INTERNATIONAL JOURNAL OF MIND, BRAIN & COGNITION
VOL. 7, NO. 1-2 JAN-DEC 2016

Twin Memory

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ABSTRACT

In this article, I examine a new concept of "Twin Memory' which has emerged in memory classification research of conscious and unconscious memory representations. It is to analyse the presence of twin memory among the various memory systems, and also to provide a platform for the twin memory "anatomy" in the field of cognitive science.

As we live in the moment of "our actual conscious experience" (Rose 1993: 9) which we also call present, and it is undoubtedly receding instantly to become a past. This past is a trajectory of time and in this arrow of time which irreversibly moves forward memory is built and shaped from the trajectory of past experiences. The past and the present have bond like double helix structure of a DNA, and memory is retrospectively mutated in a space between them, each time we recall them. In the process of "memory mutation" memories are transformed, permeated with new meanings and edited by causality. The act of remembering begins with the encoding of a perceptual or conceptual event within a given cognitive environment that represents all aspects of the state of the system that are relevant to the event and its encoding. It ends with the creation of a cognitive state referred to as ecphoric information. It is constructed on the basis of both the (usually receded) engram and the retrieval cue (cf. Buschke 1987). The retrieval of our past experiences become represented within "the mix of molecules, of ions, proteins and lipids that make up the ten billion nerve cells of our brains" (Rose 1993: 5), and we collectively call them memory systems. A crucial component of cognition is memory. Memory is made up of a

number of different and inter-related systems that are defined, among other features, by how we access them or the type of information encoded (Squire 1992; Miyashita 2004). Some memories are easy to access while others require "search strategy" to retrieve them. For example, an essential password of a bank locker has been lost; without this password I won't be able to get the locked treasure in it. In such a situation the hidden or lost memory require twin memory to recall them. We may also call it copycat of the original memory. A simple nudging to the memory by the twin memory may dig out a chunk or various distributed proportions of other memories. There are two sources involved in this procedure of nudging to the memory. The first one is "external event," it may comprise anything from tangible evidence like dress, place, book, shoe, body, colour, skin, watch, face, etc. to intangible objects like smell, taste, sound, laugh, touch, feelings, emotions, pain, happiness, a word, name, a particular incidence, evidence, environment, etc. The second source is "internal event" which is a chunk of memory nudging other memories to life; it is like a box within a box and the process of getting another box in them continues nonstop. It is something like one is opening and passing through various doors in a huge building to reach the roof top. It is like a butterfly flying from one flower to another, never standing still. And also when the "external event" meets with the "internal event" point of comparison, reflection and also repulsion succinctly arrive among them; which mainly gives birth to the process of "twin memory." These all processes of nudging the hidden or lost memory takes place in "connective patterns" within the memory systems. Here, however, one may argue straightforwardly that in the issue of twin memory seeing connective patterns in unconnected data to relate to the memory pattern is simple a case of pareidolia. It is "an optical illusion when people see familiar shapes or objects in textures or patterns, coupled with over active imaginations" (Austin 2016). It is a form of apophenia, which is when people see patterns or connections in unconnected data. For example, a man seeing his own childhood in another child, and also seeing the statue of Buddha on Mars have a similar

phenomenon of pareidolia. Indeed, if there is no connectivity between both the subjects/objects but still connective patterns may evolve in between them; as it takes place mostly with our memory which reflect on to other memory or object and starts searching for some connectivity with them. For example, a past and a present, as we know that both of them are distinct from each other but still they are interrelated. In our mental time travel from the present to the pastsome of these past memories are either lost or forgotten. But do we then really forget them at all? For this, Steven Rose in *The Making of Memory* writes that "memory is encoded in some way within our brains, so that, if only we could find the key to accessing them, every detail of our past would become as transparent to us as is the present moment of our consciousness" (Rose 1993: 5). *What is this key*? Unconsciously/consciously, we are adding some units and changing others to access all of the memory lanes. It can be a challenge to retrieve a position of memory that is hidden or lost but the rewards are worth it. We have been creating units for years that access the various memory lanes. Similarly, interfacing the hidden or lost memory with similar objects, incidences, situations and factors may also retrieve them. This phenomenon occurs with two methods: "Unconscious Interfacing" and "Conscious Interfacing" of the mind. As our brain is borrowing innumerable information from our surroundings, environment, impressions of people, objects, actions and also from our own behaviour, etc., but these borrowing are mostly taking place without notifying us. The received information then stored into specific region of the brain cells can be later awakened by a cluster of memory; forasmuch a cluster of negative memory is likely to awake another negative memory rather a positive memory. These kinds of information are stored basically with semantic memory. If the memory isn't consciously retrieved and fetched back into consciousness then it becomes "Unconscious Interfacing." When the memory is consciously retrieved and fetched back into consciousness then it becomes "Conscious Interfacing." Even if a large part of the memory is lost and only little fragments of it left away, then also it may rebuild itself with remaining clusters and may generate a new copy of the lost

