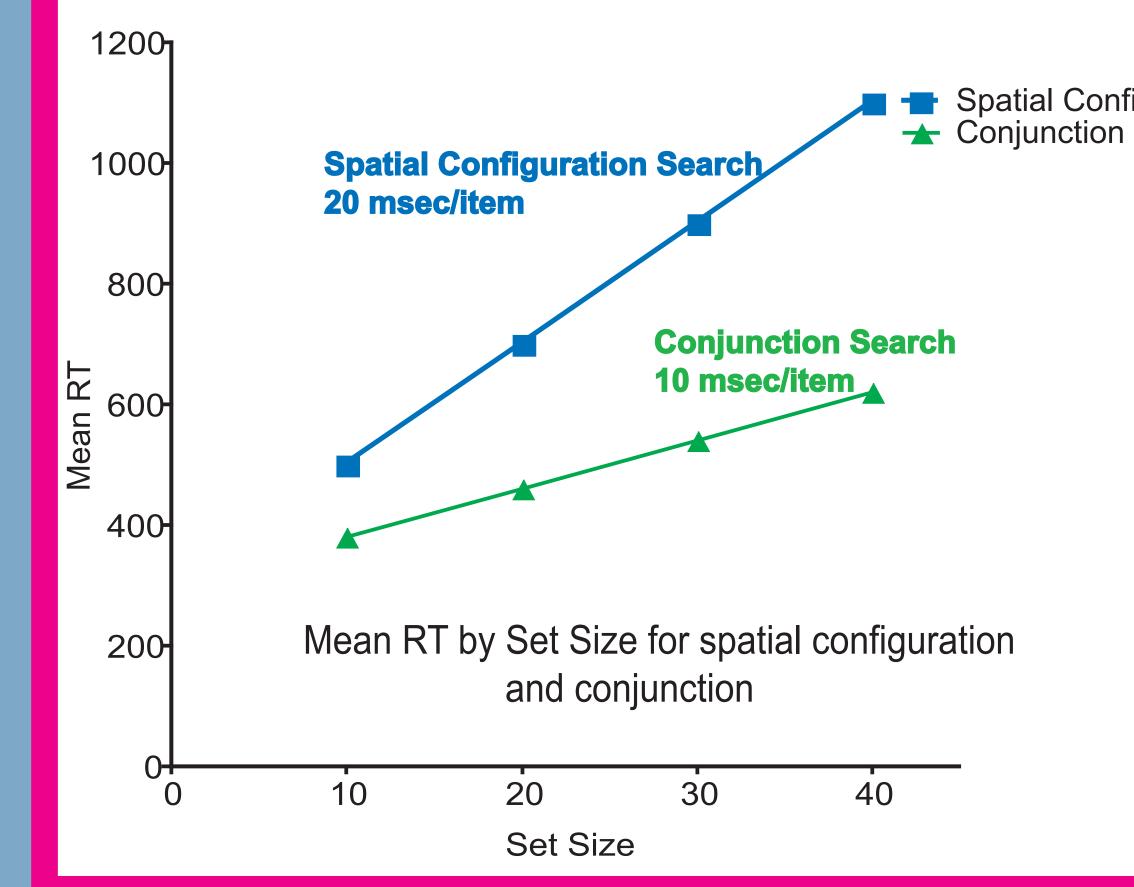
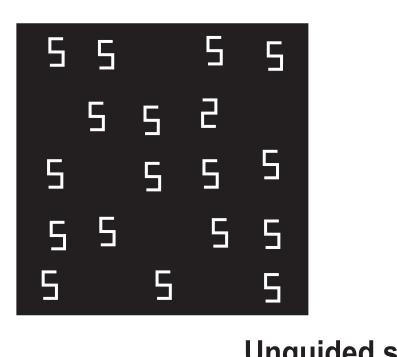
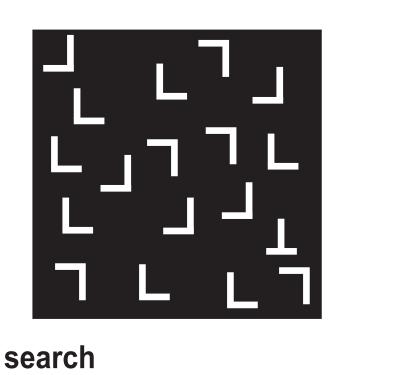
Vision Sciences Society 2004

