

# UNLOCKING THE EMOTIONAL BRAIN



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## *NEW INSIGHTS FROM NEUROSCIENCE*

The new brain science of memory reconsolidation centres on the surprising discovery of the brain's ability to delete a specific, unwanted emotional learning, including core, non-conscious beliefs and schemas, at the level of the physical, neural synapsis that encode it in emotional memory. Deletion of the emotional learning underlying a particular symptom eliminates that symptom down to its emotional roots. The detection of memory reconsolidation, a type of neuroplasticity or synaptic change that can erase emotional learning, was both a breakthrough and a turnaround in our knowledge of learning and memory.

In their ground-breaking book: **Unlocking the Emotional Brain: Eliminating Symptoms at Their Roots Using Memory Reconsolidation**, Bruce Ecker, Robin Ticic, Laurel Hulley (2012) present a conceptual and methodological framework for psychotherapy within an emotional learning and unlearning paradigm. The authors propose a process that may prove to be a universal template for deep elimination of any existing learned response.

Memory reconsolidation is the only type of neuroplasticity currently known to neuroscience that is capable of unlocking locked synapses and eliminating emotional learning from implicit memory. It is applicable for dispelling a vast range of presenting symptoms and problems generated by existing learnings held in implicit memory - learnings that the individual is unaware of possessing, even as these learnings re activate and drive unwanted responses of behaviour, mood, emotion or thought.

The emotional brain - particularly the subcortical emotional brain or limbic system – is often described as "primitive" and "irrational," and its unwanted, problematic responses are usually characterized as "maladaptive" and "deregulated," but these pathologizing and pejorative terms prove to be fundamentally at odds with what research has revealed about emotional learning. The Emotional Coherence Framework emphasizes recognizing and utilizing the full extent of the coherence and adaptive functioning of emotional implicit learning because the therapeutic leverage gained is very great for both case conceptualization and methodology. The intention within this framework is to learn how to maximize our ability to cooperate with the brain's own powerful processes of change.

## Emotional Memory: A Blessing and a Curse

Emotional learning usually consists of much more than stored memory of the "raw data" of what one's senses were registering and what emotions one was experiencing during an original experience. Also learned - that is, stored in implicit memory - is a constructed *mental model* of how the world functions, a template or schema that is the individual's sense-making generalization of the raw data of perception and emotion. This model is created and stored with no awareness of doing so. It does not exist in words but is no less well-defined or coherent for that. The emotional brain then uses this model or schema for self-protectively *anticipating* similar experiences in the future and recognizing them instantly when they begin (or seem) to occur.

Emotional memory converts the past into an expectation of the future, without our awareness, and that is both a blessing and a curse. It is a blessing because we rely daily on emotional implicit memory to navigate us through all sorts of situations without having to go through the relatively slow, labour-intensive process of figuring out, conceptually and verbally, what to do; we simply know what to do and we know it quickly. It is easy to take for granted the amazing efficiency and speed with which we access and are guided by a truly vast library of implicit knowings. Yet our emotional implicit memory is also a curse because it makes the worst experiences in our past persist as felt emotional realities in the present and in our present sense of the future.

As a relatively simple example, consider a man who undertakes psychotherapy for social anxiety and for the first time becomes directly aware, and puts into words, that he lives and moves within the expectation of being shamed and rejected if he differs openly with another person about anything. All his life, this non-conscious expectation has wordlessly defined *how the world is* - or so it has felt to him because his emotional brain formed that implicit model of human beings based on childhood perceptions during family interactions. His social anxiety had seemed to him a mysterious affliction, but now, with this retrieval - this shift from implicit to explicit knowing - his anxiety makes deep sense as the emotion that naturally accompanies his living knowledge of how people respond. Yet, his learned constructs had never appeared in his prior experience of that anxiety; nothing indicated that this was actually memory of the past. The constructs we form do not normally show up in conscious experience themselves, much as a coloured lens just in front of the eye is not itself visible.

We easily see in discussing this man that what seemed and felt so real to him about the world was not an external reality at all, but rather a vivid illusion or mirage maintained by his own implicit constructs in emotional memory.