memory. Into this process conscious stimuli influence unconscious behaviour in classic priming procedures. Can it be said that unconscious primes influence conscious behaviour? Not really; according to one study at least, it only influences other unconscious information. Specifically, Balota (1983) found semantic priming from both primes that were in awareness and primes that were outside of awareness (i.e., imperceptible). The two kinds of primes differed, however, when it came to influencing direct memory tests (Czigler 2010: 21) of recalling the hidden or lost memory in the models specifically identified as STM (short-term memory or "working memory") or LTM (long-term memory or "reference memory"). One reason to demarcate conscious versus unconscious processing in the model is that the information in conscious awareness is assumed to gain access to much deeper and extensive perceptual and conceptual analysis using long-term memory information than information that is outside of conscious awareness. Therefore, directing conscious awareness is an important skill for harnessing information processing to succeed at a task (Czigler 2010: 6). Now in order to find out the hidden or lost memory (e.g., the password of the bank treasure) I try to recall it by identifying relevant information related to it. Likewise I collect similar things, objects, words, numbers, etc., any related thing to the password. The filtering of the information continued to take place until the password was recovered. Of course, either encoding of information into an unconscious store or encoding of information into a conscious store could be influenced by the ability to filter out or exclude irrelevant items. This type of mechanism also agrees well with the notion that individuals with better span are those who are better able to exclude or inhibit irrelevant information (Lustig 2007).

Distinctively, the mind selects in between the interplaying of "conscious interfacing" or the "unconscious interfacing" which one is more effective at the moment of searching the lost information. Therefore, the first point involves the contrasting between the conscious and the unconscious efforts led by the mind, heretofore, the second point abstracts which one either the

"conscious interfacing" or the "unconscious interfacing" is more dominant upon each other for finding the lost information (e.g., the password of the bank treasure). Both the conscious and the unconscious interplay according to their regular practises of movement on the neural circuits; as in a certain task (e.g., of recalling memory) some people are more conscious than others, meanwhile, some people may be using their unconscious interfaces much more than conscious interfaces to transcend the experiences limited to one's imagination. Precisely because the mind has to choose one path either conscious or the unconscious at a regular interval before processing an information, in fact, both of them reel together into a cyclic precision, henceforth, like a wheel they are creating a movement to recollect, to fetch, even to delete (to make a new space for memory), to disconnect (between memories), to store, to relate, or to reveal the sought information. The information after being extracted from different departments of the brain and then processed by the synaptic modules is unconsciously fetched to awareness. Moreover, the interplay between conscious and unconscious elements of working memory makes for some fascinating phenomena (Simons & Rensink 2005) and among them is the formation of various meeting (convergent) points during their interaction, collision and fusion. This mechanism in which the different "internal events" reflecting on to the different "external events" to wake the hidden or lost memory from the subconscious mind in order to fetch it back to conscious mind may decode it.

In particular, I request the reader of this article to perform a small experiment along with me to test the theory of "twin memory." In this experiment you have to take a stick in your hand. Open your palm and then beat the stick noisily on your palm. What does it remind to you at once? Certainly, it reminded me of my school days when the teacher used to beat me in the same way for being poor in my studies. While feeling pain on my palm it immediately nudged to the memories of the school days, that of similar pain. If you were lucky enough to skip the teacher's stick then the procuring memory would be much different at this stage. Here we must notice that we didn't make any effort for any memory of the school days or to any memory

related to pain on the palm as it arrived quickly only after the stick was beaten on the palm. Before beating of the stick my mind wasn't thinking anything about the school or about the teacher but it was thinking something else. You must have also observed here the recent incident of pain has similarity with the past incident of pain. The recent incident of pain pushes the similar "suppressed memory" of pain to life, henceforth it has found its "twin brother." Here the stick acts as an "external event" to prompt this task of memory retrieval. In a similar fashion, a happy event occurring in one's life may also recall and submerge him into a series of past happy events. Similarly, a negative memory may instigate several other negative memories at once and it may also lead to a "nervous breakdown."

