Multi-Associative Encoding Strategies for Enhancing Long Term Memory

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Forgetfulness
BY BILLY COLLINS

The name of the author is the first to go
followed obediently by the title, the plot,
the heartbreaking conclusion, the entire novel
which suddenly becomes one you have never read, never
even heard of,

as if, one by one, the memories you used to harbor
decided to retire to the southern hemisphere of the brain,
to a little fishing village where there are no phones.

Long ago you kissed the names of the nine muses goodbye
and watched the quadratic equation pack its bag,
and even now as you memorize the order of the planets,

something else is slipping away, a state flower perhaps,
the address of an uncle, the capital of Paraguay.

Whatever it is you are struggling to remember,
it is not poised on the tip of your tongue
or even lurking in some obscure corner of your spleen.

It has floated away down a dark mythological river
whose name begins with an L as far as you can recall

on your own way to oblivion where you will join those
who have even forgotten how to swim and how to ride a
bicycle.

No wonder you rise in the middle of the night
to look up the date of a famous battle in a book on war.
No wonder the moon in the window seems to have drifted
out of a love poem that you used to know by heart (Collins,
1999).

It has been estimated that it takes about 10 years and 100,000 units of knowledge in a field to achieve expert status (Ericcson, 1996). The accrual alone of that much knowledge is admirable but the retention of it has to be nothing short of amazing. The age-old struggle of connecting short term and long term memory is very real but the question must be asked: is true learning all that complex?

The Adaptive Character of Thought theory proposed by John R. Anderson in the early 1990's proposes that literacy - at least foundationally - is, in fact, much simpler. According to the ACT (which should not be confused with other similar acronyms, i.e. American College Test, Arms Control Today magazine, Acoustical Ceiling Tile, Alliance for Cannabis Therapeutics), intelligence is simply the "accrual and tuning" of small units of knowledge that combine to produce complex cognition (Anderson, 1983).

In short, the brain is like a network. When a semantic unit of information or fact is considered, a copy of it goes into your working memory. The gist of an actual episodic experience, called a *trace,* is then created which plans a route into your long term memory. This intended "synthesis" into long term memory takes place *as long as* there is a recurrent connection between the new knowledge and a previous "node" of understanding. Information can stay in working memory as long as it is being revisited. The trace, however, is a function of time and will start to decay with inattention. Beyond a certain point, if a fact has not established a connection to your long term memory it slips below a certain threshold and will be irretrievable, i.e. forgotten (Anderson, 1996).

The Destruction of the Box

A better metaphor for this can be found in the world of engineering. Frank Lloyd Wright, the famed archictect, once spoke of the "destruction of the box." Wright believed the traditional box house was a Fascist symbol.

Architecture of freedom, he declared, needs something better. The result was a transformation of the Victorian living room into a free-flowing space, devoid of corners, each room overlapping into the next (Brooks, 1981). Wright's idea of interconnectedness, though by no means a modern concept, transformed the house into a unified network, each room refreshingly connected to another by way of overlapping connections. Now let's try this with a proposition.

What were the only other U.S. states prior to Alaska and Hawaii to achieve statehood in the twentieth century?

Even if given the answer, chances are a year, a month, a week from now it would be gone. Why? Because a singular fact is simply a proposition in a box. Now what if it could be given multiple associations? What if its corners could be lopped off and a novel connection made to it that would increase the trace avenues necessary to guide it into long term memory? New Mexico, Arizona, and Oklahoma is the answer. The abbreviations are NM, A & O, which can be rearranged from NMAO into MONA as in the Mona Lisa.

Now some would say this is simply a mnemonic device for learning isolated trivia (It should be stated here that "trivial," meaning "of little importance," should not be confused with "trivia" - from the Latin "tri-" and "via," meaning three streets or "crossroads"). According to the ACT model, a process called *spreading activation* is responsible for retrieval of stored long-term knowledge. The proposition that New Mexico, Arizona, and Oklahoma were the three states prior to Alaska and Hawaii to achieve statehood becomes

activated in your working memory and seeks a connection with *any other* activated areas in your long term memory. Connecting it with the Mona Lisa may seem unrelated but as long as the Mona Lisa is a part of your declarative knowledge base the connection has been made!

