The effect of traumatic events on memory

Memory

Scientists have keen on pressuring secrete of memory for hundreds of years, undoubtedly, obliteration and inheritance are one of the most mysterious and romantic subjects.

Dominick Cobb plants memory in Robert Fischer via a designed dream, changes his subconsciousness thus influences his reactions in reality, Inception. These kinds of stories are no longer restricted in friction movies. Nowadays memory is ahottopicinneuroscience, notonly enhancingit, but erasing or inheriting it.

Before we explore how to delete traumatic event, it is necessary to briefly understand how our brain works to remember an event.

Information transmits from the outside through our vision, auditory, olfaction, taste and tactile. Memory is the ways that we store and evoke items we've sensed. Different types of memories therefore stored differently. There is a structure in the brain called the hippocampus that is key to short-term memory, which only responses to the data that catches our attention (fire alert) or we need it soon (a telephone number). Long-term memory is much more complicated, it involves three main processes: encoding, reserve and retrieval.

First of all, encoding: new concepts are broken down into composite parts to establish various meaning. Moreover, we collect the context around us when we receive a new conception, or another episode occurs in our life. For instance, I might associate the phrase " beautiful flower" with its key

descriptive ideas —white color, faint scent smell, elliptical petal, floating in hometown pond — and thus such contextual memories as ‘” it is such happy summer that I’m swimming beside these lotus with my brother.”

Reserve: when we store the newly-caught episode, we attach it to any other related memories, such as “ similar to magnolia but living in the shallow water,” and hence, consolidate the new conception with older memories.

After above processes, we recall the conception, by tracing the various meaning codes stored in our brain and decoding these consolidated memories to regain a new meaning. If I forget what “ beautiful flower” means, I might think of its relative pointer-hints, such as “ white” or “ hometown pond.” Pointers associate with other pointers that even a single hint may let me to recover the whole context.

Then the following question is: how do our brains transfer a short-term memory like “ beautiful flower” and into a long-term memory? We use hippocampus again; temporary links are constructed among cortex neurons due to a short-term memory event. For example, “ white” gets stored in the visual region of the cortex, and the faint scent of a blooming flower gets stored in the olfactory area. When I remember the new fact, “ beautiful flower,” it will converge on my hippocampus, which sends these new memory data along a established path several times to strengthen internal links.

“ The short-term memory flows alone the path, with the beginning at the hippocampus, circulating through several limbic systems (to pick up any timing associations like “ early morning on June 1st,” and spatial associations

like “ bond street station”), then pass over various parts of the cortex, finally back to the hippocampus. Making the information flow around the circuit many times strengthens the links enough that they “ stabilize,” and no longer need the hippocampus to bring the data together, says neuroscientistBruno Dubucof the Canadian Institutes of Neuroscience, Mental Health, and Addiction. “ The strengthened memory paths, enhanced with environment connections, become a part of long-term memory.”[1]

Recalling memories re-fires many of the same neural paths we originally used to sense the experience and, therefore, almost re-creates the event.[2] In other word, memory just like glass, it behaves plastically during storing memory and eventually fixes shape at the end of process. When we recall this memory, it will be abstracted and activated from the cortex, becoming soft and plastic again, memory reshapes its structure instead of the original one. Taken in this sense, theoretically, memory manipulation and obliteration are reasonable and realizable.

When a distressing event occurs, a fearful memory created that could last a very long time period and depressingly affect a person’s life. Researchers from the University of Toronto trained mice to terror a sound by matching that sound with an electric shock to their feet, so when the sound rang, the mice would freeze in fear. This sense of feeling can be relieved by training called “ extinction training”: repeatedly ringing the tone without adding electric shock. Behavioral therapybuilt around such “ extinction training” in mice models has proven that it is useful in decreasing the degree of negative emotional response to a traumatic memory, however these fear memories

commonly relapse and rarely can be completely removed via this kind of physical training.

Further study focuses on the amygdala, a part of the brain located at the end of hippocampus, known to response to fear conditioning in both people and animals. Using sound to threaten the mice, they detected that certain cells in the nerve circuits in amygdala conducted much more current after playing a loud, sudden sound around the mice than they stay in a calm, normal environment. As for rodents, the neural functions capacitating fear memory formation and correspondently reconsolidation are situated in the amygdala. As for humans, brain and lesion imaging analysis confirm that most of fear memory mainly encoding in the key area—amygdala.