In the next piece of evidence first it raises a question in the context of twin memory: Does memory have a twin brother? Yes. For example, recently, I taught at Patna University in the department of English. There I was stopped by an empty classroom when I was passing by its doors. The doors recalled me that once I was appraised by an English teacher in the room for saving a flying sparrow (in this incidence the sparrow seemed looking for an exit in the closed classroom. I had immediately switched off the ceiling fans in the classroom when the sparrow was flying near to them. I feared that it might be hit by the moving blades of the ceiling fans. Then I opened a window and the sparrow found its exit). When I entered the classroom I couldn't tell what exactly the feelings were, but sometimes now, as a new visitor to the past, I try to catch back into the bygone moments. The smells of the same wooden desks in the classroom brought with it memories that I never recalled previously. I looked up at the ceiling fans and also my eyes raced for the sparrow among them. This signifies that of our existence in day to day life depending upon external/internal events for the reminder of the past and the present events. People remember and forget numerous things every day. So you may put a reminder in your cell phone, or put your hand watch on an alarm, or tag a small note at your working desk, or tell someone to remind you of your specific task, or do anything to make you

recalled and reminded so not to miss the essential task. If I asked you to tell me the last thing you forgot, perhaps you would say that you forgot to do some task that you had intended to do, like take a vitamin, run an errand, or give someone a message. In keeping with earlier terminology (e.g. Harris 1984), we will call this type of memory (remembering to perform actions) prospective memory. Prospective memory can be contrasted with remembering actions previously performed or, more generally, previously encountered episodes, called retrospective memory. One readily apparent difference between retrospective memory (as it is typically studied in the laboratory) and prospective memory is that there is usually an agent prompting remembering in retrospective memory tasks. In typical retrospective memory tasks studied in the laboratory, experimenters put subjects in a retrieval mode (Tulving 1983), which initiates remembering and sensitizes subjects to the meaning of retrieved memories. By contrast, in prospective memory tasks, internal or external events must trigger remembering that it is time to perform an intended action, in the absence of being in a retrieval mode. In this sense, prospective memory is more similar to the involuntary remembering (Ebbinghaus 1964; Richardson-Klavehn, Gardiner & Java 1994) that occurs when thoughts spontaneously come to mind – a phenomenon that occurs frequently in everyday life. Moreover, retrieving the information from explicit episodic memory (retrospective, remembering or conscious recollection) "is contingent on the establishment of a special mental set, dubbed episodic 'retrieval mode'" (Tulving 2005: 5).

According to Moscovitch (1994) explicit episodic (retrospective) memory is mediated by several subsystems corresponding to unique neuropsychological components (p. 34). The position that explicit episodic memory performance is only based on conceptual information overlooked that memory tasks are often constructed in a way that subjects can rely (completely) on conceptual information (p. 54). One primary subsystem is the medial-temporal/hippocampal module, which mediates the encoding, storage, and retrieval of associative information. A central feature of this subsystem is that it processes information specifically for the purposes of associative retrieval, with

retrieval proceeding in an automatic, nonstrategic fashion. In particular, this module accepts consciously-attended information (cues for memory retrieval) and automatically produces interactions between the cues and memory traces previously associated with the cues. If the cue is sufficient (i.e., if the attended information produces enough interaction [ecphory] with a memory trace), then the module delivers that memory trace to consciousness rapidly, obligatorily, and with few cognitive resources. Further, the module operates reflexively, such that if the attended information (a cue) does not interact sufficiently with a particular memory trace, then that memory trace is not retrieved (unless another subsystem strategically generates additional cues for input to the hippocampal module). Moscovitch assumed that such strategic processes are mediated by a prefrontal subsystem and that both the automatic, hippocampal module and the strategic, prefrontal subsystem are involved in explicit episodic retrospective memory (McDaniel, Robinson-Riegler & Einstein 1998). The working assumption is that prospective memory retrieval is supported by the automatic associative memory module. This assumption provides an account of how prospective remembering occurs despite the fact that there is no external agent to prompt memory retrieval. The idea is that when a prospective memory target event is encountered, if the target event is consciously processed, then it is input to the associative memory module. If there is sufficient interaction (ecphory) between the cue (the target event) and the memory trace that specifies the intended action, then that intended action is automatically delivered to consciousness (i.e., the idea to perform the intended action is retrieved). If there is not sufficient ecphory, then the intended action is not delivered to consciousness and prospective remembering does not occur (Moscovitch 1994: 34).

