

PSYC 2530: Mental Imagery

From the 1880s to 2020s and back

Matthew J. C. Crump

Reminders

Readings are from chapter 2 on [Mental Imagery](#)

Roadmap

1 Mental imagery and
introspection

2 Aphantasia and
Hyperphantasia

3 Imagery and Memory

4 Imagery debate

mental imagery

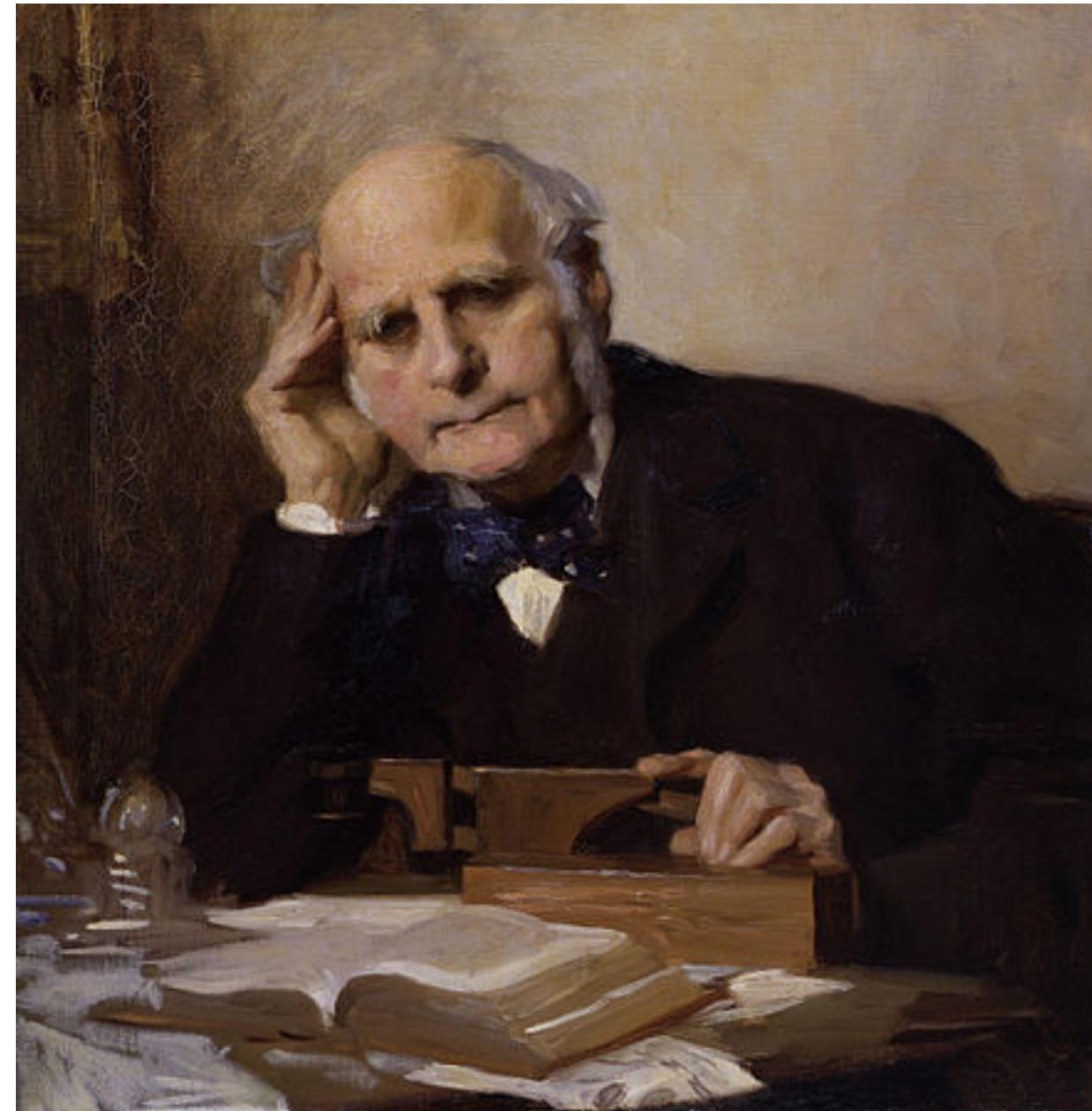
Mental imagery is the subjective experience of internal perception-like sensations. Some examples include:

1. Visual imagery, or “seeing” pictures in your mind’s eye
2. Auditory imagery, or “hearing” sounds/music in your head
3. Taste/smell imagery

