

Journal of Cognition and Neuroethics

Memory Reconsolidation: Hope for a Terminal Analysis?

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Biography

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Publication Details

Journal of Cognition and Neuroethics (ISSN: 2166-5087). March, 2019. Volume 6, Issue 1.

Citation

Mehuron, Kate. 2019. "Memory Reconsolidation: Hope for a Terminal Analysis?" *Journal of Cognition and Neuroethics* 6 (1): 57–73.

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Abstract

Some psychoanalysts have commented on memory reconsolidation as a concept that corroborates the Freudian notion of *Nachträglichkeit*, often translated as deferred action. This paper supports this claim, although for different reasons than those offered by these psychoanalysts. According to some psychoanalysts, the analytic relationship, with the assistance of deferred action, both contextualizes traumatic memories and through re-telling, helps the patient to see that the “here and now” is no longer the “there and then.” This essay concurs, but parses the several senses of *Nachträglichkeit*, showing that the psychoanalytic translation debates about it are resolvable. Replacement of some senses of this term by the much-ignored Freudian memory-motive structure can explain, better than “deferred action” or other translations, the efficacy of this sort of recontextualization of remembered experience. The findings of neurophenomenology enrich this account of the memory-motive structure, showing its dynamic aspects that imply the possibility of psychic transformation. I conclude that there is hope for a terminal analysis, but it is also coherent to consider that unending psychoanalysis can be a way of life.

Keywords

Consolidation, Memory Reconsolidation, Phenomenology, Neurophenomenology, *Nachträglichkeit*, Deferred Action, *Après-Coup*, Subjectivity

Psychoanalysis, considered as a form of life, is not oriented toward a cure. Rather, Freud’s remarks in “Terminal and Interminable Analysis” suggest that he anticipates his own self-analysis as coterminous with the rest of his life (Freud [1937] 1950). His reflections express his evaluative oscillation between the medical teleology of a psychoanalytic cure and the existential trajectory of an unending analysis (Leupold-Loewenthal 1988). His cases describe both finite and unending analysis, and presuppose certain psychic processes that constitute psychotherapeutic change.

Memory reconsolidation is one such process identified by neurocognitive research that may be constitutive of psychotherapeutic change. I argue that although memory reconsolidation is not the only constitutive process, it is an ordinary phenomenon in everyday subjective experience and it is implicit in the psychoanalytic iterations of Freud’s term *Nachträglichkeit*, literally meaning “a belated coming to terms with early experiences.” The post-Freudian psychoanalytic accounts of *Nachträglichkeit* have generated many debates regarding this term’s appropriate translation, the coherence

of its assumptions about bidirectional psychic operations and its implications for the psychotherapeutic process. Some psychoanalytic theorists argue that memory reconsolidation corroborates *Nachträglichkeit*. I find that Freud gave an early account of the neurocognitive structure of *Nachträglichkeit* in his *Project for a Scientific Psychology* although he did not want to publish this account in his lifetime (Freud [1895] 1950).

My view is that the concept of memory reconsolidation resolves the debates regarding the nature of bidirectional psychic activity that some psychoanalysts believe to be implied by *Nachträglichkeit*. It is an explanatory framework that was implicit in Freud's *Project*. His early account describes the memory-motive structure, which is a phrase coined, as we shall see, by neuroscientists Pribram and Gill in their exegesis of Freud's *Project*. I propose that the memory-motive structure, with the integration of current brain science, successfully resolves the putative problem of bidirectional psychic causality and need not resolve the matter of translation. Rather, a new term or perhaps more than one should replace these translations, in order to denote the experimentally corroborated neurocognitive mechanisms at play in psychotherapeutic change. One such mechanism is the memory-motive structure. Replacement of psychoanalytic debates over the sense of *Nachträglichkeit* leads to more coherence in the psychotherapeutic assumptions and neurocognitive findings regarding the operations of memory.

Memory Reconsolidation

Experimental neurocognitive research has demonstrated a process called memory reconsolidation. Explanations of memory reconsolidation imply that a newly acquired memory is not an addition to the series of memories related to this memory but is reconstructive. The new is incorporated into the antecedent, which is restructured in total, resulting in a unique mnemonic inscription. Neurocognitive distinctions and connections between procedural, implicit memory and declarative, retrievable memory illustrate a mnemonic network stimulated during this reconstructive activity (Squire & Kandel 2009; Paller 2000). The idea of memory reconsolidation captures the experimental finding that a new human experience can, under certain conditions, change the meaning of a previous experience and integrate the new experience into its structure, thus changing the remembered experience as a whole.

