

What is memory?

definition

- experience that changes brain and behavior

memory is not just one thing

Who studies memory?

Psychologists

- types, performance

Neuroscientists

- neural cellular basis

Biologists

- molecular basis

Applied psychologists

- reliability

Clinical psychologists

- mental health aspects

Kinds of memory?

- declarative
- non-declarative
- sensory store
- short-term
- long-term
- conscious
- unconscious
- working
- long-term
- procedural
- semantic
- episodic
- implicit
- explicit



Non-Declarative and Declarative

Non-declarative

kinds

- perceptual-motor skills, habits, emotional learning, conditioning, habituation, sensitization

properties

- "Reflexive not reflective"
 - expressed as change in behavior not as conscious recollection
- non-vertebrate memory (all they have?)

Declarative

- memory for facts, ideas, and events that can be brought into conscious recollection as a verbal proposition or image

Non-Declarative

non-associative (1 stimulus)

habituation

- developmental studies
 - e.g., visual stimuli, loud noises, etc.
- neural habituation - synaptic plasticity
 - Sherrington (1908) - cat- limb withdraw
 - Spencer & Thompson (1966) - reduction in neurotransmitter

sensitization - painful or noxious stimuli

- ↻ **associative** (two stimuli)
- ↻ classical conditioning (Pavlov)
 - (bell)-(food) -> salivation (UR)
- ↻ operant, instrumental conditioning
 - useful outcomes to behaviors reinforced
- ↻ neural mechanisms - Hebbian learning? LTP, etc....

Declarative

- ↻ multi-store model (Atkinson & Shiffrin, 60's)
- ↻ sensory store
- ↻ short-term (working memory)
- ↻ long-term memory

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graph LR
    A["iconic  
echoic...etc"] --> B["spatial  
verbal  
mathematical  
etc...."]
    B --> C["long-lasting  
robust, facts,  
events, etc."]
  
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Sensory Store

- ↻ **Iconic** -images on the retina persist
 - possibly to fill in during saccades
 - Sperling - cued partial report procedure
 - > 1 4 5 9
 - > 4 2 0 5
 - > 1 3 5 6
- ↻ **Echoic** - sound "images" persist
 - possibly to help with language comprehension

Short-term

- ↻ **capacity limited** (7 + or - 2, Miller, 72)
 - items/chunks
 - 1812177614921984
- ↻ **duration limited**
 - unlimited with rehearsal - phone numbers, etc.
 - limited 20secs. without rehearsal (distracting task)

- ↻ **coding and representation** (Conrad, 64)
- ↻ **assess confusability**
 - visual -> RX and OQ
 - acoustic -> VZ and FS
- ↻ **visual presentation - acoustic errors**
- ↻ **deaf people - visual confusions**

Working Memory- an Update

- ↻ **Baddeley Model**
 - central executive processor
 - phonological loop
 - e.g., number strings
 - visiospatial sketchpad
 - e.g., mental rotation - (Shepherd and Cooper, 72)

Working Memory- Brain

↳ frontal lobes...

- exact organization still in dispute

↳ reasonably local by comparison

Long-term

↳ procedural

- knowledge of how to do things
- little studied by cognitive psychologists

↳ semantic

- memory for meaning, facts, stories
- nearly exclusively studied

↳ episodic

- memory for events in which we participate
- recently studied intensely

Processing

↳ encoding

↳ storage

↳ retrieval

↳ forgetting

Encoding

↳ Factors that affect...

If you are born on an odd number day...

you are in group 1

Else

you are in group 2

Instructions

Take out a piece of paper and number it from 1 to 25.

I would like you to listen to each word and to determine if there is an "e" or a "g" in the word.

If there is, please write down "Y" if there is not, please write down "N".

Instructions

Take out a piece of paper and number it from 1 to 25.

I would like you to listen to each word and to determine if the word represents something pleasant.

If it does, please write down "P" if there is not, please write down "U".

Cap projector....

Lemon	
Sugar	
Apple	
Hammer	
Meadow	
Oven	Cabin
Slipper	Infant
Salad	Arrow
Hotel	Flower
Cottage	Engine
Fireplace	Candy
Barrel	Coffee
Palace	
Butter	
Cellar	

Please write down as many words as you can remember

Encoding

☞ Factors that affect...