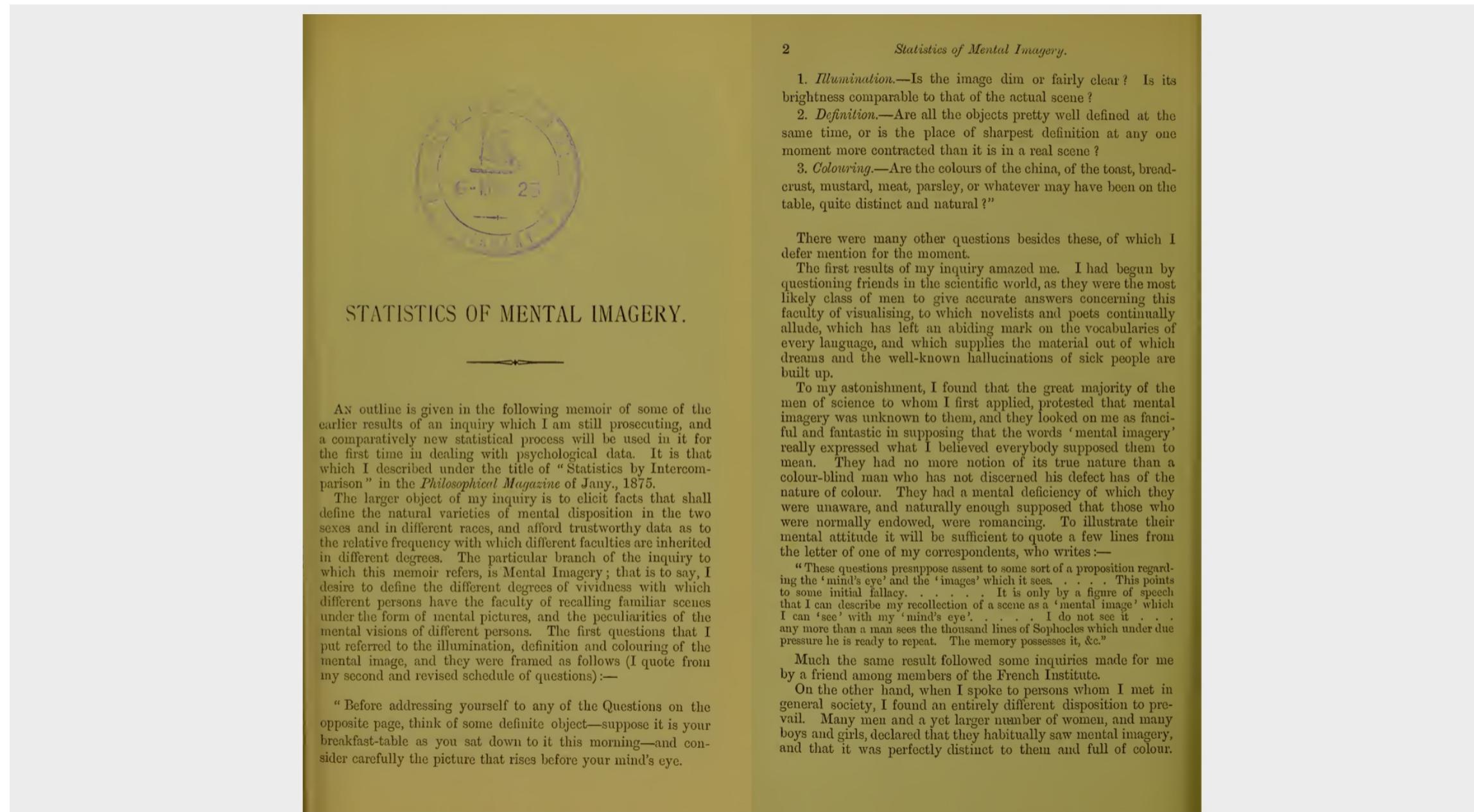
Vividness of mental imagery

In 1880, Sir Francis Galton conducted early research on the vividness of mental imagery.

[Read his original work here](#)



Statistics of mental Imagery



2 *Statistics of Mental Imagery.*

1. *Illumination*.—Is the image dim or fairly clear? Is its brightness comparable to that of the actual scene?

2. *Definition*.—Are all the objects pretty well defined at the same time, or is the place of sharpest definition at any one moment more contracted than it is in a real scene?

3. *Colouring*.—Are the colours of the china, of the toast, bread-crust, mustard, meat, parsley, or whatever may have been on the table, quite distinct and natural?"

There were many other questions besides these, of which I defer mention for the moment.

The first results of my inquiry amazed me. I had begun by questioning friends in the scientific world, as they were the most likely class of men to give accurate answers concerning this faculty of visualising, to which novelists and poets continually allude, which has left an abiding mark on the vocabularies of every language, and which supplies the material out of which dreams and the well-known hallucinations of sick people are built up.

