Attentional Processing of Geometric Figures

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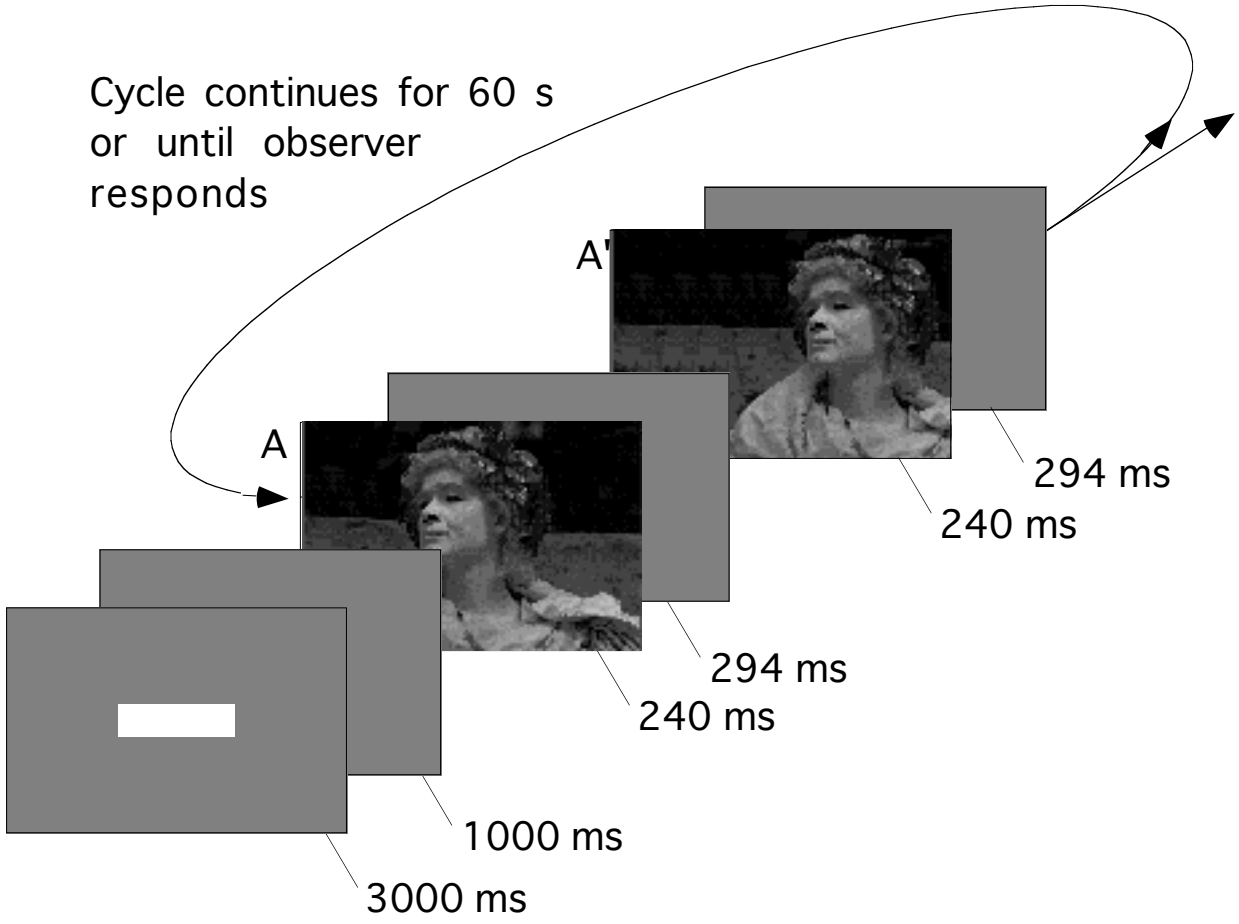
1. Change Blindness

Flicker paradigm (Rensink, O'Regan, and Clark, 1995)

- Create original & modified pictures
- Repeat: (flickering display)
  - **First picture** presented briefly (c. 200-400 ms)
  - Blank field presented briefly
  - **Second picture** presented briefly
  - Blank field presented briefly
- Continue cycle until observer notices the change



Empirical Results:

- Large changes in scenes can go unseen for long periods of time (10-30 s).
- This is true even when:
  - observers know that changes are occurring
  - changes are continually repeated

Theoretical Implications:

- *Focused attention is needed to perceive change*
- Unattended representations are **volatile**, being overwritten by any new representations formed at the same location in the image.