In visual search, it is assumed that RT by set size functions are LINEAR



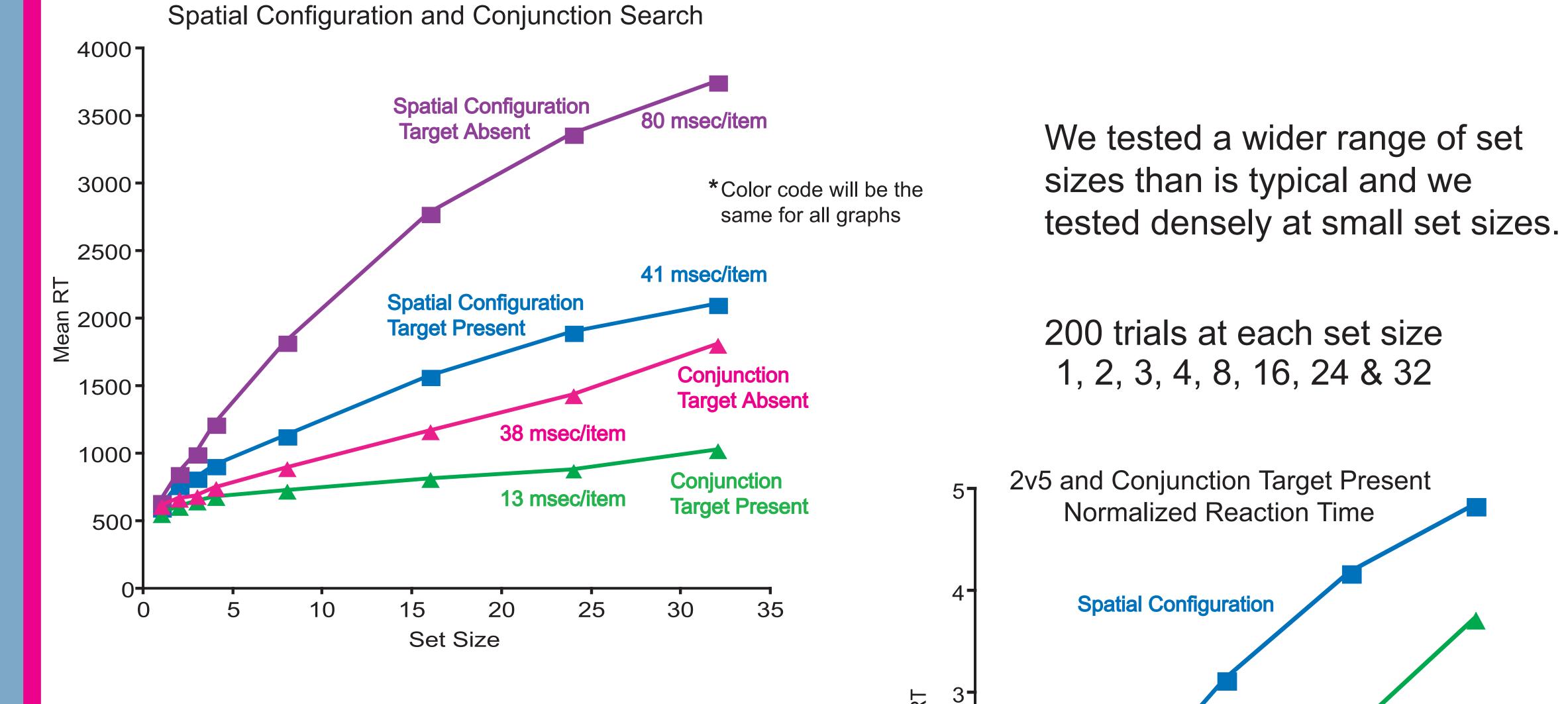




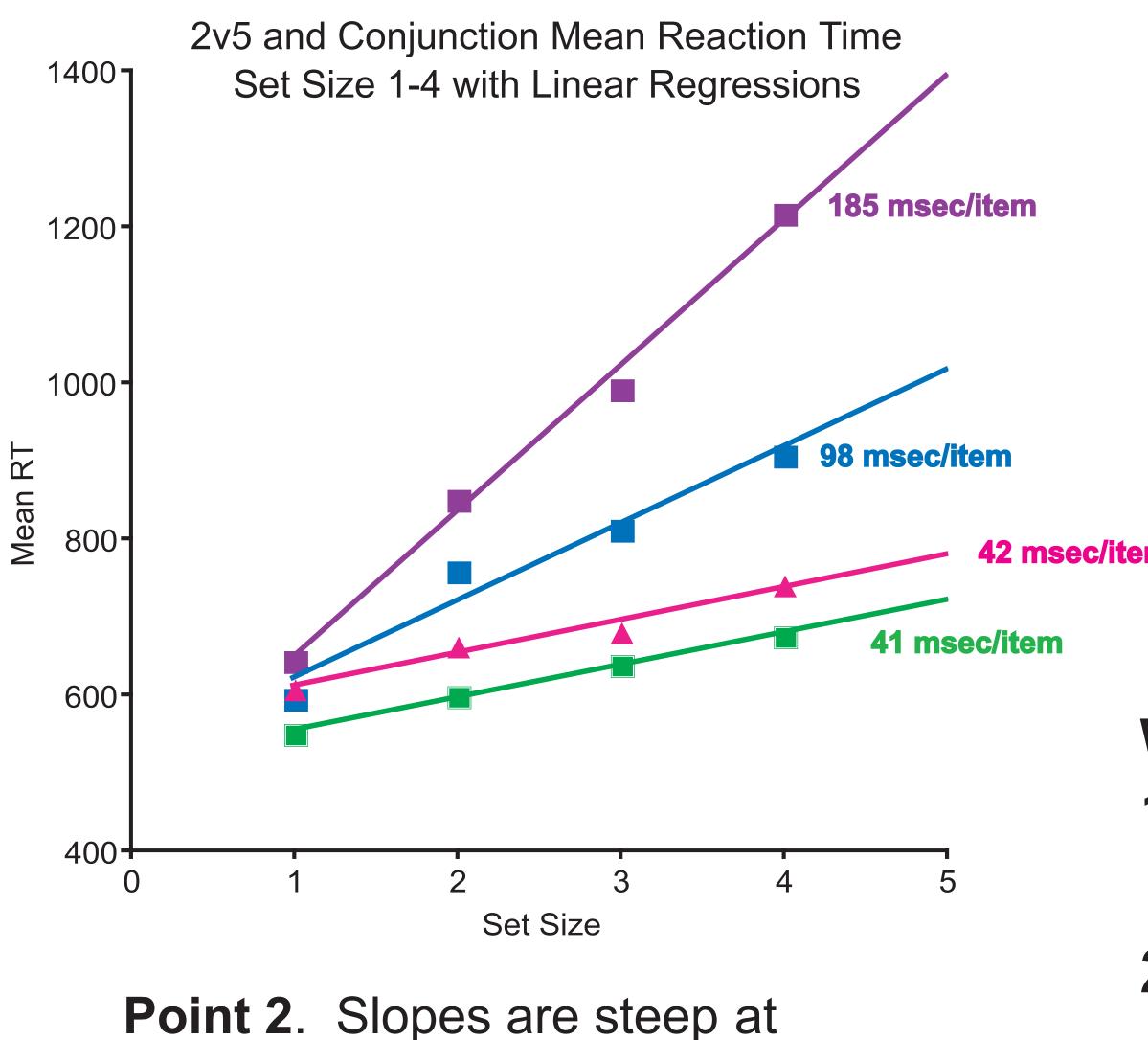
searching for a red vertical bar searching for a 2 among fives among green vertical and red horizontal bars or a T among Ls

Spatial configuration and conjunction search produce linear RT by set size functions. Any departure from linearity is attributed to a speed accuracy trade-off.

Today's news: RT by set size functions are NON-LINEAR Mean Reaction Time by Set Size



Point 1. RT by set size functions are non-linear.



small set sizes.

Point 3. The non-linearity is proportionally greater for conjunction search than for spatial configuration search.

(Mean RT ssN - Mean RT ss1)

WE HYPOTHESIZE:

- . Two factors contribute to the non-linearity.
- 2. One factor is the time required to begin guided search.