The String Game

Now let's take the multi-associative encoding one step further. The String Game is a fun way to exponentially add to your declarative knowledge base based on the principle just described. The further you go in the string the more connections you make between the information you are encoding and your accumulating store of declarative knowledge.

We'll continue with the Mona Lisa

We now want to make a connection to the Mona Lisa by discovering something about her that we previously did not know (Wikipedia can be a great resource for this game, it's easy to use and can provide quick access to anywhere the string might lead).

We seek out a few quick facts such as she was painted by Leonardo da Vinci, she's Italian, she has no eyebrows, she was once stolen, etc. For pictures, though, let's try to find something

visually unique. After scanning the portrait for a few extra moments we find there's one man-made object in the picture - a bridge over her left shoulder! The fact is novel and easy to remember. We also know bridge is the name of a card game. A-ha! So we choose "bridge" as the next stop on our string.

BRIDGE

From a wikipedia search of the card game "bridge" we learn that bidding and taking all 13 tricks is called a "GRAND SLAM," which is also a baseball and tennis term! The tennis connotation is a little lesser known so we will use "GRAND SLAM in tennis" as our next stop (It's important to choose words that will lead to information that has not yet been encoded. This enlarges the overall network of knowledge available for activation. The tendency will be to quickly make associations using only prior knowledge. Novelty, however, is the key. It is what makes the game fun and is necessary to sustain the process.)

Of the 4 Grand Slam events in tennis, we see that only one is not an "Open" - Wimbledon! We're familiar with the term but don't know a lot about it so it's a good choice for our next stop.

But first, let's review...
When we think of the MONA LISA we see a bridge over her left shoulder...
We are reminded of BRIDGE the card game which we have learned is associated with a grand slam (taking all 13 tricks)...
The GRAND SLAM in tennis is made up of 4 events - the U.S., Australian & French Opens and Wimbledon....
WIMBLEDON is the only non-Open in the Grand Slam and is located in ???...

Ah yes, another -DON...LONDON! London becomes our next stop.

From LONDON we can remember the city's airport - Heathrow - as in throwing heath - a flower - on the tennis court.
Thanks to a quick search, we find that HEATH is an actor as well as a candy bar (you could go those ways if you wanted to) or the state flower of Victoria, the smallest state in Australia. We choose VICTORIA which reminds us of Queen Victoria...

At this point, the best way to proceed is by making a chart or a table listing the starting word, a fact that you consider novel and therefore unforgettable, and a new word derived from that fact.
We would continue our Mona Lisa string up to 30 places in the following way...

Mona Lisa	the structure located above her left shoulder	
Bridge	the card game, taking all 13 tricks	
Grand Slam	In tennis, the only event that's not an "Open"	
Wimbledon	Located in another – don…London	
London	Heathrow airport (throw flowers on the court)	
Heath	State flower of Australia's smallest state	

Victoria	What color Queen Victoria wore	
White	Where Queen Victoria died	
Isle of Wight	Who else lived there, extend white to whiTEN	
Tennyson	White light, wrote Charge of the Light Brigade	
Light Brigade	fought in the Crimean War	
Crimean	Visually extends to CrimeanDPUNISHMENT	
Crime&Punishment	Classic by Russian author	
Dostoevsky	Good Scrabble name, letters add up to 21	
21	Card game, another name for black jack	
Black Jack	Read backwards becomes an actor	
Jack Black	Black sky, Mom worked on Hubble telescope	
Hubble	only planet Hubble can't photograph (glare)	
Mercury	Abbreviation on the periodic table	
Hg	First name of science fiction writer	
Hg Wells	Had a moon crater named after him	
Crater	Name of America's deepest lake	
Crater Lake	Located in this state	
Oregon	Famous name of settler's path	
Oregon Trail	Food item that got wasted most (in the tons)	
Bacon	A man of science	
Sir Francis Bacon	Died when snow didn't sanitize a bird he ate	
Snowbird	Northerners who flock to Florida in RVs	
Winnebago	Prefix sounds like a Canadian city	
Winnipeg	Home to world's longest skating rink	

Continuing on, a skate is also a fish, the eggs of which are called a mermaid's purse. Once again, the novelty of each connection along the string is what strengthens the trace connections from each informational unit into your long term memory.

