# Human-Centered Design

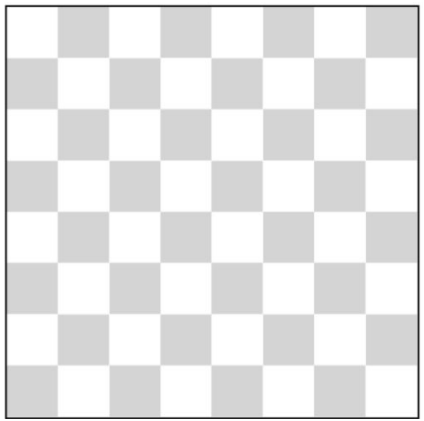
## Cognitive Load Theory Intuition

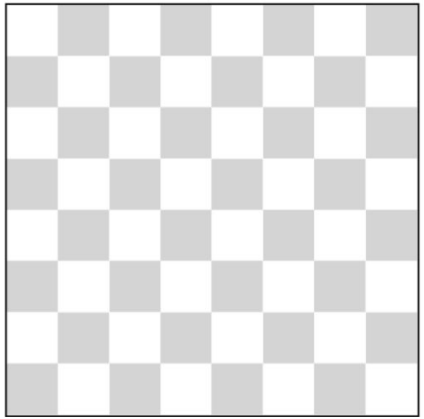


WashU CSE 256A
Prof. Kelleher
#19: Mon, Apr 01, 2024

# While we wait...

Find a piece of paper and draw yourself two large empty chess boards:





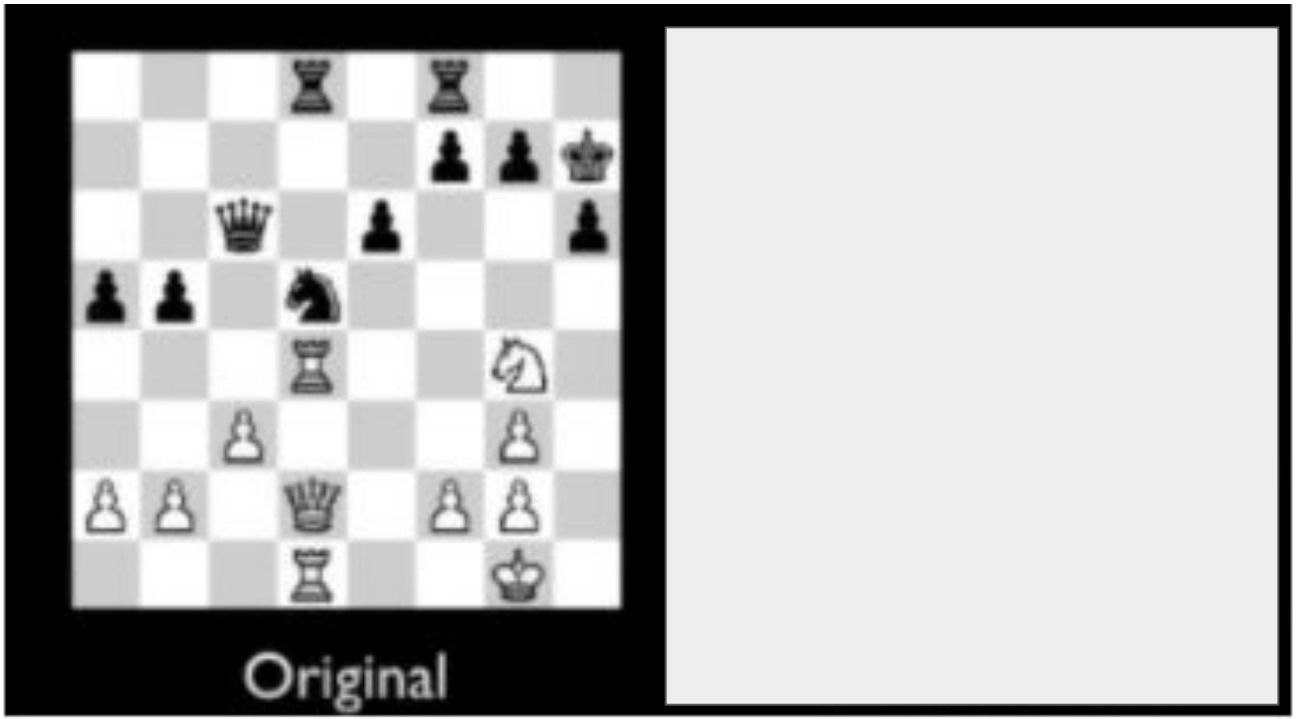
# Nuts and Bolts

- If you haven’t published your pages site, please do ASAP. I can’t release user tests without the sites being available.
- Problem solving exam timing.
  - Push back by a week? (This then sits next to problem solving submission 2)

