# Where Objects Come Froms Attention, Segmentation, and Textons Ohad Ben-Shahar' Bram & Scholl' and Steven W. Zucker

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4: Implications

**Main Conclusions** 

orientation or curvature discontinuities,

Texture boundaries, defined by either

However: The texture's grain (or main

direction) does not directly influence

attention (contra Avrahami, 1999). In

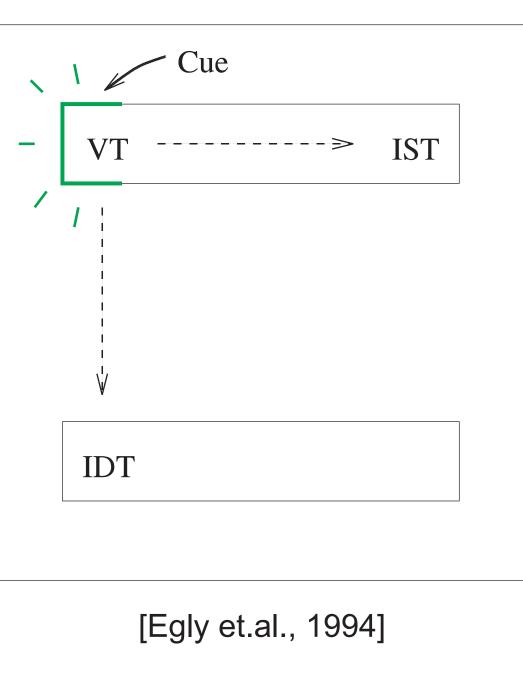
other words, it is changes in the

distribution of textons, rather than

their absolute values, that influence

yield 'objects' of attention.

#### **Object-Based Attention**









### 1: Motivation: Joining Two Literatures

#### Object-Based Attention (OBA)

Background: The units of attention are discrete objects : Objects are often defined only intuitively

#### Texton-Based Segmentation (TBS) in Early Vision **Background**: Rigorous models of boundary formation

Little contact with other aspects of visual cognition **Problem** 

#### **Our Goal**

Bridge these literatures with one of the most conspicuous features (textons) of early vision: Orientation.

#### Questions

- Does texture segmentation (based on either orientation or curvature) result in multiple 'objects' of attention?
- How does early visual structure defined by textons influence the flow of attention through scenes?
- Can attentional effects provide new types of empirical support for models of texture segmentation?

