# Preliminaries

## Seminar in Cognitive Modelling: Lecture 1

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# Your Course Lecturers

Frank Mollica

Neil Bramley

# What is a seminar?

- A discussion

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## Relevant Learning Objectives

- Demonstrate understanding of a range of classic and current articles in cognitive science by summarizing and critiquing their central ideas and/or results.
- Search the literature and synthesize information from several papers on the same topic and create a coherent presentation on that topic.
- Communicate key findings in cognitive science to inter-disciplinary audiences.

# What is cognitive science?

The study of mental representations and processes.

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The study of mental representations and processes.

- A mental representation is a description of information in the mind.
- A mental process is a procedure for translating:
  - sensory information into representations;
  - representations into other representations; and
  - representations into actions/behavior.

# Required Background

This course is suitable for outside students. But bear in mind:

- The course assumes knowledge of cognitive science
- By the second semester, knowledge of:
  - linear algebra (vectors / matrix multiplication, orthogonality, eigenvectors);
  - probability theory (discrete and continuous univariate random variables, expectations, Bayes rule);
  - statistics (linear / logistic regression); and
  - model evaluation.
- Data visualization and programming experience will be useful but there is no required programming.

# Course Roadmap: Semester 1

| Week | Tuesday | Thursday |
|---|---|---|
| 1 | *Lit. Review* | *Presentation Skills* |

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| 4 | Biological Motion | Categorization |

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| 9 | Time | Rationality |
| 10 | Memory | Expertise |
| 11 | Space | Analogical Reasoning |
| 12 | Theory of Mind | Judgement & Decision Making |

*Italics* denotes required attendance.

# Course Roadmap: Semester 2

| Week | Tuesday | Thursday |
|---|---|---|
| 1 | *Computational Models* | *Evaluation Metrics* |

# Course Roadmap: Semester 2

| Week | Tuesday | Thursday |
|---|---|---|
| 1 | *Computational Models* | *Evaluation Metrics* |
| 2 | TBD | TBD |
| 3 | TBD | TBD |
| 4 | TBD | TBD |
| 5 | TBD | TBD |
| 6 | TBD | TBD |
| 7 | TBD | TBD |
| 8 | TBD | TBD |
| 9 | TBD | TBD |
| 10 | TBD | TBD |
| 11 | TBD | TBD |
| 12 | TBD | TBD |

