Early use of color ~~but not~~ and local structure in rapid scene perception

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1 INTRODUCTION

Turn your head and you see a different scene. In the first tens of milliseconds, what information does the brain use to put together the percept of a new scene? Does any of the following information play an early role in scene perception: distributions of color and luminance, small-scale local structures, and large-scale configurations?
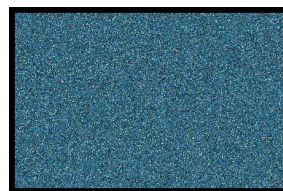
2 STIMULI & METHOD

90 colour photographs of natural scenes, 384 x 256 pixels, 11 x 7 deg of visual angle at a distance of 59 cm.

C: Coherent picture
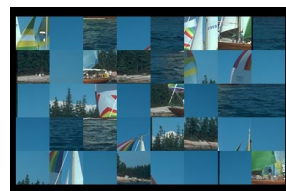
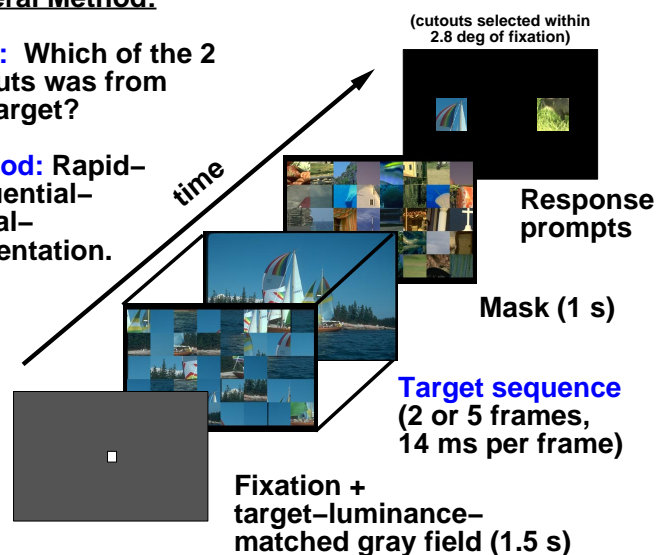**J**: coarsely **J**umbled picture [46 x 46 pixels per chunk]

F: **F**inely jumbled picture [1 pixel per chunk]

General Method:

Task: Which of the 2 cutouts was from the target?

Method: Rapid-Sequential-Visual-Presentation.

(cutouts selected within 2.8 deg of fixation)

time

Response prompts

Mask (1 s)

Target sequence (2 or 5 frames, 14 ms per frame)

Fixation + target-luminance-matched gray field (1.5 s)

Within-subject design, **target-sequence** being the sole factor.

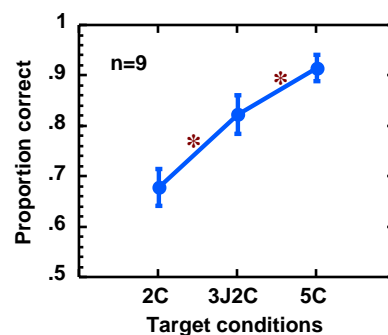Each picture was shown only once to a subject.

3 EXPERIMENT 1

Q: Is global configural information used during the early stage of scene perception?

Target sequences

2C   3J2C   5C

Response prompts in color, with distractor taken from a different picture: v.s.

n=9

Proportion correct / Target conditions

Results:

Significant main effect of target conditions (p<.001).

Planned comparisons (LSD) also showed significant pairwise differences.

Ans. 1: Global configural information is useful during the first 42 ms. Removing it by coarsely scrambling the coherent picture during this period lowers performance.

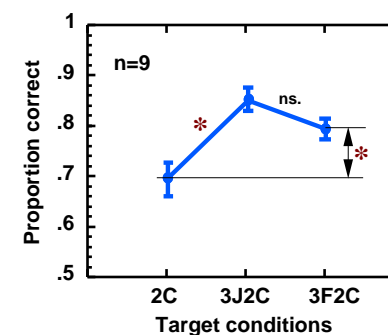**Ans. 2:** Relative to a gray field, a scramble picture also contains information that has an early utility.

4 EXPERIMENT 2

Q: What information in a jumbled picture is used early?

Target sequences

2C   3J2C   3F2C

Response prompts same as in Experiment 1

n=9

ns.

Proportion correct / Target conditions

Results:

Significant main effect of target conditions (p<.001).

Planned comparisons (LSD) showed no significant difference between 3J2C and 3F2C.

Ans.: Early availability of color and luminance distributions facilitates recognition performance.

Additional utility of local structures present in a coarsely jumbled image is minimal in this case.
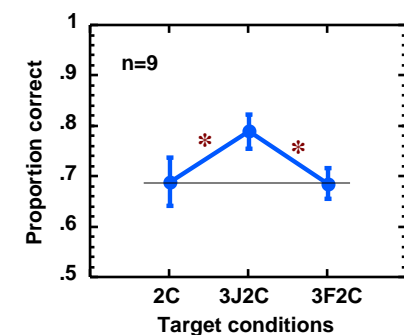
5 EXPERIMENT 3

Q: What happens when the color is made less diagnostic?

Target sequences

Identical to Experiment 2.

Reponse Prompts

Rendered as histogram-equalized black-and-white images.

vs.

n=9

Proportion correct / Target conditions

Results:

Significant main effect of target conditions (p<.05).

Planned comparisons (LSD) showed no significant difference between 2C and 3F2C.

Ans: Early utility of local structures was revealed after the usefulness of color and luminance distributions had been eliminated.

6 DISCUSSION

During the first 42 ms ...

Performance: [everything] > [local structures, distributions of color and luminance] > = [color and luminance distributions only] > = [mean luminance only]

Information: everything   local structures, distributions of color and luminance   color and luminance distributions only   mean luminance only

- Both the small-scale structure of a scene and its color and luminance distributions can be used during the early stage of scene processing.

- These two sources of information are not complimentary. Their effect on performance are non-additive.

- Information beyond local structure and color/luminance distributions also play an early role in scene perception.