MENTAL IMAGERY

PSY435

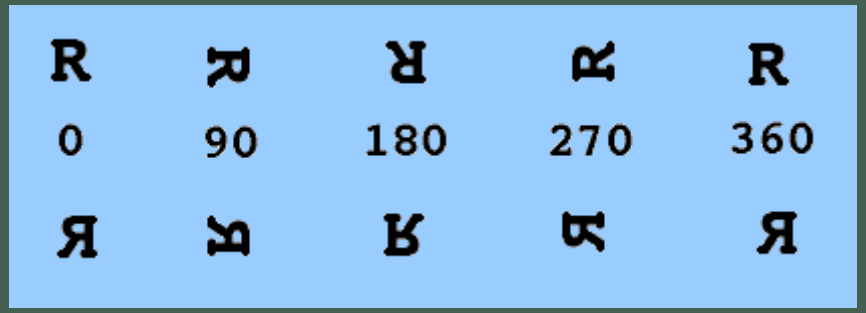
Roadmap

- What is the difference between perceiving and imagining?
- How does mental imagery work?
- What does it look like in the brain?

Roger Shepard's study of Mental Rotation:

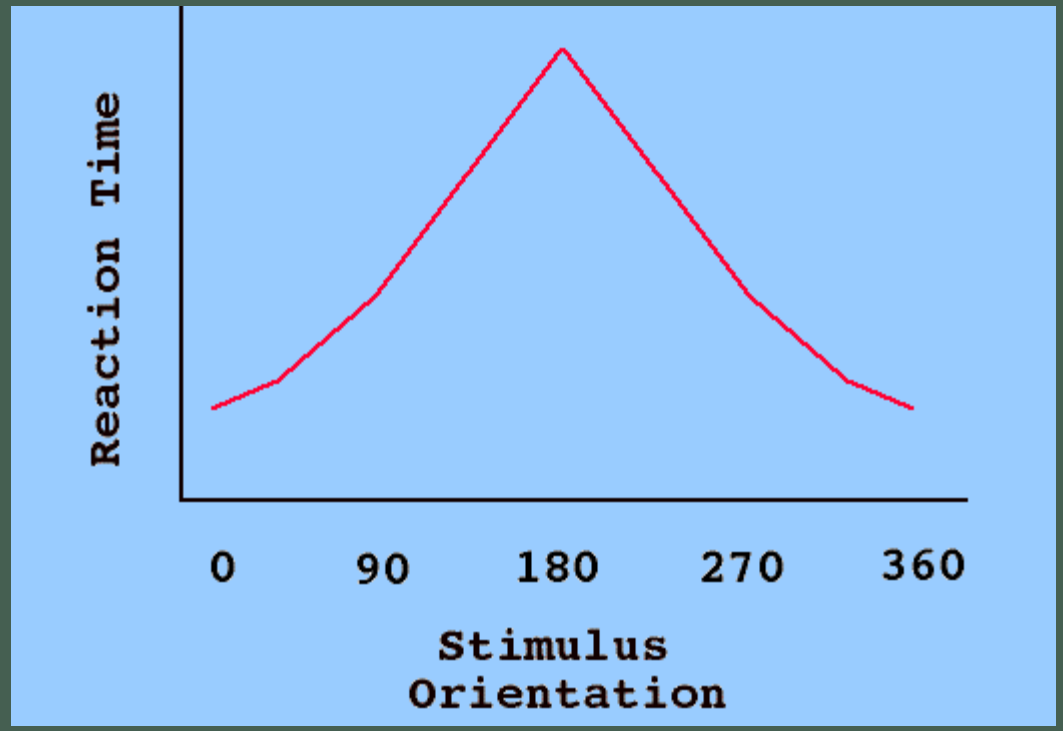
Question: Do the movements of mental images have characteristics similar to movements of real objects?

i.e. What is the nature of mental imagery?



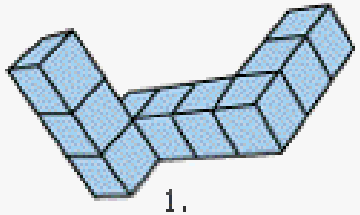
Subjects were asked to judge whether the letters were normal or mirror reversed. It was assumed that the letters would be mentally rotated to "upright" positions in order to make this judgement.

Results

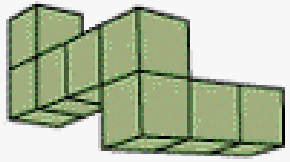


The greater the angle the letter had to be rotated to get back to upright…the longer it took subjects to judge whether they were mirror reversed or not.

Standard

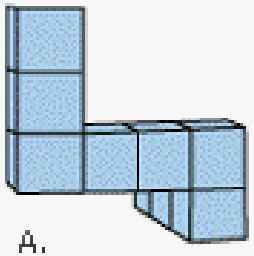


1.



2.

Comparison shapes



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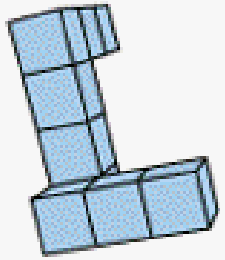
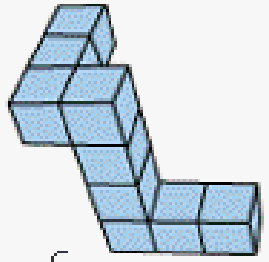
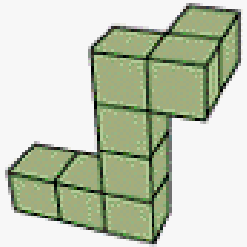


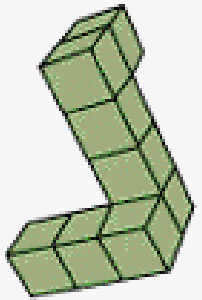
B.



