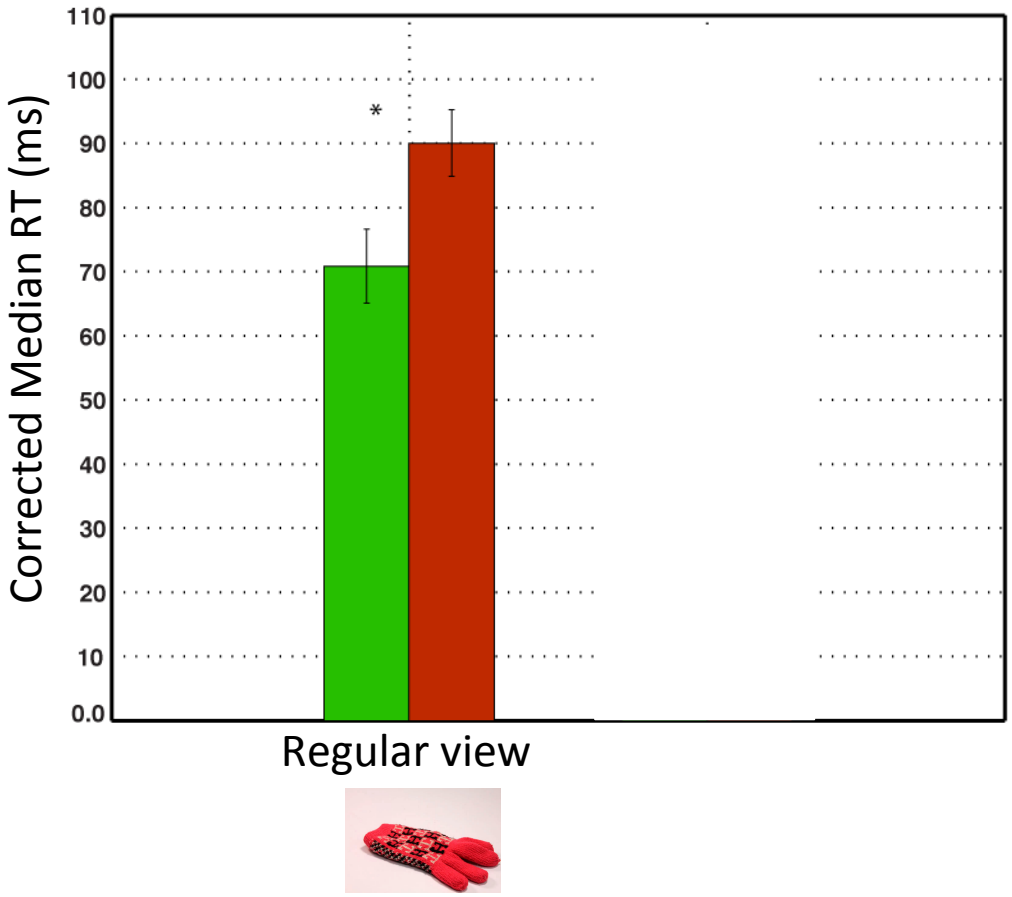
Results: Distribution of Reaction times for two tasks (Close-up View)



Results: Distribution of Reaction times for two tasks (Close-up View)

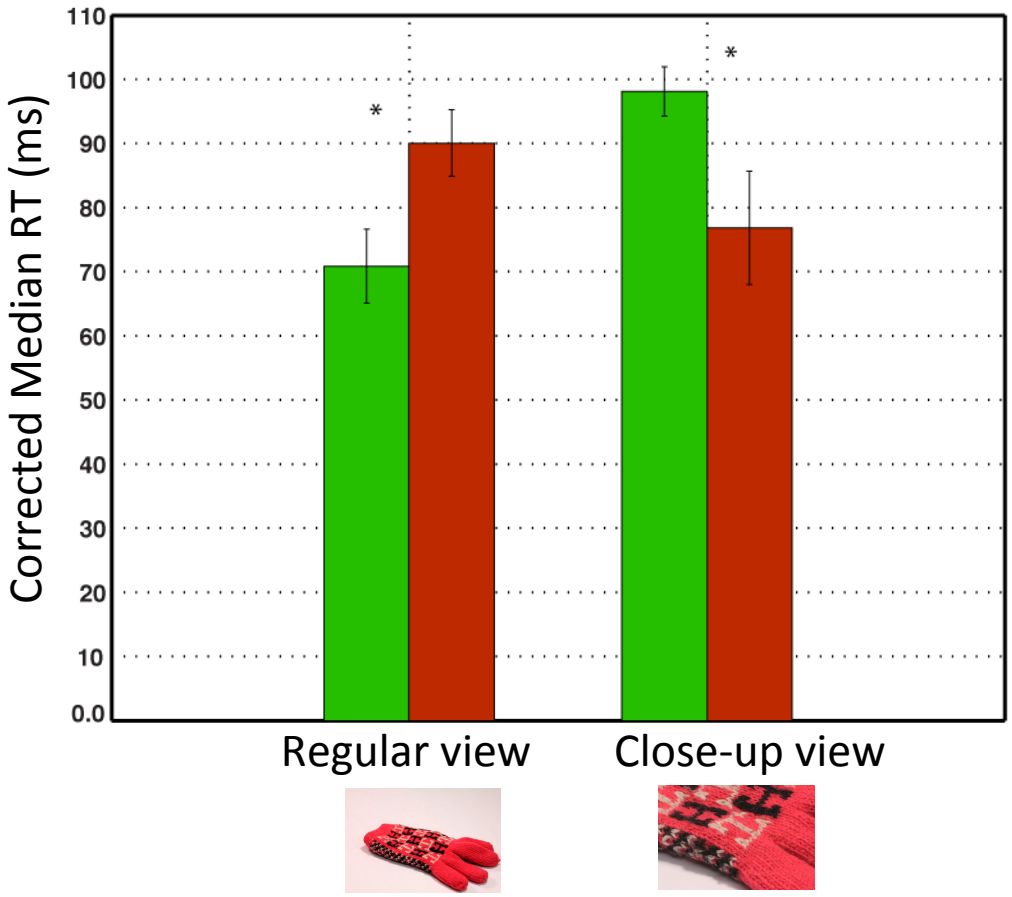


Results: Median baseline-corrected reaction time for two tasks



* Bootstrap $p < 0.05$

Results: Effect of tasks on baseline-corrected reaction time of two zoom levels



* Bootstrap $p < 0.05$

Questions

1. How fast is material recognition?

2. Does the speed of material recognition depend on viewing conditions?

Summary

• Material recognition is slower than object recognition under regular views.

• Material recognition is faster than object recognition when the images are zoomed in.

Implications

- These results suggest that material recognition may be a separate process from object recognition, and might involve different cortical processes

- The optimal range for material recognition from images might be different from that of the object recognition.

Acknowledgement

Ted Adelson and Ruth Rosenholtz

Lavanya Sharan

Results: Distribution of Reaction times for two tasks (Regular View)