Metadata of the chapter that will be visualized online

Series Title	Current Clinical Psychiatry	
Chapter Title	Foundations of Psychodynamic Therapy: Implicit Emotional Learning	
Chapter SubTitle		
Copyright Year	2012	
Copyright Holder	Springer Science + Business Media, LLC	
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Keywords (separated by '-')	Implicit emotional learning - Psychotherapy

Chapter 14
Foundations of Psychodynamic Therapy: Implicit Emotional Learning

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Keywords Implicit emotional learning • Psychotherapy

At its core, psychotherapy is about helping a person to make meaningful, enduring changes. Although change can come about in many ways and for many reasons, enduring change depends on learning. How does a psychotherapist facilitate learning so that there is enduring change in a patient's experience and/or behavior? Though therapists are concerned to varying degrees with multiple aspects of a patient's cognition, motivation, and emotional experience, change ultimately depends on learning – the acquisition of new knowledge that alters existing representations and expectations.

We must consider that a significant feature of psychopathology revolves around the phenomenal experience of a symptom: it is peremptory, unbidden, and seemingly outside one's control. Whether it is a thought, a behavior, or a feeling, the symptom is experienced as foreign and, for the most part, irrational. To explain the irrationality of symptoms, psychoanalytic theories include structures or processes that exist outside awareness.[1] These unconscious or implicit processes are thought to play a role in the formation and maintenance of symptoms.[2] Concepts such as the repetition compulsion (e.g. [1, 2]) include the gratification of implicit motives, which compels people to remain symptomatic despite the apparent irrationality of their symptoms. Implicit processes are presumably involved not only in the formation and maintenance of symptoms, but also in the changes required to alleviate symptoms and to alter the substrate from which they emerge. Models of psychodynamic therapy and therapeutic process therefore must account for the involvement of implicit learning in change. We must also address implicit learning as it pertains to the emotional and motivational aspects of symptom formation; hence, we focus on implicit *emotional* learning.

[1] Other theories of psychopathology, of course, attempt to explain irrationality without referring to awareness and unawareness.

[2] We use implicit and explicit here in a descriptive sense; further explication of these terms, as well as identifying levels and kinds of awareness, will take place more fully later in the chapter in the context of specific studies.

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R.A. Levy et al. (eds.), *Psychodynamic Psychotherapy Research: Evidence-Based Practice and Practice-Based Evidence*, Current Clinical Psychiatry,
DOI 10.1007/978-1-60761-792-1_14, © Springer Science+Business Media, LLC 2012

We can approach implicit emotional learning from two directions: from a clinical-theoretical perspective and from a research perspective. From a clinical-theoretical perspective, there are many reasons to assert that emotional learning outside awareness is important. We might consider, for example, the formative, developmental impact of early attachment relationships on current experience (e.g. [3]), and the extent to which one is aware of such influences; or, the influence of a hysterical or repressive personality style on learning and awareness (e.g. [4]). For present purposes, however, we will focus our discussion of implicit emotional learning on its role in treatment rather than its role in development or personality formation.

One central set of questions in the psychodynamic treatment literature concerns the processes by which change (i.e., learning) occurs. These questions emerge in many guises, but often turn on whether learning takes places because of explicit intellectual insight, as suggested by a traditional view of interpretation as the nexus of change (e.g. [1, 5, 6]); or because of the affective quality of the therapeutic relationship, as Alexander and French [7] suggested through their use of the term "corrective emotional experience" (also see [8]). Briefly, an emphasis on insight privileges the development of explicit awareness centered on a new interpretation or understanding of, for example, early relationship history. In contrast, an emphasis on corrective emotional experience favors experiential aspects of the therapeutic relationship and their role in learning. The experience of the therapeutic relationship is thought to offset the patient's tendency to expect or even to recreate features of an older, conflicted relationship. Implicit features of the therapeutic relationship (sometimes referred to as the "common factors" among varied schools of psychotherapy) include those elements that are part of the structure of the therapist–patient interaction: a therapist who is in some combination interested, warm, open, nurturing, and available. The clinical-theoretical debate about insight and corrective emotional experience can be understood as reflecting two different, and perhaps overlapping, forms of learning: explicit learning in the form of insight, and implicit learning that occurs when the therapeutic relationship provides a corrective to early experience.

Research on implicit learning has direct parallels to the clinical-theoretical perspective and, in particular, to questions regarding the roles of insight and corrective emotional experience in therapeutic process. For example, there is a long history of work in learning theory that centers on the idea that learning can occur outside awareness, or implicitly [9–11]. In contrast, with the rise of cognitive theory, learning is viewed as an inferential process based on self-reflective (i.e., metacognitive) knowledge, necessarily involving explicit awareness. These two opposing perspectives seem to parallel the notion that learning in psychotherapy occurs via either corrective emotional implicit associations outside awareness, or explicit, higher-order interpretation and insight.