# **Orientation-Based** Segmentation [Nothdurft, 1991] [Musap & Levi, 1999]

### 3: Results

**Divided-Attention Task** 

**Jittered Uniform Flows** 

**Cueing Task** 

**Cueing Task** 

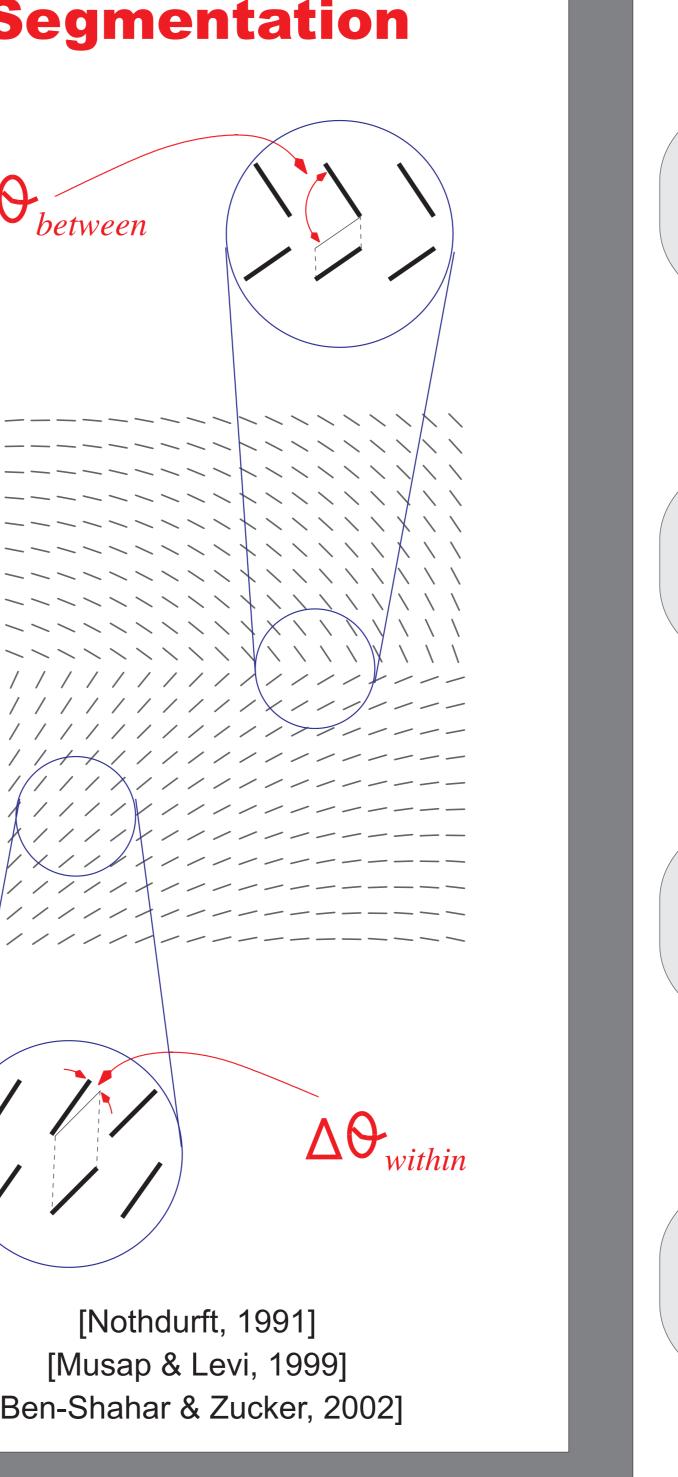
**Jittered Uniform Flows** 

**Divided-Attention Task** 

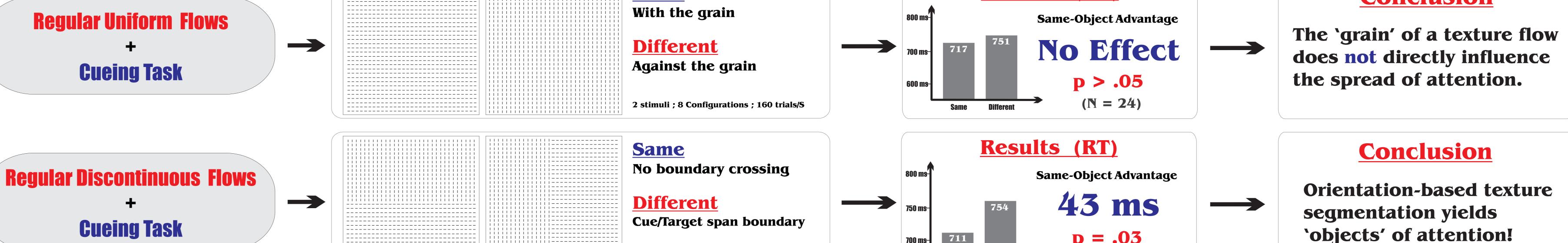
**Divided-Attention Task** 

**Divided-Attention Task** 

**Divided-Attention Task** 



#### Results (RT) **Same** Conclusion



**Different** 

With the grain

**Different** 

**Different** 

With the grain

Against the grain

2 stimuli ; 8 configurations ; 160 trials/

**Probes span boundary** 

No boundary crossing

**Probes span <u>curvature</u>** 

No boundary crossing

Probes span <u>curvature</u>

4 stimuli ; 16 configurations ; 320 trials/S

**Different** 

Same

Differen

**Different** 

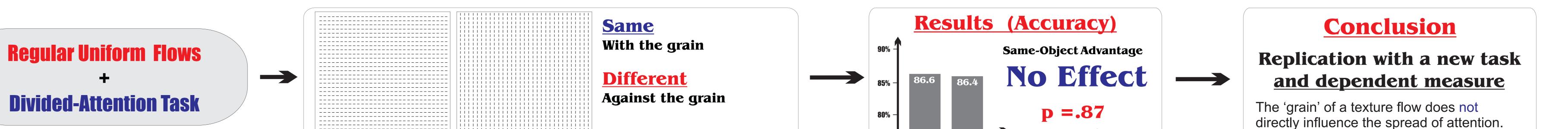
**Same** 

**Different** 

Cue/target span boundary

Against the grain

**Probes span boundary** 



Results (Accuracy)

Results (RT)

Results (RT)

Results (Accuracy)

Results (Accuracy)

Results (Accuracy)

Results (Accuracy)

4.9 %

No Effect -

No Effect ->

No Effect ->

#### Conclusion Replication with a new task

and dependent measure Orientation-based texture segmentation yields 'objects' of attention!

#### Conclusion

Still no direct effect of texture flow 'grain' on the spread of attention.

#### Conclusion

No boundary effect with jittered textures: Not enough sensitivity?

#### **Conclusion**

4th Replication!

The 'grain' of a texture flow does not directly influence the spread of attention.

#### **Conclusion**

**Orientation-based texture** segmentation yields 'objects' of attention defined by global structure!

#### **Conclusion**

Even curvature-based texture segmentation yields 'objects' of attention defined by global structure!

This holds for 'objects' defined by both tangential curvature and normal curvature.

#### attention.

The formation of attentional objects in static texture flows is a result of global structure as opposed to local grouping.

#### Contributions of TBS to OBA

A wealth of stimuli whose partition into objects goes beyond intuitive appeal.

Opportunity to study the connection between attention and fundamental visual features that later give rise to objects: 'texton-based attention'?

#### **Contributions of OBA to TBS**

Use of proven methodologies to provide new types of empirical support for models of segmentation.

Linking early visual processes to other aspects of visual cognition.

#### Methodological Contributions

The first study to use converging evidence from two different OBA paradigms and dependent measures.

