

THE MAN WHO FORGOT EVERYTHING

By Steven Shapin October 14, 2013

In the movie “Groundhog Day,” the TV weatherman Phil Connors finds himself living the same day again and again. This has its advantages, as he has hundreds of chances to get things right. He can learn to speak French, to sculpt ice, to play jazz piano, and to become the kind of person with whom his beautiful colleague Rita might fall in love. But it’s a torment, too. An awful solitude flows from the fact that he’s the only one in Punxsutawney, Pennsylvania, who knows that something has gone terribly wrong with time. Nobody else seems to have any memory of all the previous iterations of the day. What is a new day for Rita is another of the same for Phil. Their realities are different—what passes between them in Phil’s world leaves no trace in hers—as are their senses of selfhood: Phil knows Rita as she cannot know him, because he knows her day after day after day, while she knows him only today. Time, reality, and identity are each curated by memory, but Phil’s and Rita’s memories work differently. From Phil’s point of view, she, and everyone else in Punxsutawney, is suffering from amnesia.

Amnesia comes in distinct varieties. In “retrograde amnesia,” a movie staple, victims are unable to retrieve some or all of their past knowledge—Who am I? Why does this woman say that she’s my wife?—but they can accumulate memories for everything that they experience after the onset of the condition. In the less cinematically attractive “anterograde amnesia,” memory of the past is more or less intact, but those who suffer from it can’t lay down new memories;

every person encountered every day is met for the first time. In extremely unfortunate cases, retrograde and anterograde amnesia can occur in the same individual, who is then said to suffer from “transient global amnesia,” a condition that is, thankfully, temporary. Amnesias vary in their duration, scope, and originating events: brain injury, stroke, tumors, epilepsy, electroconvulsive therapy, and psychological trauma are common causes, while drug and alcohol use, malnutrition, and chemotherapy may play a part.

There isn't a lot that modern medicine can do for amnesiacs. If cerebral bleeding or clots are involved, these may be treated, and occupational and cognitive therapy can help in some cases. Usually, either the condition goes away or amnesiacs learn to live with it as best they can—unless the notion of learning is itself compromised, along with what it means to have a life. Then, a few select amnesiacs disappear from systems of medical treatment and reappear as star players in neuroscience and cognitive psychology.

No star ever shone more brightly in these areas than Henry Gustave Molaison, a patient who, for more than half a century, until his death, in 2008, was known only as H.M., and who is now the subject of a book, “Permanent Present Tense” (Basic), by Suzanne Corkin, the neuroscientist most intimately involved in his case. Born in 1926 near Hartford, Connecticut, Molaison enjoyed what seems to have been a normal working-class childhood until, at about the age of ten, he began suffering from epilepsy, possibly as a result of a head injury sustained in a bicycle accident. The seizures grew more severe and, by his mid-teens, he would foam at the mouth and bite his tongue, while his limbs convulsed rhythmically. At high school, the teasing was cruel, and Molaison apparently responded by developing a blandly polite outward manner and becoming withdrawn. He enjoyed listening to Sousa marches and Arthur Godfrey on the radio, delighted in collecting guns and going shooting with his father. In a period when eugenic

theories still circulated, Molaison's doctors reportedly told him that he shouldn't have sex, since he would likely reproduce children who were similarly damaged.

Graduating from school, Molaison worked for some years at low-level mechanical jobs, but, despite a cocktail of maximum-dose anti-epileptic drugs, he had little in the way of an autonomous working or social life. By the early nineteen-fifties, an eminent local neurosurgeon named William Beecher Scoville worried that the medications might be reaching dangerous levels and began thinking about a more direct way of controlling the seizures. Scoville had previously performed thirty partial lobotomies, but the precise form of the procedure on Molaison's brain was what the surgeon later called "a frankly experimental operation," meant to locate and excise the bits thought to be responsible for his seizures. On August 25, 1953, with a cheap jury-rigged hand drill, Scoville carved two holes in Molaison's skull, one just above each of his eyes. Molaison was given only a local anesthetic, so that he could be awake to report on his sensations when different cerebral areas were stimulated. Scoville lifted up Molaison's frontal lobes with a spatula and reached far into the center of his brain. Then, using a silver straw, Scoville sucked out fist-size chunks of the medial temporal lobes on both sides of Molaison's brain. The excised tissue included most of the sea-horse-shaped structure called the hippocampus, as well as the parahippocampal gyrus, the uncus, the anterior temporal cortex, and the almond-shaped amygdala.

