

PERCEPTION, ATTENTION AND MEMORY: A CLOSE RELATIONSHIP

Norbert Fortin, PhD



Bio Sci 38: Mind, Memory, and the Brain

OVERVIEW

- The brain actively constructs your sensory experience
 - Innate rules, assumptions and shortcuts of perception
 - Phantom limbs
 - Unusual perception (e.g., synesthesia)
- Specific perceptual functions in specific cortical areas
 - Motion perception (area MT)
 - Face perception (Inferotemporal cortex; IT)
- Can we really separate perception from memory?
- Role of attention in perception and memory

THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

INNATE RULES, ASSUMPTIONS AND SHORTCUTS

- Our brain has evolved for a very different world than the one we live in now.



VS

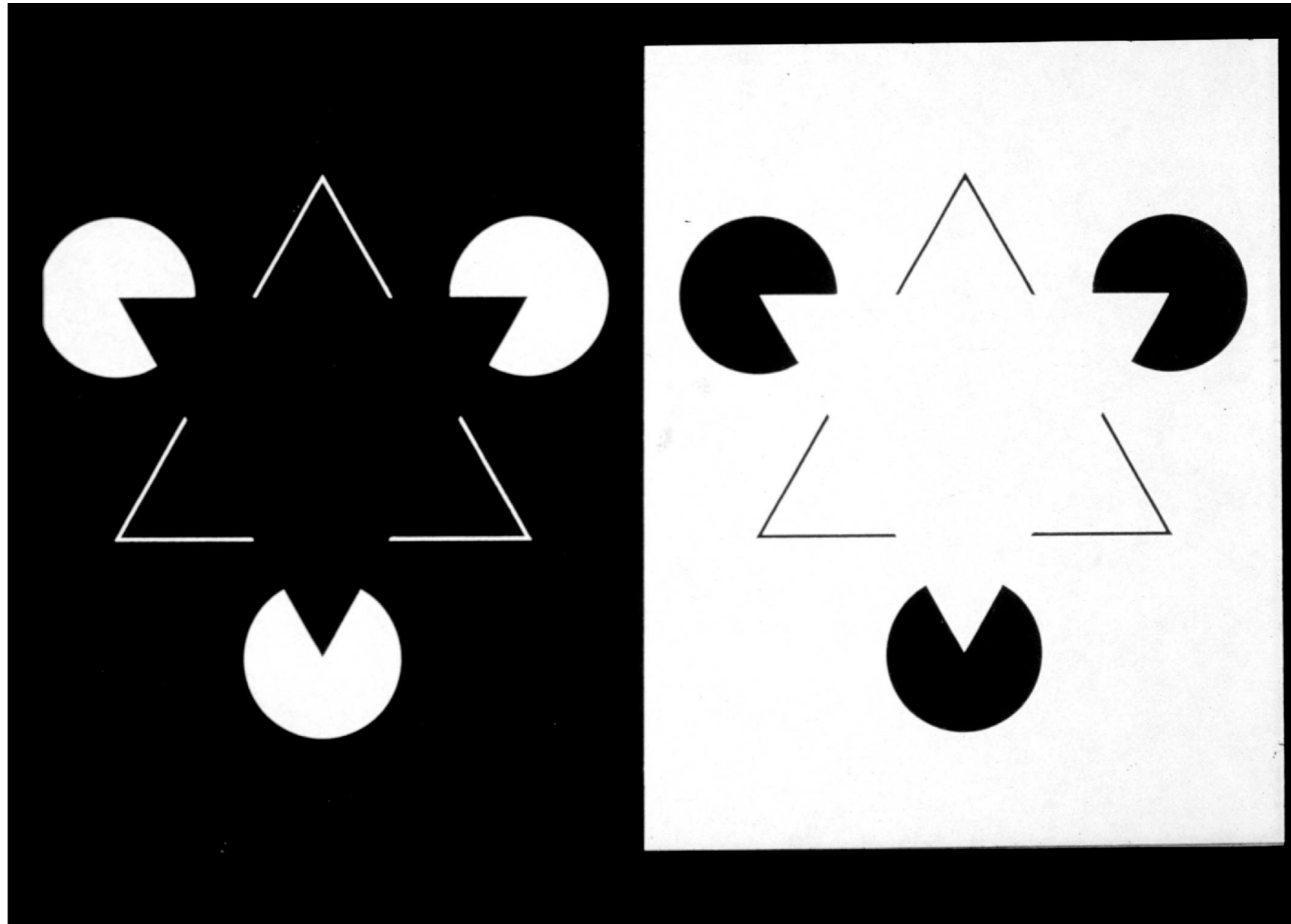


- Our ancestors lived in a very dangerous world, and had to make quick decisions to survive.
- We evolved innate rules, assumptions and short-cuts to help us quickly decide in a hostile environment

THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

EXAMPLES OF INNATE RULES, ASSUMPTIONS AND SHORTCUTS

Demo of illusory contours

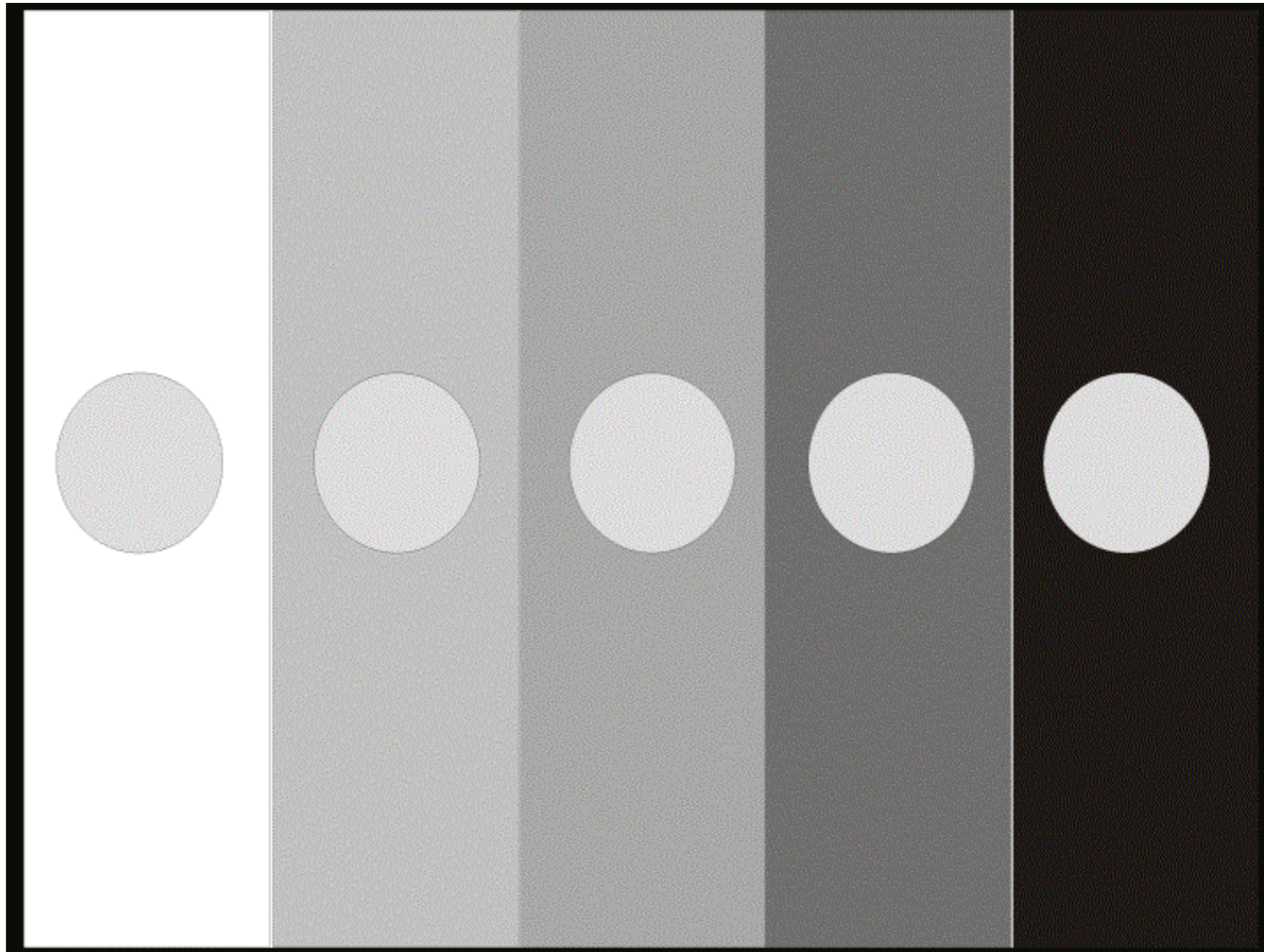


Your brain creates the contours of objects

THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

EXAMPLES OF INNATE RULES, ASSUMPTIONS AND SHORTCUTS

Demo of simultaneous contrasts

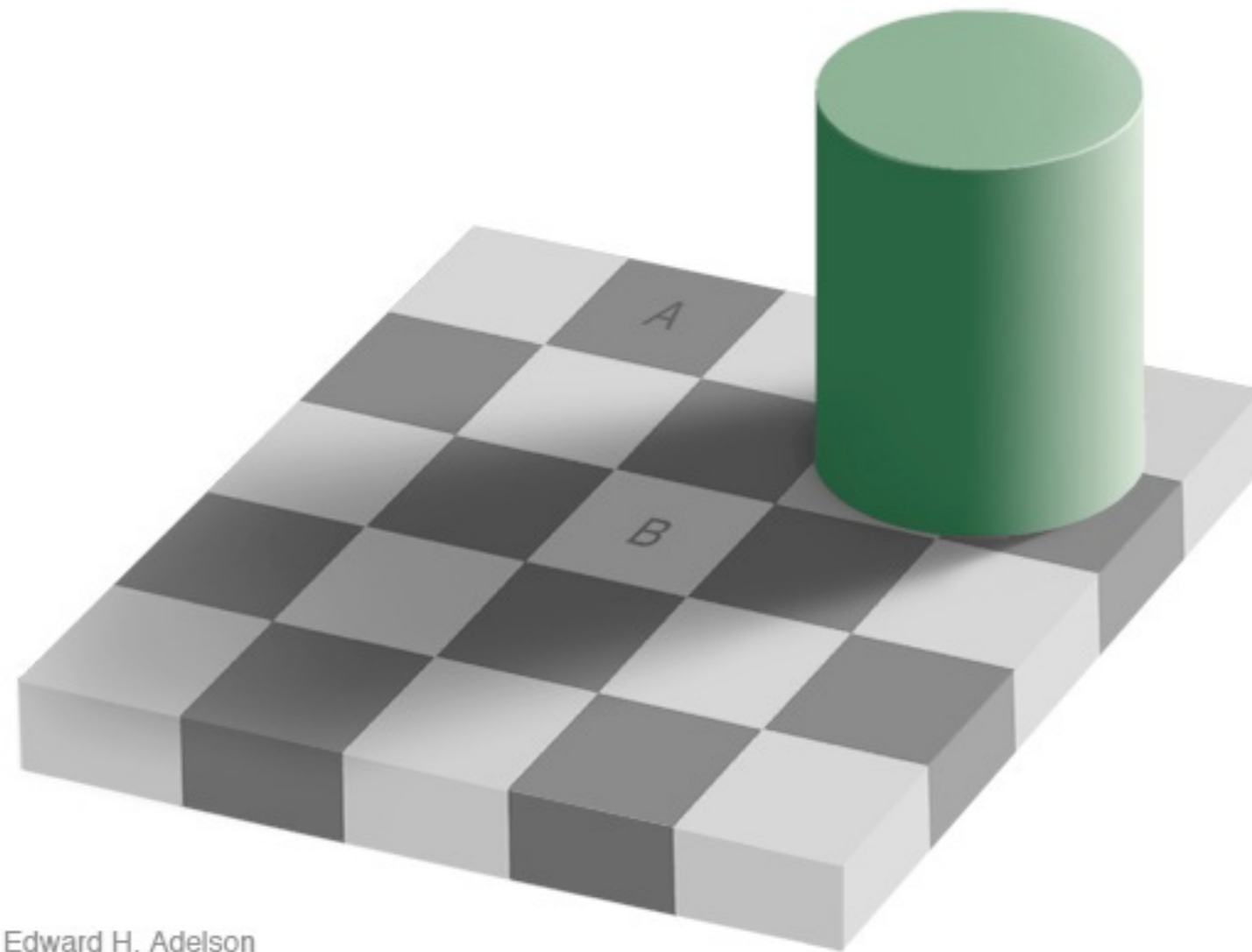