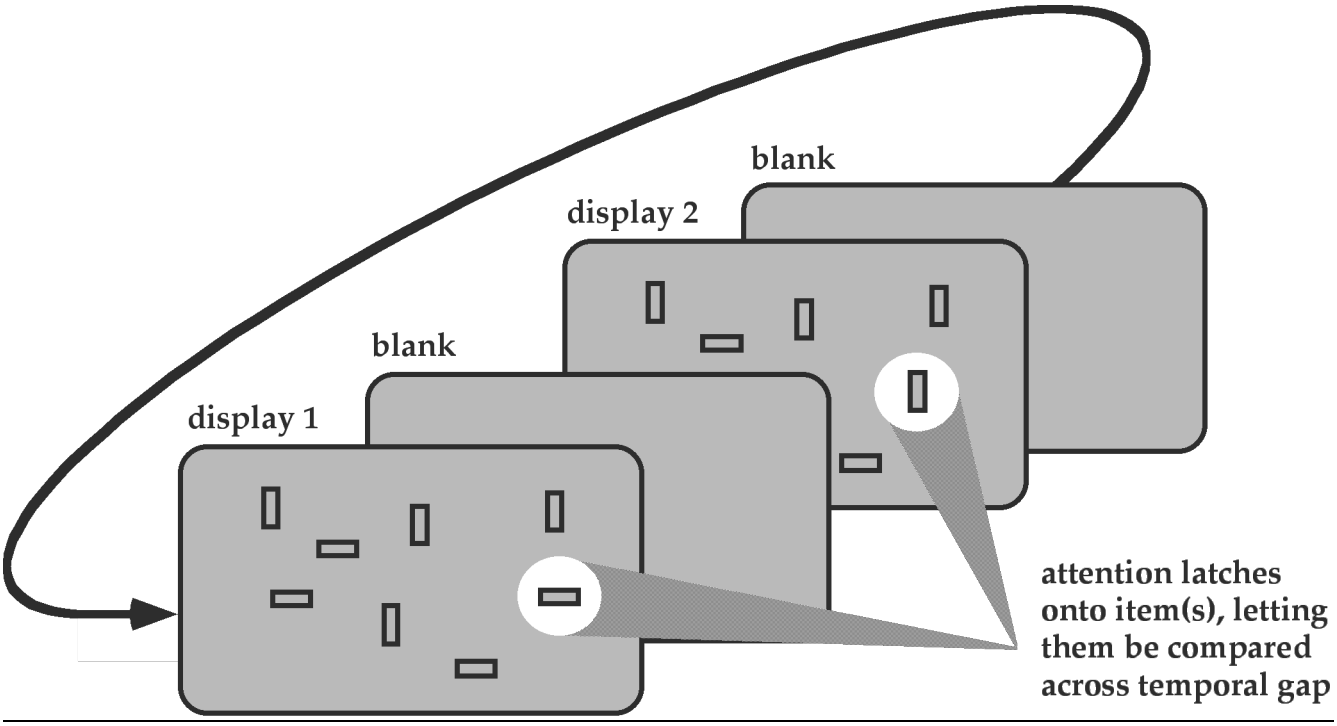
If this picture is true…

⇒ use change blindness to determine properties of attentional mechanisms.

2. Attentional Processing of Shape

To study attentional mechanisms,

⇒ use flicker paradigm with simple stimuli (Rensink, 1996)



Stimuli:

- medium gray backgrounds (and blank fields)
- black outlined figures (e.g. rectangles); 0.42° x 1.3°
- on-time = 80 ms; off-time = 120 ms

Task (visual search):

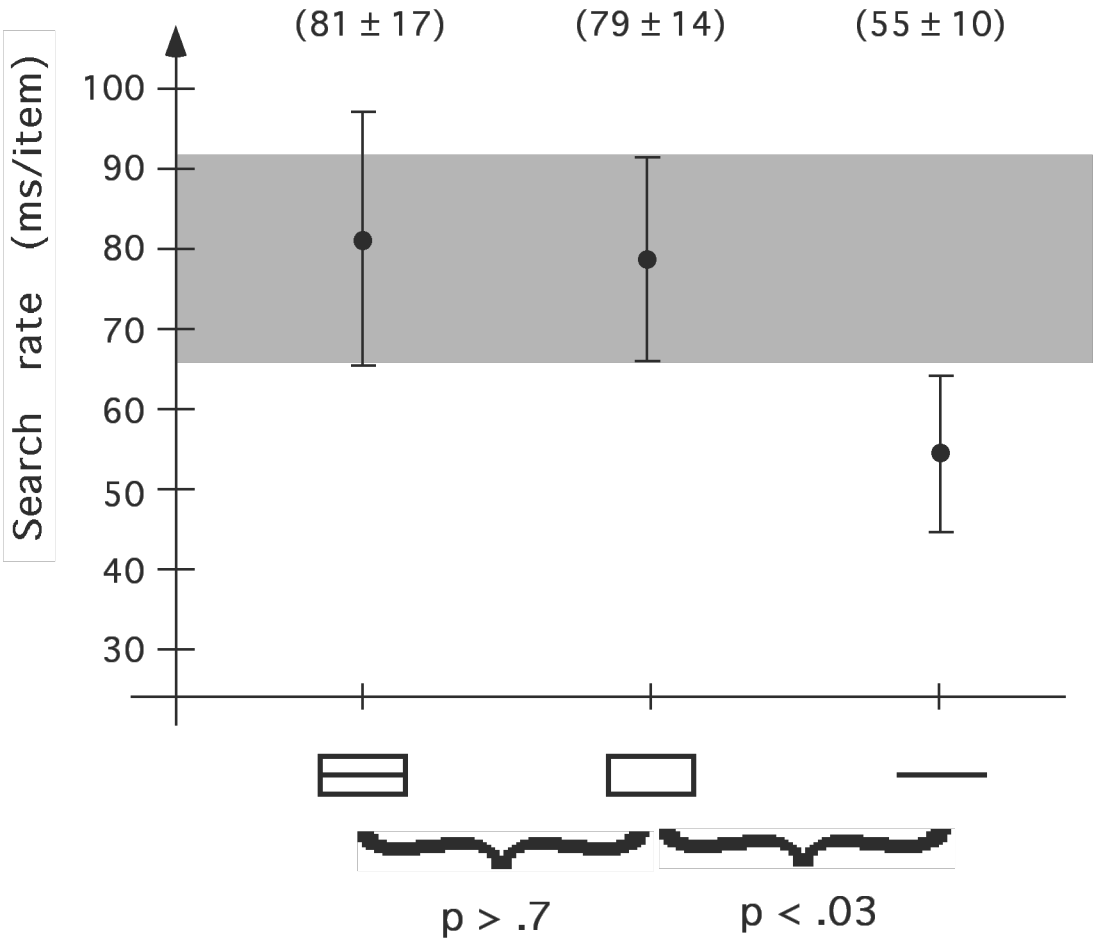
- on half the trials, one item changes orientation
- on each trial, observer must determine whether change is or is not occurring