Memory reconsolidation is accepted by brain science research as key to fundamental research into the biology of long-term memory (Hall 2013). The neurological foundation of memory in general depends on chains of neurochemical, synaptic interactions. Neurons' branching dendrites receive signals from other nerve cells and send information

across the synapses to the next cells. Brain science demonstrates that there is no single thing called memory, rather types of memory achieving different biological purposes using different neural pathways. By 2000, the neurological process of reconsolidation was demonstrated by Nobel-prize winning neuroscientist Eric Kandel. Kandel proved that synaptic networks sprout new branches as we learn, based on the type and activation of chemical neurotransmitters passing between neurons (Kandel 2007).

Memory consolidation refers to a category of biochemical and synaptic processes that stabilize a memory trace or synaptic signature after its initial acquisition. Consolidation differentiates into at least three specific processes: synaptic consolidation, which occurs within the first few hours after learning, and system consolidation, where hippocampus-dependent memories become independent of the hippocampus, during a series of retrievals over a period of weeks to years (Paller 2009). The third process, reconsolidation, is key to the mutability of memory retrieval. In reconsolidation, memories are mutable by reactivation of the memory trace under experiential and biochemical conditions that differ from the memory trace's prior activations. Reconsolidation is corroborated by drug-free non-invasive behavioral human experiments.

Daniella Schiller, director of the Schiller Laboratory of Affective Neuroscience at Mt. Sinai School of Medicine, conducts this non-invasive behavioral research on human subjects, using behavioral interventions into the subjects' memory reconsolidation process. She conducted human behavior modification experiments on sixty-five people, training them to fear, by electroshock, a series of virtual colored blocks that were visually floated before them. Then, the groups experienced behavioral modification interventions designed to erase their fear response (Schiller, Monfils, Raio, Johnson and LeDoux 2009). The subjects were divided into three groups. The first group experienced a version of exposure therapy that is common in clinical treatments of anxiety disorders. They repeatedly saw the virtual blocks with no shock. Eventually they lost their fear. The second group was shown the virtual blocks once again, several hours after the shock, but with no shock. Their responses remained fearful. The third group saw the blocks again, without shock, within ten minutes of the fearful shock experience. Within this drastically narrowed time frame of re-exposure, this group experienced erasure of fear associated with seeing the blocks. This group's recovery from fear is explained as the result of a behavioral intervention into the synaptic signatures or memory traces activated during the reconsolidation process. Schiller's behavior modification experiments dovetail with neuroscientist Karim Nadar's earlier experiments that effected consolidation as well as reconsolidation, showing the protein synthesis involved in memory retrieval. There is a biochemical rewriting of the synaptic signature for each recall. Behavioral intervention into

this narrow window of memory retrieval can change the biochemical update of its synaptic signature (Nadar 2003). Schiller's study and its findings have been replicated many times over, confirming her results (Specter 2014).

Physiological data gathered in experimental studies of memory retrieval by the use of functional imaging technology, pharmacological facilitation of memory retrieval, positron emission tomography (PET) and magnetic resonance imaging (MRI) has led to strong neurobiological evidence for reconsolidation of memories after their reactivation. The evidence suggests that new memories are formed on the background of retrieval of past experience. It is memory of the past that organizes and provides meaning to the present perceptual experience. Memories such as those associated with post-traumatic stress are primed by the release of neurotransmitters on the occasion of the emotionally significant remembered event.

Neuroscientist S.J. Sara verifies the prevailing view that memory operations are widely distributed in the brain, and that specific information is stored in sensory cortices (Sara 2000). Activation of the brainstem neuromodulatory systems, through conditioned arousal response to the context, plays an essential role in both retrieval and reconsolidation. Release of neuromodulators facilitate attention and sensory processing of incoming information during retrieval, triggering intracellular processes upon which stable long-term memory is dependent and promoting reconsolidation of newly reorganized memory. Retrieval must involve initial activation of relevant or selected intrinsic networks and extrinsic stimuli, with integration of these different sources of information into meaningful traces. The initial process must involve some orientation of attention to a particular stimulus or ensemble of stimuli.