# Consensus builders

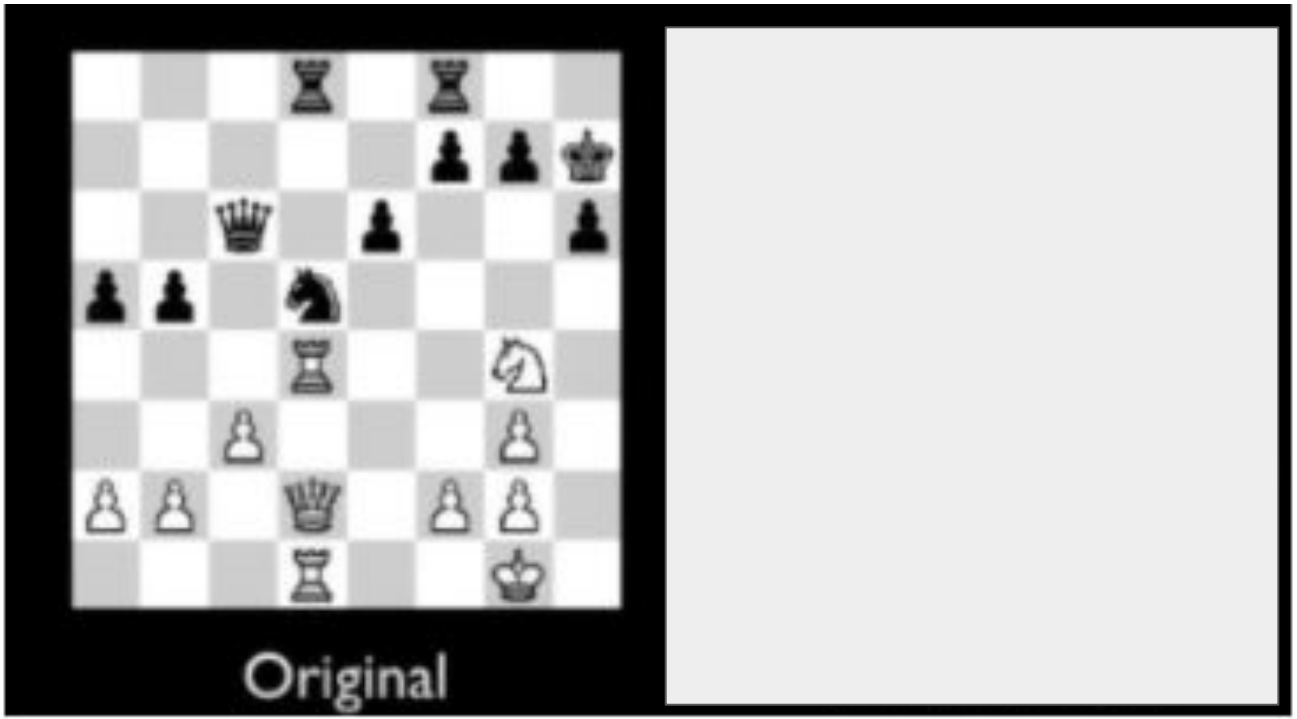
Who has tried a new restaurant most recently?