Dependence of speed on item shape

Compare search rates for items of **different shapes**

- within-subject designs (counterbalanced)
- 12 subjects each condition
- three shapes compared in each experimental condition

Results:

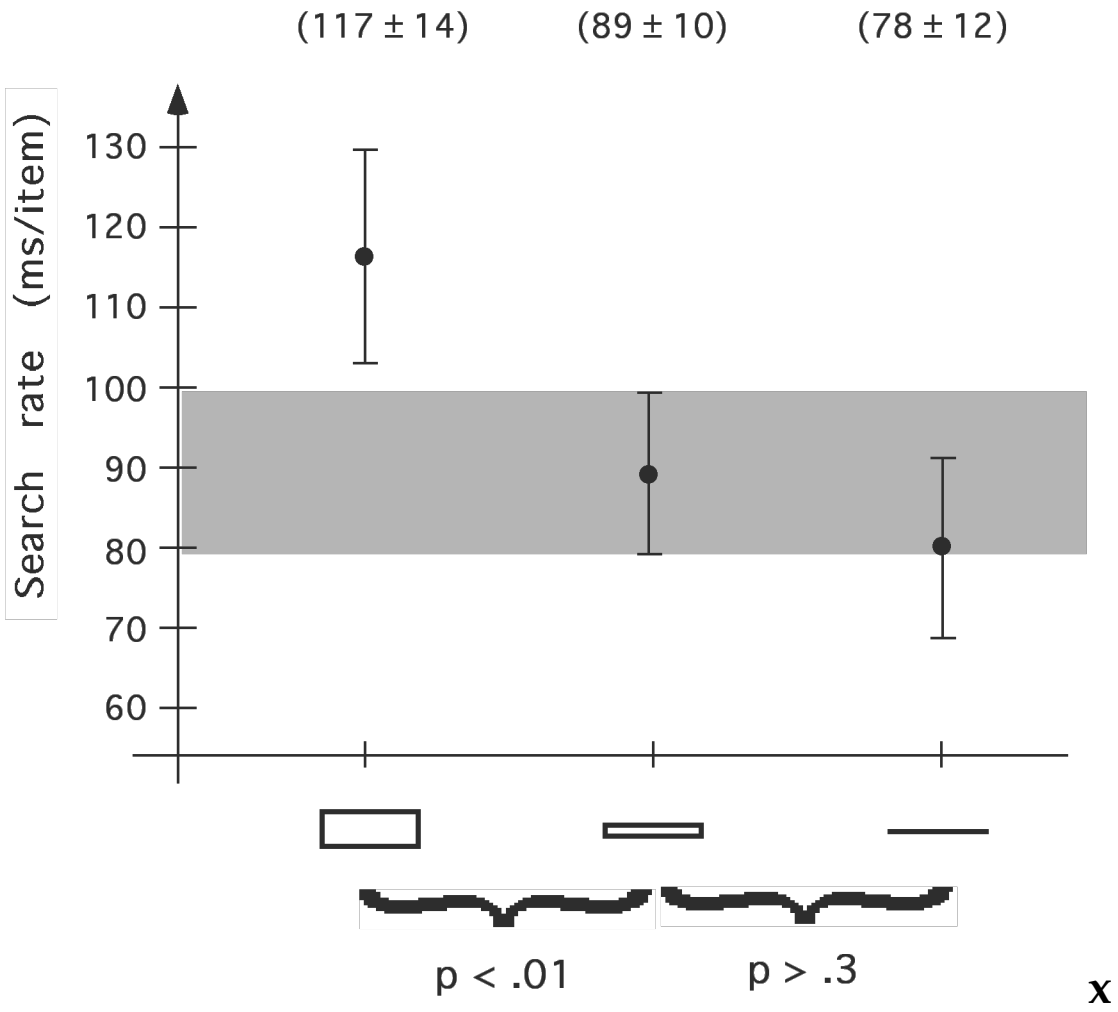


- **2-bar and 3-bar items have same speed**
- **single line is faster**

  - different aspect ratio?

Why is single line faster?

