

# Your reality and our brains

## How human mind processes information



**Can we study what is going on in people's heads?**



# Behaviour and environment

## BEHAVIOURIST PERSPECTIVE

STIMULI



NON-EMPIRICAL  
Non-scientific



CONTROL OF  
BEHAVIOUR



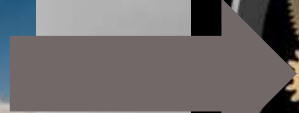
# Human cognition

## COGNITIVE PSYCHOLOGY

DATA  
PROCESSING

CONTROL OF  
BEHAVIOUR

STIMULI



# Human cognition

**DATA  
PROCESSING**

**CONTROL OF  
BEHAVIOUR**

**STIMULI**

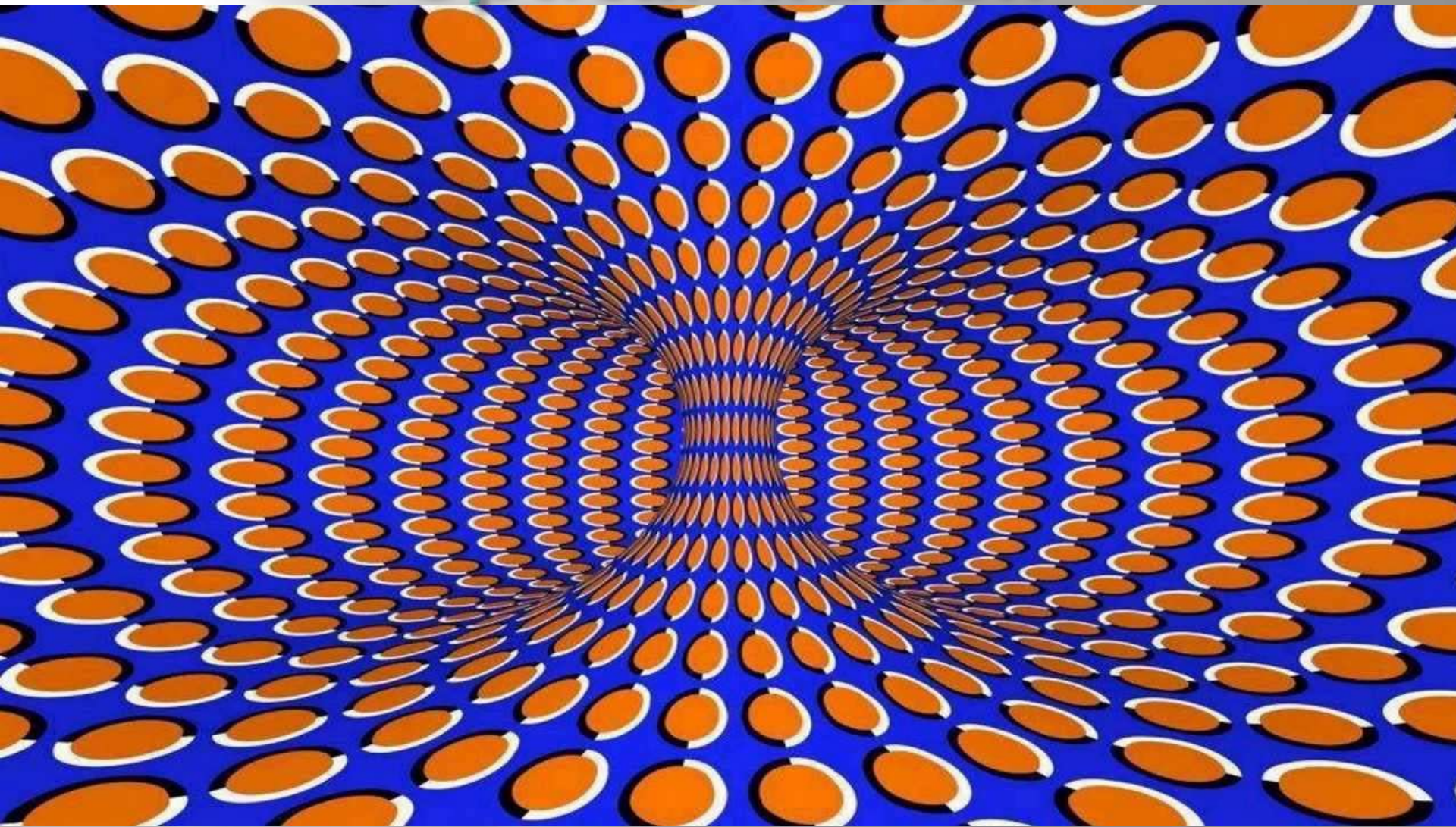


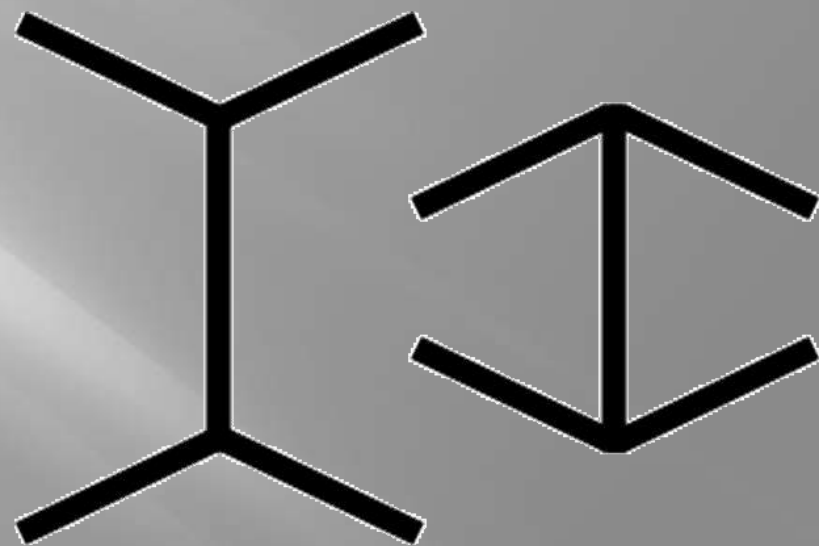
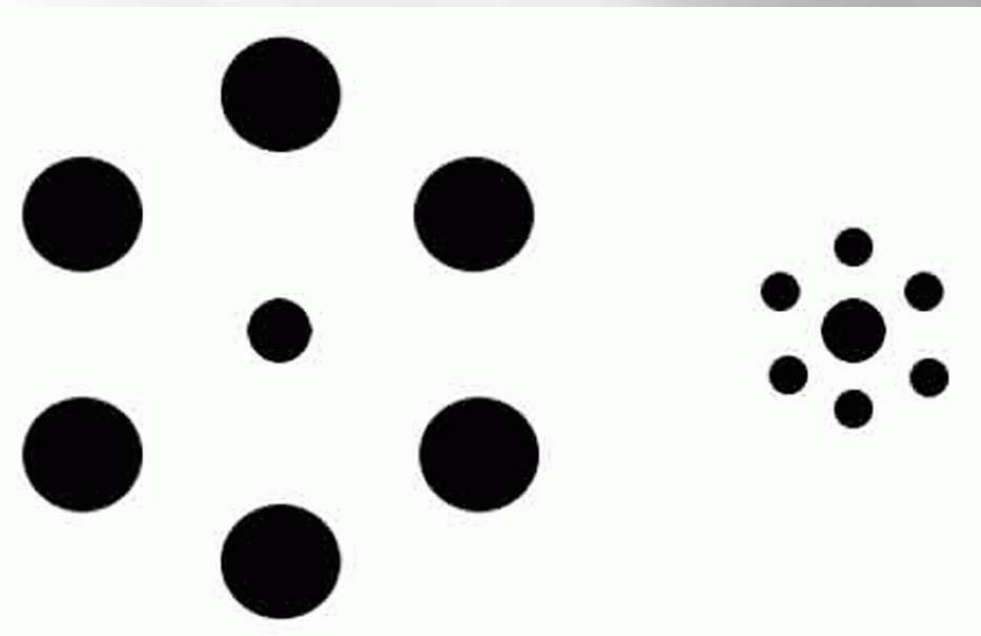
# Cognitive psychology

*The world of experience is produced by the man who experiences it.*

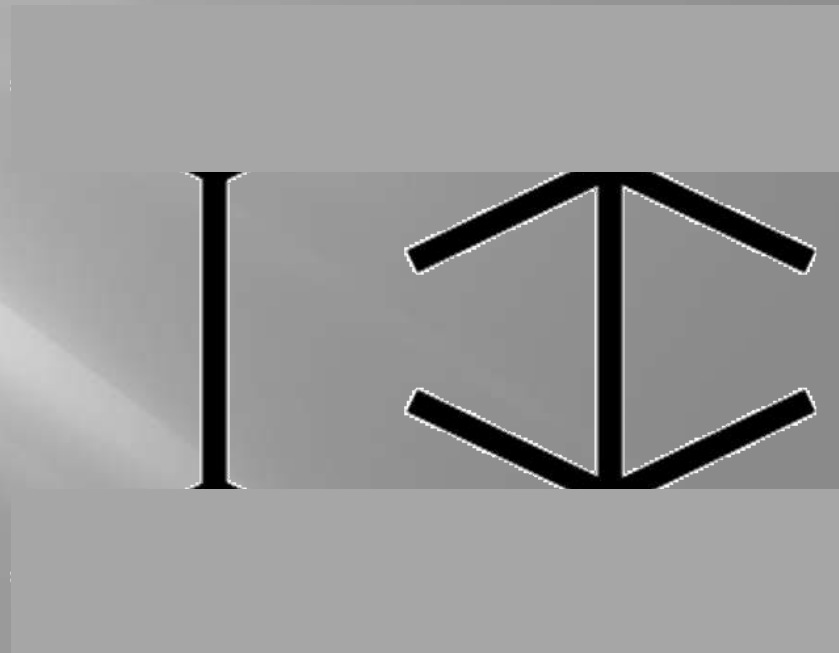
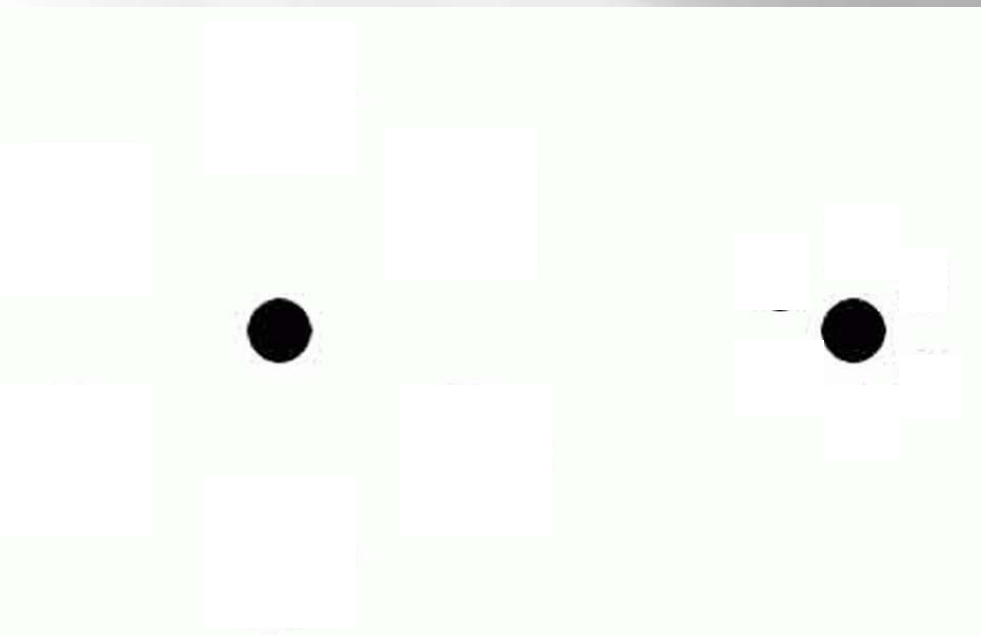
**(Ulric G. Neisser, 1967)**

