

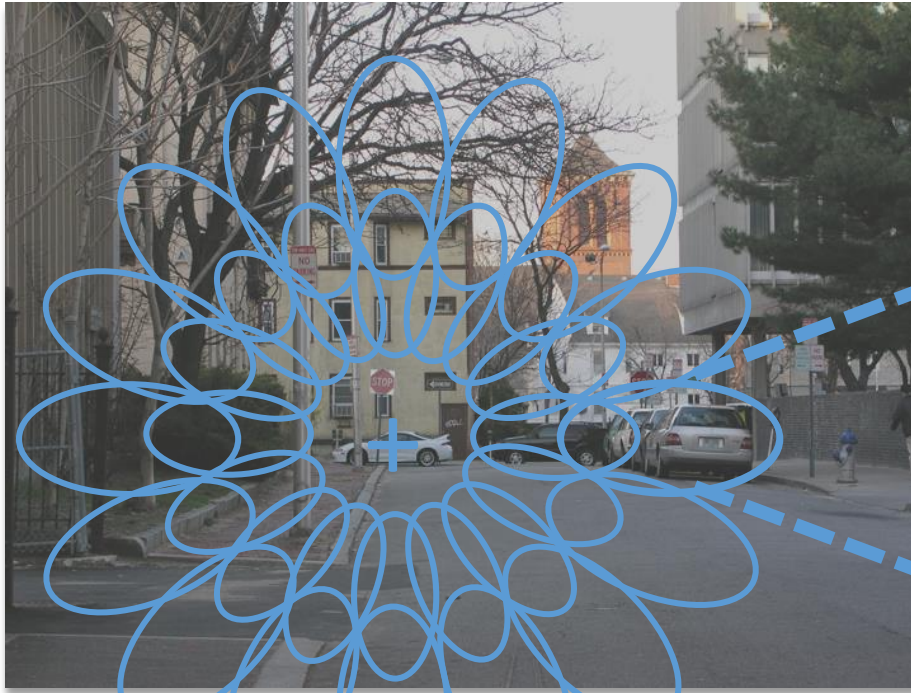
Crowding with informative flankers

Shaiyan Keshvari & Ruth Rosenholtz

The plan

1. Introduce a texture model of peripheral vision
2. Explain an unexpected, but intuitive, prediction of the model for crowded displays
3. Briefly review grouping in crowding experiments
4. Show preliminary evidence that for grouping simple crowded displays, this prediction holds

The periphery compresses input into a statistical representation



Texture Tiling Model (TTM): each ellipse is a “pooling region” where statistics are measured

Which statistics? Portilla & Simoncelli 2000

Balas et. al, 2009; Freeman & Simoncelli, 2011; Rosenholtz et al., 2012; Freeman et al. 2013.

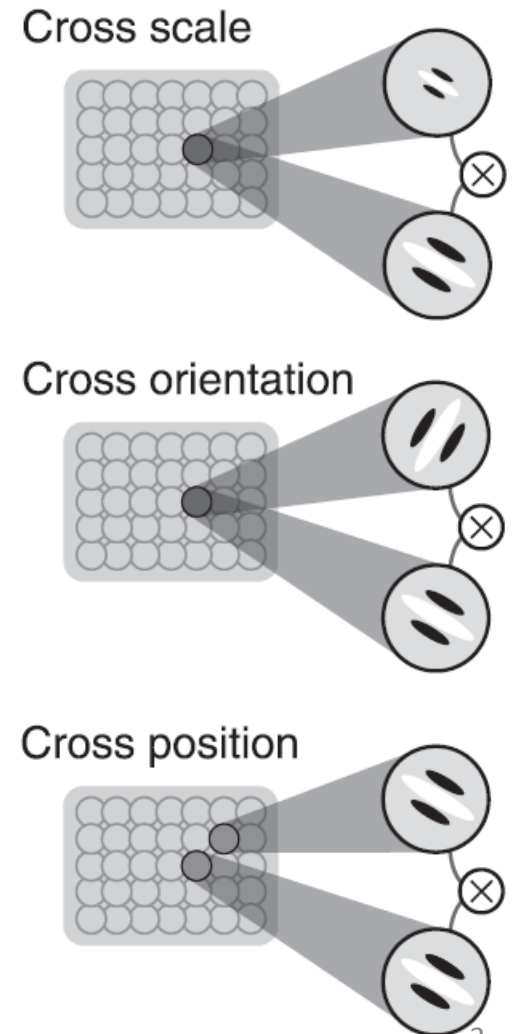


Diagram from Freeman et al., 2013.