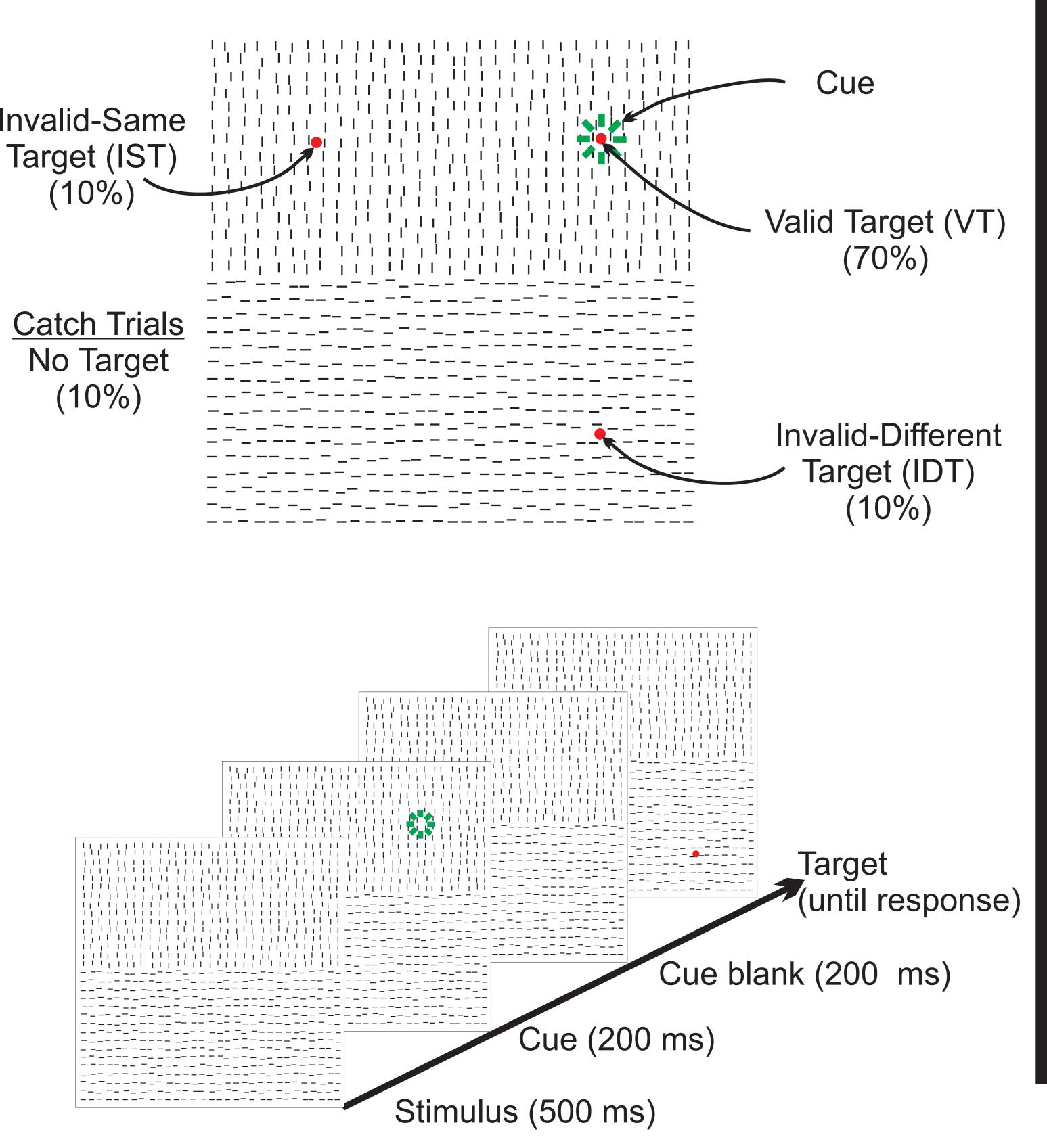
A lesson for OBA research: The divided attention paradigm is stronger and more sensitive than cueing.