Here, however, we must not forget that a human brain is an automatic machine which doesn't require any electrical switch of consciousness to access memories all the time. Even a dead brain or an impaired brain keeps functioning for a given time according to their neural circuits and networks. As information

flows through the neural circuits and networks of the brain, the activity of the neurons act according to the strengthening and weakening of the synapses (synaptic plasticity) and this mechanism is called "long term potential" or "LTP." Each millisecond different types of new information are added to our brain and we might not notice them. It appears to be common intuition that storage of new information in the brain should correspond to some "additive process" at the substrate level, anything from synaptic strengthening to formation of new synapses. Seminal theories like Hebb's (1949) favoured this view. Findings, such as long-term potentiation (LTP) (Bliss & Lomo 1973; Gustafsson & Wigstrom 1988), synaptic learning in Aplysia (Abrams & Kandel 1988), and cortical synapse formation after environmental enrichment (Greenough & Bailey 1988) have strengthened the point. Consequently, computer models of associative networks have adopted differential strengthening of connections as a basic mechanism (Hopfield 1982; Linsker 1988; Palm 1981; Sejnowski & Rosenberg 1987). The strengthening mechanism according to memory retrieval mode continues to enhance and enlarge the memory patterns in various ways. These patterns also give birth to new memory systems and sub-systems. Although it is still based on hypothetical constructs, the view that human memory is composed of five interrelated memory systems (Nyberg & Tulving 1996; Tulving 1983, 1985, 1993; Tulving & Schacter 1990). Initially these took the form of various dichotomies, such as those between short-term and long-term memory (e.g., Shallice & Warrington 1970; Warrington & Shallice 1969), episodic and semantic memory (Kinsbourne & Wood 1975; Tulving 1972; Warrington 1975), and procedural and declarative memory (Cohen 1984; Cohen & Squire 1980; Squire & Cohen 1984). Now, however, more comprehensive structures have been proposed (e.g., Johnson 1990; Squire 1987; Tulving 1983, 1987; Warrington 1979; Weiskrantz 1987, 1990) as "twin memory." While placing it among the five interrelated memory systems may be potentially controversial, but instead of this situation I believe that the procedural placement for it would be with unconscious and conscious memory representations.

Whereas both the conscious and unconscious mechanisms contribute to the general priming effect, the degree of involvement of each is difficult to determine. However, it is clear that the underlying operations of the priming effect are not uniformly conscious in nature (Gilchrist, Cowan & Nelson 2008: 20). Unconscious and conscious processes operate in a variety of cognitive tasks but the findings from these two areas allow for a clear dissociation between conscious and unconscious processes. Using a broad definition, conscious information can be considered any stimulus, either externally – or internally – generated, which we are aware of at any given time – thus, these items are "in mind." In contrast, unconscious stimuli are those items which are currently not in awareness, and have no reportability. Although one is typically unable to classify unconscious information, previous studies find that these still exert effects on behaviour, particularly on indirect or implicit tests of memory. Both conscious and unconscious mechanisms may be involved in myriad cognitive tasks, operating in a similar manner as automatic familiarity and controlled recollection (Jacoby 1991: 513-541). Cowan (1988, 1995, 1999, 2005) summarized diverse evidence relevant to the conscious versus unconscious status of information in activated memory versus the focus of attention. What is critical is that sensory features from multiple stimuli can become activated in memory at the same time, without evidence that they enter awareness. However, deeper processing seems to require awareness, making the system more like that of Broadbent (1958), he proposed a very simple model of memory that took into account the latest evidence; in that model, a large amount of sensory information was encoded in a temporary buffer (like what is now called working memory). However, only a small proportion of it ever made its way into the limited-capacity part of memory, where it was analyzed and categorized with the benefit of the vast amount of information saved in long-term memory, and eventually added to that long-term bank of knowledge. Atkinson & Shiffrin (1968) then developed that sort of memory framework into a more explicit model in which mathematical simulations were made of

the transfer of information from one store to another through encoding, retrieval, and rehearsal processes. Baddeley & Hitch (1974) soon found that this simple treatment of working memory would not do. In addition to information temporarily held in a form likely to be related to consciousness (James 1890), they argued in favour of other storage faculties that operated automatically, outside of voluntary control. Cowan (1988) was noncommittal about whether the automatically activated information could include semantic information. Unlike Broadbent I still assume that it may but, like Broadbent, I do not believe that automatic activation of semantic features captures attention. The evidence comes from separate auditory and visual studies (Gilchrist, Cowan & Nelson 2008: 12). For example, importantly, when individuals familiar with major-minor tonal music listen to such music, they transfer the sensual pitch information (that is, information about the pitches of the tones of melodies or chords) into a cognitive representation of the location of tones and chords within the tonal hierarchy of a key, as well as within the (major-minor) tonal key space. In other words, when processing harmonic information, listeners relate new harmonic information to the previous harmonic context in terms of harmonic distance, and in terms of its functional-harmonic information. The representations of such regularities are stored in long-term memory, and by its very nature it needs listening experience to extract the statistical properties of the probabilities for the transitions of chord functions (Tillmann, Bharucha & Bigand 2000). These statistical properties are implicitly learned in the sense that they are extracted without conscious effort by the individuals, and stored in a long-term memory format.