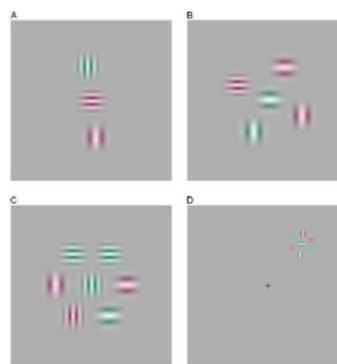
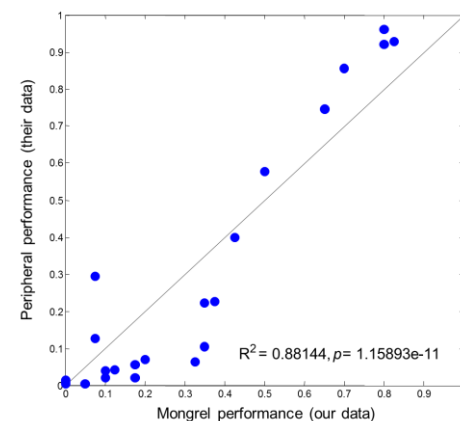
Last year at VSS

We showed that you can explain the results of several crowding papers using TTM (in prep)

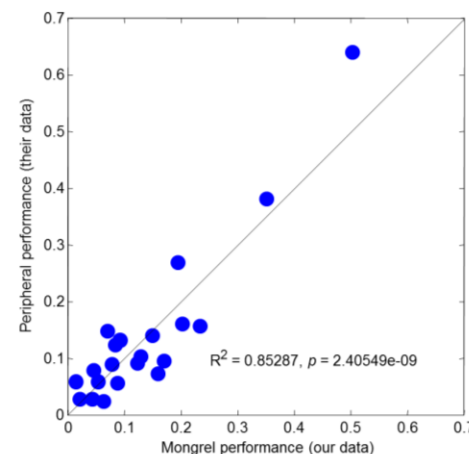
1. orientation & position judgments
2. Feature Integration Theory style task
3. series of letter ID tasks