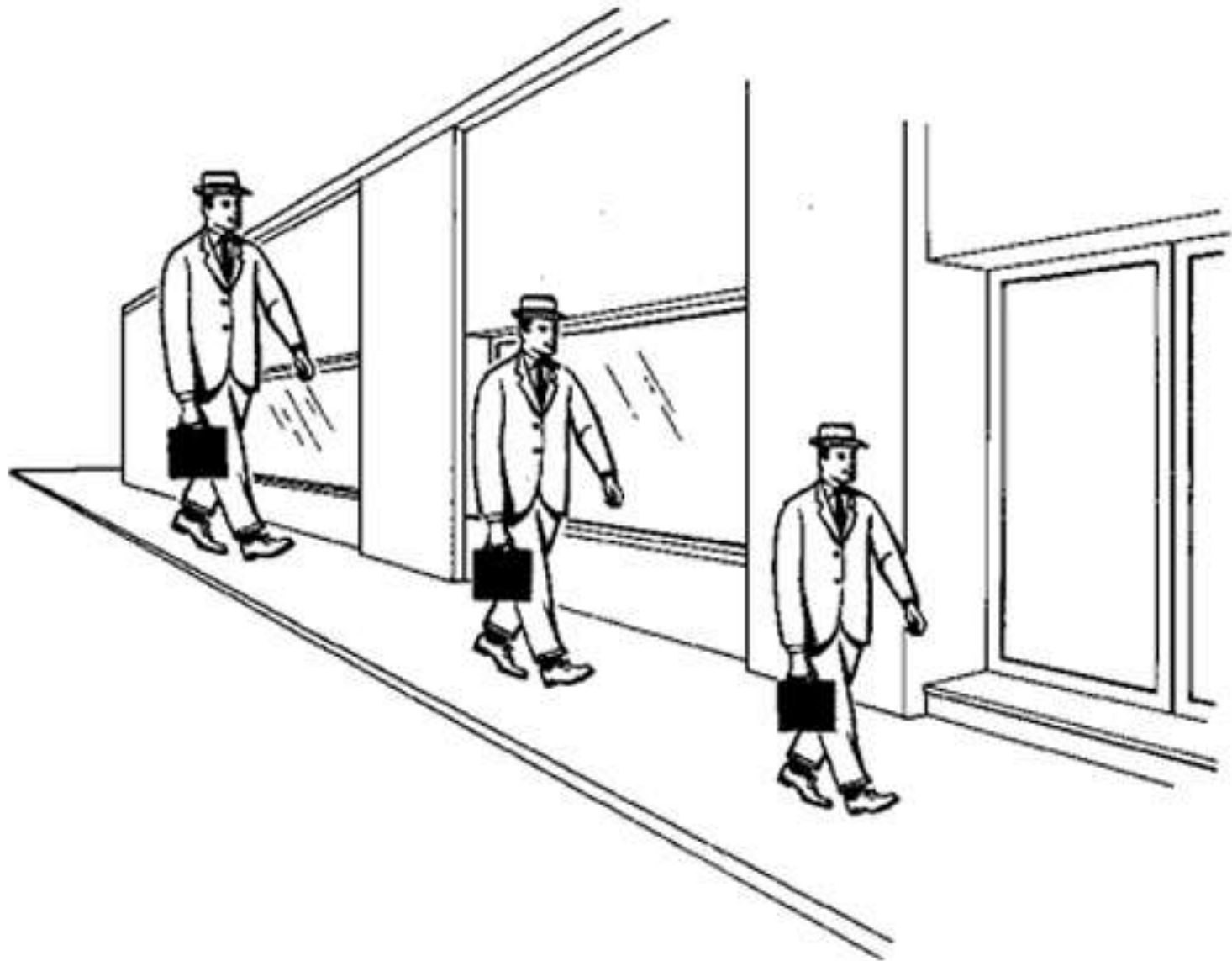
# Optical illusion











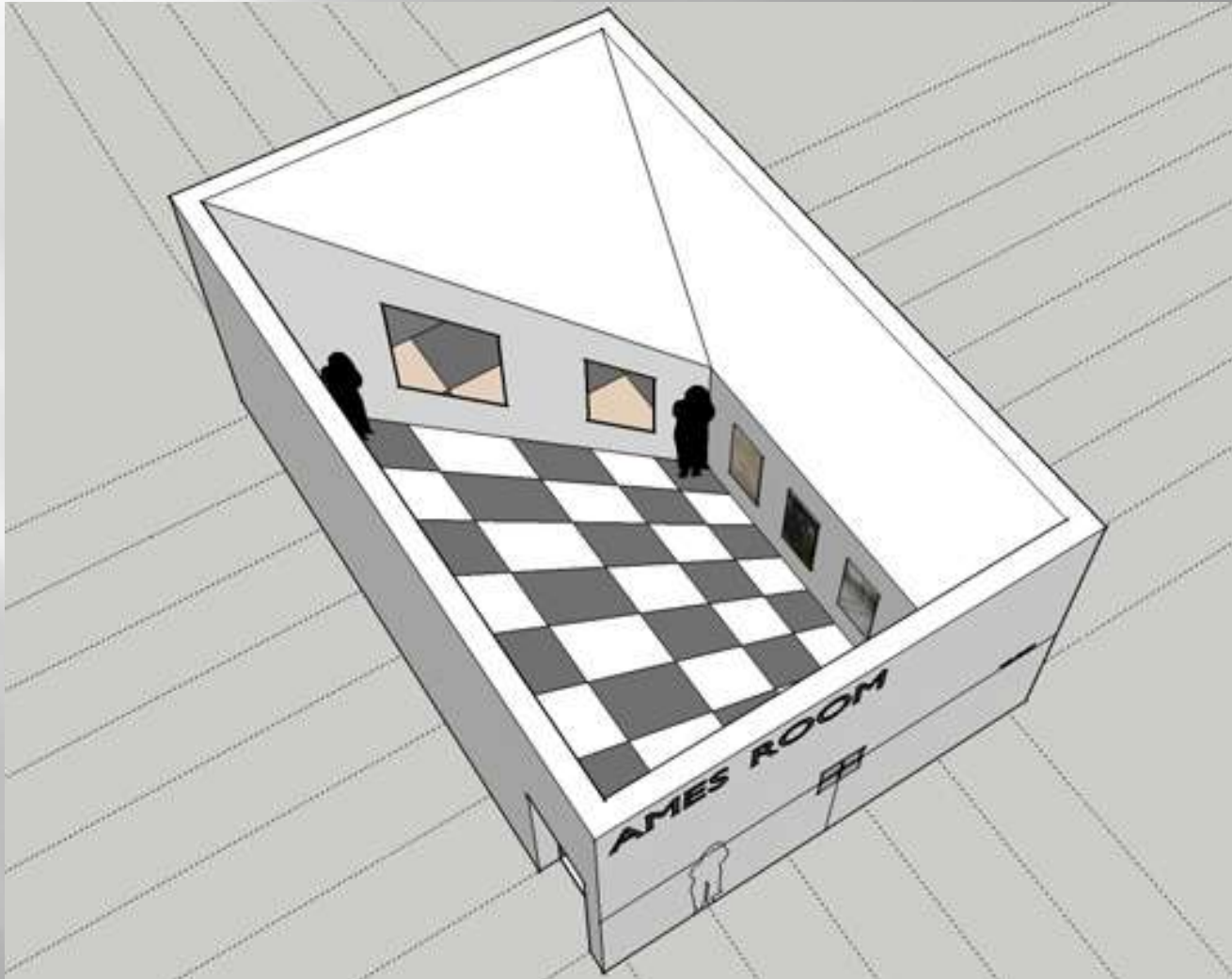


# The Ames room



# The Ames room

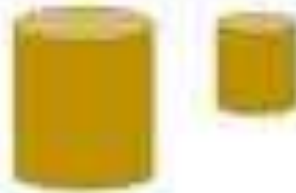
*Manipulation of monocular depth cues*



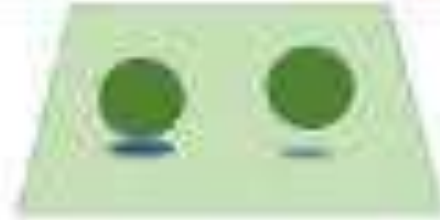
# Monocular depth cues



Occlusion



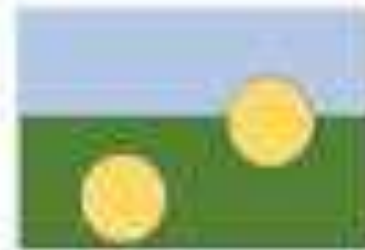
Relative size



Cast Shadows



Shading



Distance to horizon



Texture gradient



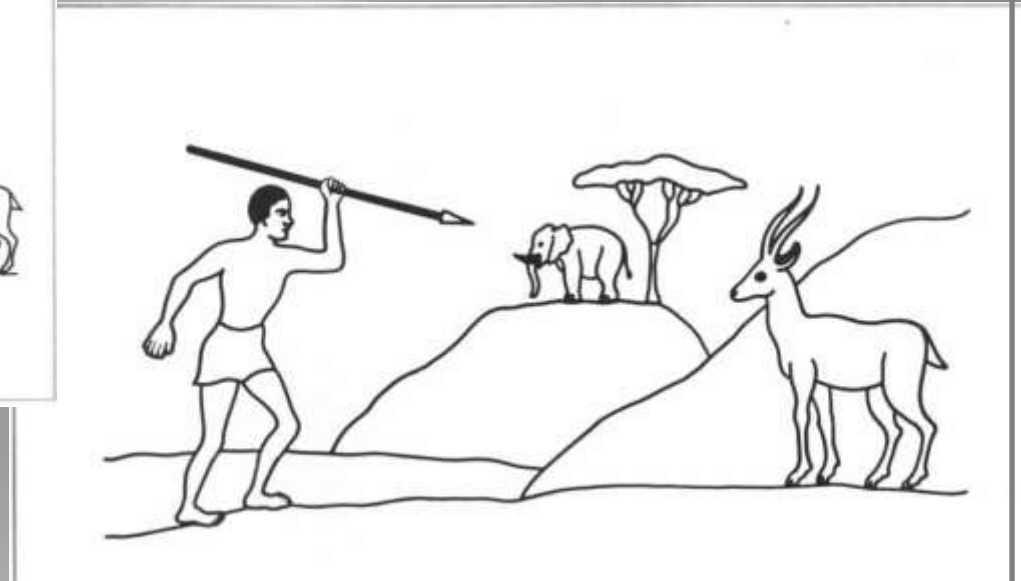
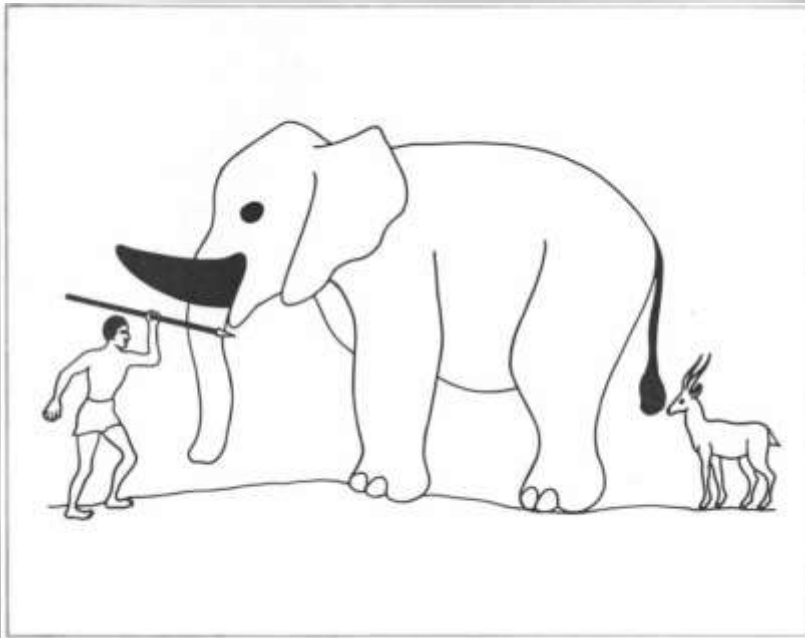
Linear perspective