C.



A.



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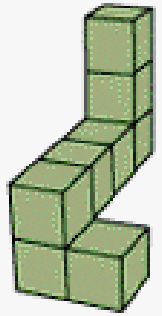
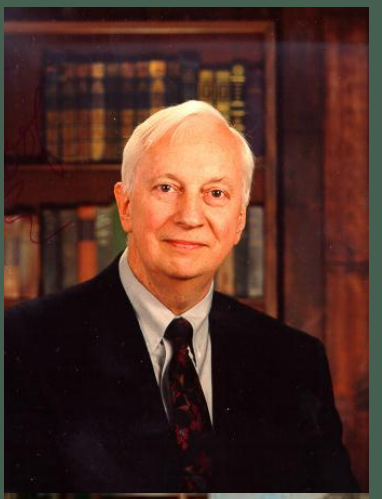


C.

Key question regarding the format or nature of mental images: Are mental images ***propositional*** or ***analog***?

- ***Propositional***: represented like any other kind of information. Semantic and logical descriptions of the properties of the "image" people believe they are experiencing.

- ***Analog***: a representation that maintains the properties of or otherwise functions in a manner functionally similar to a real visual image.



Zenon Pylyshn

Stephen Kosslyn

For example…consider the representation of a square.

Propositional code: (1) four straight lines
(2) at right angles to each other
(3) each line segment connected
at the end to two others

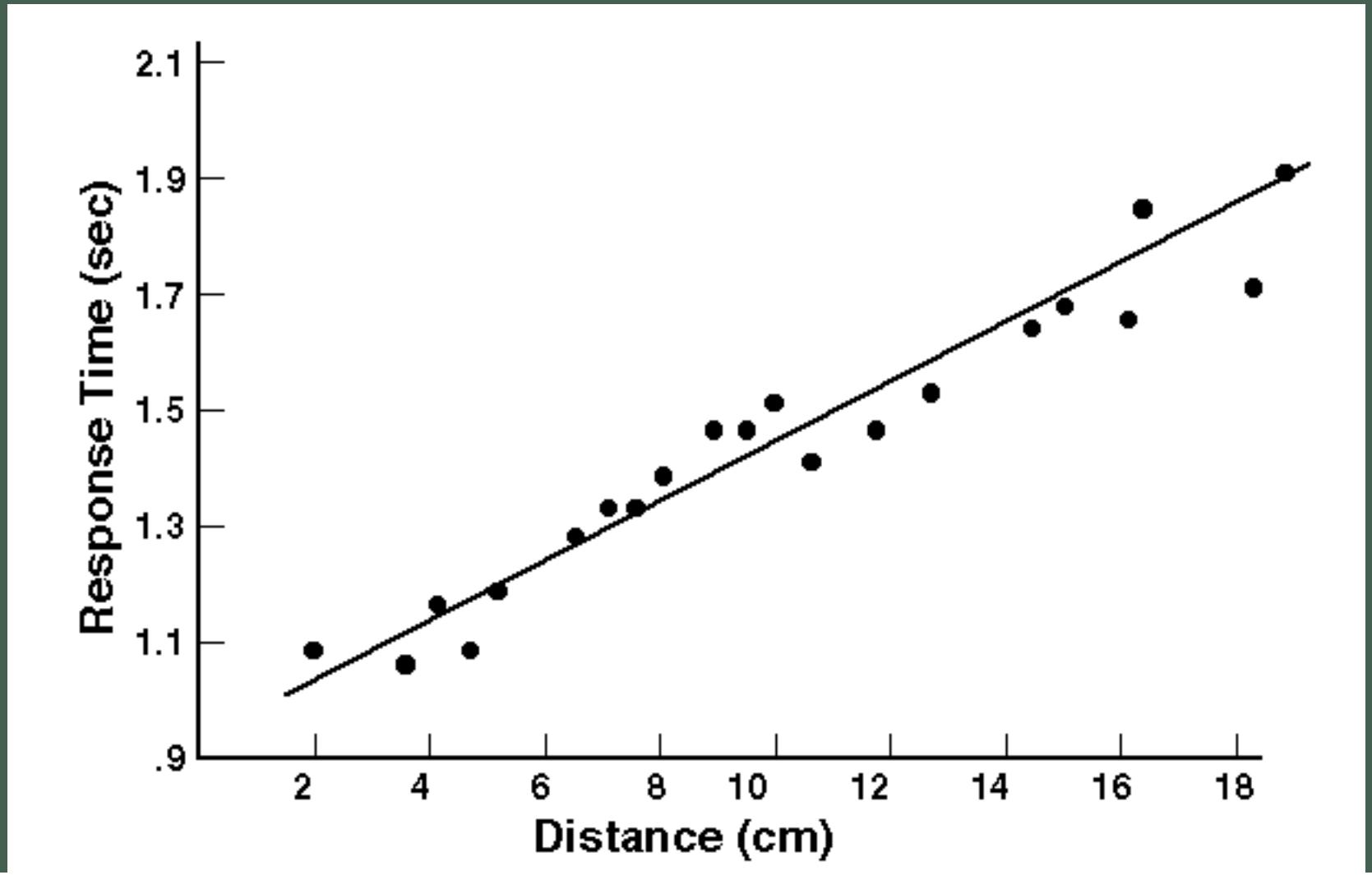
Analog code:

Kosslyn & colleagues (1978)

Subjects memorize fictional map (redraw it).

“Imagine black speck moving from straw hut to well” then press key.

The distance scanned in a mental image is directly related to the time it takes to complete the scan.