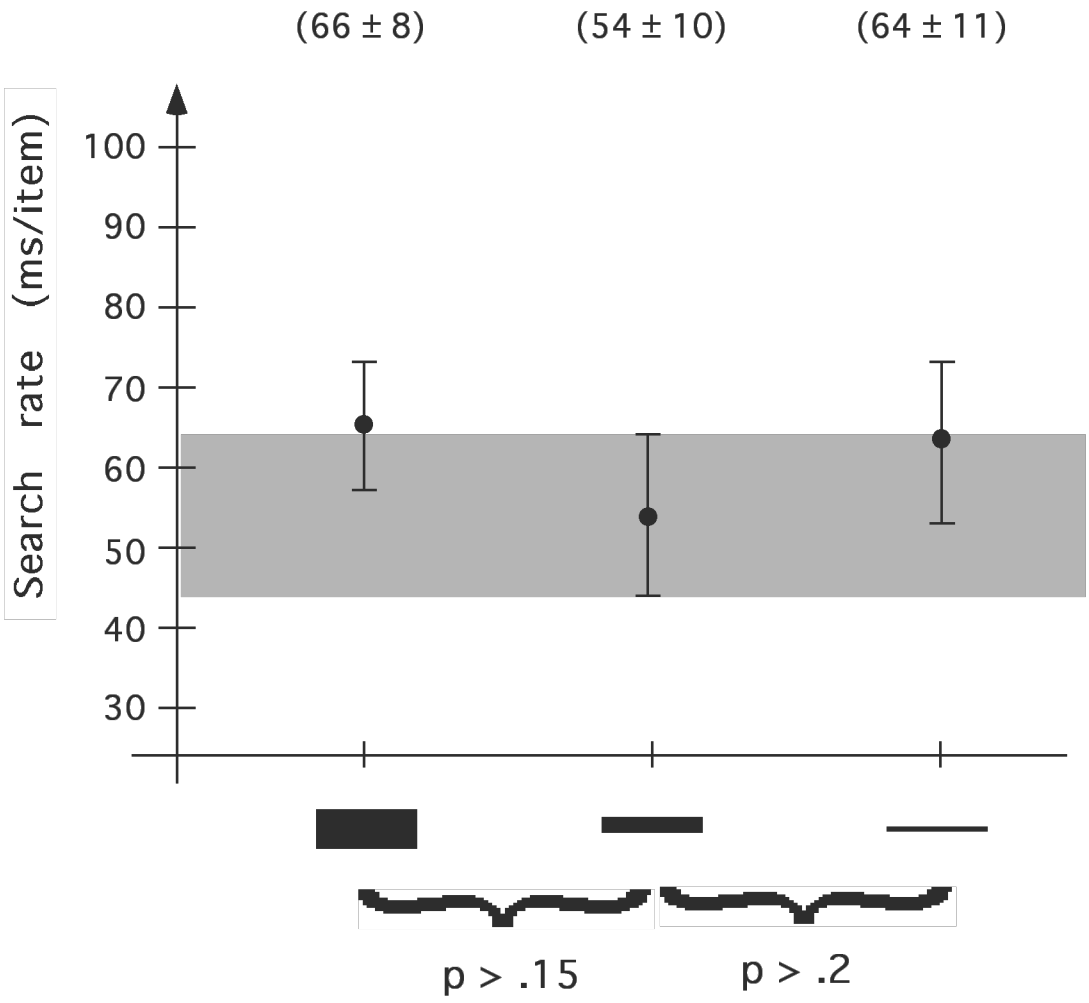
⇒ Possibility: aspect ratio (width)
Test: narrow (0.14°) vs. wider rectangle (0.42°)



- **single line about same speed as narrow rectangle**
- **aspect ratio may be critical feature**
  - or is it number of parts in item?

Why is single line faster?