The context of the visual scene influences perception

THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

EXAMPLES OF INNATE RULES, ASSUMPTIONS AND SHORTCUTS

Demo of simultaneous contrasts



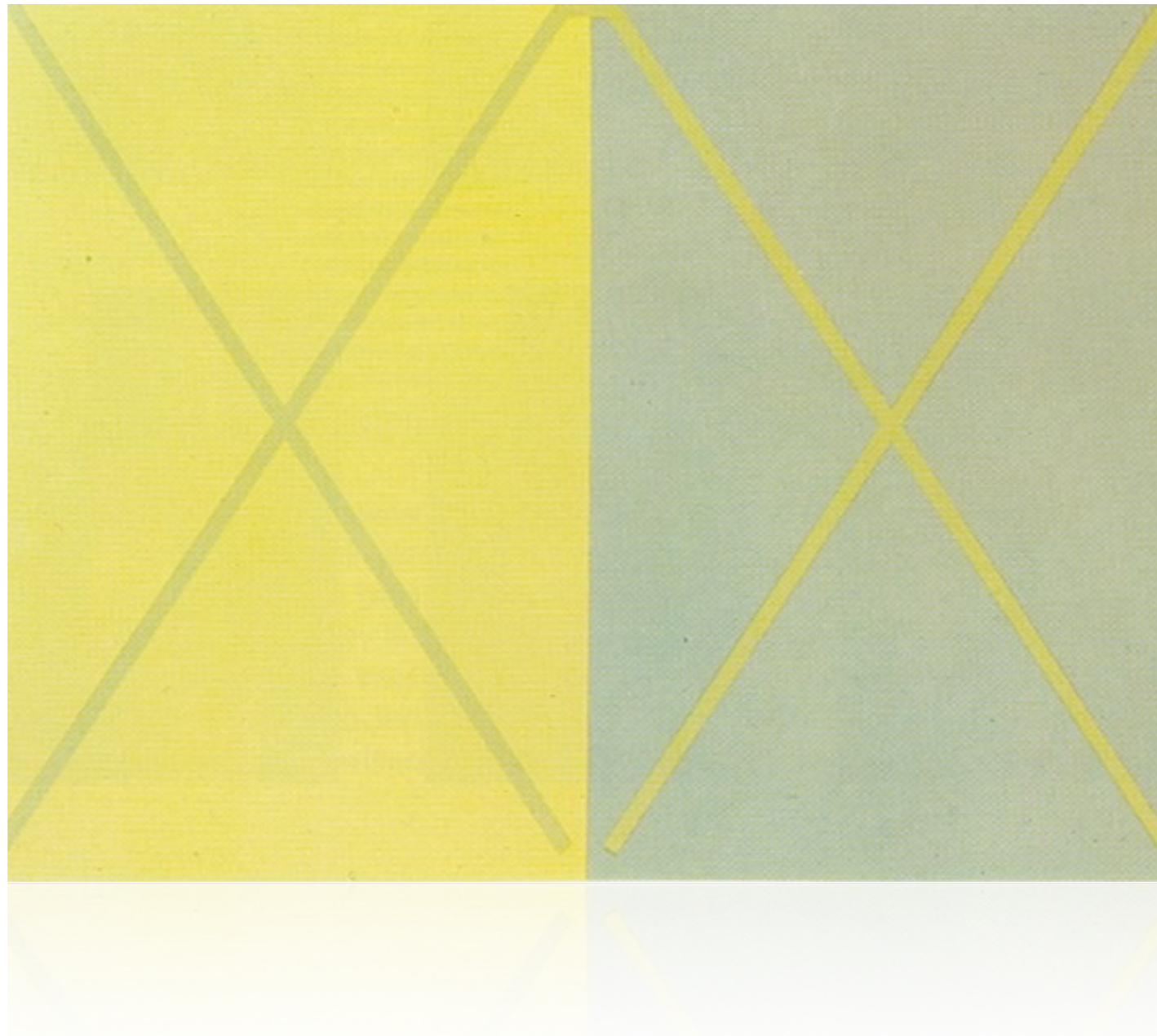
Edward H. Adelson

The context of the visual scene influences perception

THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

EXAMPLES OF INNATE RULES, ASSUMPTIONS AND SHORTCUTS

