



# The Role of Neuroscience in Learning Transfer

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The image features a dark blue background with a large, faint, light blue circle in the center. In the four corners, there are decorative white line-art patterns resembling circuit traces or neural network connections, with small circles at the end of the lines.

Let's Start with Some Controversy!

# Neuroscience is Generally Considered a Physical Science

- Affective Neuroscience
- Behavioral Neuroscience
- Clinical Neuroscience
- Cognitive Neuroscience
- Cognition and Cognitive Neuroscience (CCN)
- Computational Neuroscience
- Cultural Neuroscience
- Developmental Neuroscience
- Molecular and Cellular Neuroscience
- Social Neuroscience
- Systems Neuroscience
- Visual Neuroscience
- Neuroanatomy
- Neuroendocrinology
- Neuroengineering
- Neuroevolution
- Neuroimaging
- Neuroinformatics
- Neurolinguistics
- Neurology
- Neuropharmacology
- Neurophilosophy
- Neurophysiology
- Neuropsychology

The background is a dark blue gradient. In the corners, there are decorative white lines that resemble circuit traces or neural network connections, with small circles at the end of the lines. These lines are arranged in a way that suggests a network or a complex system.

# Risk of Extrapolating from Physical Sciences to Behaviors

# Some Authors Feel Neuroscience Is Critical for L&D; Others Reject It as Irrelevant

## Why Learning Neuroscience Matters

By **Christiaan Vermeulen**  
Thursday, April 21, 2016

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The only way businesses can maintain their competitive advantage in this rapidly changing, information soaked world is to out-think, out-learn, and out-create the competition. By gaining deep insight into how the brain functions—in support of learning, creating, and problem solving—we can better prepare workers to adapt to the evolving and expanding workplace.

### Enter Neuroscience

The science of learning is an interdisciplinary field of study that examines how people learn and how the learning and development (L&D) field can improve talent management, performance improvement, organizational learning, training, and instructional design.

According to Dr. Andre Vermeulen, CEO of Neuro-Link, a company that specializes in the neuroscience of workplace learning, there are several reasons L&D should explore the study of neuroscience. First and foremost, it brings to bear findings from hard sciences (such as physiology and chemistry) to learning theories. Until now, the science of learning was rooted principally in behavioral sciences like education and psychology.

“While these areas of research have greatly advanced, our understanding of knowledge transfer, new skill development, and behavior change has relied extensively on hypothetical constructs,” says Vermeulen. Scientific research focusing specifically on the brain—physiology, neuro-physiology, chemistry, psychoneuroimmunology, and immunology—offers direct observations of relevant variables, and can often validate or disprove earlier assumptions.

## What Do You Know About Brain Science and Adult Learning?

By **Patti Shank**  
Thursday, April 14, 2016

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We’re hearing a lot these days about how the talent development community can use what experts know about brain science (or neuroscience) to improve adult learning. In fact, we often hear training suppliers and L&D consultants discuss how their products and services take advantage of the latest neuroscience research. But exactly what do we know about the intersection of brain science and adult learning?

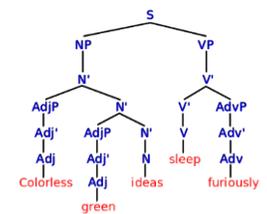
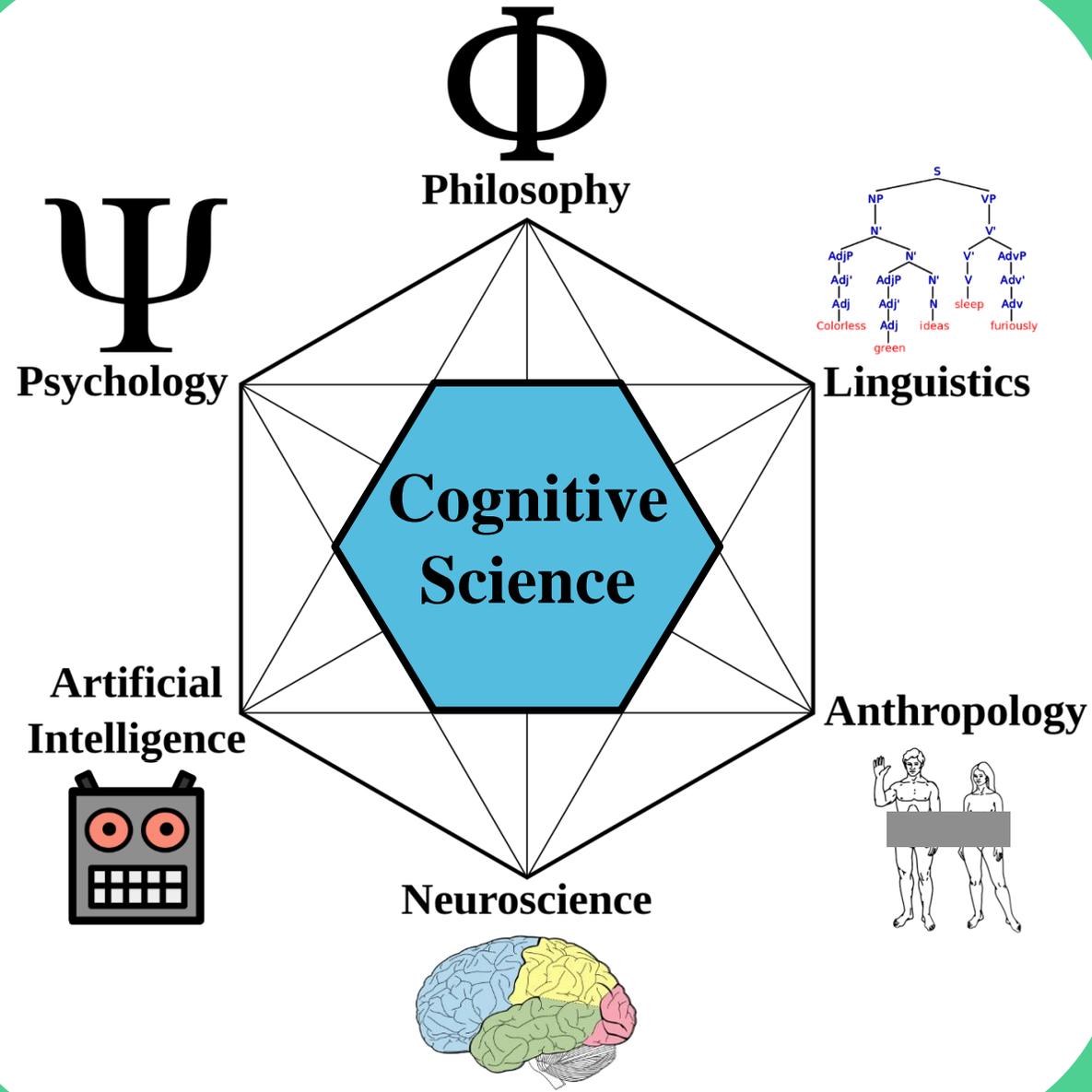
Let’s start our exploration by answering a key question. (Select the BEST answer, and don’t worry about whether it is “correct.” Just have some fun.)

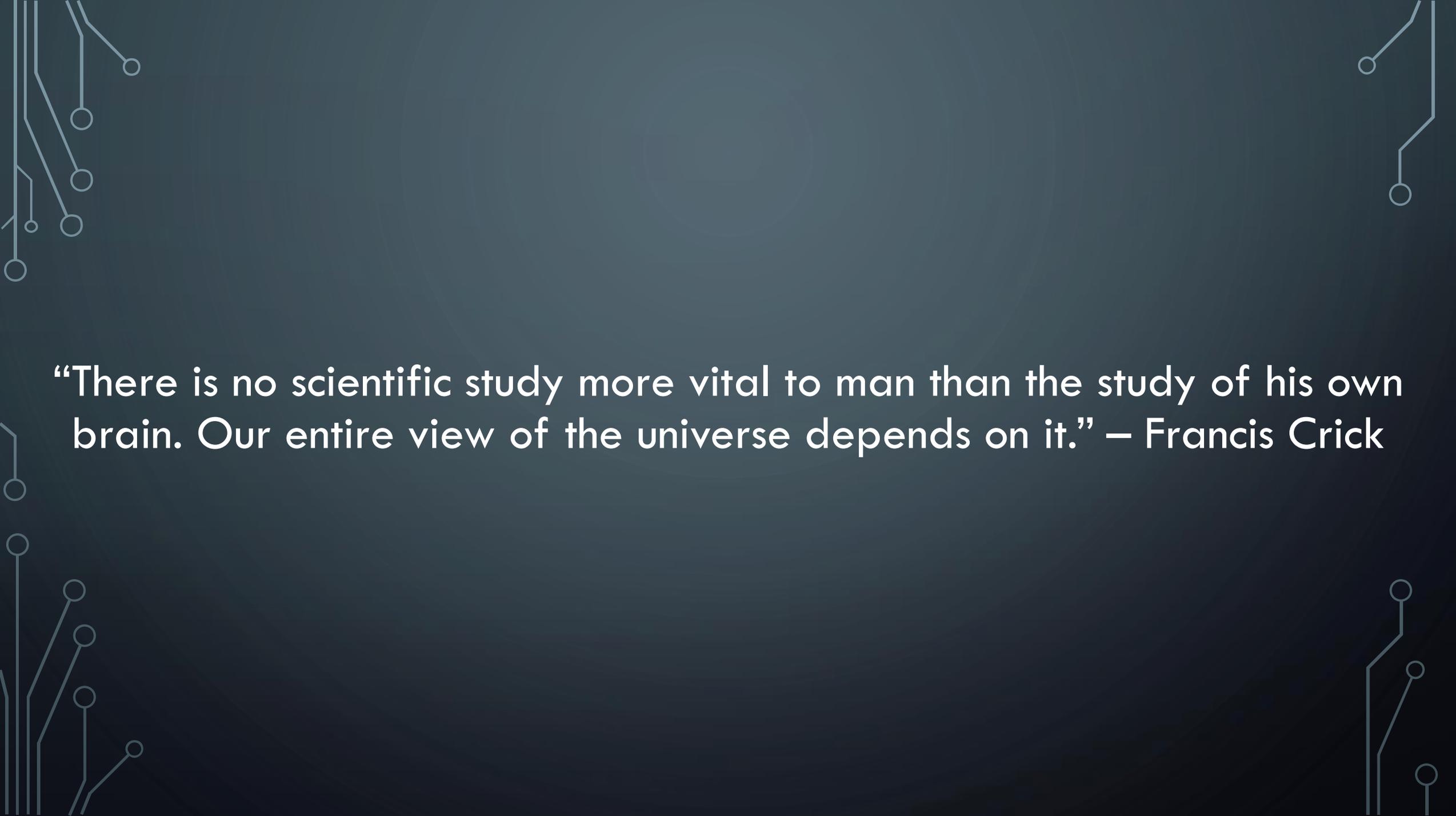
**How much have we learned from brain science in the last 10 years that we can directly apply to adult learning?**

