

# The Cognitive-Affective Neuroscience of the Unconscious

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## **ABSTRACT**

There is an ongoing debate about how best to conceptualize the unconscious. Early psychodynamic views employed theories influenced by physics to explain clinical material, while subsequent cognitivist views relied on computational models of the mind to explain laboratory data. More recently, advances in cognitive-affective neuroscience have provided new insights into the workings of unconscious cognition and affect. We briefly review some of this recent work and its clinical implications.

## **CASE REPORT**

Indira was a 32-year-old woman who complained of difficulties in her relationships with men. Indira said that she perceives most men as untrustworthy, rarely allowed herself to get close to a man, and then invariably experienced some form of betrayal or hurt. During her first session, she gave a detailed description of a difficult childhood. Her father had a severe drinking problem—when sober, he would be loving and kind; when drunk, he would often be physi-

cally or verbally abusive to her mother and herself. In her second session, Indira stated that she had come to see her psychiatrist because of his excellent reputation, but that she was upset that some of his comments at their initial encounter seemed inappropriately critical of her and was unwilling to continue the therapy. Over the next several sessions, she alternated between indicating a sense of attachment to and reliance on her therapist and feeling let down by his words or actions.

## **COGNITIVE-AFFECTIVE NEUROSCIENCE**

### **Neuroanatomy/Neurochemistry**

Psychodynamic theory of the unconscious has scrutinized material produced in therapy in general and the transference, in particular. Researchers interested in the cognitive and affective unconscious have focused instead on laboratory paradigms, such as subliminal perception, implicit cognition, and directed forgetting. Nevertheless, since Freud's efforts to base psychoanalysis in science and Jung's attempts at empirical investigation,<sup>1</sup> there has been interest in scientific data relevant to analytic theory<sup>2-5</sup> and in the reformulation of its concepts using advances in cognitive science.<sup>6-10</sup>

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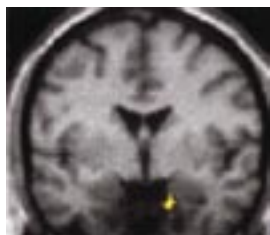
Authors' note: This case is based on an amalgam of the authors' experience.

A cognitive-affective neuroscience of the unconscious has been spurred forward by advances in functional imaging. Emotional responses in the absence of conscious perception, for example, are mediated by regions including the amygdala<sup>11-13</sup> and somatosensory association areas (Figure 1).<sup>14</sup> Implicit cognitive learning, on the other hand, is mediated by regions including the striatum.<sup>15</sup> The control of unwanted memories appears associated with increased dorsolateral prefrontal activation and reduced hippocampal activation (Figure 2).<sup>16</sup>

A range of other neuroanatomical investigations may also be relevant to modern understanding of unconscious processes.<sup>17-24</sup> While a good deal of work has focused on mechanisms that apply across individuals, there is an expanding database of studies<sup>25-29</sup> documenting individual differences in unconscious cognitive-affective processes and their neurological correlates.<sup>25-29</sup> Complementing research on the psychobiology of the unconscious, a series of publications<sup>30-33</sup> have contributed to understanding the neuronal basis of consciousness.

Work on the molecular pathways involved in mediating key unconscious processes is at an early stage. Nevertheless, there has been some progress, with interest, for example, in the neurochemistry underlying implicit versus explicit memory.<sup>34,35</sup> Most recently, investigators using pharmacological administration combined with cognitive-affective paradigms or functional magnetic resonance imaging have suggested<sup>36,37</sup> that monoamine neurotransmitters and steroid hormones<sup>38,39</sup> play a crucial role in mediating implicit cognitive-affective processes.

**FIGURE 1.**  
Activation in the region of the right amygdala in response to presentation of masked angry faces<sup>12</sup>



Morris JS, Ohman A, Dolan RJ. Conscious and unconscious emotional learning in the human amygdala. *Nature*. 1998;393:467-470. Reprinted by permission from Macmillan Publishers Ltd: *Nature*. 1998;393:467-470, Copyright 1998.