In this chapter, we will examine current approaches to conceptualizing learning theory and draw links relevant to psychodynamic theory and psychotherapy. Although our description will center on basic science approaches to learning and learning theory (including neuroscientific evidence), we will identify main features of these theories and related research findings which may enhance our understanding of psychodynamic principles. In reviewing research pertaining to explicit and implicit emotional learning, we will also provide links between the research and a clinical case.

Explicit and Implicit Learning

Dual-process models of the mind have gained favor recently. The flowering of cognitive psychology in the last half-century led to a persistent emphasis on higher-order cognition – especially deliberate reasoning and thought. Meanwhile, research into another aspect of the mind lay dormant. Mental processes were thought to exist outside one's dominant focus, forming a critical substrate of the mind. Until recently, such processes were little studied; but over the last decade, they have come into their own as a focus of research. Terms as varied as automatic [12], implicit [13], and unconscious

[14] have become common in the psychological lexicon. In keeping with this development, dual-processing models that incorporate both levels of processing – explicit and implicit – have also gained prominence. These models are especially salient in efforts to conceptualize attitudes [15], although they are equally evident in other areas (e.g. [16, 17]).

Several essential differences are thought to exist between implicit and explicit processes, although there are also, not surprisingly, areas of ambiguity. In attitude studies, for example, explicit processes usually reflect recently acquired attitudes that stem from deliberate self-reports of what is currently in awareness (e.g. [18]). Studies on learning show a similar pattern. For example, a person's awareness of the relationship between two events (their contingency – if X, then Y) can lead to immediate learning as reflected in autonomic activity [19]. These explicit processes are commonly understood to have certain attributes or properties: deliberate, based on conscious thought or reasoning, controlled, variable, self-reported, and in awareness. Such processes involve complex cognition or meta-cognition in that they often require reflexive awareness and qualities associated with such awareness.

Implicit processes in attitude studies, in contrast, are often inferred from performance on reaction-time tasks or other indirect measures. They are considered "older" and more stable than explicit processes. In learning studies, there has been extensive research on these processes, as captured by associations between events (e.g., stimulus–response (S–R)). Thorndike [9], for example, was one of the early proponents of how associations constantly shape what people (and animals) do. Implicit processes are commonly understood as having specific attributes: automatic, spontaneous, enduring, and outside awareness. Such processes seem to involve foundational cognition in that they form the associative substrate from which complex cognitive processes emerge.

In using the terms "explicit" and "implicit," researchers often refer to different things. These concepts are used in a systematic sense (e.g., implicit and explicit systems of the mind); in a descriptive, adjectival sense (e.g., to note that something is spontaneous or deliberate); and to refer to processes. In recent years, researchers have attempted to go beyond the terms explicit and implicit processing by conceptualizing what underlies them as, respectively, propositional and associative processes. For example, reviews on attitude change [15] and learning [17] argue that associative and propositional processes underlie the implicit–explicit distinction. Associative processes are rooted in the history of learning theory, which revolved around understanding the strengthening or weakening of S–R connections (e.g. [9, 20]). Modern-day attitude theories rely on the idea that associations are activated automatically when a relevant stimulus is encountered and do not require much cognitive effort. Further, the activation of a specific association depends in part on the memory, and in part on the situation; this activation is also thought to occur regardless of whether or not the resulting response is "true" [15]. Propositional processes are based on logical inferences that rest on information. In S–R learning, for example, verbal instructions (propositional) about the S–R relationship can lead to an immediate autonomic response; no actual experience with S and R is necessary for the learning to occur. With attitudes, logical inferences are thought to be concerned with validation of beliefs or evaluations that rest on a subjective sense of validity [15].

From our perspective, emphasizing the processes underlying explicit–implicit is a desirable way to proceed, with important limitations. Even if we focus on propositional and associative processes, at some point we will be forced to identify properties that are emergent from or concordant with these processes. In identifying such properties, we might also observe that there is significant uncertainty about whether these properties differentiate associative from propositional processes. Some properties might differentiate the two – for example, the mental effort involved in engaging associative processes appears markedly less than when engaging propositional processes. Other properties, however, highlight the ambiguity inherent in the two processes. For example, an autonomic response indicating that a person has learned a particular S–R relationship is identical whether the learning is associational (due to an actual S–R pairing) or propositional (due to verbal information about the S–R pairing). Another ambiguity is that the relationship between awareness and associative/

propositional processes is unclear [19]. These areas of ambiguity are also evident in attempting to understand whether and how associational and propositional processes affect each other. The interaction of these processes highlights many important questions. For present purposes, we understand implicit learning as involving primarily an associative process, and explicit learning as involving primarily a propositional process. In what follows, we will first focus on an area of significant ambiguity – how awareness maps on to explicit and implicit learning. Awareness, of course, is a key element of psychodynamic theory in conceptualizing unconscious processes. Then, we will describe selected studies that highlight some of the issues that emerge in examining the interaction between explicit–implicit learning and awareness.