To my astonishment, I found that the great majority of the men of science to whom I first applied, protested that mental imagery was unknown to them, and they looked on me as fanciful and fantastic in supposing that the words 'mental imagery' really expressed what I believed everybody supposed them to mean. They had no more notion of its true nature than a colour-blind man who has not discerned his defect has of the nature of colour. They had a mental deficiency of which they were unaware, and naturally enough supposed that those who were normally endowed, were romancing. To illustrate their mental attitude it will be sufficient to quote a few lines from the letter of one of my correspondents, who writes:—

"These questions presuppose assent to some sort of a proposition regarding the 'mind's eye' and the 'images' which it sees . . . This points to some initial fallacy. . . . It is only by a figure of speech that I can describe my recollection of a scene as a 'mental image' which I can 'see' with my 'mind's eye'. . . . I do not see it . . . any more than a man sees the thousand lines of Sophocles which under due pressure he is ready to repeat. The memory possesses it, &c."

Much the same result followed some inquiries made for me by a friend among members of the French Institute.

On the other hand, when I spoke to persons whom I met in general society, I found an entirely different disposition to prevail. Many men and a yet larger number of women, and many boys and girls, declared that they habitually saw mental imagery, and that it was perfectly distinct to them and full of colour.

What Galton did...

Galton asked 100 “distinguished men” to describe the vividness of their mental imagery.

He used a “Breakfast table task”...

Breakfast Table task

Think of some definite object – suppose it is your breakfast-table as you sat down to it this morning – and consider carefully the picture that rises before your mind's eye.

1. Illumination. – Is the image dim or fairly clear? Is its brightness comparable to that of the actual scene ?
2. Definition – Are all the objects pretty well defined at the same time, or is the place of sharpest definition at any one moment more contracted than it is in a real scene?
3. Colouring – Are the colours of the china, of the toast, bread-crust, mustard, meat, parsley, or whatever may have been on the table, quite distinct and natural?

What would you say?

Imagine what you last ate in your mind's eye. How would you rate the vividness of your mental imagery?

1. Extremely vivid, like you are eating it all over again in real life
2. Vivid, you can picture it pretty well
3. Fuzzy, not really life-like, but you can remember it
4. No imagery, not at all life-like, no mental pictures

What did Galton find?

Galton found a wide range of individual differences in self-reported mental imagery abilities

Extremely vivid

Brilliant, distinct, never blotchy.

Quite comparable to the real object. I feel as though I was dazzled, e.g., when recalling the sun to my mental vision.

In some instances quite as bright as an actual scene.

medium vivid

*Fairly clear, not quite comparable to that of the actual scene.
Some objects are more sharply defined than others, the more
familiar objects coming more distinctly in my mind.*

not vivid

My powers are zero. To my consciousness there is almost no association of memory with objective visual impressions. I recollect the breakfast table, but do not see it.

Introspection

Galton employed the method of introspection.

Introspection involves “inspecting” and describing the qualities of your own subjective mental experience.

Titchener's Introspectionism

E. B. Titchener was an American Psychologist who advocated Introspectionist approaches to answering questions about psychological phenomena.

E. B. Titchener



Structuralism
Introspectionism

Margaret Floy
Washburn



Born in NYC
First Woman to
receive Ph.D.
in Psych (1894)

Replicating Galton's findings

In the early 1900s, several American psychologists also measured individual differences in mental imagery using Galton's task, and other kinds of questionnaires.

- they generally found similar results as Galton

Titchener's questionnaire

French, F. C. (1902). Mental imagery of students: A summary of the replies given to Titchener's questionary by 118 juniors in Vassar college. Psychological Review, 9(1), 40.

<https://doi.org/10/cqj438>

	Actual No. Yes.	Actual No. No.	Percentage. Yes.	Percentage. No.
I. Think of a bunch of white rosebuds, lying among fern-leaves in a florist's box.				
a. Are the colors—the creamy white, the green, the shining white—quite distinct and natural?	118	0	100	0
b, 1. Do you see the flowers in a good light?	106	12	90	10
2. Is the image as bright as the objects would be if they lay on the table before you?	59	52	53	47
c, 1. Are the flowers, and leaves, and box, well defined and clear cut?	115	3	97.5	2.5
2. Can you see the whole group of objects together, or is one part distinctly outlined while the others are blurred?	58	43	57	43
d, 1. Can you call up the scent of the rosebuds?	103	15	87	13
2. Of the moist ferns?	65	53	55	45
3. Of the damp pasteboard?	75	43	64	36
e, 1. Can you feel the softness of the rose petals?	114	4	96.6	3.4
2. The roughness of the ferns?	106	12	90	10
3. The stiffness of the box?	106	11	91	9
f. Can you feel the coldness of the buds as you lay them against your cheek?	108	10	92	8
g, 1. Can you feel the prick of a thorn?	85	31	73	27
2. Can you see the drop of blood welling out upon your finger?	110	4	96.5	3.5
3. Can you feel the smart and soreness of the wound?	62	52	54	46
h. Can you call up the taste of				
1. Candied rose leaves?	36	70	34	66
2. Candied violets?	87	29	75	25

Limitations of Introspectionism?