**Are depth cues hard-wired?  
Do they work the same way  
in all people?**

# Why is the elephant so tiny...?

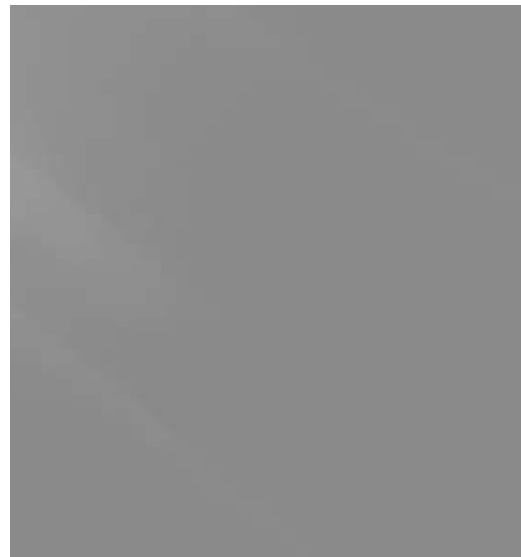
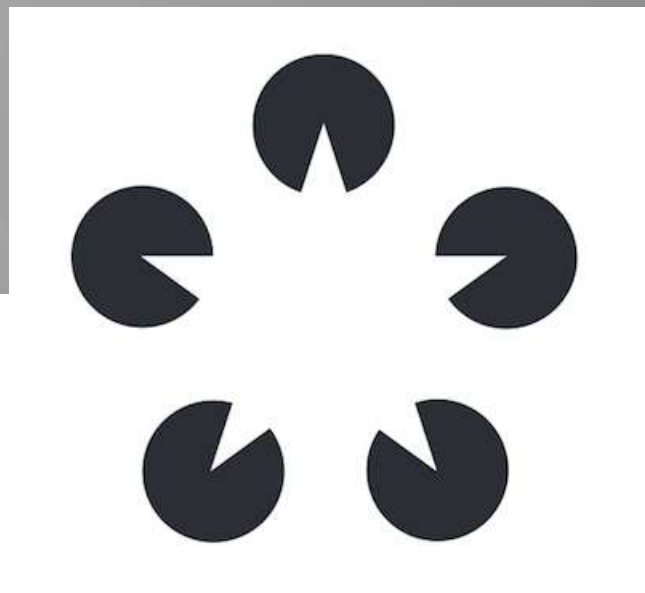
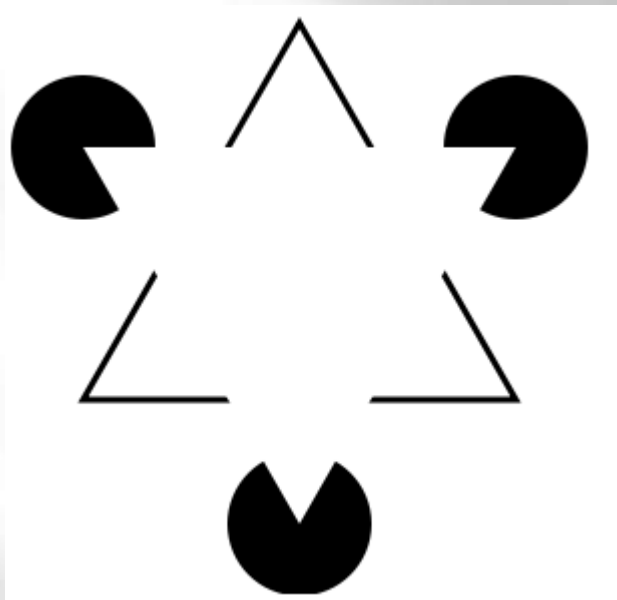
Deregowski, J. B. (1972). Pictorial perception and culture. *Scientific American*, 227(5), 82-88.

## Western cultures vs. African tribes: The Hudson test





# “Gestalt” principles



THE CAT

AAT

# Semantic priming

THE CAT

HAT



# Analyzing experience - how cognitive science works



# Analyzing experience - how cognitive science works



CYAN



MAGENTA



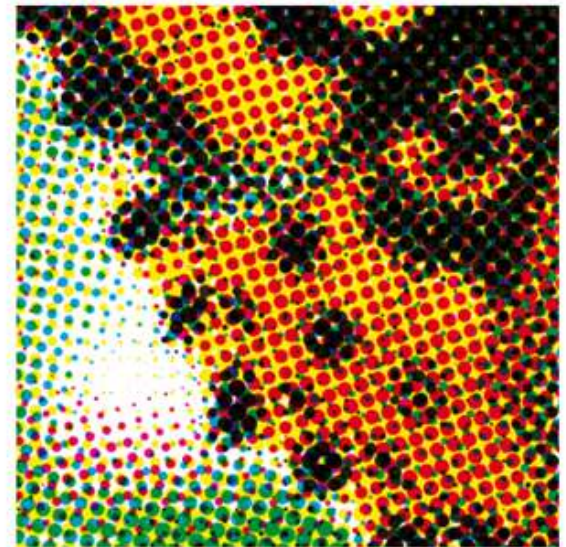
YELLOW



BLACK

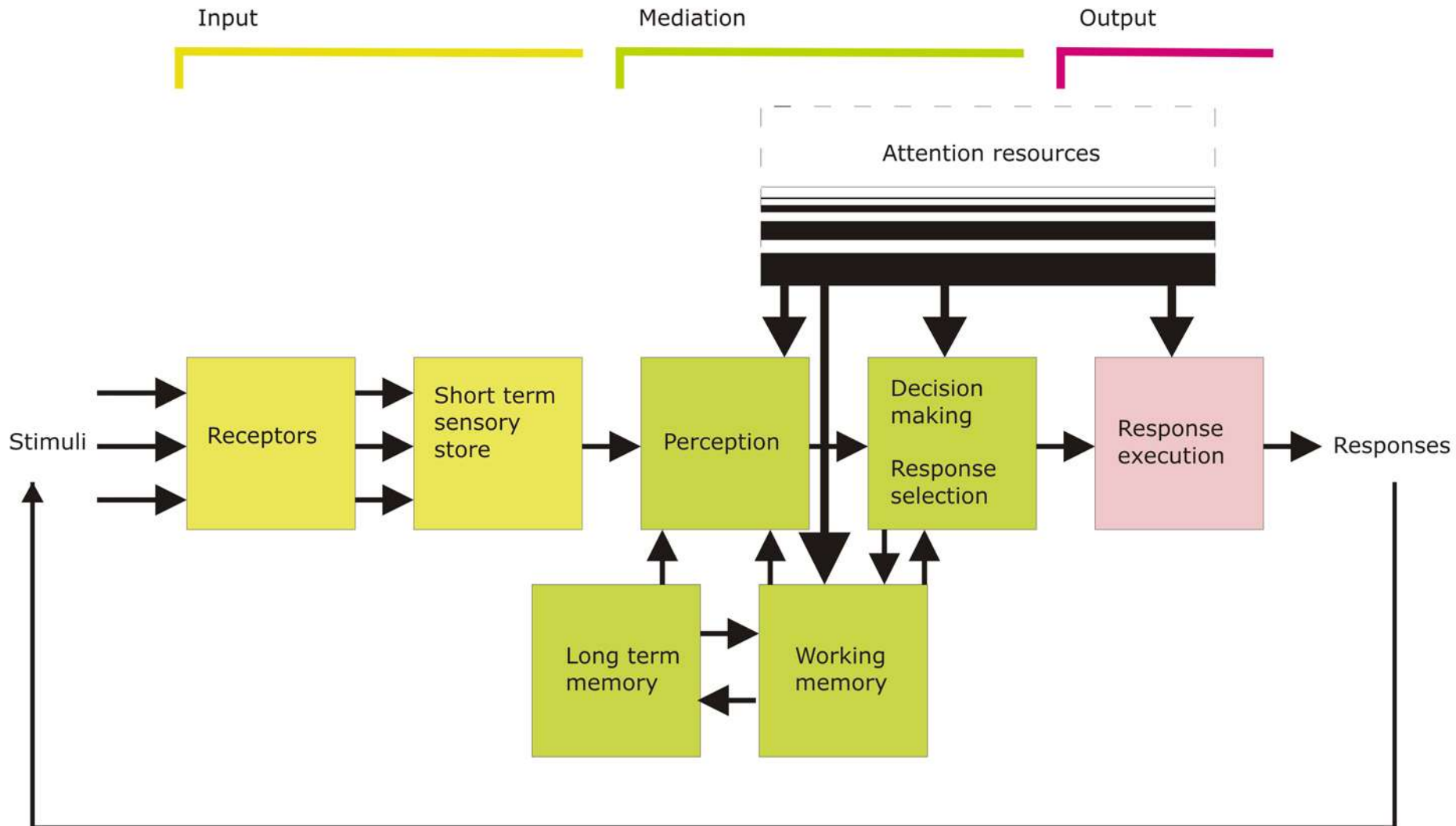


FINAL CMYK



DETAIL VIEW

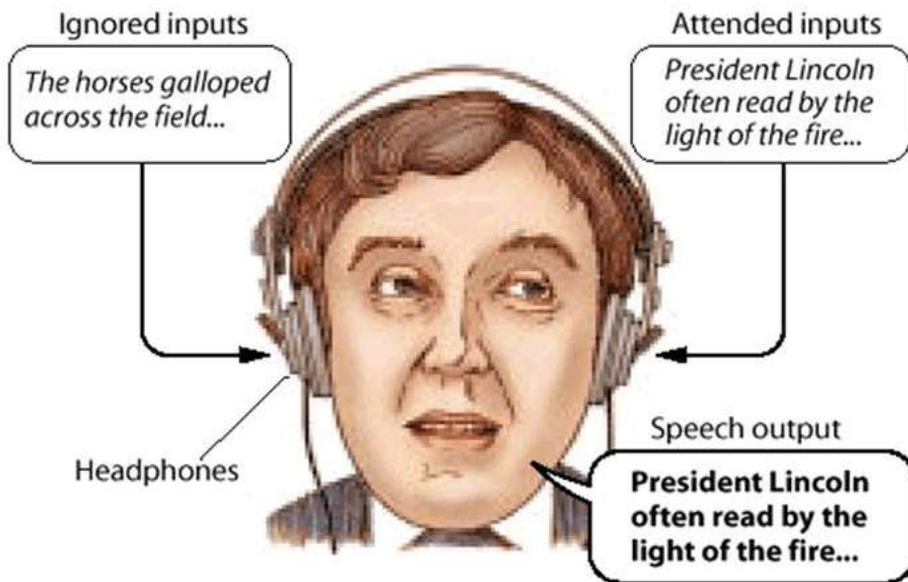
# Cognitive processing



# Attention

## Selective attention – the “cocktail party problem”

### Dichotic Listening Task





# Selective and divided attention

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

# The “Invisible Gorilla” experiment

Simons, D. J., & Chabris, C. F. (1999). Gorillas in our midst: Sustained inattention blindness for dynamic events. *Perception*, 28(9), 1059-1074.