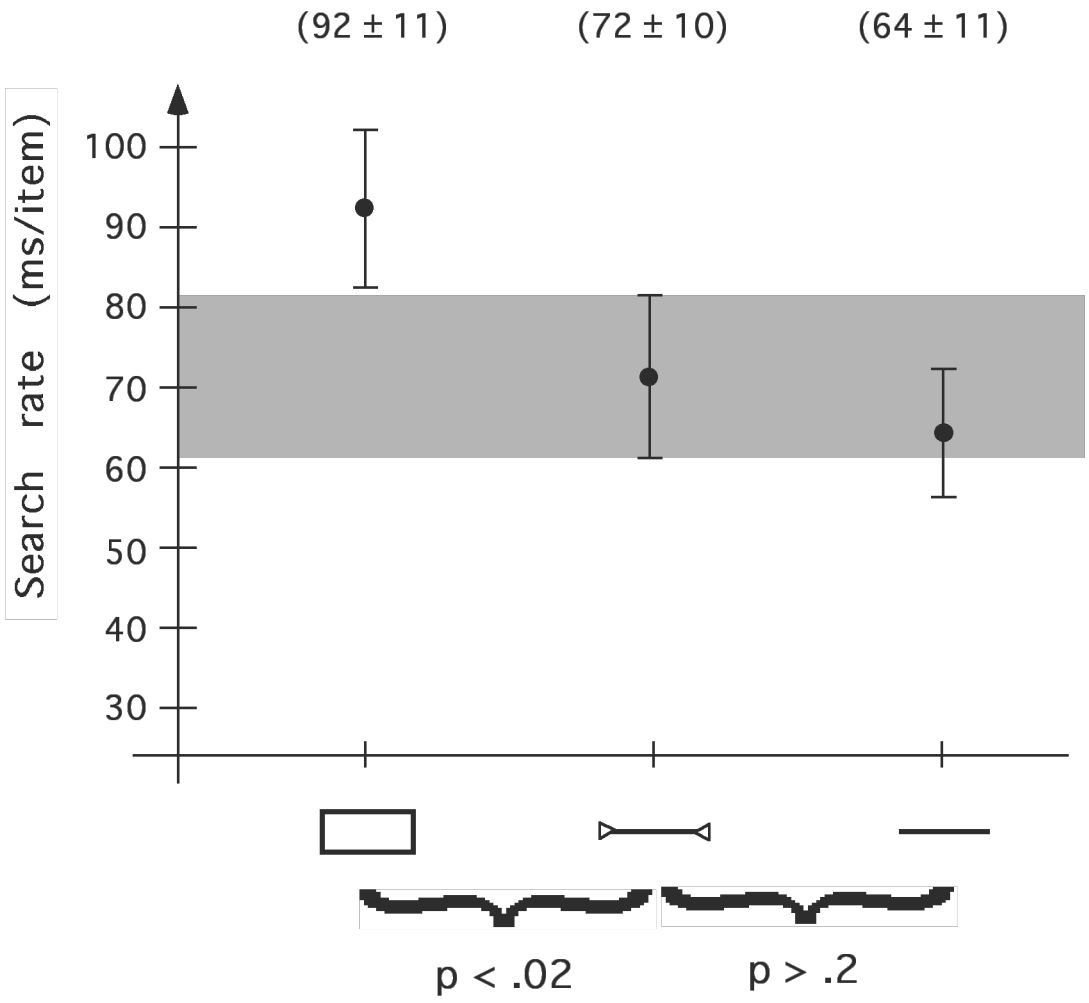
⇒ Possibility: number of parts (lines) in figure
Test: solid rectangles of varying width



- **same speed for all**
- **aspect ratio <u>not</u> critical feature**
  - something about constituent pieces
  ⇒ free line endings?

Why is single line faster?

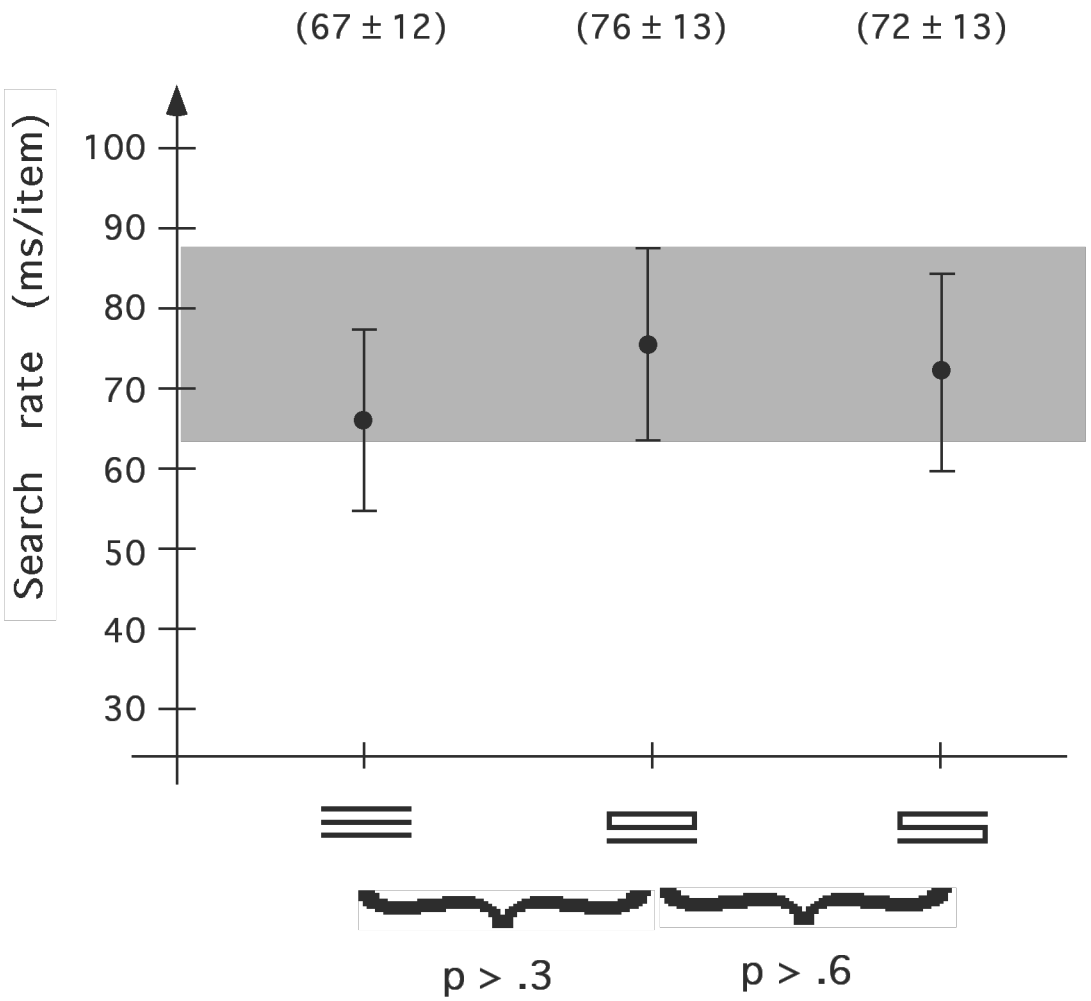
⇒ Possibility: free line endings
Test: add small triangles to ends



- **free ends not main factor ⇒ number ofpieces?**
  - simple items (one piece) ⇒ faster
  - compound items (several pieces) ⇒ slower

Is it number of pieces alone, or way they are connected?