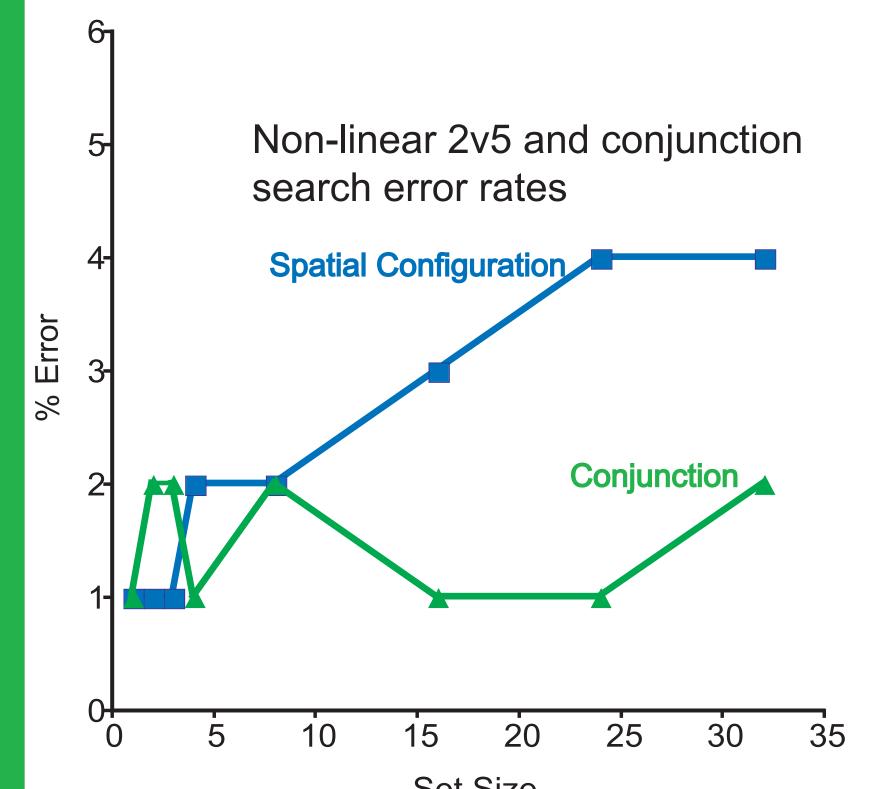
This research was supported by a grant from the National Eye Institute. Thank you!

Does guidance take time to develop during a visual search trial? 1 Kristin O. Michod, 1,2 Jeremy M. Wolfe, 1,2 Todd S. Horowitz, 1,2 Evan M. Palmer 1 Brigham and Women's Hospital, 2 Harvard Medical School

Alternative Hypotheses

Is the non-linearity due to a speed-accuracy trade-off?

If non-linear search results are due to a speed-accuracy trade-off, we would except error rates to increase as a function of decreased reaction time.



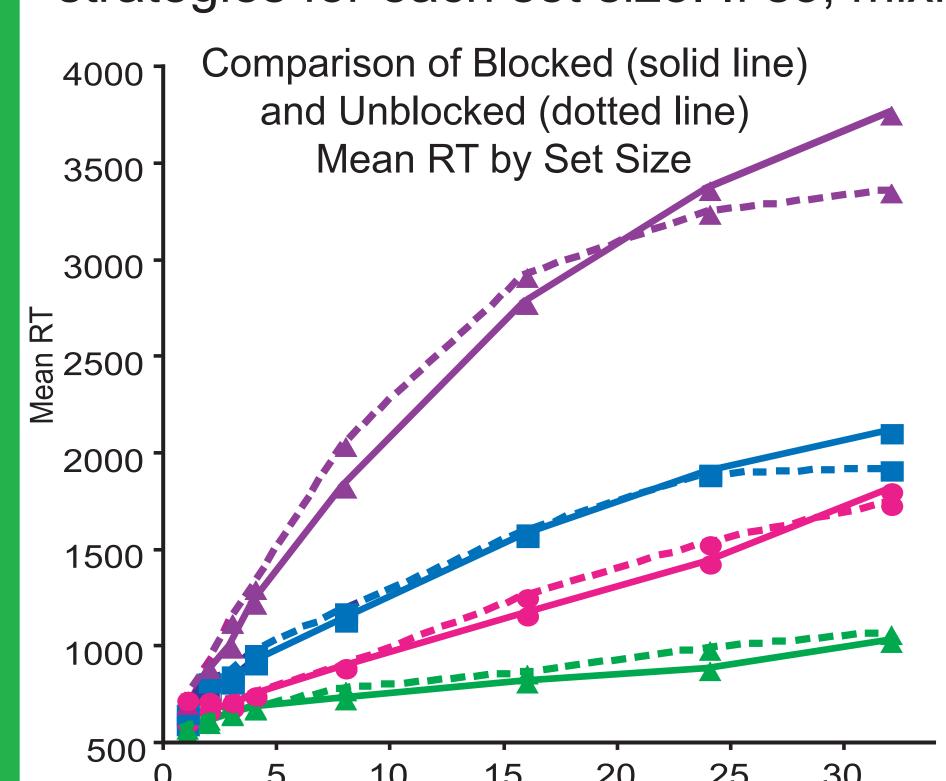
Error rates for conjunction search do not increase with set size.