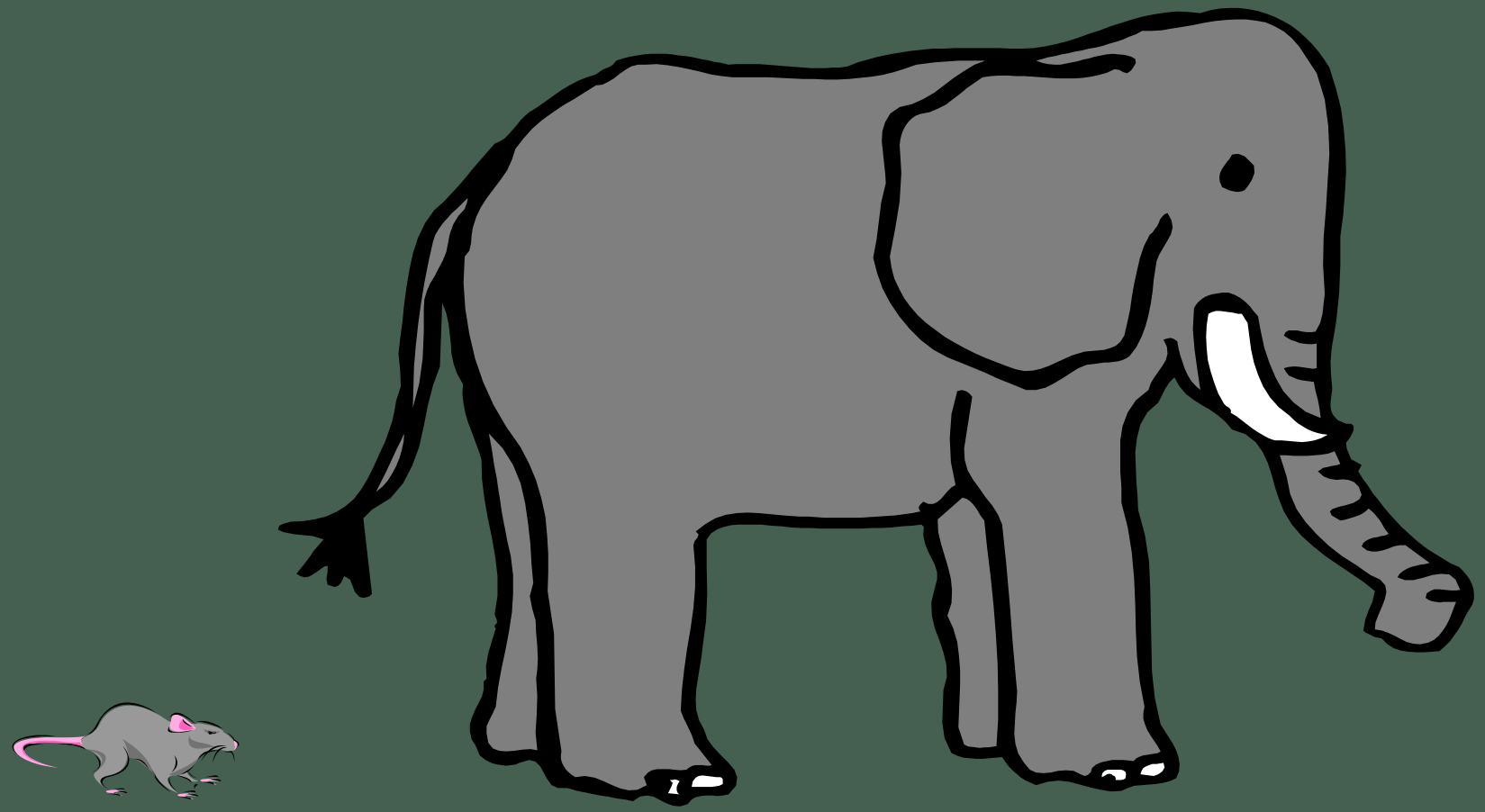
Is it just the imagined scale of the map?
Does scale have any effect?

It shouldn’t, given a purely propositional position.

Eugene is in Oregon.
Eugene is south of Portland.
But the ease of finding it on a map varies with map size (at least in real life).

“Imagine a mouse next to an elephant…”

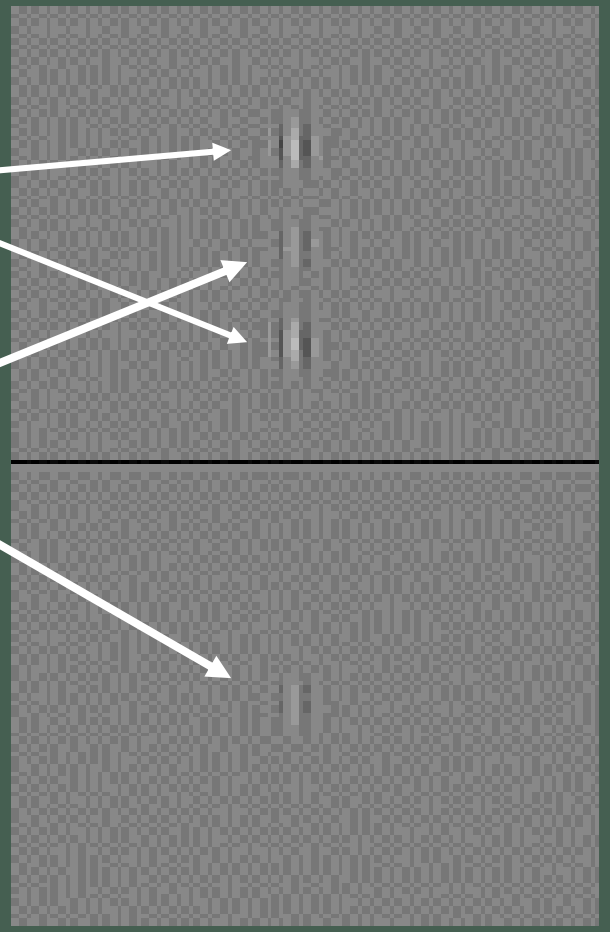
“Imagine a mouse next to an elephant…”