Sara remarks that "how those particular stimuli recognized as 'meaningful' or how they can activate the specific distributed networks presumed to be the neuronal substrate of the memory still remains unknown"(Sara 2000, 75). Schiller remarked in a published interview that the preservation and transformation of long term memory does not lie solely in protein synthesis nor the synapses, but rather in the stories that subjects tell and re-tell, updating the emotional details of the event (Hall 2013, 54). Her assertion of the significant role of emotion and narrative, and Sara's emphasis on the importance of emotionally significant priming in the context of the remembered event is consistent with findings by memory implantation techniques developed by psychologist Elizabeth Loftus.

Loftus established the mutability of long-term memory in the 1990s by her behavioral research on memory implantation. Her technique relies on narrative methods with human subjects. In one of Loftus' experiments, the "lost in the mall" study, subjects were given a journal filled with stories of three events from their childhood that their family members

helped to write. One was a fictitious event fertilized by plausible details: at age five the child was lost in a mall and rescued by a stranger. In subsequent interviews with these subjects, a significant subset of the subjects told vivid memories of this fictitious event (Loftus & Pickrell 1995). In a recent interview, Loftus comments, “Memory works more like a Wikipedia page; you can go in there and change it, but so can other people” (Specter 2014, 44).

Memory reconsolidation is effected both by timely behavioral updates of someone’s synaptic signature associated with recall and by narrative updates or re-telling of someone’s long-term memory. Loftus’ research demonstrates the complexity of false memory in the context of re-telling memories. The intersubjective context of re-telling adds to the vividness, for the subjects, of their re-told memories and the conviction with which subjects believe their own updates. This intersubjective emotional context, whether psychotherapeutic, family, or community based, is key to the narrative force that effects long-term memory reconsolidation. The meaningfulness of memory is contingent not only on the physiological causality of the neuromodulatory system, but also on the intersubjective narrative context within which specific memories unfold and are altered.

Here and Now and There and Then

Some psychoanalysts have commented on memory reconsolidation as a concept that corroborates the Freudian idea of *Nachträglichkeit* (Bleichmar 2010, House 2017). This term is translated by James Strachey in the *Standard Edition* as deferred action and by psychoanalysts Laplanche and Pontalis as *après-coup* or literally, “afterwardness” (Laplanche and Pontalis [1967] 1973). I find that it is not necessary to wrestle with the question of translation itself. Translations convey the assumptions and conceptual confusions that are the focus of this paper. The salient confusion resides in the notion of bidirectional psychic activity implied by the translation debates. First, I summarize the historical backdrop of the concept.

In the *Project for a Scientific Psychology*, Freud introduced the term *Nachträglichkeit*, translated by Strachey as a technical term: deferred action. This translation implies a psychic temporizing operation. We recall that the ordinary meaning is “a belated coming to terms with early experiences.” The ordinary phrase suggests a human meaning-making activity, such as we find, for example, in intersubjective dialogue or journal writing. Freud applies the notion of *Nachträglichkeit* in the context of his clinical practice. For example, his 1918 case “From the History of an Infantile Neurosis” describes his patient to have responded with a dream at age four to a sexual trauma experienced

at age one and a half. Freud posited that the patient at this later date was only then psychologically capable of reacting to the earlier trauma event. Freud cites another example of the same twenty-five year old patient, when he consciously apprehends and verbalizes an experience dating from four years of age (Freud [1918] 1955). On the basis of these observations and more from his clinical practice, Freud developed a psychoanalytic sense of *Nachträglichkeit*: the reactivation and reinterpretation of an earlier memory that cannot be assimilated at the time of occurrence, because of the nature of the event itself and its effect on the patient in the specific context of her developmental and maturational state. Subsequently Freud's use of the term appears in various forms throughout his corpus but not in any one paper devoted to the concept itself (Auchincloss and Samberg 2012).