## INATTENTIONAL BLINDNESS



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## INATTENTIONAL BLINDNESS – results:

*“Did you notice anything unusual?” (only 54% DID notice)*

	Easy White team	Easy Black team	HARD White team	HARD Black team
TRANSPARENT Umbrella	58	92	33	42
TRANSPARENT Gorilla	8	67	8	25
OPAQUE Umbrella	100	58	83	58
OPAQUE Gorilla	42	83	50	58

# The “Invisible Gorilla” experiment

Simons, D. J., & Chabris, C. F. (1999). Gorillas in our midst: Sustained inattention blindness for dynamic events. *Perception*, 28(9), 1059-1074.

## INATTENTIONAL (CHANGE) BLINDNESS

- ▣ Occurs when attention is not drawn to the stimuli at the moment of change
- ▣ Perceptual salience ( $\neq$  unusual occurrence of the element) reduces change blindness

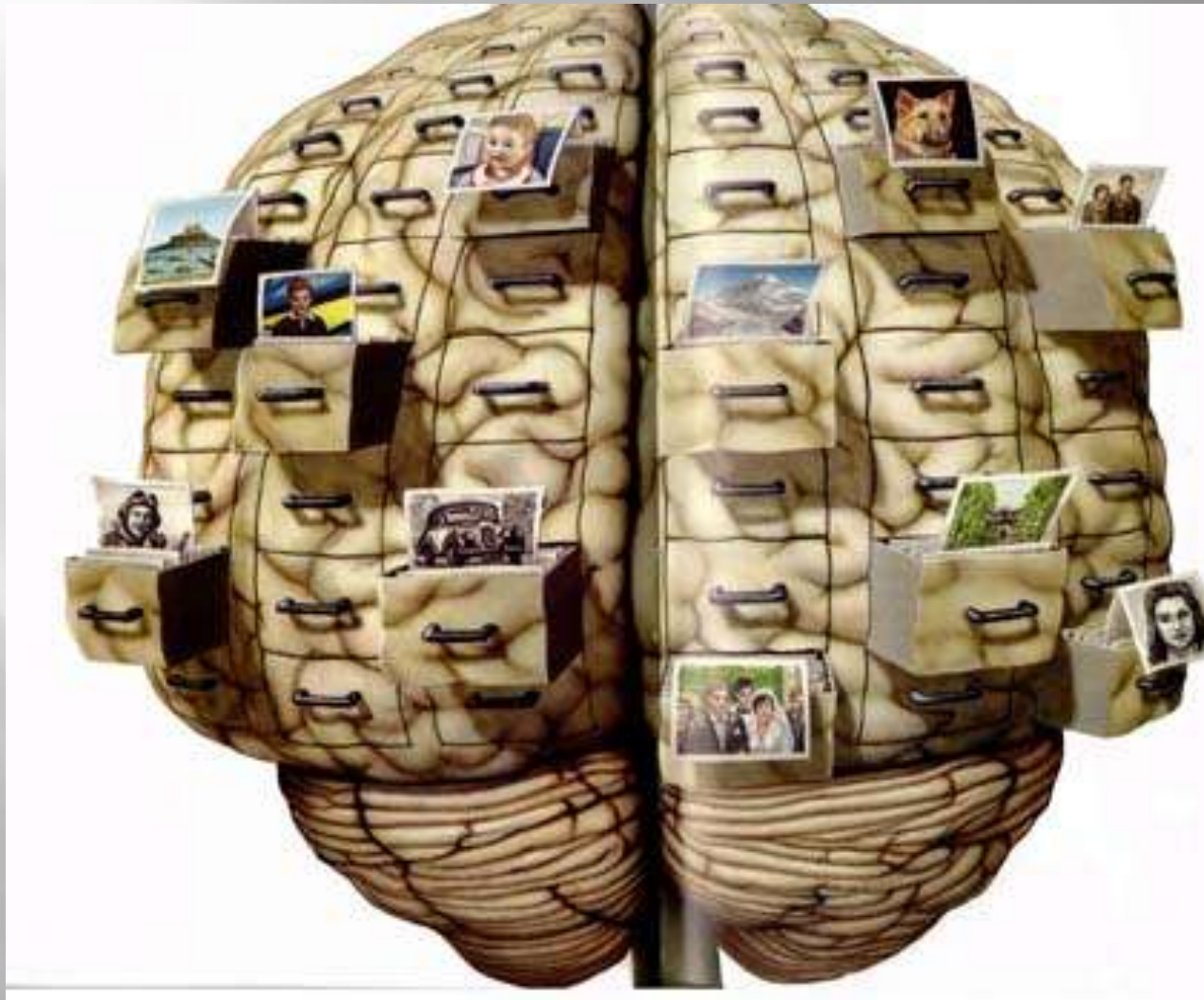
Would I do better at this  
task?



*Beware of change blindness*  
**blindness** 😊

*(type of metacognitive error)*

# How vivid is your memory?



# “Flashbulb” memories





# Remember that time when you got lost in a shopping mall...

*Do you remember that time when you...? Can you give details?*



# Lost in the shopping mall

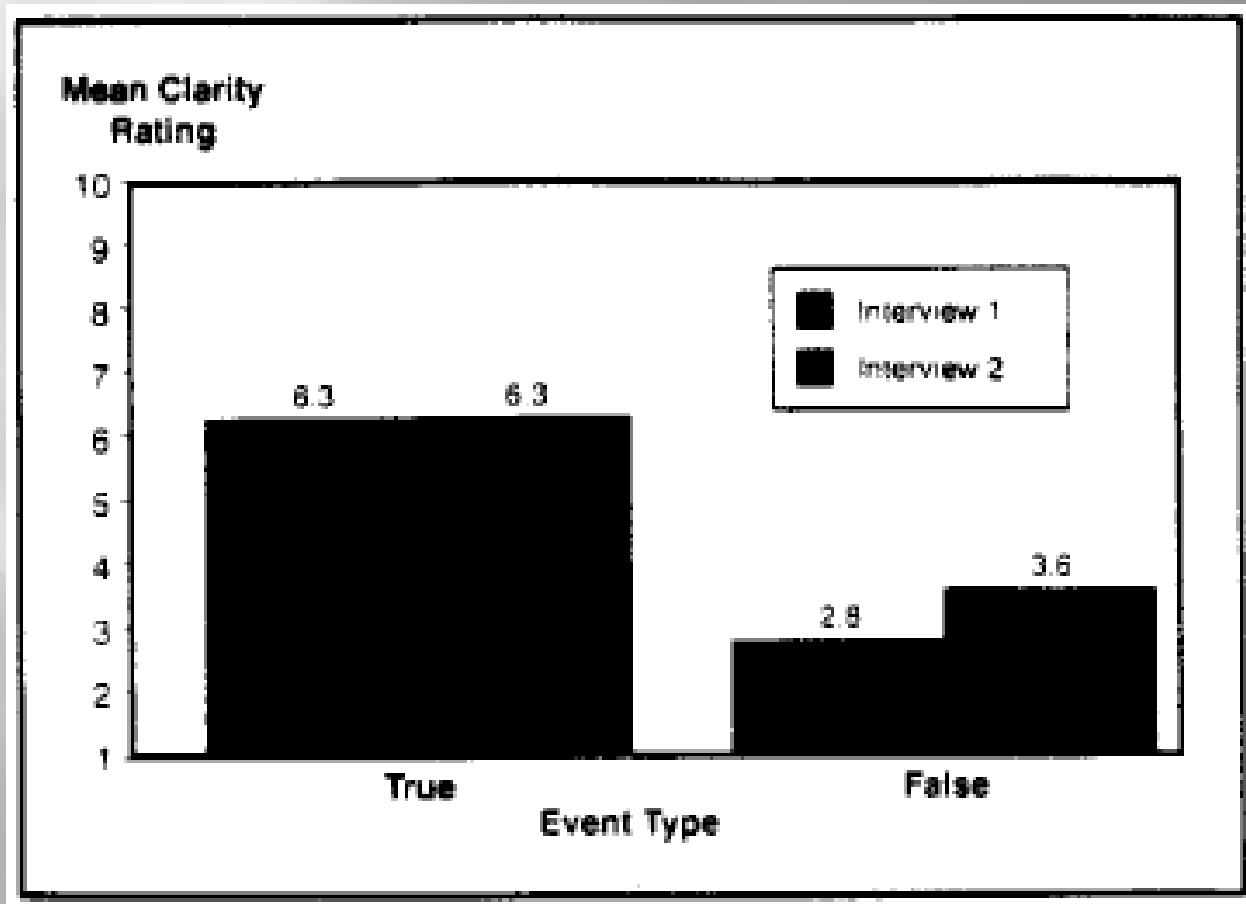
Loftus, E. F., & Pickrell, J. E. (1995). The formation of false memories. *Psychiatric Annals*, 25(12), 720-725.

Tell us whether you remember this and provide details.

	True events (3 × 24 = 72)	False event (out of 24)
“Remembered” events	49 (68%) Described by more words	6 (25%) Described by less words

# Lost in the shopping mall

Loftus, E. F., & Pickrell, J. E. (1995). The formation of false memories. *Psychiatric Annals*, 25(12), 720-725.



**Does it matter whether our  
memories are accurate or  
not?**

**Elizabeth F. Loftus**



# Eyewitness testimony

Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory. *Journal of Verbal Learning and Verbal Behavior*, 13(5), 585-589.

*The way you ask questions matters...*



# Eyewitness testimony

Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory. *Journal of Verbal Learning and Verbal Behavior*, 13(5), 585-589.

“Car speed...?”

	Estimated speed (mph)
<i>Cars smashed...</i>	40.8
<i>Cars collided...</i>	39.3
<i>Cars bumped...</i>	38.1
<i>Cars hit...</i>	34.0
<i>Cars contacted...</i>	31.8



# Eyewitness testimony

Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory. *Journal of Verbal Learning and Verbal Behavior*, 13(5), 585-589.