“Imagine a mouse eating cheese…”

“Imagine a mouse next to a paperclip…”

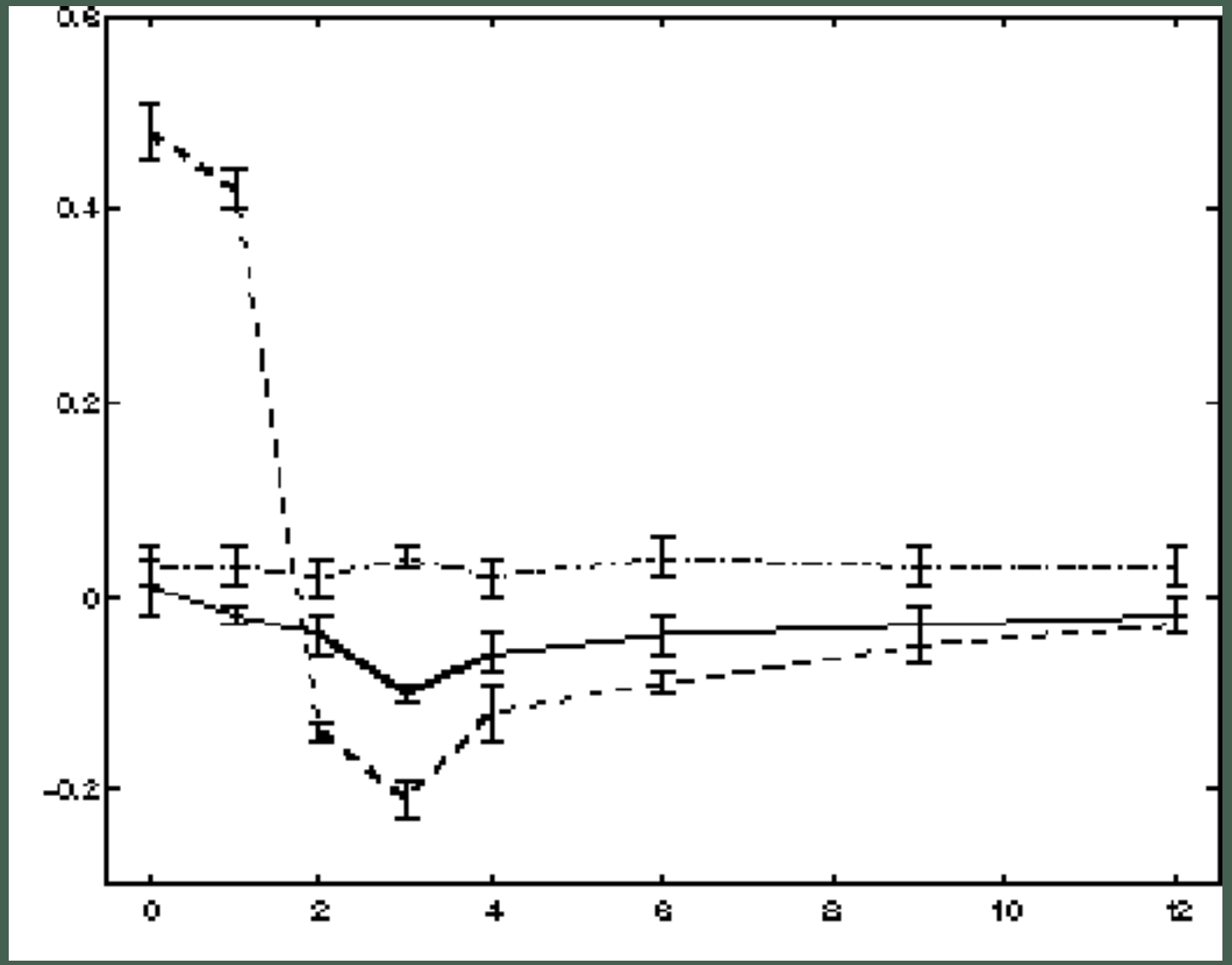
Enhancement of Target Detection through Mental Imagery (Ishai and Sagi, 1995)



Under normal circumstances, the **top** target is ***easier to detect*** than the **bottom** target.

But when subject ***mentally imaged*** the flanking stimuli, they showed a similar level of improvement in the bottom condition!