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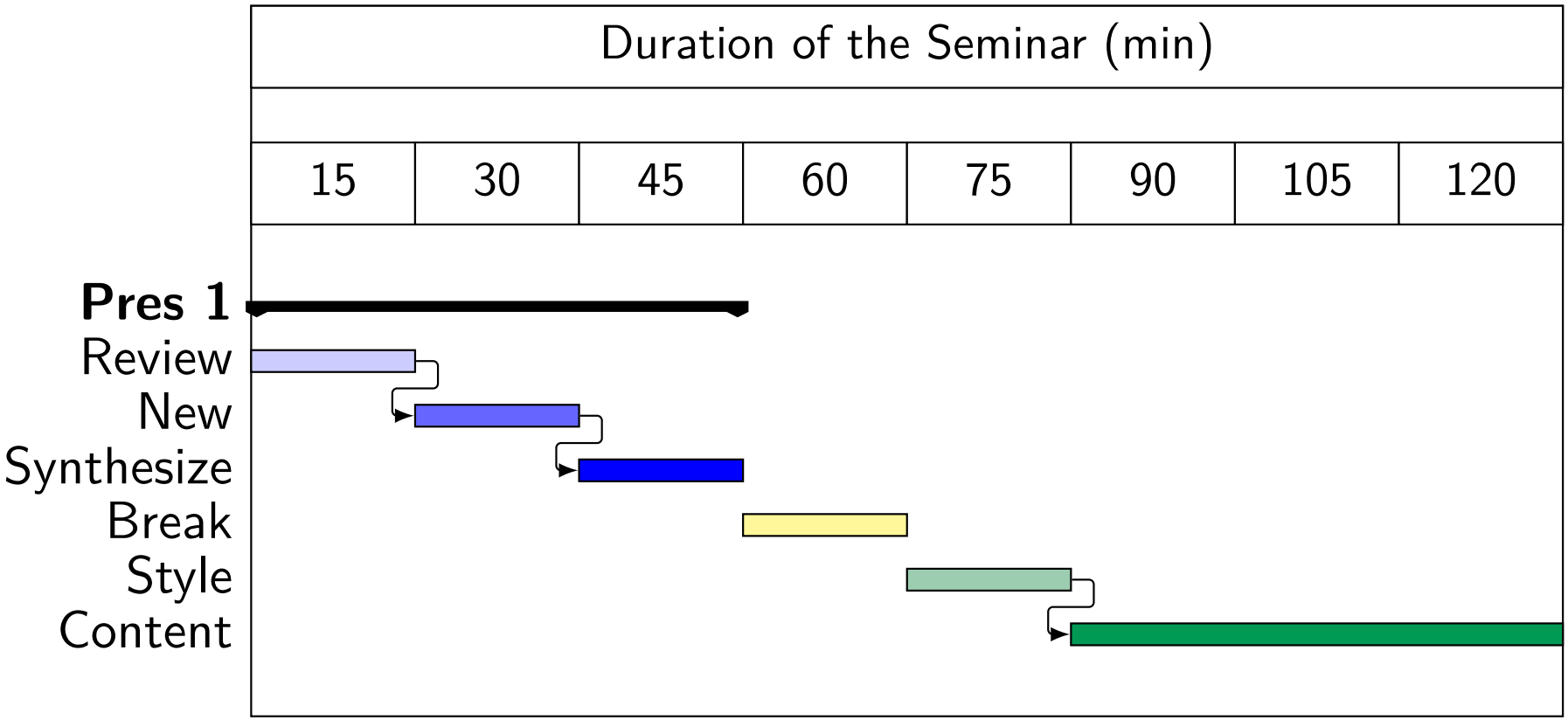
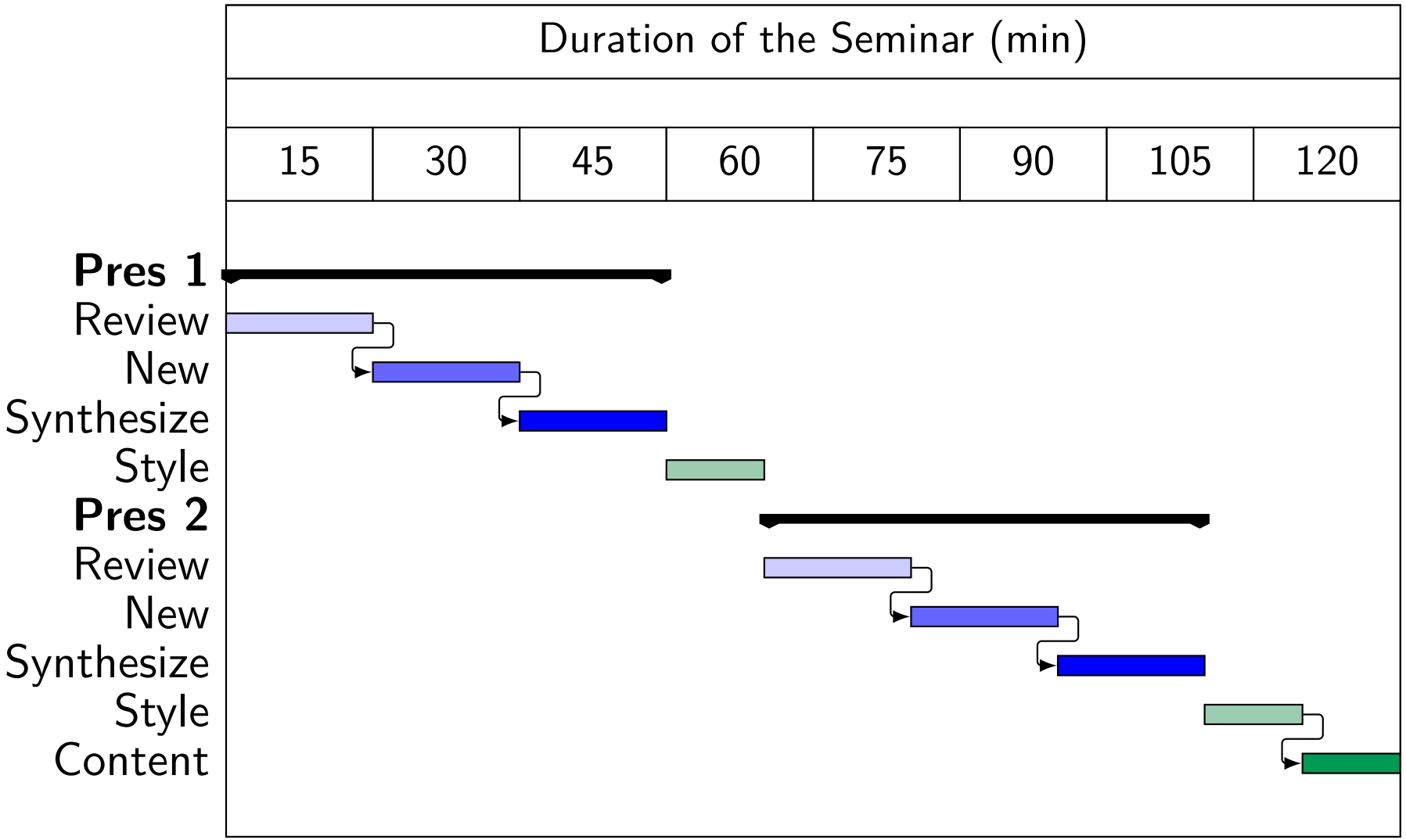
# Class Format - Single Presentation