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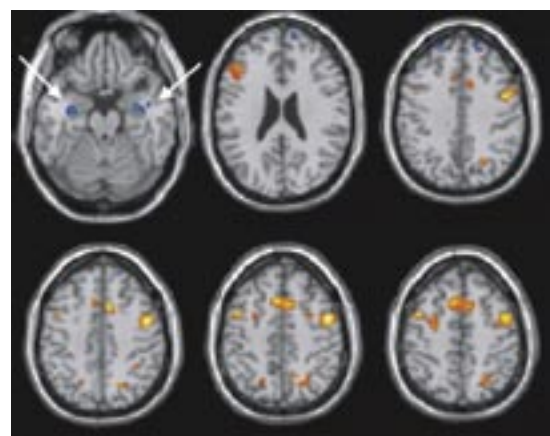
### Gene/Environment

Early writers usually viewed the dynamic unconscious as an unchanging or fixed entity, but with a specific configuration of unconscious drives and defenses emerging in relation to a particular set of circumstances. Subsequent empirical research has suggested that unconscious processes are influenced by both genetic and environmental contributions; individual differences play a role in shaping implicit cognition and affect,<sup>25-28</sup> and environmental or social information also plays an important role in automatically influencing behavior.<sup>40</sup>

### Evolutionary Approaches

Some researchers<sup>41-43</sup> have provided evolutionary approaches to psychodynamic constructs. Of particular interest, Reber<sup>44</sup> has argued that the neurological structures that underpin implicit cognitive-affective processes are evolutionarily older, and preceded those subserving explicit processes (Figure 3). He discusses evidence that the circuits underpinning implicit cognition shows greater

**FIGURE 2.**  
fMRI study of direct forgetting: yellow areas indicate increased activation during suppression trials, while blue areas indicate deactivation during suppression trials, compared with respond trials. White arrows show deactivation of hippocampus during suppression<sup>16</sup>



Anderson MC, Ochsner KN, Kuhl B, et al. Neural systems underlying the suppression of unwanted memories. *Science*. 2004;303:232-235. Reprinted with permission from Anderson MC et al. *Science*. 2004;303:232-235. Copyright 2004.

fMRI=functional magnetic resonance imaging.

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cross-species commonality, emerge earlier in human life, and are less disruptive to dysfunction in disease (eg, during Alzheimer's disease).

## CLINICAL IMPLICATIONS

### DSM-IV-TR *Diagnosis*

Given the emphasis of current nosological systems on operational definitions, it is not surprising that concepts about the unconscious exert little influence. The term "neurosis" has been dropped from the *Diagnostic and Statistical Manual of Mental Disorders* and there are no disorders of repression. Although current diagnostic systems continue to include a category of dissociative disorders, these are defined in terms of their symptomatology, and without specific reference to the concept of unconscious dissociation that was delineated by Janet and expanded by subsequent authors.<sup>45</sup>

### Assessment/Evaluation

There remains a debate between those who believe that psychoanalytic theory provides a basis for much of the current work on unconscious processes, and those who argue that early theory should be jettisoned.<sup>7,46</sup> Clinical eval-

uation of memories of abuse has been particularly controversial. However, this is increasingly informed by cognitive-affective neuroscience.<sup>47</sup> There is also controversy about the extent to which different laboratory paradigms actually do measure unconscious processes.<sup>48</sup> Various scales are informed by the psychoanalytic literature,<sup>49,50</sup> yet their use tends to be restricted to a narrow research context.

### Pharmacotherapy/Psychotherapy

In the past, barbiturates were used to encourage the expression of unconscious motivation.<sup>51</sup> Today, it is possible to speculate about the use of specific pharmacologic agents to influence implicit cognition and affect.<sup>34,35</sup> From a psychotherapeutic perspective, concepts of the unconscious remain integral in psychodynamic schools, while other methods have a significant interest in reframing earlier constructs. The classic concept of transference for example, has been criticized<sup>54</sup> and reframed in more cognitive-affective terms.<sup>55-57</sup>

## CONCLUSION

A key debate on the unconscious has reflected a deeper philosophical argument; in approaching the mind, should explanations follow the format of the laws of natural science or is it necessary to couch understanding in terms typically employed in the humanities?<sup>7,58</sup> Advances in cognitive-affective neuroscience arguably provide a new basis for incorporating both perspectives; the structure of the brain-mind allows the embodiment of both conscious and unconscious mental processes.<sup>9,23,59</sup> Such advances have already influenced clinical practice, but their full impact remains to be determined. **CNS**

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**FIGURE 3.** Limbic neurocircuitry underlying implicit (red) and explicit (green) cognitive-affective processes<sup>52,53</sup>



Salloway S, Malloy P, Cummings JL. *The Neuropsychiatry of Limbic and Subcortical Disorders*. Washington, DC: American Psychiatric Press; 1997. Adapted with permission from *The Neuropsychiatry of Limbic and Subcortical Disorders*. American Psychiatric Publishing, Inc.

Stein DJ. *Cognitive-Affective Neuroscience of Mood and Anxiety Disorders*. London, England: Martin Dunitz; 2003. Reprinted with permission from Martin Dunitz (Taylor & Francis Books)

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