- A. We have learned a great deal from brain science.**
- B. We have learned some key items from brain science.**
- C. We have learned little from brain science.**

Case in Point: Remember the *Baby Einstein* videos, acquired by Walt Disney, that vowed to make babies smarter, based on brain science? **Lawsuits claimed** that not only were the declarations false, but several **studies** revealed that children under two years of age should not watch *any* television, including DVDs.

“According to De Bruyckere, Kirschner, & Hulshof, most of what we attribute to neuroscience is actually coming from *cognitive science*, not *neuroscience*.”

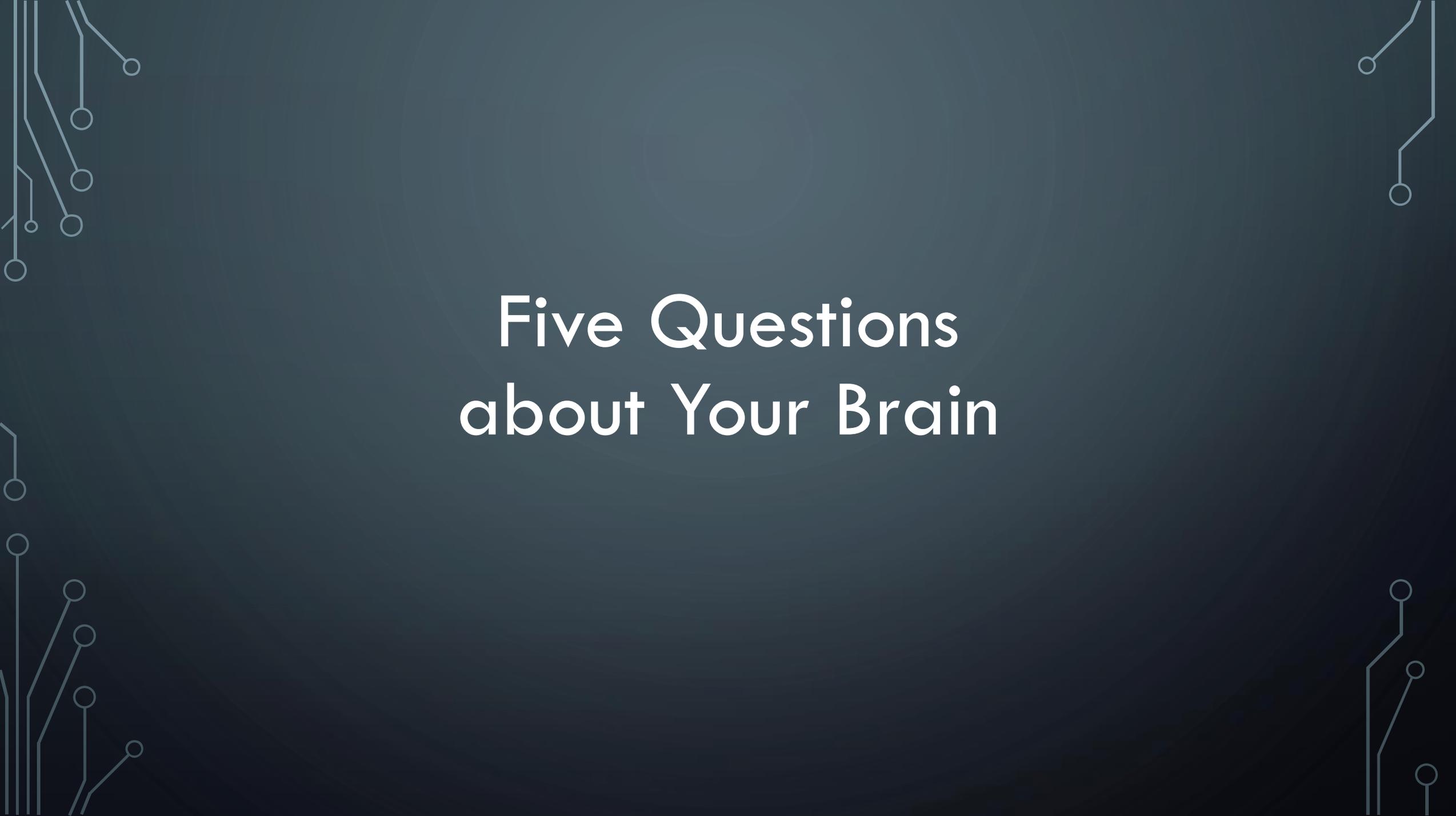




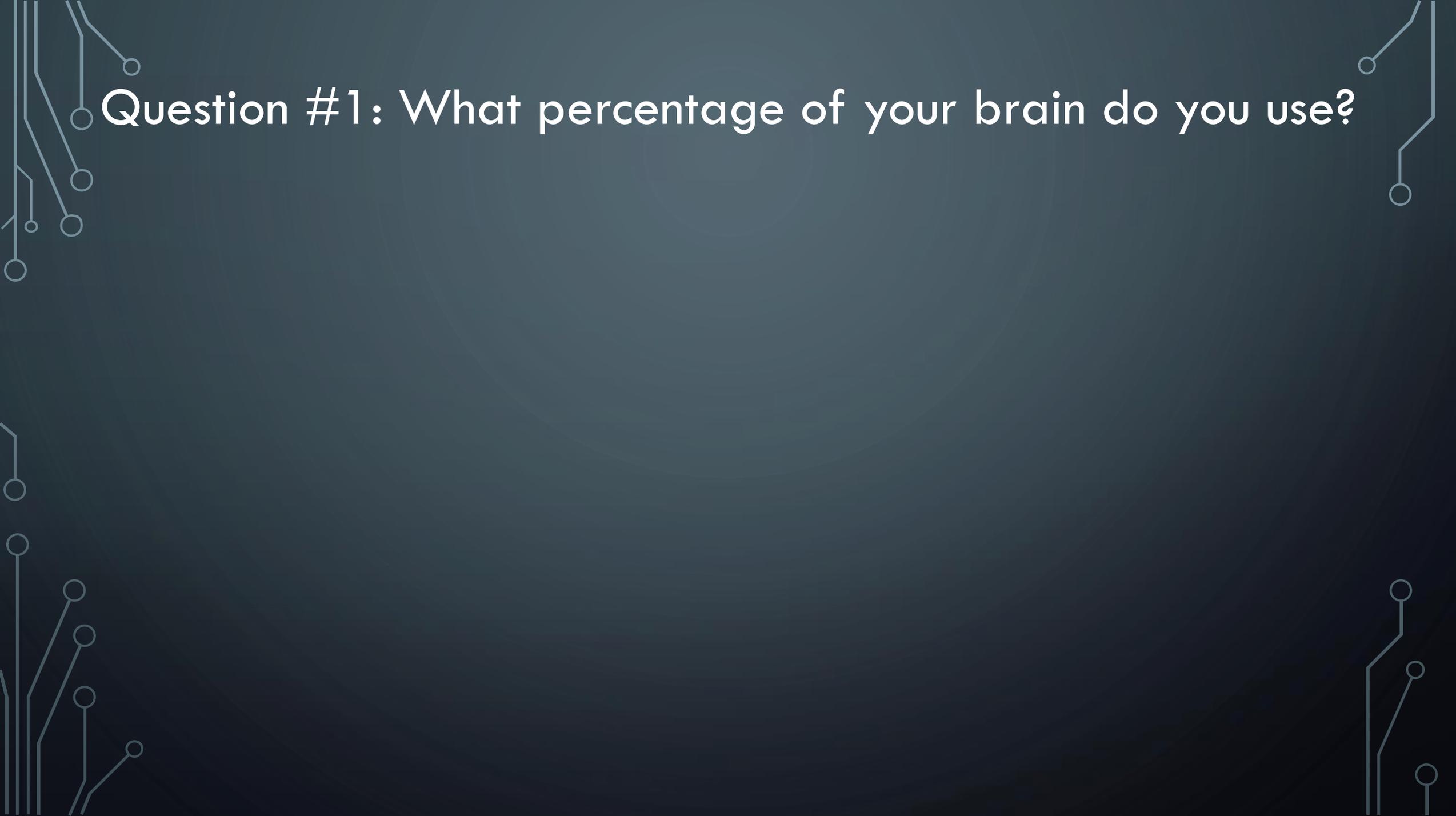
“There is no scientific study more vital to man than the study of his own brain. Our entire view of the universe depends on it.” – Francis Crick

