Thanks for the Memories

By Peter M. Mellette

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After graduating from Dartmouth College with a degree in policy studies, Peter continued his interest in health care policy through work as a Washington D.C. consultant and during that time, met his wife of 36 years, Kerry Crowley Mellette. They have two daughters.

After attending law school at the University of Richmond, Peter focused his law practice on representing health care providers. Peter has had two cases in his career go to the U.S. Supreme Court and both successfully resolved in the clients' favor. After working in Richmond for 20 years, Peter relocated his practice to Williamsburg.

Peter participates in a variety of community and bar activities, including past service as chairman of the Virginia State Bar Clients' Protection Fund Board, Hospice House and Support Care of Williamsburg, Literacy for Life and the Rotary Club of Williamsburg.

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Introduction: What Do Bob Hope Songs, Christmas and 9/11 Have in Common?

How many of you remember the Bob Hope theme song, "Thanks for the Memories"? Did the title trigger a particular memory of a time and place when you heard the song? Do you remember who you were with when you heard it? When we recall a memory, we have the ability to reexperience an event. We can remember what we were doing, who was with us, how we felt, and the smells and tastes associated with the event. Each of these experiences can be recorded and recalled as if we were still in the time and place of the event.

The December holidays, for example, trigger a flood of strong memories and emotions tied to particular events, smells, and experiences. And it's not just the fruitcake or another unwanted gift that keeps being passed around. Frequently family member reactions to each other are based on events that occurred years earlier. I've often wondered what I can do to help certain family members get beyond those insults from thirty years earlier that they continue to live out today.

Certain collective memories are so vivid that they seem to have occurred only yesterday. You remember specific details and feelings and even what was said. This is particularly true of "flashbulb memories," connected to specific life events or historical moments such as the Japanese attack on Pearl Harbor, John F. Kennedy's assassination, the Challenger explosion, or 9/11. What is it about these memories and how they are imprinted in our brains that is so significant? And are our recollections of such life events accurate?

To answer those questions, I will draw both upon depictions of memory in literature and film and upon recent neuroscientific findings. But first, let me share with you how I became interested in the topic.

Memory in Literature

I've always been curious about how the brain works. It represents one of the last frontiers of knowledge that we still do not understand. And part of the mystery comes from having to use a brain to study the brain. As the physicists a century ago realized, it is difficult to study a subject where the study itself alters the result.

When I was a senior in high school, my ambitious English teacher insisted that we read lots of interesting books. James Joyce's

Ulysses, which attempts to capture the stream of consciousness within the human mind, was one. Over the course of several hundred pages, Joyce took us on a one-day journey through Dublin and through the mind of Leopold Bloom, showcasing the scattered thought patterns and *non sequiturs* (like the love of certain sausages) emanating from Bloom's mind and body over the course of "Bloomsday."

My high school English class also covered Marcel Proust's seven volume epic, *Á la Recherche de Temps Perdu*, known in English as "Remembrance of Things Past" or "In Search of Lost Time." Proust's epic follows a lifetime process of remembrance. In its famous opening passage, the narrator describes how the taste of a particular tea with a particular pastry, a madeleine, suddenly transported him back to his childhood. Other tastes, smells, and sensations similarly prompt Proust to recall other episodes of his life in French society as vividly as though he were re-living them.

Joyce's and Proust's classics share a preoccupation with the human brain, reflecting different aspects of how the mind and memory work. For instance, Proust's childhood fears of dreaming (a focus of the first volume) perhaps unwittingly anticipate a conclusion of subsequent scientists—that the method by which the brain sorts information for long-term retrieval probably occurs during the dreaming process.

A review of what brain science has uncovered over the last decade about information collection and storage will prepare us for a closer look at Joyce's representation of the stream of consciousness and at Proust's process of recollection.

The Science of Memory

Dr. Michio Kaku, a professor of theoretical physics at City University of New York, wrote in his 2014 book *The Future of the Mind* about advances in neuroscience that reveal how memories are formed, stored, and then recalled. Various sensory images and data enter the brain through the brain stem and then go to the thalamus, from the thalamus to various lobes of the brain, and then on to the prefrontal cortex, where those data are retained as short-term memory for a period of minutes or hours (104-05).

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Kaku describes the sheer volume of unprocessed information that goes into forming short-term memory by considering in detail one source: vision. He notes that there are 130 million cells in the eye's retina, the cones and the rods. These organelles process and record 100 million bits of information from the surrounding landscape at any one time. These data are then sent at a rate of 9 million bits per second along the optic nerve to the thalamus. The thalamus then transmits the information, via neurons within the brain, to the occipital lobe. The visual cortex in the occipital lobe then analyzes the data in at least eight separate areas for color, motion, distance, and shape. Finally, the information is passed along to the prefrontal cortex, where you "see" the image and form a short-term memory.

