

# Retrieval Practice: The roads between research and practice

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*The US National Archive by Flickr*

research  **ED**

Haninge, Sweden, March 10th 2018

# A Journey from Neuroscience to the Classroom



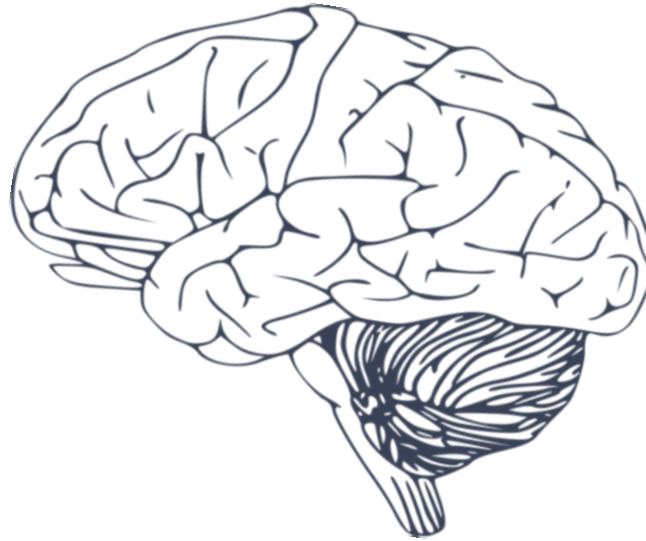
## Retrieval Practice



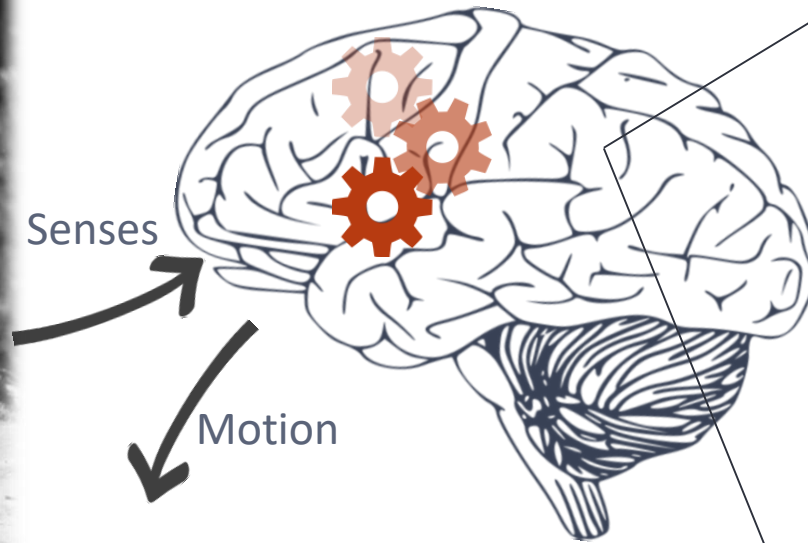
- Neuroscience of Retrieval
- Cognitive Science : Retrieval Practice
- Guidelines for application
- Barriers for Students and for Teachers
- Reasons, Solutions?
- Education – Research Communication

# What does the brain do?

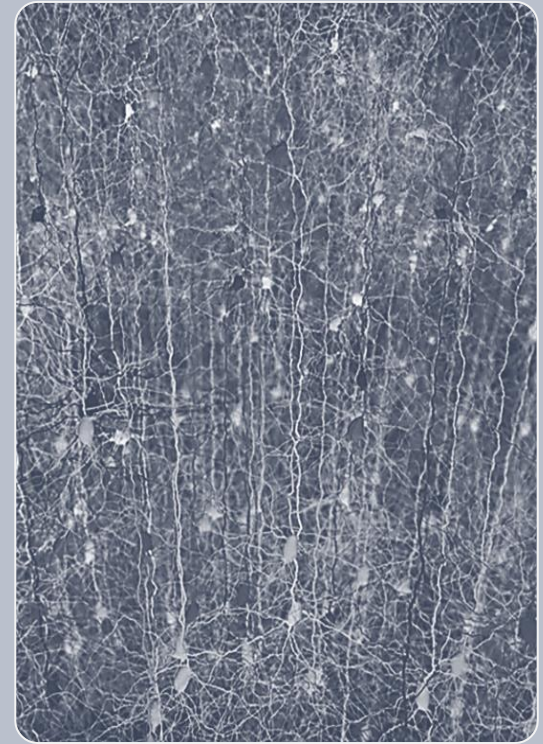
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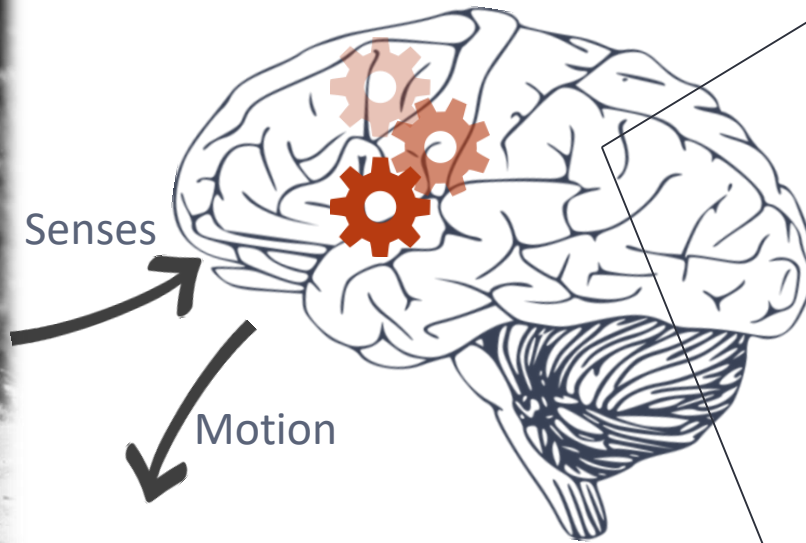
# Interacting with the Environment



Long Term Memory

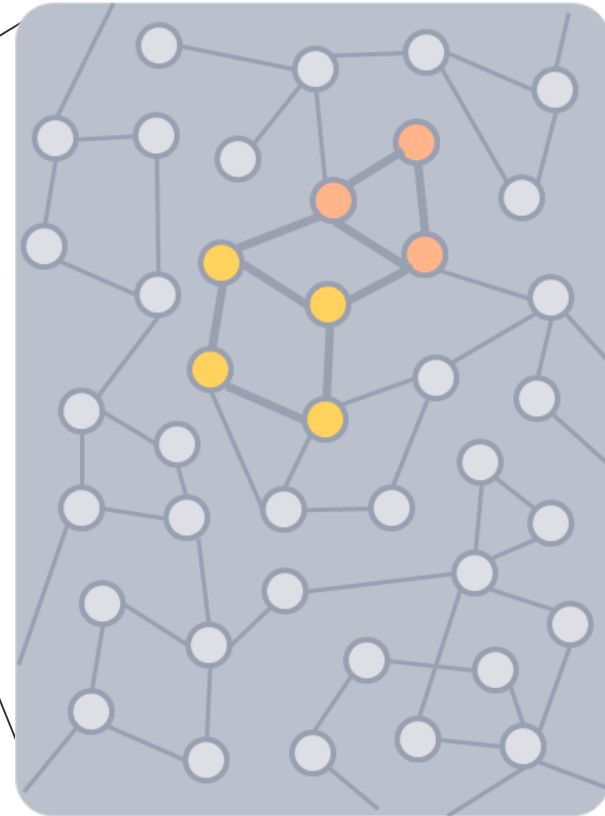


# Neural Representations






?