Error rates for spatial configuration search are quite low (under 5%).

With standard corrections for speedaccuracy trade-offs, these errors do not fully explain these non-linearities.

Are subjects adopting different strategies for different set sizes?

Since original set sizes were blocked, subjects may have been adopting different strategies for each set size. If so, mixing set sizes should eliminate non-linearity.

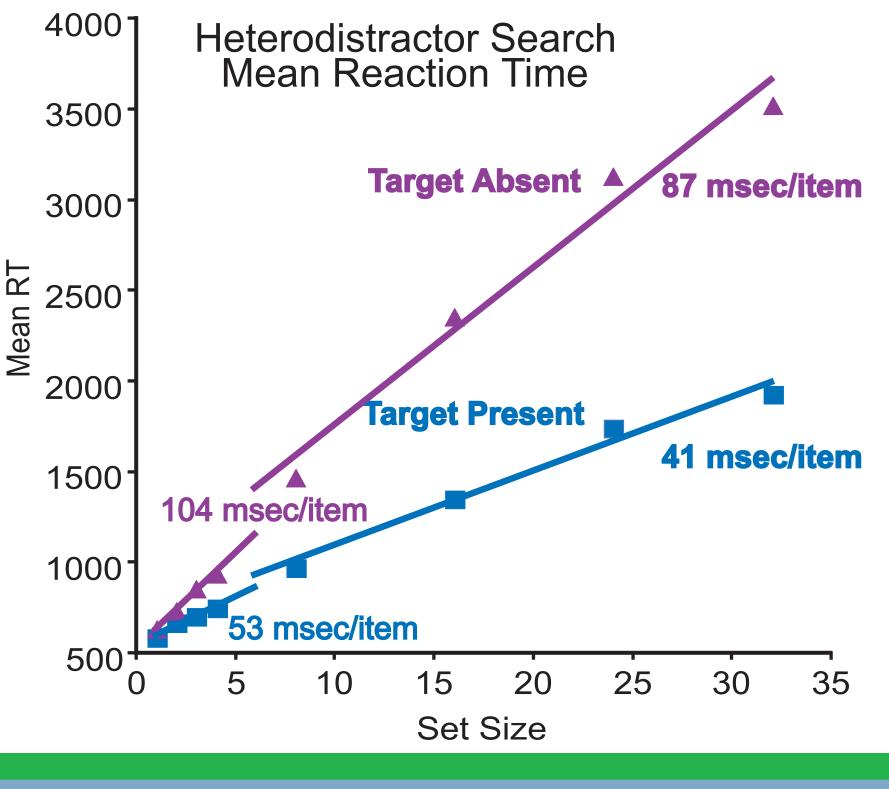


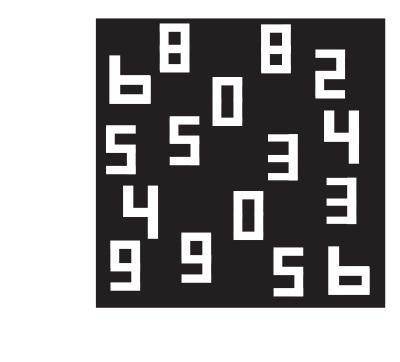
We compared a version with single set sizes run in blocks of 200 trials to a version with all set sizes intermixed.

The results are similar.

Is the non-linearity in unguided search an artifact of homogeneous distractors?

Maybe homogeneous distractors become easier to reject as they become more numerous. Therefore, searching through a heterogeneous display should eliminate non-linearity.