# Agenda

- Five questions about your brain – *need paper, pen, and highlighter if you have one!*
- Applying cognitive science to L&D
- Q&A

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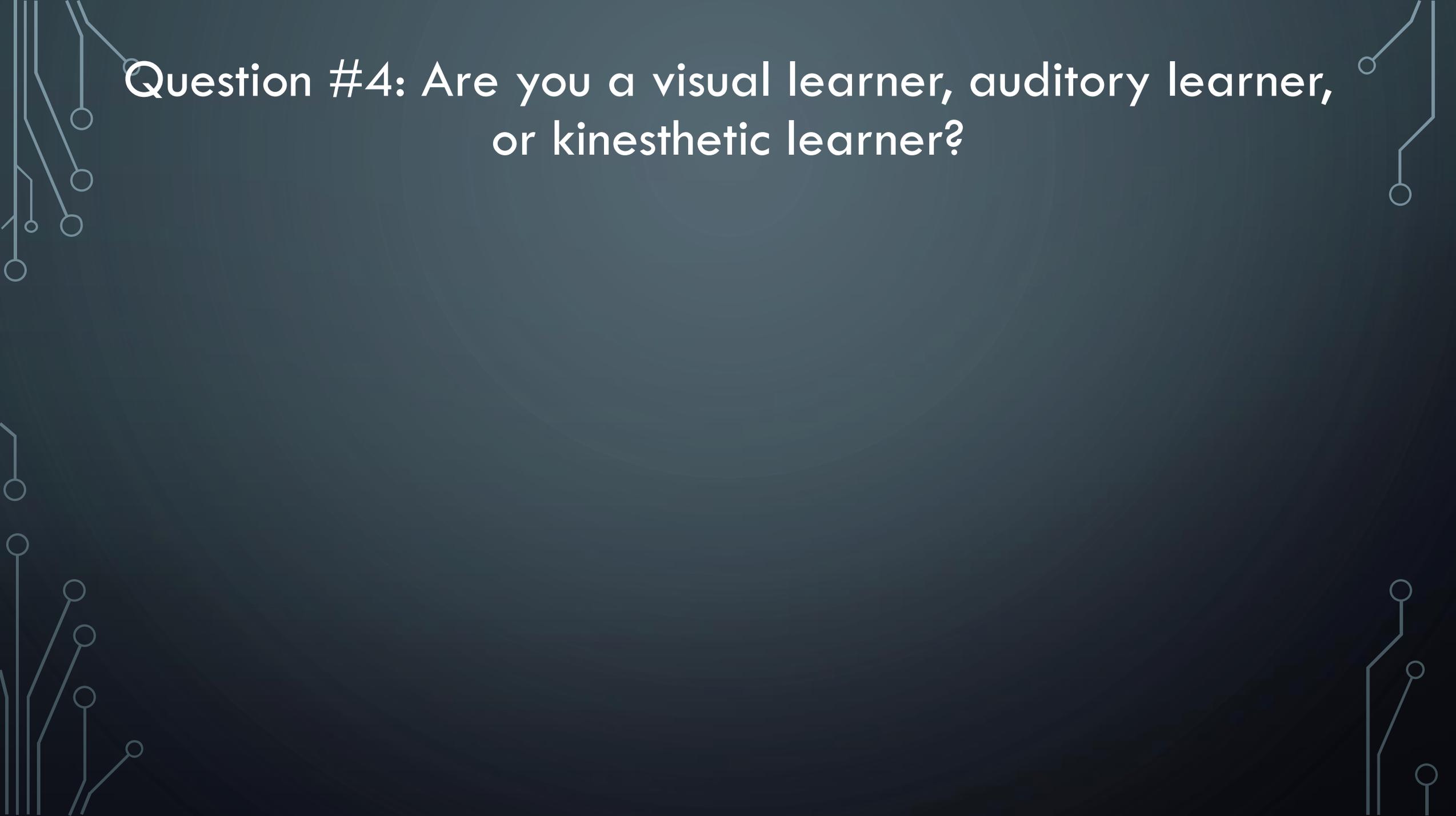
# Five Questions about Your Brain

The background is a dark blue gradient with a large, faint, light blue circle in the center. The corners are decorated with white circuit-like lines and small circles, resembling a stylized brain or neural network.

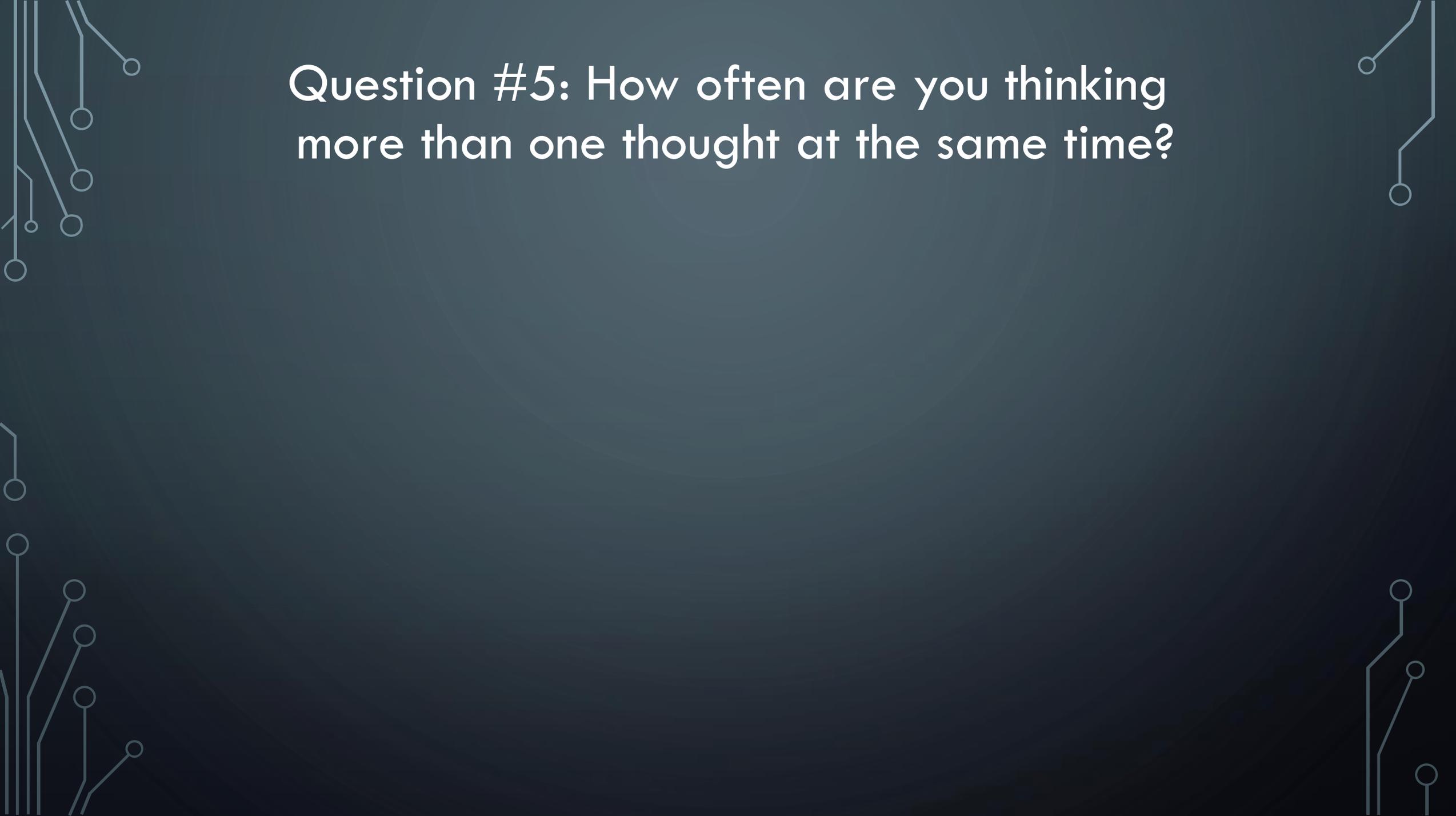
Question #1: What percentage of your brain do you use?

Question #2: Are you left-brained or right-brained?

Question #3: When you drink alcohol, what impact does it have on your brain?

The background is a dark blue gradient. In the corners, there are decorative white lines that resemble a circuit board or a network diagram, with small circles at the end of the lines. The text is centered in the upper half of the image.

Question #4: Are you a visual learner, auditory learner, or kinesthetic learner?



Question #5: How often are you thinking more than one thought at the same time?

# All 5 Questions Touch on Neuromyths



We only use 10% of our brains.



People are left- or right-brained.



Alcohol kills brain cells.

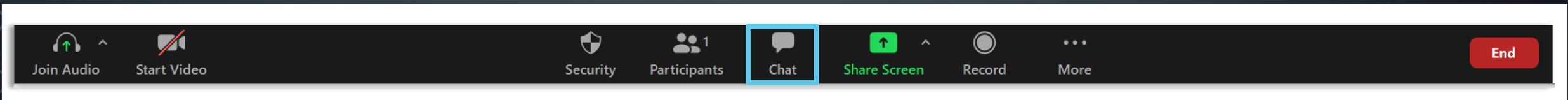


People learn better when teaching techniques match their preferred learning style.



We can actively attend to 2 things at once.

Please open Zoom Group Chat



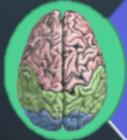
# Looking at the answers you wrote down, were you surprised by one or more of these 5 neuromyths?