# Study this chessboard…(30 secs)

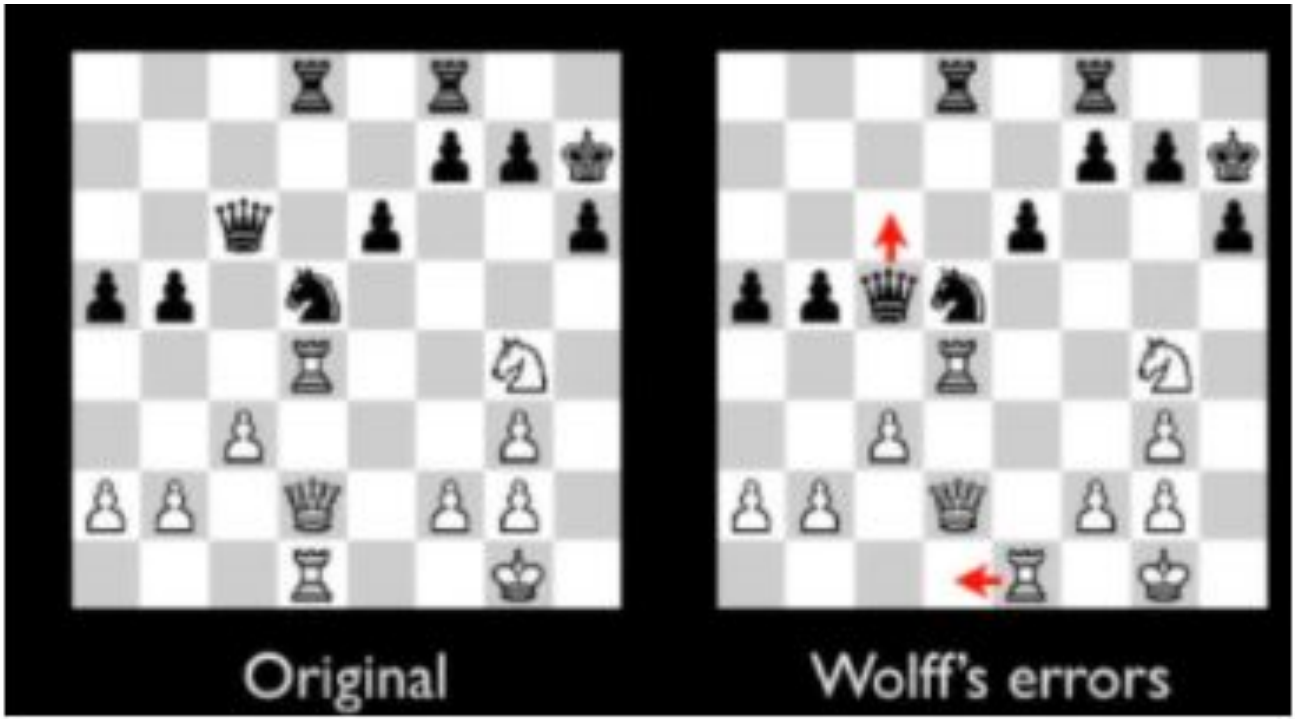


# Waiting 30

# How many pieces did you get right?



# A Chess Grandmaster (Patrick Wolff)



# Study this chessboard…. (30 sec)



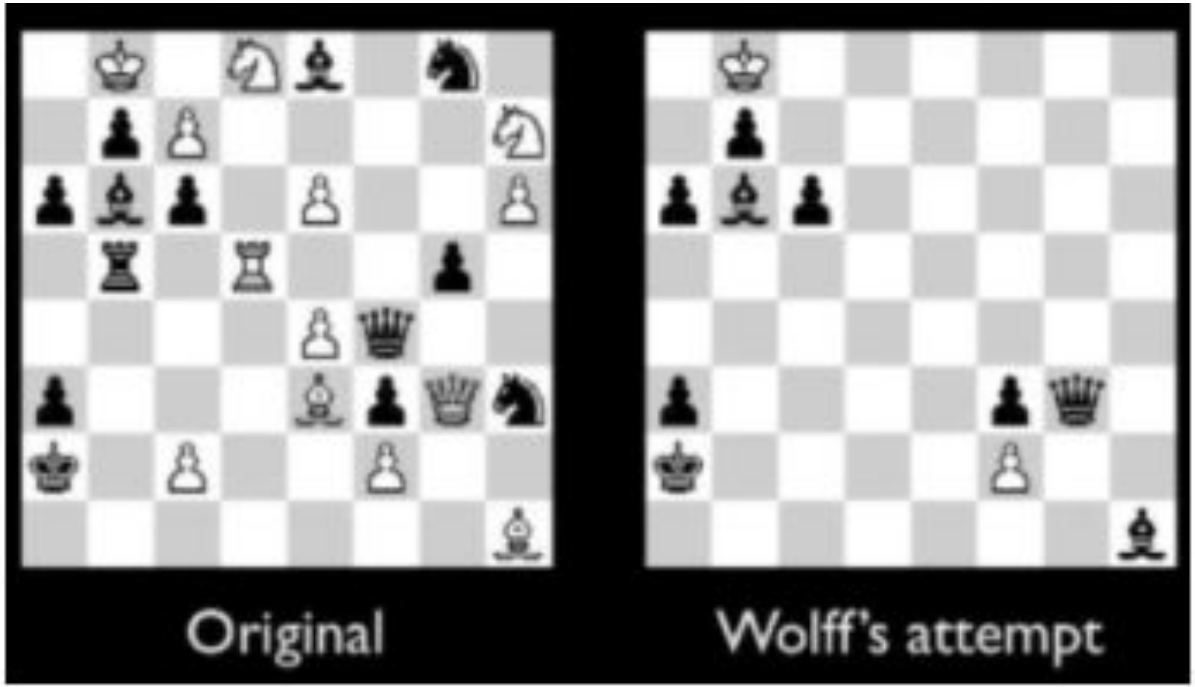
Original

# Waiting 30

# How many pieces did you get right?



# A Chess Grandmaster?



# Our performance

Only the first chess board was from an actual game!

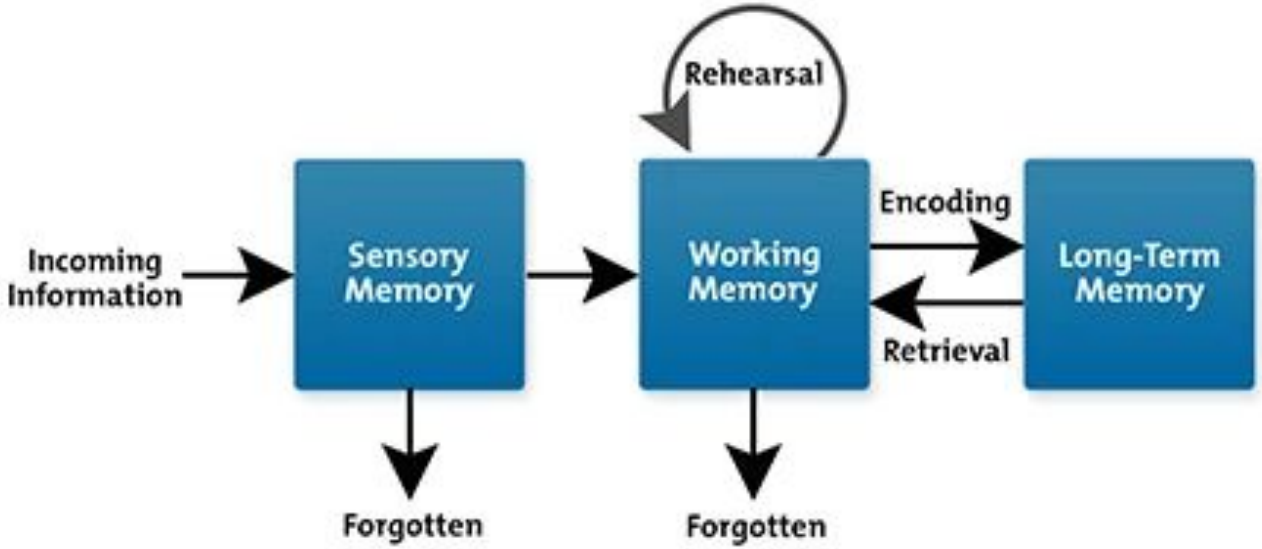
Chess players w/ real board: X pieces correct