It hardly seems an exaggeration to regard the limbic brain's power to create emotional reality as a kind of magic that immerses one in a potent spell that feels absolutely real and would last for a lifetime. However, thanks to a fortunate confluence of developments in clinical knowledge and brain science, we now know how to induce the emotional brain to use its power to break emotional spells that it previously created.

### Non-Verbal Modelling of the World Begins Very Early and Lasts a Lifetime

The emotional brain's completely nonverbal, implicit yet highly specific meaning-making and modelling of the world is innate and begins very early in life. For example, infants three months old form expectational models of contingency and respond according to these models, and 18-month-old children can form mental models of other people as wanting things that differ from what they themselves want and will give the other what he or she wants and can form models that distinguish between intentional and accidental actions. There is evidence that this process of meaning-making actually begins before we are born, in our mother's womb.

The timeless, unfading persistence of underlying, symptom-generating learnings across decades of life, long after the original circumstances that induced their formation have ceased to exist, is often taken as meaning that they are maladaptive and that the symptoms they produce signify a dysregulation of emotional brain networks. However, when symptoms turn out to have full underlying coherence and a positive, adaptive, urgent purpose in the context of a person's actual life experience, such pathologizing conceptualizations seem ill-founded. Furthermore, memory research has established that learnings accompanied by strong emotion form neural circuits in subcortical implicit memory that are exceptionally durable, normally lasting a lifetime.

The brain is working as evolution apparently shaped it to do when, decades after the formation of such emotional knowledge, this tacit knowledge is triggered in response to current perceptual cues and launches behaviours and emotions according to the original adaptive learning.

Such faithful retriggering is, in fact, proper functioning of the brain's emotional learning centres, not a faulty condition of disorder or dysregulation - unless one is prepared to say that it is a dysregulation of evolution itself, not of the individual.

### Separate Memory Networks in the Brain

The hidden workings of emotional memory are greatly clarified by recognizing that memories of events are different from the learnings based on those events. Each of these memory types is stored in its own separate network in the brain. Consider perfectionism as an example of an emotional learning that therapists frequently encounter. Some clients describe clear memories of original experiences in which being imperfect on their part incurred intense shaming or rejection, but they have no awareness of the resulting implicit learning that has since ruled their responses in life – that it's urgent to be perfect to avoid such suffering. In contrast, other clients are aware of their learned expectation that imperfection is too dangerous to risk, but even when that expectation is triggered, they have no memory of the original life experiences in which that learning formed.

The original, concrete experiences and the learning formed from those experiences are the stuff of two different and separate kinds of memory. The first is episodic memory, or the memory of events that makes up our autobiographical narratives. The second is emotional implicit memory, or nonverbal memory of learned models of how the world functions. Obviously, the cause of the perfectionism is the existence of the emotional learning - the core belief that any imperfection brings rejection, so I've got to be perfect – and not the episodic memory of original events. For this reason, emotional learnings are the target for the erasure process using new neuroscience. Memory of events is unaffected by that erasure. In other words, after erasure, clients remember what happened in their lives, but become free of their learning-driven emotional reactions.

Even highly competent, mature people who are rational in most areas of life can be suddenly undone when a current circumstance - often perfectly innocuous in itself - triggers an ultra-durable emotional learning from the past that's still tightly enmeshed in their neural wiring. Once the implicit memory is triggered, they're seized by an emotional state that has a life all its own, with no cognitive awareness of why such a reaction is happening.

It could be self-criticism or volcanic rage, numbness or raw panic, underachieving or inconsolable sorrow. Regardless, one's calm, cognitively evolved state of mind is no match for such a flare-up from the emotional implicit memory system.

It should be obvious, then, why it's so hard to triumph over old conditioning. In a very real way, we're going up against nature. Since 19<sup>th</sup> century Russian psychologist Ivan Pavlov's day, even lab studies of the extinction of implicit learnings never achieved erasure, only temporary suppression.