If you were trying to investigate cognitive abilities, what would be some limitations of introspection?

Some issues

Common complaints about introspection include:

1. The measure is subjective
2. The measure is not independently observable or easily verifiable
3. People might be lying
4. People might not be able to describe their own mental processes
5. Different descriptions could actually refer to the same experience

The decline of introspectionism

In American psychology, the method of introspectionism was heavily criticized by Behaviorists, and lost popularity across the early 1900s.

We discuss the Behaviorist period in chapter 6.

Roadmap

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introspection

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4 Imagery debate

Back to the future

Let's fast-forward to mental imagery in the 2010s...



Loss of imagery phenomenology with intact visuo-spatial task performance: A case of 'blind imagination'

Adam Z.J. Zeman^a, Sergio Della Sala^{b,*}, Lorna A. Torrens^c, Viktoria-Eleni Gountouna^b,
David J. McGonigle^{d,1}, Robert H. Logie^b

^a Department of Neurology, Peninsula Medical School, Exeter, UK

^b Human Cognitive Neuroscience and Centre for Cognitive Ageing and Cognitive Epidemiology, Psychology, University of Edinburgh, Edinburgh, UK

^c Robert Fergusson Unit, Royal Edinburgh Hospital, Edinburgh, UK

^d Centre for Functional Imaging Studies, Western General Hospital, Edinburgh, UK

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ABSTRACT

The capacity for imagery, enabling us to visualise absent items and events, is a ubiquitous feature of our experience. This paper describes the case of a patient, MX, who abruptly lost the ability to generate visual images. He rated himself as experiencing almost no imagery on standard questionnaires, yet performed normally on standard tests of perception, visual imagery and visual memory. These unexpected findings were explored using functional MRI scanning (fMRI). Activation patterns while viewing famous faces were not significantly different between MX and controls, including expected activity in the fusiform gyrus. However, during attempted imagery, activation in MX's brain was significantly reduced in a network of posterior regions while activity in frontal regions was increased compared to controls. These findings are interpreted as suggesting that MX adopted a different cognitive strategy from controls when performing the imagery task. Evidence from experimental tasks thought to rely on mental imagery, such as the Brooks' matrices and mental rotation, support this interpretation. Taken together, these results indicate that successful performance in visual imagery and visual memory tasks can be dissociated from the phenomenal experience of visual imagery.

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marks 1973

Zeman and colleagues used an updated questionnaire to measure vividness of mental imagery

Table 1. *The rating scale used in the Vividness of Visual Imagery Questionnaire*

Rating	Description
1	'Perfectly clear and as vivid as normal vision'
2	'Clear and reasonably vivid'
3	'Moderately clear and vivid'
4	'Vague and dim'
5	'No image at all, you only "know" that you are thinking of the object'

VVIQ items

APPENDIX

Items contained in the Vividness of Visual Imagery Questionnaire

For items 1–4, think of some relative or friend whom you frequently see (but who is not with you at present) and consider carefully the picture that comes before your mind's eye.

Item

1. The exact contour of face, head, shoulders and body.
2. Characteristic poses of head, attitudes of body, etc.
3. The precise carriage, length of step, etc., in walking.
4. The different colours worn in some familiar clothes.

Visualize a rising sun. Consider carefully the picture that comes before your mind's eye.

Item

5. The sun is rising above the horizon into a hazy sky.
6. The sky clears and surrounds the sun with blueness.
7. Clouds. A storm blows up, with flashes of lightning.
8. A rainbow appears.

Think of the front of a shop which you often go to. Consider the picture that comes before your mind's eye.

Item

9. The overall appearance of the shop from the opposite side of the road.
10. A window display including colours, shapes and details of individual items for sale.
11. You are near the entrance. The colour, shape and details of the door.
12. You enter the shop and go to the counter. The counter assistant serves you. Money changes hands.

Finally, think of a country scene which involves trees, mountains and a lake. Consider the picture that comes before your mind's eye.

Item

13. The contours of the landscape.
14. The colour and shape of the trees.
15. The colour and shape of the lake.
16. A strong wind blows on the trees and on the lake causing waves.