The operation relieved the severity and the frequency of Molaison's seizures, but there was a disastrous side effect. As Scoville and a colleague noted, Molaison could no longer "find his way to the bathroom, and he seemed to recall nothing of the day-to-day events of his hospital life." Molaison's testable intelligence remained normal; his basic personality seemed unchanged; and he could remember quite a lot of his past, but he was no longer able to form new memories. He could remember how to get to the house in which his family previously lived, but not to the one to which they moved ten months before the

operation was performed. He would use the lawn mower one day and not have a clue where it was the next. He could read the same magazine day after day without showing any sign that he had encountered it before. H.M. had become a stunningly pure case of anterograde amnesia.

Scoville later called the operation “a tragic mistake” and warned neurosurgeons never to repeat it, but neuroscience and cognitive psychology benefitted hugely. The operation could not have been better designed if the intent had been to create a new kind of experimental object that showed where in the brain memory lived: there was no other way that Molaison’s brain injuries could have occurred, and no other way that the precision of his memory damage could have been brought about. Molaison gave scientists a way to map cognitive functions onto brain structures. It became possible to subdivide memory into different types and to locate their cerebral Zip Codes.

Molaison could no longer acquire so-called episodic memories (memory of discrete events in his life) or semantic memories (general knowledge of the world, including the meanings of newly encountered words). These forms of memory, taken together, constitute what cognitive psychologists call declarative memory—the ability that allows you consciously to retrieve past happenings and facts learned in the past. Several years later, researchers correlated evidence from Molaison with the results of other operations and reached a major neuroscientific conclusion: the capacity to form new memories lived in the hippocampus, almost all of which Scoville had bilaterally removed.

VIDEO FROM THE NEW YORKER

What the Government Shutdown Means for Americans

Molaison was employed at a sheltered work center near Hartford. One of his tasks was packing balloons into small bags, stopping when the right number had been put in. But he could not remember what that number was. If asked to fetch a tool, he would forget which tool was needed before reaching the store; his supervisor began providing him with a picture of it. Personal hygiene is also memory-dependent, and one of Molaison's caretakers took to leaving notes around the place to remind him to raise the toilet seat. Molaison could not remember when he had eaten, and the cues arising from his stomach were rarely sufficient to signal that he was either hungry or replete. He'd tell the same story to the same person over and over, unaware that he'd told it before. Molaison could not securely retain memories of the deaths of loved ones, so each confrontation with the fact of a long-ago passing was as raw as the first. Unable to keep in mind what had happened to his parents, he put notes in his wallet telling him that his father was dead and that his mother was in a nursing home. But, without the notes, he found it hard to remember where his parents were or if they were dead or alive.

When you asked Molaison a question, he could retain it long enough to answer; when he was eating French toast, he could remember previous mouthfuls and

could see the evidence that he had started eating it. His unimpaired ability to do these sort of things illustrated a distinction, made by William James, between “primary” and “secondary” memory. Primary memory, now generally known as working memory, evidently did not depend upon the structures that Scoville had removed. The domain of working memory is a hybrid of the instantaneous present and of what James referred to as the “just past.” The experienced present has duration; it is not a point but a plateau. For those few seconds of the precisely now and the just past, the present is unarchived, accessible without conscious search. Beyond that, we have to call up the fragments of past presents. The plateau of Molaison’s working memory was between thirty and sixty seconds long—not very different from that of most people—and this was what allowed him to eat a meal, read the newspaper, solve endless crossword puzzles, and carry on a conversation. But nothing that happened on the plateau of working memory stuck, and his past presents laid down no sediments that could be dredged up by any future presents.