Similar processes are occurring for other senses, which transmit information through the thalamus and through appropriate areas of the brain to the prefrontal cortex. Information is transmitted through the olfactory cortex for smells, the auditory cortex for sounds, the sensory or motor cortex for various other senses, and the amygdala for emotions. Each of these senses and responses to sensory stimuli require billions of neurons firing in sequence, transmitting millions of bits of information per second. Joyce's Leopold Bloom captured the stream of those impulses in his thoughts as best as the early 20th century understanding allowed.

The brain then transmits information used to create longer-term memories from the prefrontal cortex to the hippocampus. The hippocampus breaks information down into categories, associated by tags, and sends it on to those areas of the brain, or cortices, where the information is retained—emotions in the amygdala, words in the temporal lobe, colors in the occipital lobe, and touch and movement in the parietal lobe.

The hippocampus is a remarkable part of the memory puzzle. According to a 2015 study published in *Nature* by University College London researcher Aidan Horner and others, the hippocampus apparently binds together the events and sensations of a memory through encoding each piece, so it can be triggered again as part of episodic recollection. All the constituent elements of an event, known as "pattern completion," are triggered when one part of the long-term memory is triggered. Through pattern completion, we have the ability to re-immerse ourselves in the experience, just as Proust did when mixing the tea and madeleines together.

Proust spent most of his life in a cork-lined room trying to capture his memories of disparate social interactions and overreactions, putting them into context. A hundred years ago, Proust did not have available today's modern technology, including the imaging technology used by scientists as a tool for connecting cause and effect. The Horner study used fMRI technology to identify areas of brain activity as they are triggered. That technology is capable of showing how activity in the hippocampus triggers the activation of each of the brain regions where the experience is stored. What's more, the same technology is able to show how our memories are recalled and become the source of dreams. The same areas of the brain that are triggered when we remember a past event are also reactivated when we dream or plan for a similar future event. The fMRI scans of subjects given specific tasks show a similar connection, or pattern completion.

Flashbulb Memory and Memory Dilution

Certain memories are stronger than others in taking you back in time to the day of the event. The smell or taste of the tea and madeleines affected Proust so strongly because it was so singularly connected to a certain time and place. We all have our own particularly powerful memory associations. These can be pleasant memories of a Thanksgiving meal with family, a Christmas around the tree singing carols—or memories of trauma, stress, and heartache. As Christopher Bergland wrote several years ago in *Psychology Today*, something about the way those memories are encoded remains vivid, particularly if they are not recalled frequently.

Bergland and other psychologists have found that a frequently recalled memory becomes less powerful as it is recalled. Through the recollection process, we probably are weaving new memories into the old, diluting the associations between a specific event and what is now a series of similar events. Memory dilution explains how two people witnessing the same event may recall different facts. The process of memory dilution can also be therapeutic, particularly helpful in dealing with traumatic events and treating PTSD.

Our common experience of the events of September 11, 2001 shows how the memory dilution process may occur. Most of us remember where we were and what we were doing when we first learned of the plane flying into the first of the World Trade Center towers. We may remember specifics about the rest of the day and events from the days that followed. But if you remember seeing a plane fly into the first tower on the morning of September 11, your mind has tricked you. A great many of us saw the footage of the plane flying into the second tower on the morning of September 11, but the footage of the attack on the first tower did not become available until September 12.

Our brains alter our recollection of events like 9/11 to fill in the gaps, providing new memories of what happened and diluting the associations connecting long-term memory with what we learned on the day of the event. Biologically, such unconscious amendments to our memories help us cope with our experiences and better defend ourselves in the future. To paraphrase Edmund Burke, George Santayana, and President Truman, "Those who do not learn from history are destined to repeat it," and this bit of wisdom applies to memories as well. If we do not gain knowledge from our own experience, we do not anticipate the new challenges necessary to advance as an individual or as a species. Our brains have evolved to incorporate such information seamlessly.

According to Daniel J. Levitin, in *The Organized Mind: Thinking Straight in the Age of Information*

Overload, "the human need to organize our lives, our environment, even our thoughts, remains strong. This need isn't simply learned, it is a biological imperative […]" (xviii). Our ability to anticipate new situations and react to them is part of the benefit of memory and dreams.