⇒ Test: compound figures, with different connections



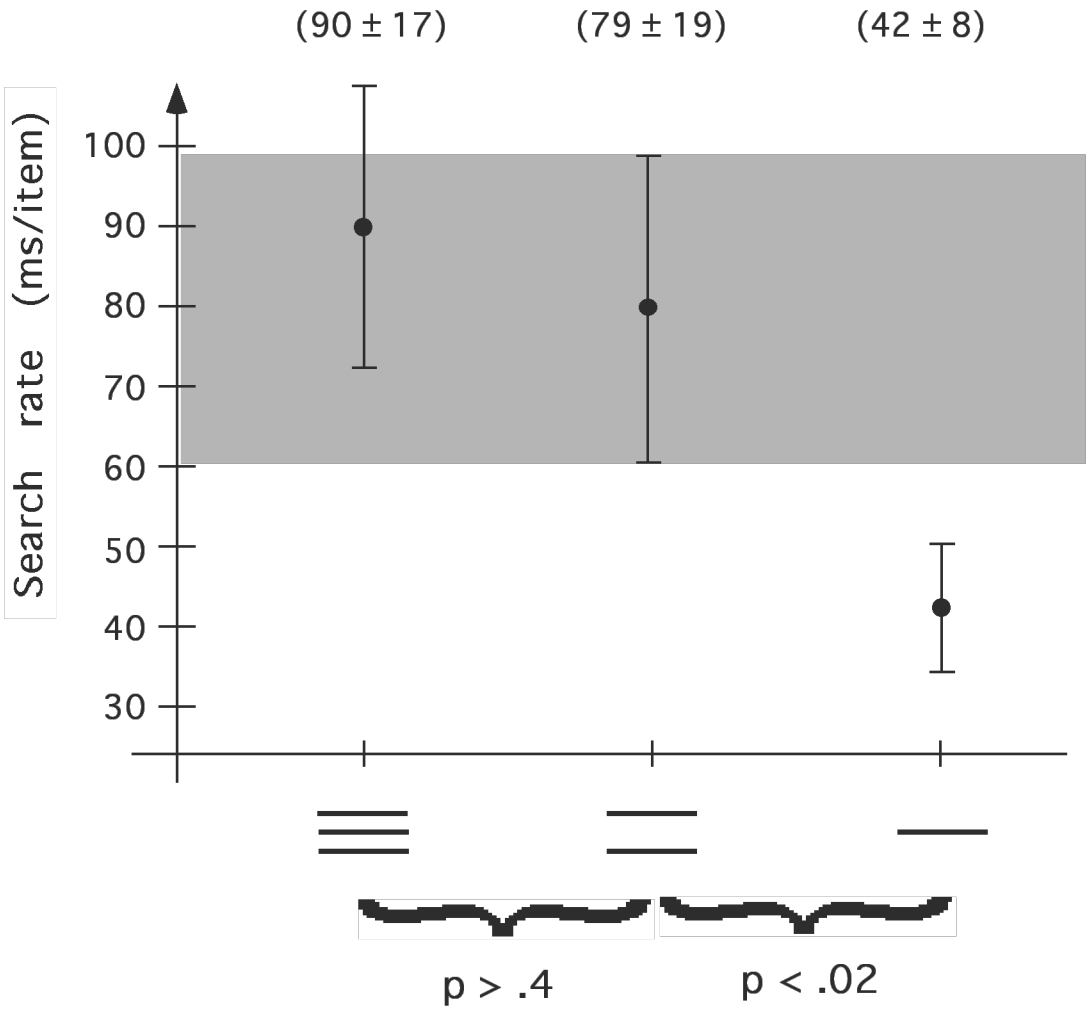
- **same speed for all**
- **connection pattern not critical**

  ⇒ compound figures via **grouping across space**

  ⇒ number of **parts alone** (one vs. several)

How many pieces in a compound figure?