Aphantasia

In 2015, Zeman and colleagues described a small group of participants who reported essentially non-existent mental imagery on the VVIQ test.

They coined the phrase “Aphantasia” to refer the condition of experiencing limited or no mental imagery.

Hyperphantasia

Hyperphantasia refers to the opposite extreme, where people report very vivid and life-like mental imagery

media interest

In the past 10 years, Zeman's research is often picked up in the media, and generates popular interest

For example, this work was recently featured in the New York Times

<https://www.nytimes.com/2021/06/08/science/minds-eye-mental-pictures-psychology.html>

Extra-ordinary claims

From the NYT article,

Joel Pearson, a cognitive neuroscientist at the University of New South Wales who has studied mental imagery since 2005, said hyperphantasia could go far beyond just having an active imagination. “It’s like having a very vivid dream and not being sure if it was real or not,” he said. “People watch a movie, and then they can watch it again in their mind, and it’s indistinguishable.”

Aphantasia.com

<https://aphantasia.com>

A website and online community for people interested in
aphantasia and hyperphantasia

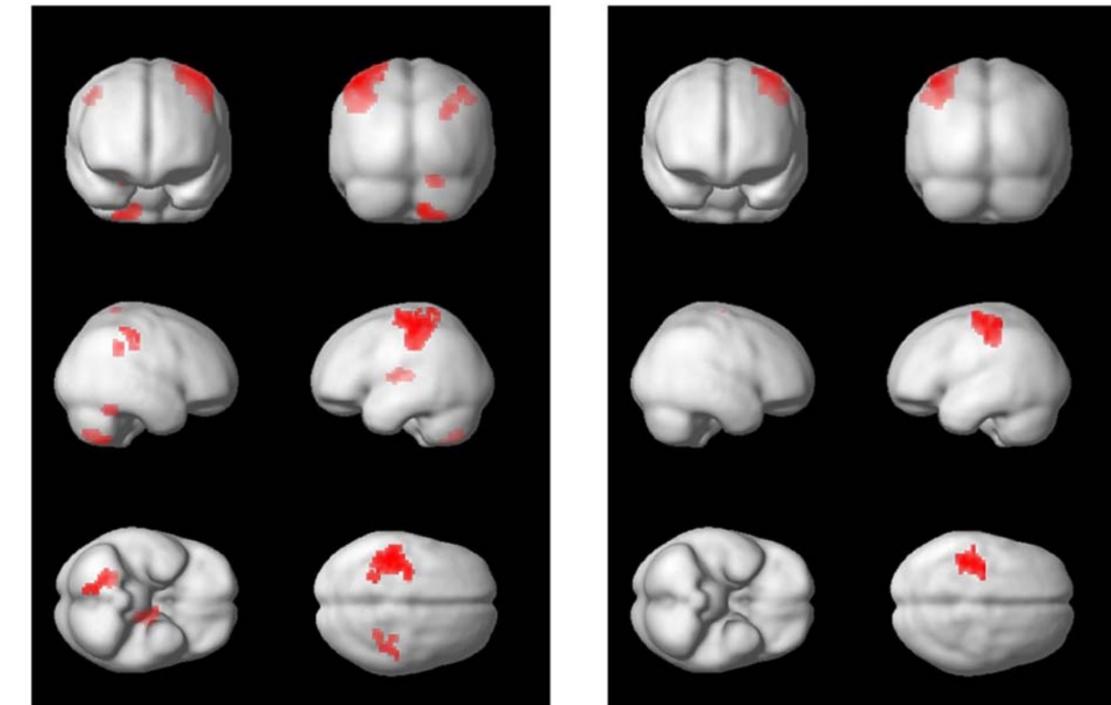
Beyond introspection

Questionnaires provide subjective report measurements based on introspection

[Brain imaging techniques](#) have also been used to provide converging evidence about mental imagery

Visual imagery and the brain

Milton et al., 2021



Hyperphantasia-Aphantasia

Control-Aphantasia

Figure 4. Areas more strongly activated in the hyperphantasic and control groups than the aphantasic group (left and right columns, respectively) in a subtraction of the perception from the visualization conditions.