It's no wonder that, until recently, brain researchers believed that the main problem in overcoming old conditioning was that the brain lacked any mechanism for actually erasing negative emotional learnings. The neural circuits of such learnings were known to be held together by ultra-durable synapses that were believed to be immutable for the lifetime of the individual, whether animal or human.

### Memory Reconsolidation: How the Brain Unlearns

Nature, however, turns out to be more ingenious than that. The brain does come equipped with a key to those locked synapses - and we have the resilience to become radically free of our early emotional learnings. This key became evident in 1997, when several labs began publishing reports of a brain process that hadn't been recognized before. This process turns off a learned emotional response at its roots, not by merely suppressing it - as in a behavioural-extinction procedure - but by actually unlocking the neural connections holding it in place and then erasing it within the nervous system. Brain researchers named this process *memory reconsolidation* and went on to demonstrate how it works in nematodes, snails, sea slugs, fish, crabs, honeybees, chicks, mice, rats, and humans. Remarkably, what the brain requires to unlock and erase a particular learning follows the same three-step process in all those species: reactivating the emotional response, unlocking the synapses maintaining it, and then creating new learning that unlearns, rewrites, and replaces the unlocked target learning.

What induces the brain to use its built-in key to unlock synapses in this process? The answer was discovered in 2004 by researchers who experimented with, of all things, a group of crabs, whose clearly visible fear responses to predators made them superbly suitable subjects. Héctor Maldonado's lab in Argentina placed crabs in a test area into which the moving image of a predator was introduced repeatedly.

Needless to say, this seemingly near-death experience conditioned an extreme fear response in the crabs. Then one subgroup was placed in the test area one at a time, but the predator image wasn't introduced, and each crab in this group was simply returned to its safe cage. Crabs in another subgroup were placed back in the test area, but saw the predator coming as usual. Put another way, while one subgroup of crabs simply experienced the familiar "bad" event in the test area, the other group experienced a counter-event that created a sharp, powerful mismatch between learned expectations ("This is where the predator shows up!") and reality ("Hey, the predator *didn't* show up!").

Previous researchers thought reactivation of emotional learning alone unlocked a learned schema. But Maldonado's breakthrough with his crab test showed that an additional experience was required to loosen the hold of the fearful schema: a vivid contradiction of the reactivated learned pattern about how the world functions - what researchers call a mismatch experience or a *prediction error* experience.

This contradictory experience, coming while the initial fearful learning was still intensely felt, quickly made the normally robust neural circuits of the target learning become labile and fragile. Then, through an ingenious procedure borrowed from earlier studies - use of a chemical agent that permanently shuts off labile, unlocked synapses but doesn't affect locked ones - Maldonado and colleagues proved that this prediction error was the key to the measurable erasure of the conditioned fear memory: only crabs that experienced the mismatch no longer responded fearfully in the test chamber.

As this experiment showed, emotional learning circuits unlock and become erasable only when a vivid new experience mismatches what a reactivated emotional learning leads an animal or person to expect. However, once a neural circuit has been unlocked, if nothing is done to erase and overwrite it during the next few hours, the synapses automatically relock - or reconsolidate - and the circuit re-stabilizes, preserving the original learning. The animal or person is then back at square one - still just as likely to be triggered by a stimulus reminiscent of the original terrifying event.

For the field of psychotherapy, the enormous relevance of later research on the neuroscience of memory reconsolidation is that it's shown conclusively that using experiential methods to achieve erasure and transformation of the brain's neural



circuits is just as effective as dousing it with chemicals, as was done with Maldonado's crabs. In fact, in controlled studies with human subjects, experiential methods have successfully erased learned fears, heroin cravings, and other types of emotional learning.

### **The Tenacity of Implicit Emotional Memory: A Psychological Prison**

*Yesterday this day's madness did prepare. Rubáiyát – Omar Khayyám*

What are attachment patterns, family of origin rules and roles like co-dependency, Post-Traumatic Stress Disorder, low self-esteem, compulsive behaviours like perfectionism, or "unresolved emotional issues" but the expression of emotional learnings? These phenomena can manifest as panic and anxiety attacks, chronic or acute depression, addictive behaviours, shame, self-criticism, rage, sexual inhibition, fear of intimacy, post-traumatic stress symptoms such as hyper-vigilance or compulsive avoidance, and many other symptoms and sufferings. Underlying the diverse behaviours, moods, emotions, and thoughts for which people seek therapy are "implicit" emotional learnings – learnings that are not in conscious awareness and that entered into memory during experiences involving strong emotion.