Suppose, for example,a friend gifts you a wooden ink pen which immediately recalls you of another wooden ink pen placed at your grandfather's desk had a particular smell. About your grandfather's pen you never recalled it after having seen it once as a toddler. But its smell and picture stored in your memory is once again brought to life by the gifted pen. This is a long term memory which can also become a short term memory, and after this you may also forget it or start tracing for it. As Abbot (2002)

suggests that long-term memory format "is that more permanent store in which information can reside in a dormant state – out of mind and unused – until you fetch it back into consciousness" (2002: 1). Therefore, the automatic consciousness is associated with the 'synergistic ecphory model' of recall and recognition of past events and things. But why do smells have this power to unlock forgotten memories? Before noticing these criteria of smells have we noticed that a similar object (e.g., the wooden ink pen) can trace back to the lost or hidden memory. Anything which has some similarity with the lost or hidden memory can evoke its submerged particles of cues once again to life. The smell reflects and reconnects to the lost past and this thing happens without consciously putting your mind to trace for it. And if there is no connectivity between the smell and the past then there will be no tracing to the past. Not necessarily.

In the next phase of the experiment I request again to the reader of this article to perform a little psychological experiment on his/her own mind. For this you have to use conscious effort to access all of those memories long stored. It is vastly stored for years and to visit them at once isn't possible so you choose specific regions of the memory those are nearly forgotten (e.g., your childhood memory). The conscious exploration into the memory lanes may become more interesting as you did so. You can call this a mental time travel from the present to the past. The neural circuits of your brain are like busy neural highways where thoughts processes continue to move at their speed, henceforth, to visit a specific memory region you have to make a route among these busy tracks. Per hour thousands of thoughts come and go, and only those thoughts which have been given more attention douse into a pool of consciousness to get life; it is as if consciousness is a screen on which projector brain projects the film of memory. Majority of thoughts aren't invited by your conscious mind; they come and fade upon their own. At this calculation you are amazed to discover that most of them are useless, irrelevant and unimportant thoughts and all of them passed through your mind faster than the speed of light travel. Come and go of the thoughts continue like a squirrel jumping

from one tree to another, never standing still. It also takes time to switch from one memory to another as the mind is always busy since its inception. Consciousness isn't capable to hold its grip on various thoughts originating from its womb. Also consciousness isn't able to project many thoughts and feelings but it stays like a silent observer to the traffic of thoughts. Even though some of the thoughts may be disturbing and exhausting that initially you have to suppress them before they can grow. The suppressing of such thoughts also takes considerable concentration, time and causations when they are suppressed by another thought or action. You may also notice that the amount of time taken for the episodic memory retrieval explains further the strong or weak connections of the wiring in a human brain. Your way of thinking may differ from others but we are same humans with same speed of thoughts travelling on our neural highways. Only the thing that matters is the kind of thoughts travelling, and thereafter, we are bringing them out into what type of actions. Furthermore, you may face another problem as to retrieve all of the childhood memories aren't possible at all. "One might expect that the older the memory, the harder it would be for a person with a memory deficit to locate it, but the reverse turns out to be the case; old memories are preserved whilst recent ones are more easily lost" (Rose 1993: 78). In your case it isn't a different story as some of your past memories failed to be recalled. Some of them may appear into fragments of colours and distorted pictures with unclear sounds and voices those you may visualise and hear but cannot understand at all, while the rest of others are still waiting to be recaptured. You aren't able to reach back into your recent or old past. You can only see that you are a small boy playing in a school with some children but many acts on daily basis at the school can't be recalled as if they were never recorded into memory by your brain. Then you find a photo album of your childhood photographs starting from a baby to boyhood to adulthood as well. They are really helpful to reconnect to the lost or hidden memories in many ways. A single photograph acts as a linkage to several other memories and you become capable to visit some of them. This album is an example of "twin memory." Thus we can say that twin memory is acting

like a bridge between the conscious and unconscious interfaces. In between there are some pictures you aren't able to recall. Afterwards, any relevant or irrelevant result to the sought memory is unobvious.

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