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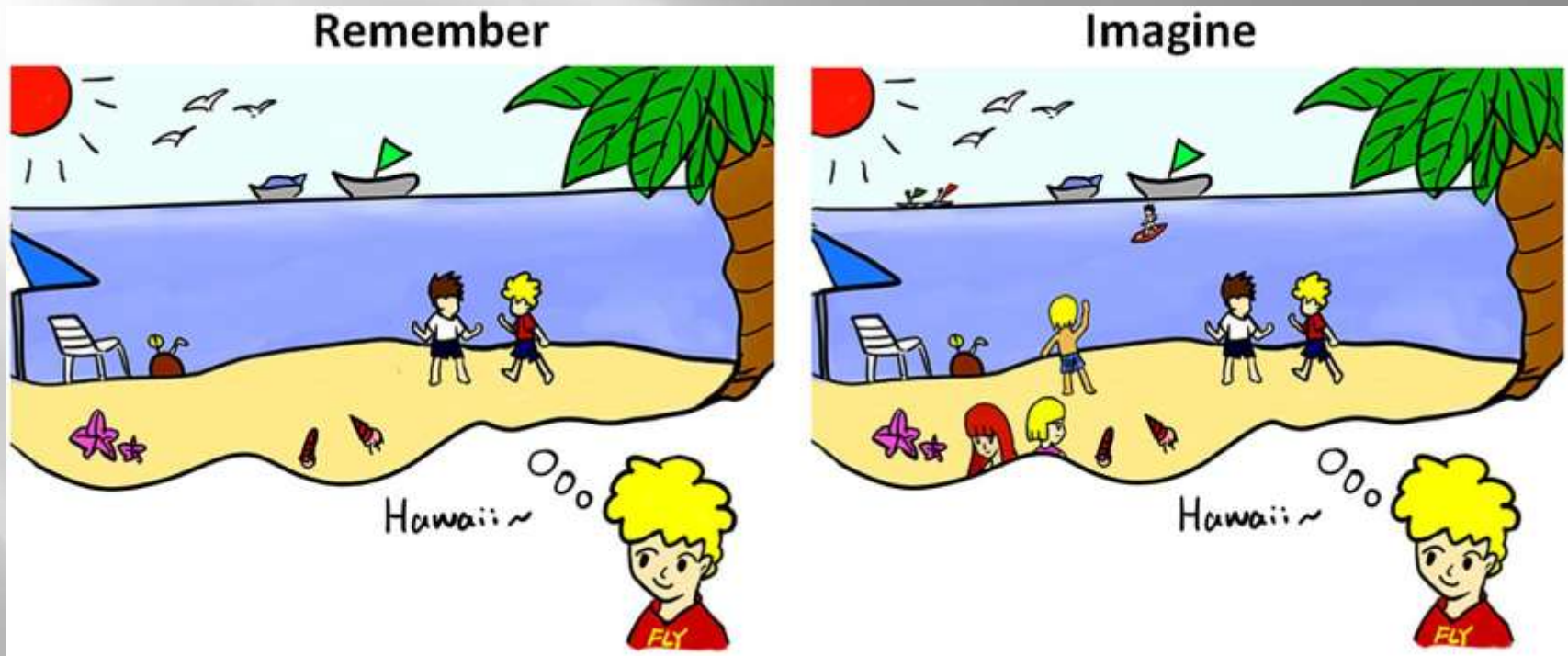
One week later:

“Any broken glass...?”

	Yes	No
<i>Smashed</i>	16	34
<i>Hit</i>	7	45
<i>Control</i>	6	44

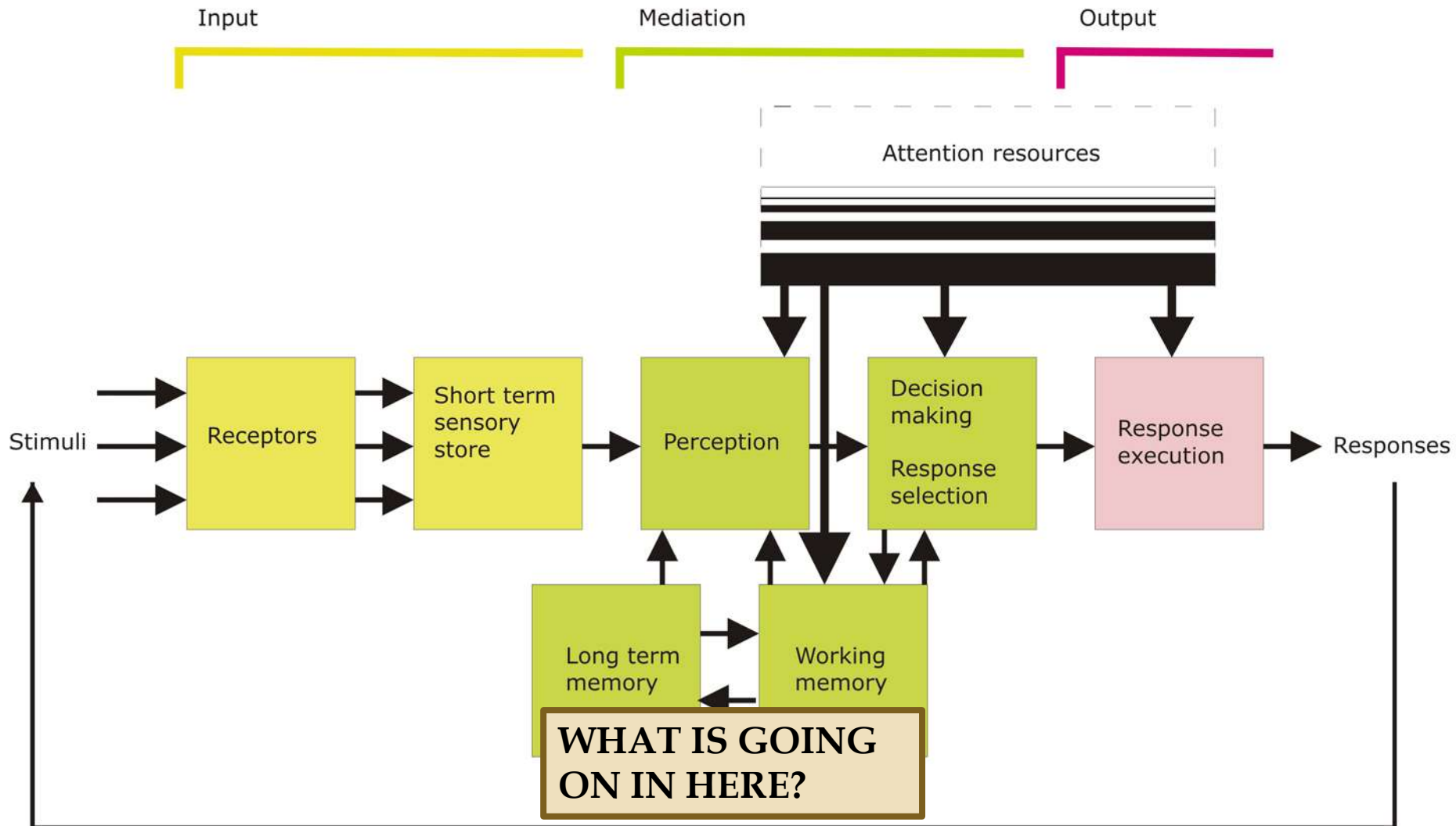
# Constructive nature of memory

*Do I distinguish between what happened and what I imagined...?*



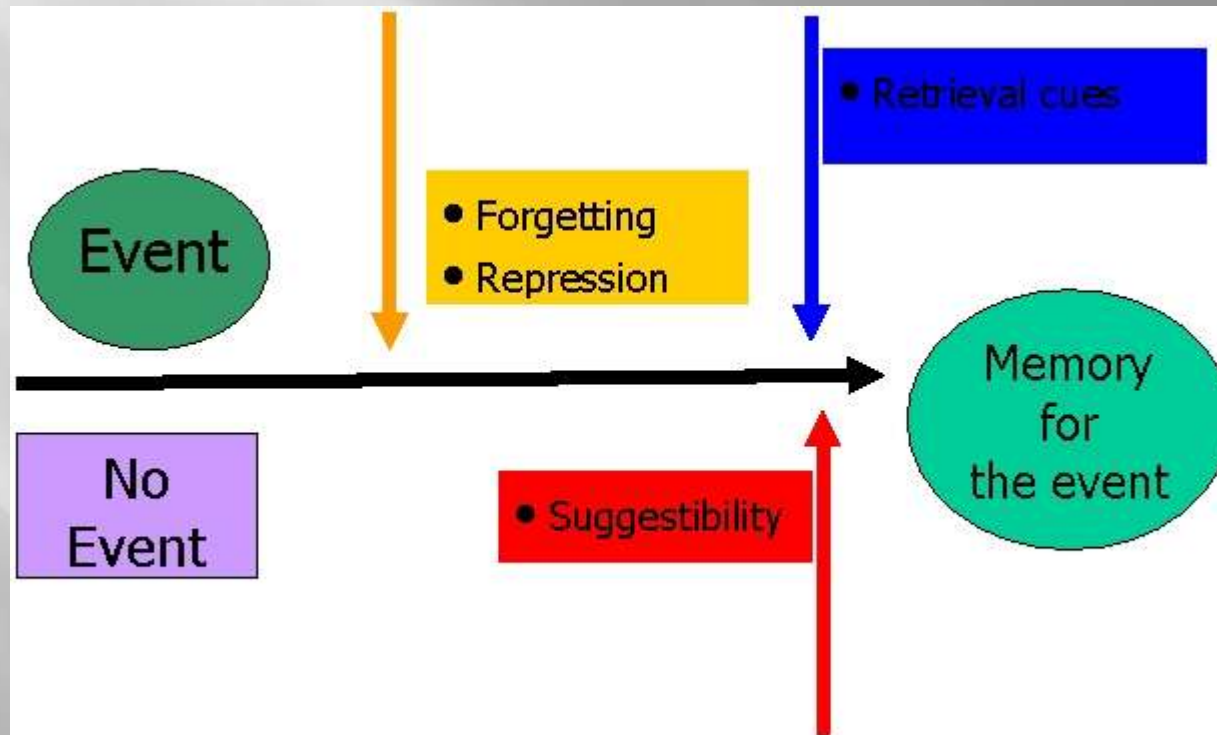


# How memory works



# If I remember correctly...

- ▣ Constructive nature of human memory



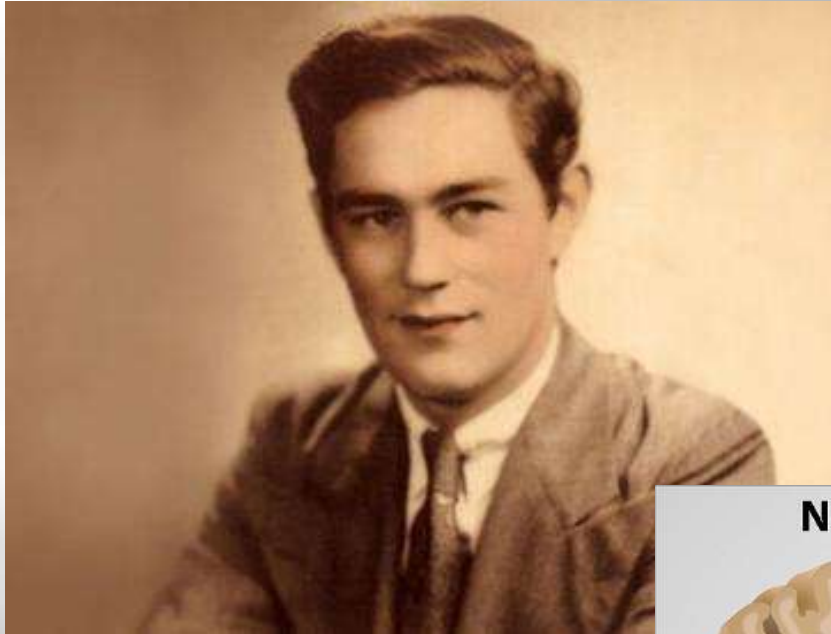
# The eyewitness testimony problem

- ▣ Conformity
- ▣ Suggestibility
- ▣ Increasing certainty
- ▣ Unconscious transference

How to eliminate these?