Implicit knowledge is often termed procedural knowledge because it consists of knowing how to perform an action (such as knowing when and how to behave in a very pleasing manner in order to be safe) or knowing how the world functions (such as "knowing" that people become rejecting or attacking as soon as they are displeased). Such knowledge consists of schemas (patterns, templates, or models) that have been abstracted or extracted from experience and stored in memory systems other than those that hold one's explicit, autobiographical, "episodic" knowledge of past events. Knowledge created by implicit learning remains out of conscious awareness even as it generates behaviours, emotions, and thoughts in response to current experiences.

Therapists routinely witness the extraordinary durability of original emotional learnings, which persist in their unrelenting vice grip on mood and behaviour decades after they were formed. The deeply ingrained quality of emotional learnings appears to be a survival-positive result of natural selection. The brain was crafted such that any learning that occurs in the presence of strong emotion becomes stored in specialized sub-cortical implicit memory circuits that are exceptionally durable.



This process where emotional learning become physically installed in long-term memory is known as consolidation.

Neuroscientists found that extinction training forms a separate learning in a physically separate memory system from that of the target learning, and the extinction learning competes against, but does not replace, the target learning. Consolidated emotional learnings were therefore believed to be indelible in memory, encoded in neural circuits by synapses that were irrevocably locked. The conclusion was that the brain's limbic system – the major sub-cortical region of implicitly emotional memory – is a kind of psychological prison in which each of us serves a life sentence.

Indelibility also implied that the only possible psychotherapeutic strategy for preventing symptoms was the use of counteractive methods that compete against an unwanted learning by building up a preferred learning and responses intended to override and suppress the unwanted response. This leaves the unwanted response relatively free to recur, so an on-going counteractive effort is typically required indefinitely, for example, teaching a relaxation technique to counteract anxiety, building up resources and positive thoughts to counteract depression, or use of oxytocin to enhance feelings of emotional connection and empathy. The strategy of counteracting predominates in the field of psychotherapy, for example all the forms of cognitive-behavioural therapy (CBT), solution-focused therapy, and the positive therapies.

### **The Prison Comes with a Key: Memory Reconsolidation**

The downfall of indelibility was the discovery of reconsolidation. The prison of emotional memory, built over aeons by evolution, comes with a key, and that key has now been found. Synapses can be unlocked. The limbic life sentence can be commuted.

At the end of the 1990's it was discovered that electro-shock procedures that had failed to dispel a learned emotional response became dramatically successful in some cases when the target response and its underlying implicit learnings were in a state of strong reactivation at the time of the shock. The targeted emotional and behavioural responses ceased and could not subsequently be re-evoked. Reactivation of a well-consolidated, longstanding implicit memory appeared to have rendered the stored emotional learning susceptible to dissolution.

Subsequent research showed that consolidated emotional learnings can be returned temporarily to a deconsolidated state, allowing erasure by new learnings before reconsolidation takes place. “Reconsolidation” refers to the process of unlocking and then relocking the synapses encoding a specific memory. Reconsolidation permits the reorganization of the existing memory as a function on new information in the retrieval environment. Reactivation of a consolidated memory can return it to a labile, sensitive state – in which it can be modified, strengthened, changed, or even erased. The distinctive markers of erasure of an emotional learning – every psychotherapist’s dream outcomes – are:

- A specific emotional reaction abruptly can no longer be reactivated by cues and triggers that formerly did so or by other stressful situations.
- Symptoms of behaviour, emotion, somatic, or thought that were expressions of that emotional reaction also disappear permanently.
- Non-recurrence of the emotional reaction and symptoms continues effortlessly and without counteractive or preventive measures of any kind.