The second thematic use of the term occurs in Freud's correspondence with Fliess, in which he describes the typical re-arrangement or re-transcription of memory-traces that occur over time and in accordance with fresh circumstances (Freud [1896] 1950). The two letters in which this process is described are notorious in psychoanalytic literature for their attributed import regarding the putative bi-directional psychic action of *Nachträglichkeit*. Prior to French psychoanalyst Jacques Lacan's public attention to the concept in his lectures of 1953-1955, the psychoanalytic community did not recognize *Nachträglichkeit* as a concept. Although at that time Lacan discussed the concept and renamed the idea *après-coup*, he did not persist in the use of the term (House 2017). In 1967 French psychoanalysts Laplanche and Pontalis translated the term as *après-coup*, or "afterwardness." They subsequently began to theorize its significance for psychotherapeutic change (LaPlanche and Pontalis 1973). They argue that Freud was concerned with the observed temporal bidirectionality of memory in connection with his observation that experiences, impressions and memory-traces may be revised at later dates to fit with fresh experiences or with the attainment of an individual's new stage of development. Such revisions and updates are endowed not only with new meaning but also with fresh psychic effectiveness. Recently, psychoanalyst Otto Kernberg introduced a translation of *Nachträglichkeit* as "retrospective modification," which has been criticized as losing in translation the intuitively understood bidirectionality of memory retrieval, especially the function of *après-coup* or "afterwardness" (Kernberg 1993).

Psychoanalyst Jonathan House succinctly summarizes this psychoanalytic intuition of the psyche's temporal bidirectionality. House notes that *Nachträglichkeit* may be a temporizing cognitive process metaphorically similar to the chronological characteristics seen in fireworks and land mines. Detonated fireworks are compared to "afterwardness," the psychic function in which results have been determined in the past by the activation

of what was desired or intended when the ensemble was constructed. Retrospective modification can be metaphorically compared to the temporizing involved in narrative re-telling of the past. Lacan, House observed, used Livy's *History of Rome* as an example of retrospective modification. As in historical revisionism, the meanings of past events are determined in the present on the basis of current needs, intentions or desires. Translations of *Nachträglichkeit* have tended to align with one or the other of two such senses, but not both, often conflating one with the other.

LaPlanche and Pontalis claim that existential phenomenology articulates an intuition similar to *Nachträglichkeit* of psychic temporalizing: that consciousness constitutes its own past, constantly subjecting its meaning to revision in alignment with current projects. As I stated earlier, the salient confusion resides in the notion of bi-directional psychic activity implied by the translation debates. The notion of bidirectional psychic activity may itself be a complex and misleading metaphor for the ordinary process of belatedly coming to terms with early experiences. If we subscribe to neurocognitive models of memory reconsolidation, the very notion of bidirectionality is not coherent when applied to the former. An overall notion of dynamic structure is a more apt expressive vehicle to convey the sense of memory reconsolidation. The "bidirectionality," subjectively felt "afterwardness," and "belatedness" of human experiences of memory are phenomenological modes or specifically temporal indices undergone by human subjectivity. These modes are subjectively dynamic, in endogenous rather than exogenous situations. The enactive model of cognition posited by neurophenomenology, provides another window into the "dynamic" aspect of the neurocognitive structure of memory.

The enactive model of cognition proposes that cognition is "not the representation of a pre-given world by a pre-given mind but is rather the enactment of a world and mind on the basis of a history of the variety of [human] actions that [our] being in the world performs" (Varela, Thompson and Rosch 1991, 9). The phenomenological interdependency of life world background and cognitive embodiment, richly described by Merleau-Ponty (Merleau-Ponty 1962) and contemporary neurophenomenologists, attends to the fundamental circularity of explanations of cognitive acts of memory. Although we find ourselves in a world that seems to be there prior to our reflection, the lived world is not separate from our cognitive acts. The dual facts of human self-understanding in the life world, and the mechanisms adduced by life world sciences are circular in an epistemological and hermeneutical way (Varela, Thompson and Rosch 1991, 11). The memory trace is a product of endogenous memory storage operations engaged during various retrieval experiences, in reciprocal interplay with the exogenous yet subjectively tinged context of the life world. A recalled episode is tantamount to

a retelling of prior retellings of the same story, rather than a replay of an ancient story set in stone long ago (Paller 2009, 745). To escape this phenomenological circularity, Laplanche and Pontalis posit that the psychoanalytic sense of *Nachträglichkeit* can provide more descriptive precision for psychotherapeutic purposes. They posit that first, with regard to trauma, it is not lived experience in general that undergoes revision, but specifically whatever was impossible on first recording to incorporate into a meaningful experience. Infantile, preverbal experiences are of central psychoanalytic interest in this regard, especially infantile preverbal traumatic experience. Second, revisions of specific mnemonic traces of partially unassimilated experience are occasioned by later situations that enlist organic or developmental maturation, to allow narrative and emotional reworking of the earlier experience and access to new levels of meaning. But as Merleau-Ponty demonstrated in *Phenomenology of Perception*, there is no specific reason why existential phenomenology or the findings of neurophenomenology cannot be applied for descriptive purposes to human developmental experience or traumatic experience at any age. Rather, I find that the psychoanalytic sense of *Nachträglichkeit*, applied solely to cases of preverbal infantile trauma, appears *ad hoc* without the contributions of enactive cognitive, hermeneutic, and phenomenological descriptions of perceptual-temporal experience. Belatedly coming to terms with one's experience enlists all of the dimensions of human brain and mind that are elucidated by these approaches.