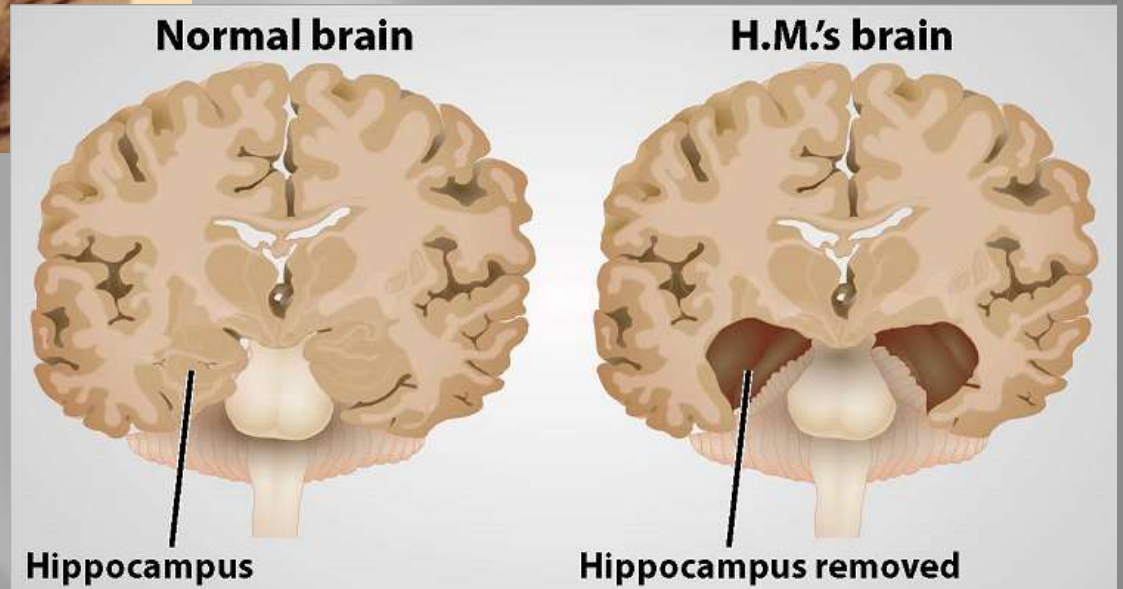
# **Workings of our brain**

# The case of H. M.

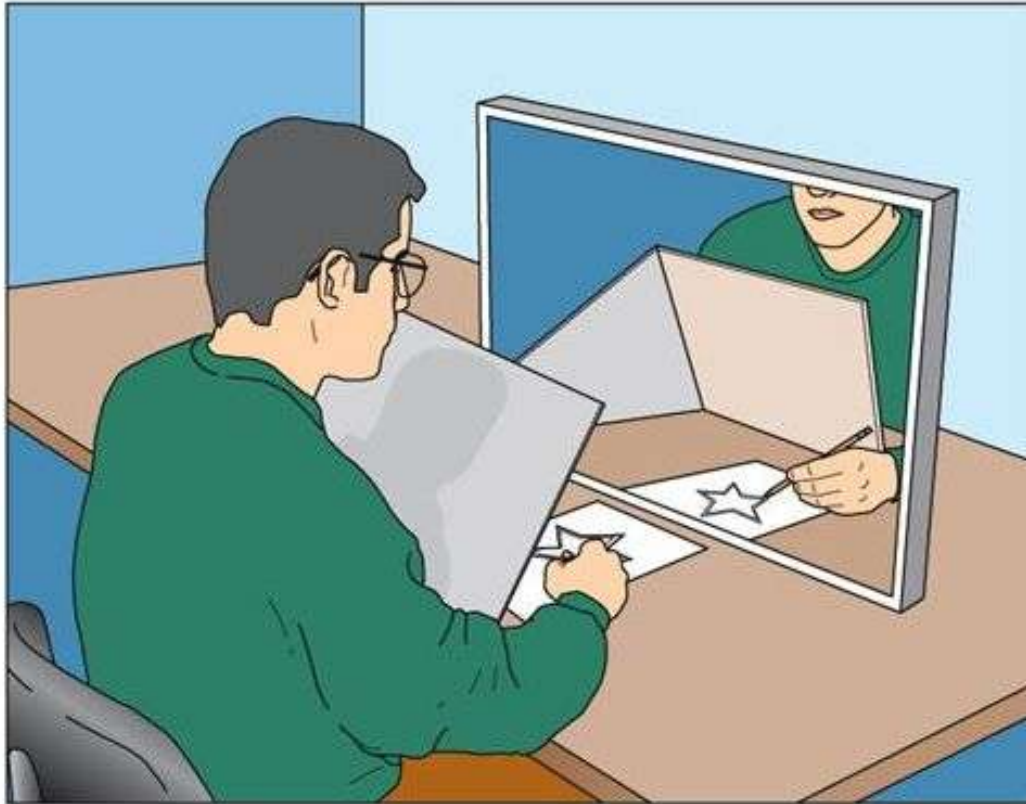


**Henry Molaison  
1953**

**Anterograde  
amnesia**



(a) The mirror-tracing task



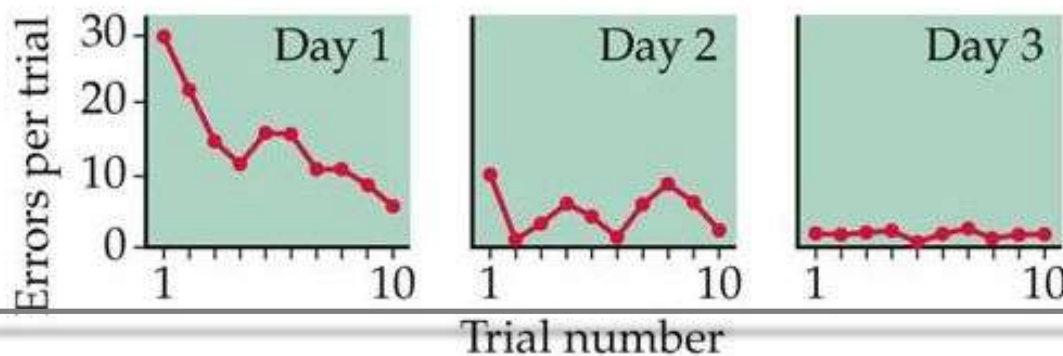
Not all memory  
is the same...

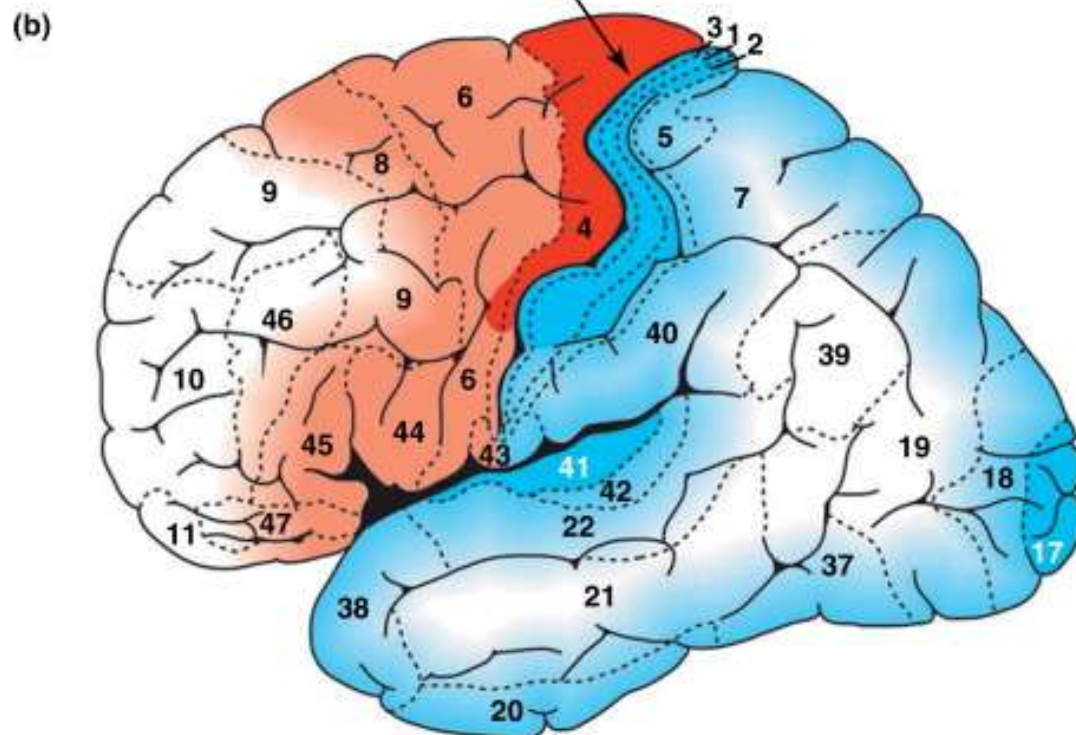
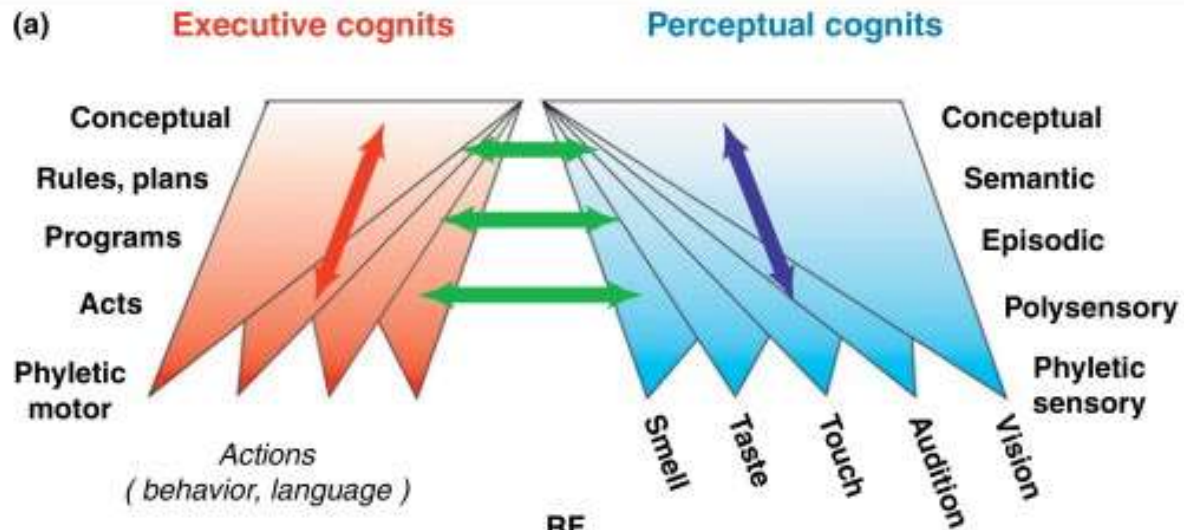
*Episodic  
memory*