### Requirements for De-Consolidation: Reactivation Plus Mismatch

In order for de-consolidation to occur, a critical additional experience must take place while the memory is still reactivated. This second experience must consist of novel perceptions that mismatch – that is, deviate saliently from – what the reactivated target memory expects and predicts about how the world functions. Both memory reactivation and memory mismatch are necessary for inducing memory labialization and reconsolidation.

The mismatch can be either a full contradiction and disconfirmation of the target memory or a novel, salient variation relative to the target memory. Absence of a mismatch experience is associated with failure to induce memory de-consolidation and reconsolidation in several studies.

A computer analogy can be used to explain how reconsolidation allows a particular emotional learning to be updated (revised or erased). Reactivating a memory is like opening a document on a computer, which allows the content of the document to be edited or deleted before the document is resaved and closed.

However, the needed second step is a perception or experience that mismatches the target memory, in the form of either a salient novelty or an outright contradiction. It is not simply that memory reactivation must differ in some manner to conditioning; instead, reconsolidation is triggered by a violation of expectation based upon prior learning, whether such a violation is qualitative (the outcome not occurring at all) or quantitative (the magnitude of the outcome not being fully predicted).

The existence of a predictive error signal (from some brain region) might be a crucial prerequisite for reconsolidation to be triggered. Reconsolidation occurs when there is new information at the time of memory retrieval. Novelty is likely derived from the mismatch between consolidated and current information, which then re-engages the encoding process.

### The Precision of Erasure Guarantees You Won't Go Even Crazier

The beauty of the reconsolidation window is that during that window, to unlearn is to erase. Yet, the extent of learnings erased via reconsolidation is highly defined and controllable, as necessary for safe clinical use of the erasure process. Reconsolidation is highly selective and affects only the memory that it experientially mismatches, whatever type of memory that may be. When de-consolidated memory is erased, erasure is limited to precisely the reactivated target learning, without impairing other closely linked emotional learnings that have not been directly reactivated. For example, erasure of a learned fear does not impair explicit autobiographical memory. After a learned fear response has been eliminated, subjects still remember the experiences in which they acquired the conditioned fear response, as well as the fact of having had the fear, but the fear is not re-evoked by remembering those experiences.

This reflects the well-established anatomical separateness of different types of memory. This allows erasure of a specific emotional implicit memory network without affecting the autobiographical, narrative learning of the same events stored in a neocortical, explicit memory network.

### Ready for Unlearning

Different techniques can be used to facilitate the brain's core process of profound unlearning. That's why this process can be fulfilled within many different systems of experiential therapy, provided that its steps match those of the reconsolidation process: First, evoke into direct experience the emotional learnings underlying the client's unwanted patterns. Then find a vivid knowledge or experience that contradicts or mismatches those learnings. Finally, combine those two into a juxtaposition experience and repeat it several times. Thus, the target learning is completely or partially "rewritten" by new learnings within the five-hour reconsolidation window – the memory's labile period. The altered memory is then allowed to reconsolidate naturally.

The natural, behavioural process of transformational change of an existing emotional learning – the brain's rules for unlearning and erasing a target learning – has three steps:

1. **Reactivate.** Re-trigger / re-evoked the target knowledge by presenting salient cues of contexts from the original learning.
2. **Mismatch / unlock.** Concurrent with reactivation, create an experience that is significantly at variance with the target learning's model and expectations of how the world functions. This step unlocks synapses and renders memory circuits labile, i.e., susceptible to being updated by new learnings.
3. **Erase or revise via new learning.** During a window period of about five hours before synapses have relocked, create a new learning experience that contradicts (for erasing) or supplements (for revising) the labile target knowledge. This new learning experience may be the same as or different from the experience used for mismatch in Step 2; it is the same, Step 3 consists of repetitions of step 2.

After the three-step procedure, there is an erasure verification step to ascertain whether the target learning still exists in memory.

The "new learning" that serves to rewrite the target learning in Step 3 above, must feel decisively real to the person based on his or her own living experience. In other words, it must be experiential learning as distinct from conceptual, intellectual learning, though it may be accompanied by the latter. It is extremely useful to take advantage of the fact that the emotional brain hardly distinguishes between imagined and physically enacted experiences.