Memories become labile when recalled. In humans and rodents alike, reactivated fear memories can be attenuated by disrupting reconsolidation with extinction training. Using functional brain imaging, we found that, after a conditioned fear memory was formed, reactivation and reconsolidation left a memory trace in the basolateral amygdala that predicted subsequent fear expression and was tightly coupled to activity in the fear circuit of the brain. In contrast, reactivation followed by disrupted reconsolidation suppressed fear, abolished the memory trace, and attenuated fear- circuit connectivity. [3]

The team then observed and recorded the proteins in the certain nerve cells we mentioned before in the amygdala during the whole scary experiment. A sort of particular calcium-permeable proteins temporarily spiked in the lateral amygdale. Because these especial proteins are uniquely unsteady

and able to be removed from the amygdala, the scientists suggested that fear memory might be permanently removed by combining protein removal and behavior therapy, which provides a opportunity for erasing fear.

In further experiments, information revealed that eliminating these particular proteins depends on another chemical modification protein called GluA1. Now, whenhorrificsoundrang, themiceon longer felt fear and continuedtheirmouse-likeactivities. Neitherotherreserved memories, northeirabilitytosavenewmemories, wereinfluenced. Theeffectof using this biochemical method wasspecific, effectiveand long-lasting. Scientist notices that memory erasure can be achieved by using drugs designed to control and enhance the elimination of calcium-permeable protein.

Another interesting property of memory is inheritance. Behaviour can be affected by events in previous generations which have been passed on through a form of genetic memory. Experiments showed that a traumatic event could affect the DNA in sperm and alter the brains and behaviour of subsequent generations. [4]

Currentlya neuroscience studyreveals that after training a group of mice to avoid a particular smell; their aversion could pass on to their descendents.

Scientists said that the results were essential for fear and anxiety memories research. The mice were trained to panic a cherry blossom smell. The further study focused on internal structural changes inside the mice sperm. The team at the Emory University School of Medicine, in the US, pointed out that a section of DNA which might responsible for olfactory sensitivity was activated in the mice’s sperm. Both the mice and their “ grandchildren” were

particularly sensitive to cherry blossom scent and would try their best to avoid this smelling, despite never having experienced cherry blossom in their lives. Another significant change occurs in brain structure. “ The experiences of a parent, even before conceiving, markedly influence both structure and function in the nervous system of subsequent generations,” the report concluded.[5]

This experiment provides convictive evidence that a traumatic event or a specific environment can affect an individual’s genetics and, by this means, genetic memory will pass on their offspring thus affect their behaviour in the future. This statement probably explains why picky eater avoids particular food. Did you ever resist such kinds of food as ginger, eggplant, celery or garlic since you born? Asking your parents and finding out the possible reasons. This sort of bias is seen as family fear. Descendants sometimes reveal imprints of their ancestor. “ There is absolutely no doubt that what happens to the sperm and egg will affect subsequent generations.” Prof Marcus Pembrey, from University College London, “ the findings were highly relevant to phobias, anxiety and post-traumatic stress disorders” He commented: “ It is high time public health researchers took human transgenerational responses seriously. I suspect we will not understand the rise in neuropsychiatric disorders or obesity, diabetes and metabolic disruptions generally without taking a multigenerational approach.” [6]

Reference:

[1]: The brain from top to bottomby Bruno Dubuc, Canadian Institutes of Neuroscience, Mental Health, and Addiction

[2]: Spatial short-term memory pinpointed in human brain, National Health Institutes, 1998.

[3]: Thomas Agren, Jonas Engman, Andreas Frick, Johannes Björkstrand, Elna-Marie Larsson, Tomas Furmark, Mats Fredrikson. Department of Psychology, Uppsala University, SE-751 42 Uppsala, Sweden. Department of Radiology, Oncology and Radiation Science, Uppsala University, SE-751 42 Uppsala, Sweden.

[4]: James Gallagher, BBC News, Thu, 05 Dec 2013 19: 34 CST

[5]: Brian G Dias&Kerry J Ressler, Nature Neuroscience, 01 December 2013

[6]: Marcus Pembrey, University College London