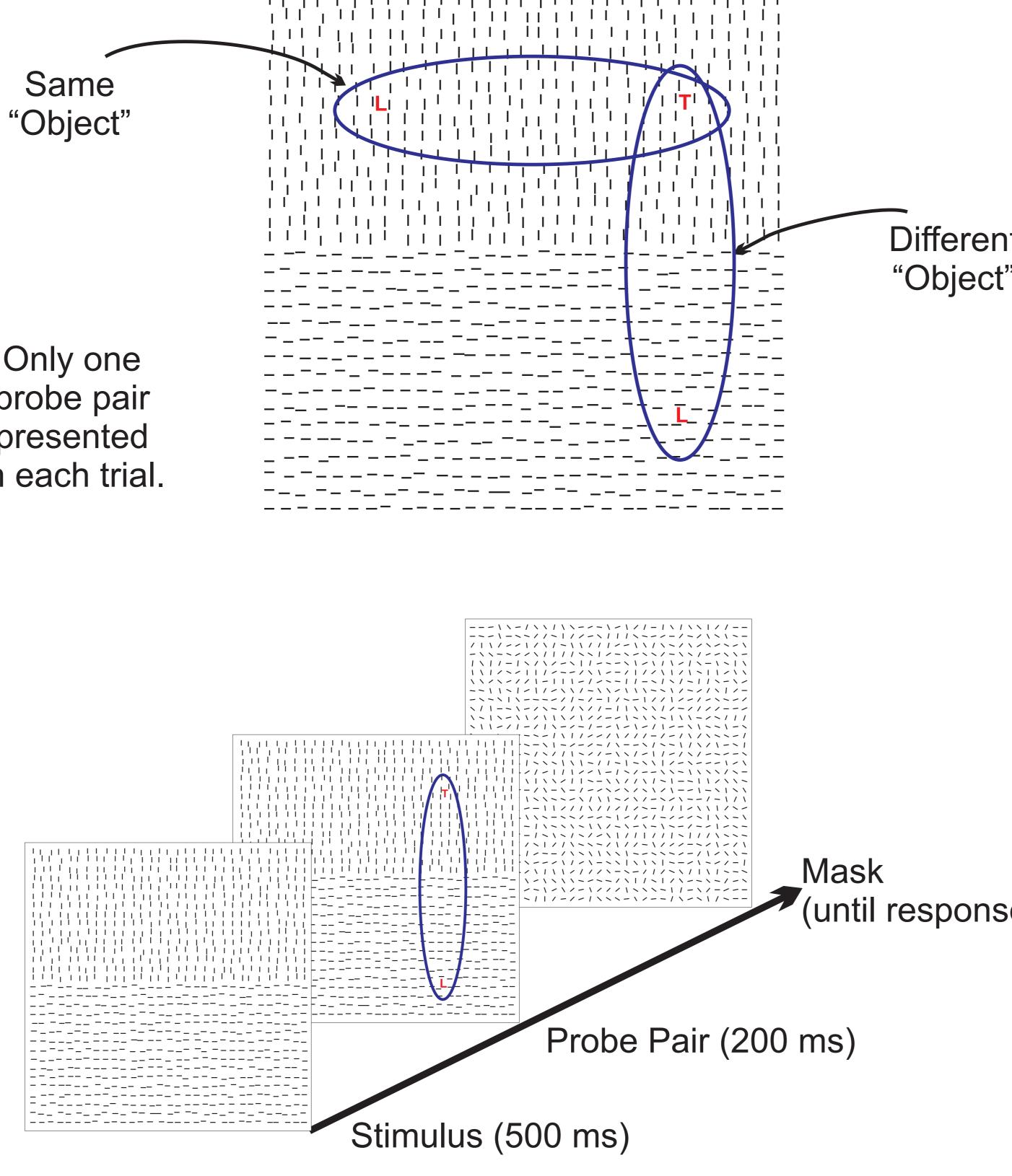
#### And a Final Take-Home Message

Merging two otherwise disparate fields benefits both in new and surprising ways, raises novel questions, and opens new research directions.

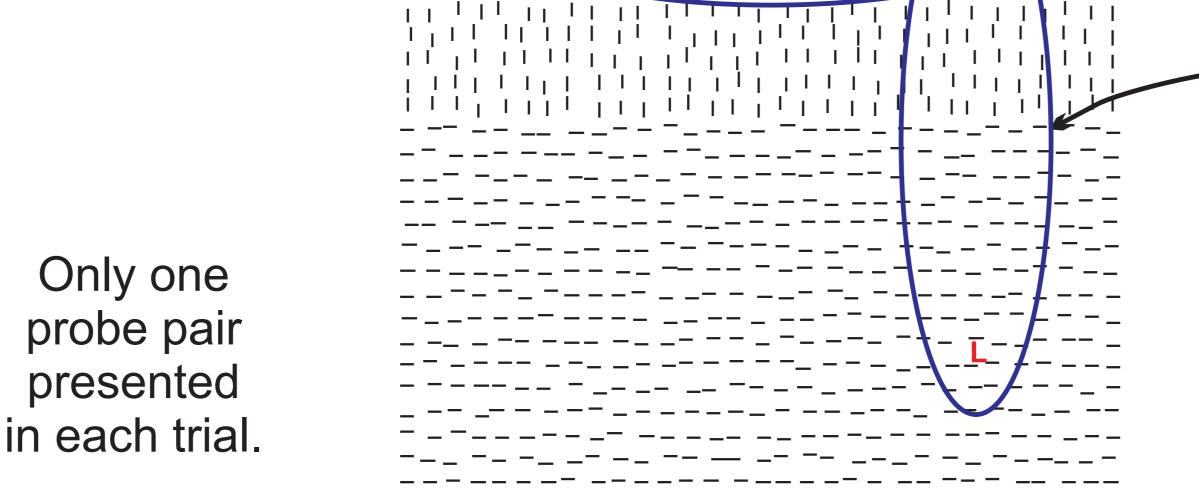
## 2; Methods; Converging Evidence from Two Attentional Paradigms