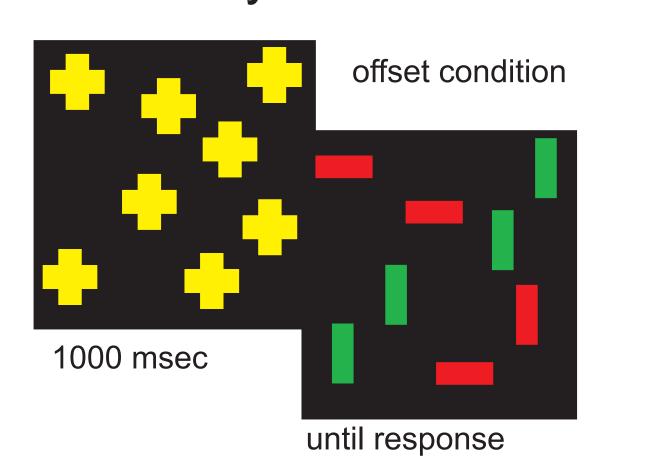


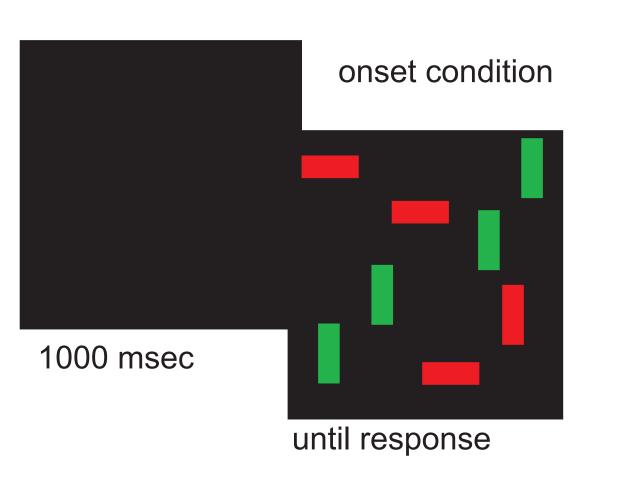
As predicted, the non-linearity was 1000reduced when distractors were heterogeneous.

Searching for a 2

Is the non-linearity an artifact of onset capture?

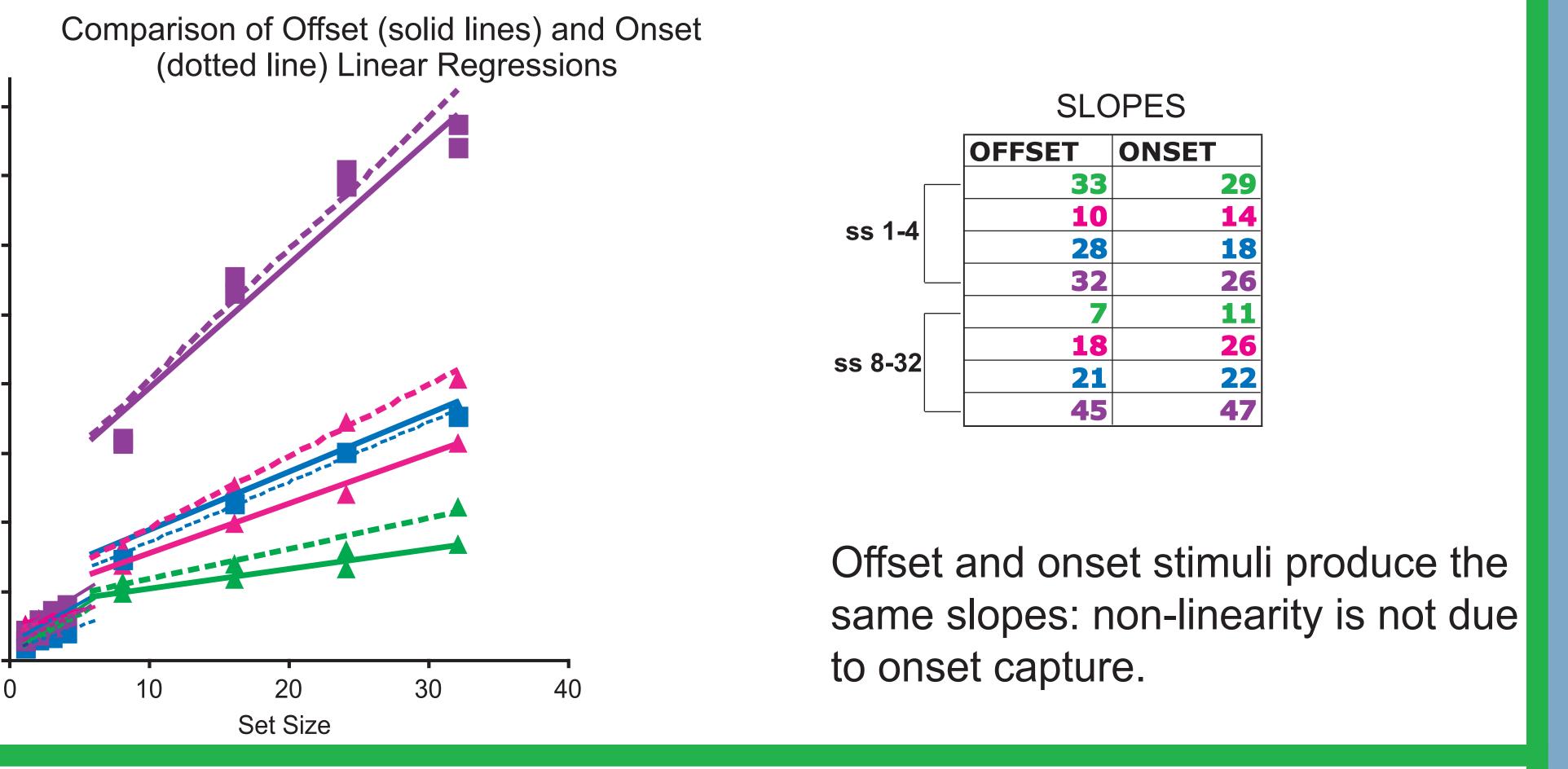
Maybe all onset stimuli are equally salient (Yantis & Jonides 1984), so that the effects of guidance are seen only when the onset transients fade away. If so, the non-linearity should not be observed with offset stimuli.