Greenwood et al., 2012

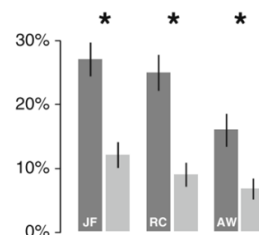


Poder & Wagemans, 2007

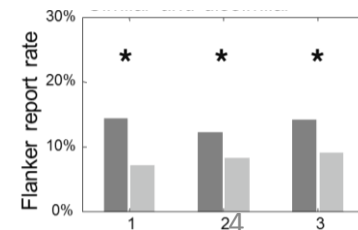


MTM

Freeman et al., 2012



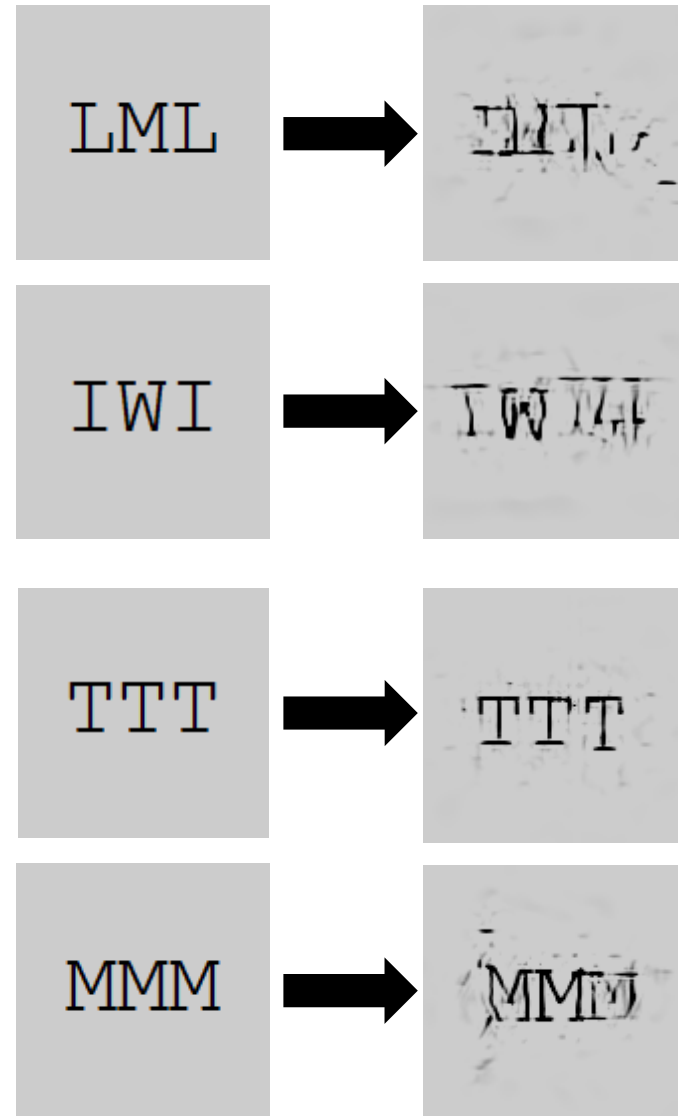
Peripheral performance (their data)



Mongrel performance (our data)

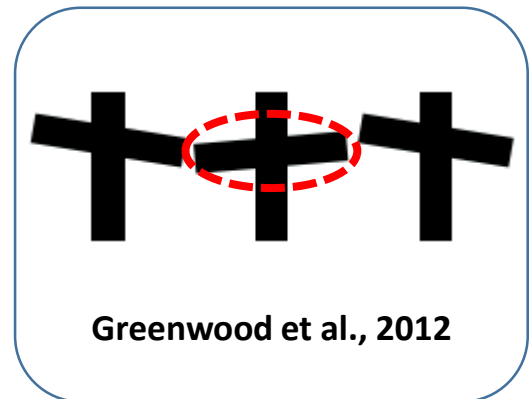
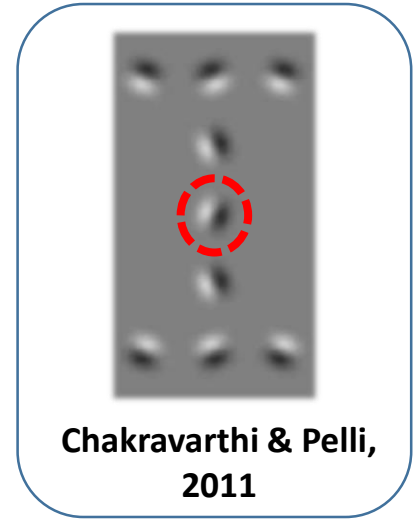
Interesting observation from previous experiment

- Generated samples from model, or “mongrels”
- Identical triplets looked better than expected
- Are the identical triplets more texture-like, and thus extra identifiable?
- Is there evidence that grouping helps? – No!



Typical crowding task is rigged

- Subject reports target, which is surrounded by “flankers”
- Flankers purposefully uninformative for task, (i.e. distracters)



Of course uninformative grouping hurts!

- By grouping, I mean gestalt-style
- Grouping usually requires target-flanker similarity

