Problem Set #2

Due: Monday January 29, 2007
Turn in to your TA at the beginning of lecture

1. a) If parallel processing is possible, which group will detect the 'A' faster in the experiment sketched below? Explain your answer.

"Find the target or targets in the following array."
Group 1: Target = A
Group 2: Target = A, P, Q, V, Z, W, X, Y, O, R

Array
E B D
A G J
C L H
J M F
N J G
D E B
H C L
M F J

b) If processing is serial, which group will detect the 'A' faster? Explain your answer.

2. Tresiman and Schmidt did an experiment with a display of four objects flanked by two black numbers. The display was flashed very briefly on a screen and followed by a "mask" (an array of dots that makes it difficult to remember what you have just seen). Participants' task was to first report the numbers, then describe the colored shapes in the middle of the display. On 18% of the trials, people reported seeing objects that weren't actually there. For example, in a display with a small red triangle and a small green circle, they might report a green triangle and a red circle.

(a) What is this phenomenon called?
(b) How does Treisman's Feature Integration Theory explain why this happens?
(c) In a variant of this experiment, shapes like the following were used.
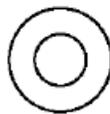
   (orange)   (blue)   (black)

When normal instructions were used (with Group A), people often reported the orange triangle as being black. However, when people (in Group B) were told that they were

being shown a carrot, a lake, and a tire, this was much less common. Why did Group B do better than Group A?
(d) Which stage of Treisman's model would the difference between Group A and Group B arise?

3.
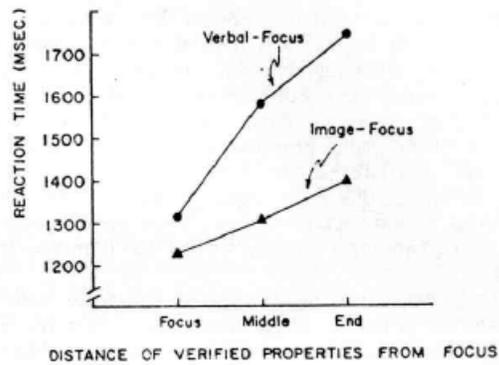
Fig. 2. Speed of verification of picture properties as a function of spatial location and distance from the point of focus.
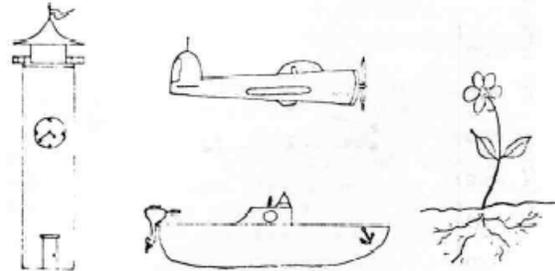
Fig. 1. Examples of line drawings used.

In this experiment, participants were shown a picture and asked to verbally describe it to themselves (verbal-focus group), or to memorize a mental image of it (image-focus group). The Image-Focus group was then asked to focus on one end of their mental image (e.g. the left side of the boat) and answer yes or no whether it contained other features ('does it have a motor?'). (a) What kind of a representation would Kosslyn say the Image-Focus group are using to do this task? (b) Why does the pattern of reaction times for the Image-Focus group support Kosslyn's claim? (c) What kind of a representation would Pylyshyn say the Image-Focus group are using to do this task? (d) Explain how Pylyshyn could explain the pattern of reaction times for the Image-Focus group. (e&f) Do you think the similarities in the pattern of data by the Verbal-Focus group to those of the Image-Focus group is more consistent with Kosslyn's ideas about representation, or with Pylyshyn's ideas? Support your opinion.

4. A casino in Vegas has approached you to submit a proposal for a computational model that can be used to predict the score of football games. Describe a neural network model suitable for this purpose, and make an argument for why it is a good way to approach this problem. Be sure to describe (a) the number of layers (b) your input representations, (c) your output representations, (d) what sort of connectivity your network would have, (e) how you will train the network (mention which learning rule you will use), and (f) give at least one feature your model has that is superior to alternative approaches (such as linear regression) that could be used to solve this problem.

5. (a) Describe one "piece" of evidence from cognitive neuroscience that supports the claim that mental imagery involves analogue representations. (b) What property or characteristic of analogue representations does your evidence highlight?