when all stimuli were onsets and when all stimuli were offsets.

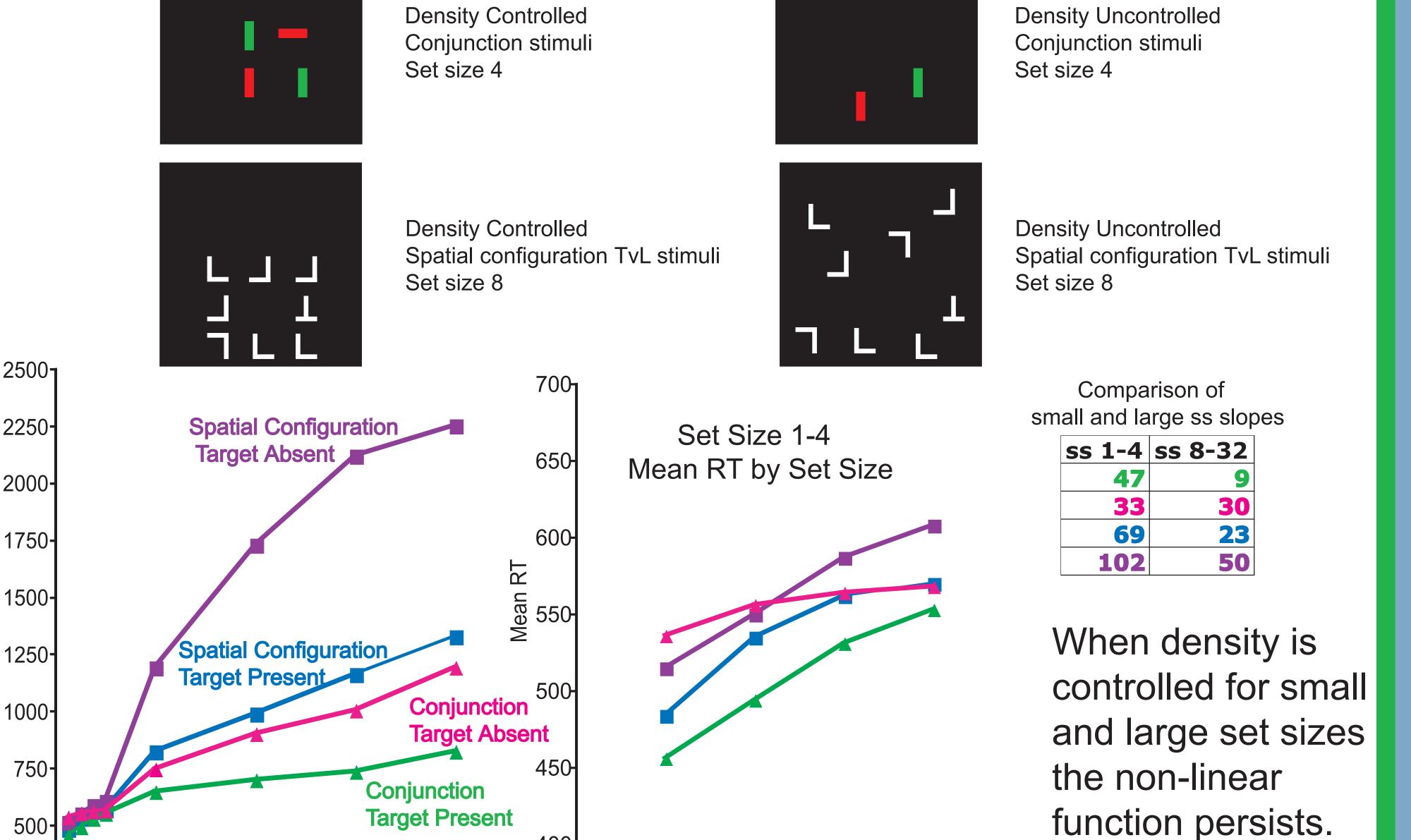
Density Uncontrolled



Is the non-linearity a density effect?

Density Effect- Typically density covaries with set size. Maybe search is faster through dense arrays.

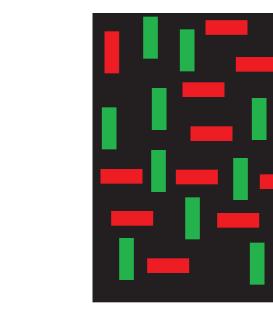
Test: Control density by packing stimuli together.

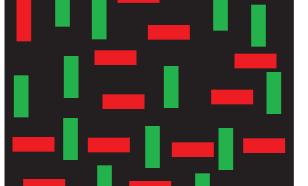


able to restrict search to the smaller subset. In this experiment, we asked when the advantage for unequal ratios becomes significant.

online gradually?

Strong Guidance





Is the non-linearity due to guidance coming

In conjunction search, people can use color and orientation to guide attention.

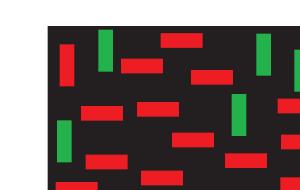
be complete before guidance comes online. This would make search more

efficient at large set sizes, producing a non-linear RT by set size function.

We know from Zohary & Hochstein (1988) that subjects search conjunction

displays more efficiently when the ratio of distractor types is unequal; they are

But if guidance is not available immediately, then search at small set sizes might



Weak Guidance

Strong Guidance

target: red vertical bar

How quickly does guidance advantage develop?

Percentile	Strong Guidance Mean RT	Weak Guidance Mean RT	Difference in Conditions	T-TEST	