Decoding dreams

Horikawa, T., Tamaki, M., Miyawaki, Y., & Kamitani, Y. (2013). Neural decoding of visual imagery during sleep. *Science*, 340(6132), 639–642. <https://doi.org/10.1126/science.1234330>

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mnemonics

Mnemonics are techniques known to help people retain information

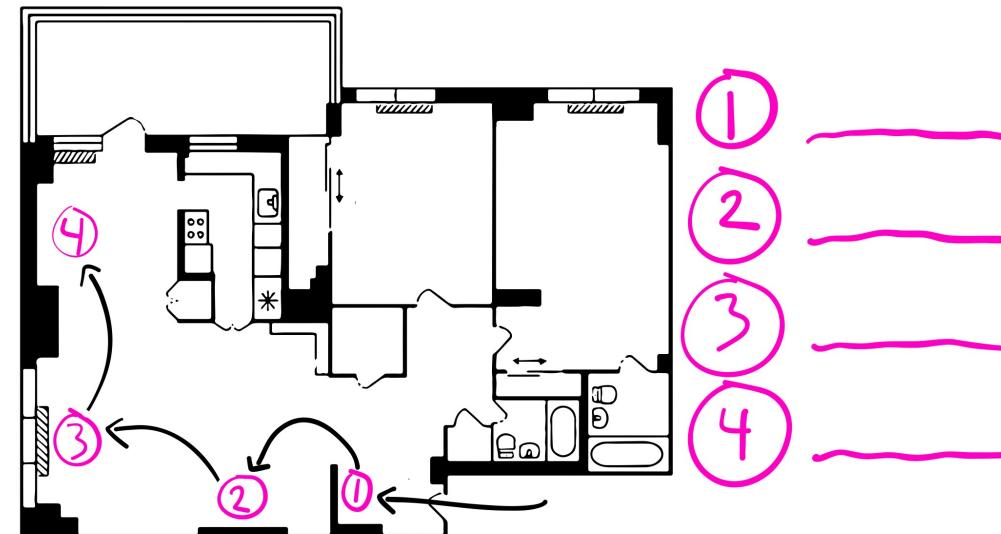
Mental imagery has been used as a mnemonic device

method of Loci

The method of loci involves associating pieces of information with locations in a familiar environment

By mentally walking through the environment, you can remember the items you associated with each location.

MEMORY PALACE



Paivio 1963

Paivio, A. (1963). Learning of adjective-noun paired associates as a function of adjective-noun word order and noun abstractness. *Canadian Journal of Psychology/Revue Canadienne de Psychologie*, 17(4), 370.

<https://doi.org/10/d2s523>

Question

Are more imageable words easier to remember than less imageable words?

memory task

Had participants learn adjective-noun pairs.

Manipulated whether the nouns were more concrete or abstract

Concrete pairs	Abstract Pairs
Ingenious-Inventor	Ingenious-Interpretation
Technical-Advertisement	Technical-Discourse
Massive-Granite	Massive-Rebellion
Subtle-Magician	Subtle-Prejudice
Profound-Philosopher	Profound-Analysis

Paivio's Procedure

The paired associates of each test list were read aloud, once, in a monotone, with approximately 2 seconds between pairs. The stimulus words were then read aloud, once, at 10-sec. intervals to allow the children sufficient time to write the responses. The stimulus words were presented in a different (randomly determined) serial order from their order in the paired-associate list, the re-ordering being identical for all groups. Since different paired lists were learned by the different groups, no pair from any particular combination of N-A order and noun abstractness appeared consistently in a favourable position (e.g., first) on learning and recall trials.

Results

TABLE I

MEAN NUMBER OF CORRECT RESPONSES TO STIMULI DURING RECALL TEST AS
A FUNCTION OF ADJECTIVE-NOUN WORD ORDER AND NOUN ABSTRACTNESS

(N = 136)	N-A order		A-N order	
	Mean	SD	Mean	SD
Concrete nouns	5.24	1.86	3.92	1.64
Abstract nouns	4.06	1.87	3.25	1.69

Explanation?

What makes more “visualizable” words be easier to remember?

Is mental imagery required to explain Paivio’s results?

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The imagery debate

In the 1960s, 70s and 80s mental imagery again became a topic of interest.

There was a renewed debate about mental imagery, and the nature of cognitive representations

Cognitive representations

A cognitive representation refers to the idea that our cognition has some type of format...

E.g., visual information can be stored digitally as pixels, on photographic film, as drawings on paper, on magnetic tape, or even described with words...

An ongoing question is what are the representations underlying our cognition?

mental imagery representations

Image-like representation

Analogs of pictures

Representation based on

symbols and rules

Not image-like

mental scanning experiments

A creative attempt to investigate the format of cognitive representations for mental imagery.

Kosslyn, S. M., Ball, T. M., & Reiser, B. J. (1978). Visual images preserve metric spatial information: Evidence from studies of image scanning. *Journal of Experimental Psychology: Human Perception and Performance*, 4(1), 47.

<https://doi.org/10/c8z6r3>

Procedure



Figure 2. The fictional map used in Experiment 2.