Chess players w/o real board: X pieces correct

Non players w/ randomized board: X pieces correct

Non players w/o randomized board: X pieces correct

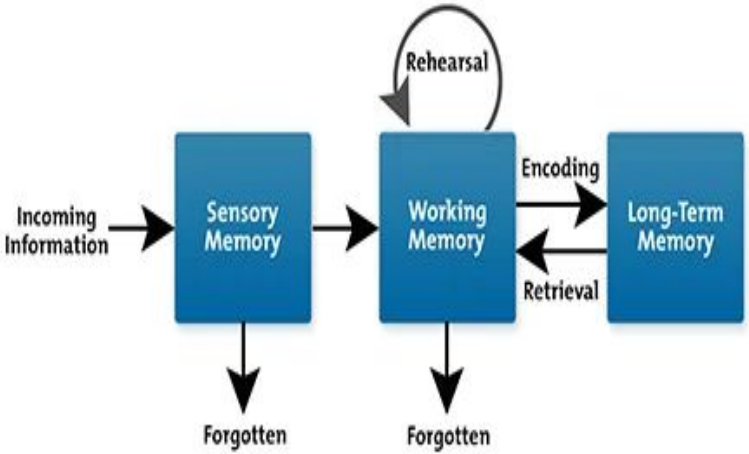
# Human Memory



# In-Class Discussion #1

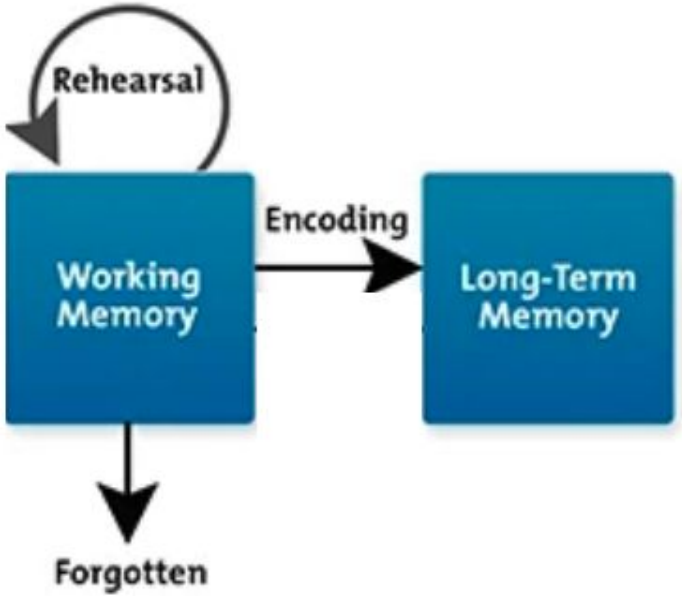
1. What explains the performance difference?
    a. For a valid chessboard, expert significantly outperforms novice
    b. For an invalid chessboard, novice and expert are not distinguishable
2. How does it relate to human memory?
3. How do you think novices and experts perform this task differently?

# The role of memory in performance

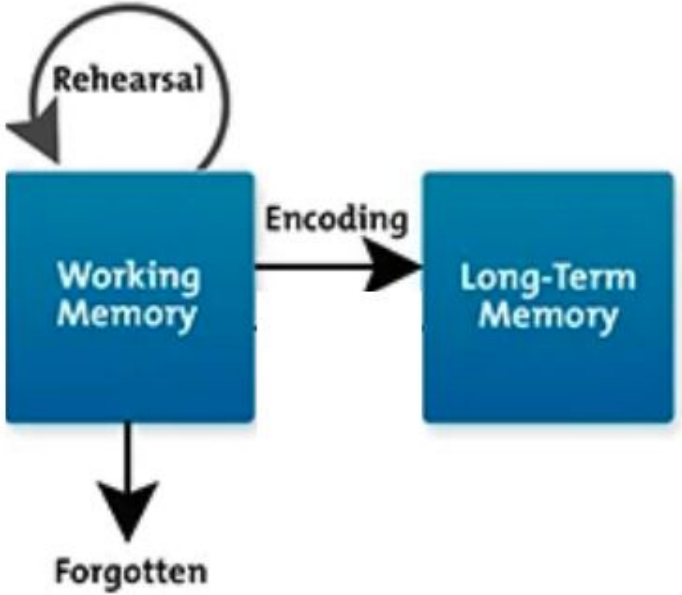


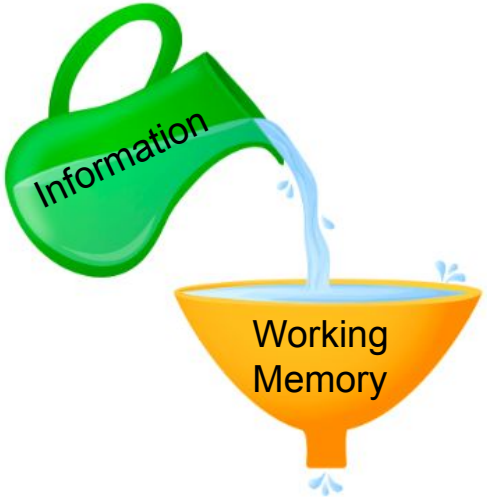



# Working Memory



# Working Memory



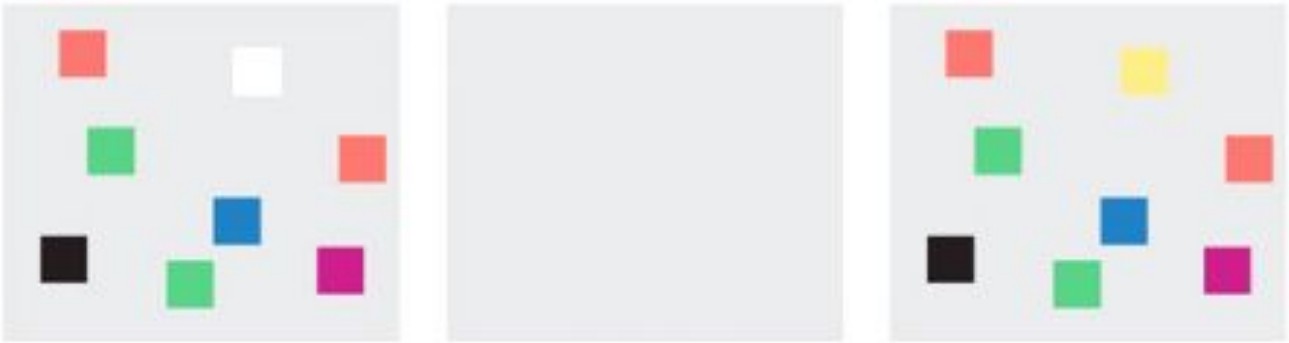



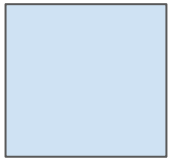


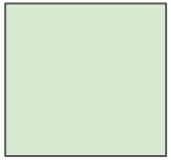

Long-term memory

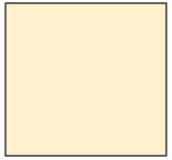
# How limited is working memory?

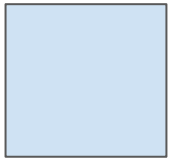
We are going to play “Same, or Different?”