# Class Format - Double Presentation



# Discussion Roles

-  **Scientific Peer Reviewer.** The paper has not been published yet and is currently submitted to a top venue where you've been assigned as a peer reviewer. Complete a full review of the paper. This includes recommending whether to accept or reject the paper.
-  **Archaeologist.** This paper was found buried under ground in the desert. You're an archeologist who must determine where this paper sits in the context of previous and subsequent work. Find and report on one older paper cited within the current paper that substantially influenced the current paper and one newer paper that cites this current paper.

Taken from: https://colinraffel.com/blog/role-playing-seminar.html

# Discussion Roles

-  **Academic Researcher.** You're a researcher who is working on a new project in this area. Propose an imaginary follow-up project not just based on the current but only possible due to the existence and success of the current paper.
-  **Private Investigator.** You are a detective who needs to run a background check on one of the paper's authors. Where have they worked? What did they study? What previous projects might have led to working on this one? What motivated them to work on this project?
-  **Social Impact Assessor.** Identify how this paper self-assesses its (likely positive) impact on the world. Have any additional positive social impacts left out? What are possible negative social impacts that were overlooked or omitted?

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# Discussion Roles – more relevant next semester

-  **Industry Practitioner.** You work at a company or organization developing an application or product of your choice (that has not already been suggested in a prior session). Bring a convincing pitch for why you should be paid to implement the method in the paper, and discuss at least one positive and negative impact of this application.
-  **Hacker.** You're a hacker who needs a demo of this paper ASAP. Implement a small part or simplified version of the paper on a small dataset or toy problem. Prepare to share the core code of the algorithm to the class and demo your implementation.

Taken from: https://colinraffel.com/blog/role-playing-seminar.html

# Portfolio

Over the course of each semester, you will build a portfolio of reflections on required papers. Each week, you need to submit one ( 200 word) entry. An entry should:

- pick a discussion role (can't use the same role consecutively);
- briefly summarise the main idea of the article (2-3 sentences);
- comment on whether or not you believe the conclusions (1-2 sentences);
- justify your belief (2-5 sentences).

The goal of the weekly entries are to ensure that you are prepared to participate in class discussions. In class, you will may also be asked to comment on the discussion and state if you revised your belief and why.
Portfolios will be marked at the end of the semester. Two entries can be missing, no questions asked and no detriment to the marks. Otherwise, no extensions.

# Assessment

## Extended Common Marking Scheme

**Semester 1 Presentation**

Formative but REQUIRED

**Semester 1 Portfolio**

Marks: 15%; Weekly (Best 8/10)

**Essay**

Marks: 40%; Due 20 Jan 2023.

**Semester 2 Presentation**

Marks: 30%; Arranged.