⇒ Test: remove lines on sides of original items



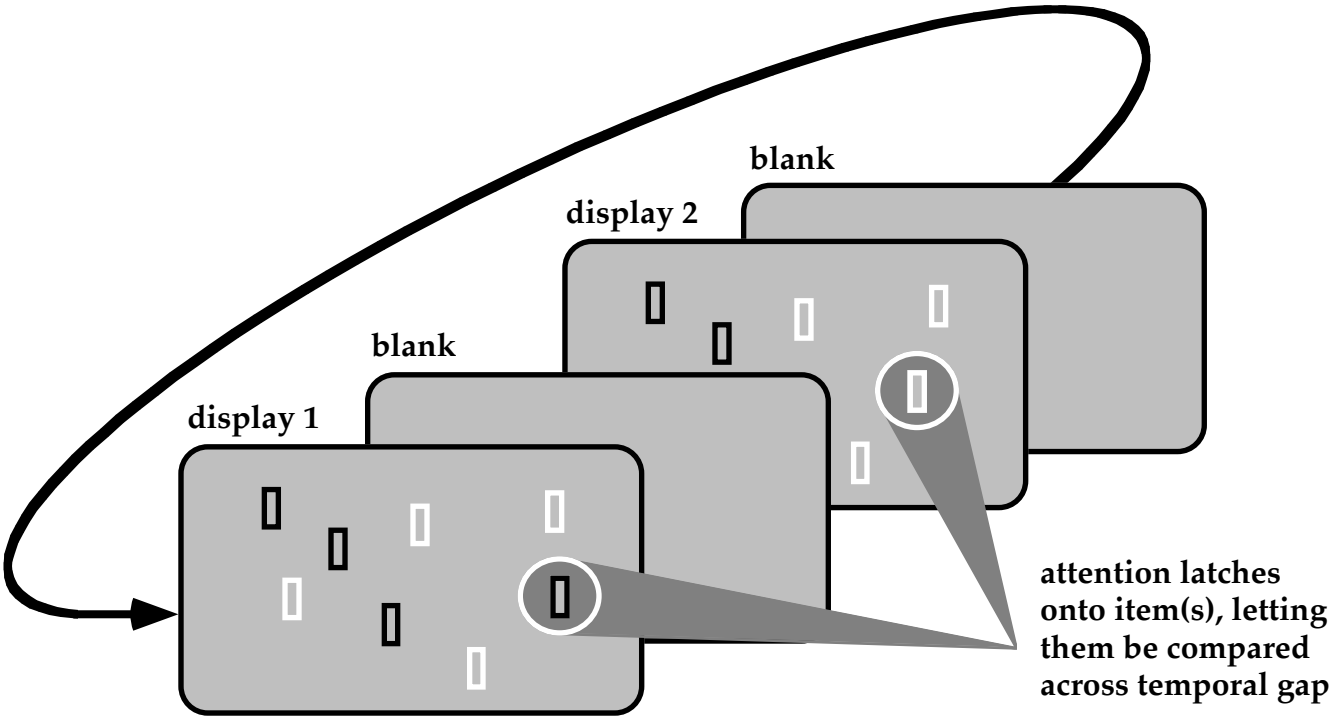
- **single line still faster**
- **2- and 3-bar items have same speed**