Demo of simultaneous contrasts of color

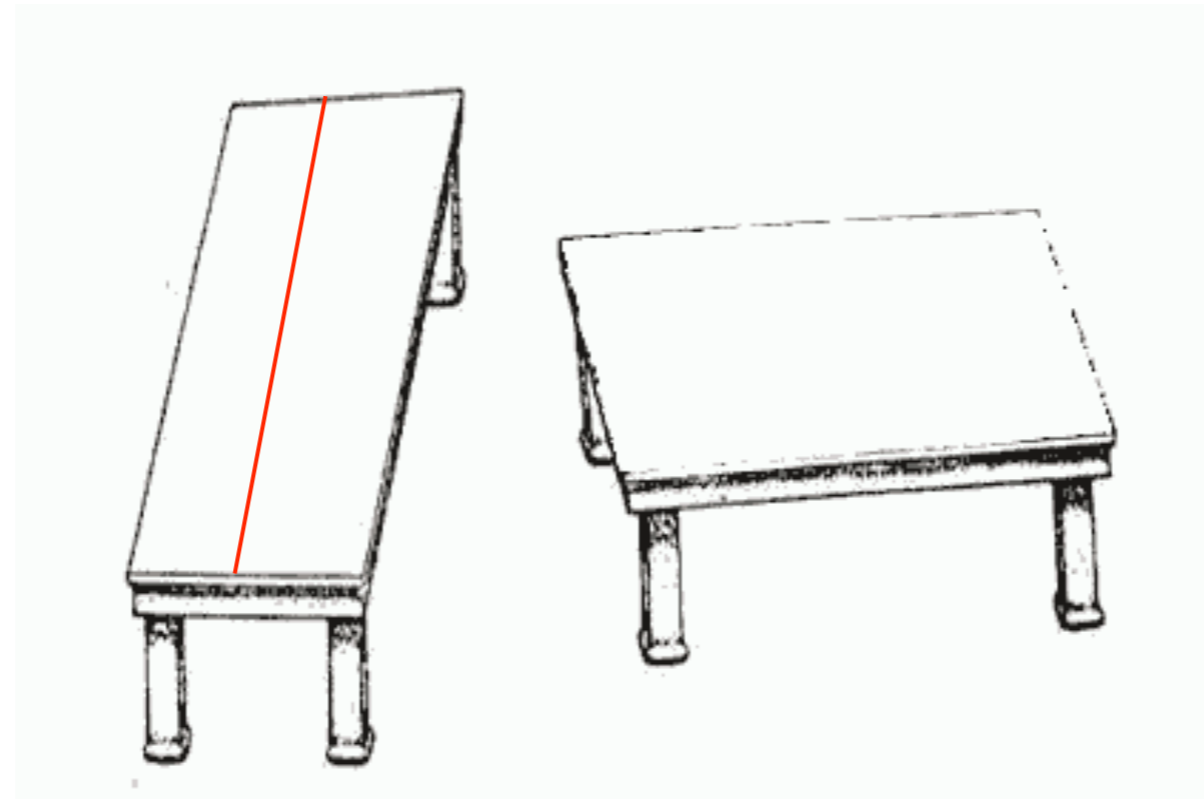


The context of the visual scene influences perception

THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

EXAMPLES OF INNATE RULES, ASSUMPTIONS AND SHORTCUTS

Demo of length perception

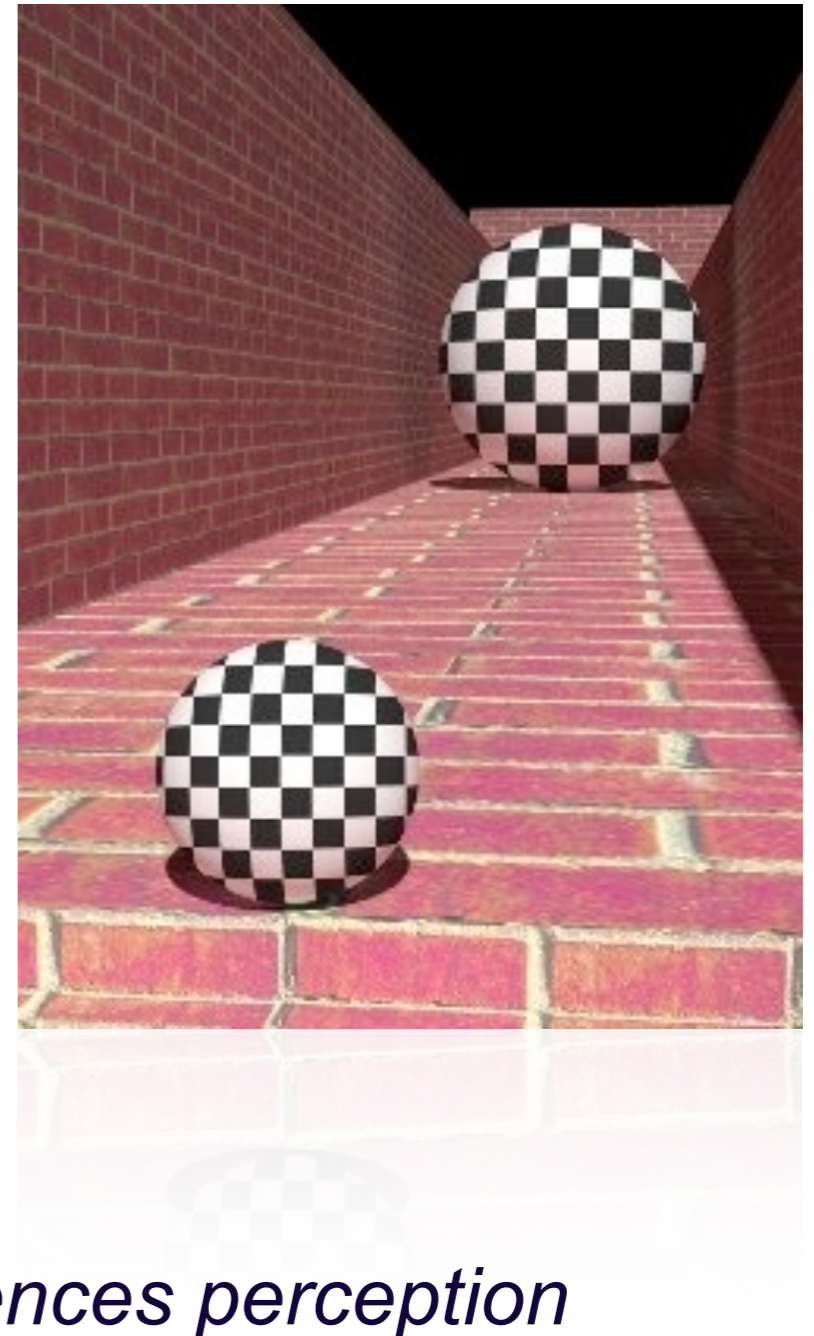
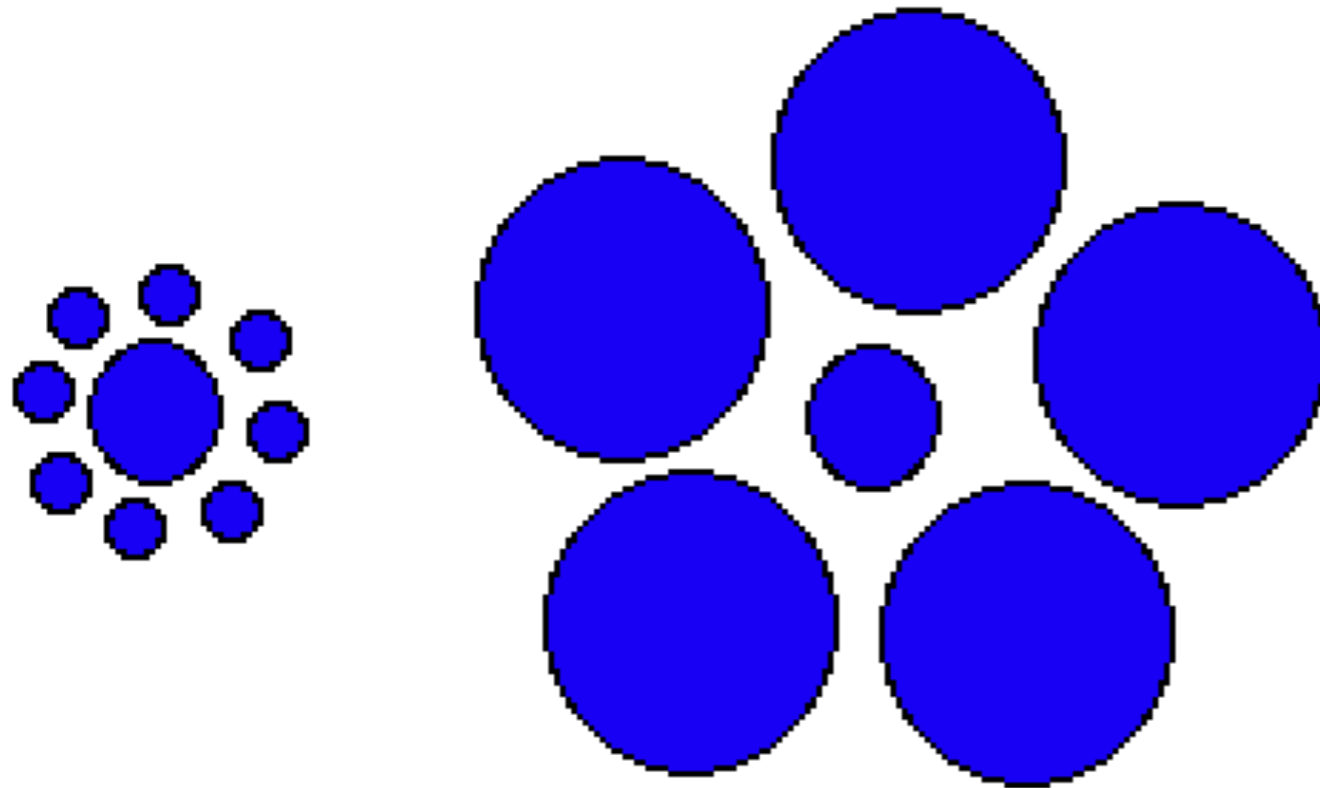


Which table is longer? Which is wider?

THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

EXAMPLES OF INNATE RULES, ASSUMPTIONS AND SHORTCUTS

Demo of relative size



The context of the visual scene influences perception

THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

EXAMPLES OF INNATE RULES, ASSUMPTIONS AND SHORTCUTS

Demo of “apparent motion”: stock market ticker

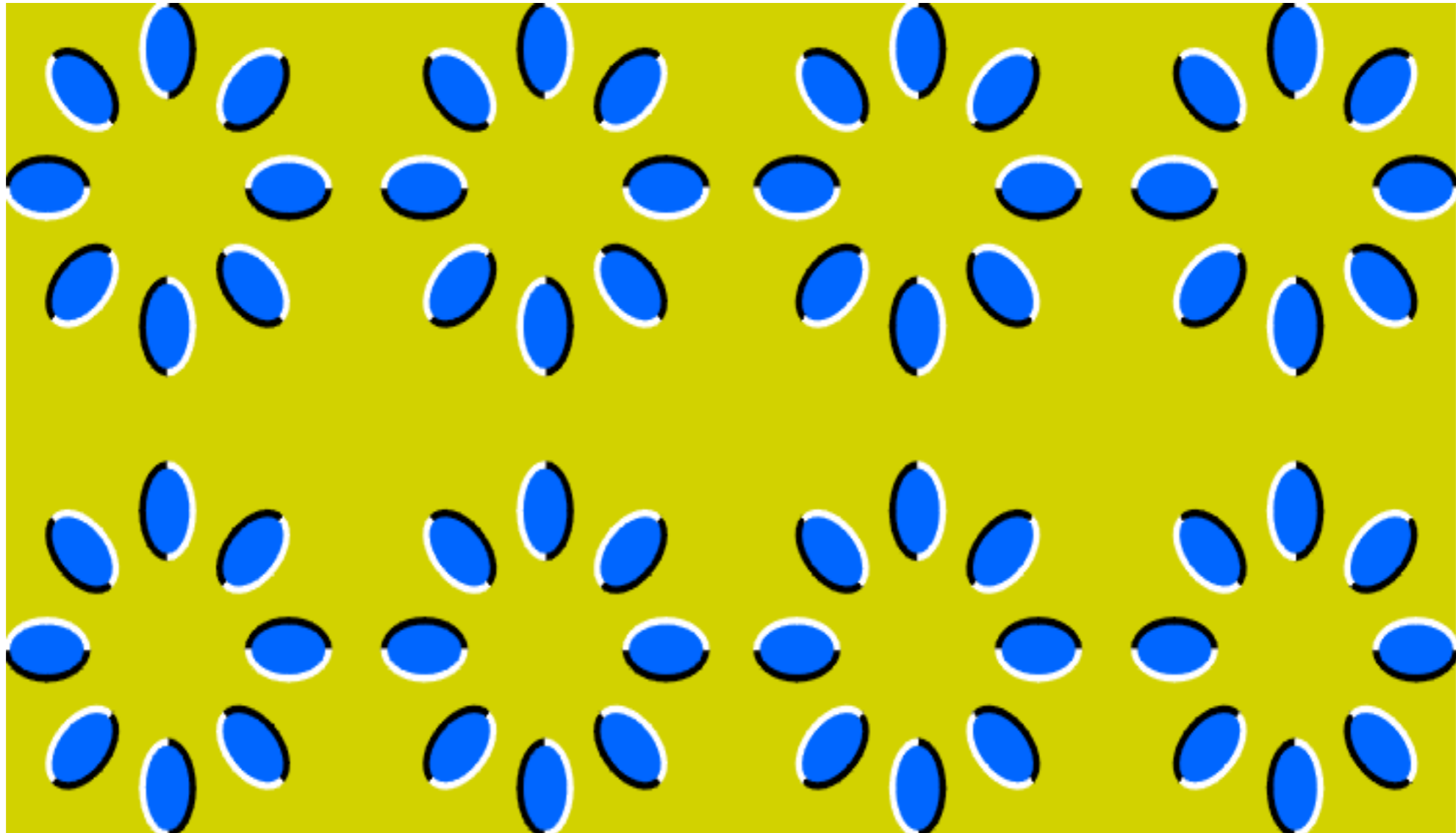


Your brain creates the illusion of motion if each stationary stimulus lights up within 50 ms

THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

EXAMPLES OF INNATE RULES, ASSUMPTIONS AND SHORTCUTS

Demo of “apparent motion”: visual illusions

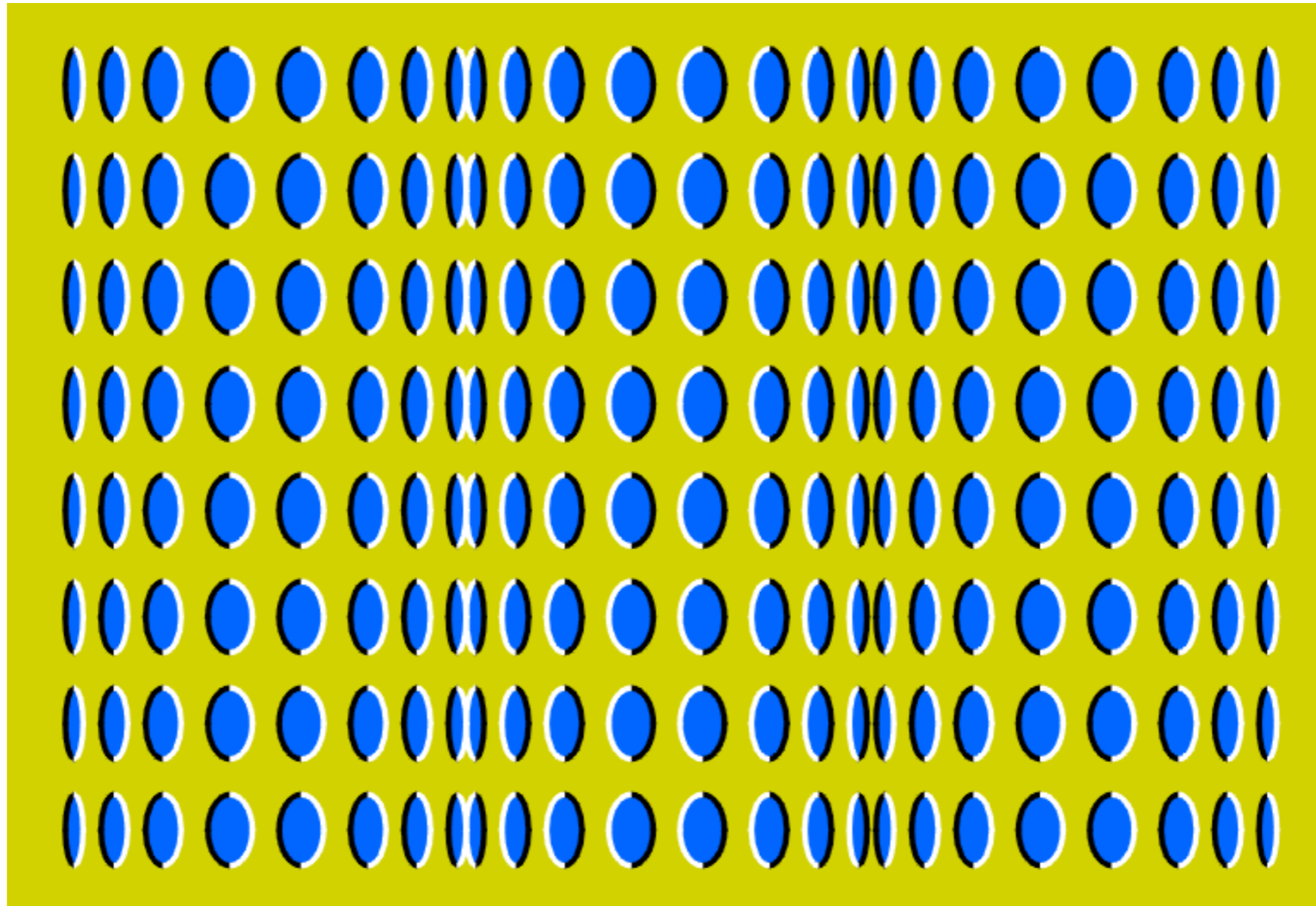


*Your brain creates the perception of motion
using some other cues as well*

THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

EXAMPLES OF INNATE RULES, ASSUMPTIONS AND SHORTCUTS

Demo of “apparent motion”: visual illusions

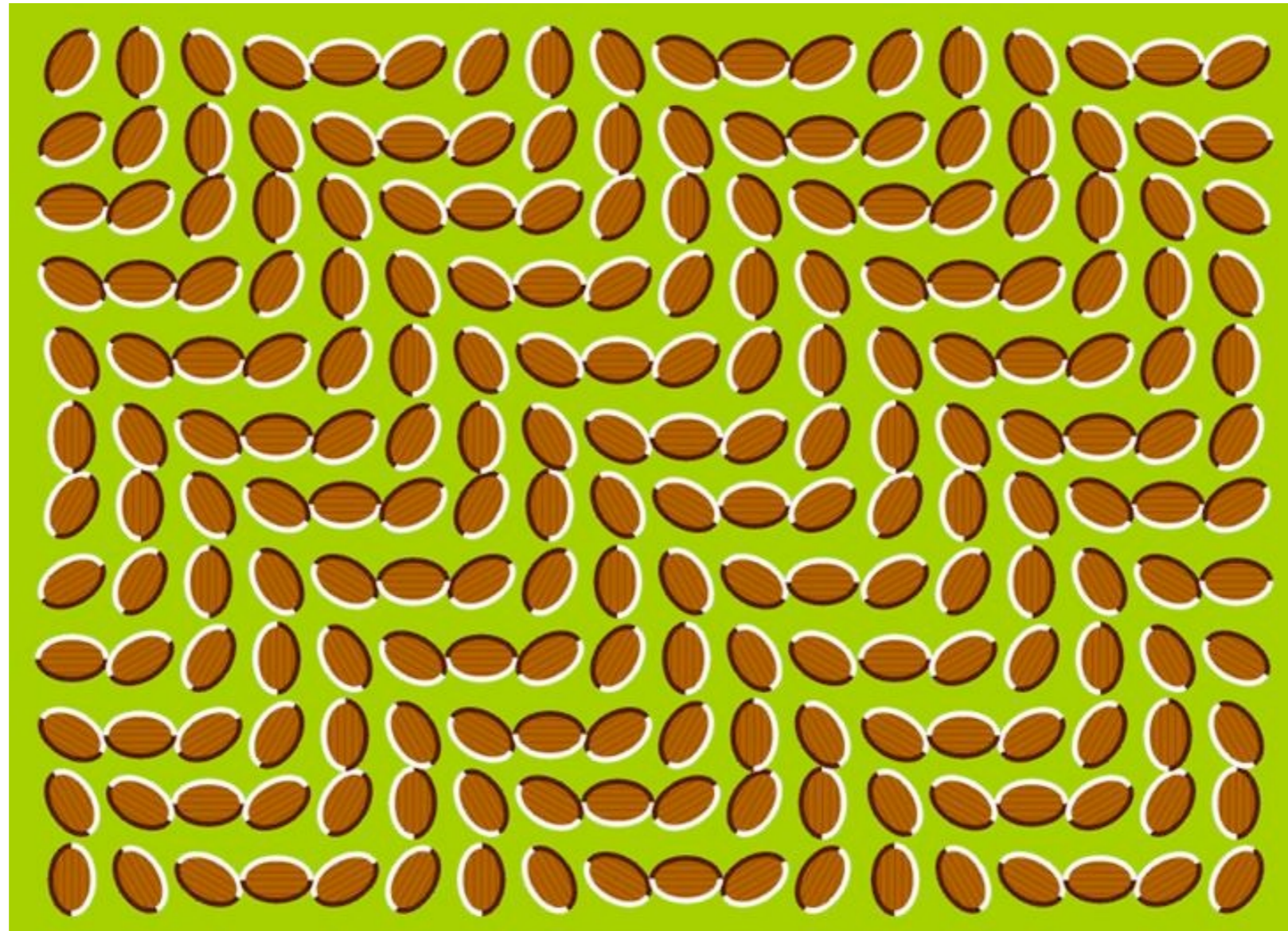


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Demo of “apparent motion”: visual illusions