**Semester 2 Portfolio**

Marks: 15%; Weekly (Best 8/10)

# Essay

We'll send out an email in a few weeks.
It's not due until early **Semester 2**.

# How we communicate

When you sign up for the course, you will have access to:

- the Course Website: contains all course materials.
- the course mailing list: used for all essential communication;
- the Learn page of the course: contains links to copyrighted literature.

We will use a Piazza forum for the course:

- you can use it to post questions about the course content;
- the main purpose is peer support: students discuss course material and help each other;
- lecturers LIGHTY moderate the discussion and contribute;
- link is on Learn, all currently enrolled students should be signed up.

# Topic Selection

Figure it out.

| Week | Tuesday | Thursday |
|---|---|---|
| 3 | Attention | Objects |
| 4 | Biological Motion | Categorization |
| 5 | Concepts | Causality |
| 6 | Development & Learning | Physical Reasoning |
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# Readings

- No textbook 📕
- Readings are listed on the website.
- If the reading is behind a copyright wall, it's on Blackboard. Otherwise, you should be able to use university resources (e.g., the library) to find them.

# Literature Review: Forward

Let's say we have an ancient, sacred source study 📜:

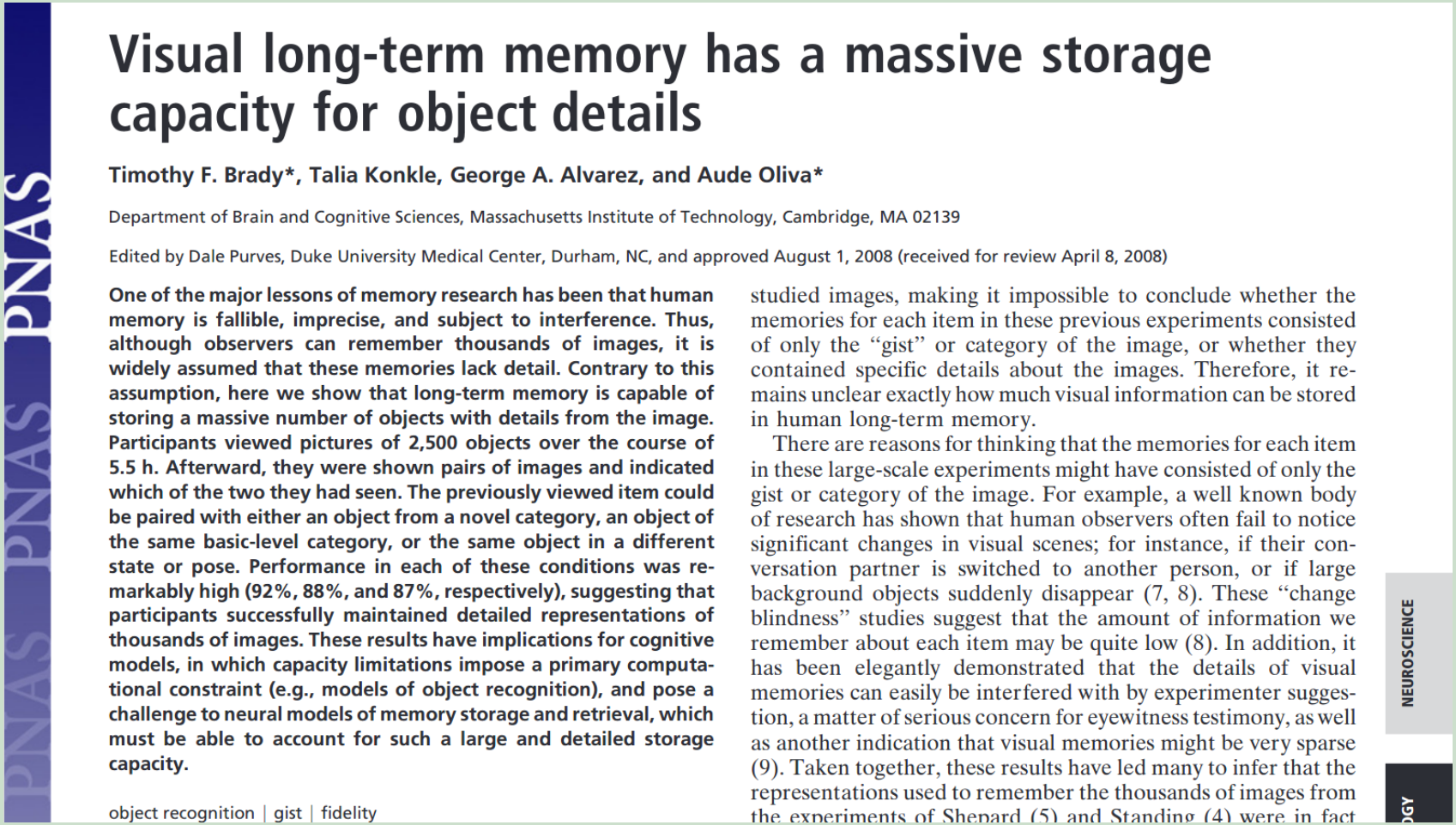
## Über das Gedächtnis


We can look at the future (e.g., with google scholar) to see what's happened since then.

# Literature Review: Backward

Let's say we have a State-Of-The-Art (SOTA) source study :

## Massive Memory Experiment



PNAS PNAS PNAS

# Visual long-term memory has a massive storage capacity for object details

**Timothy F. Brady*, Talia Konkle, George A. Alvarez, and Aude Oliva***

Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology, Cambridge, MA 02139

Edited by Dale Purves, Duke University Medical Center, Durham, NC, and approved August 1, 2008 (received for review April 8, 2008)

**One of the major lessons of memory research has been that human memory is fallible, imprecise, and subject to interference. Thus, although observers can remember thousands of images, it is widely assumed that these memories lack detail. Contrary to this assumption, here we show that long-term memory is capable of storing a massive number of objects with details from the image. Participants viewed pictures of 2,500 objects over the course of 5.5 h. Afterward, they were shown pairs of images and indicated which of the two they had seen. The previously viewed item could be paired with either an object from a novel category, an object of the same basic-level category, or the same object in a different state or pose. Performance in each of these conditions was remarkably high (92%, 88%, and 87%, respectively), suggesting that participants successfully maintained detailed representations of thousands of images. These results have implications for cognitive models, in which capacity limitations impose a primary computational constraint (e.g., models of object recognition), and pose a challenge to neural models of memory storage and retrieval, which must be able to account for such a large and detailed storage capacity.