Awareness

The history of the relationship between awareness and learning is lengthy and controversial. Implicit learning is thought to occur without awareness [9, 10]; reinforcing events automatically create S–R links that are independent of a person's awareness. The S–R links themselves are connections or imprints, and do not convey information in any meaningful way. In contrast, the cognitive revolution highlighted the importance of information in learning. Careful examination of phenomena such as attention and conscious expectancy led to findings that seemed to contradict the idea that learning – especially motor or autonomic learning – could occur outside awareness (e.g. [21]). It seemed, for example, that in order for a person to show autonomic or motor learned responses, the person would need to be aware of the relationship or contingency between S and R. In another example, simple verbal instructions about the S–R relationship can lead to an immediate autonomic response; no actual experience with S and R is necessary for the learning to occur. This supports the idea that propositional processes – complex cognitive manipulation of information via verbal instruction reflecting awareness – are sufficient for learning to occur. An actual presentation of the S–R relationship is unnecessary. In stark contrast, a vast literature on animal learning shows the salience of using associative principles in understanding behavior. It is clear that such principles capture many aspects of learning, and that awareness may not be necessary. The difference between human and animal learning points to a major question about how to understand propositional and associative processes in terms of complex cognitive constructs such as awareness, attention, expectancy, and the like.

Significant philosophical issues attach to the role of awareness (consciousness) in learning. We will not address those issues here, except to note that awareness might be understood as an emergent or concordant property that exists in the interaction between associative and propositional processes. Awareness, in other words, is complexly related to these processes.[3]

Awareness can be characterized in two distinct ways – primary and secondary. Similar distinctions regarding awareness have been made previously in the literature (e.g. [23]). Primary awareness (or perceptual awareness) refers to the phenomenal experience of an object. This awareness is perceptual in the sense that there is no real way to challenge an individual's subjective sense or phenomenal experience of the quality of an object. Secondary awareness, in contrast, refers to taking a recursive perspective toward an object; it is awareness of being aware. This awareness presumably involves more complex cognition than primary awareness, and it bears similarity to the propositional processes that are investigated via self-report.

In addition to distinguishing between primary and secondary awareness (or "levels" of awareness), we must also be clear about the object toward which awareness is directed. The object can be

[3] Brakel [22], for example, sets forth a model of mind in which primary process (often associated with activity outside awareness) is propositional.

physical – either an object itself or its representation. However, the object can also refer to something like the relationship between S and R; this understanding of "object" is typically the kind of awareness that researchers have investigated in studies of human autonomic learning. The modern-day understanding of human autonomic learning is that a person must be "aware" of the contingency between S and R in order for learning to occur. In this case, the object of awareness is a relationship and the level of awareness is usually secondary (i.e., awareness of being aware).

Studies on implicit emotional learning are often ambiguous regarding the level of awareness investigated, as well as specification of the object of awareness. For example, the acquisition of a learned response without awareness of the S–R contingency can be examined experimentally when a stimulus is in primary awareness (and available to secondary awareness), or when a stimulus is virtually inaccessible to primary awareness (i.e., subthreshold) and therefore very likely unavailable to secondary awareness. Variations of these experimental variables illustrate the complexities of awareness and of its role in learning.

Implicit Emotional Learning

In later sections of this chapter, we will describe several studies undertaken from a cognitive neuroscience perspective with potential relevance to psychoanalytic concepts, and in particular, to ideas concerning implicit emotional learning. These studies explore basic psychological processes, using principles of association derived from Pavlovian (S–R) theory and related phenomena, which may be applicable in identifying broad truths about learning, emotion, and unconscious mental processes. Such studies may also have implications for how we learn – and in the context of treatment – how learning and change occur. Although these studies do not directly involve clinical populations or treatment, they focus on core learning principles that can inform us indirectly about how we conceptualize these issues.

Two forms of implicit learning are illustrated in the studies described. In the traditional Pavlovian approach, the conditional stimulus (CS) takes on a signal or predictive value in relation to the unconditional stimulus (US). Awareness of the relationship between CS and US – the contingency – is what is thought to be necessary for the conditional response (CR) to emerge. A second approach, which is termed evaluative learning (or evaluative conditioning; e.g. [24, 25]), rests on the observation that simple contiguity (in space or time) between two stimuli facilitates the transfer of affect from one (US) to another (CS). We begin with a discussion of implicit evaluative learning and then turn to implicit Pavlovian learning. A clinical case is used to illustrate aspects of each kind of learning in a long-term psychodynamic psychotherapy.