Flanker orientations

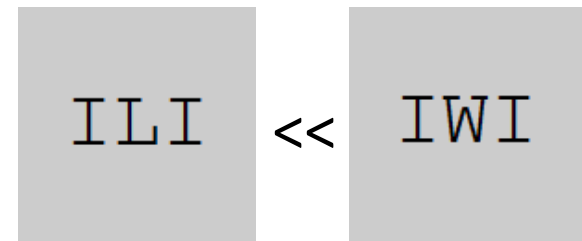
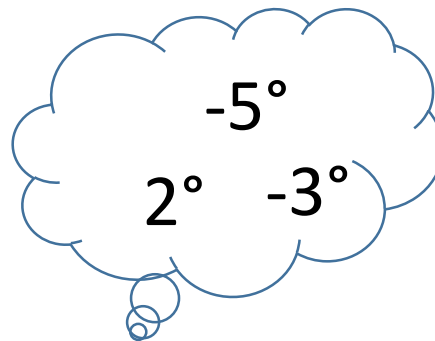
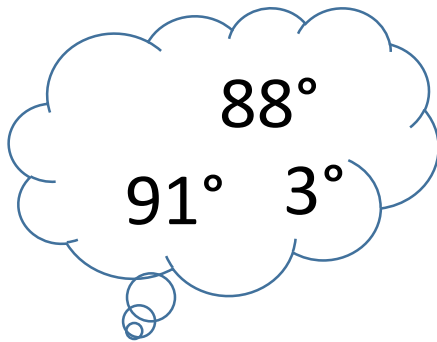
$\pm 10^\circ$ (strong crowding)



$\pm 40^\circ$ (weak crowding)



Greenwood et al, 2012

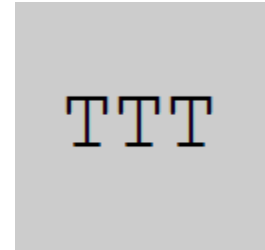


Freeman et al., 2012



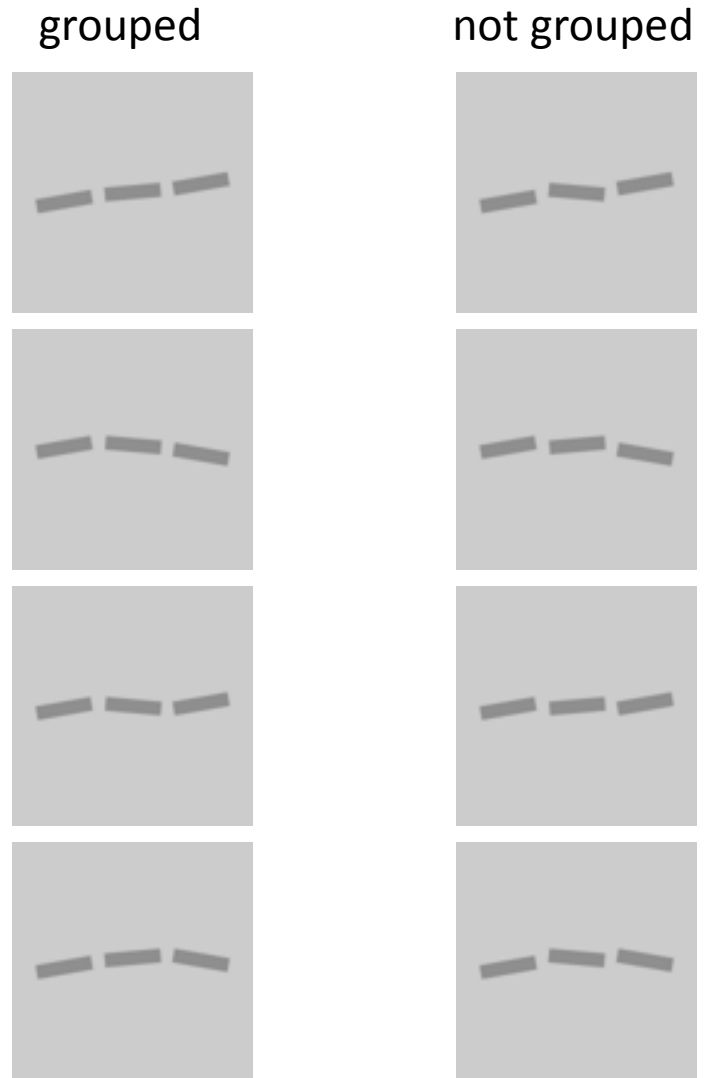
What if the flankers helped?