*Semantic  
memory*

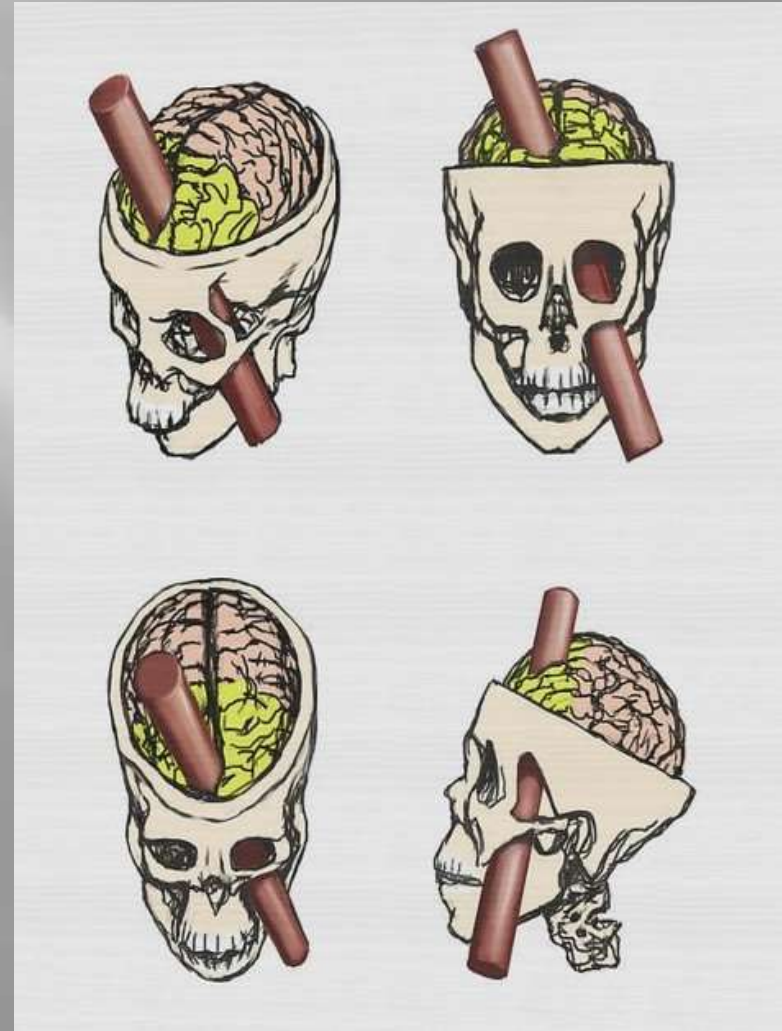
*Procedural  
memory*

(b) Performance of H.M. on mirror-tracing task





# The Phineas Gage Case

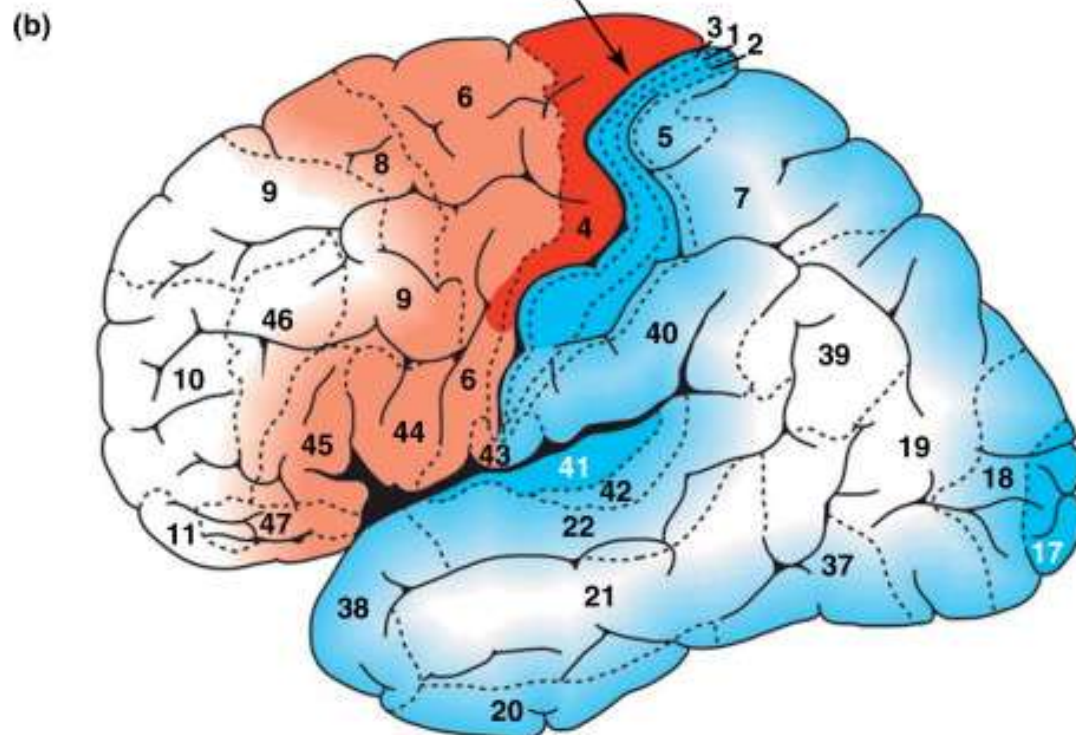
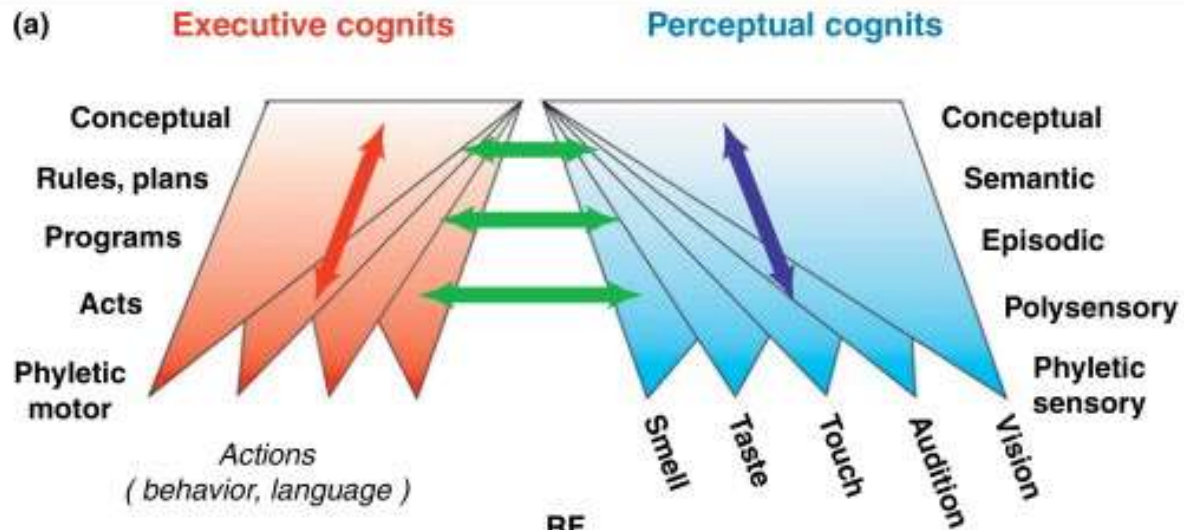




# The Phineas Gage Case

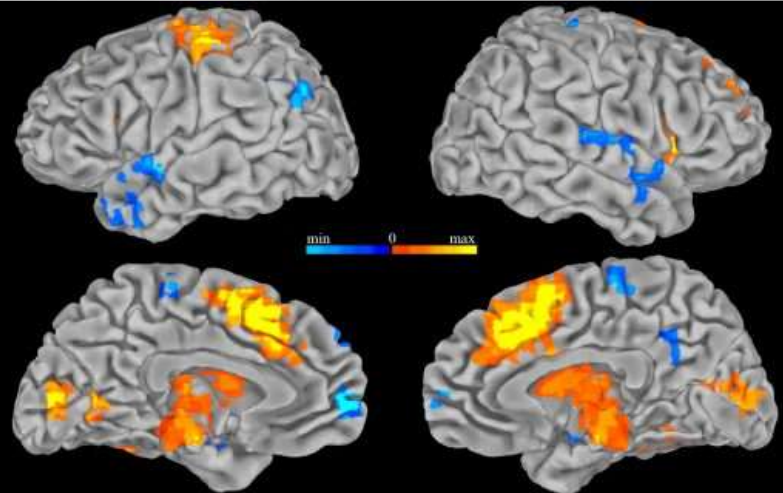
*The equilibrium or balance, so to speak, between his intellectual faculties and animal propensities, seems to have been destroyed. He is fitful, irreverent, indulging at times in the grossest profanity (which was not previously his custom), manifesting but little deference for his fellows, impatient of restraint or advice when it conflicts with his desires, at times pertinaciously obstinate, yet capricious and vacillating, devising many plans of future operations, which are no sooner arranged than they are abandoned in turn for others appearing more feasible. A child in his intellectual capacity and manifestations, he has the animal passions of a strong man. Previous to his injury, although untrained in the schools, he possessed a well-balanced mind, and was looked upon by those who knew him as a shrewd, smart business man, very energetic and persistent in executing all his plans of operation. In this regard his mind was radically changed, so decidedly that his friends and acquaintances said he was "no longer Gage."*