The neurocognitive science perspective concurs that traumas that have occurred early in life when the appropriate memory systems have not formed may be inaccessible to words. It might be difficult or impossible to contextualize information if the brain areas required were not developed or were shut down when the information was originally absorbed. So, according to both neurocognitive science and psychoanalytic theory, the therapeutic relationship may function to contextualize traumatic memories and to gradually assist the patient to experience and see that the "here and now" is no longer the "there and then" of trauma. In this way, memory reconsolidation is an explanatory framework that clarifies the therapeutic efficacy of the analytic relationship in the context of the timely use of psychoanalytic interpretation (Bleichmar 2004, Tuttle 2004). Although experimental settings for memory manipulation may be able to predict specific response patterns by human brains in controlled settings, these manipulations are shown to be inadequate for predicting the responses of embodied brains or minds, for whom the phenomenological life world comprises their "outside memory" (Joldersma 2016). On the basis of the foregoing discussion, I concur that the psychoanalytic relationship presents a potential situation for the stimulation and reworking of memory traces in the present, but this situation is actualized by unpredictable and uncontrolled means.

Freud's late metaphor of the palimpsest, an ancient writing tool, is apt at representing the structural aspect of embodied memory, over the course of lived time (Freud [1924] 1925). According to neurophenomenology, consolidation and reconsolidation of long-term memories are based on the subject's recent modifications, with shortened retention intervals in the retrieval pattern generated by the recently activated synaptic signature. In other words, each time a memory is retrieved, the information in question is associated with other recent information that expands the operative nature and meaning of the memory. In human subjective recall, new events and the unique context or the outside memory instigate reinterpretation of the retrieval. This is a memory structure that dynamically influences the present memory state and simultaneously effects remembrance of the past, giving "the past" new and effective meaning in the present and motivating future behavior. Freud's palimpsest can record a great amount of material while always remaining "new." But this material leaves a faint, but perceptible trace on the waxen surface below which can be seen if one were to lift up the sheet of plastic and examine the wax surface. This, for Freud, is similar to the way the psychic system, receiving sense impressions from the outside world, remains unmarked by those impressions which pass through it to a deeper layer where they are recorded as unconscious memory. He writes that "the appearance and disappearance of the writing" is similar to "the flickering-up and passing-away of consciousness in the process of perception" (Freud [1924] 1925, 230). Freud's metaphor evokes his earlier neurocognitive model of memory reconsolidation. I turn to this earlier model to show that its corroborated structure includes motivation, a neurocognitive element that is indispensable to the belated coming to terms with early experiences that is key to psychotherapeutic change.

Memory-Motive Structure

Freud in *Project for a Scientific Psychology* initially broached significant aspects of memory reconsolidation. He did not have the scientific information necessary to fully remark on the biochemical, genetic, and molecular processes now known to constitute long term memory storage. Rather the *Project* develops a nineteenth century account of neuropsychological processes, measured by the galvanometer of his time as action currents of electrical nerve impulses. Neuroscientists Pribram and Gill in *Freud's 'Project' Re-Assessed*, look at Freud's treatise as the "Rosetta Stone" for improved contemporary intercommunication of biology, neurology, and psychoanalytic theory (Pribram and Gill 1976). The *Project*, they claim, gives operational definitions of neurological and

behavioral mechanisms that anticipate later psychoanalytic concepts such as drive reduction, ego strength, wish fulfillment, and reality testing. They demonstrate that the *Project* provides a prescient view of the relation between psychic internal and external environment, concretely formulated in a memory-based structure of motivation. Their critique of Freud's neuropsychological treatise unpacks inconsistencies and errors from the point of view of contemporary neuroscience in his account of drives, affect, and pleasure/unpleasure. Aside from errors, Pribram and Gill tease out Freud's reliance on neuron theory that is consistent with the theory, as it exists today, yet written two years before the term "synapse" named the discontinuities intercalated between the elements that compose the nervous system. Freud called these discontinuities the "contact barrier" and in all other respects the elementary, cellular composition of the nervous system described in the *Project* is compatible with current neurophysiological conceptualization.