Long Term Memory

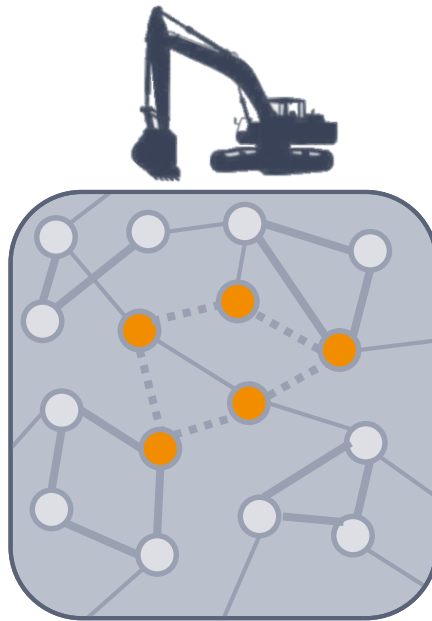


# Neuroscience of Retrieval

-  New concept
-  Existing concepts
-  inactive

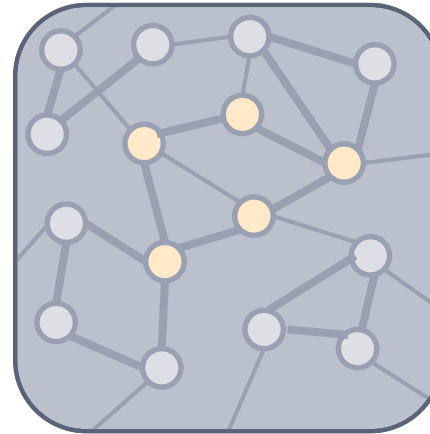


Encoding

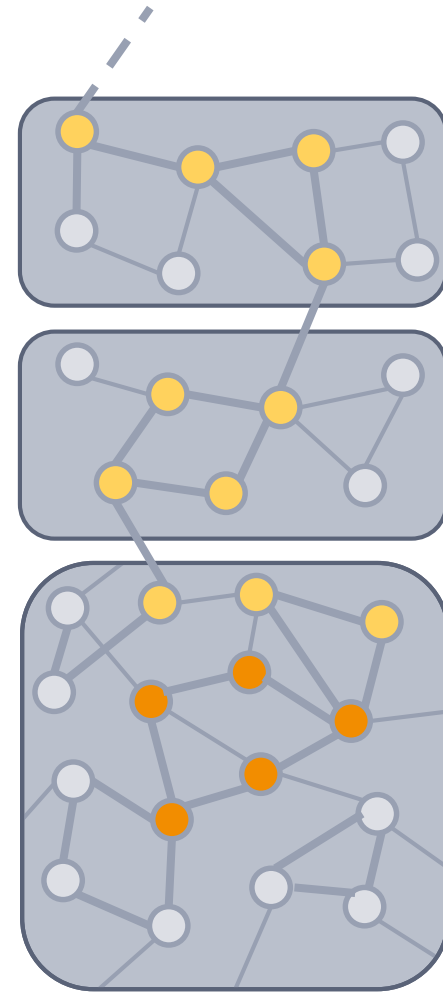


Consolidation

plasticity



Storage

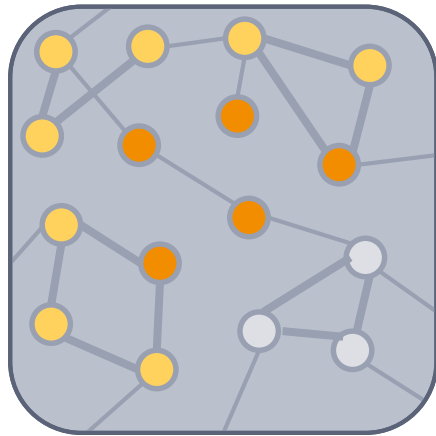


Retrieval





# Understanding Retrieval

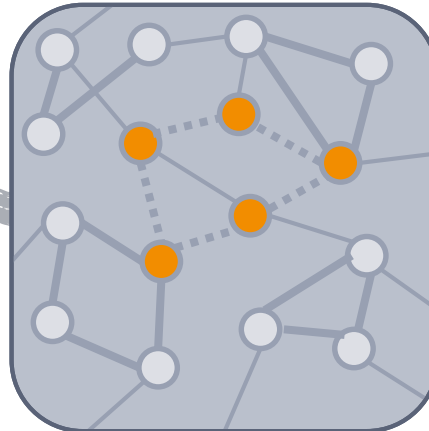


**Encoding**  
Active

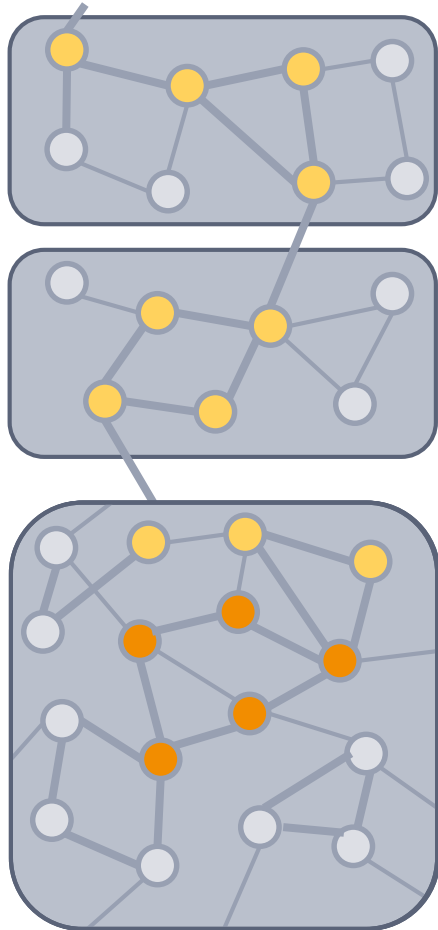
**Consolidation**  
Building connections



**Storage**  
Inactive



*Based on: Nader and Hardt,  
Nature Reviews Neuroscience, 2009*



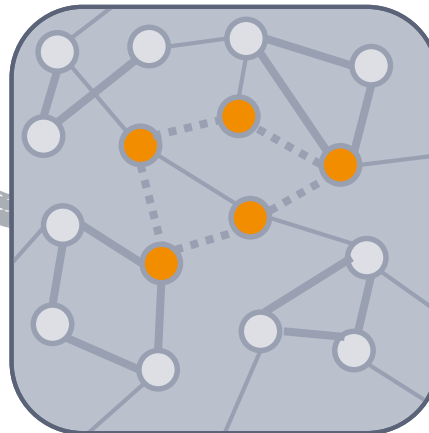
**Encoding**  
Active



**Re-Consolidation**  
Building connections



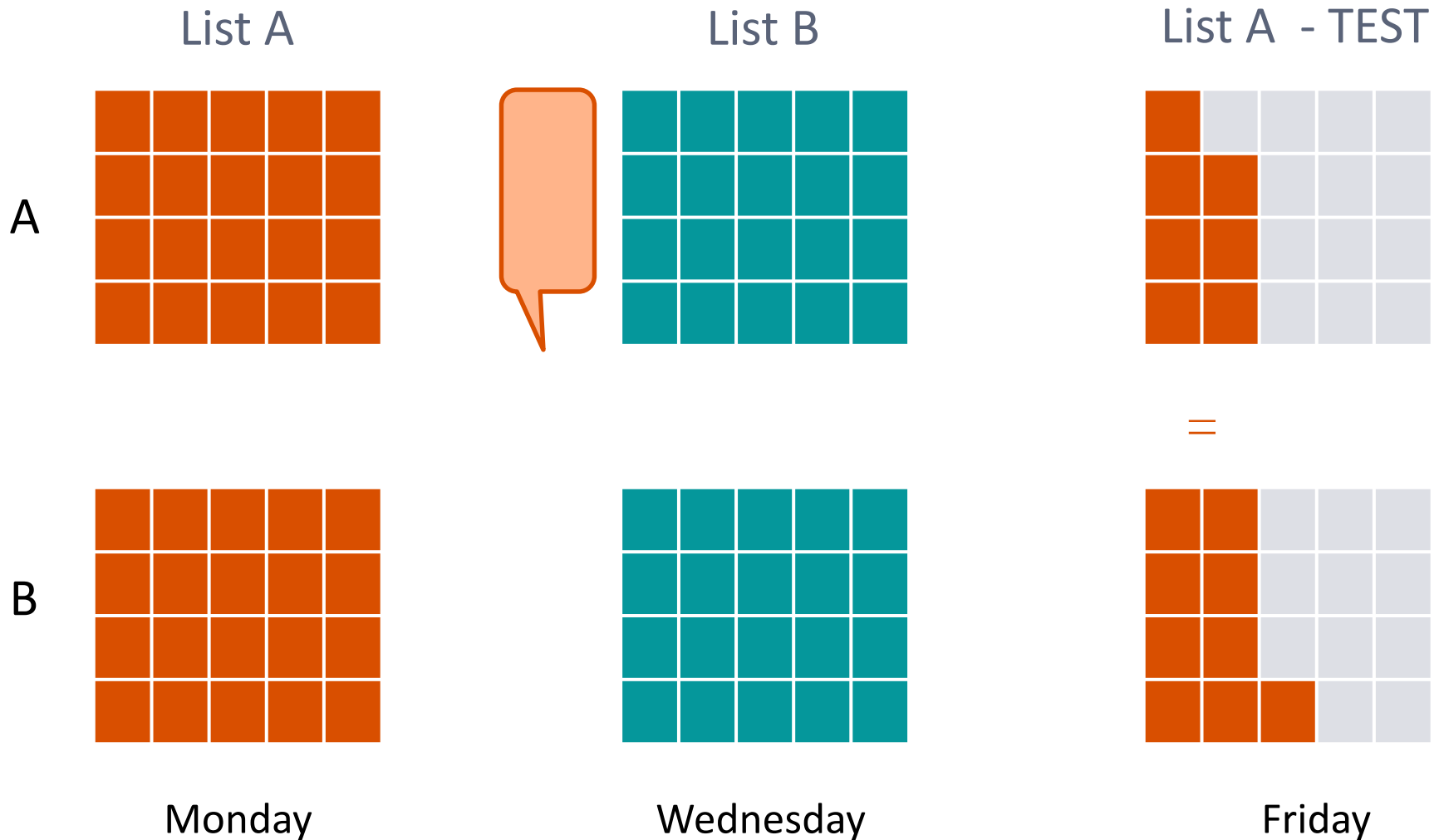
**Storage**  
Inactive



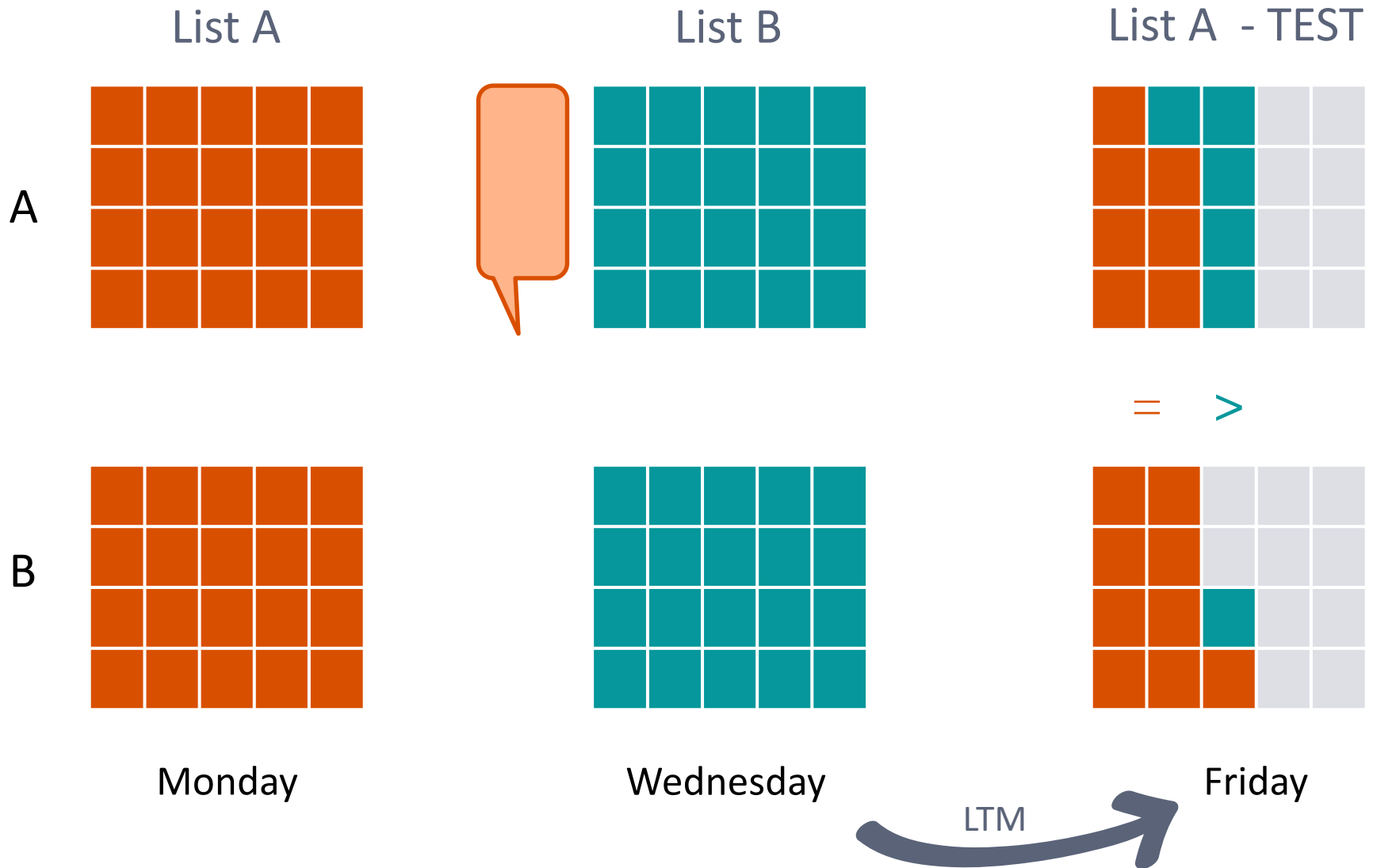
*Based on: Nader and Hardt,  
Nature Reviews Neuroscience, 2009*



# Reconsolidation in Human Memory



# Reconsolidation in Human Memory



# Retrieval and Reconsolidation

**Activation → Malleability →  
Long-Term modification**

## Erasing Memories

Animal models  
Future: trauma, phobia

## Updating Memories

Eyewitness testimony  
Memory Illusions

## Enhancing Memory

Cognitive Psychology

# Cognitive Science of Retrieval Practice

*Karpicke & Roediger, Science 2008:*

Experiment: 40 students learned 40 words in a new language (Swahili)