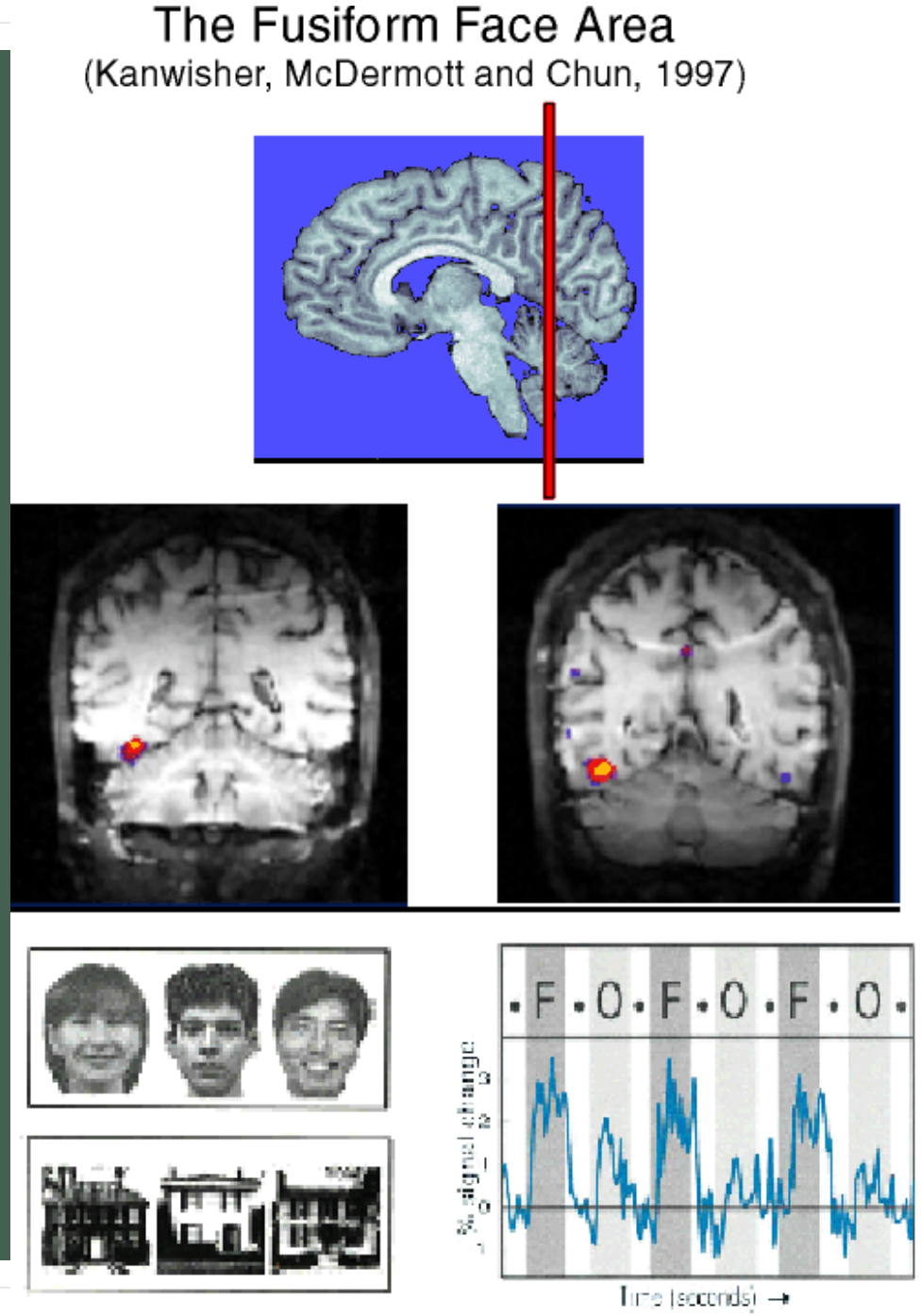
detection threshold *(lower is better)*



target to mask distance

Mental manipulation
=
Physical manipulation

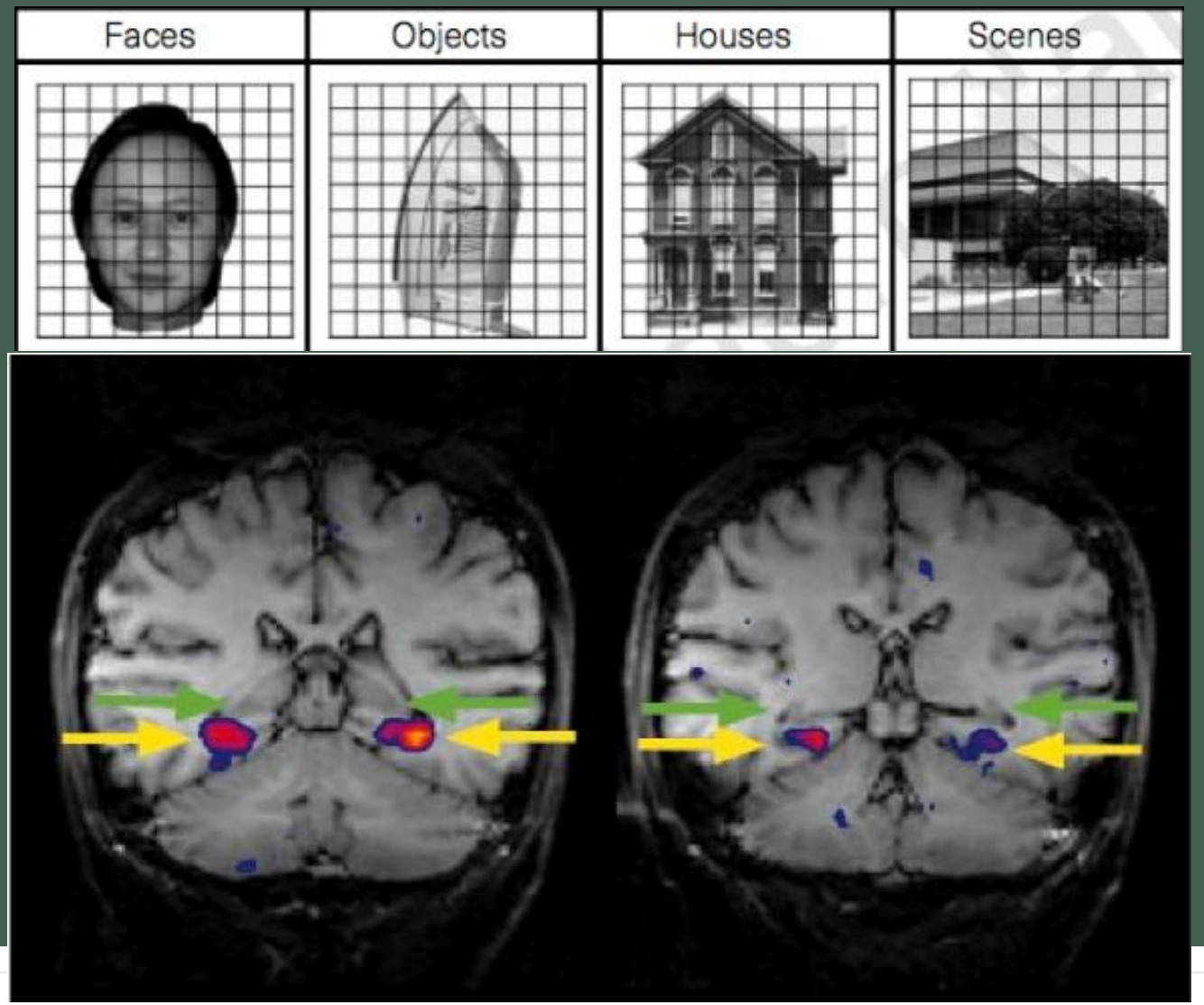
What's happening in the brain?



