The Accuracy of Memory in *Memento*

An Examination of Characteristic Memory Processes Portrayed in Film

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Memento introduces us to Leonard Shelby, a former insurance investigator who now suffers from anterograde amnesia and defies odds to find and exact revenge on the man who killed his wife. Since he is unable to form new memories due to his condition, Leonard leaves himself clues in the form of photographs and tattoos on his own body. Throughout the film, *Memento* offers a relatively accurate portrayal of several key characteristics of memory, including the dissociable systems of declarative and procedural memory. The film is arguably more and less successful at portraying different aspects supporting the Standard Consolidation Theory of memory, however.

Leonard retains memories of his wife and memories leading up to her attack, but suffers from anterograde amnesia after the incident and is unable to form any new memories. However, Leonard exhibits retained procedural memory in that he still remembers how to drive a car even though he cannot remember who the car he drives actually belongs to. In addition, Sammy Jankis (who we learn is actually Leonard), exhibits retained motor skills in that he remembers how to inject his diabetic wife with insulin, but is unable to remember when he has already given her shots (which ultimately leads to her death). These characteristics of losing the ability to create new, declarative memories but retaining the ability to remember skills and retain non-declarative memories is something the film ultimately portrayed accurately and **suggests that declarative and procedural memory rely on different neurological structures**. These same characteristics were observed in patient H.M., who sustained damage to the hippocampal region of his brain. In a study conducted with H.M. by John Gabrieli in 1993, this dissociation between declarative and non-declarative memory was shown by having H.M. perform a task where he traced an outline of a shape in a mirror (Gabrieli et al., 1993). Over time, H.M. showed that he could learn how to

perform this motor skill task by tracing a shape fewer and fewer errors at a rate that was comparable with a healthy control subject, even though H.M. did not retain any memory of having practiced the task before.

Throughout the movie, Leonard is consistently able to re-experience vivid memories he has of his wife and his job as an insurance investigator. The depiction of Leonard's memories of his wife are extremely vivid and seem to be tied to various sensory aspects. Assuming these memories have already been consolidated, this portrayal of memory supports the **Standard Consolidation Theory** of memory which opposes the Multiple Trace Theory in saying that the hippocampus is responsible for binding information from the neocortex to establish a pointer to neocortical sensory neuron, but that eventually, over many hippocampally-driven reinstatements information is can eventually be represented independently in the neocortex without help from the hippocampus. Conversely, multiple trace theory suggests that there are no *true* episodic memories that are created without the hippocampus: it argues that the long-term memories that are represented in the neocortex without help from the hippocampus are autobiographical semantic memories, which involves a feeling of "knowing" vs. "reliving". In other words, we are able to recall these memories because we learn about this information from others and are thus unable to re-experience these events fully. Contrary to this, Leonard could completely reimagine his experiences with his wife fully, suggesting that they were, in fact, "true" episodic memories. Ultimately, this aspect of episodic memory is something that the movie portrayed accurately as well. Support for the role played by cortical reinstatement in memory consolidation (and consequently Standard Consolidation Theory) was shown in a study conducted by Gordon in 2014 where individuals were trained to encode imagined associations between individual words.

It was shown that similar areas in the brain that were active during encoding were reactivated during retrieval, which supports this idea of cortical reinstatement patterns supported by Standard Consolidation Theory.

One aspect of the movie that doesn't quite make sense is the fact that Leonard is able to clearly remember events that happen on the night his wife was attacked. He is able to vividly recall and effectively "relive" the moments leading up to this attack, which would contradict the fact that people with anterograde amnesia often can't remember the traumatic events leading up to their brain injury, which is called retrograde amnesia. This loss of past memories leading up to the attack is called *retrograde amnesia* and happens because damage to the hippocampus interrupts the process of cortical reinstatement and consequently the process of memory consolidation by which hippocampally-driven processes allow information to be represented in the neocortices independent of the hippocampus. This inaccurate depiction not only violates aspect of Standard Consolidation Theory but also **Ribot's law**, which states that there is temporally graded memory loss observed from the time of injury. This occurs because recently acquired memories are not yet consolidated in memory are still hippocampally-dependent. An accurate depiction would have left Leonard with hazy memory leading up the event of his wife's attack and no memory of the actually event that caused his injury. Work done with patient H.M. by Brenda Milner reveals that his early memory was entirely intact and that he began exhibiting partial loss of memory in the three years leading up to his surgery (Squire et al., 2009).

Overall, *Memento* does a commendable job at portraying the experience of having anterograde amnesia relatively accurately. The film accurately depicts Leonard's condition as

affecting his ability to make new episodic memories and not affecting his procedural memory (e.g. his ability to learn new skills). The film's depiction of various aspects of memory according to Standard Consolidation Theory is arguably less accurate: although the film accurately shows that Leonard is able to retrieve "true" episodic memories of his wife, it is less accurate in showing that Leonard can completely recall the events leading up to the night of his injury. All in all, despite a few minor errors, *Memento* is able to convey the frustration experienced by Leonard and many people in real life that suffer from anterograde amnesia through its unique storytelling format.

Works Cited

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