Since modern science suggests that dreams come from the same parts of the brain that process and store our long-term memories, maybe Shakespeare came closer than Joyce or Proust to getting it right about memories. Shakespeare gave the wizard Prospero a statement that I continue to find as intriguing as I did when a youth, even when I heard it repeatedly as part of high school play rehearsals of *The Tempest*: "We are of such stuff / As dreams are made on, and our little life / Is rounded with sleep" (IV.i.150-52). Despite living 400 years ago, before our modern understanding of brain function, Shakespeare seemingly identified the role of dreams in making us who we are and in processing our days' events.

Memory Overload and Failure

Think about all of the stimuli in the environment that creates those millions of bits of memory during waking hours. We spend a quarter to a third of the typical life processing those bits through sleep. Even with our modern experience of computers, it is amazing what our brains are able to receive, interpret, and process into memories. It is also amazing that our brains are able to access those memories so seamlessly and so vividly. We increasingly depend upon such access in our fast-paced world.

Levitin notes that "our brains are busier than ever before. We're assaulted with facts, pseudo facts, jibber-jabber, and rumor, all posing as information. […] We don't tend to have general memory failures; we have specific, temporary memory failures for one or two things" (xx). Said another way, we don't usually lose our mind, just our car keys.

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Any discussion of memory failures is incomplete without addressing memory loss and various forms of dementia. There is no cure for Alzheimer's disease or other forms of dementia—yet. Based on studies within the last five years, Alzheimer's appears to occur through the loss of function or the destruction of the neural circuits that carry information through the brain via electronic impulse. The aging of the brain tissue is the most common risk factor, but what is the cause-effect relationship? The most notable feature besides the neural atrophy are the plaques of beta amyloid which surround the damaged neurons.

A second observation about Alzheimer's involves the complex role of innate, non-neuronal brain cells known as glia cells. In a healthy brain, the glia which surround the neurons typically have a protective influence, creating the myelin protein that facilitates impulse transmission. Astrocytes, another form of glia, appear to regulate the neural synapses and release neurotransmitters into the brain environment. In normal brains, these actions help communicate information and may aid in the storage and triggering of memories.

In Alzheimer's, however, the microglia appear to respond to the plaque but, due to chronic inflammation, do not remove the plaque quickly enough. Instead, the glia release neurotoxins and oxidizing agents which cause more inflammation and damage. In other words, the protective glial cells that normally work with neurons appear to work *against* the neurons in Alzheimer's patients.

If recent studies are validated, Alzheimer's is potentially caused by an immune response leading to disrupted cell function. One recent study links the presence of the keystone pathogen in chronic periodontitis to Alzheimer's. Part of the treatment may be to use antibiotics and inhibitors targeting proteases created by *Porphyromonas gingivalis* to reduce neuroinflammation and plaque formation.

Solutions for Memory Loss

Alzheimer's and other dementias destroy brain tissue. Therapies may reduce or even reverse damage. In addition to future treatments for Alzheimer's and other dementias, we may be able to enhance memory by borrowing the concept of shared memory from computer science.

Modern science is approaching the point of mimicking the memory process. Recent studies have captured the brain activity generated by certain experiments in mice where the knowledge in the form of electronic impulses has been shared with other mice. Potentially this would allow us to capture the memories of individuals we care about and preserve or share them with others. Other experiments funded by the US Department of Defense on humans have used charges through implanted electrodes to enhance memory in brains impaired by traumatic injury. The same study suggests it has the opposite effect on a well-functioning brain.

If legal and ethical hurdles could be addressed, we might even develop the future technology described in movies like *The Matrix* or *Brainstorm*, where information can be uploaded through a port into the brain or a helmet with electrodes. With specific reference to the heart attack triggered by shared information in *Brainstorm*, Dr. Kaku notes the risks of encoding the same thoughts and emotions into a different person (112). He also notes the risks of creating false memories in people, like those the Schwarzenegger character experienced in the movie *Total Recall*. In pondering that eventuality, one need only think about the "alternative facts" of the last few years and how they might become someone's reality if safeguards are not in place.

Final Thoughts

I've often thought how useful a photographic memory would be. Presumably I wouldn't miss anything or have to do or read something over again. If our understanding of memory and the process of recollection improves, I might invest in improving my own memory and maybe even consider acquiring someone else's memories. No one—not even the idiot savant, nor others with photographic memories, nor those using memory tricks—has total recall or the answers to all of life's questions. As my paper suggests, the best answer for why memory is important is that, like our appreciation of the lessons of history and good literature, it keeps us from making the same mistake twice.

Joshua Foer, in *Moonwalking with Einstein: The Art and Science of Remembering Everything*, wrote about his experiences becoming the USA Memory Champion. After a year of becoming proficient with the Memory Championship tasks and still losing his car keys, Foer asks, "why bother investing in one's memory in an age of externalized memories? The best answer I can give is the one that I received unwittingly from [my experiences in meeting a brain damaged individual], whose memory had been so completely lost that he could not place himself in time or space, or relative to other people" (269).

