Local structure facilitates *rapid* scene perception

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1 INTRODUCTION

After we found conclusive evidence for the utility of local structure in early scene recognition (Tjan et al., ARVO 99) we wondered:

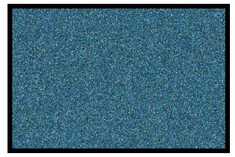
How does the visual system combine extracted information of different sources?

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: **C**oherent picture

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

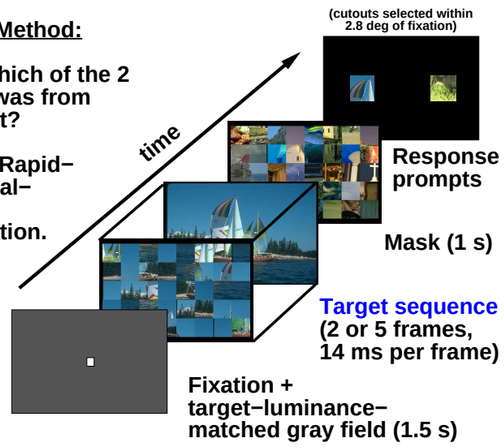


F: **F**inely jumbled picture
[1 pixel per chunk]

General Method:

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

Method: Rapid−Sequential−Visual−Presentation.



Within−subject design, target−sequence being the sole factor.

Each picture was shown only once to a subject.

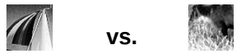
3 EXPERIMENT 1

Q: Does the visual system extract information from each stimulus independently?

Target sequences

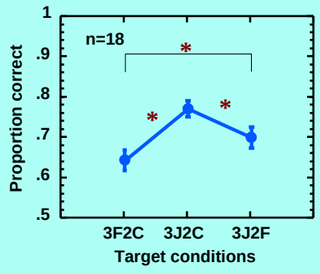
3F2C **3J2C** **3J2F**

Reponse Prompts: Rendered as histogram−equalized black−and−white images.



vs.

RESULT



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

Planned comparisons (LSD) also showed significant pairwise differences.

If the visual system extracts information from each stimulus independently and relies on the better predictor we expected to find either equal performance for 3F2C and 3J2C, or for 3J2F and 3J2C.

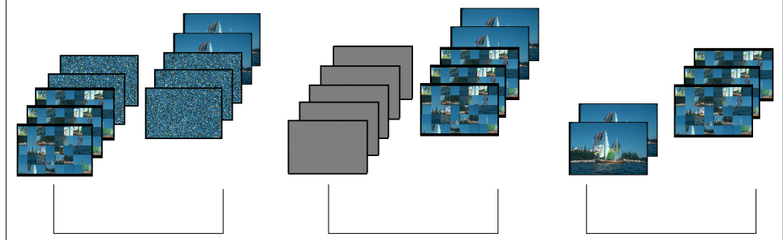
Instead, we find a significant better performance for the 3J2C condition, demonstrating a non−lineraly interaction of the two sources of information.

Tjan, B. S., Ruppertsberg, A. I., & Bülthoff, H. H. (1999) Early use of color and local structure inrapid scene perception. Investigative Ophthalmology & Visual Science. Vol. 40/4, No. 2182.

4 EXPERIMENT 2

Q: Is this information extraction work regardless of the order of presentation?

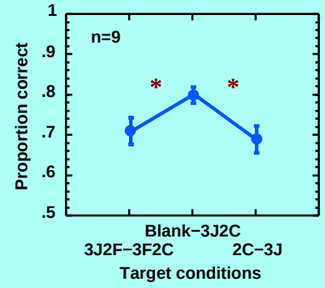
Two target sequences per condition each flanked by fixation dot and mask before response prompts



3J2F−3F2C* **Blank−3J2C** **2C−3J***

***and opposite temporal order**

RESULT



No temporal order effect:
3J2F−3F2C: $t(8,0.05) > t_{data}=2.10$
2C−3J: $t(8,0.05) > t_{data}=1.14$

Significant main effect of target conditions (p = 0.001).

Planned comparisons (LSD) also showed a significant difference of Blank−3J2C to the other two conditions.

We find that participants perfomed best when the information was presented in the sequence where local structure was immediately followed by the coherent picture. (Blank−3J2C).

5 TAKE HOME

These results show that the level of facilitation by local structures (3J) is beyond a simple combination of two sources of information (3J and 2C).

Local structures prime scene recognition by interacting with the normal process for rapid scene perception.