The *Project* develops an account of the neural mechanism that, while receptive and capable of discharge, still maintains the ability to delay and retain excitation. Central to Freud's memory-motive structure is the idea that neurological excitation is both transmitted but also stored in neurons as a negative quantity of energy. Freud extrapolated from the graded electronic phenomena discovered in his time: when electronic potentials reach a certain magnitude then discharge, an action current results in a nerve impulse. He saw that subsequently the potential is gradually reconstituted. This storage to which Freud refers is translated by Strachey as cathexis, deriving from the Greek *cathodos*: the root of the English "cathode" or negative potential. Contemporary terminology discards Freud's notion of stored quantity of energy in favor of neurochemical changes recorded from nervous tissues called "potentials."

Freud posited a functional split between two neurological systems. The peripheral nervous system, *phi*, are neurons that by virtue of contact of the environment are responsible for receptivity and motor discharge. *Psi*, or the neural apparatus in contact with endogenous excitation, is given over to retention. Freud found *psi* as most interesting from a psychological point of view. Here, branches of neurons, in contact with others, develop networks of selective facilitation: the basis of the memory trace. Pribram and Gill note the neurological fact that every neuron has several paths of connection with other neurons. The *Project* describes several contact barriers or synapses that allow selective facilitation to occur and thus the flow of nerve impulses to become directional. This neurological operation is identified by Freud as the motive process that guides behavior.

Freud's early metapsychology draws an identity between the memory trace and the structure of motive. Each memory trace is doubly determined by endogenous and

exogenous neuronal excitations. Memories are the feedback or retentional aspects of these facilitations; motives the feedforward aspects of excitations that run to completion thus guiding motivational behavior (Pribram & Gill 1976, 70). The *Project* describes tension between the primary function of immediate discharge and the secondary function of equilibrium; tension established when the system receives endogenous stimuli from somatic elements, simultaneously realizing potentials in the external world. The *Project* shows the executive, prefrontal secondary process to slowly defend against the accruing excitation, which results when key neurons are stimulated to initiate the “generation of unpleasure.” Both in the *Project* and current neurophysiology the ego or prefrontal executive process operates by an emergent feedforward directive that is willed, intentional and voluntary, exercising inhibitory influences on a facilitative primary process (Pribram and Gill 1976, 81).

For example, Freud describes the mesh between the infant’s experiences of nurture by caregivers, in which unpleasure is brought to an end by the pleasurable relief of tension. He notes that only by caregiving interventions can memory-motive structures cathect as wishes develop neurological complexity, and get organized as inhibitory ego functions. In Freud’s account, wishes are memory traces of satisfactory experiences. Inhibition is necessary for wishes to modify into expectation, and to permit reality testing. Pribram and Gill claim that Freud’s linkage, in the *Project*, of motive and memory in the structure of the wish is one of his fundamental contributions to brain science. The memory-motive structure is testable, they claim, at both the neurological and behavioral level, independent of any psychoanalytic situation (Pribram & Gill 1976, 71). The mechanism that allows ego or prefrontal executive control to develop rather than to be overwhelmed by large amounts of excitation is the process of satisfaction, or learning by reinforcement.

Learning, in Freud’s time, was experimentally observed and called consolidation and reconsolidation. By the mid-1880s, memory consolidation was the topic of laboratory study by German psychologist Hermann Ebbinghaus. Studies of human subjects’ repetitious recall of lists of syllables yielded two principles of memory storage: that different types of memory have different life spans, and that repetition makes memories last longer. German psychologists George Müller and Alfons Pilzecker observed memory’s resistance to interference over time and its high susceptibility to disruption, if made to learn additional material during a memorization task. The effects of such interference, confirmed by subsequent studies of humans and animals, is considered by clinical neurologists to be the mechanism operative in retroactive amnesia caused by head traumas and epileptic seizures. Memory traces of events immediately prior to the trauma

do not have the chance to undergo consolidation and to gain resistance to interference (Squire and Kandel 2009).