Are the same brain mechanisms involved in perception and imagery?

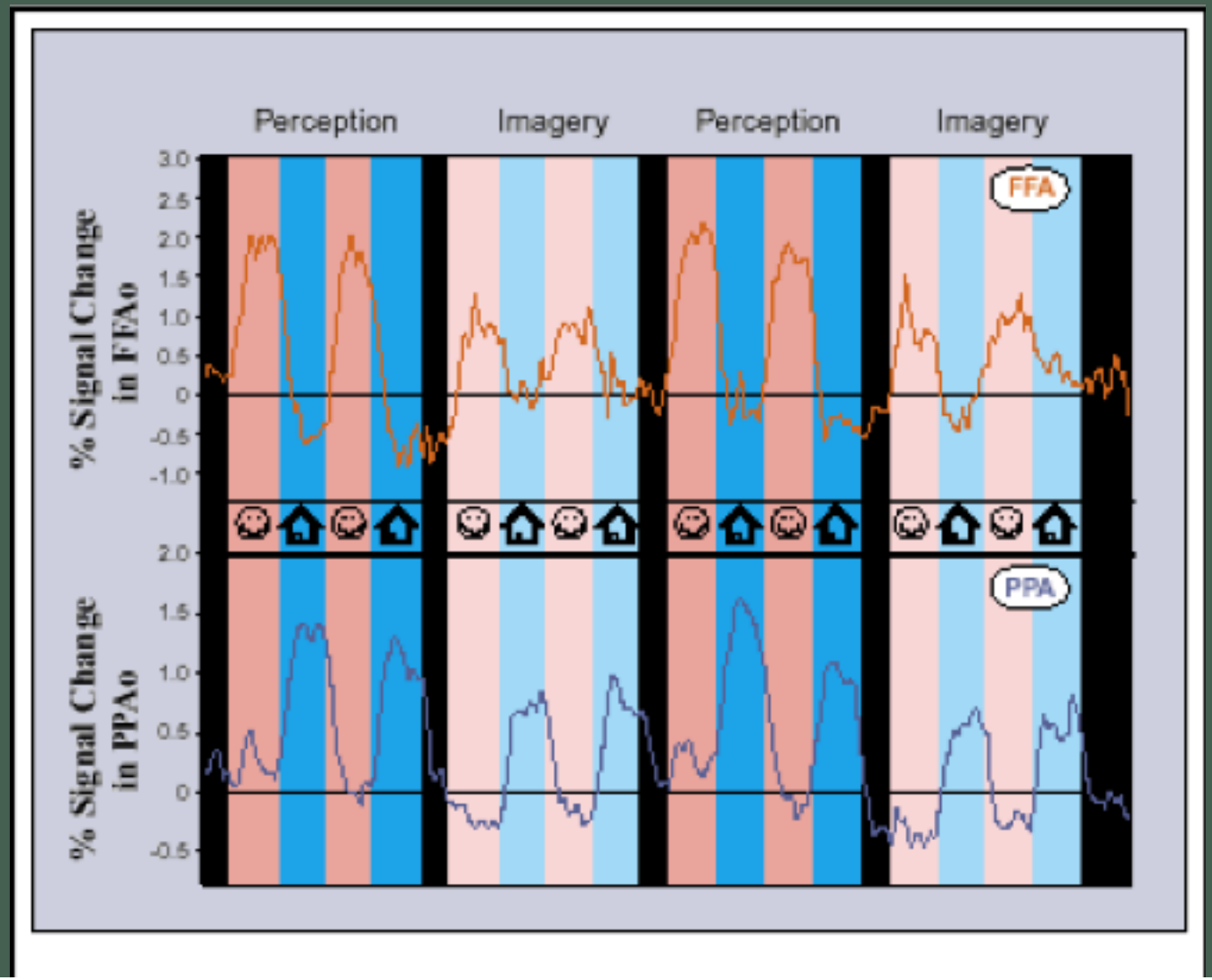
Fusiform Face Area (FFA)

Para-hippocampal Place Area (PPA)