Implicit Evaluative Learning

In daily life, one might encounter a person reporting a puzzling reaction to an object or event: "I don't know why I like (or don't like) it, I just do." This experience illustrates preference or liking with unknown origins. One understanding how such a preference develops centers on implicit (associative) processes. In this model, the affective valence of one object is thought to transfer to another object. When both objects are in awareness, associative and propositional processes are likely to interact. For example, a person might have a negative associative reaction (perhaps based on past experience) to object A (US). If object A is then paired with a relatively neutral item for that person – object B (CS) – the person might automatically react negatively (via association) to object B. However, more complex (propositional) cognition could take over and lead to greater liking of the object B because of a conscious belief that one "should" like object A, or because the affective link between object A and object B can be deliberately minimized. When the affective object A is *outside* awareness, however, the

source of the reaction to object B is unclear. The person may react to object B based on a previous associative link that is now outside awareness; in other words, the source of the response to object B is unknown and could help to explain irrational symptoms associated with object B.

Basic Science Example

In an evaluative learning paradigm, pairing of an initially neutral stimulus (CS) with a positive or negative stimulus (US) leads to a new response to the CS that is consistent with the affective valence of the US with which it had been previously paired. The response to the CS is usually a behavioral measure such as reaction time or liking ratings. Variations in CS or US, and how the US is presented, have allowed researchers to examine associative learning such that neither the stimuli nor the measures require manifest propositional processes. Previous findings have shown that such learning indeed takes place, especially with relatively simple stimuli such as single words or faces expressing emotion. In addition, previous findings have supported the conclusion that the effects observed were relatively limited in time – perhaps only up to a second. In a recent study conducted by our lab group [26], we sought to examine this evaluative learning effect further by focusing on three questions: (1) Do naturalistic situations (pictures) yield an evaluative learning effect? (2) How does awareness influence the effect? (3) What is the time course of learning? We used an evaluative learning paradigm in which the US was presented virtually outside primary awareness and in which we examined the impact of learning over time.

In this study, the US involved presentations of emotionally evocative pictures that were perceptually masked – or presented in such a way that the participant had only a fleeting experience in awareness of fragments of the picture. The pictures were taken from an emotion picture library [27], and depicted people in complex and graphic positive or negative situations. The CS was a neutral geometric figure-ideograph that also served, simultaneously, as the perceptual mask by appearing on the screen immediately after the US. For an individual trial presentation, a participant was shown a positive or negative picture (US), which was linked with a CS that followed immediately at the same screen location (spatial and temporal contiguity). The main measure was a liking rating of the CS. At times, a participant could experience a fleeting flash (of the briefly presented US) just prior to the CS appearing on the screen; at other times, there was no such experience even though a US had been presented. A participant saw a series of trials as described, and provided liking ratings for each individual ideograph (CSs). We then examined whether the aggregate liking ratings of the formerly neutral CSs had been influenced by the preceding pictures.

The results suggest strongly that implicit evaluative learning takes place with complex, naturalistic emotional stimuli, and that these effects last at least several seconds if not much longer. Additionally, we made more detailed observations about the relationship between awareness of the US and the evaluative learning effect. Participants reported in a post-experiment questionnaire occasionally noticing a fleeting flash of a fragment of an object just prior to an individual presentation of the CS; however, no participant was able to identify – based on subjective experience – what was presented. We also conducted extensive behavioral (forced-choice identification) tests to examine whether participants could discriminate between the actual picture presented and a foil. These tests showed that participants could, in fact, discriminate between the two pictures, which suggests that enough partial information was processed for them to do so. Overall, then, the relationship between awareness and the evaluative learning effect in this study is complex. Based on the behavioral data, participants were aware of the US *in some sense* – at least enough to perform successfully on the forced-choice test. However, there was no indication of secondary awareness of the full nature of the US other than reports of fleeting fragments of images. We can conclude that participants may have had primary awareness of the US, though quite possibly only as a partial image. Nonetheless, the results of the study suggest that implicit evaluative learning takes place with naturalistic scenes,

and that participants were not reflexively aware of the US but were perceptually aware during the learning process.

In summary, it seems that associative links (via evaluative learning) to complex, naturalistic, emotional stimuli can be established without a person's reflective awareness that such links have been established. Further, such learning may have more lasting effects than previously thought (consistent with findings reported elsewhere showing that evaluative learning may sometimes be stronger when participants are unaware of the relationship between CS and US than when they are aware, e.g. [28]).

Clinical Example: Ms. G (Part 1)

A woman in her early 30s, Ms. G, started weekly psychotherapy because of general unhappiness marked by intense moodiness and instability in relationships, and by a largely directionless career. After graduating from an elite college, Ms. G found herself in a series of chaotic romantic relationships with men, and struggling – through several false starts – to establish a career. She was living a marginal existence in a large city, surviving month to month on odd jobs and her ability to find a boyfriend to live with.