- Difficult to separate grouping and “informativeness”
 - we tried!
 - usually a confound
 - why people don’t do it
- Evidence from Freeman et al. 2012: items actually *represented* better, not simply misreporting flanker as target



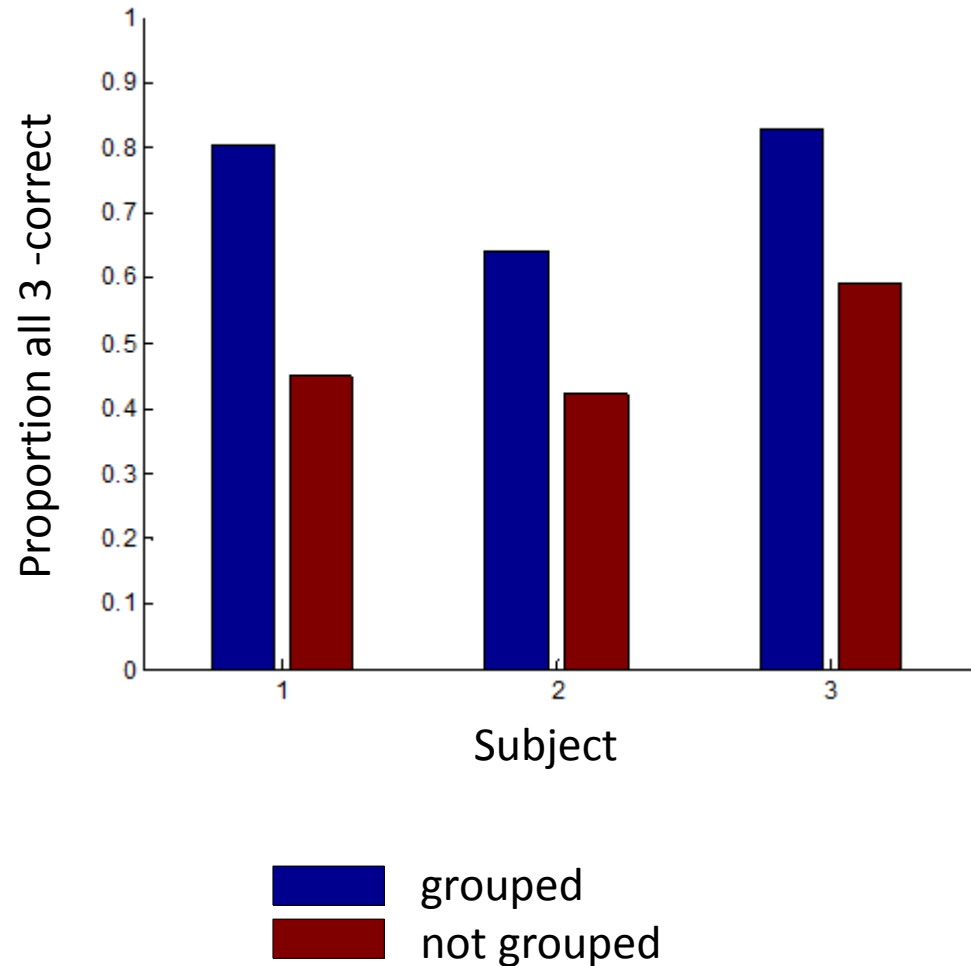
Crowding with aligned bars

- Peripheral crowding task ($n=3$, 320 trials), subjects report all three tilts (+ or -). 2 naïve, 1 author
- Stimuli either formed a contour (grouped) or didn't
- Matched grouped and not-grouped stimuli for flanker informativeness



Results

- Grouping helps!
- Not just averaging or substitution
- Almost identical to performance for just “target” report



Summary

- TTM predicts better representation of texture-like stimuli, and grouping can lead to this
- Grouping usually increases difficulty because flankers are uninformative to target identity
- When the perception of a group is informative, performance increases
- This has implications for peripheral perception of scenes (see Ruth's talk!)

Table 2 Response rates in Experiment 2. Crowded. Similar or dissimilar

	Identical Trial	Similar Trial	Dissimilar Trial
Target	88% \pm 1%	23% \pm 7%	47% \pm 4%
Flanker	n/a	60% \pm 6%	24% \pm 1%
Absent	12% \pm 1%	17% \pm 1%	29% \pm 4%
Total	100%	100%	100%