MASHUA - Boat

**Study (S)**

MASHUA

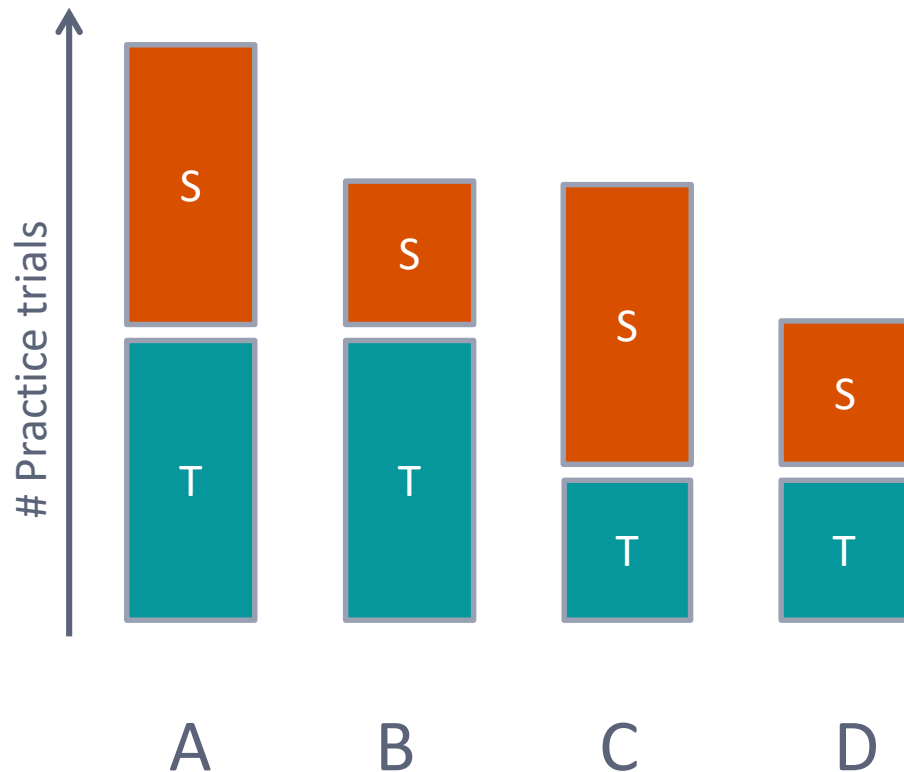
?

**Test (T)**

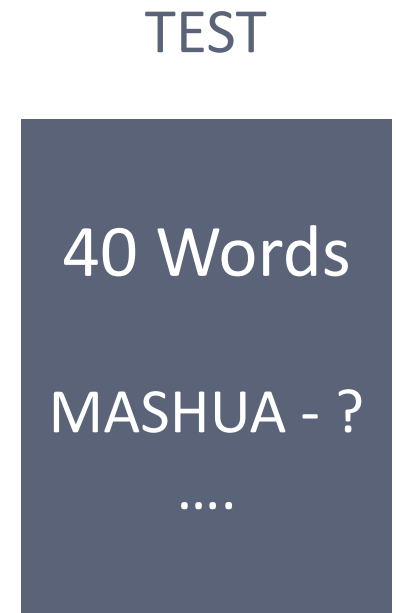
S T S T S T S T

Learning Phase

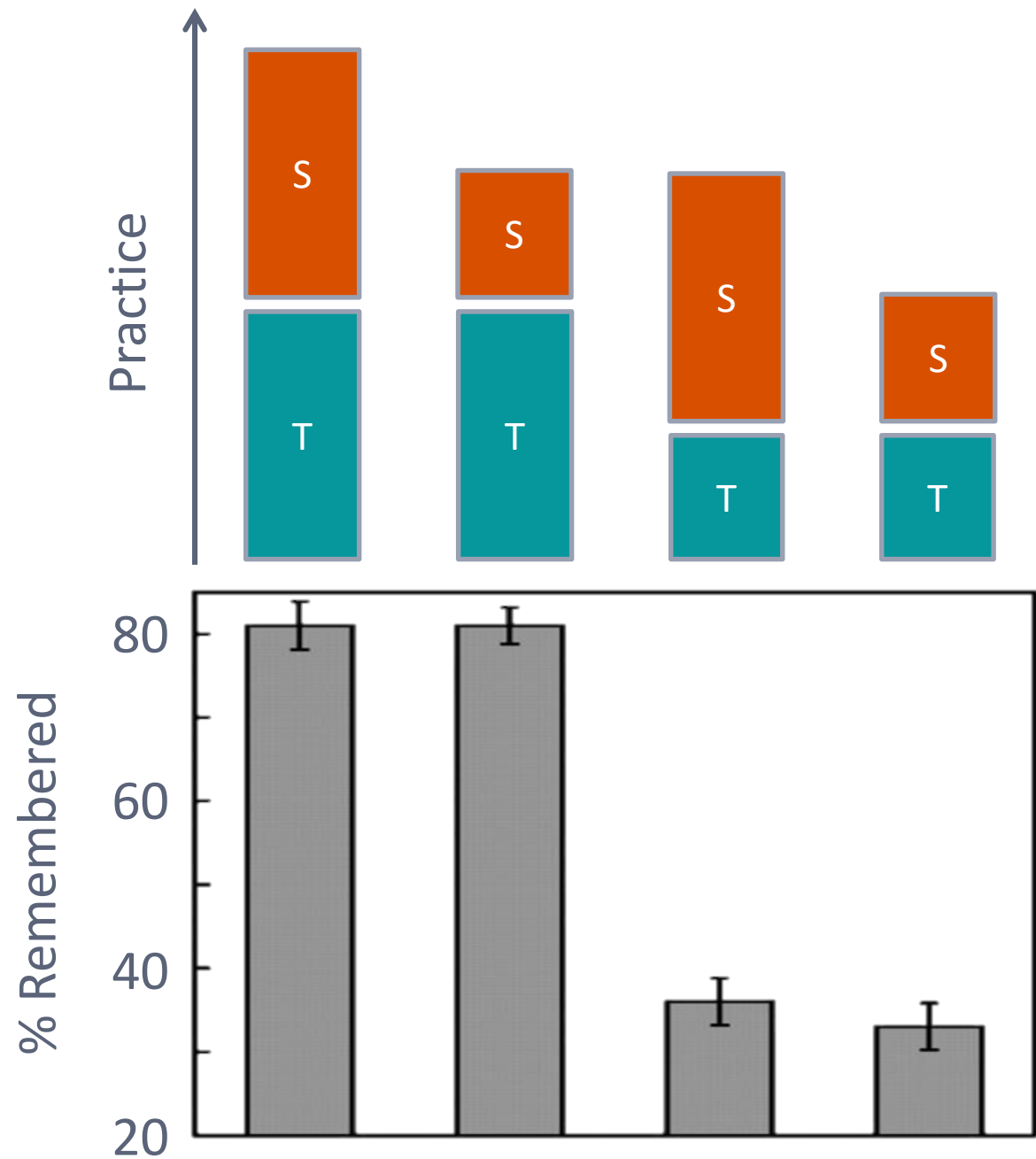
# Experimental Design



4 Experimental Groups



# Results



# More Information



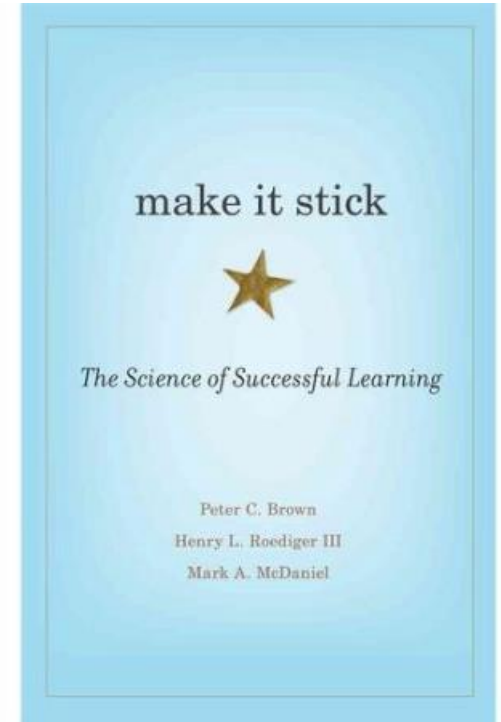
**THE LEARNING SCIENTISTS**

[www.learningscientists.org](http://www.learningscientists.org)



**Retrieval Practice**

[www.retrievalpractice.org](http://www.retrievalpractice.org)