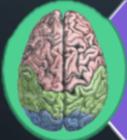
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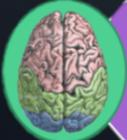
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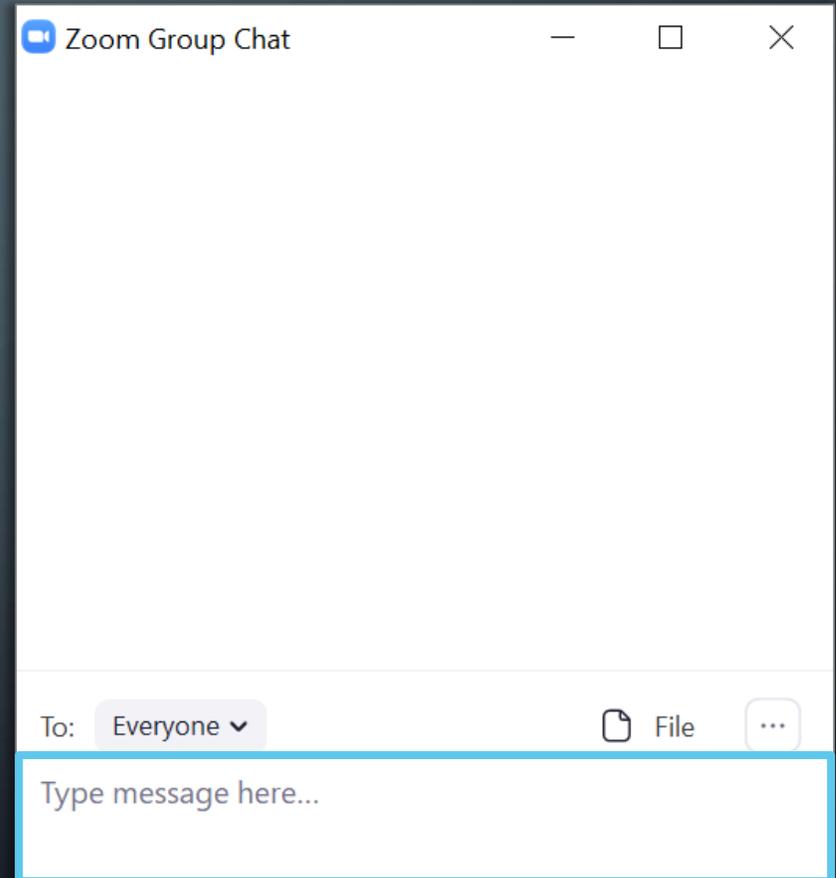
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# 5 Neuromyths



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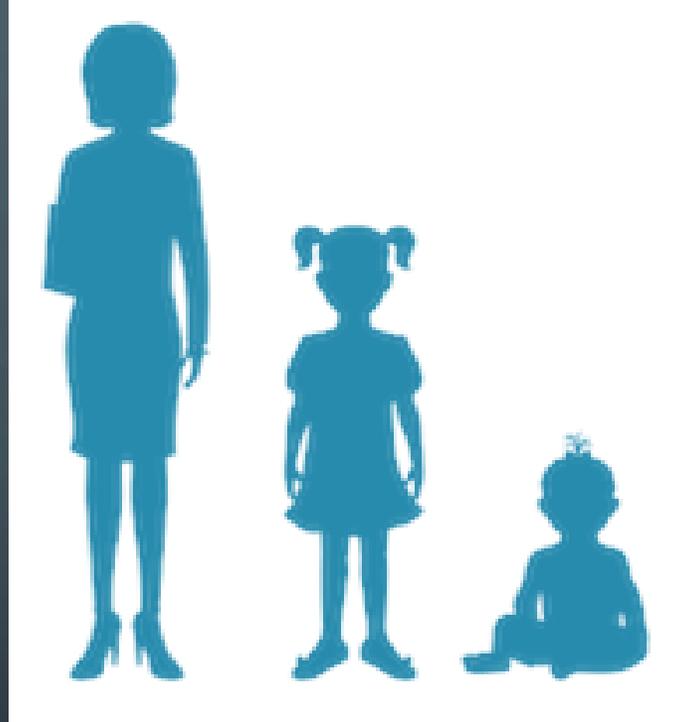
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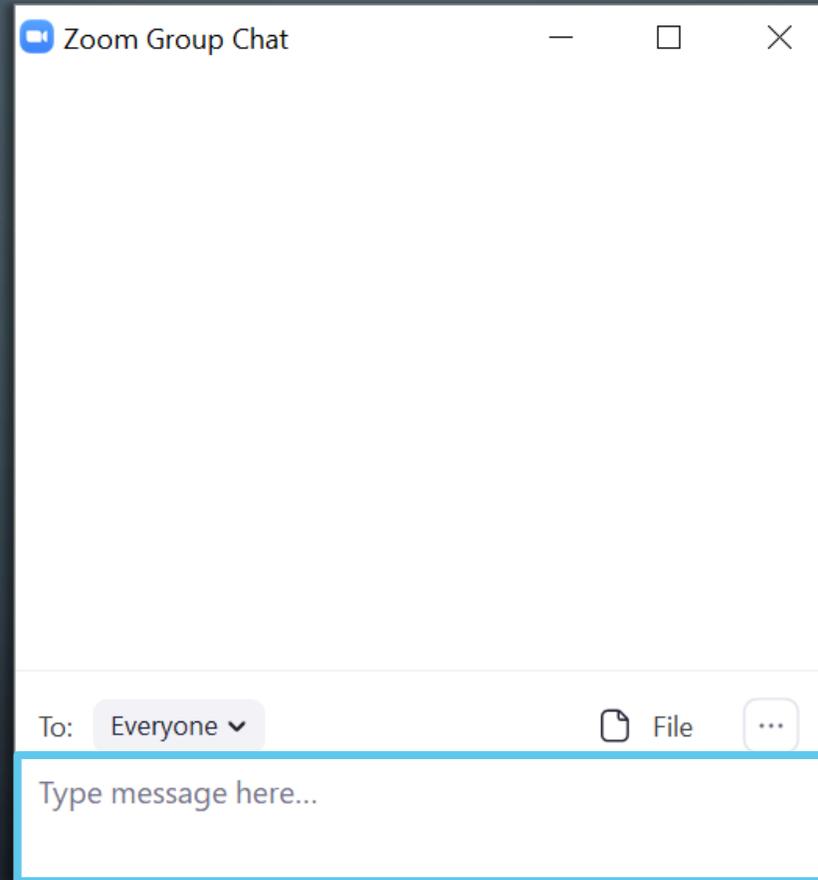
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How often do you perform cognitive tasks  
after skipping a meal?



# 5 Neuromyths



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🔍 Find a Therapist (City or Zip)



E E Smith

Not Born Yesterday

## Are You Left- or Right-Brain Dominant?

Left-brained people are smarter. Right?

Posted Oct 19, 2012



Almost everything I thought I knew about right and left brain activity has been stood on its head (so to speak!) by a recent article in my local newspaper. I knew that left-brain dominant people tended to be logical, rational and organized, and that right-brain dominance fosters creativity, imagination and artistry. That about sums up my preconceived notions.

Now I learn that our brains, contrary to popular belief, are not actually divided into two spheres. But the neocortex is, and it makes up two-thirds of the brain. The explanation of what goes on there might take a left-brain dominant person to understand, but essentially the neocortex is the most advanced part of the brain. It determines how we think, and whether we are "right-brained" or "left-brained." Dominance decides how the entire neocortex works. Left-brain dominant people are more likely to be clinical and cold in their judgments and problem solving. Language recognition is a function of the left hemisphere, too, and that makes languages easier for those with left-brain dominance.

But strangely enough, the left brain is wired to the right brain; the left brain controls the right brain.

Logic is not the only attribute of left-brain dominance; there are more specific characteristics, too. Some are unexpected. For example, left-brained people are likely to be dog lovers, and prefer classical music. They also cannot be hypnotized. Lawyers, judges and bankers tend to be left-brained.

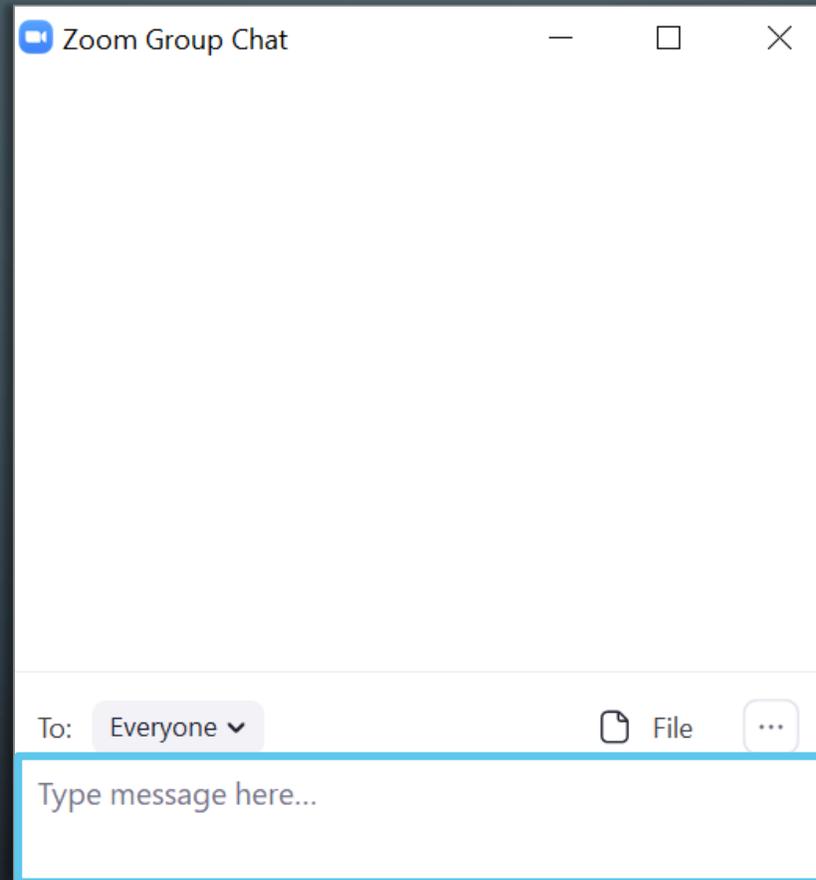
So much for the left-brainers. What about the rest of us? The right hemisphere is associated with creativity, emotion and intuition. It also controls the left side of the body, so right-brained people are often left-handed. Right-brain dominant people are characterized as artistic, innovative and often random. Their thought processes are sometimes viewed as irregular and roundabout, but use of "free association" often breeds originality and inventiveness. Certain occupations are associated with right-brained people, including politics, acting and athletics. Many occupations that require creative thinking, perceptiveness and spontaneity are in the field of the right-brain dominant.