☞ elaboration - depth of processing

- deep versus surface (Craik and Lockhart, 72)

Encoding and the Brain

- PET study on depth of processing (Kapur et al. 1994)
- scans during a deep vs. shallow encoding tasks
- left inferior prefrontal cortex activates for deep encoding but not for shallow
- suggestion of hippocampus for novelty processing and for consolidation

mnemonic devices

- method of loci
- image associations
 - Luria - The mind of a mnemonist
 - synesthesia

similarity/distinctiveness

- categorically arranged lists easier
- distinctive items easier

robin	book
crow	dog
mockingbird	cake
pigeon	tree
blue jay	mail
duck	bracelet
cardinal	button
eagle	shoe
penguin	lamp
ostrich	path
hawk	plant
owl	spoon
sparrow	paper
chicken	peach

expertise and meaningfulness

- chess experts
 - real versus random configurations - encoding advantage
- other-race effect for recognizing faces

Short-term into Long-term

Example

- What did you have for lunch yesterday?
- What did you have for lunch 2 days ago?
- What did you have for lunch 3 days ago?
- What did you have for lunch 4 days ago?
- What did you have for lunch 5 days ago?

☞ Some things get in....

☞ Some things don't.....

☞ Consolidation - the process by which short term memories become long term memories.....

☞ consolidation - days, weeks, month, years

- selected memories get consolidated
 - hippocampus - cognitive memories
 - amygdala - emotional memories

☞ long-term memories

- resistant to forgetting

Consolidation

☞ HM - A case study

☞ bicycle accident - age 9

- HM developed intractable epilepsy
- surgery in 1953 - aged 27

☞ bilateral damage to:

- hippocampus and mediotemporal lobes

☞ total impairment of consolidation

☞ two types of memory (Milner's tests)

- tracing stars with mirror
- every day repeated
- every day "new" to HM
- but...he improved!

- learning with no conscious memory

☞ REM Sleep and Consolidation

- long standing hypothesis

- experiment
 - rats replay memories in sleep
 - (Wilson & McNaughton, 94)

Storage

☞ Where?

☞ What?

- working memory - frontal
- semantic
- episodic
- procedural knowledge
- All sorts of mixes....?

Working Memory Storage

Where?

frontal

- neuropsychology - case studies
- neuroimaging
- electrophysiology in primates

organization

- still in dispute

Episodic Memory Storage

Where?

Schacter (1996)

- close to where it is perceived
- visual memories
- tactile and motor memories
- auditory memories
- olfactory memories

Everywhere...

Semantic/Procedural Memory Storage

Where?

- probably same as for events/episodes holds....
- close to where it is encoded...

Convergence zones theory (Damasio)

- no single location for engram of past experience
- memories consist of sensory fragments
- bound together by association
- remembering is a process by which we construct the memory by binding together and reactivating the sensory fragments
- convergence zones start the reactivation

Retrieval

Recognition

- knowing the something is correct
 - e.g., Harrisburg is the capitol of Pennsylvania
- knowing that something is familiar
 - e.g. perceptual stimuli, faces, music, smells

Recall

- interrogating memory to retrieve a fact
 - e.g., What is the capitol of Pennsylvania

How many things can you recognize?

How many things can you recall?

Equally remarkable...

☞ *What you know you don't know!*

- What is the largest shopping mall in Russia?
- What is the name of the president of the Ukraine?

☞ Implication

- memory retrieval is not a massive serial search through a lot of data...

☞ Keys, cues

- access in parallel
- context narrows search?
- context *speeds* activation

Context 1

- ☞ ball
- ☞ pitcher
- ☞ diamond
- ☞ hot dog
- ☞ field
- ☞ bat

Context 2

- ☞ vampire
- ☞ spider
- ☞ witch
- ☞ dracula
- ☞ spooky
- ☞ bat

Mechanistic

☞ parallel access

- more keys make it **faster!**

☞ Implication

- memory retrieval is a parallel process

☞ Metamemory....

- how what we know about what we know determines the strategy for retrieving
 - I know that...
 - I think I know that ...wait...
 - I know I don't know that...

Recall Dichotomy (Moscovitch)

- ↻ associative (effortless)
 - cue -> brings to life
 - Proust
 - hippocampus and mediotemporal areas
- ↻ effortful
 - interrogate your memory
 - what did you do last Thanksgiving?
 - right pre-frontal lobe

Remember or Forget?