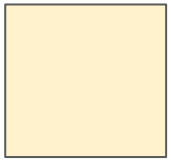










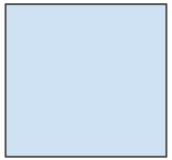
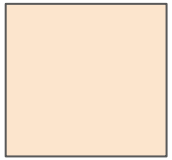
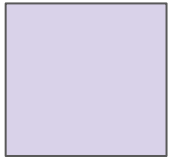
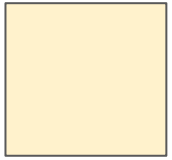
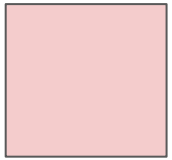


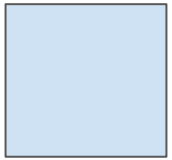
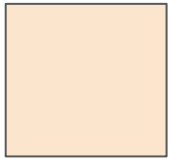
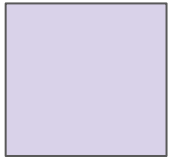
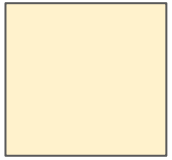
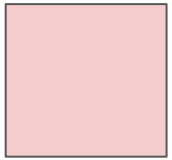


# Same or different?

# Same or different?

Different!

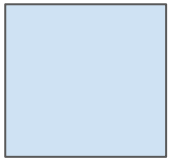
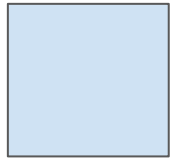






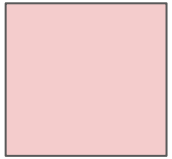
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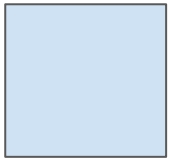
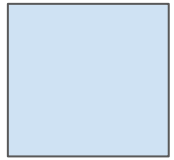
# Same or different?

Same!

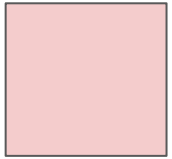







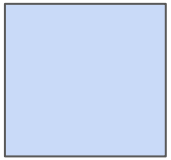
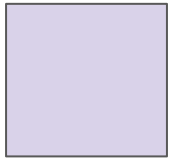


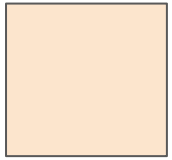


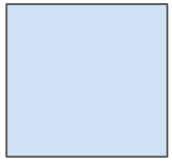
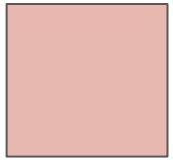
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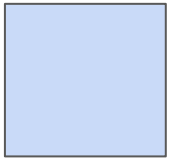
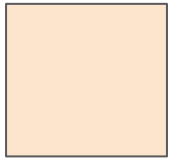
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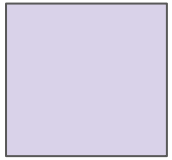
Different!

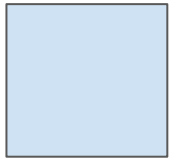
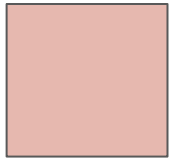