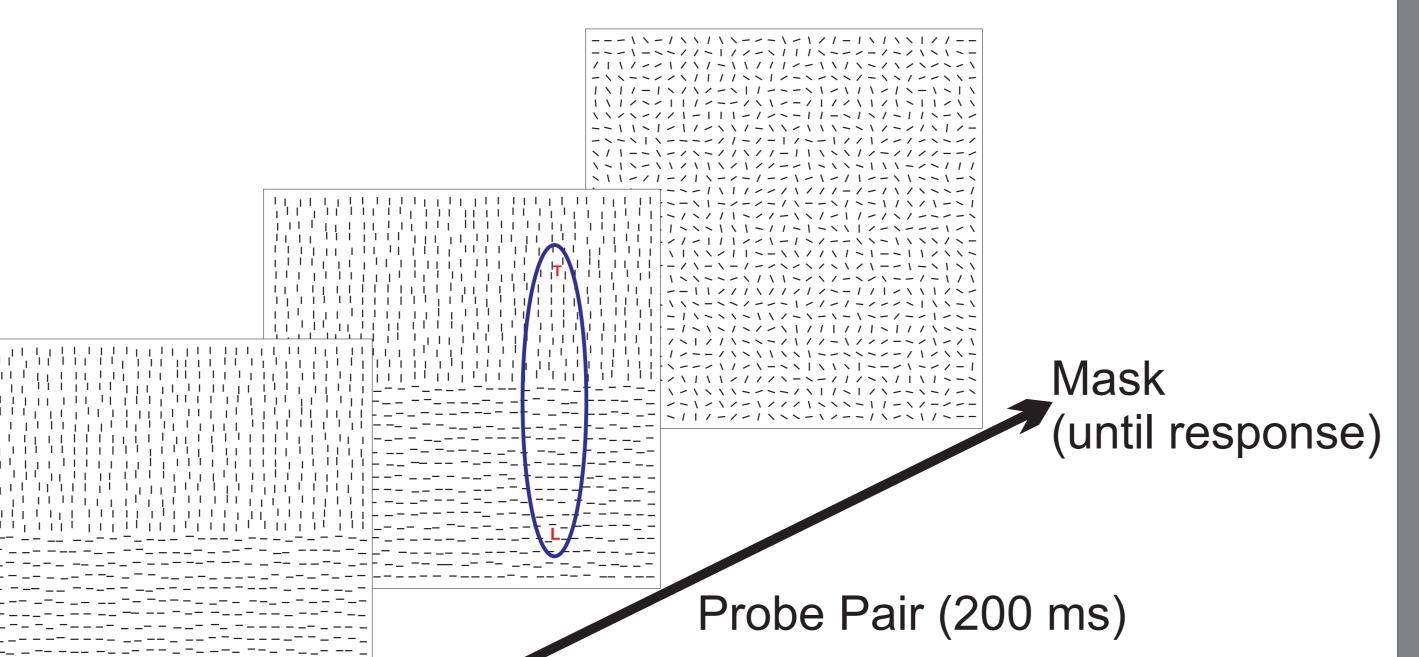
#### Cueing (RT) Speeded target detection





# Are the 2 probes identical?





# **Divided Attention (Accuracy)**