In schools, left-brained ways of thinking are generally favored over right-brained, primarily because of the logical and analytical skills of left-brained students. Right brain focused curricula concentrate on the visual and artistic, using metaphors, movement and role-playing. Again, certain specific characteristics are commonly found in right-brain dominant individuals, such as being good at art or sports, and being able to memorize words or lyrics easily. They can also be hypnotized.

But are we really one or the other? We are not. A lot of what we consider either left or right brain activity is actually being done on both sides. In fact, most people are more or less equal on both sides of the brain; take the example of a scientist who is analytical and good at math, so he is characterized as being left-brained. However, he also is creative in making up and evaluating experiments, characteristic of the right-brained.

A label of left- or right-brained is not important; people should not let themselves be pigeon-holed, because both hemispheres are functioning. In other words, most people are not entirely one or the other; there is usually a mix, with a little more preference toward one side of the brain or the other. That may explain why I am artistic and creative (right-brain functions) but good at languages (a left-brain attribute).

Which topics or subjects would a right-brained person have trouble learning?



# PET Scans Show Activity throughout the Brain



# 5 Neuromyths



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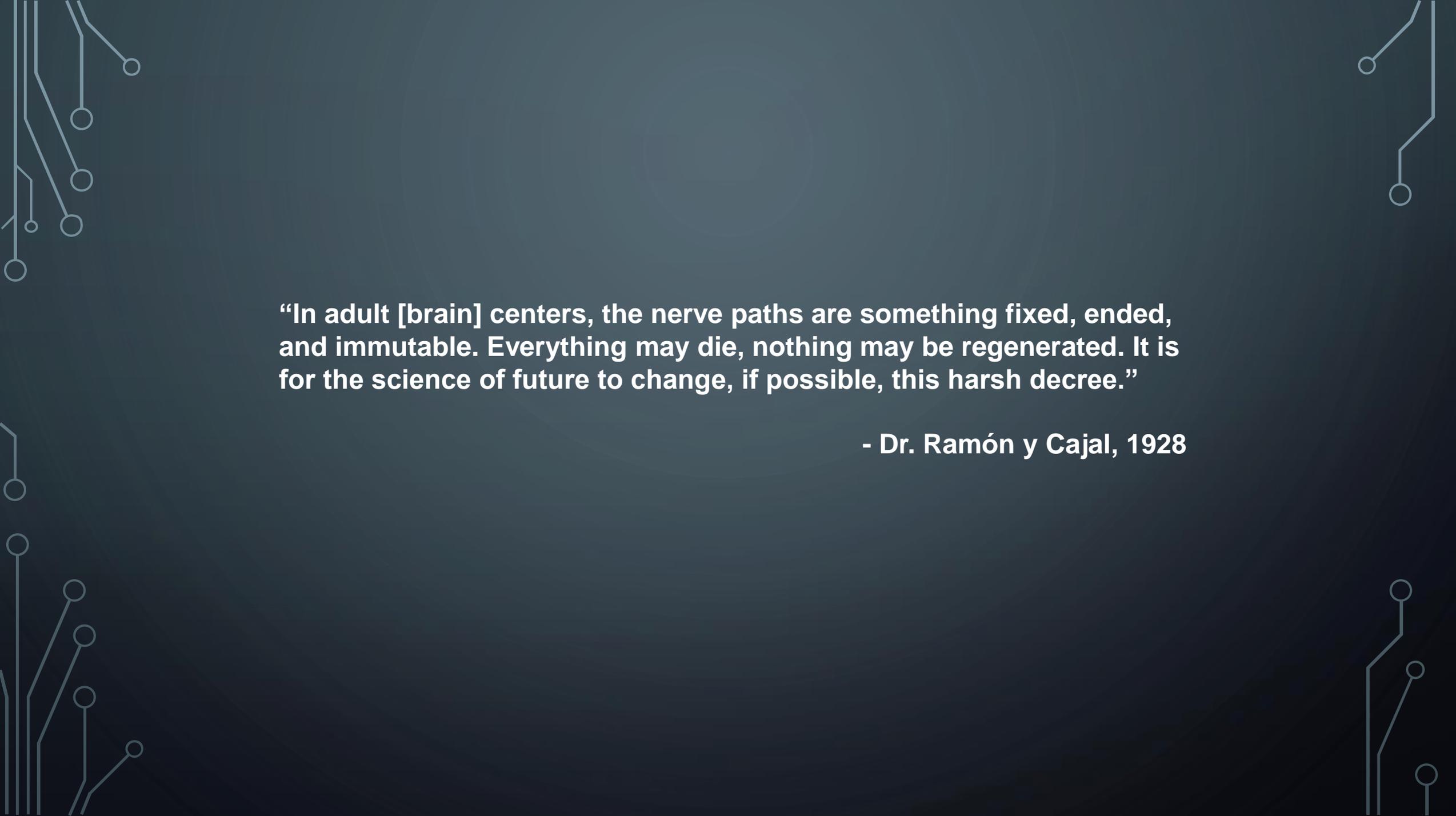
Alcohol kills brain cells.



People learn better when teaching techniques match their preferred learning style.



We can actively attend to 2 things at once.



**“In adult [brain] centers, the nerve paths are something fixed, ended, and immutable. Everything may die, nothing may be regenerated. It is for the science of future to change, if possible, this harsh decree.”**

**- Dr. Ramón y Cajal, 1928**



Good News	Not-So-Good News
<p>Research on neurogenesis now shows that we <u>continually replace neurons and build new connections among neurons</u> through physical or mental activity.</p>	<p>Research on neurogenesis now shows that we continually replace neurons and build new connections among neurons <u>through physical or mental activity.</u></p>

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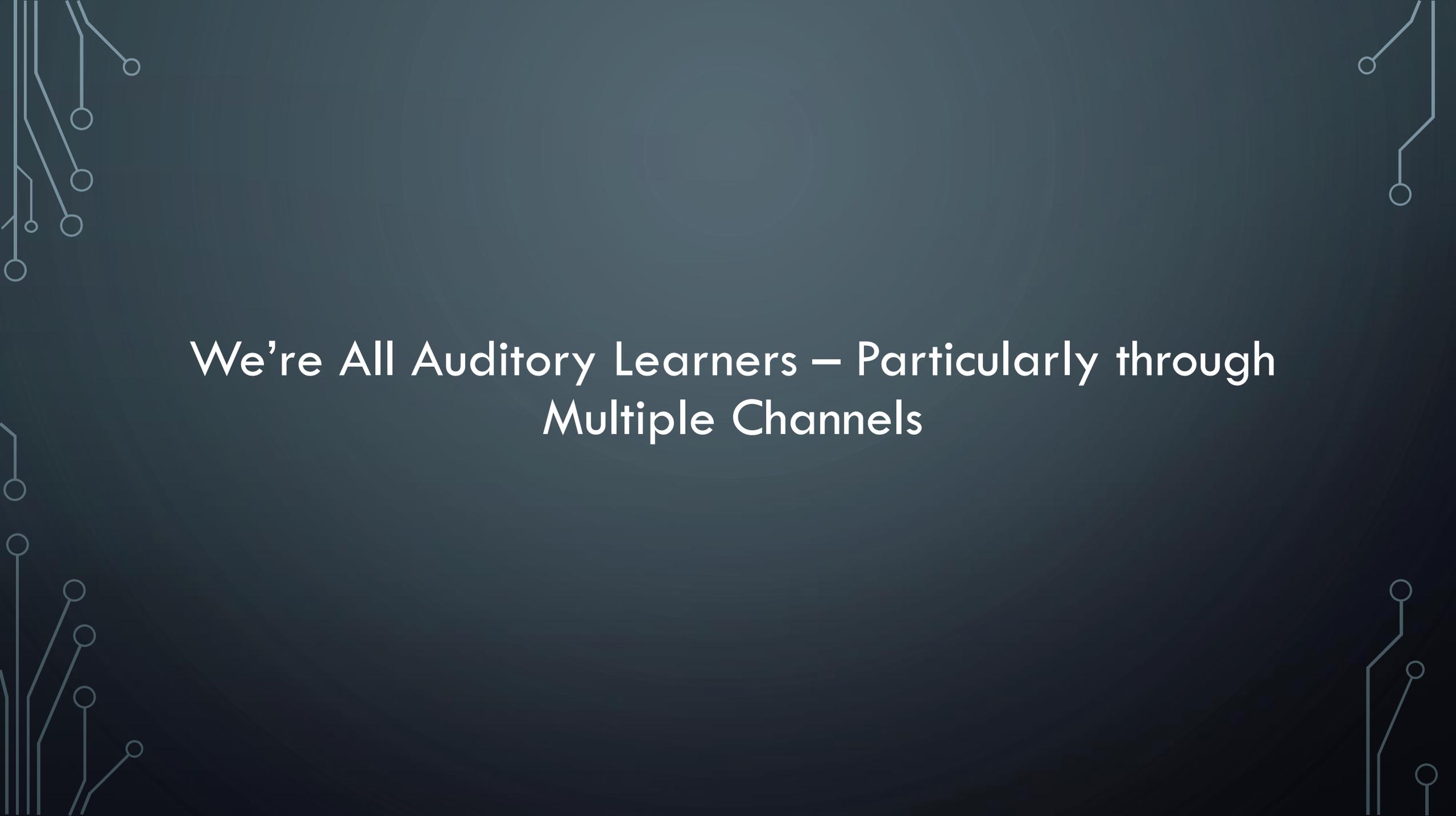
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The image features a dark blue background with a large, faint, light blue circle centered behind the text. In the four corners, there are decorative white line-art elements resembling circuit traces or neural pathways, with small circles at the end of the lines.