It's more complicated.....

Recognition

	happened	did not happen
remember	hits	false alarms
do not remember	miss	correct rejection

Retrieval

Everything in between.....

Forgetting

- ↻ Do we ever forget?
 - Loftus and Loftus 60's
 - A.) Everything learned permanently?
 - B.) Some details permanently lost?
- ↻ most psychologists believed A.)
 - Penfield (50's) temporal lobe stimulation

Forgetting can be good...

- ↻ Luria (20's) Mind of a Mnemonist
- ↻ difficulties
 - forgetting
 - cluttered mind...
 - bombarded with extraneous material

Forgetting can be bad...

☞ Donald Thompson - psychologist

- Interviewed on TV
- Questioned in connection with a rape...
 - Matched the witness description very closely
 - Identified
- iron clad alibi....

- witness had watched the program before the rape
 - source confusion error

Ways to Forget

☞ filling in the gaps....

☞ source confusion error

- imagination
- disregard for reality

☞ confabulation

Filling in the gaps

☞ Script based memory (Shank & Abelson)

☞ Example

- restaurant script
- dentist office script

☞ What do we remember explicitly?

☞ What diverges from the script...

☞ Text comprehension

- Scripts
 - Greet host/hostess
 - Be seated
 - Look at menu
 - Order drinks
 - Get drinks
 - Order meal
 - Get meal
 - Ask for check
 - Pay

SHORT TEST



- candy
- sugar
- sour
- tooth
- heart
- taste
- salt
- snack
- syrup
- eat
- flavor

Was “sweet” on the list?

Imperfections of Memory

- Memory intrusions (Rodieger and McDermott)

Results

- 40% wrote down yes
- 84% of those expressed “high confidence”
- 86% actually remembered seeing it

Source Confusion Errors

- something is recognized familiar
- context or source of the memory confused

Loftus

misinformation

- confuse the incident with interview

imagination inflation

- confuse the incident with imagination of it
- clinical use

filling in the gaps...

- confuse the incident with the script

Implicit versus explicit memory

Explicit - tagged with context...

- e.g., you remember locking the door because the key got stuck...

Implicit - unconscious memory

- a feeling that you “just know”
- “I just know I locked the door!”
- some other evidence of memory that is not consciously retrievable

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Priminga tool for probing implicit memory

Children's memory

- ☞ experiments of S. Ceci
- ☞ Parents supplied data
 - + and - events of 3-6 year old children
 - Stitches - bike falls, trips to amusement park
- ☞ Children asked to think about real and nonreal events
- ☞ Wait 10 weeks and interview

- ☞ Results
 - 50% of children agreed to at least one non-real event!!!!

Example

- ☞ finger caught in mouse trap
- ☞ 4-years old
- ☞ "My brother Collin was trying to get a blowtorch away from me and I wouldn't let him take it so he pushed me into the woodpile where the mousetrap was and then my finger got caught in it...an then my Mommy, Daddy and me and Collin drove to the hospital and the doctor put a bandage on this finger"....(child indicates which finger)
- ☞ Professionals who are trained to work with children could not reliability determine which children were telling true and false stories....

Even when told that the story was incorrect

The children continued to insist it happened

Children and Misleading Info

- ☞ real events
 - "Sam Stone" visited preschool class
 - introduced by the teacher
 - greeted the children
 - told them the book they were reading was one of his favorites
 - left in less than 2 mins

Children and Misleading Info

- ☞ implanting information
 - 4 interviews
 - misleading information presented
 - When Sam Stone got the bear dirty- what kind of stuff did he get on the bear?
 - When Sam ripped the book, was it because he was angry or was it by accident?

☞ results

- final interview with a new-comer
 - 72% of children agreed that Sam had committed at least one of the misdeeds
 - 44% claimed they actually saw him do it

☞ adult experts

- researchers
- law enforcement officials
- therapists

☞ viewed videotapes of the children

- at chance in discriminating the true/false tales
- and yet...
- were all completely confident that they were able to do so!

Discussion questions: Loftus

☞ What percentage of your childhood memory do you think is accurate

☞ Give some examples of the misinformation effect in daily life?

☞ Do you think we actually forget things?

☞ Do you believe in repressed memories?

☞ Do you believe in recovered memories?