Ms. G was in long-term psychodynamic therapy for many years; the following sequence took place in the fourth year of therapy. By this time, Ms. G had begun to establish herself in a career, saving enough money to live alone in an apartment. This was an extremely important developmental step for Ms. G, in that along with the emergence of some financial independence, it signaled her ability to keep from jumping into one chaotic relationship after another. Ms. G was initially thrilled and proud. However, soon after moving, she was overcome with a depressive episode of unknown origin; she started to neglect her work and withdraw from social events. The new apartment was suddenly and unaccountably viewed negatively.

Over the next year, several themes emerged in the therapy that shed light on the etiology of the puzzling depressive symptoms, and on efforts to help Ms. G change. Over time, Ms. G's associations kept returning, in one form or another, to her early childhood experiences of intense physical abuse and emotional neglect by her father. Ms. G recalled that in response to each episode of abuse, she typically retreated to her childhood room, alone. She vividly recalled shutting herself in the room, feeling despondent and at times suicidal. Here, the etiology of Ms. G's symptom could be understood in an evaluative learning context: her implicit negative memory of the early childhood room (object A or US) is linked associatively to her explicit experience of the new apartment (object B or CS).

The evaluative learning findings also suggest that what is learned may have lasting effects, and may be most powerful when the person is unaware of the CS–US link. However, the course of therapy and impetus to change was clearly – and not surprisingly – more complicated than the findings suggest. Ms. G was initially unaware of the possible link between her childhood room and her new apartment. At some point after Ms. G associated repeatedly to her childhood room, the therapist interpreted the link – in other words, making explicit (via reflexive awareness) the CS–US link. Ms. G responded tearfully, acknowledging that this understanding made much sense, and returned to this understanding in the following session. However, did this new awareness, accomplished through interpretation, lead to change? Not in any measurable way for at least 6 months!

Yet, over a longer period of time (1.5–2 years post-move), Ms. G showed increasing comfort with her new apartment and a waning of depressive symptoms. It is unclear what specifically contributed to this change, although we offer two possible explanations. First, it is possible that the interpretation simply took time to take effect. Second, the transference situation throughout this phase of the therapy was very likely based on unresolved paternal conflict.[4] For example, Ms. G reacted strongly

[4] Space limitations preclude more detailed discussion of this issue.

to the (male) therapist's absences, and often voiced worry that he did not approve of her impulsive behavior. Further, Ms. G sometimes evoked anger and frustration in the therapist, which was understood in part as an unwitting effort to re-enact her childhood relationship with her father. We speculate that the therapist as a supportive (not abusive) paternal figure established corrective associations for Ms. G that facilitated her working through the depressive episode. In other words, we consider the possibility that part of what helped Ms. G at this time with this issue was a corrective experience based on associative – not just propositional – elements of the therapy. The "new" room – the new apartment – was now associated with a "new" object – the therapist.

Implicit Pavlovian (Associative) Learning

In Pavlovian studies on learning, the CS takes on a signal or predictive value in relation to the US. Awareness of the contingency between CS and US is thought to be necessary for the CR to emerge. The contingency is usually probabilistic, which can affect the time course of acquisition of a response. Furthermore, both the acquisition and maintenance of a response depend on many factors such as the type of conditioning, reinforcement, blocking, and extinction (see [20], for a general overview). Two examples follow: in the first example, we challenge the findings that contingency or reflexive awareness is necessary for associative learning to occur; in the second example, we identify a brain response using a Pavlovian learning paradigm that is thought to index implicit expectation.

Clinical Example: Ms. G (Part 2)

Can a person experience an emotional event and *unconsciously* associate different things (cues) with the event? If so, at another point in the future, something that manifestly seems irrelevant – but is really a cue via unconscious association – may in fact be quite relevant to understanding the original event. In this example, the manifestly irrelevant cue contains predictive information about what might follow (which is different from the evaluative learning example described previously, where the affect is transferred from one object to another).

A simple but common example can be observed with Ms. G, who often struggled with substance abuse, occasionally binging on alcohol or various street drugs. After an initial period during which she denied having a problem, Ms. G acknowledged the need to stop drinking and using drugs. She spoke tearfully about her father's difficulties with alcohol abuse and said that she desperately wanted to be different from him in this way. However in her efforts to stop, Ms. G routinely experienced the following sequence: she would vow to avoid drinking on a particular evening when out with friends; then, after a few hours of "being good," she would ultimately succumb, saying "one thing led to another and before I knew it, I was back at the bar and headed for a blackout."

Part of the therapy process was aimed at identifying cues both within and outside Ms. G's awareness. Ms. G could readily identify some "triggers," such as certain friends, events, or neighborhoods. In identifying these triggers, Ms. G could sometimes stem the tide of drinking to excess but more often than not she would lose control and give in. We speculate that it was only through gradual identification of implicit cues that Ms. G was able to gain control of her behavior.