**We're All Kinesthetic Learners.**

The image features a dark blue background with a large, faint, light blue circle in the center. In the four corners, there are decorative white line-art patterns resembling circuit traces or neural network connections, with small circles at the end of the lines.

**We're All Visual Learners.**

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We're All Auditory Learners – Particularly through  
Multiple Channels

# 5 Neuromyths



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Play (k)

0:20 / 1:36

Scroll for details







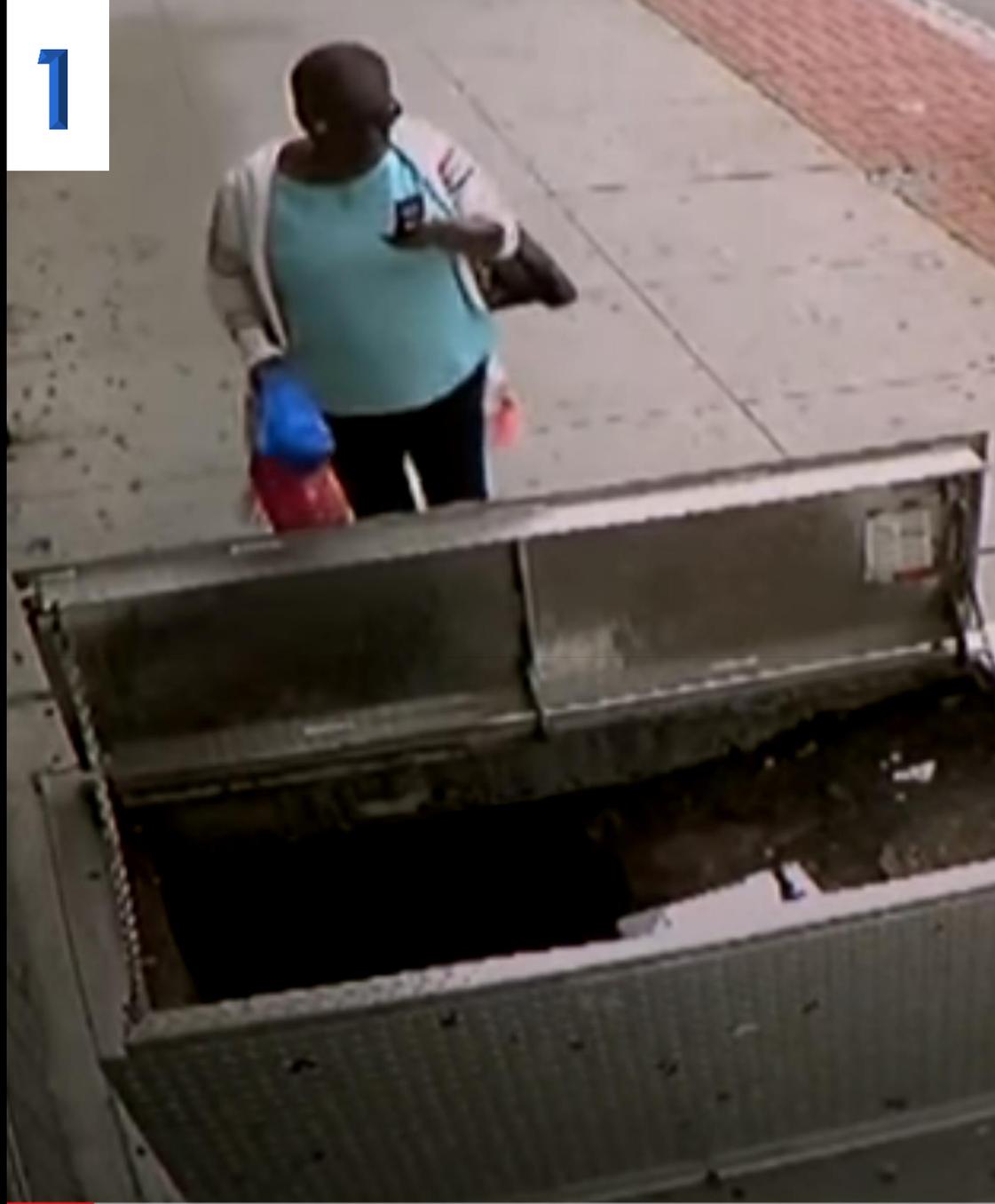
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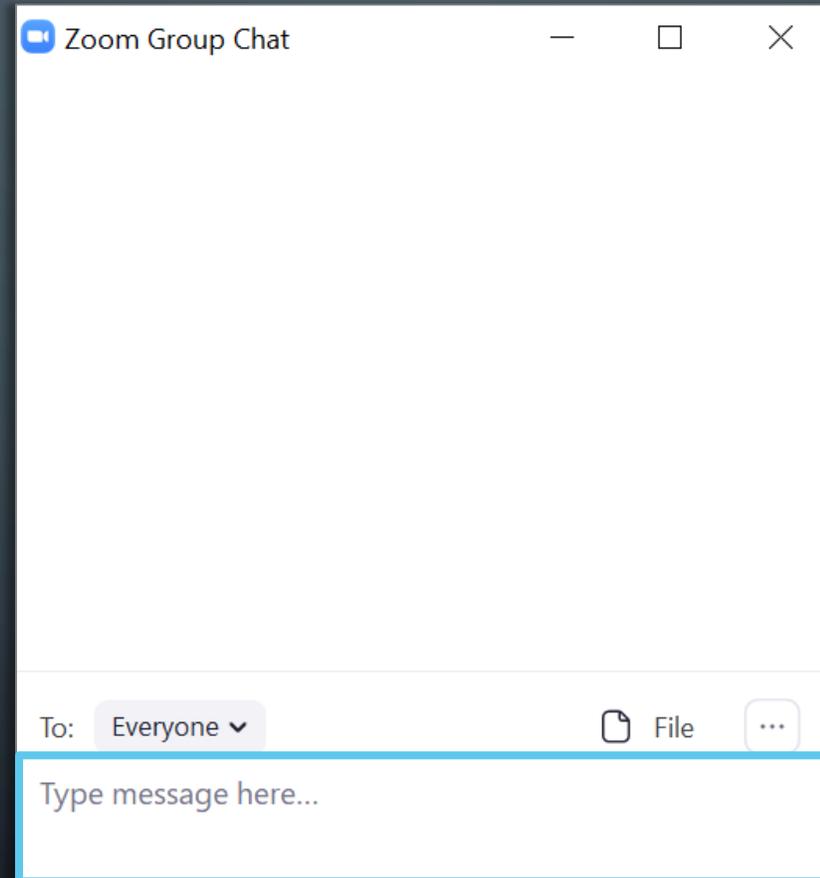
1



2



What could you start doing differently tomorrow based on the neuromyths that we debunked tonight?