### Sequence of Experiences That the Brain Requires for Fundamental Dissolution of Problematic Implicit Knowledge

#### 1. Accessing Sequence

- **Step A – Symptom identification:** Actively clarify with the client what to regard as the presenting symptom(s) – the specific behaviours, somatics, emotions, and / or thoughts that the client wants to eliminate – and when they happen, that is, the precepts and contexts that evoke or intensify them.
- **Step B – Retrieval of target learning / symptom-necessitating emotional schema:** Retrieve into explicit awareness, as a visceral emotional experience, the details of the emotional learning underlying and driving the presenting symptom.
- **Step C – Identification of accessible contradictory / disconfirming knowledge:** Identify a vivid experience (past or present) available to the client that can serve as living knowledge that fundamentally incompatible with the model of reality in the target emotional learning retrieved in Step B, such that both cannot possibly be true. The disconfirming knowledge material must be mutually exclusive, ontologically, with the target learning. It may be already part of the client's personal knowledge or may be created by a new experience.

## 2. Erasure Sequence

- **Step 1:** Reactivation of symptom-necessitating emotional schema.
- **Step 2:** Juxtaposed, vivid experience of contradictory knowledge.
- **Step 3:** Repetitions of the juxtaposed experience in Step 2.

## 3. Verification Step

- **Step 4:** Verification of change by observation of critical markers.
  - Emotional non-reactivation
  - Symptom cessation
  - Effortless performance

## Advantages and Applications of the Meta-Map of Common Factors of Transformational Change

The therapeutic reconsolidation process can contribute to psychotherapy integration by providing:

- A unified understanding of the transformational change of emotional schemas formed by all types of learning.
- A clarification of how the mechanism of deep, lasting change operates in a given psychotherapy system on both the neurological and subjective levels.
- A cross-platform template for understanding and comparing different methodologies and methods.
- A therapist's meta-map that positions him or her to have a flexible choice of methods and approaches with a given client, and guides the use of these methods for efficient, transformational work.
- A lens for discerning therapy systems that have an inherent capacity to produce transformational change as distinct from those that inherently produce counteractive (incremental, relapse-susceptible) change.

Therapies that comprise the sequence include:

- Coherence Therapy
- Accelerated Experiential Dynamic Psychotherapy (AEDP)
- Emotion-Focused Therapy (EFT)
- Interpersonal Neurobiology (IPNB)
- **Eye-Movement Desensitization and Reprocessing (EMDR)\***
- **Emotional Freedom Techniques (EFT)\*, particularly Matrix Re-imprinting (MR)\***
- **Neuro-Linguistic Programming (NLP)\* Techniques, particularly Brain Working Recursive Therapy (BWRT)\***

\*These are therapies offered at this practice

## Conclusion

Memory reconsolidation appears to have the potential to revolutionize the practice of psychotherapy. This is the only behavioural process known to neuroscience that achieves true eradication of an emotional learning, and it does so through the only known form of neuroplasticity capable of unlocking the synapses maintaining an existing learning: memory reconsolidation.

A unified framework of behavioural, emotional, and synaptic change embodies the brain's rules for profound unlearning, and the existence of these innate rules means that each one of us is equipped to outgrow and shed the constraints of our earlier learnings and to continue evolving our knowledge, our relationship to life and our world of meaning.

The required common factors for transformational change, as opposed to counteractive change, are empirically grounded in neuroscience, non-theoretical, technique-independent and can be used in dispelling emotional implicit learnings of all clinically relevant types, whether formed in attachment, existential, social, traumatic, or other experiences. The factors are process functions, without being tied to any particular techniques for implementing them or to any particular clinical school, theory, or system.

The discoveries of brain science can help us create liberating breakthroughs for our clients more consistently than was ever thought possible. We may even find that memory reconsolidation is a core process detectable in all therapies that regularly yield transformational change. While neuroscience may speak in an esoteric, polysyllabic language, it's offered us a profound new understanding of how to alleviate some of the oldest forms of human suffering. In the future, it will surely tell us a great deal more.





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