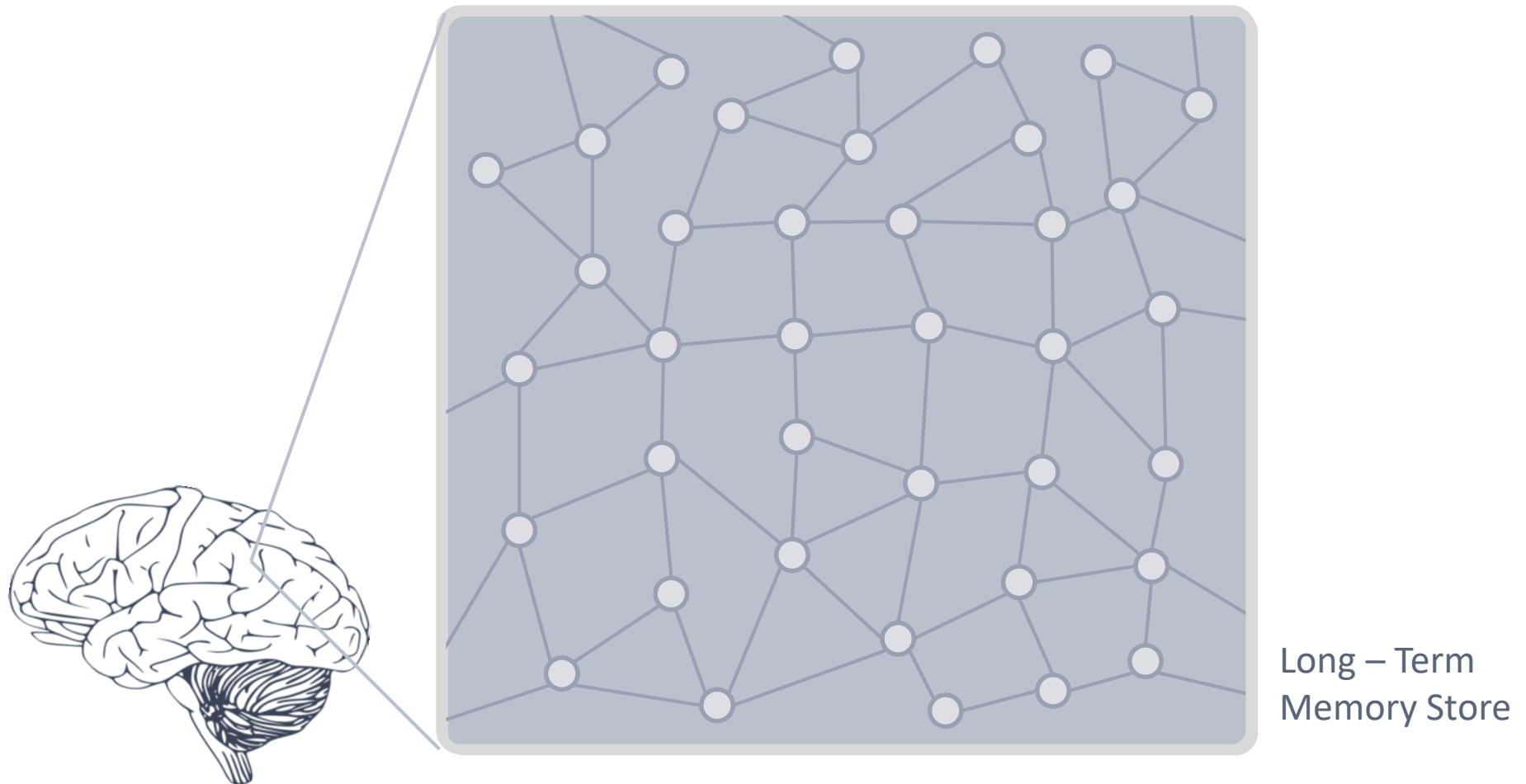


**Make it stick**

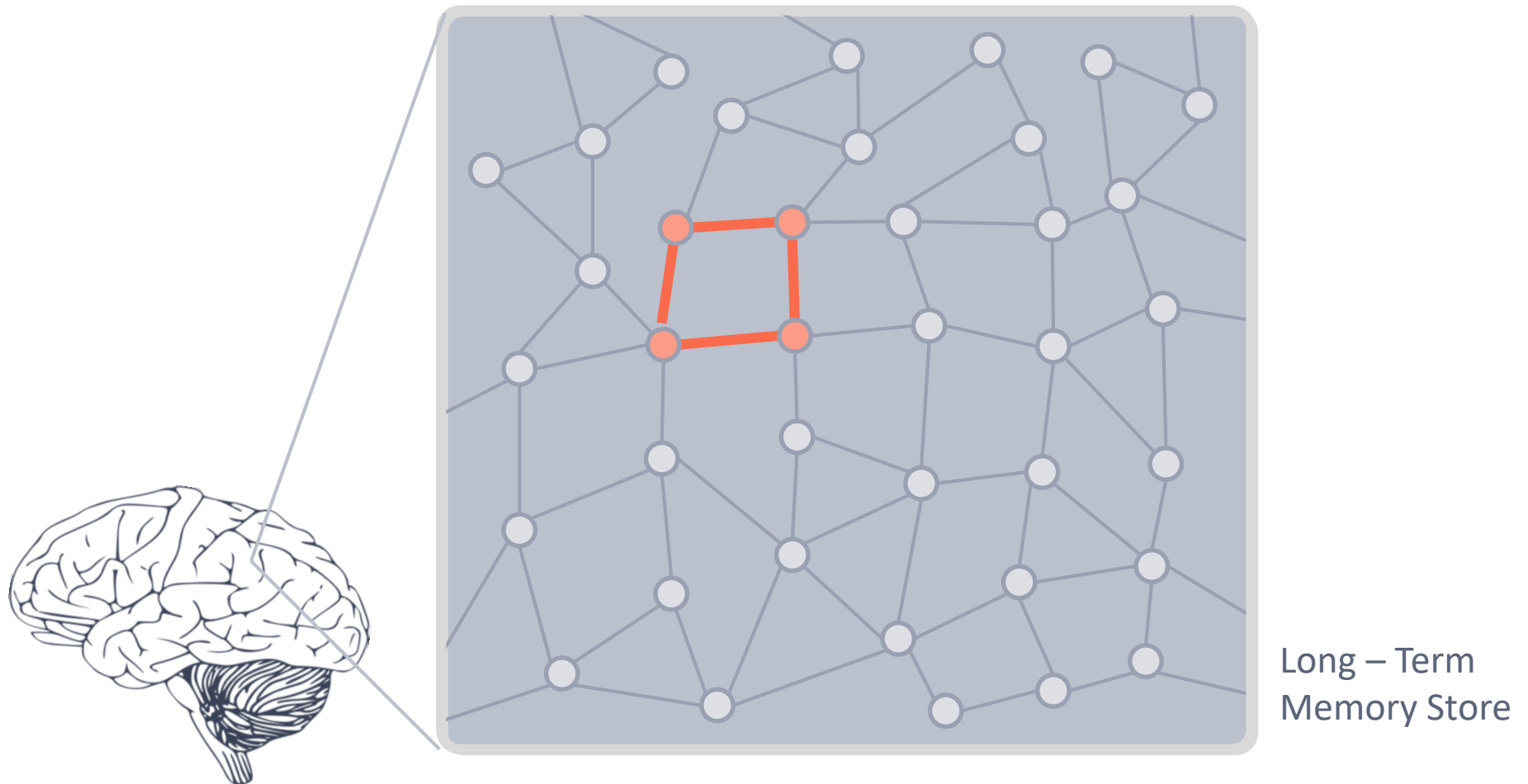


# Conclusions

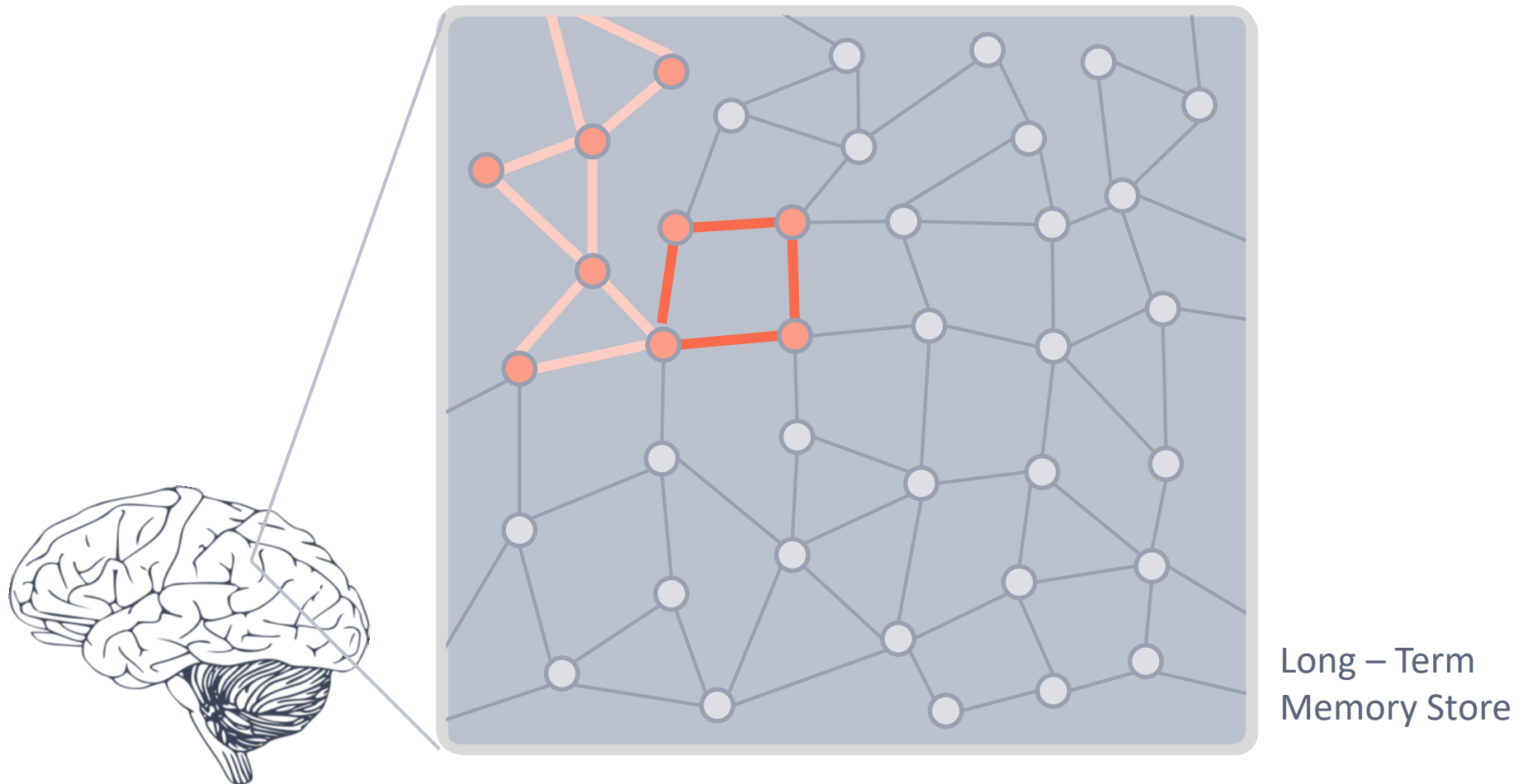
**Retrieval (or Testing) is a highly effective practice strategy.**