10	478	480	2	0.267	The first 10 persont of trials above po
20	542	538	-3	0.168	The first 10 percent of trials show no evidence of differential guidance.
30	586	586	-1	0.448	
40	631	639		0.160	By the 50th percentile, there is evidence for more guidance in the strong guidance condition than in the weak
50	682	702	20	0.021	guidance condition.
60	739	769	30	0.002	garaarroo corrantiorri
70	811	842	31	0.007	The fastest responses are about 480 msec. The evidence for guidance is
80	901	958	57	0.003	apparent when RTs are about 750 msec
90	1036	1143	107	0.003	This suggests that guidance takes approximately 250-300 msec to develop in a trial.
100	1422	1628	205	0.001	

Conclusions

- In visual search, reaction time by set size functions are non-linear.
- 2. This non-linearity is greater for conjunction search than for spatial configuration search.
- . For spatial configuration search the non-linearity can be largely attributed to distractor homogeneity.
- 4. For conjunction search the non-linearity can be attributed to guidance coming online gradually. This appears to take approximately 200-300 msec.

Zohary E. & Hochstein S. (1988). How serial is serial processing in vision? *Perception*, 18, 191-200. (1984) Abrupt Visual Onsets and Selective Attention: Evidence From Visual Search. Journal of Experimental Psychology: Human Perception and Performance, 10(5), 601-620