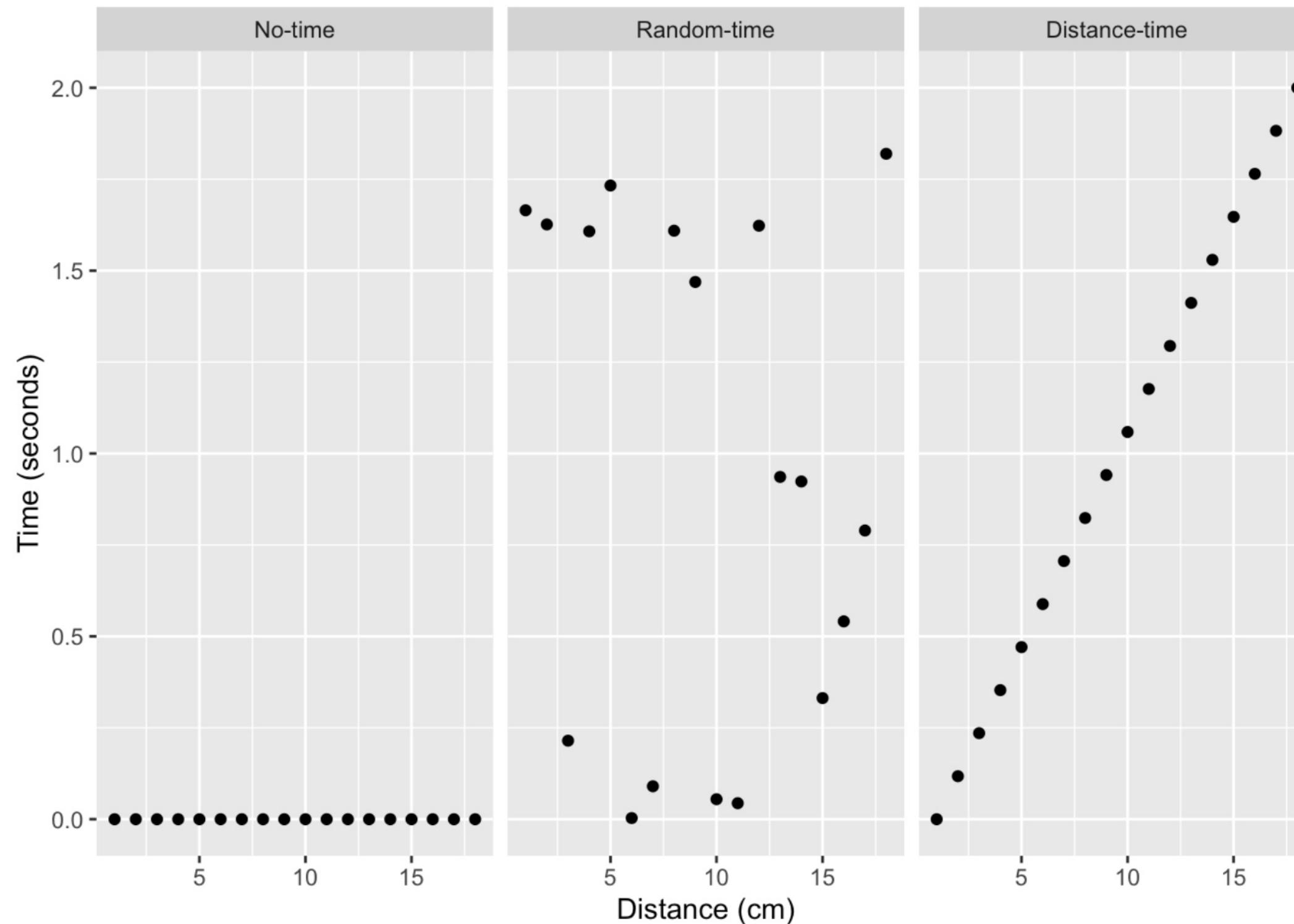
Kosslyn's question

Imagine the island in your head...

How long will it take for people to mentally scan their attention from one location on the island to another?

Will mental scanning times depend on how far away the locations are...even though they are imagined distances?