Imagined Faces, Imagined Places

O'Craven & Kanwisher, 2000



FFA activated when imagining a face

PPA activated when imagining a place

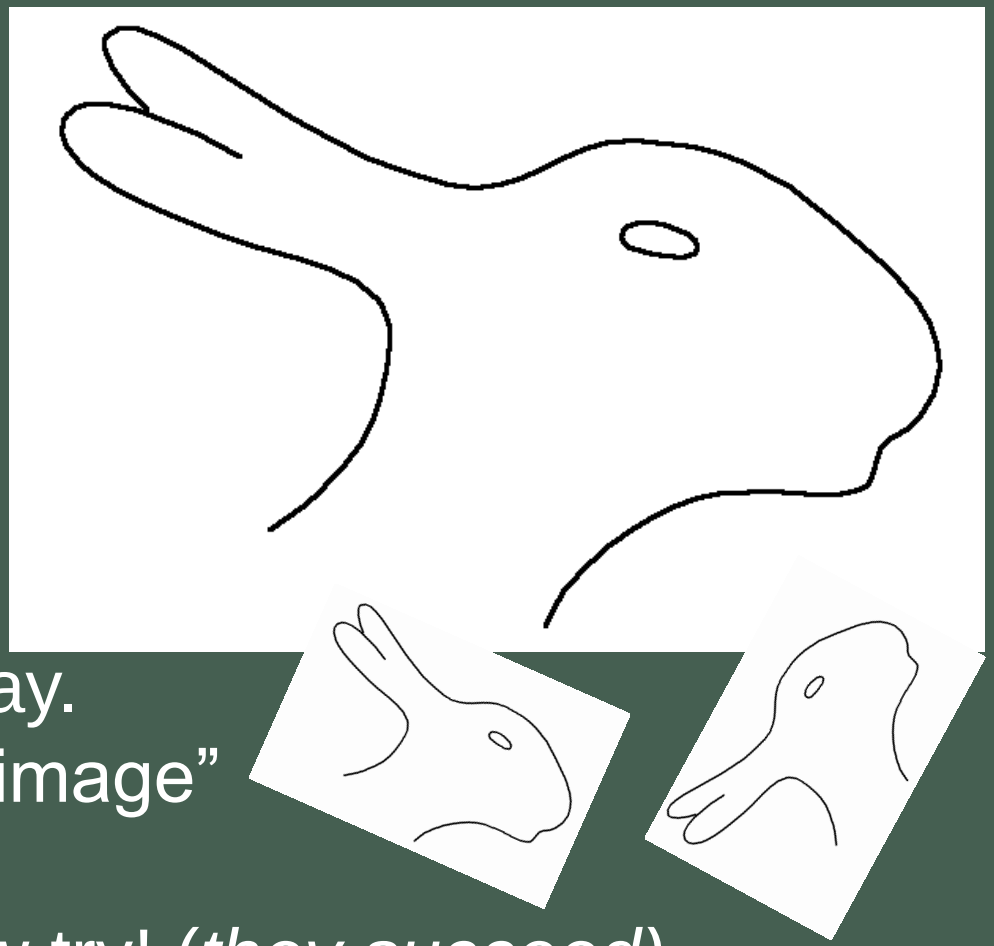
Conclusions

- Creation and use of mental images can be studied in the lab
- Mental images are at least a little bit like pictures (i.e. the timing of transformations and scanning is similar, perceptual interactions can be mimicked by imagery, imagery and perception interfere with each other, similar brain regions are recruited by imagery and perception …)

- But how far does this correspondence between image and picture really go?? There are some noteworthy differences between the two…

Chambers & Reisberg

1. Subjects view figure, form image



2. Figure taken away.
3. “Reinterpret the image” (*they fail)*
4. Draw image; now try! (*they succeed)*

Mental Images are more rigid

One a mental image has been formed it is difficult to change the representation on the fly.

Lets try it…

Altered Imagery

Some individuals are either born with or have neurological deficits that give them extraordinary imagery abilities…..

Luria's S. Span: 70 items forward or backward, even after 15 yrs.

*"**Yes, yes ... This was a series you gave me when we were in your apartment ... You were sitting at the table and I in the rocking chair ... You were wearing a gray suit and you looked at me like this ... Now, then, I can see you saying** ..."*

(S. then recalls list).

Vivid Imagery, even for digits:

“Take the number 1. This is a proud, well-built man; 2 is a high-spirited woman; 3 is a gloomy person (why, I don’t know); 6 is a man with swollen feet; 7 a man with a mustache; 8 a very stout woman.”

S had **Synesthesia**:

When shown object, S would see it, hear it, taste it, etc.

Related to memory ability? ?

Pencil and the fence, egg on the wall

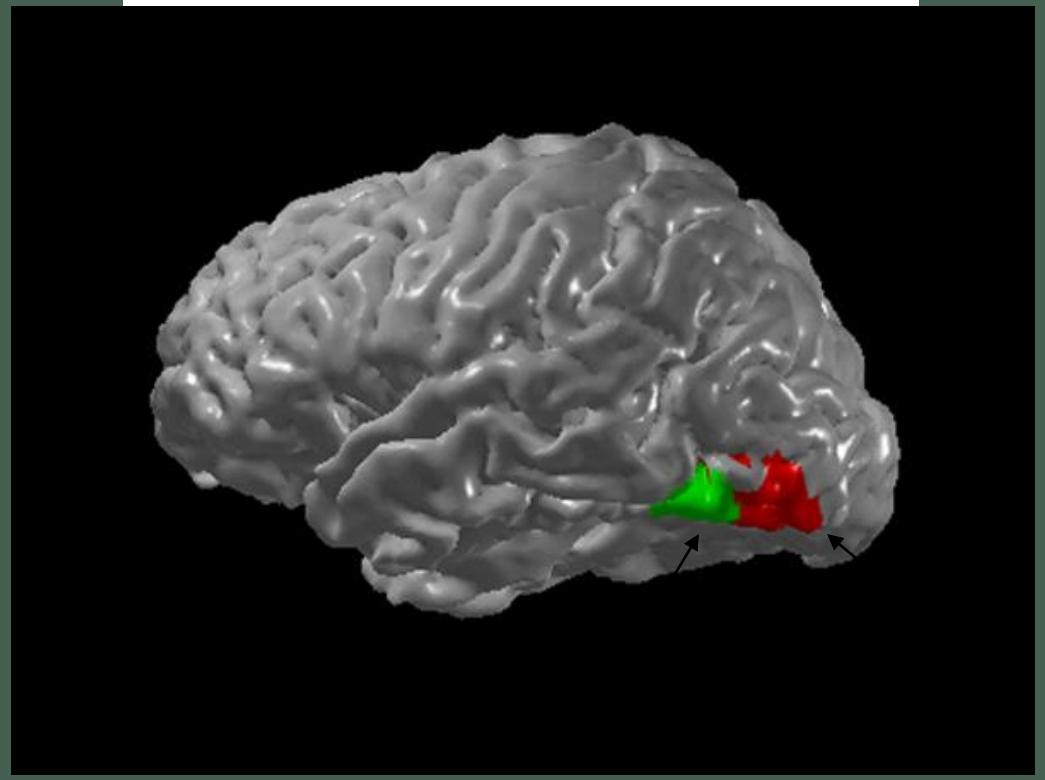
“I read that ‘the work got under way normally.’
As for *work*, I see that work is going on ... there’s a factory .. But there’s that word *normally*. What I see is a big, ruddy-cheeked woman, a normal woman.. Then the expression *got under way*. Who? What is all this? You have industry .. that is, a factory, and this normal woman - but how does this all fit together? How much I have to get rid of just to get the simple idea of the thing!