The implicit cues were more challenging to identify, although they emerged in Ms. G's associations. For example in associations to her childhood experiences and her father's drinking, Ms. G became aware of a pattern: a household filled with weeks of sadistic anger and tension, followed by sudden emotional release and drunken celebration. She recalled numerous examples of her father

behaving similarly; she realized after quite some time that one predisposing condition to *her* drinking was a mental state in which she felt "elated" after finishing a project. She felt such relief about "not having screwed something up" that she invariably wanted to celebrate – by drinking.

In learning terms, Ms. G's celebratory drinking episodes were implicitly associated with her father: she was unaware of the predictive relationship between a mental state (elation) and drinking. We speculate that identification of this association – a cue (elation; CS) that then "predicts" a particular behavior (drinking; US) – led to therapeutic change. Of course, much additional work around this implicit association to father took place, especially in facilitating Ms. G's dawning awareness that, through her drinking, she was also identifying with her drunken father. Clearly, multiple factors contribute to learning and change.

Basic Science Example

While our clinical and psychodynamic observations lead us to believe that generalizations of the kind just described happen outside awareness, the learning theory literature contradicts this observation in at least one important way. As discussed earlier in this chapter, there are many reasons to conclude from recent research that cognitive factors – especially awareness of the S–R contingency – are essential in autonomic or motor learning (e.g. [17, 21]). Exploration of the relationship between awareness and S–R learning has, for the most part, involved efforts to measure secondary awareness through self-report measures or moment-to-moment probes about knowledge of the contingency (e.g. [29]).

In what follows, we describe two studies in which we sought to examine the question of whether implicit (or at the time what we called unconscious) associative learning could be demonstrated. In these studies, we made two critical changes to previous efforts to examine this phenomenon. First, we used stimuli (CSs) that were presented so quickly (below the threshold for visual perceptual awareness) that we had reason to believe they were outside both primary and secondary awareness. Since the stimuli were outside awareness, we reasoned that participants could not possibly have known the S–R contingency. We reasoned further that if we could establish a CR to subthreshold stimuli we might show that associative learning could take place fully outside awareness. Second, in these studies, we relied primarily on measures of central nervous system activity as an index of implicit learning. Using event-related brain potentials (ERPs), we hoped to take advantage of the sensitivity of ERPs as well as extend learning theory to understanding the central nervous system.

In these studies [30, 31], the experimental approach involved using a trace conditioning paradigm in which there is a delay between offset of the CS and onset of the US. This paradigm has been used previously to show that learning as measured by skeletal reactions (e.g., eyeblinks) seems to require awareness of the S–R contingency (e.g. [32]). Each of our studies used slightly different CS–US parameters, while measuring ERPs.[5] In one study [31], the CSs were facial schematics with emotional expressions; the US was a mild finger shock; and the CS–US delay was 800 ms. In the other study [31], the CSs were words (cancer and murder); the US was a white noise blast; and the CS–US delay was 3 s. In both studies, the stimuli were presented in three phases: (1) in awareness (40 ms); (2) outside awareness via brief (1 ms) subthreshold presentations; and (3) in awareness (40 ms). The second phase was the acquisition phase during which the CS–US link was established (using varied probabilities). From a participant's perspective during the acquisition phase, the US (finger shock or white noise) comes on randomly since there is no conscious visual percept of the CS. A key question is whether change occurs between phases 1 and 3 (presentations of the CSs in awareness) due to

[5] We also reported findings from measuring facial EMG; Bunce, Bernat, Wong, Shevrin [33].

learning in phase 2. After the main experiment, we collected subjective and behavioral measures of awareness.

ERP methodology allows for millisecond (ms) resolution of brain activity as measured across an array of scalp electrodes. The brain responses are time locked to the onset of the presentation of the CSs so that when individual trials are averaged, overall time-related patterns can be detected. Considering the ERP results from both studies, some strikingly consistent results emerged when comparing phase 1 and 3 results and the difference between CS+(linked to US in phase 2) and CS−(not linked to US in phase 2). Specifically, the results showed greater activation for the CS+than the CS−at around 300 ms post-stimulus onset, which in ERP terminology is a P300 component. Additionally, two ERP components after the P300 – LP and SW – also differentiated the CS+and CS−. There was some indication in the second study [31] that even earlier differentiation occurred at around 100 ms post-stimulus (P1–P2). The awareness measures of the CSs (presented for subthreshold durations identical to those used in phase 2 learning) showed in both behavioral and subjective responses that participants were completely unaware of the CSs. This suggests strongly that associative learning in phase 2 was outside awareness.

In summary, the results across two studies using different S–R parameters suggest that associative learning – as measured by central nervous system brain activity – can occur outside awareness. Further, and consistent with the clinical example described previously, a person could possibly have been aware of his or her reaction in phase 3 to the CS (which was in awareness). This awareness is parallel to Ms. G's awareness that elation (CS) seemed to lead to drinking (US); Ms. G was unaware, however, of the developmental origin of the association.