Both the neurocognitive model of memory reconsolidation and the Freudian model of *Nachträglichkeit* question the veracity of memory, but for different reasons. Freud's account of primary and secondary processes proposes that the conscious retrieval of some traumatic memories can occur only in distorted form. Both his palimpsest metaphor and his neurocognitive account in the *Project* describe the inscription of new experiential mnemonic residues on the unconscious and the censorious activities of consciousness itself, leading to memory distortion. The Freudian notion of repression assumes a general impossibility of recall of some traumatic memories, due to their fixated, inassimilable status within the unconscious. Some psychoanalytic psychotherapists claim that the neurocognitive concept of memory reconsolidation challenges and replaces the Freudian notion of repression. The neuroscience model hypothesizes that under stress, information may not be recalled simply because the appropriate memory systems were either not formed or not functioning while the traumatic event occurred. Using a different descriptive framework, Freud believed that threatening thoughts, feelings, or events may be pushed into the unconscious because of a motivation to protect the ego from overwhelming anxiety. Regardless of descriptive differences, the memory-motive structure is constituted in part by memory traces formed prior to secondary processes. These memory traces are inherent to normal development. On this account, repressed traumatic memory traces described by psychoanalytic theory are only a subset of these developmental traces.

Each time a memory is retrieved *qua* memory, the information in question is associated with other recent information that expands the effect and meaning of it. The integrated memory-motive structure, experimentally corroborated, shows *that* the stories we tell, within specific contexts primed for re-telling and recall of certain long-term memories, can update memories, potentially converting these updates to motivational pathways activated by decisions and anticipatory behavior. Exactly *how* this occurs remains in the brain science research agenda. Neuroscientist Karl Pribram describes, in his intellectual autobiography, the history of experimental studies that establish how forms of memory can best be understood as self-organizing structures of complexity (Pribram 2013). We are used to an image of the human psyche as an onion whose respective layers of cognitive functions can be stripped away. The onion image conveys the idea that the surface complexity of reflectivity can be reduced to the simple core of self-experience. Neuroscientist Joseph LeDoux shows that this paradigm is outdated, similar to the way that the layers of the brain and its functions were described prior to brain science

discoveries of the self-organizing capacities of mind (LeDoux 1996). The common error in outdated models of intrapsychic structures and brain function is to imagine the mind/brain entity as organized by hierarchy, from simple to complex, rather than to imagine this dynamic entity as embodied complexity in its entirety: self-creative or autopoietic (Varela, Thompson and Rosch 1991).

Biologically based cognition is orchestrated by self-organizing neurological networks that are foundational to embodied, reflective experience. Emergent global properties of human cognitive capacities are not replicable in controlled experimental situations. Although the tools of brain science are advancing measurements of the neurological temporal and perceptual events that correlate with cognitive acts, brain science itself cannot causally induce the global transformations of embodied mind observed in ordinary situations such as our rapid recognition of others, associative memory, infant language acquisition or prefrontal executive development. The question “What is a neural network that it may be capable of supporting a human, embodied existence?” is an enigma common to brain science, neurophenomenology and psychoanalysis (Globus cited in Varela, Thompson and Rosch 1991, 127). Significant to any answer is Freud’s notice of the neurological mechanisms that support the conversion of memory updates to motivational pathways activated by decisions and anticipatory behavior.

Conclusion

Freud’s memory-motive structure, integrated with the findings of brain science and neurophenomenological descriptions, helps us to “see” how remembrance of the past transforms long-term memory by giving it refreshed, significant meaning and significance. This account is compatible with existential phenomenology’s view of memory as an embodied experience that is dynamically reciprocal in its exchanges with the life world. In this reciprocal involvement, at work are complex pre-reflective, pre-thematic layers of mind as well as reflective, autobiographical, and recollective networks of complexity. The memory-motive structure functions within worldly modalities of temporal-perceptual expressiveness. The former can be disrupted and changed by insufficient learning techniques, trauma and repression, affecting one’s sense of one’s own narrative self and one’s own worldly agency. Humans live in an embodied temporal continuum throughout their lifespan that includes all kinds of modes of disruption that will generate, depending on the intersubjective context, different versions of belatedly coming to terms with one’s experience.

This essay points to the desirable convergence between existential phenomenology, psychoanalysis and brain science. The convergence is desirable because experimental research on self-organizing structures of mind verifies the autopoietic findings of phenomenology and sheds some light on the *how* of psychotherapeutic change. The memory-motive structure is an autopoietic process over one's life span that does not terminate within a specific situation. Rather, it implies that an ongoing self-analysis can be part of a coherent way of life.

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