Color-Grapheme *Synesthesia*

SYNESTHESIA
0123456789

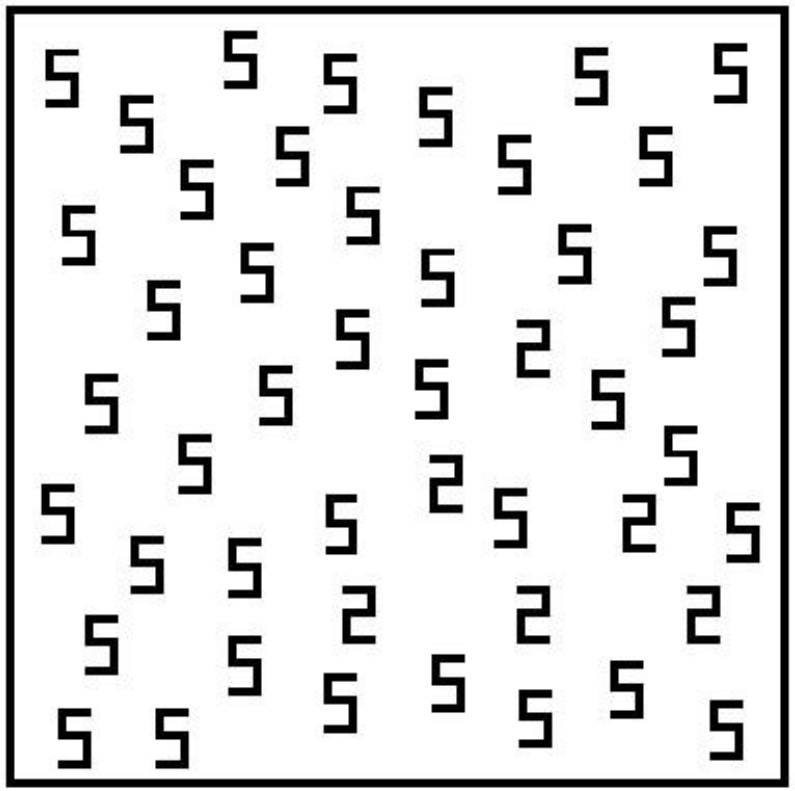
Letters and numbers are perceived as being inherently colored.

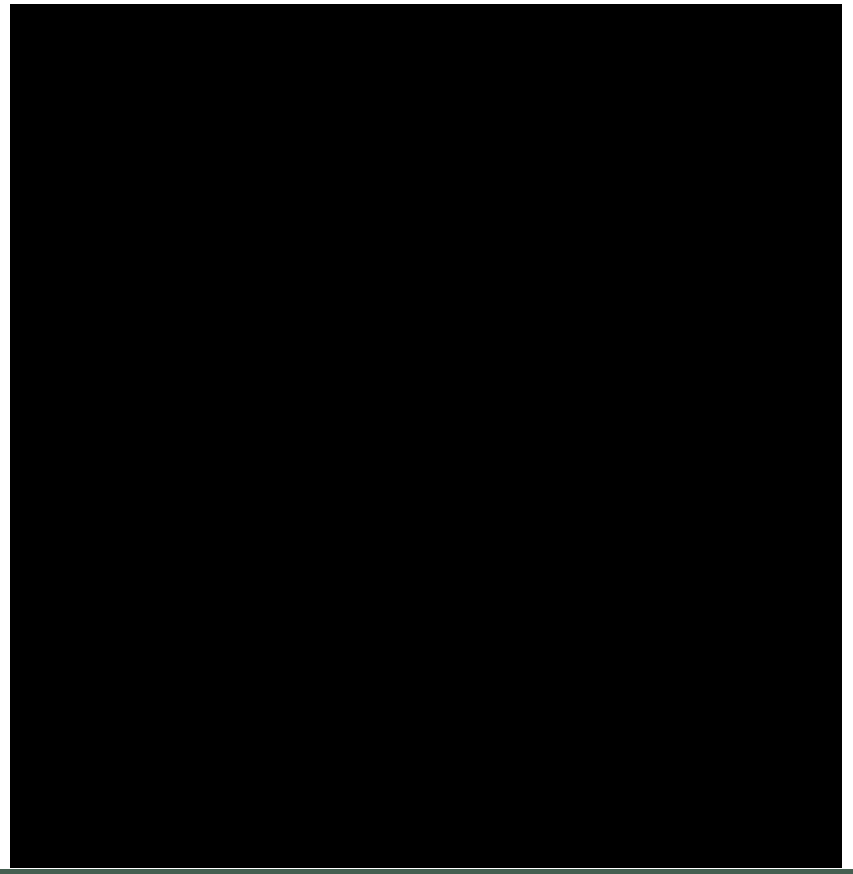
This color/letter mapping is consistent within the individual, and this is a heritable trait.



Automatic perception of color imagery?

How many 2's?





Difficult, slow search

Synesthetes see Pop-out, making it an easy search