There was a sense in which Molaison was able to learn, though it’s probably wrong to say that he learned *things*. In a way that’s not adequately understood, but which may have to do with the fact that some semantic learning is sustained by structures that Scoville left intact, he seemed occasionally to acquire odd pieces of new factual knowledge—for example, that there were things called contact lenses and that there was a famous person named Yoko Ono, though he was not too clear what kind of person that was (“an important man in Japan”). As he aged, he learned to use a walker; as time went on, he gradually learned how to move around new environments and even to acquire what seems to have been a mental map of new places that had, in some way, become familiar. He might not have been able to supply an answer to a question about just where he was, but he acted, so to speak, as if he knew, and could take account of, its corners and sharp edges.

In 1945, the philosopher Gilbert Ryle distinguished between “knowing how”

(procedural knowledge of the sort that's involved in riding a bike) and "knowing that" (for example, the ability to acquire, archive, and retrieve facts about how a bike works). In one striking experiment, Molaison was asked repeatedly to trace a star in an apparatus that insured that he could see the figure and his hand only in a mirror. Each time he took the test, he thought that he had never done it before, and yet his accuracy markedly improved through iterations. "Well, this is strange," he said. "I thought that that would be difficult. But it seems as though I've done it quite well." In the language of modern psychology, his improvement in the star-tracing experiment belonged to "non-declarative" memory: Molaison retained an ability to learn motor skills, so scientists concluded that these capacities resided not in the hippocampus and nearby structures but elsewhere in the brain. Molaison's inadvertent gift to science was helping researchers understand that memory is not a single process, and that its various capacities do not reside in a single cerebral structure.

Neuroscientists describe Molaison as "arguably the single most important patient ever studied in neuropsychology"; his was "the brain that changed everything," "the most famous brain in the world." Major careers in neuroscience were built on Molaison's condition and on access to him as an experimental subject, and no career was more substantially defined by Molaison than that of Suzanne Corkin.

Corkin writes that Henry Molaison was "part of my life for decades." Forty-six years, to be exact. In 1961, as a graduate student at McGill University, she joined the laboratory of a colleague of Scoville's, and met Molaison the following year. After moving to M.I.T. a few years later and setting up her own neuroscience lab, Corkin began a scientific and legal association with Molaison that's unique in the history of science. The Clinical Research Center at M.I.T. became, Corkin writes, Molaison's "home away from home," and the scientists interested

in investigating his brain and his behavior became his “family.” Between 1966 and 2000, Molaison visited Corkin’s lab fifty-five times for testing and observation, sometimes staying at M.I.T. for weeks at a time. These visits became, another writer noted, “the only salient feature of his life.” Molaison wound up becoming Corkin’s legal responsibility. When he was admitted to a long-term-care facility, Molaison’s hospital chart listed Corkin as “the only interested relative, friend, or contact.”

By the late seventies, Corkin legally controlled access to the patient. There was no end of investigators dying for a chance to meet Molaison, but Corkin required any scientist wishing to study Molaison “to visit my lab first and present the proposed research protocol at our weekly lab meeting.” In the course of fifty years, about a hundred scientists got to experiment on Molaison; many others were turned away. With great difficulty, the science journalist Philip Hilts persuaded Corkin to grant him access, and his moving book “Memory’s Ghost” (1995) was the first account of Molaison that was written for a general audience. The staff at Molaison’s care facility was directed to keep quiet about him, neither confirming nor denying the presence of any such person. Toward the end of his life, Molaison’s problems had come to include dementia, and Corkin made arrangements for a postmortem brain donation, which she regards as “a beautiful finale to his enduring contributions” to science. Corkin drafted a set of rules governing the handling of Molaison’s death. They were attached to his medical chart, and stipulated that she must be contacted immediately as death approached.