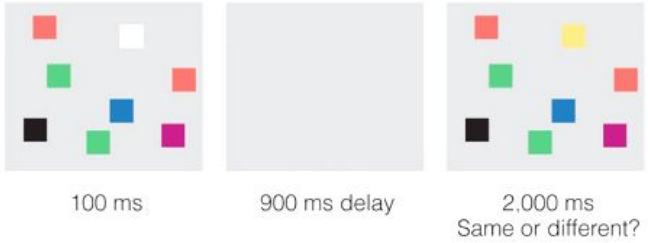



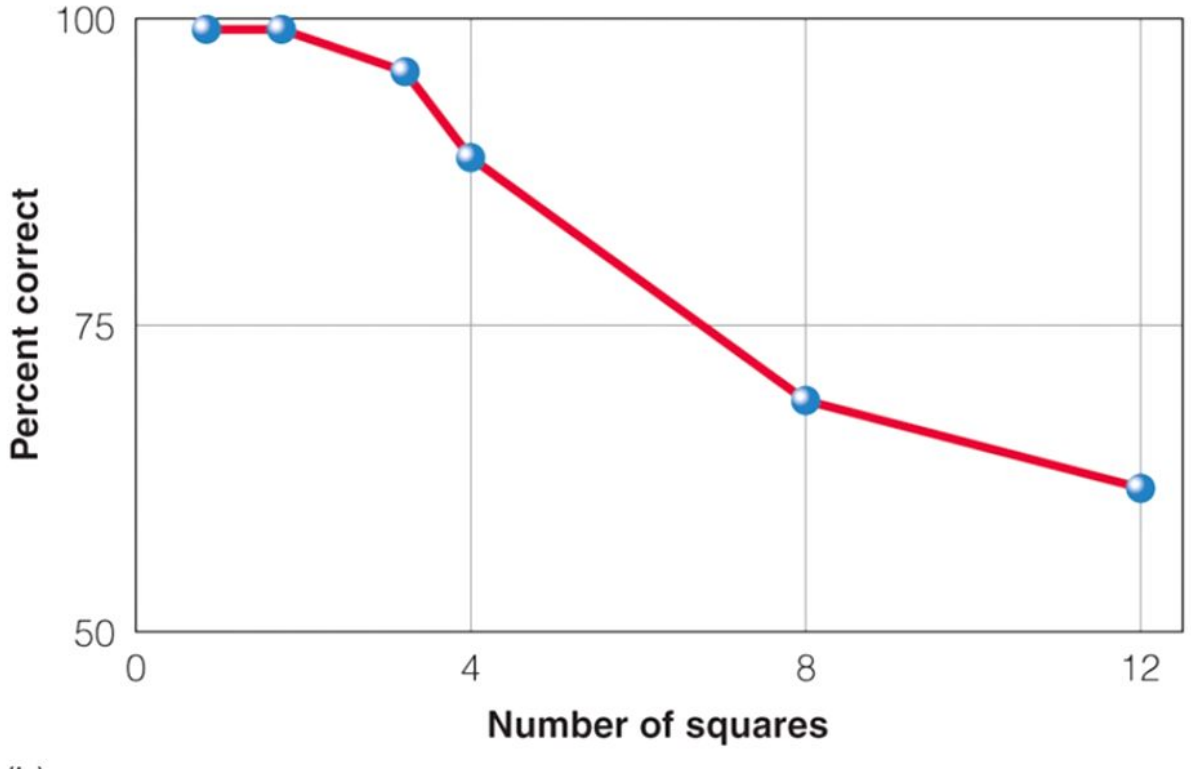
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