> How we perceive the world and how we act in it are products of how and what we remember. We're all just a bundle of habits shaped by our memories. And to the extent that we control our lives, we do so by gradually altering those habits, which is to say the networks of our memory. […] Our ability to find humor in the world, to make connections between previously unconnected notions, to create new ideas, to share in a common culture: All these essentially human acts depend on memory. […] Our memories make us who we are. They are the seat of our values and source of our character. (269-70)

So…thanks to the memories for making us who we are. And thanks for all the writers, historians, scientists and artists who have explored the inner workings of the mind looking for answers, only to find that the brain functions that create memories are the essence of what makes us human and helps us evolve as a species.

WORKS CITED

Bergland, Christopher. "How Does the Brain Remember the Places of Your Past?" *The Athlete's Way*, Nov. 30, 2013. *Psychology Today*. https://www.psychologytoday.com/us/blog/the-athletes-way/201311/how-does-the-brain-remember-the-places-your-past Downloaded 10/23/2017.

---. "Why Do the Songs from Your Past Evoke Such Vivid Memories?" *The Athlete's Way*, (Dec. 11, 2013. *Psychology Today* https://www.psychologytoday.com/us/blog/the-athletes-way/201312/why-do-the-songs-your-past-evoke-such-vivid-memories

Downloaded 10/23/2017.
Carey, Benedict. "'Pacemaker' for the Brain Can Help Memory, Study Finds." *NY Times*, April 20, 2017). https://www.nytimes.com/2017/04/20/health/brain-memory-dementia-epilepsy-treatments.html
Ezzyat, Youssef, et al. "Direct Brain Stimulation Modulates Encoding States and Memory Performance in Humans." *Cell* abstract, (April 21, 2017), www.cell.com/current-biology/pdf/S0960-9822(17)30326-3.pdf
Fields, R. Douglas. *The Other Brain*. New York: Simon & Schuster, 2010.
Foer, Joshua. *Moonwalking with Einstein: The Art and Science of Remembering Everything*. London: Penguin Books, 2011.
Joyce, James. *Ulysses*. New York: Random House, 1922.
Kaku, Michio. *The Future of the Mind: The Scientific Quest to Understand, Enhance and Empower the Mind*. New York: Random House, 2014.
Kragel, James E., et al. "Neural Activity in the Medial Temporal Lobe Reveals the Fidelity of Mental Time Travel." *The Journal of Neuroscience* Vol. 35, No.7 (February 18, 2015), 2914-2926.
Horner, Aidan J., et al. "Evidence for holistic episodic recollection via hippocampal pattern completion." *Nature Communications* Vol. 6, No. 7462 (2015), https://www.nature.com/articles/ncomms8462.
Levitin, Daniel J. *The Organized Mind: Thinking Straight in the Age of Information Overload*. New York: Penguin Random House, 2014.
Miller, Greg. "How Our Brains Make Memories." *Smithsonian.com* (May 2010) https://www.smithsonianmag.com/science-nature/how-our-brains-make-memories-14466850/
Proust, Marcel. *Swann's Way*. Christopher Prendergast, tr. New York: Random House, 2004.
Pusey, Allen, "Ulysses Goes on Trial", *ABA Journal* 72 (November 2017)
Schacter, Daniel L. and Addis, Donna R. "The cognitive neuroscience of constructive memory: remembering the past and imagining the future." *Philosophical Transactions of the Royal Society of Biological Sciences* Vol. 362, No. 1481 (May 29, 2017), 773-86. http://rstb.royalsocietypublishing.org/content/362/1481/773
Shen, Helen. "Portrait of a Memory." *Nature* Vol. 553, Nos. 146-148 (Jan. 11, 2018)
Taylor, Benjamin. *Proust: The Search*. New Haven: Yale University Press, 2015.
Wright, William A., ed. *The Complete Works of William Shakespeare*. (The Tempest, Act. IV, scene 1, lines 150-152) New York: Garden City Publishing Co., 1936. 1319.

Torch Clubs Online

In addition to the great resource IATC provides at Torch.org, many clubs have their own websites, where you can get timely information about upcoming events and more.

Albany, NY	albanytorchclub.org
Central PA	acuri.net/torchclub
Chambersburg, PA	aliveinthevalley.org/default-1.html
Durham-Chapel Hill, NC	durhamchapelhilltorch.org
Erie, PA	erietorchclub.com
Fox Valley, WI	torchfoxvalley.org
Frederick, MD	fredtorch.org/home.html
Hagerstown, MD	hagertorch.org
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