“Permanent Present Tense” is about Molaison’s mind as a resource for understanding how human minds normally work and how memory is normally processed and stored. “Studying how Henry forgot gave us a better understanding of how we remember,” Corkin writes. She isn’t at ease with existential questions, but there’s a chapter called “Henry’s Emotional Life,” which offers her view that he did indeed have one. He could not track his own

aging in the way that is, sadly, normal for the rest of us. A psychiatrist who was asked to examine Molaison reported that “he did not think of death.” Molaison could recognize his aging face in the mirror, but he could not associate that changing image with a history of his own body and mind. Once, he was looking in the mirror when a nurse asked him, “What do you think about how you look?” He replied, “I’m not a boy.” When Molaison was more than fifty years old, Corkin inquired how old he thought he was, and he responded, “Around thirty.” She then got out a mirror and asked him again; this time the answer was “Maybe forty.” Molaison’s aging body necessarily reflected the passage of time, while the mirror image that he saw, playing the role of the painting of Dorian Gray, did not.

Almost everyone was a stranger to Molaison, and all social interactions were brief encounters—in the moment, without a past and never to have a future. It’s a circumstance that one can imagine as a source of constant terror—Who is the stranger in my room? Where am I?—but Molaison coped with it by adopting a genial manner, always eager to please, “as if everyone were an old friend.” All the scientists who met Molaison reported on his affable, even jokey, manner. His emotional life, apart from rare outbursts of rage, was placid. His boss at the sheltered workshop described him as “a perfect gentleman” who never even “looks at the girls.” Asked about sexuality, Molaison’s formulaic response was that the doctors had told him that he shouldn’t have sexual relations. The psychiatrist brought in by Corkin decided to press the matter. He asked Molaison if he knew what an erection was, and, when the answer that came back was “A building,” tried another tack. What is a “hard-on”? “Without smiling, frowning, or any change in facial muscular,” Molaison showed that he knew perfectly well what was being asked: “A man gets it, below the belt.”

Molaison recycled his jokes, which was probably just as well for his caretakers, since, if you paused to think about them, the effect would be chilling. Referring to Molaison’s preoccupation with crossword puzzles, Corkin once said to him,

“You’re the puzzle king of the world.” “I’m puzzling” was the response. Talking to a scientist at the M.I.T. lab, Molaison cracked a one-liner about his testing regimen: “It’s a funny thing—you just live and learn. I’m living, and you’re learning.”

Yet, despite his surface affability, life wasn’t easy for him. Over time, he came to understand that other people laid down memories and that he did not. He also grasped the fact that others’ ability to retrieve from memory “the right way” to behave in countless ordinary situations wasn’t available to him. What was automatic for normal people was necessarily a matter of deliberation for Molaison—hence one of his most common expressions: “I’m having a little argument with myself.” He *worried*: “Right now, I’m wondering. Have I done or said anything amiss? You see, at this moment everything looks clear to me, but what happened just before? That’s what worries me.”

Although Molaison could form no new memories, few lives have been more archived and memorialized. There have already been several theatre pieces about him, and Columbia Pictures is planning a movie from Corkin’s point of view. (*Variety* reported that, when the producer Scott Rudin was asked why he wasn’t telling the story through Molaison’s eyes, he answered, “Whoooah, that’d be sooo trippy!”) In a way, Molaison had plenty of memories; it’s just that he couldn’t access them and, therefore, didn’t own them. As Molaison’s relatives died off, Corkin became, she says, “Henry’s sole keeper,” now “in the position of knowing more about Henry than any living person,” and, of course, vastly more than he knew about himself. Over the years, Corkin had archived Molaison’s medical history, his psychological-test results, and the traces produced by scans of his living brain. She now received boxes of Molaison family mementos as gifts from relatives. The mementos and the stories collected from family members allowed Corkin to reconstruct those pieces of Molaison’s preoperative history which he could no longer retrieve; the experiments and observations amassed over nearly fifty years of science constituted an externalized memory of the

conscious life he did not know he had lived.

In Plato's *Phaedrus*, Socrates tells a story about the Egyptian invention of writing. The god Theuth came to Thamus, the king of Upper Egypt, with a brilliant new technology for making marks as records of thoughts. Thamus worried that people "will trust to the external written characters and not remember of themselves":

The specific which you have discovered is an aid not to memory, but to reminiscence, and you give your disciples not truth, but only the semblance of truth; they will be hearers of many things and will have learned nothing; they will appear to be omniscient and will generally know nothing.