Clinical Example: Ms. G (Part 3)

A person usually makes explicit associations to an emotional event. As has been observed in the consulting room, a highly emotional or traumatic event can lead to complex reactions that include conscious worry that another similar event will occur. However, from a psychodynamic perspective, we might also expect that complex reactions to a trauma will occur outside awareness.

Ms. G's struggles often involved chaotic romantic relationships that ended up in aggressive fights (with Ms. G as both the source and object of abuse). These fights were reminiscent of the physical abuse by her father. In one romantic relationship, Ms. G felt that she had finally found a partner who did not have (in her words) "a big temper." For months, it seemed that she was right. Eventually, however, Ms. G became increasingly provocative, which expectably elicited anger in her partner. It seemed that Ms. G was unwittingly interacting with her partner as if he were a (paternal) figure from her past. Is there any neurobehavioral evidence for complex reactions to trauma that exist outside awareness?

Basic Science Example

In an effort to address this question and others like it, we decided first to establish evidence that learning in awareness had taken place during an aversive situation. We then examined the effects – outside awareness – of what was learned. In this study [34], we used a paired-stimulus aversive learning paradigm that is similar in structure to our studies previously described. The CSs were facial schematics with emotional expressions; the US was a mild finger shock; and the CS–US delay was 2,500 ms. The stimuli were presented in three phases, with the following awareness conditions: (1) outside awareness (1 ms); (2) in awareness during learning; and (3) outside awareness (1 ms).

The second phase was the acquisition phase during which the CS–US link was established (using varied probabilities). From a participant's perspective during the acquisition phase, the US (finger shock) was clearly predicted by the CS + (in awareness) such that learning occurred quickly. For this study, a key question is whether change occurs *outside awareness* between phases 1 and 3, as a result of the aversive learning in phase 2. After the main experiment, we collected subjective and behavioral measures of awareness.

ERPs and autonomic reactions (skin conductance; SCR) were monitored during the experiment. The aversive learning phase 2 results showed expected ERP and SCR responses indicating that learning took place. Examination of the response to the CSs presented outside awareness (phases 1–3) revealed two striking things. First, it was clear that the subthreshold CSs in phase 3 (now associatively linked to the aversive experience) elicited an autonomic reaction. This finding was consistent with earlier reports that CSs presented outside the focus of attention could elicit a CR [35]. Second, an unexpected ERP response was observed, an expectancy wave, which emerged just prior to the time when the US had been delivered in phase 2. This expectancy wave, elicited in response to subthreshold CSs, showed that the brain was organizing in anticipation of the US, and that *this anticipation was elicited unconsciously.* The subjective and behavioral measures of awareness showed that participants were completely unaware of the CSs in phases 1 and 3 – there was no indication whatsoever of primary or secondary awareness.

In summary, results from this study suggest that after associative learning takes place in awareness, there is evidence showing that the CSs are salient outside awareness. Additionally, the subthreshold CSs elicited an expectancy wave response, which was an initially surprising although ultimately understandable finding. It was as if the brain were organizing – outside awareness – in anticipation of a previously experienced aversive (traumatic) event. More specifically, participants were unaware of the eliciting stimuli (CSs). Whether participants had secondary awareness of "expecting" the US in phase 3 is less clear, although subjective reports indicated that participants had no such awareness. It seems plausible, then, to conclude that anticipation of an aversive event occurred entirely unconsciously. This conclusion is consistent with the possibility that Ms. G harbored an implicit expectation that her partner would have "a big temper" in a way that was reminiscent of her father's, although the results do not speak fully to the possibility of enactment.

Conclusions

Implications of Studies on Implicit Emotional Learning for Clinical Theory and Practice

Studies on implicit, associative processes – evaluative learning and Pavlovian learning – inform our theories of psychopathology and treatment in multiple, interrelated ways. Experimental data help us to understand how unconscious or implicit processes might contribute to the formation and maintenance of symptoms. Research results also force consideration of the relative roles of explicit (reflexive, interpretive, propositional) and implicit (associative) activities in facilitating change through psychotherapy.

Evaluative learning involves the transfer of affect from one thing to another. One study [26] suggests that associative links to complex, naturalistic, emotional stimuli can be established without reflexive awareness that such links have been established. Further, it seems that such learning may have more lasting effects than previously thought. In our clinical example (Ms. G, Part 1), Ms. G's depressive experience in her new apartment was initially puzzling. In psychotherapy, her depression was associatively and implicitly linked to her troubled experience in her childhood room.

We describe how the impetus to treatment change likely involved both explicit interpretation of the associative link and an implicit corrective association in the therapeutic relationship (see [5] for a similar perspective).

Pavlovian learning involves establishing a predictive relationship between two events, with awareness having a varied role. Our clinical examples show that attention to implicit associations can inform etiology and treatment.