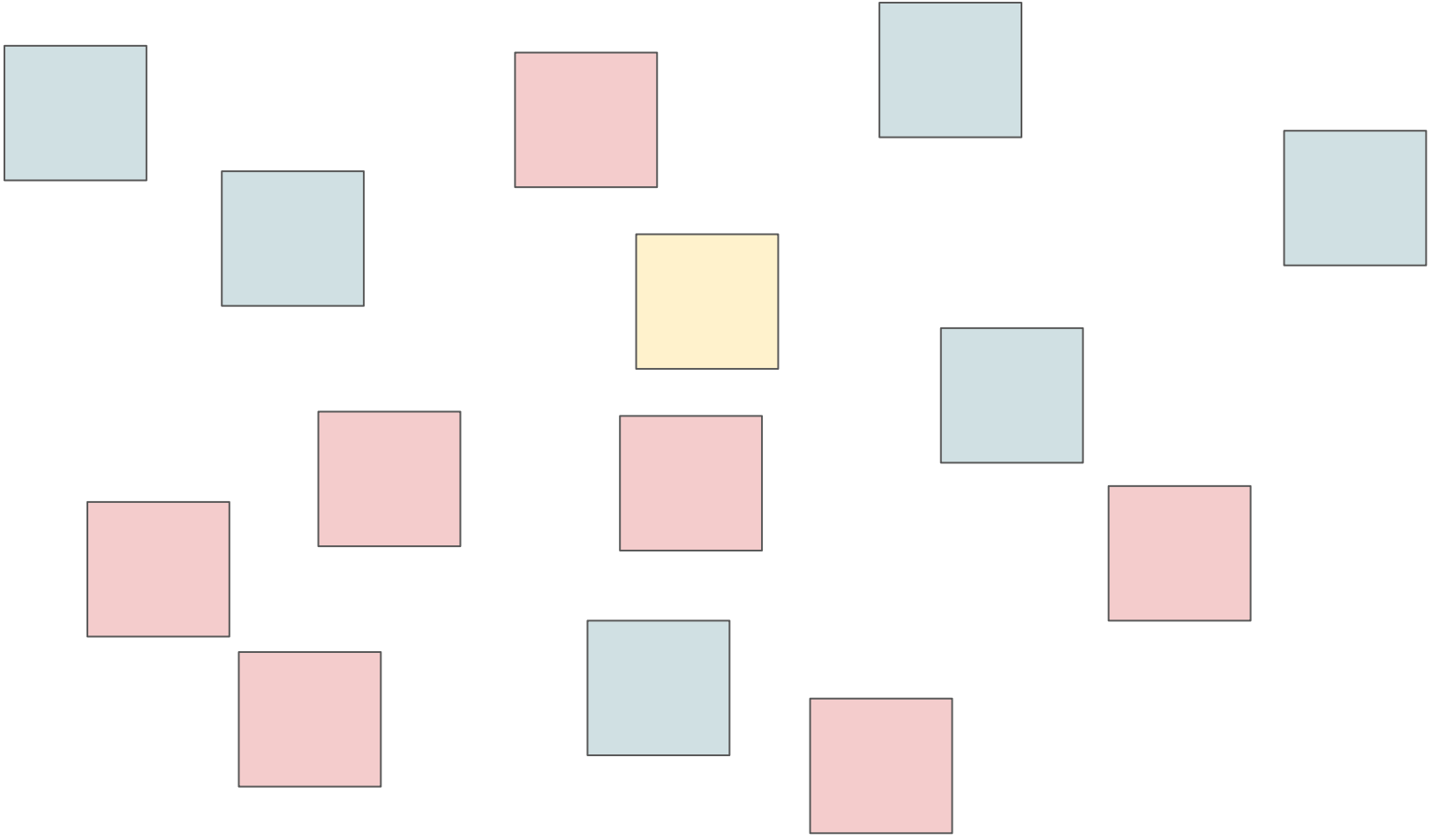
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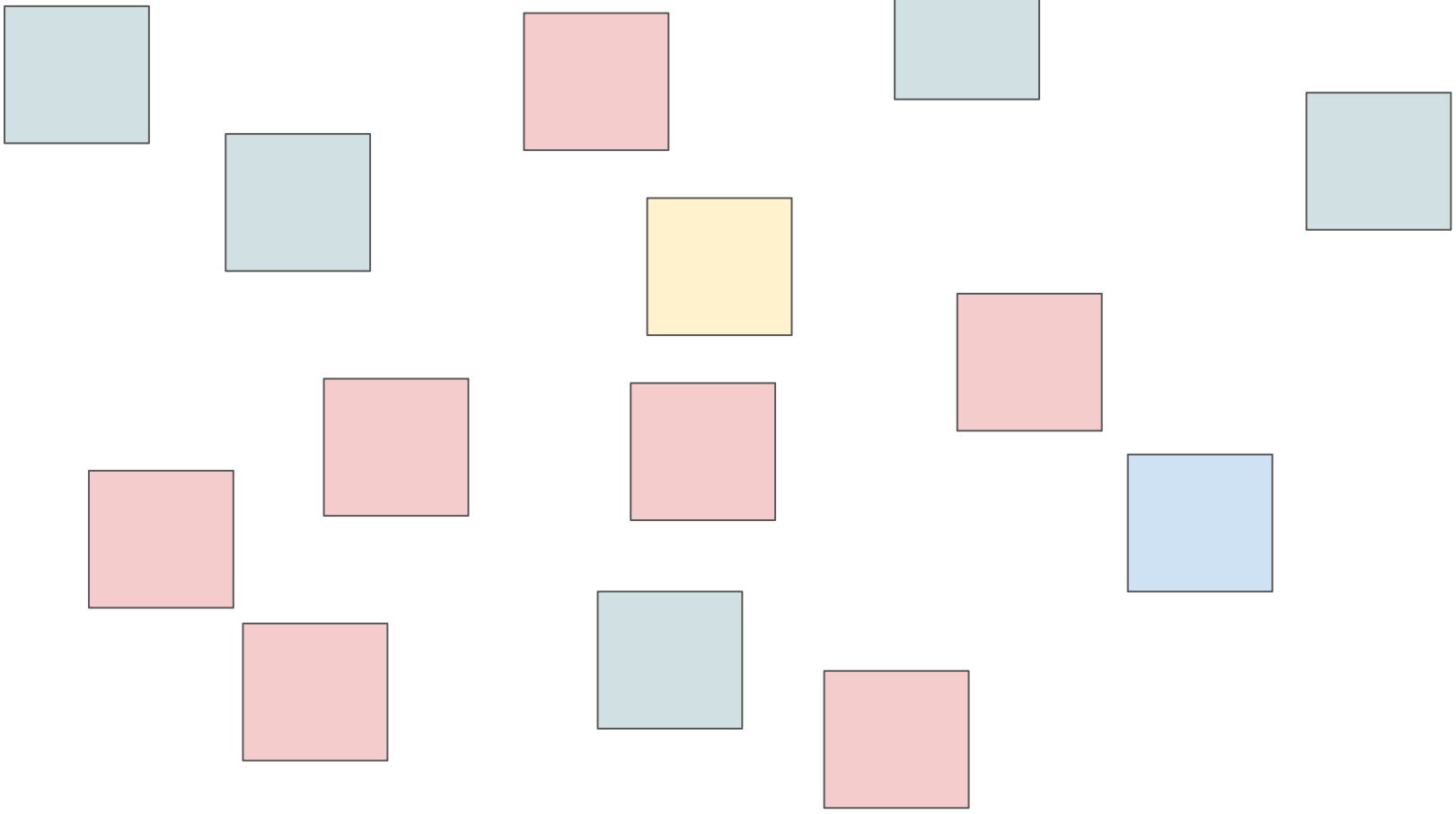
Different!