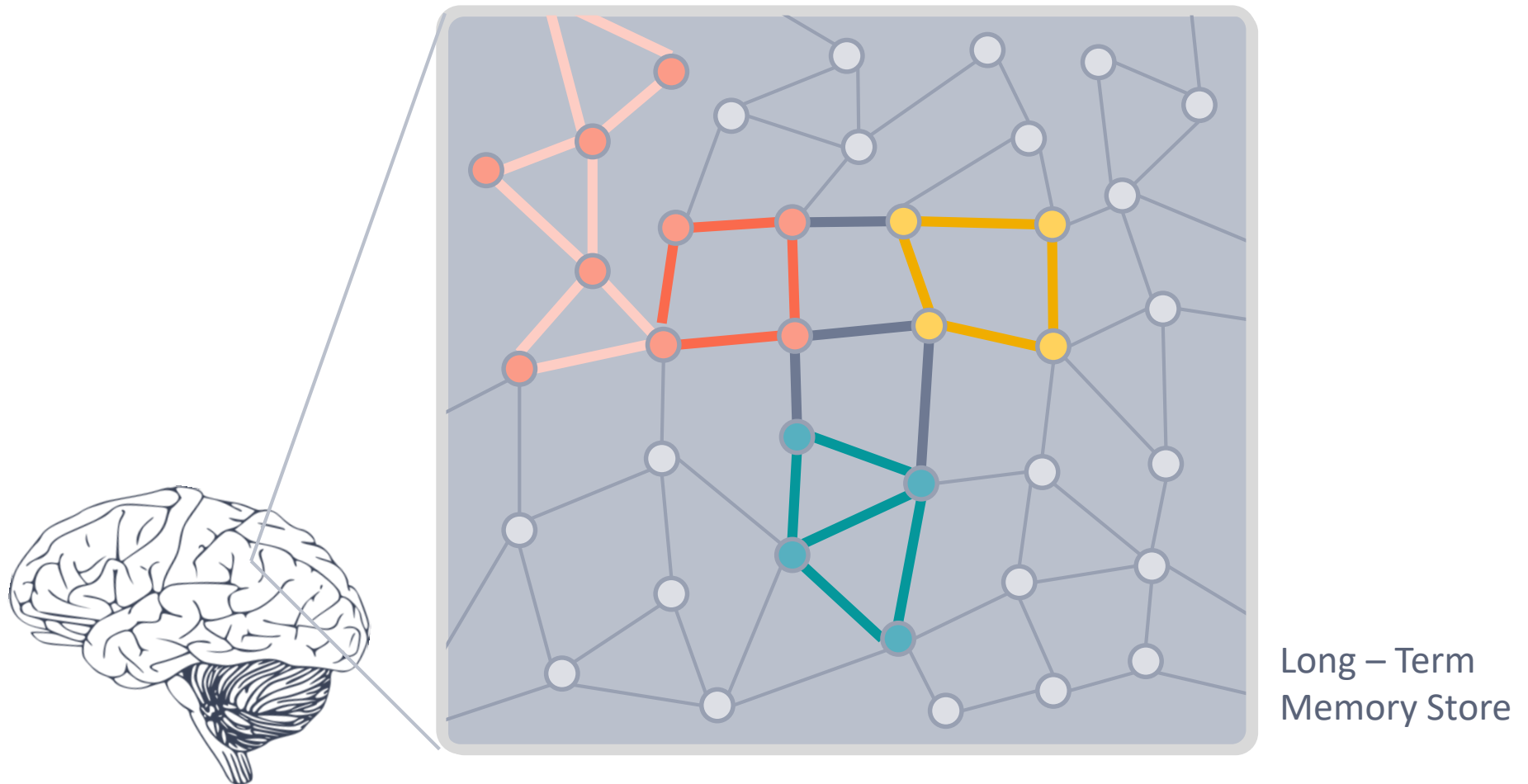
# Conclusions



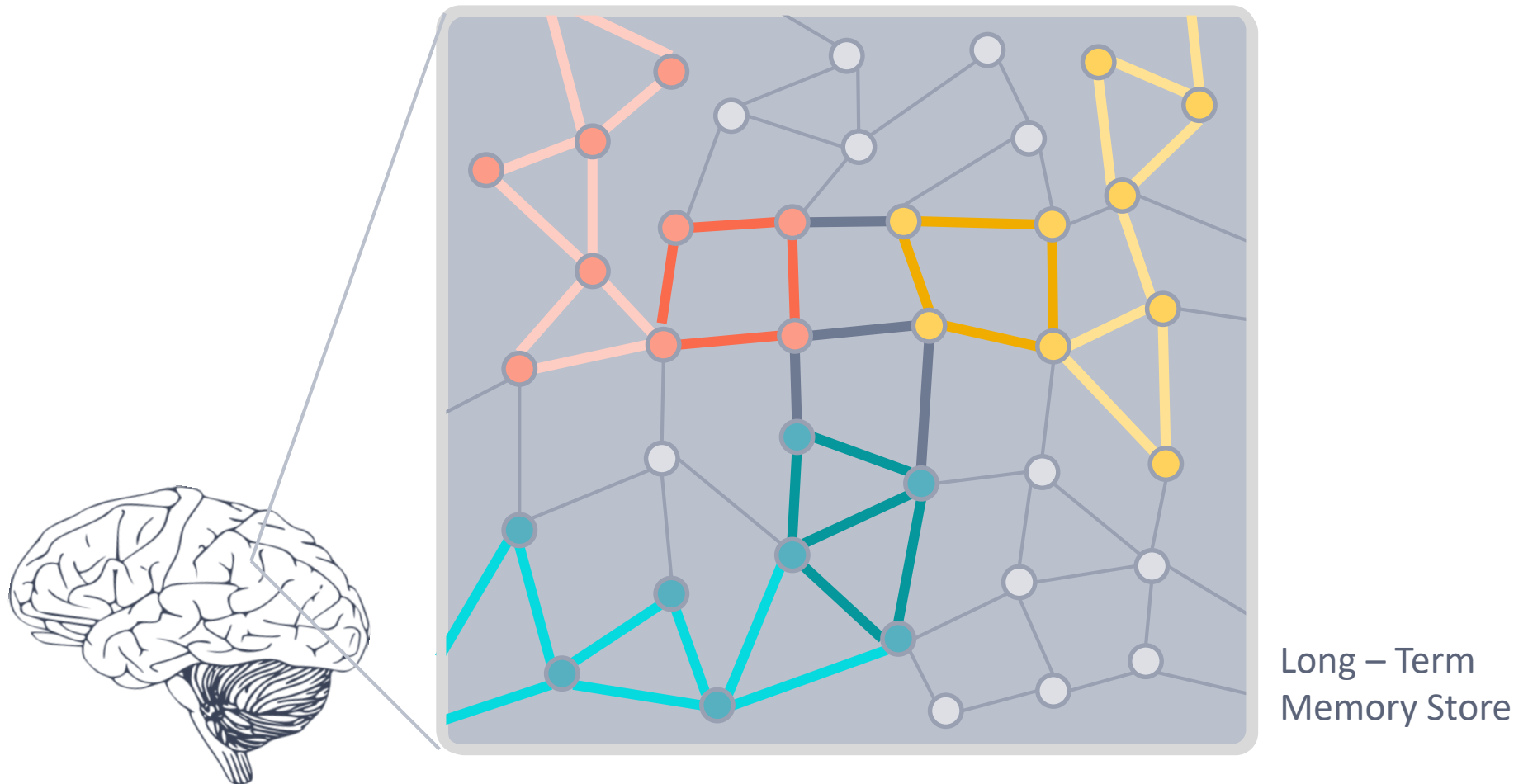
# Conclusions



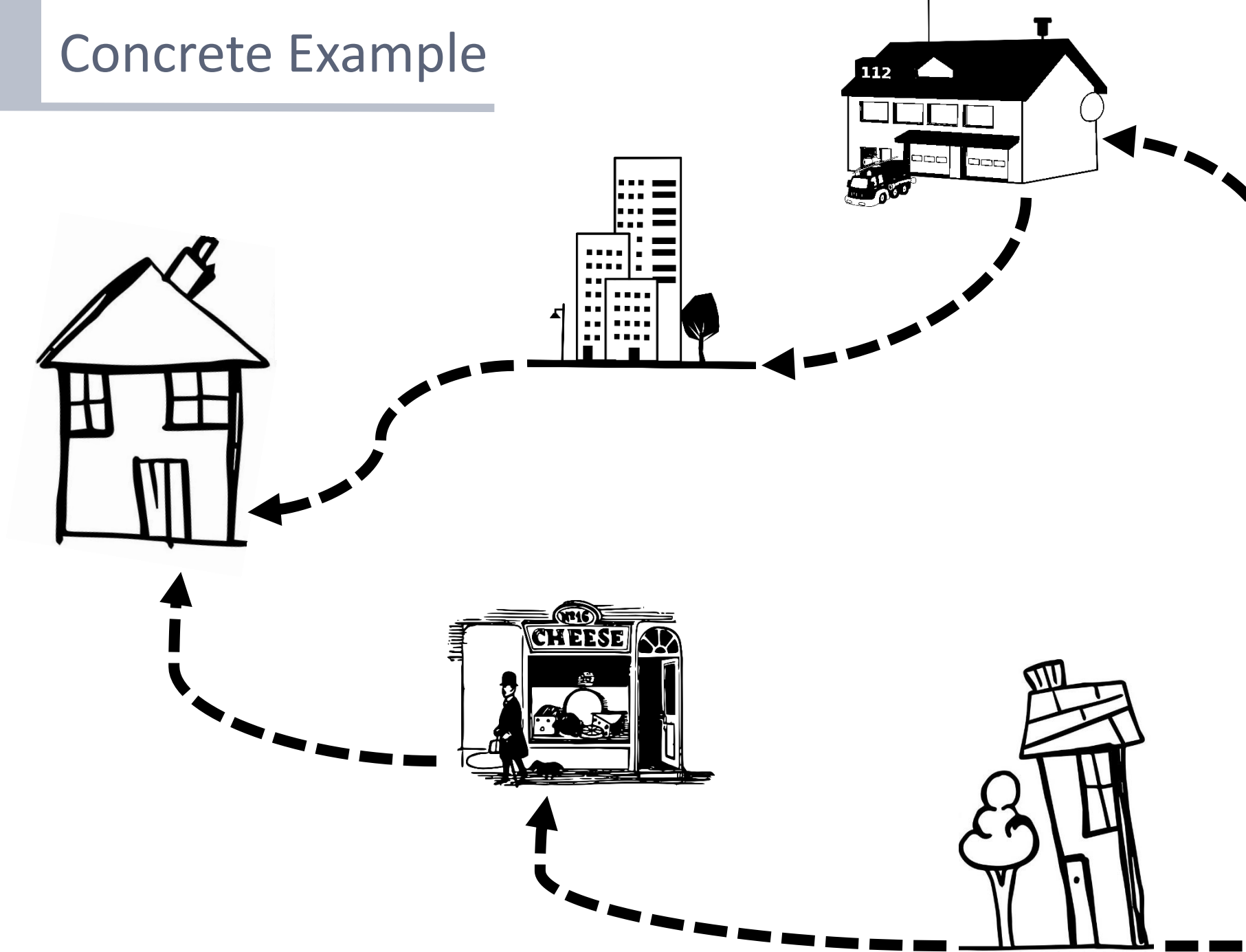
# Conclusions



# Conclusions



# Concrete Example



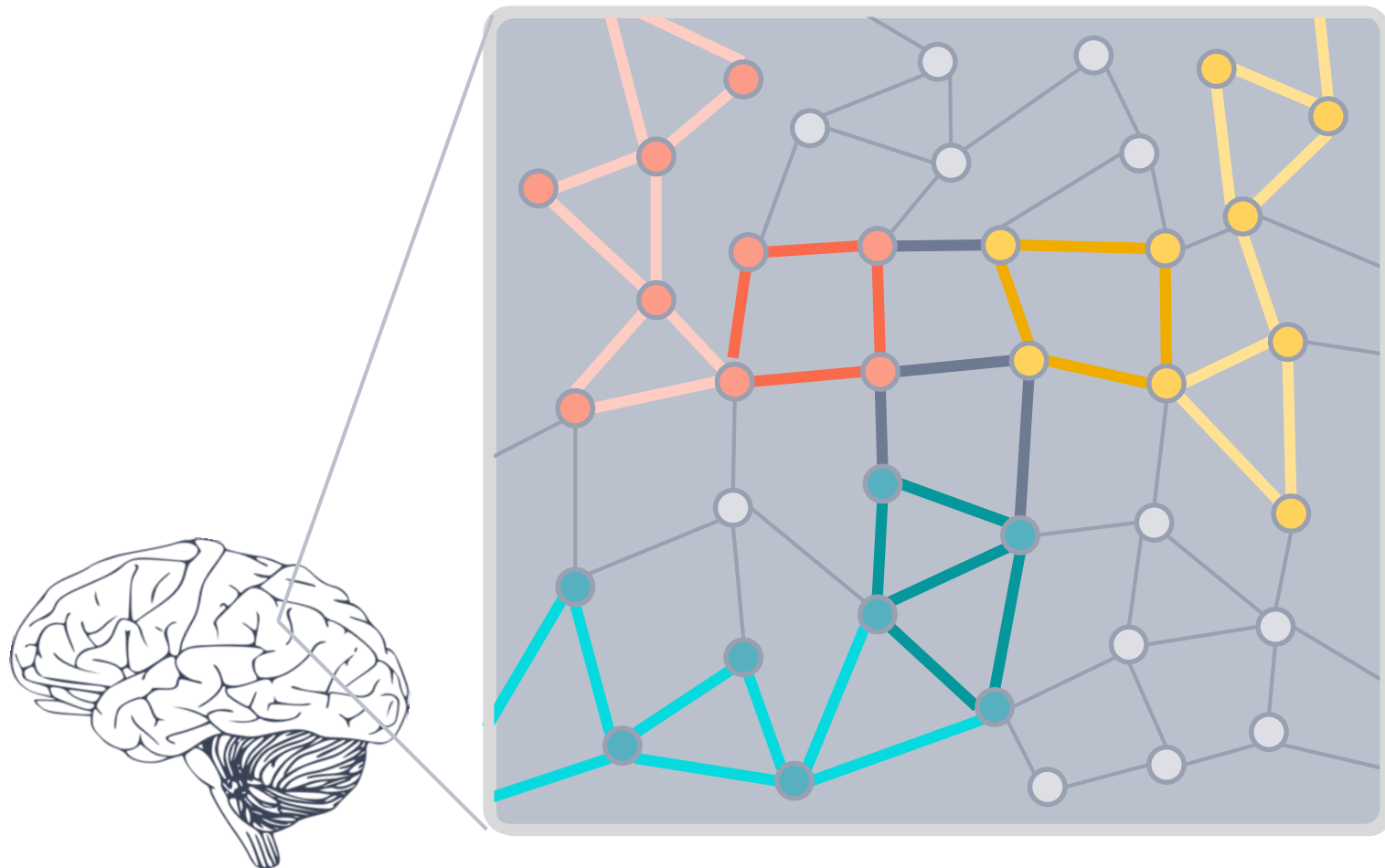
# Critical Points

- ✓ **Active** in students minds
- ✓ Retrieval **Practice** follows initial learning
- ✓ **Post-retrieval** experience – feedback, making new connections
- ✓ **Long-term** effect – effective when **effortful**  
↓  
Spacing, Varying,



**BUT....**

How come not Everybody uses  
Retrieval Practice all the time ?!?



