DISCLOSURES

No income or benefit from pharma
Partner/Author: Brain Educators LLC
braineducators.com
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neuropsychiatry pocket reference
Simonides

566-468 BCE
What if we had PERFECT recall?
THE HUMAN BRAIN CAN THEORETICALLY HOLD
THE EQUIVALENT OF 2.5 PETABYTES OF DATA

How much is a petabyte?

1 Byte=True/False

1 Kilobyte=1 word

1 Megabyte=500 pg book or
1 min of MP3 audio

1 Gigabyte=20 min video
(4.7 gigabytes=DVD)

1 Terabyte=60 stacks of paper
the height of the Eiffel Tower
or 200,000 photos or songs

1 Petabyte=1000 terabytes or
1 million gigabytes

2.5 Petabytes could store
about 300 years of standard
def TV

or 25% of the US Library of
Congress' entire print and
media collections

Paul Reber Sci Amer 4/19/10
Memory Palaces: Castles in the Air

On mnemonic devices:
Of ostentation prodigious, but fundamentally barren.
...matters of strangeness without worthiness.

Sir Francis Bacon
1561-1626
PERFECT recall may not be so perfect

Funes the Memorious

Perfect recall since a brain injury at 19. He was bothered that a dog at 3:14 seen from the side would have the same name as a dog at 3:15 seen from the front.

Tortured by his memory, the fictional Funes could barely sleep.

If we remembered everything, we should on most occasions be as ill off as if we remembered nothing.”
Wm James

Jorge Luis Borges
Prodigious memory or pattern recognition usually comes at a social cost

A calendar savant with social deficits. Could remember details of 12,000 books he'd read. Inspired the character Raymond in the Rain Man. Not autistic. His hemispheres were disconnected due to FG Syndrome.

Kim Peek
1951-2009

Solomon Shereshevsky
1886-1958

a journalist called on carpet for not taking notes at an important meeting

SYNESTHESIA, NORMAL IQ
METAPHOR A MYSTERY TO HIM
Why are some memories so powerful?
EMOTIONAL VALENCE
Emotional (limbic) valence aids memory

Flashbulb memory of traumatic events
Stores so much data that time can appear to slow down

The brain stores the data AND the emotional importance (valence)

Common Flashbulb Memory: 9/11

Without emotional valence we are not changed by our memories
The Capgras Delusion

A family member has been replaced by an imposter.

The face is the same but there is no emotional connection (no emotional valence) so the person doesn't feel familiar.

Without emotional valence memories don't feel familiar.
What if we had NO ability to remember?

HM

Can this degree of amnesia occur without the help of a surgeon?
WHY DO SOME AMNESICS SPIN TALL TALES TO FILL IN THE GAPS?

Confabulation (honest lying) may require orbitofrontal damage

This causes loss of self monitoring
How do we remember?

A thought is put in working memory

The hippocampus consolidates it, puts it somewhere and keeps a map of where it went

Long term memories may be stored in temporal association cortex

THAT'S HOW DECLARATIVE MEMORY MAY WORK
But HM could learn new motor skills without his hippocampus.

Long term PROCEDURAL (motor) MEMORY is different.

Your basal ganglia learn how to ride a bicycle.

And store this kind of learning in your cerebellum.
AUTOBIOGRAPHICAL MEMORY IS DIFFERENT THAN MEMORY FOR FACTS

Episodic (autobiographical) memories are stronger due to emotional valence

The memory of relationships is more autobiographical than factual

AJ has incredible autobiographical memory but her memory is only average for other things

Parker et al, Neurocase 2006
MEMORIES CHANGE NEURONS

Experience may be encoded in memory by LONG TERM POTENTIATION

The more neuron A stimulates neuron B, the more efficient neuron B becomes

Neuron B can become sensitized for many years, thought to be the basis of long term memory

Eric Kandel demonstrated dendritic spine growth with learned behavior in aplysia
MEMORY CAN CHANGE OUR BRAINS

THE KNOWLEDGE

Every street within 6 miles of Charring Cross

25000 streets
20000 landmarks

Posterior hippocampus grows in those who pass The Knowledge & shrinks to normal when they retire (not in bus drivers or mnemonists)

Woolett & Maguire Current Biol 21 (2011) 2109
REMEMBERING CAN BE PAINFUL

Trauma memory can be intense & long-lasting

Memory may be inaccurate but feel true: FALSE MEMORY SYNDROME

Recall reconsolidates (and changes) a memory

Don't believe everything you think  (Gabbard)
FEAR MEMORY CAN BE MANIPULATED

Memories can be implanted
Loftus E Sci Amer 277 (1997) 70

Emotional Valence can be changed in an Optogenetic Mouse Model

HC dentate neurons encode memory
BLAmyg neurons encode valence (fear vs reward)
Mice habituated to positive or negative valence memories could have valence switched!

NOT REMEMBERING CAN BE PAINFUL

But HM did not appear pained by his amnesia

Amnesia after traumatic brain injury is typically painful

And word finding issues of normal aging drive us to distraction
THE FEELING OF FAMILIARITY (emotional valence) MAY BE ALL THAT REMAINS

Eventually the not remembering no longer seems to be painful to the person with Alzheimer Disease

Photo: Alex ten Napel
Huff Post 10/2014
AGING-RELATED MEMORY LOSS MAY BE REVERSIBLE

CREB overexpression in dorsal CA1 ameliorates long-term memory deficits in aged rats

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1/4/2017

Abstract The molecular mechanisms underlying age-related cognitive deficits are not yet fully
MEMORY CAN BE THERAPEUTIC

We judge ourselves by comparison with remembered figures

Memory can help us through hard times

Our collective memory can help us NOT repeat the past

Many psychotherapies utilize memory as a therapeutic tool

Mechanism: ? reconsolidation
BUT DON'T UNDERESTIMATE THE VALUE OF FORGETTING

Does the internet prevent us from reinventing ourselves?

Is Jean Valjean entitled to rehabilitation?

ONE DOES NOT SIMPLY

“TAKE IT OFF GOOGLE”
IS MEMORY BECOMING VESTIGIAL?

iPhone 10
The tallest iPhone yet.

Dropbox
All your photos, videos, and docs anywhere.

Google Glass
SUMMARY

WE ARE DEFINED BY OUR MEMORIES
WISH FOR A GOOD BUT NOT A PERFECT MEMORY

MEMORY HELPS US ENDURE DIFFICULT TIMES
MEMORY RECONSOLIDATION MAY BE HOW SOME PSYCHOTHERAPIES WORK

MEMORY CHANGES OUR BRAINS
EMOTIONAL CONNECTION EMBEDS A MEMORY MOST FIRMLY
Forgetting to Remember
Remembering to Forget

Sheldon Benjamin
THANK YOU

A trip down memory lane