It's important to remember that you don't have to operate *within* the string to encode information using the multi-associative approach. If I want my students to remember Nathan Hale said "Give me liberty or give me death," I must simply buttress the proposition using novel connections. A fictitious story of a hail storm in Philadelphia causing the liberty bell to fall resulting in the death of a visiting tourist – Hail, Liberty, and Death – and voila the connection has been made!

With accrual, though, comes the age-old question of what to learn and how best to learn it. Learning is in essence a language, the effective communication of which depends on a shared background knowledge and the ability to retrieve it when necessary. It has been said that eighty percent of all cultural literacy is over 100 years old (Hirsch, 2002). In order to retrieve information efficiently it must be stored in numerous places and accessed by way of its connections – or crossroads – to other knowledge.

Examples of creative association

The trick is making *novel* connections. Unlike purely semantic or unrelated information, we perceive novelties much the same way we do real experiences. This is because novelty must first pass through our taste or preference filter. When we consider something unique it is reflective of who we are. The strength of creative traces are more personal and therefore much stronger than those forged by purely trivial information. Creative connections are endless but the following are the most easily adopted.

Alpha-numeric –

What year did President Calvin Coolidge die?

A=1, B=2, C = 3...Z=26, A=27…
Calvin Coolidge = CC = 33…1933!

Typographic -

A second approach akin to alpha-numeric is linking letters with pictures. This approach is known to artists as typography. A common internet search will confirm that this is a very under-explored concept. An example of typography as an encoding device for a Civil War fact is

(In American English "86" is a verb meaning to "get rid of" or "nix")

We can also see the number

1 in TOKYO…

Tokyo is number 1 among world cities in population.

The graphic arts can be employed to produce an effect reminiscent of some of e.e. cummings' poetry. In the example below, Yellow Crane Tower is one of

China's most recognizable pagodas.

Pictographic

Perhaps even a simpler method is through the use of what I call picformation. Anderson says the informational unit is limited in the number of elements or associations it can contain, specifically five (Anderson, 1983). Why not take advantage of this capability then to embed as much content as possible in the singular unit?

The fact that Brazil is the leading producer of coffee in the world is piggybacked with the national flag.

The proposition is that it will take just as much memory to remember the two pieces of information as it will the one.

Spatial

Sometimes visualizing a unit of information spatially is the only way to synthesize it outside of sheer rote learning.

					8
	9			11	10
					1
7	6	2	4	5	
					3

Touch the letters from 1-11 in order a few times until you feel confident you can remember the pattern spatially. Now add a general knowledge of U.S. geography and congratulations! You've just learned not only the states of the Confederacy during the Civil War but also the order in which they seceded! Here, try it again…

The Confederacy was made up of South Carolina, Mississippi, Florida, Alabama, Georgia, Louisiana, Texas, Virginia, Arkansas, North Carolina, and Tennessee.

Conclusion

Henry Melvill is credited with saying "our lives are connected by a thousand invisible threads" (Gould & Hessenmueller, 1904). The prospect of increasing learning retention through recurrent cultural literacy and, more importantly, multi-associative encoding is exciting and fairly easy to employ.

The power of such strategies lies in their novelty to us which activates our personal interests and tastes, insuring that the content being encoded will be revisited (almost nostalgically) until the information becomes synthesized into long-term memory. Creativity is crucial to sustaining the novelty of the process though, but many of these approaches - alpha-numeric, typographic, pictographic, spatial – are simply twists on everyday thinking skills.

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