# What are the barriers?

Learners fail to predict their long-term learning outcomes



# Retrieval Practice Works?

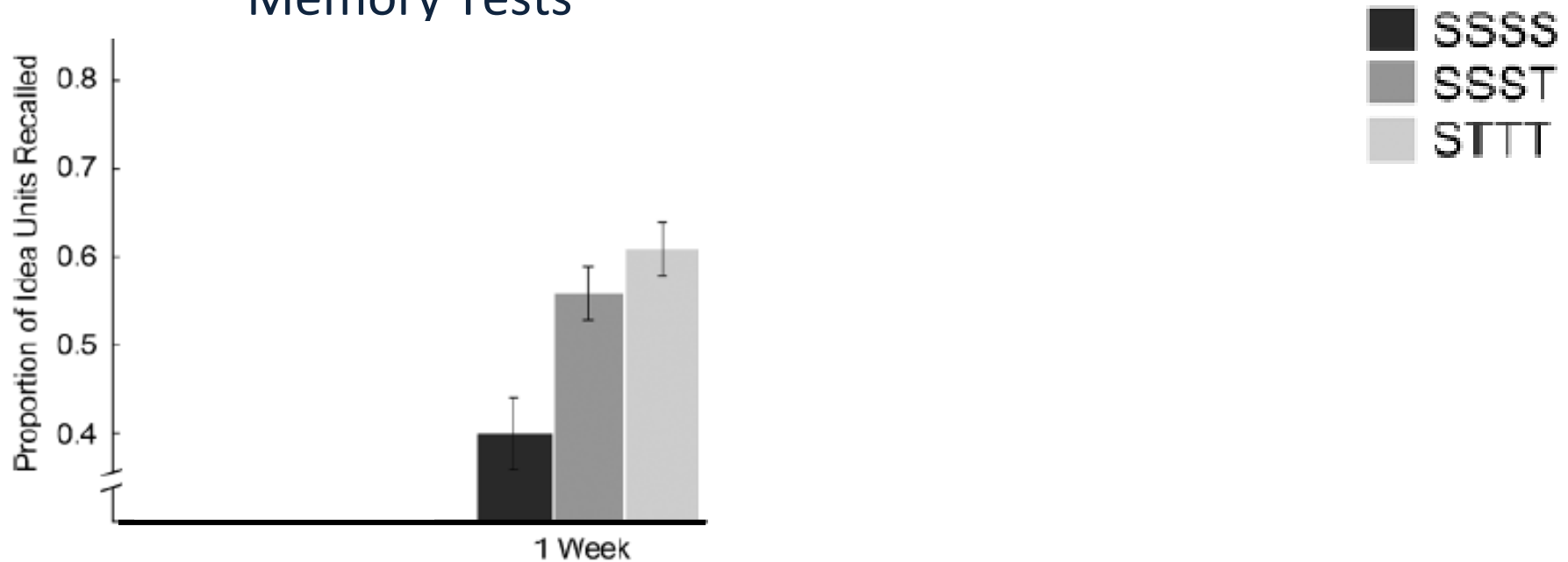
3 groups learning texts by **S**tudying or by **T**esting

## Memory Tests



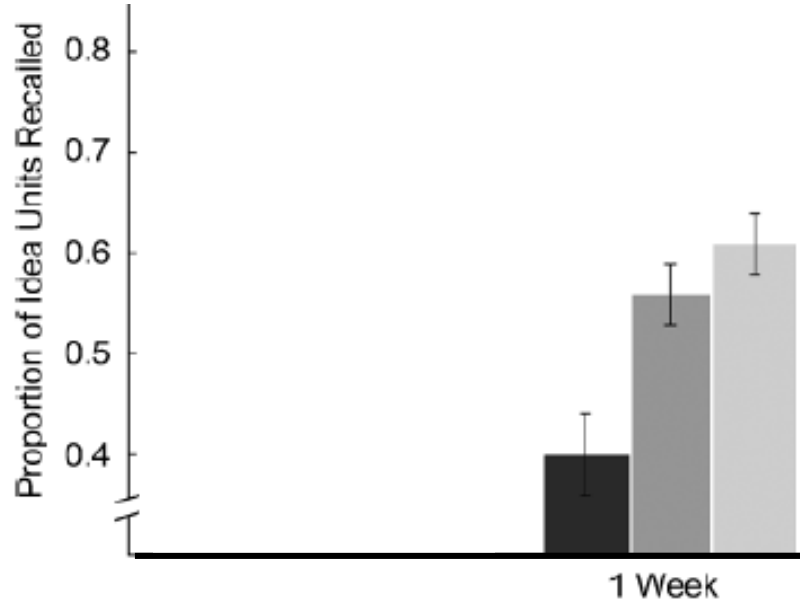
# Retrieval Practice Works?

## Memory Tests

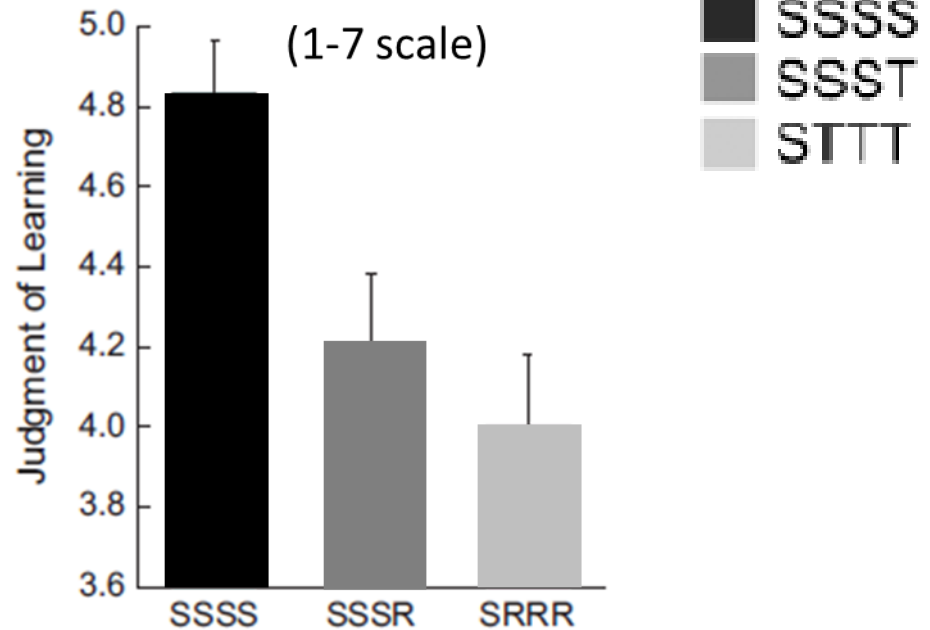


# Retrieval Practice Works?

## Memory Test

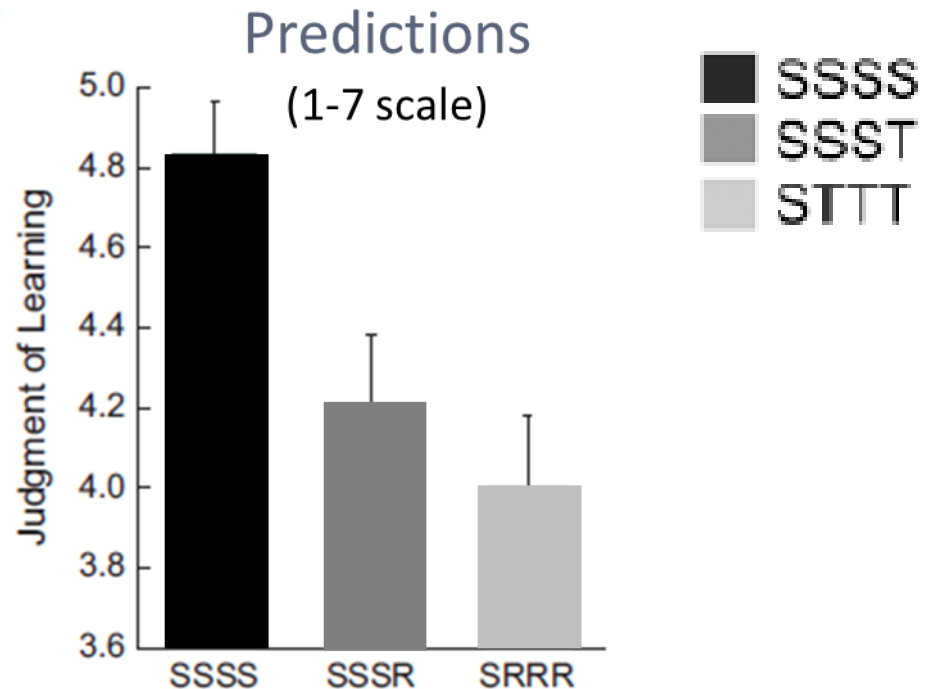
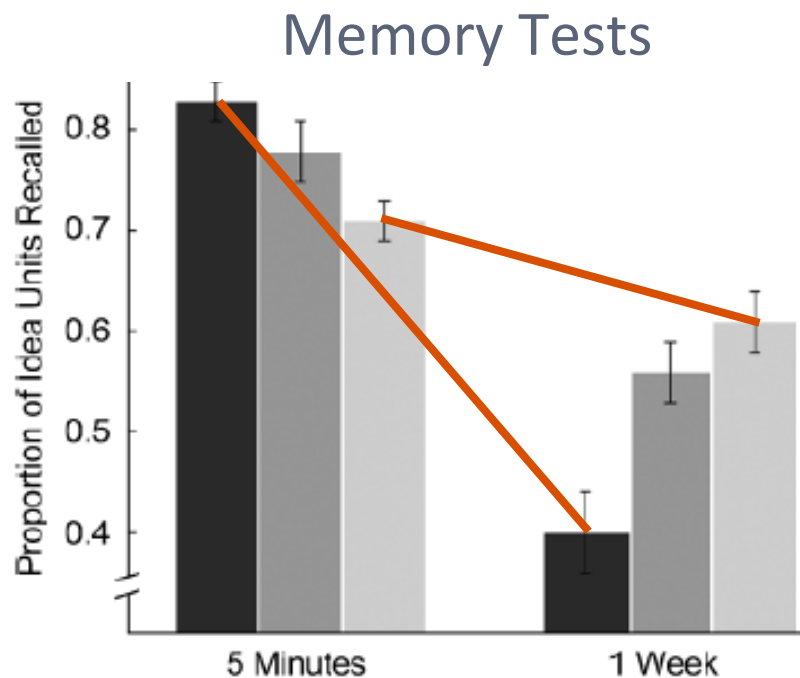