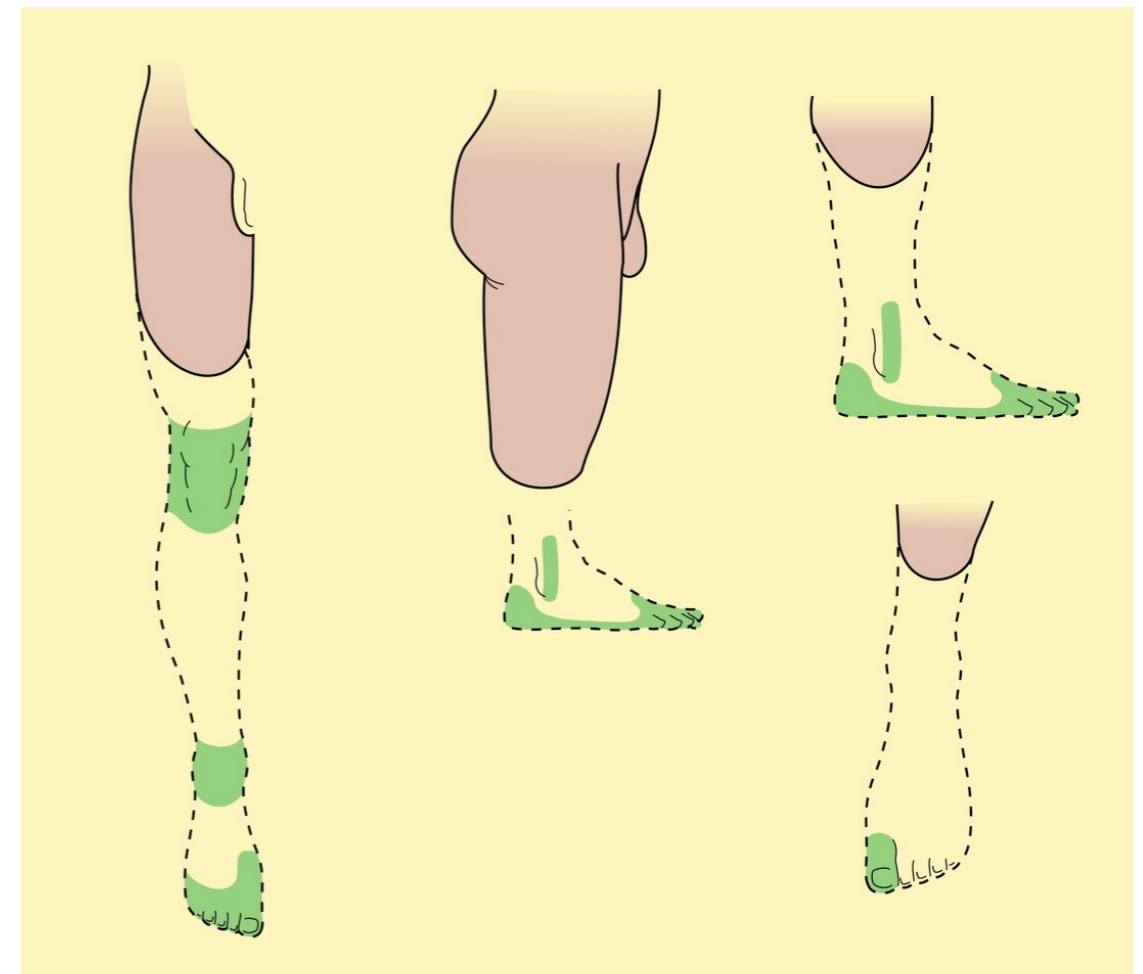
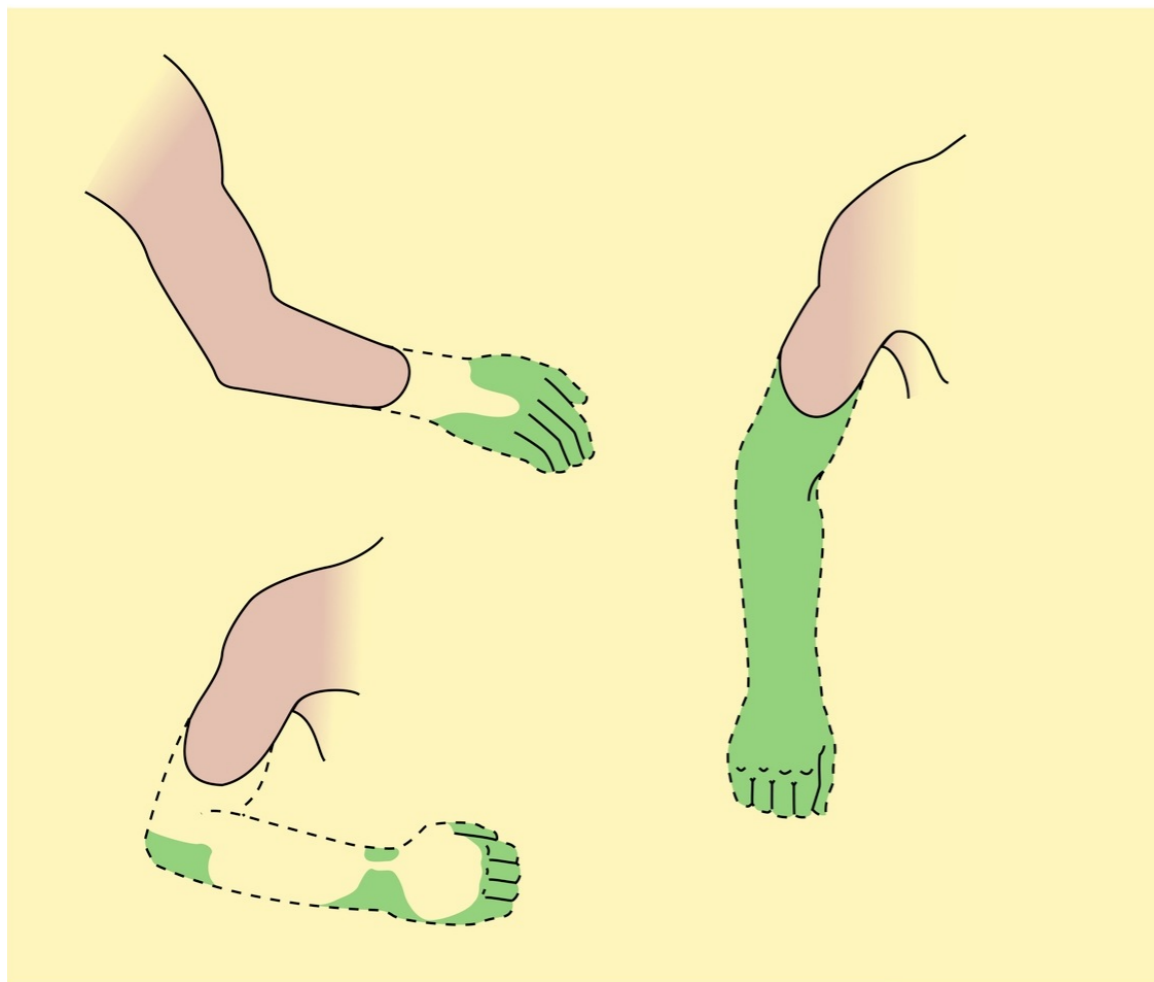
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THE BRAIN ACTIVELY CONSTRUCTS YOUR SENSORY EXPERIENCE

SENSATION IN PHANTOM LIMBS

Our brain can “construct” feeling in any body part, even if that part is amputated

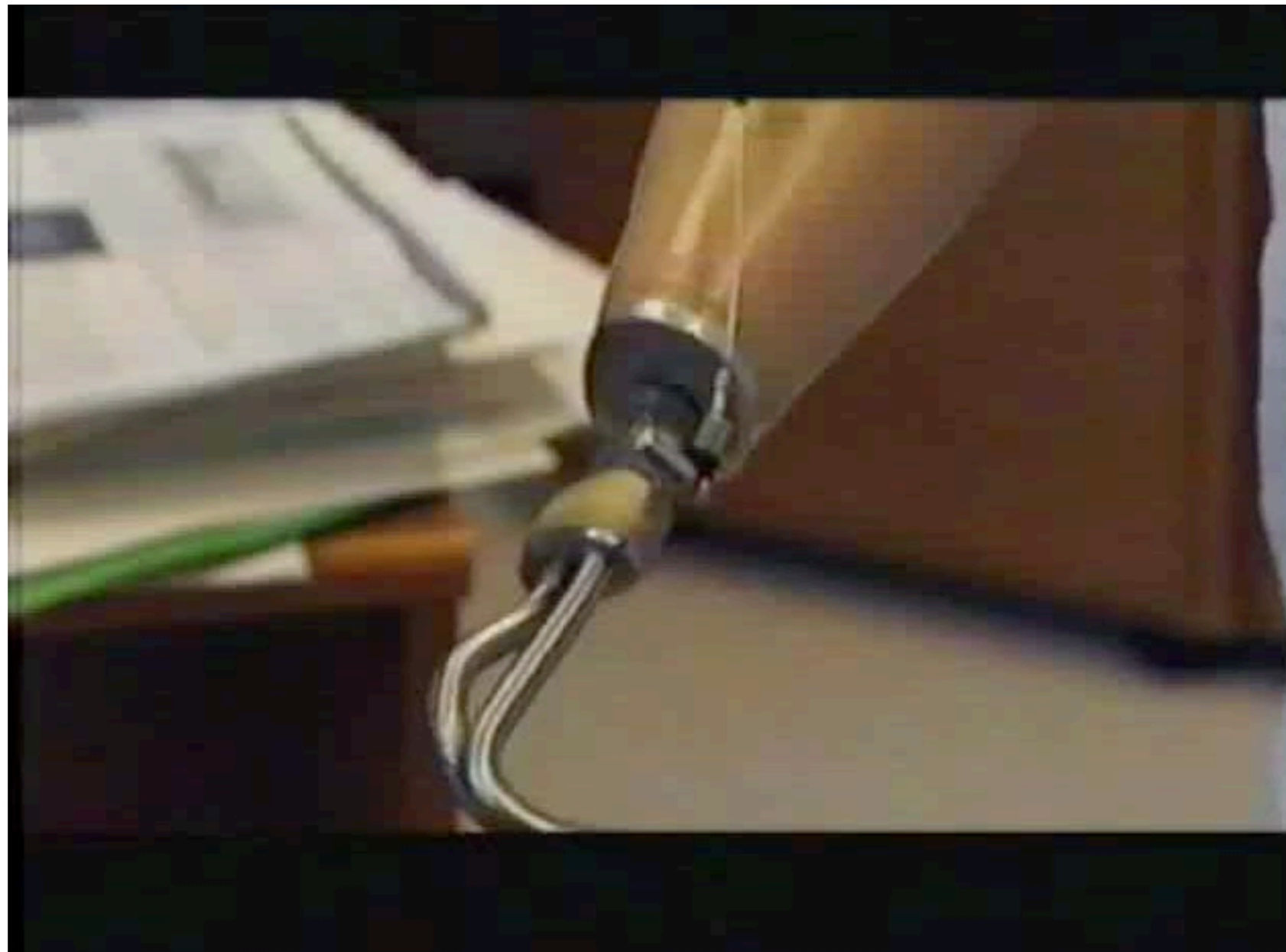
The example of “phantom limbs”



