Note: source http://www.human-memory.net

DECLARATIVE (EXPLICIT) & PROCEDURAL (IMPLICIT) MEMORY

Long-term memory is often divided into two further main types: **explicit** (or **declarative**) memory and **implicit** (or **procedural**) memory.

Declarative memory ("knowing what") is memory of facts and events, and refers to those memories that can be **consciously** recalled (or "declared"). It is sometimes called **explicit memory**, since it consists of information that is explicitly stored and retrieved, although it is more properly a subset of explicit memory. Declarative memory can be further sub-divided into episodic memory and semantic memory.

Procedural memory ("knowing how") is the **unconscious** memory of skills and how to do things, particularly the use of objects or movements of the body, such as tying a shoelace, playing a guitar or riding a bike. These memories are typically acquired through repetition and practice, and are composed of automatic sensorimotor behaviours that are so deeply embedded that we are no longer aware of them.

Once learned, these "body memories" allow us to carry out ordinary motor actions more or less automatically. Procedural memory is sometimes referred to as **implicit memory**, because previous experiences aid in the performance of a task without explicit and conscious awareness of these previous experiences, although it is more properly a subset of implicit memory.

These different types of long-term memory are stored in different regions of the brain and undergo quite different processes. Declarative memories are encoded by the **hippocampus**, **entorhinal cortex** and **perirhinal cortex** (all within the **medial temporal lobe** of the brain), but are consolidated and stored in the **temporal cortex** and elsewhere. Procedural memories, on the other hand, do not appear to involve the hippocampus at all, and are encoded and stored by the **cerebellum**, **putamen**, **caudate nucleus** and the **motor cortex**, all of which are involved in motor control. Learned skills such as riding a bike are stored in the putamen; instinctive actions such as grooming are stored in the caudate nucleus; and the cerebellum is involved with timing and coordination of body skills. Thus, without the medial temporal lobe (the structure that includes the hippocampus), a person is still able to form new procedural memories (such as playing the piano, for example), but cannot remember the events during which they happened or were learned. Note: the amygdala is also involved in initial consolidating of the implicit (procedural) memory

Perhaps the most famous study demonstrating the separation of the declarative and procedural memories is that of a patient known as **"H.M."**, who had parts of his medial temporal lobe, hippocampus and amygdala removed in 1953 in an attempt to cure his intractable epilepsy. After the surgery, H.M. could still form new procedural memories and short-term memories, but long-lasting declarative memories could no longer be formed. The nature of the exact brain surgery he underwent, and the types of amnesia he experienced, allowed a good understanding of how particular areas of the brain are linked to specific processes in memory formation. In particular, his ability to recall memories from well **before** his surgery, but his inability to create **new** long-term memories, suggests that encoding and retrieval of long-term memory information is mediated by distinct systems within the medial temporal lobe, particularly the hippocampus. The fact that he was able to learn hand-eye coordination skills such as **mirror drawing**, despite having absolutely no memory of having learned or practised the task before, also suggested the existence **different types** of long-term memory, which are now known as declarative and procedural memories

There is strong evidence, notably by studying **amnesic** patients and the effect of **priming**, to suggest that implicit memory is largely distinct from explicit memory, and operates through a different process in the brain. Studies of the effects of amnesia have shown that it is quite possible to have an intact **implicit** memory despite a severely impaired **explicit** memory. Priming is the effect in which exposure to a stimulus influences response to a subsequent stimulus, so that, for instance, if a person reads a list of words including the word “concert”, and is later asked to complete a word starting with “con”, there is a higher probability that they will answer “concert” than, say, “contact”, “connect”, etc. Studies from amnesic patients indicate that priming is controlled by a brain system separate from the medial temporal system that supports explicit memory.

??? Did You Know ???

Children under the age of about seven pick up **new languages** easily without giving it much conscious thought, using procedural (or implicit) memory.
Adults, on the other hand, actively learn the rules and vocabulary of a new language using declarative (or explicit) memory.

??? Did You Know ???

Studies have show that **musicians** tend to have a better memory than non-musicians, not just for music, but for words and pictures too. Interestingly, they also tend to use **different strategies** for memorization, being more likely than non-musicians to group words into similar **semantic categories**, and less likely to **verbalize** pictures.