**Harlow, 1868**

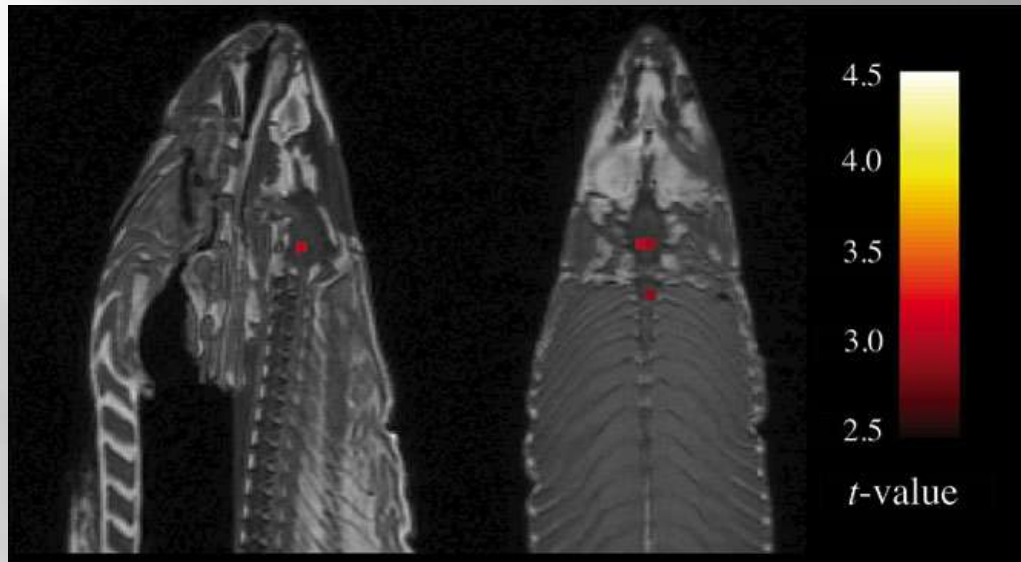


# “The brain craze”

## Functional brain imaging revolution

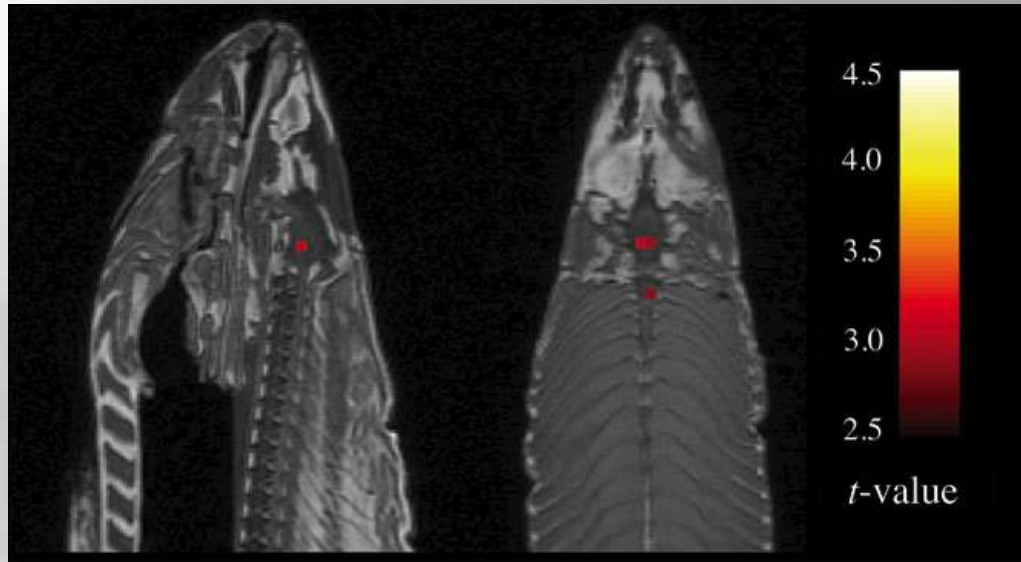


# “The brain craze”

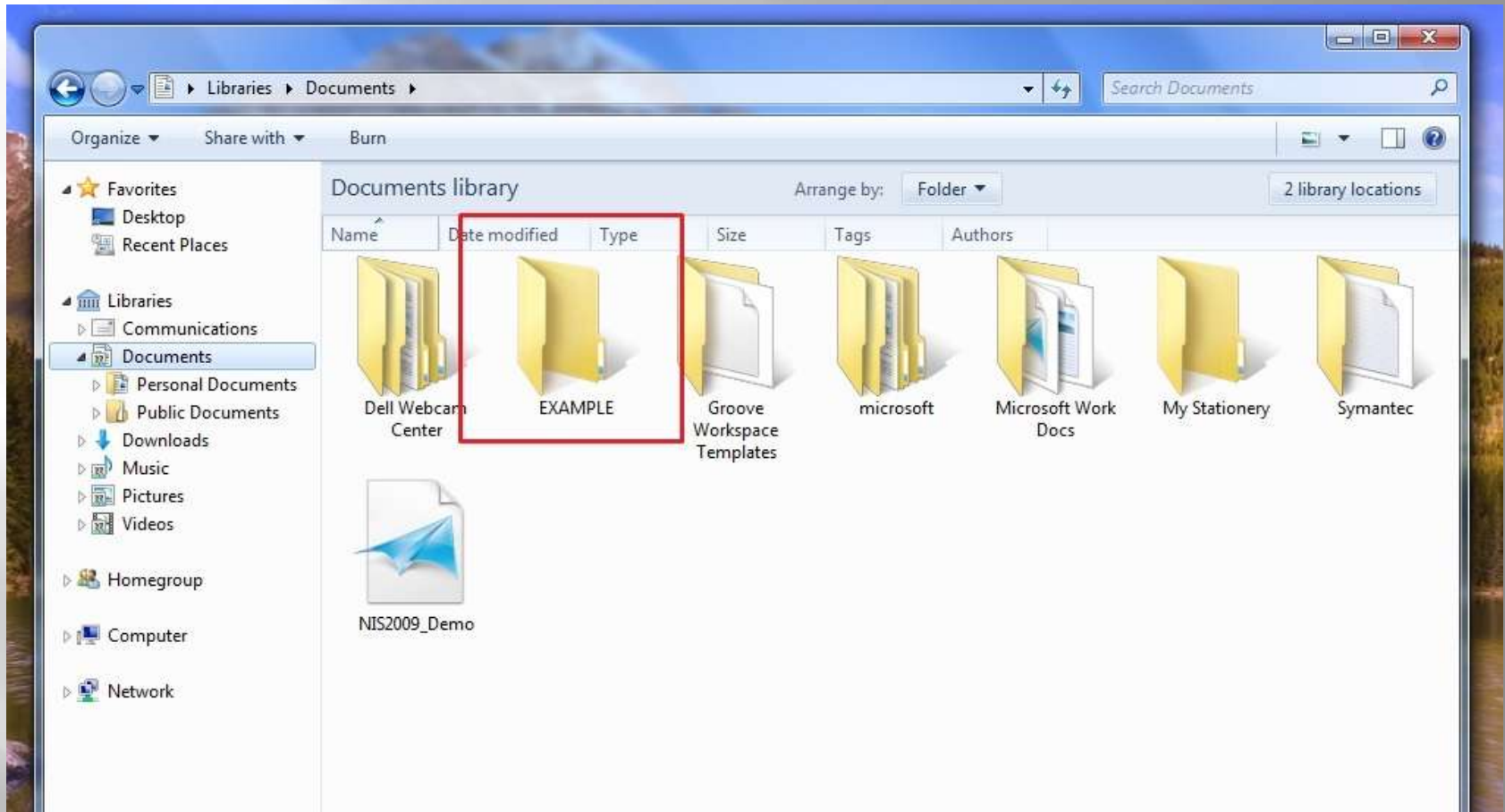


**Are dirty plastic cups crucial  
for the expansion of  
knowledge?**

# “The brain craze”



- ▣ Most of our brain is active all the time – very complex actions
- ▣ More activity  $\neq$  this part is important for the task
- ▣ What about less activity?
- ▣ **The brain isn't parcelled out according to our psychological categories!**



OPENNESS



CONSCIENTIOUSNESS



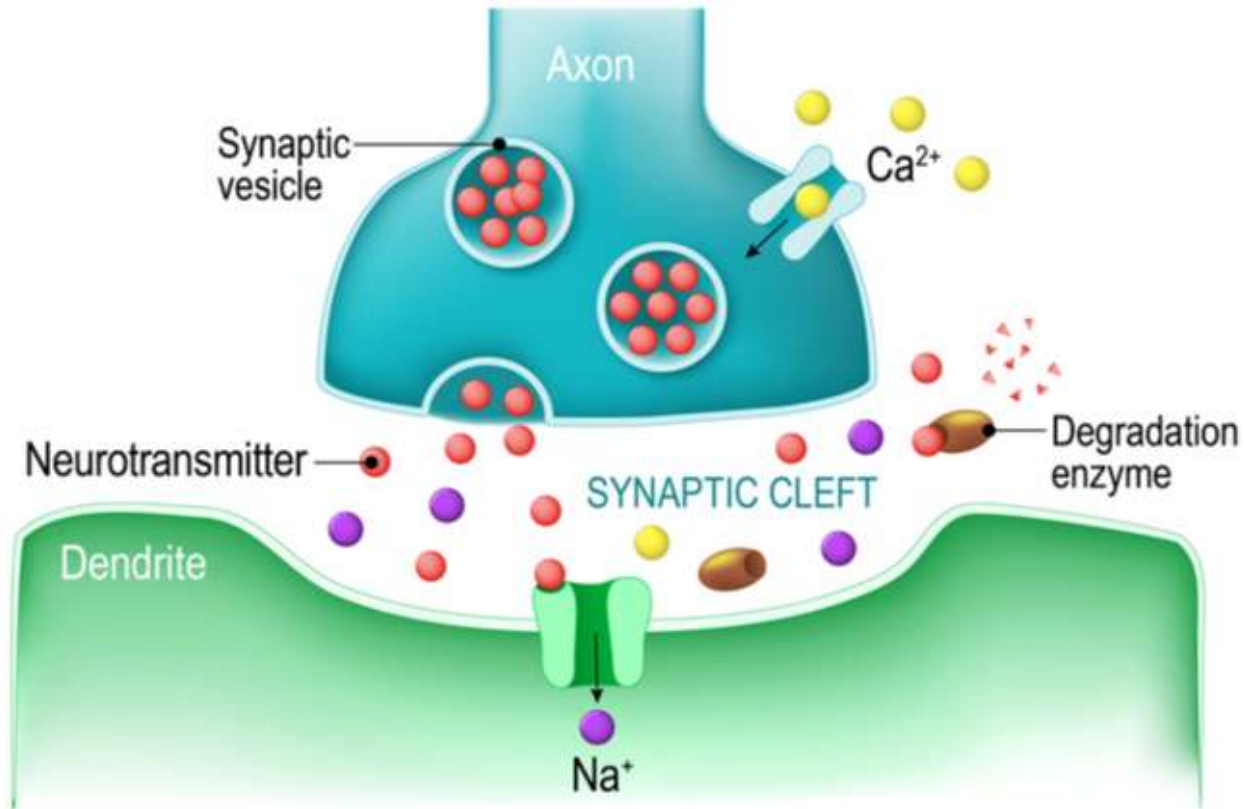
NEUROTICISM



EXTRAVERSION

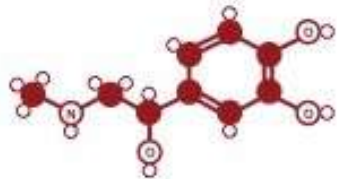


AGREEABLENESS



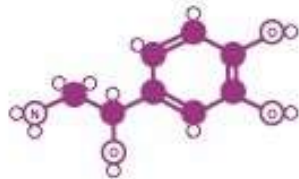


## ADRENALINE



Fight or flight neurotransmitter

## NORADRENALINE



Concentration neurotransmitter

## DOPAMINE



Pleasure neurotransmitter

## SEROTONIN



Mood neurotransmitter

## GABA



Calming neurotransmitter

## ACETYLCHOLINE



Learning neurotransmitter

## GLUTAMATE



Memory neurotransmitter

## ENDORPHINS



Euphoria neurotransmitter

# Thank you!