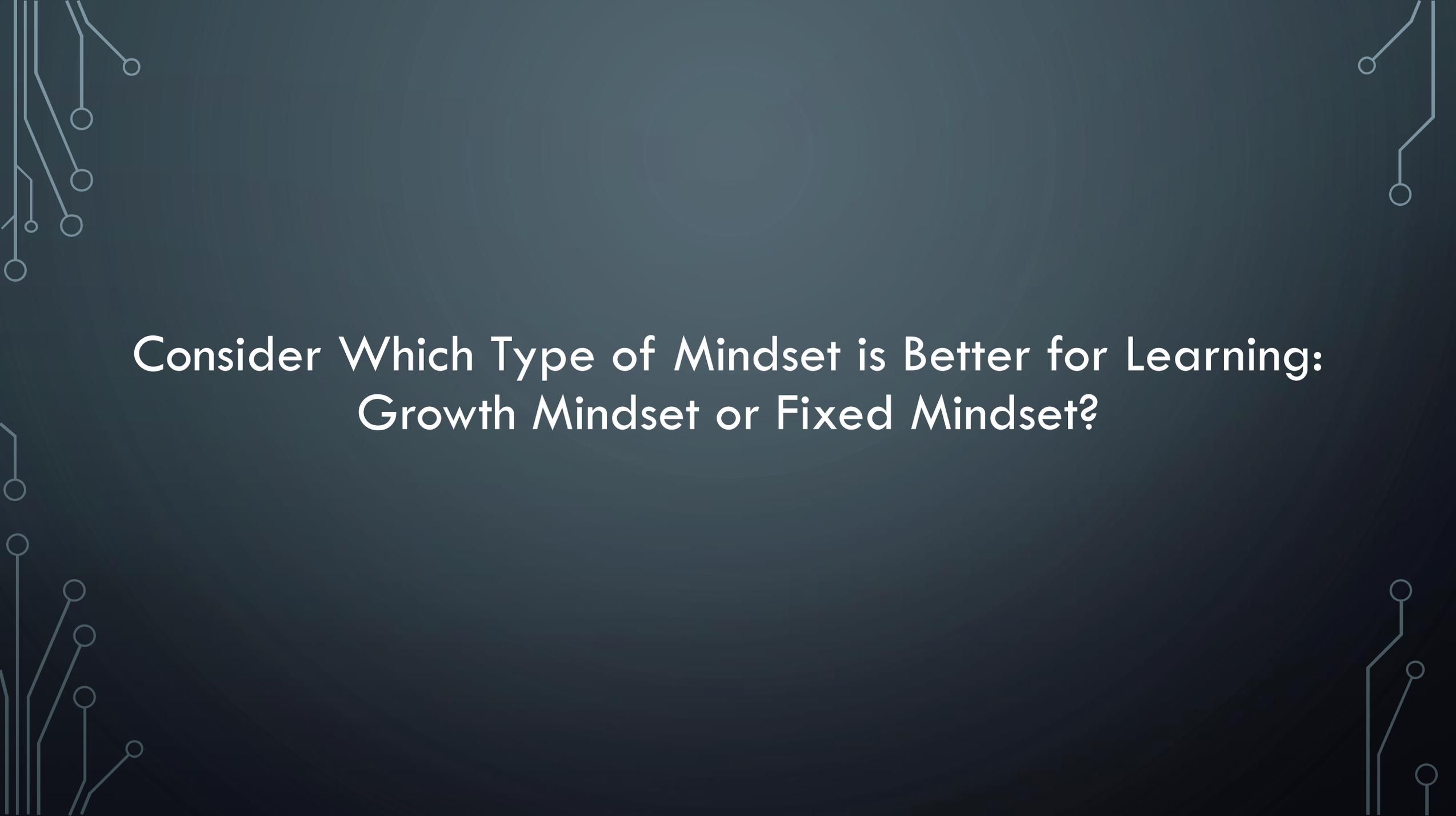
The background is a dark blue gradient. In the corners, there are decorative white line-art elements resembling circuit traces or neural pathways. These elements consist of thin lines that branch out and terminate in small circles, creating a sense of connectivity and technology.

# Applying Cognitive Science to L&D

# Applying Cognitive Science to L&D

1. Help establish a culture that fosters continuous learning
2. Use specific strategies to maximize learning transfer and retention
3. Continually refresh the process based on the latest research

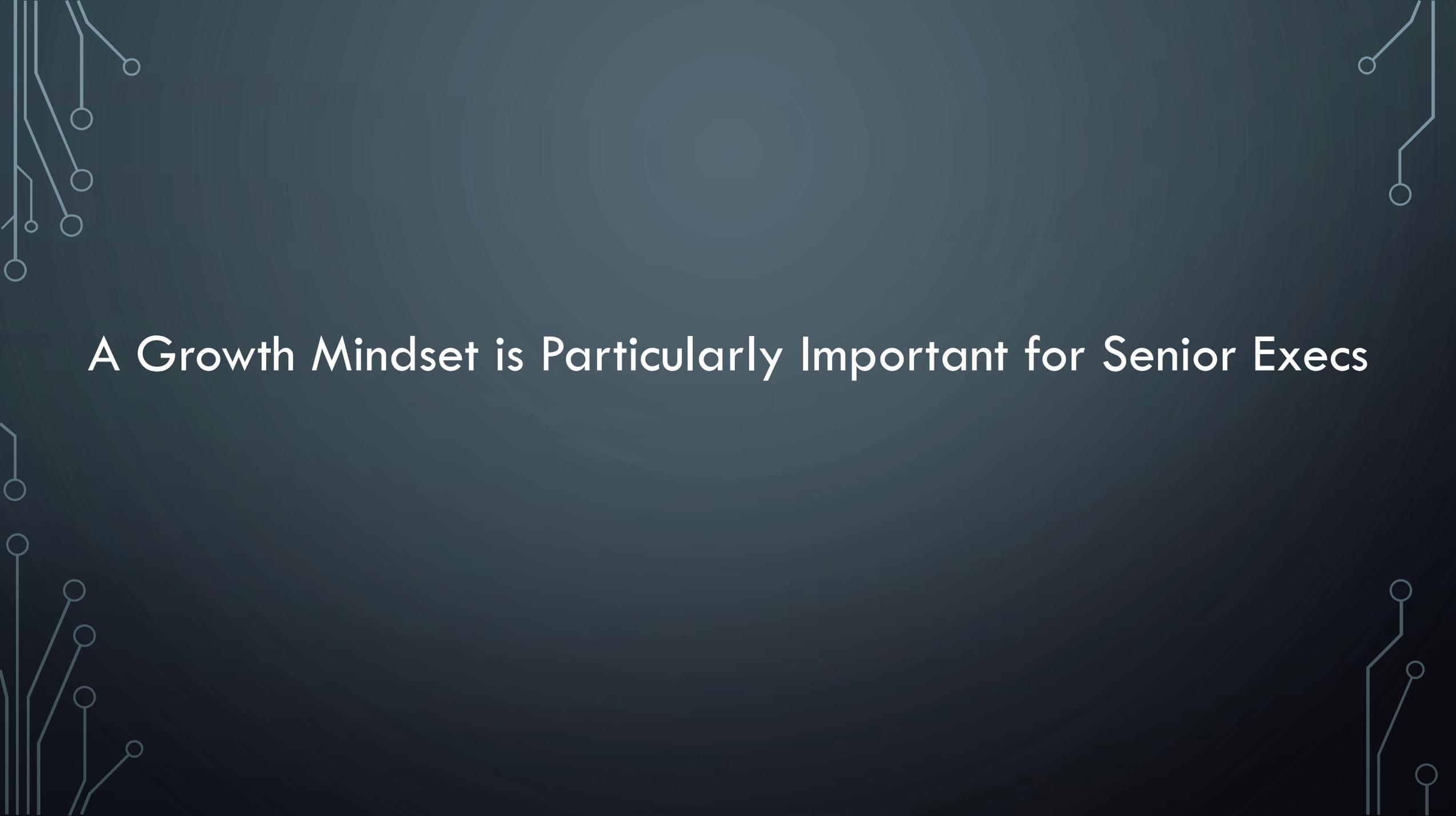


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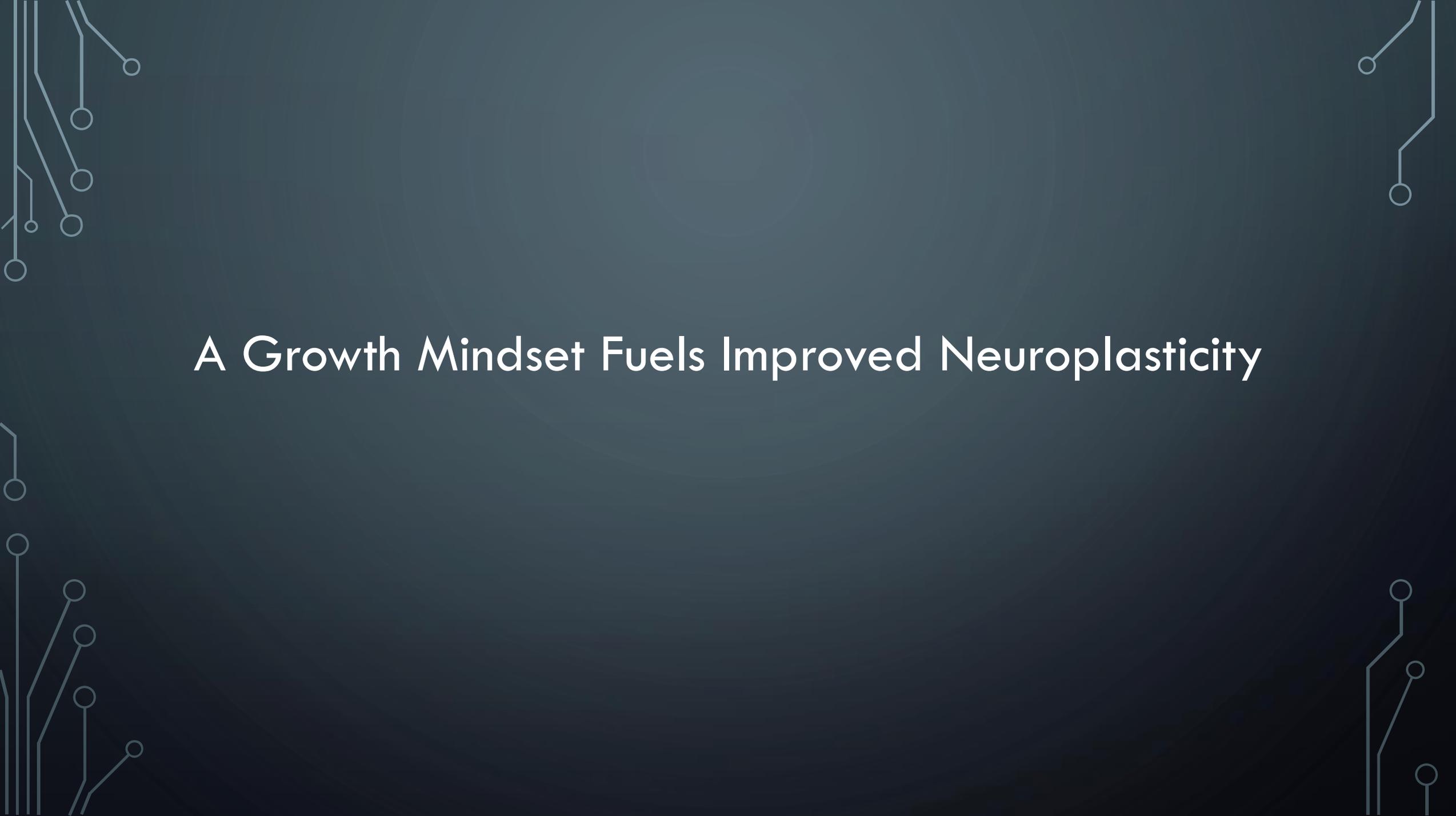
Consider Which Type of Mindset is Better for Learning:  
Growth Mindset or Fixed Mindset?