Possible results



Results

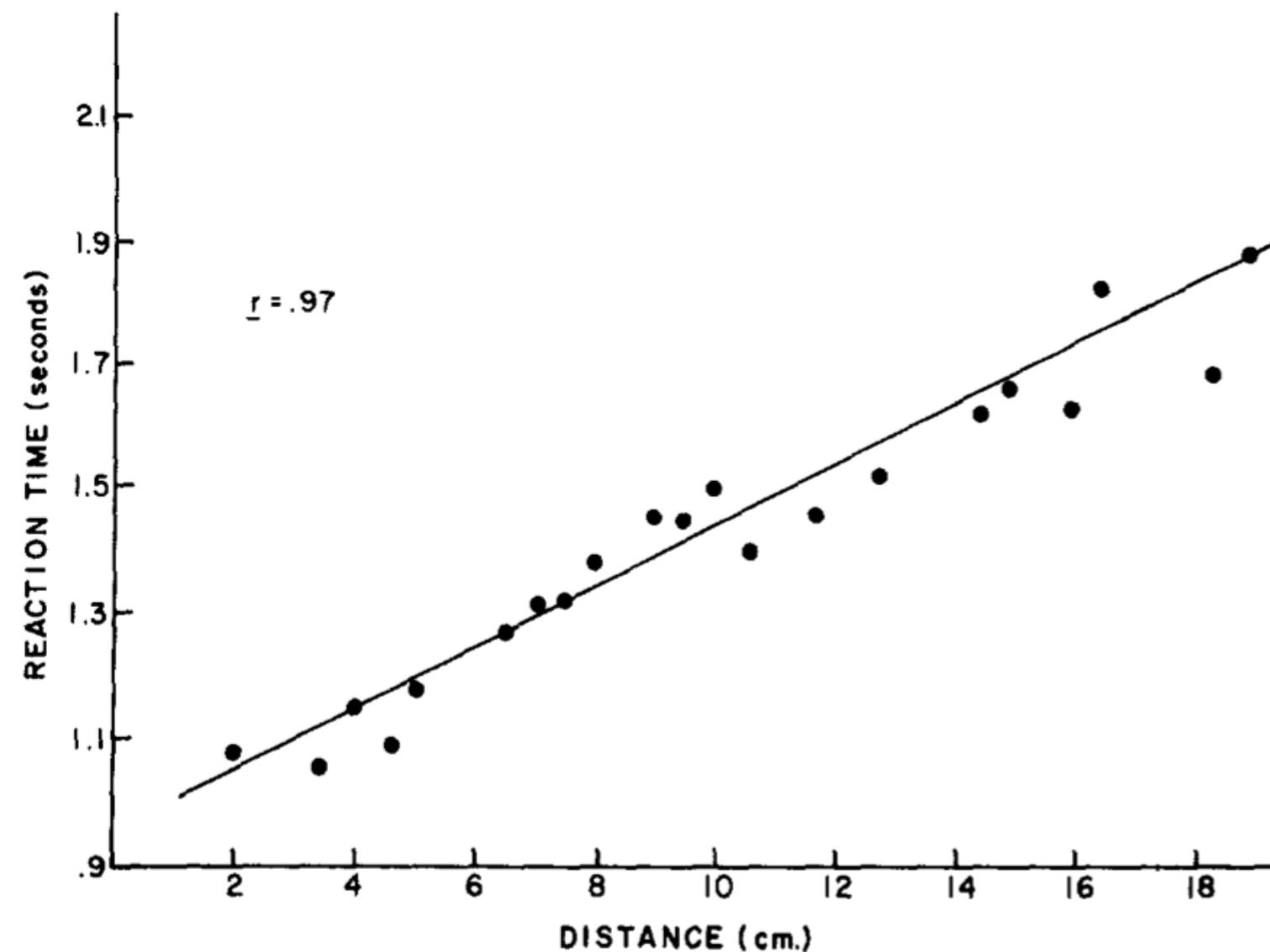


Figure 3. The results of Experiment 2: Time to scan between all pairs of locations on the imaged map.

Inferences

The time to mentally scan an image appears to be influenced by spatial distances in the actual image

What do these results mean for cognitive representations of mental imagery?

Kosslyn's pictures

The evidence is consistent with the pictorial or analog representation assumption.

It takes time to scan real images as a function of distance scanned.

but..

Pylyshyn's Propositions

The evidence could be consistent with other accounts too.
The island could be represented in terms of propositions, and it could take time to process relational information between locations.

Example of propositional knowledge

The island contains objects

The rock is on the north end of the island

The grass is on the north-west side of the island.

The grass is south-west of the rock

Summary

1. Since Galton, research has consistently suggested there are large individual differences in mental imagery
2. Mental imagery is a debated construct in cognition, and has been used to consider questions of cognitive representation
3. As we will learn next class, early mental imagery research was conducted for reasons you might find surprising

Back to Galton

In 1880, why was Galton so interested in mental imagery?

A quote from his paper:

The larger object of my inquiry is to elicit facts that shall define the natural varieties of mental disposition in the two sexes and in different races, and afford trustworthy data as to the relative frequency with which different faculties are inherited in different degrees.

What's next

Continue working through the readings and mini-lectures for this learning module. Then complete quizzes/assignments by the deadline.

When you are finished move onto the next learning module where we will cover eugenics, psychology, and intelligence testing.