  ⇒ compound figures via **grouping across space**

  ⇒ compound figures have **2 or more pieces**

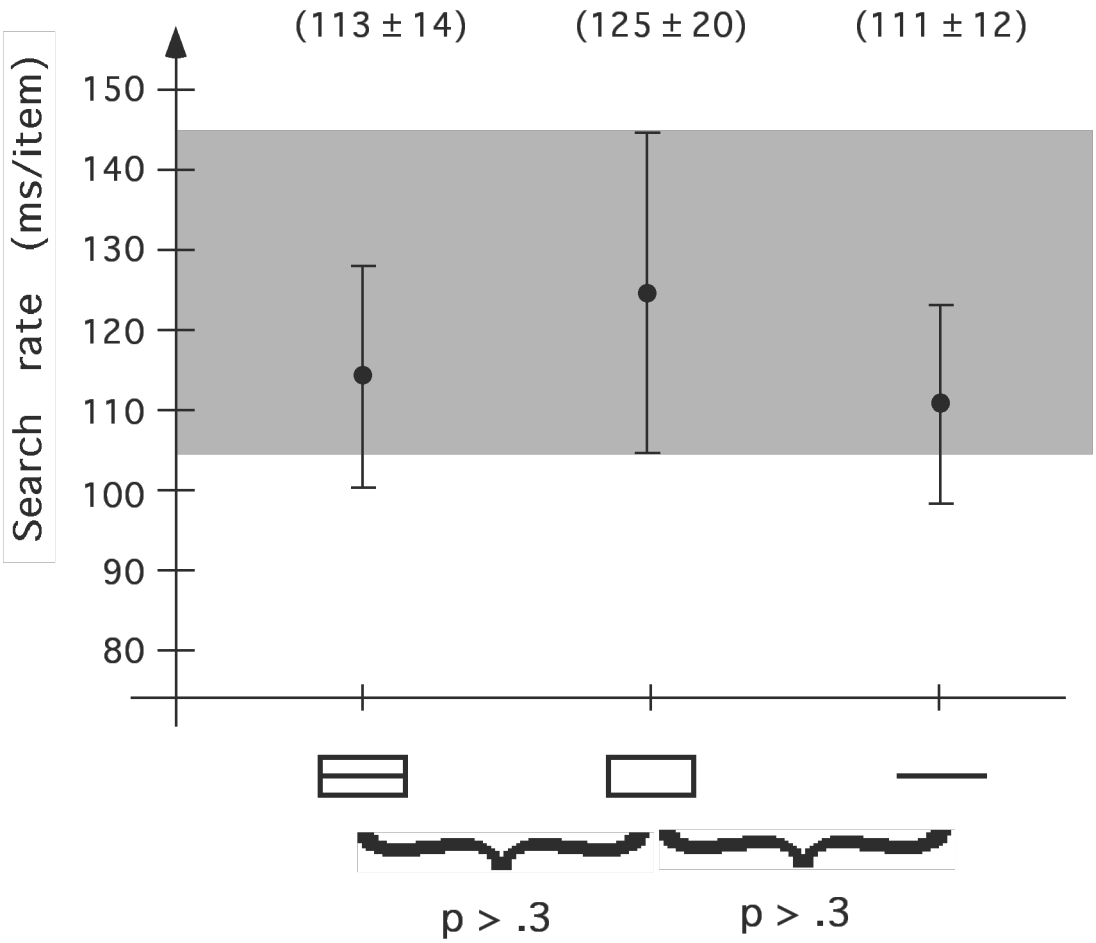
3. Type of feature change

Compare search rates for items of different shapes
- use changes in **contrast sign**, and **location**
- 12 subjects each condition
- three shapes compared in each experimental condition



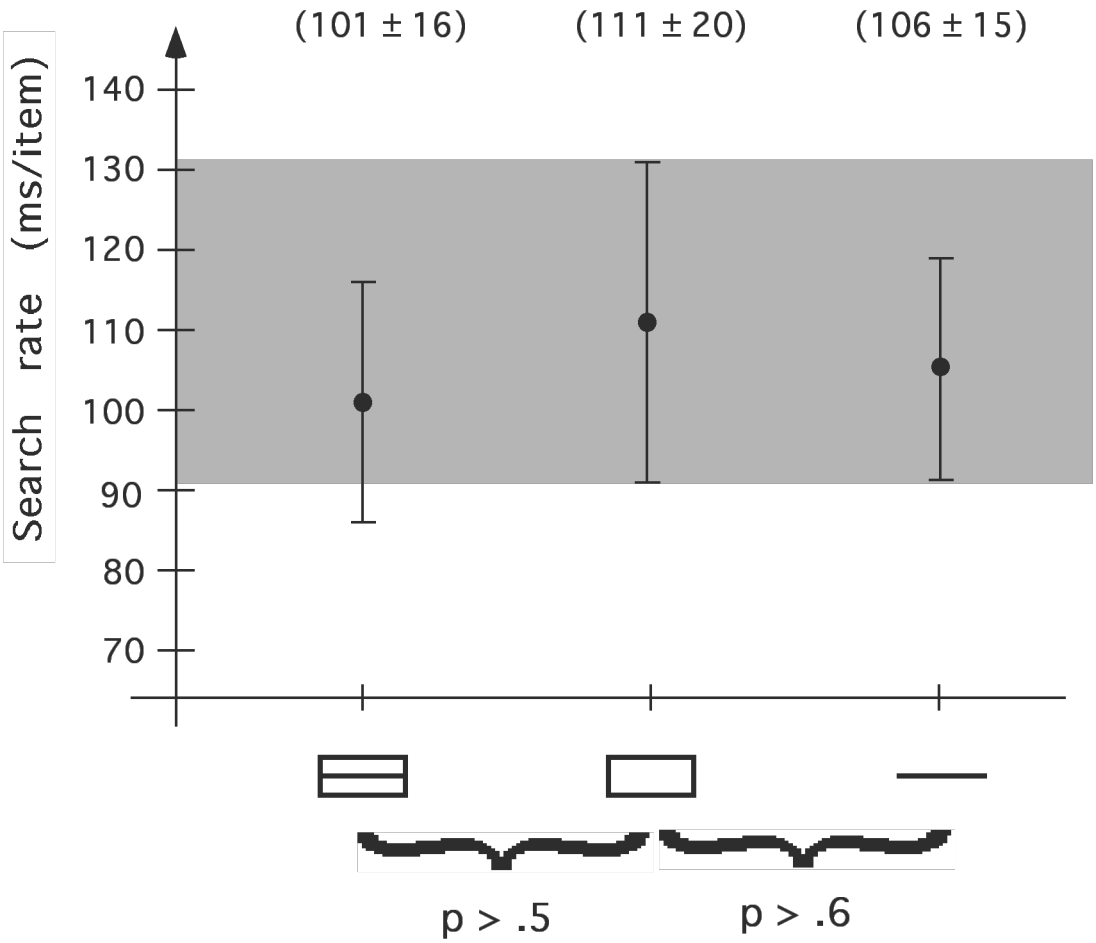
Target is item with **changing polarity.**

Results (change in contrast sign):



- **no difference between simple and compound figures**

Results (change in location):



- **no difference between simple and compound figures**

4. Summary

- Search for orientation change depends on shape of item
  - relatively fast (c. 60 ms/item) when item has **1 part**
  - relatively slow (c. 90 ms/item) when item has **2+ parts**

  ⇒ two kinds of figures: **simple** and **compound**

- Extra processing (c. 30 ms/item) for compound figures is **mandatory**, even though simple/compound distinction is irrelevant for task.

  ⇒ initial analysis of structure for compound items?

- No simple/compound distinction for changes in **location** or **contrast sign** (i.e., non-geometrical properties)

  ⇒ mandatory processing of compound figures occurs only when geometric properties involved

  ⇒ analysis of geometric properties is **task-dependent**