## Predictions



# Retrieval Practice Works?

## Retrieval is Effective in the Long-Term



# Retrieval Practice vs. Re-Study

Different mechanisms of memory:





# The Paradox

Short-Term

Long-Term



Restudy



Retrieval Practice



**Desirable Difficulty**

*(Bjork, 1994)*

# Re-Read and Succeed



Color code:

**Learning**

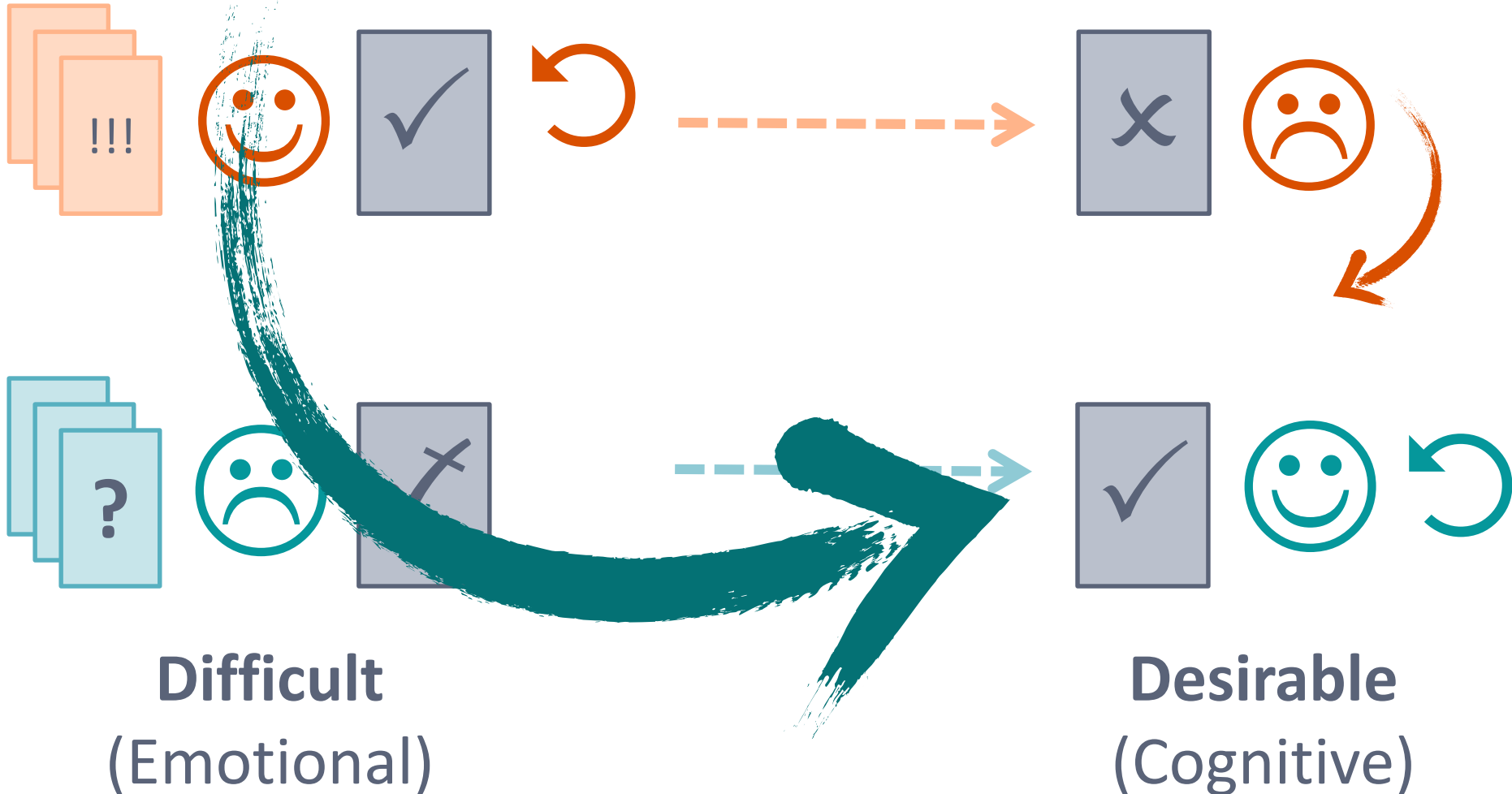
**Testing**

**Motivation**

# Cognitive vs. Emotional

**Short-Term**

**Long-Term**

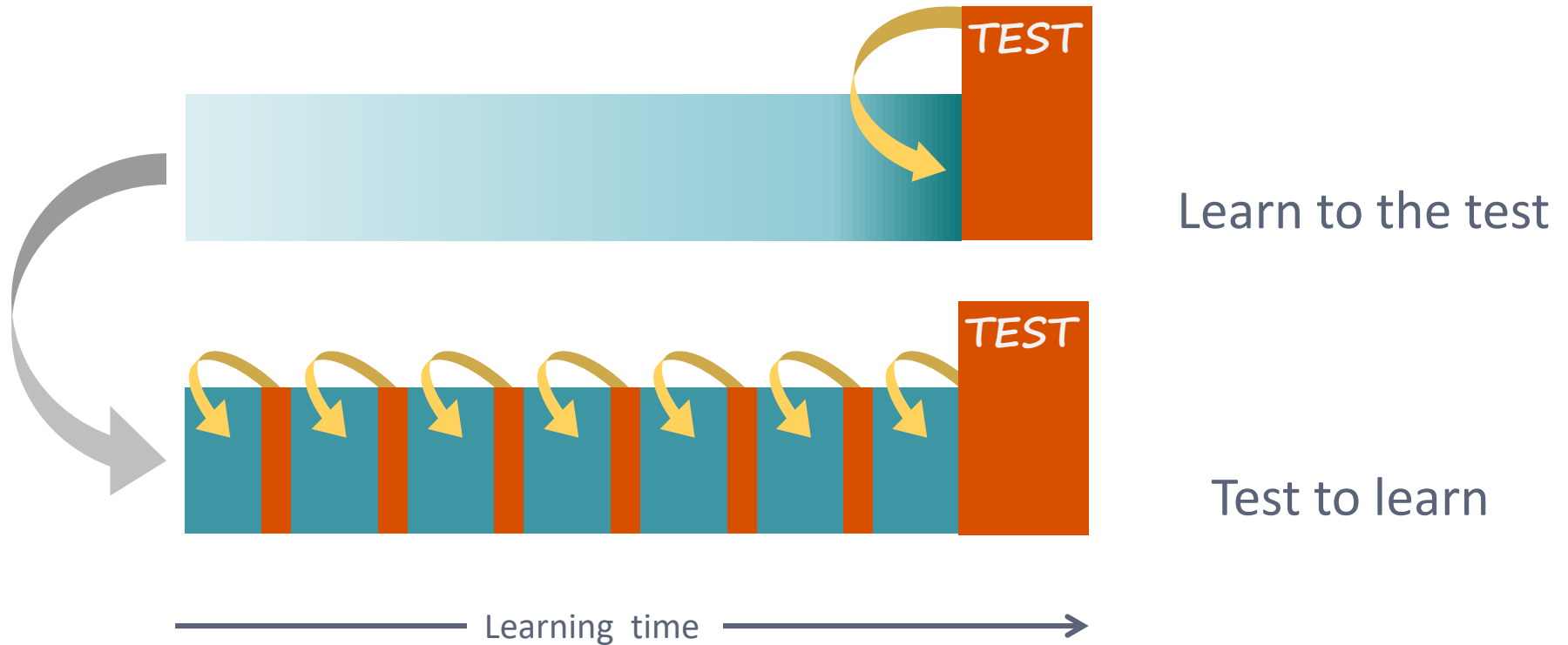


The Answer

# TEACHERS

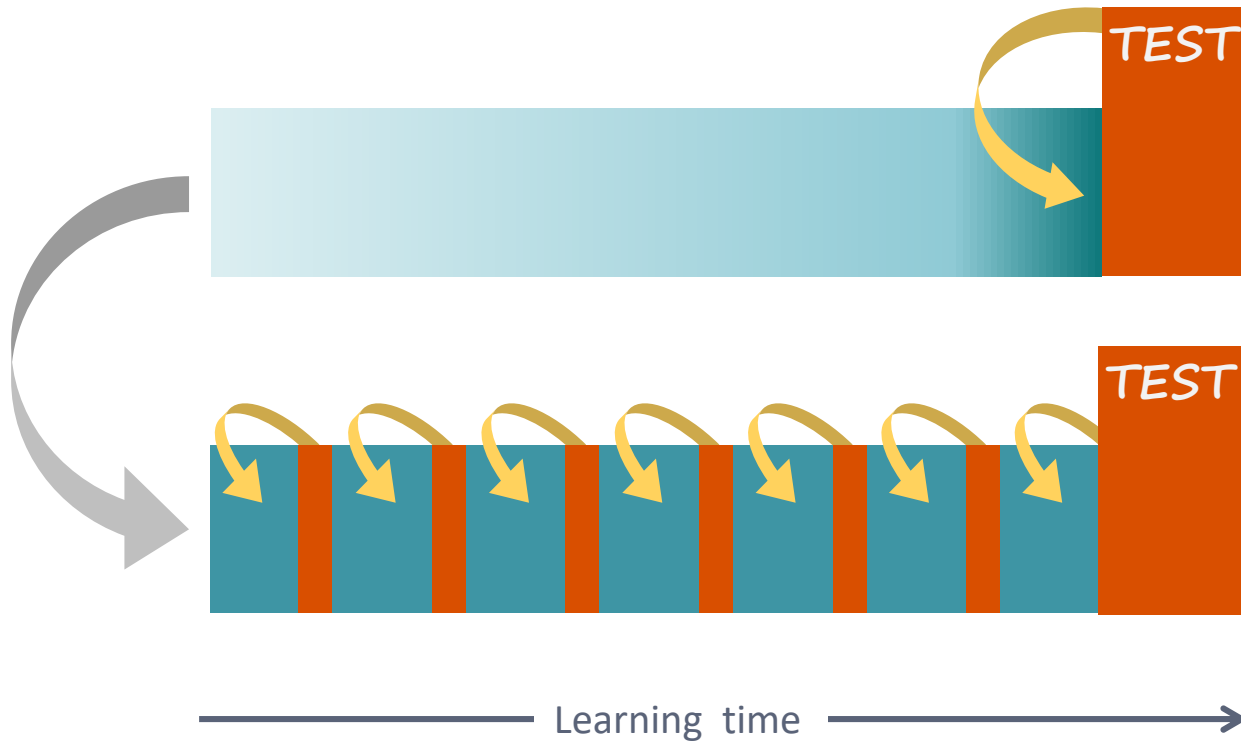
RETRIEVAL PRACTICE as a **ROUTINE**

# Retrieval FOR Learning



Color code:    **Learning**       **Testing**       **Motivation**

# Retrieval FOR Learning



Color code:

Learning

Testing

Motivation

ALL THE STUDENTS

ALL THE TIME



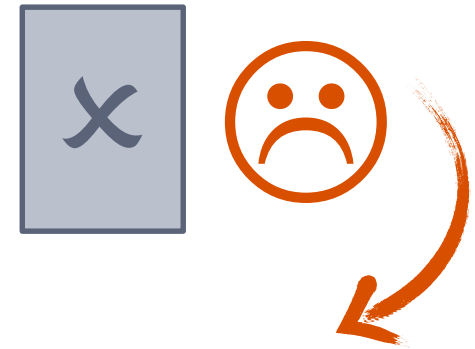
**Closing  
Gaps (?)**

# Barriers for Teachers

Short-Term



Long-Term



Difficult



Desirable



# Barriers for Teachers

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My Experience (based on survey):

1. Teachers understand and appreciate the benefits of retrieval practice for students.

2. Identify many barriers:

TIME, lack of support, incompatible “system”

3. They ask for support

Discipline Specific PD, available materials, professional support

# Barriers for Teachers

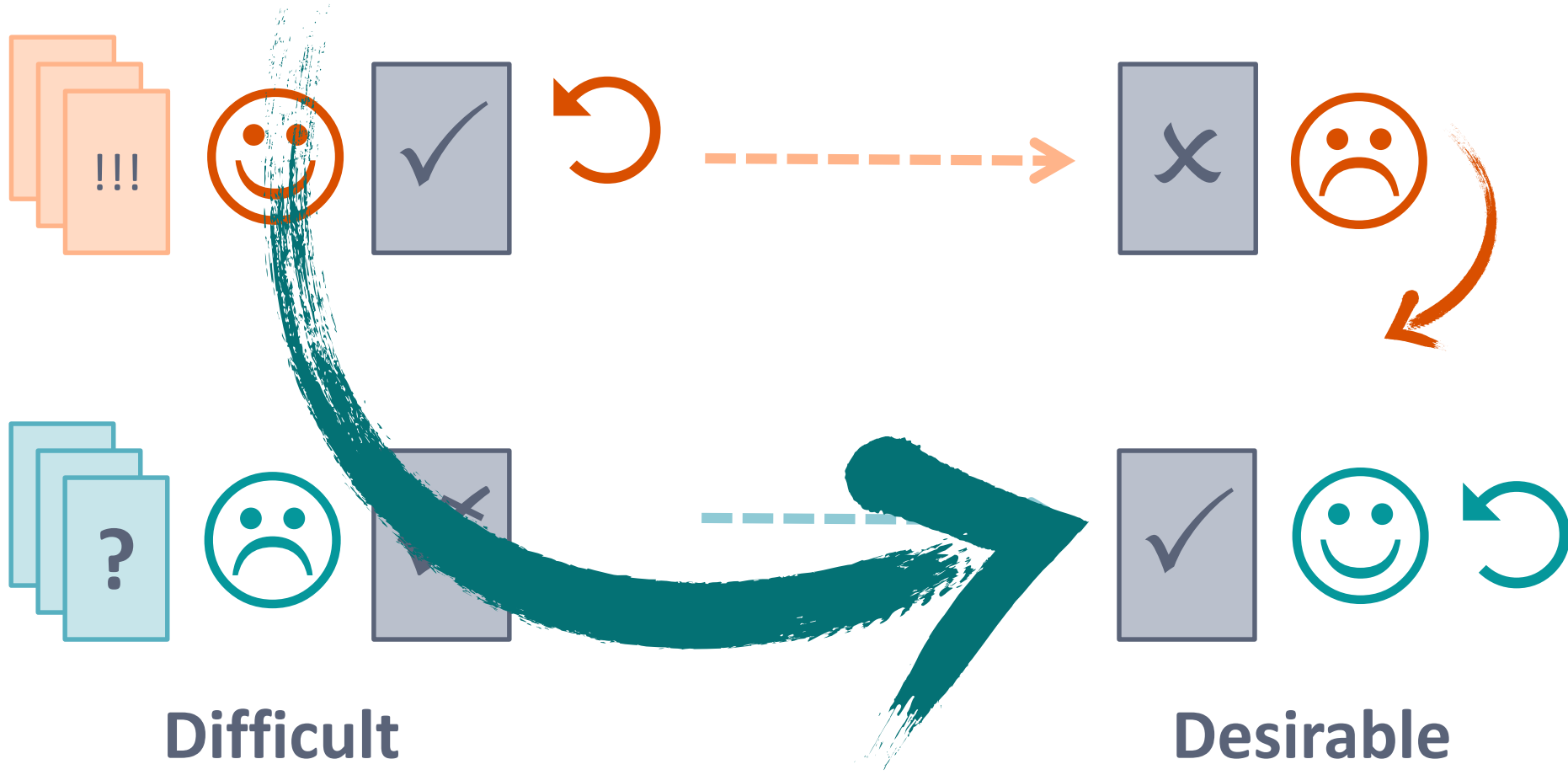
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What is your experience?

# Barriers for Teachers

Short-Term

Long-Term



# What can we do?

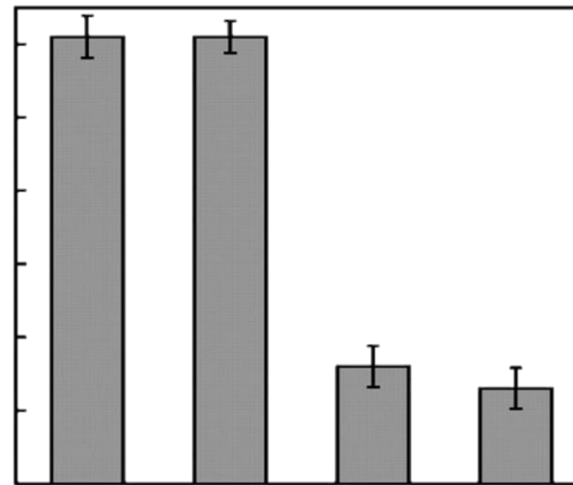
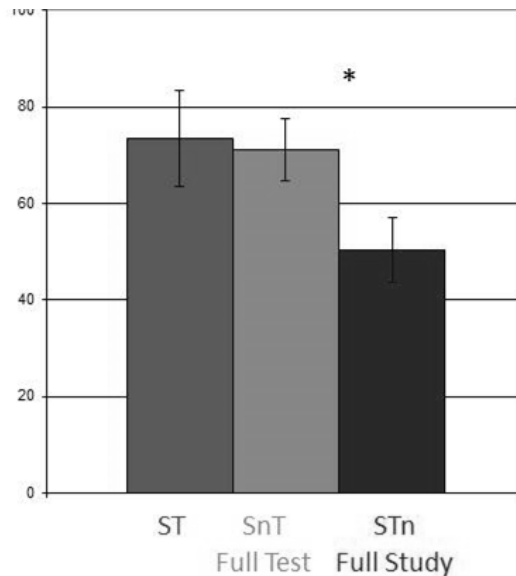
Global

Developing a community and culture of  
Bridging research and education.

Local

Cognitive research in schools  
Goal #1: Inform, engage, experience

*Ben Hur,  
Bueno,  
Reisner,  
Somer &  
Weinberg  
2011*



*Karpicke &  
Roediger  
Science  
2008*

# The Journey



Research

research  **ED**  
Communication

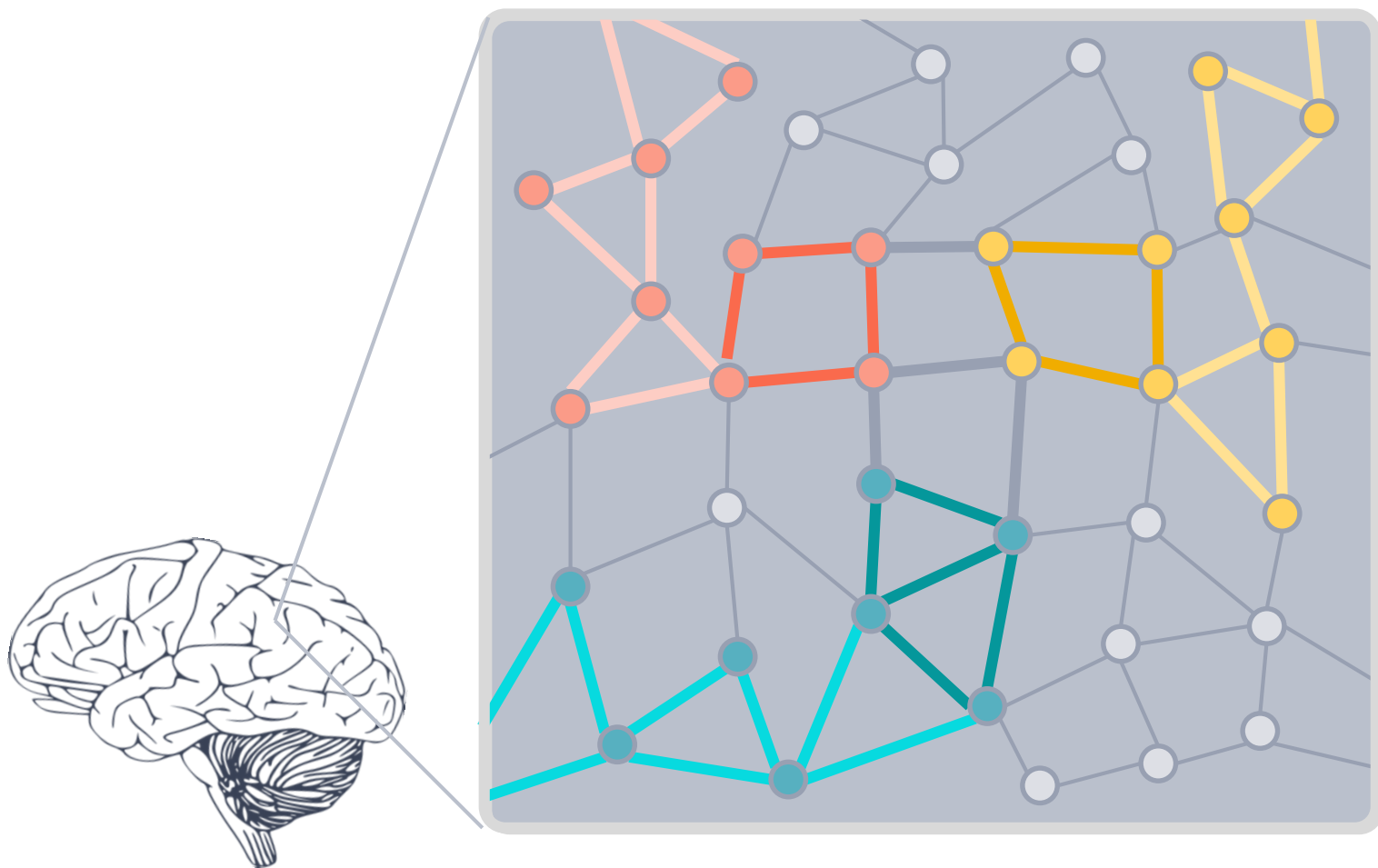
Education



# The present and the future



# Thank You!



More...

Sample questions – Practice Retrieval  
Share your experience  
Learn more



<https://goo.gl/forms/d8YP7Hj4LGjrBBnI3>



@EfratFurst