**

object recognition | gist | fidelity

studied images, making it impossible to conclude whether the memories for each item in these previous experiments consisted of only the "gist" or category of the image, or whether they contained specific details about the images. Therefore, it remains unclear exactly how much visual information can be stored in human long-term memory.

There are reasons for thinking that the memories for each item in these large-scale experiments might have consisted of only the gist or category of the image. For example, a well known body of research has shown that human observers often fail to notice significant changes in visual scenes; for instance, if their conversation partner is switched to another person, or if large background objects suddenly disappear (7, 8). These "change blindness" studies suggest that the amount of information we remember about each item may be quite low (8). In addition, it has been elegantly demonstrated that the details of visual memories can easily be interfered with by experimenter suggestion, a matter of serious concern for eyewitness testimony, as well as another indication that visual memories might be very sparse (9). Taken together, these results have led many to infer that the representations used to remember the thousands of images from the experiments of Shepard (5) and Standing (4) were in fact

NEUROSCIENCE

We can look at the past via what it cites (reference lists).

# Literature Review: Where do I begin?

"It is a tremendous act of violence to begin anything. I am not able to begin. I simply skip what should be the beginning."

—Rainer Maria Rilke

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-  Live.

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-  Live.
-  Listen.

# Literature Review: Where do I begin?

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-  Live.
-  Listen.
-  Talk.

# Literature Review: Where do I begin?

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-  Live.
-  Listen.
-  Talk.
-  Journals/conference proceedings

# Literature Review Exercise

Let's read this article, Fantastic Beasts and How to Rank Them;
Come up with a research question; and
Find 10 papers that would be good for a literature review.

# Take-homes

- Summary:
  1. Backward Search
  2. Forward Search
- Next time: **Presentations**
  1. What makes a good presentation?
  2. What makes a bad presentation?