The background is a dark blue gradient with faint, glowing circuit-like patterns in the corners. These patterns consist of thin white lines that branch out and terminate in small white circles, resembling a stylized neural network or a circuit board layout. The patterns are most prominent in the top-left, top-right, bottom-left, and bottom-right corners, framing the central text.

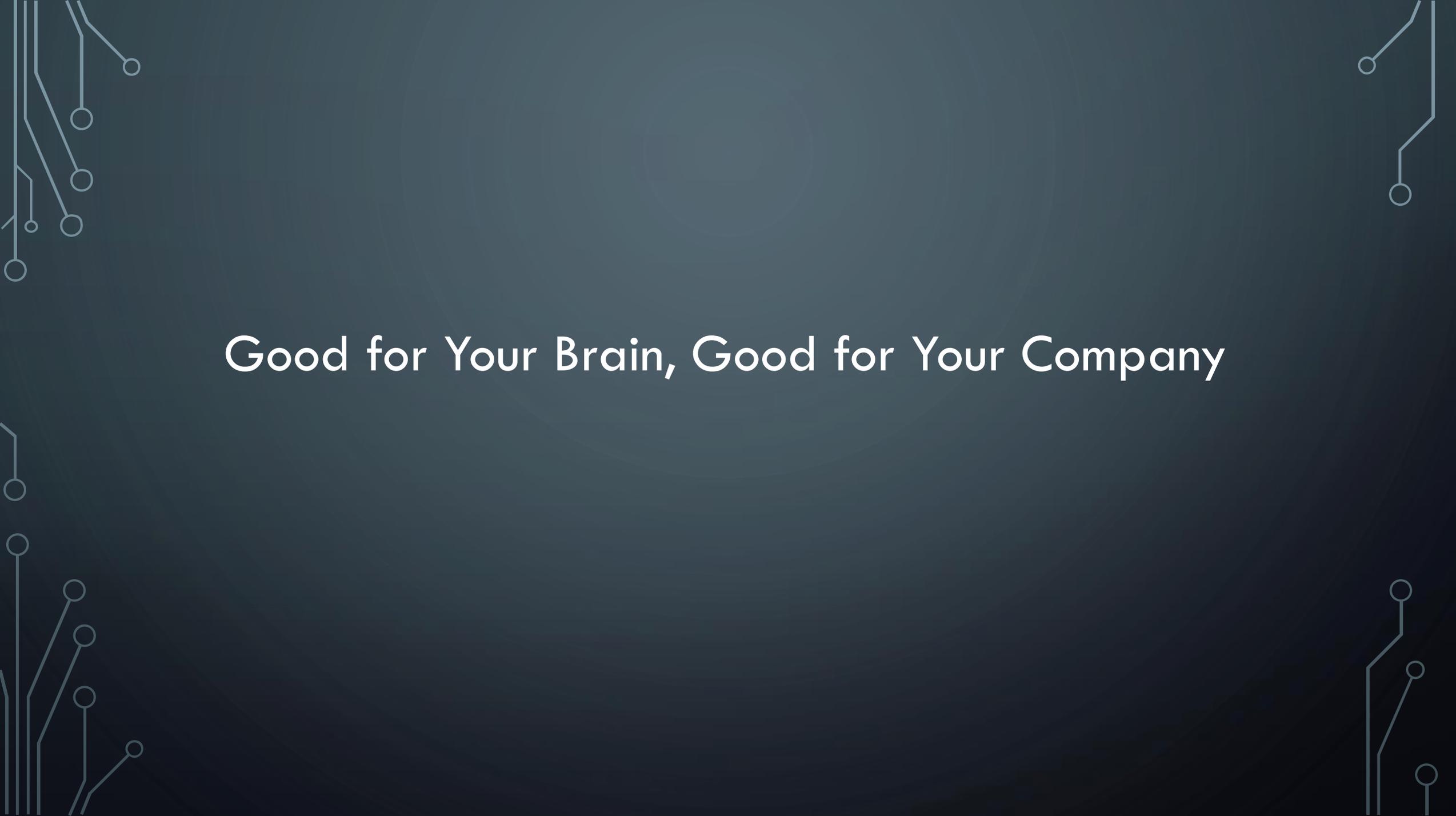
# Brain Imaging Study of People With Growth or Fixed Mindset

The image features a dark blue background with a subtle, large-scale pattern of overlapping circles. In the four corners, there are decorative white line-art elements resembling circuit traces or neural network connections, with small circles at the end of the lines.

A Growth Mindset is Particularly Important for Senior Execs

The image features a dark blue background with a faint, large-scale circuit board pattern. In the corners, there are more prominent, light-colored circuit traces and nodes, resembling a stylized neural network or a complex electronic circuit. The central text is white and stands out against the dark background.

# A Growth Mindset Fuels Improved Neuroplasticity

The image features a dark blue background with a large, faint, light blue circle in the center. In the four corners, there are decorative white line-art patterns resembling circuit traces or neural connections, with small circles at the end of the lines.

Good for Your Brain, Good for Your Company

# Applying Cognitive Science to L&D

1. Help establish a culture that fosters continuous learning
2. Use specific strategies to maximize learning transfer and retention
3. Continually refresh the process based on the latest research



# Applying Cognitive Science to L&D



## Attention

Focused concentration on the task or concept without distraction



## Generation

Learner to have direct interaction with the learning task to generate their own thinking



## Emotion

Emotional cues associated with the learning task



## Spacing

Adequate time gaps for new learning to be digested, consolidated and rehearsed



## Attention

Focused concentration on the task or concept without distraction

## Summary

- Remove external distractions as much as possible
- Give examples, examples, examples
- Always give the context – first!
- Use emotion, gamification, and/or storytelling to keep learning relevant to the learner



## Generation

Learner to have direct interaction with the learning task to generate their own thinking

## Summary

- Ask good questions to help people *think*
- Test, test, test
- Have students teach other people



## Emotion

Emotional cues associated with the learning task

### Summary

- Always protect your learners' self-esteem
- Set clear expectations – agenda, objectives, etc.
- Give learners room to make choices
- Encourage group interaction as much as possible
- Make the rules clear and enforce them fairly



## Spacing

Adequate time gaps for new learning to be digested, consolidated and rehearsed

Better than highlighting... Better than re-reading notes over and over again... Better than cramming (i.e., “massed” practice) was....  
**DISTRIBUTED PRACTICE.**

### 6 Study Sessions

Back to back	68% of content remembered 1 month later
Separated by a day	86% of content remembered 1 month later
Reviewed once per month	95% of content remembered 1 month later.

# Applying Cognitive Science to L&D

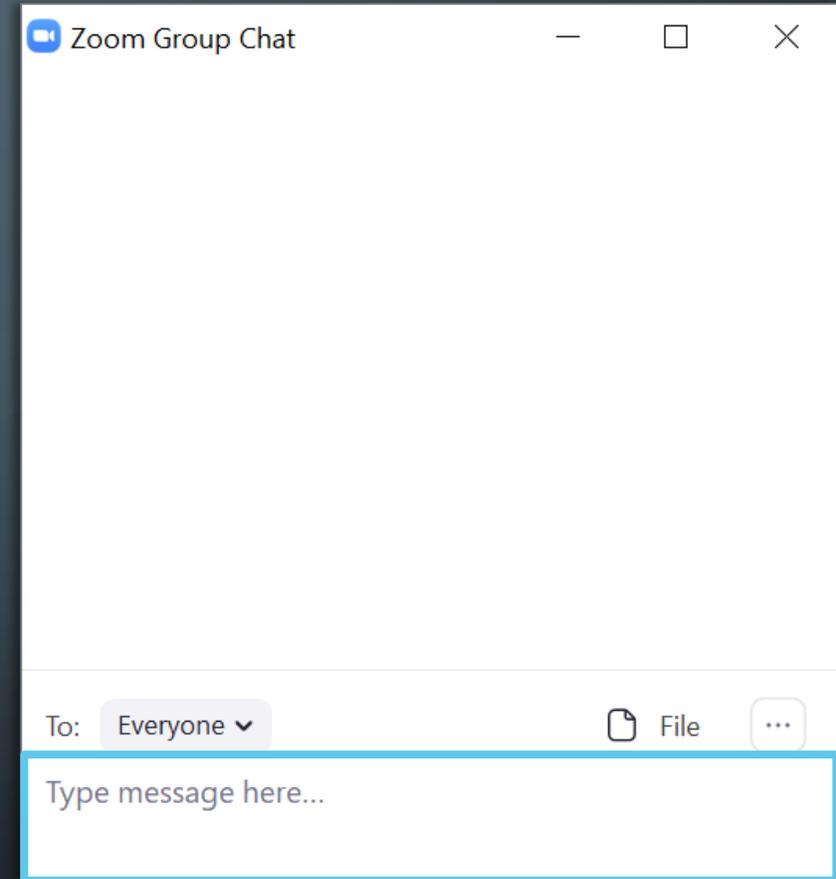
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The image features a dark blue background with a subtle, large-scale pattern of concentric circles. In the four corners, there are decorative white line-art elements resembling circuit traces or a stylized tree structure, with small circles at the end of the lines.

One Caveat: Consider the Source

# How Might These Conclusions from Cognitive Science Impact Your Long-Term T&D Strategy?





# Thank you!

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**QA**