# Luck & Vogel (1997)



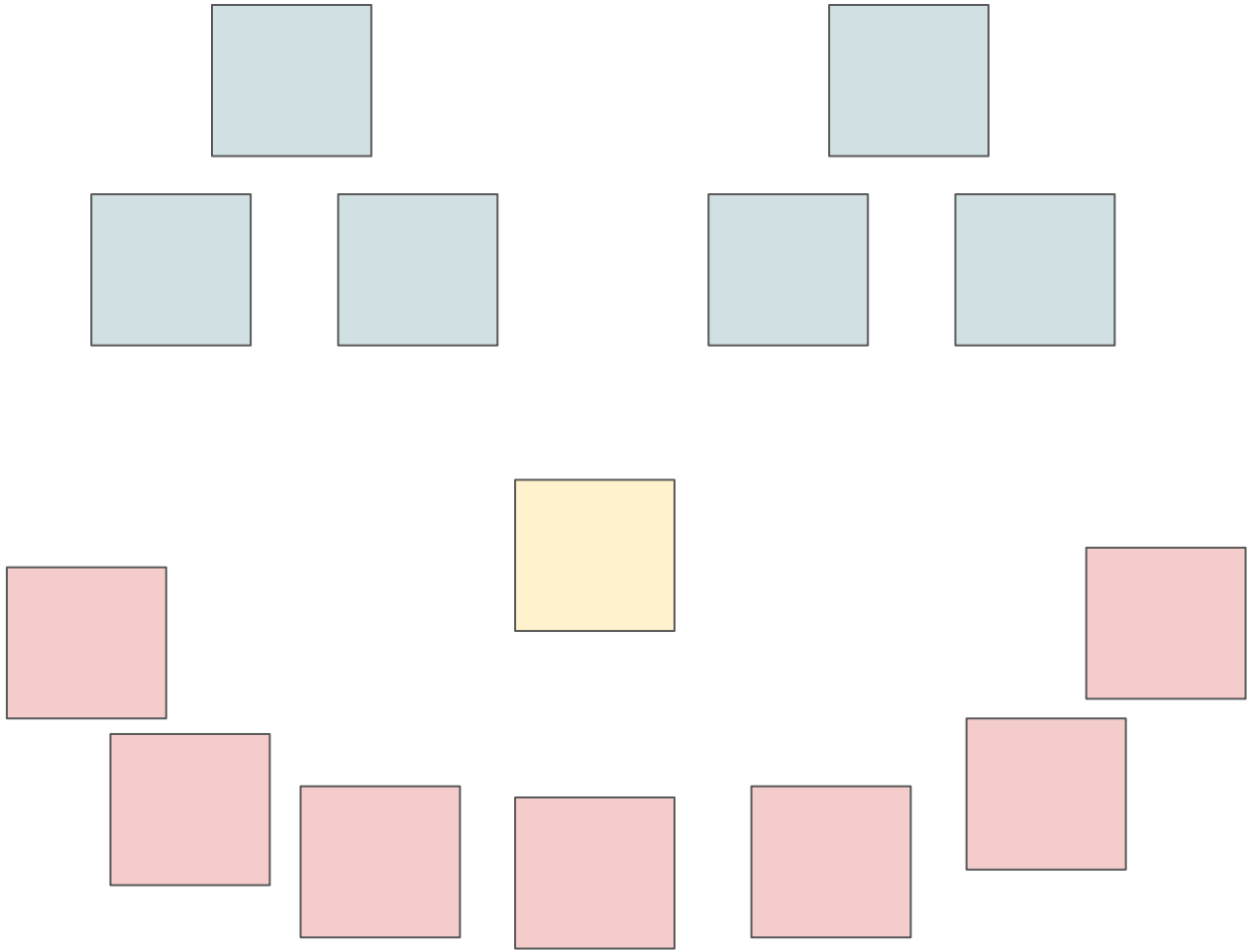


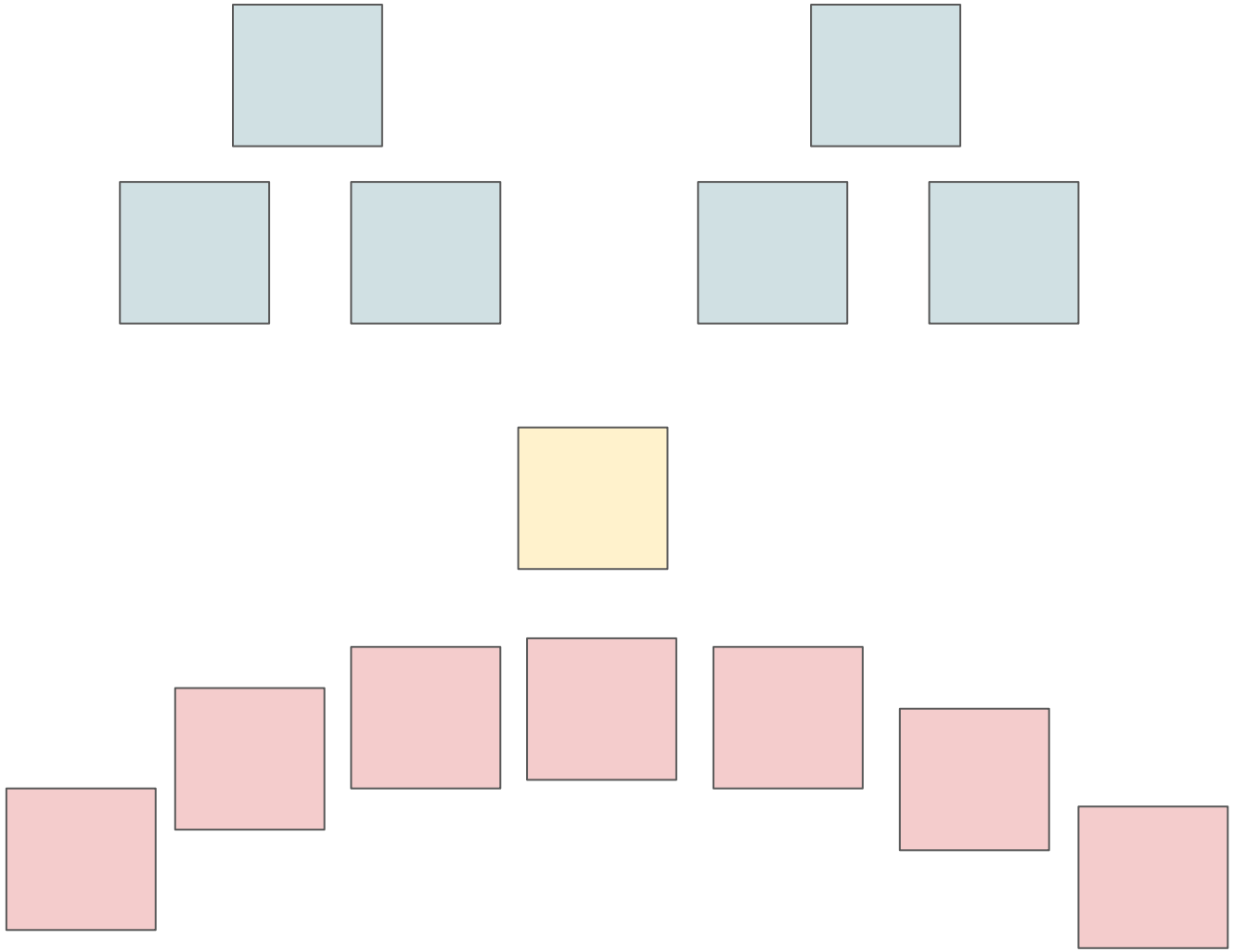


# Same or different?

# Same or different?

Different! Why was that so hard?





# Same or different?

Different! Why was that so easy?

# Chunking



14 separate
“units”



1
psychological
“unit”

# Chunking



14 separate
“units”

UTGDLEPCMDSLFEKP



1
psychological
“unit”

# Chunking



14 separate “units”

UTGDLEPCMDSLFEKP

SAINTLOUISMISSOURI



1 psychological “unit”

# Chunking



14 separate “units”

UTGDLEPCMDSLFEKP

SAINTLOUISMISSOURI

LOLWRUDTGIFASAPGG



1 psychological “unit”

# Chunking in Chess



# Take Aways

- We all have about the same short term memory capacity and it represents a significant limitation. Things that don’t fit just get lost.
- A significant part of expertise comes through stored knowledge that can be accessed with a simple label and unpacked.

We can think of the challenge of learning as helping people to develop new structures in long term memory that allow them to hold onto and process a greater amount of information at once.

# In Class Discussion #2

Cognitive Load Theory finds that learning is limited by short term memory capacity. Given this:

1. Think of something that you found difficult to learn. How were you using your short term memory? What uses of short term memory were and were not aligned with learning for you?
2. How should we design for a very limited working memory, especially when trying to teach complicated material?

# Next time:

We will discuss the types of cognitive load on working memory