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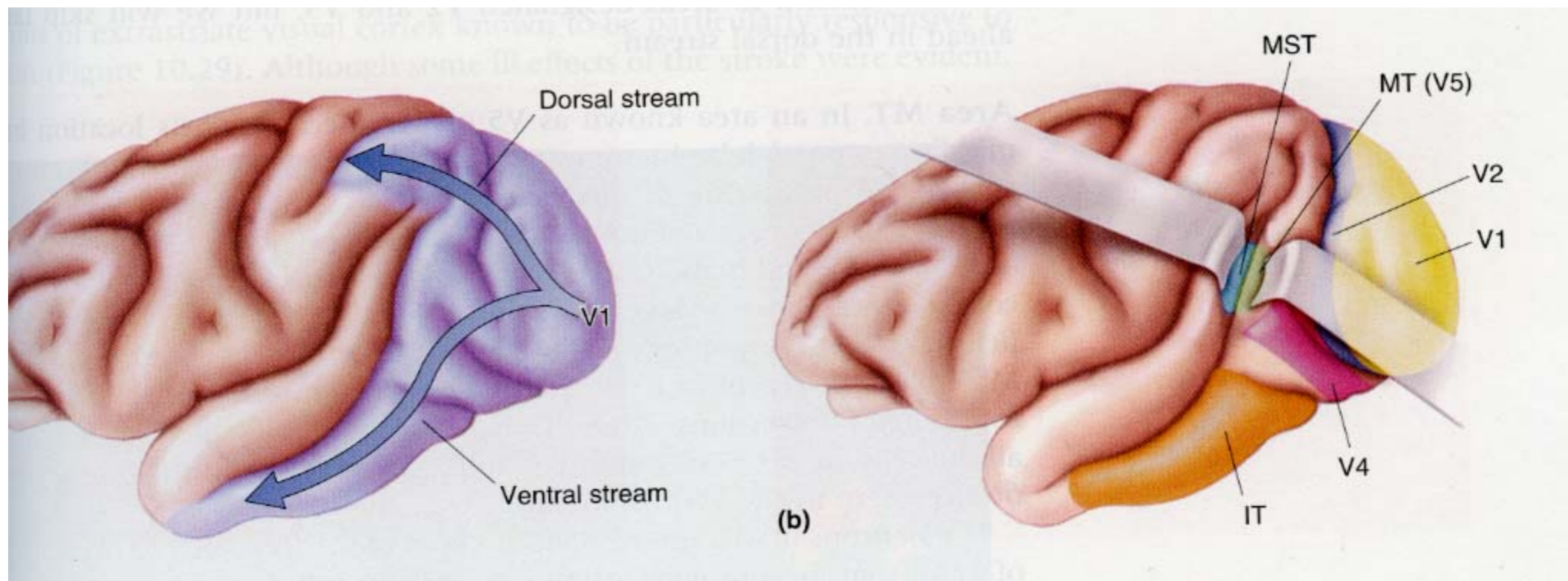
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SPECIFIC PERCEPTUAL FUNCTIONS IN SPECIFIC CORTICAL AREAS

DISTINCT VISUAL PROCESSING STREAMS

The **dorsal** stream is important for “**where**” information (e.g., location, motion), while the **ventral** stream is important for “**what**” information (e.g., objects, faces)



Dorsal stream: V1, V2, MT (motion), MST (optic flow) and other dorsal areas

Ventral stream: V1, V2, V3, V4 (color), IT (objects, faces) and other ventral areas

SPECIFIC PERCEPTUAL FUNCTIONS IN SPECIFIC CORTICAL AREAS

DISTINCT VISUAL PROCESSING STREAMS

Motion perception (area MT)



SPECIFIC PERCEPTUAL FUNCTIONS IN SPECIFIC CORTICAL AREAS

DISTINCT VISUAL PROCESSING STREAMS

Face perception (Inferotemporal cortex, or IT)



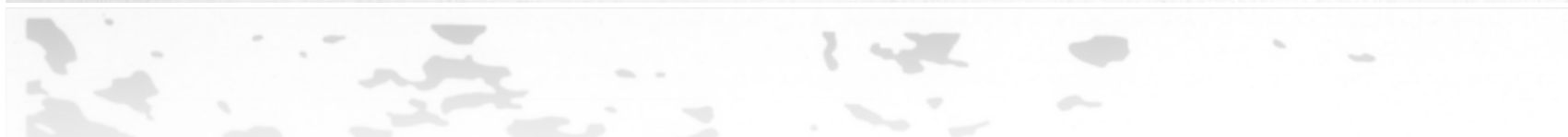
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CAN WE REALLY SEPARATE PERCEPTION FROM MEMORY?

YOUR BRAIN "FILLS IN" A LOT OF YOUR PERCEPTIONS USING YOUR MEMORIES

What do you see here?



CAN WE REALLY SEPARATE PERCEPTION FROM MEMORY?

YOUR BRAIN "FILLS IN" A LOT OF YOUR PERCEPTIONS USING YOUR MEMORIES

What do you see here?

A large, bold, black letter 'B' is centered on a white background. The letter is composed of a vertical bar on the left and two horizontal bars on the right, forming a classic 'B' shape.

CAN WE REALLY SEPARATE PERCEPTION FROM MEMORY?

YOUR BRAIN "FILLS IN" A LOT OF YOUR PERCEPTIONS USING YOUR MEMORIES

What do you see here?

12
ABC
14

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ROLE OF ATTENTION IN PERCEPTION AND MEMORY

TOO MUCH INFORMATION

- We cannot possibly process all the sensory info that is coming in.
- Our brain makes decisions about where it will allocate its attention.
- This allocation will be driven by your previous knowledge of how the world works (i.e., your memories) and what you are thinking at the time.

ROLE OF ATTENTION IN PERCEPTION AND MEMORY

TOO MUCH INFORMATION

The example of “change blindness”



ROLE OF ATTENTION IN PERCEPTION AND MEMORY

TOO MUCH INFORMATION

The Art of Misdirection

(too long for class - watch on your own)



<https://www.youtube.com/watch?v=GZGY0wPAnus>

ROLE OF ATTENTION IN PERCEPTION AND MEMORY

TOO MUCH INFORMATION

“How many times do people in white shirts pass the ball?”

Selective Attention Test
from Simons & Chabris (1999)



<https://www.youtube.com/watch?v=vJG698U2Mvo>