Thamus was right. In everyday life, we don't much care whether what we remember is contained between our ears or resides on a piece of paper. We rely on our partners, colleagues, and friends to remind us of obligations; we stick Post-its on computers and fridge doors to cue us to buy milk or have the car serviced; our cell phones ping to announce coming appointments and remember all our phone numbers for us. Increasingly, our memories are distributed across a landscape populated by things and other people, and, in that respect, it's possible to see Molaison as standing merely at a pathological extreme of memory's normalcy: after the operation, *all* of Molaison's declarative memory lived outside his own body, while only some of ours does.

In the classical world, the celebrated ancient "art of memory" involved using the divided spaces of well-known buildings as receptacles for the ordered topics of a public speech, and similar tactics were widely used well into the Enlightenment. Even a generation ago, many schools still relied on a large amount of rote memorization—poems, chronologies of kings and queens, Latin declensions.

Those memory practices aren't dead, but, with the names and dates of the Plantagenet kings now just a click away, there is less and less need for them. Instead, development of memory skills is becoming an exotic niche pursuit, as Joshua Foer explored in "Moonwalking with Einstein," his book about training for the U.S.A. Memory Championships.

The accelerating changes in technologies of memory, spectacular though they are, are a matter of degree rather than of kind. Through the early modern period and beyond, people jotted down nice turns of phrase in commonplace books, and inserted slips or marginal comments in printed books, as a way of coping with a world of information that, as the historian Ann Blair has shown, already contained "too much to know." Molaison and his caretakers also used little pieces of paper as memory prostheses, and in the 2000 noir film "Memento," which was inspired by Molaison's condition, the detective suffering from anterograde amnesia seeks to externalize his memory through scribbled notes, tattoos, and Polaroid photographs.

The Quantified Self movement encourages everyone to follow Silicon Valley utopians in forming a personal digital register of every item of food consumed and every measurable bodily state. A camera worn on the neck of a "lifelogger" records everything seen, and a digital recorder captures everything heard. It's all there—nothing filtered, nothing lost, nothing distorted by the messiness of internal memory. Wearable computers like Google Glass hold out the promise of still more powerful modes of self-archiving. We shall be as gods, and about ourselves we shall know all things. Technology will banish forgetting, and the stores of undeformed memory will live forever in the cloud, retrievable at will. The name for our remaining problems will be "search": all we'll have to do is remember what we're looking for, master a few tricks for finding it, and, finally, offload the initiation of search onto external prompts that will remind us to remember.

As Molaison lay dying, in December, 2008, Suzanne Corkin swung into action: his brain had to be chilled and scanned while still in his body, quickly extracted from the skull, and then flown to San Diego, where it would be carefully dissected and preserved. Molaison “had grown to mean something to me,” but there was still vitally important scientific work to be done. She writes, “My interest in Henry had always been primarily intellectual; how else would I explain why I had stood on a chair in the basement of Mass. General, ecstatic to see his brain removed expertly from his skull? My role as a scientist had always been perfectly clear to me.” This was no time for sentiment or reflection.

With Molaison’s brain nestled in a cooler, a film crew followed Corkin and a San Diego neuroscientist from the hospital to Logan Airport. She writes that “walking through the airport, we felt like celebrities.” They enacted “a formal exchange for the camera,” and the brain was carried onto the plane. “I felt sad to see Henry’s brain go,” Corkin writes. “It was my last goodbye to him.” It was now the brain’s turn to become a celebrity. Embedded in frozen gelatine, it was carefully sliced into twenty-four hundred and one seventy-micron-thin slices, each one, as it was cut, rolling up “like a slice of pale prosciutto.” The whole process was streamed live as a Webcast, where it had several million real-time hits, and the footage can now be watched on the Web site of the Brain Observatory at the University of California, San Diego. Each slice is now encased in glass, and a digitized image of it occupies a terabyte of data. It has been promised that the images will be put together as a “Google Earth-like search engine” for the brain. If it isn’t already, Molaison’s now disembodied organ will soon become the best-known brain there has ever been, an enduring memorial to the man who forgot everything.

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Photograph courtesy of Suzanne Corkin.

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