We first describe two studies (that contradict earlier findings in the literature) suggesting that associative learning – as measured by central nervous system brain activity – can occur outside awareness [5]. In our clinical example (Ms. G, Part 2), we illustrate how Ms. G's inability to stop her drug and alcohol abuse was connected to at least one implicit cue: that the feeling of elation seemed to lead to – or predict – excessive drinking. Additional exploration showed that Ms. G was unaware of the developmental origin of the association, and that helping her to articulate these origins explicitly may also have facilitated change. In another study, we show that after associative learning takes place in awareness, the original stimuli continue to be salient outside awareness [30, 31]. We identify implicit expectation in brain activity: anticipation of a previously experienced aversive event can occur entirely unconsciously. In our clinical example (Ms. G, Part 3), we describe how Ms. G inexplicably encountered problems in a relationship that manifestly seemed good. The problems seemed to stem from an implicit expectation that her partner would have "a big temper" like her father's.

In addition to highlighting associative learning of the evaluative and Pavlovian types, our studies illustrate how conceptualizing the relationship between learning and awareness is relevant to understanding psychopathology and treatment. The hallmark of a symptom is a disjunctive, peremptory, and puzzling emotional experience, such as Ms. G's inexplicable depression; inability to stop drinking; and tendency to spoil a relationship. The studies discussed illustrate divergent activity between what happens implicitly and explicitly, which may be one way of understanding the formation and maintenance of a symptom. Stated differently, the studies show that learning takes place in *and* out of awareness; further, it is the *interaction* between what happens in and out of awareness that may lead to disjunctive symptomatic experiences. From a methodological perspective, our studies are also consistent with those showing the limits of measures based primarily on propositional cognition or self-report (e.g. [36]). It is advisable to use both explicit and implicit approaches in order to obtain a full understanding of any phenomenon.

The results from Pavlovian learning studies may have particular relevance to psychodynamic theory, in that such studies reveal how predictive information (if X then Y) is organized implicitly. Such predictive information may be closely connected to our understanding of the dynamic unconscious.

One example of this connection is the identification of brain activity that indexes an anticipatory reaction outside awareness in response to a memory of a previous aversive event. This is an especially intriguing finding. From a phenomenological perspective, the finding suggests that a previously traumatized person may not have any experience of explicit worry or apprehension. Yet, simultaneously, processes unfolding outside awareness might give rise to implicit expectation of another traumatic event. Such implicit expectation (in which [34] posit an associative link, not a propositional belief), may or may not lead to pathological symptom formation. There are a variety of reasons, however, to believe that this anticipatory response outside awareness may be related to the psychodynamic construct of signal anxiety [37]. One way to conceptualize signal anxiety is that it involves an implicit expectation associated with a previous trauma; this expectation may reflect the operation of psychological defense. However, it is important to remember that the Wong et al. [34] study did not test specific psychodynamic constructs related to signal anxiety. For example, no distinction was made between a reality-based and fantasy-based trauma, and there was no effort to measure psychological defense. The limits of this study are also evident in the clinical case (Ms. G, Part 3). Implicit expectation based on previous trauma can explain several things. However, the

observation that Ms. G may have actively provoked a fight with her partner – being both the object and the source of anger – refers to a more complex motivational construct having to do with the *need* or *wish* to repeat rather than the fact of repeating. Yet, the finding of implicit expectation in brain activity provides a tantalizing clue that is consistent with the idea that implicit or unconscious processes need to be incorporated strongly into our models of the mind.

Future Directions in Learning Theory

This chapter has focused primarily on basic science approaches to implicit–explicit learning and learning theory. In reviewing the research, we identified parallels to psychodynamic principles (especially the role of unconscious processes) in order to illustrate some universal applications of learning theory. We also realize, however, that there are limits to analog or conceptual studies of the sort that we report. For example, drawing equivalence between an aversive stimulus in the laboratory and a trauma in vivo has significant limitations. An obvious extension of this line of inquiry, which might address such limitations, includes investigations of clinical populations using some of the principles and methodology described here. These studies are now beginning to emerge in the literature, most notably in the effort to systematically understand the role of implicit processes in psychopathology. Investigations of fear [38], phobia [39], panic [40], and anxiety [41] are some examples.

On a larger scale, new developments in learning theory have begun to strongly support the idea that much learning happens implicitly in a social context. Recent work in infant–child development and the emergence of language illustrates clearly that the social context is an essential factor contributing to the success or failure of learning [42]. Evidence is also rapidly accumulating that much learning in social contexts takes place implicitly, especially for infants; however, there is some debate about the mechanisms involved [42]. For example, the traditional Pavlovian learning model described in this chapter will probably need to incorporate more elements of probability than is done in current S–R models. However, what is clear from these new developments in infant–child research, as well as the research described in this chapter, is that much more learning happens implicitly than previously believed; it would be wise to take this into account in future theories of psychopathology and psychotherapy.

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