Chapter 11

Emotion and delusion: Seeking common ground between neuroscience and the psychotherapies

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Abstract

This chapter explores areas of common ground between psychoanalysis and neuroscience—of which many areas exist. Emotion is an area of obvious overlap between the two fields and is especially important for any discussion of delusional beliefs. The chapter highlights such links and particularly suggests ways in which developments in neuroscience can potentially enrich psychoanalysis. We focus especially on the issue of emotional regulation, and the many ways in which false beliefs might be emotionally driven, in doing so focusing on the topics of self-deception, emotion and stereotyping, emotion in decision making, dreams and psychosis, and neurological disorders such as confabulation and anososgnosia. The chapter concludes by highlighting the need to develop a strong two-way relationship between the two fields.

Keywords: emotion regulation; decision making; anosognosia; confabulation; psychoanalysis; neuroscience.

Introduction

A central driving force in the recent reunification of psychoanalysis and neuroscience has been a shared interest in emotion, and a growing interest in the potential role of emotion and delusional beliefs (Solms and Turnbull, 2002; Turnbull and Solms, 2007). Cognitive neuroscience had, for many years, not been especially focused on the issue of emotion. However, the recent development of affective neuroscience (e.g. Panksepp, 1998) has made it clear that an understanding of basic emotions and their role in shaping high-level cognition opens a great deal of common ground with psychoanalysis.

The question of the number and nature of basic emotion systems has generated a large and complicated literature in recent years (Damasio, 1999; Panksepp, 1998; Rolls, 1999). In part, work has attempted to establish what the number of basic emotions might be (see Panksepp, 1998; Solms and Turnbull, 2002, Chapter 4, for a brief review). The literature suggests that there are a number of different ways of attempting to measure the phenomena of emotion (Johnson-Laird and Oatley, 2000; Panksepp, 2000; Stearns, 2000). The field does, however, seem to generally agree on a shortlist of at least four basic emotions. These are firstly 'happiness', or positive

Box 11.1 Term definitions

Anosognosia: A condition in which neurological patients hold delusional beliefs, typically about their bodies, and deny that they are disabled. Prototypically, they tend to be paralysed on the left side of their body, after large right-sided strokes.

Confabulation: A term used to describe a condition seen in neurological patients who hold false beliefs—who believe, for example, that they are living in a hotel not a hospital, or that their spouse is an imposter.

Defence: Psychological processes that organize and maintain mental life in a way that protects the individual from aversive emotional experiences.

emotion of one description or another (Panksepp and Burgdorf, 2000; Schultz, 1998). In addition, at least three negative emotions most notably those of 'sadness', 'anger', and 'fear' have been identified in the literature (Calder et al., 2001; Panksepp, 1998). Each basic emotion appears to have relative chemical and anatomical independence (Panksepp, 1998). These are common to all classes of mammal species, and distributed across a range of subcortical structures, overlapping in the upper brain stem (periaqueductal grey)—(see Watt, 2000; Solms and Turnbull, 2002, Chapter 4, for a review).

This anatomical distribution is also demonstrable in humans, as in the work of Damasio in the functional imaging of human beings experiencing powerful emotional states in the scanner (Damasio et al., 2000). Thus, in the sadness condition, we see symmetrical activation of subcortical structures, especially in the upper brainstem, hypothalamus, and anterior cingulate. At the same time there is almost no change to cortical brain regions, or indeed in some cases there is a degree of *deactivation*. Thus, participants in the sadness condition (some of whom were reported to be able to cry in the scanner) are experiencing powerful emotional states, activating a range of phylogenetically ancient brain structures, but not activating the cortex (McManus, 2002; Springer and Deutch, 1998).

This represents a general survey of the current state of the field, when focusing on the *experience* of basis emotions. However, had we been writing this chapter 20 or 30 years ago on the topic of the neuropsychology of emotion, we would have stressed an entirely *different* class of evidence (see Borod, 2000 for a review). Several decades ago the theme of hemispherical asymmetry of function in relation to emotion was a fairly substantial research topic (Borod, 1992; Borod and Caron, 1980; Borod et al., 1983; Davidson, 1993; Sackheim et al., 1978; Schiff and MacDonald, 1990). A number of studies demonstrated that the *right* cerebral hemisphere has selective advantage in, for example, perceiving the emotion in speech (i.e. speech prosody) and in recognizing the facial expressions associated with emotions even controlling the musculature experience of emotion (see Borod, 2000 for a review).

So the question, then, is how to square this older literature in neuropsychology (which suggests a right hemisphere cortical advantage for emotion) with the neuroscientific evidence which suggests a subcortical (and laterally symmetrical) role for a number of basic emotional systems (see Gainotti, 1997 for a review). This argument seems to hang on the question of the 'cognitive' versus the 'visceral' aspects of the emotional state (see Solms and Turnbull, 2002, Chapter 4, for a brief review). That is, the cortical systems (which tend to be rightward lateralized) appear to underpin the more visuospatial and cognitive aspects of emotion, for example recognizing that someone has a sad face (Bruce and Young, 1986; Ellis and Young, 1990; Parkin, 1996). This requires a complex computation about the way in which the musculature expresses itself across the face. This includes calculations of the relative position of the mouth, the shape and tension of

the musculature underpinning the cheek, the position and tension of extraorbital muscles, etc. (see Keltner and Ekman, 2000, for a review). These complex visuospatial calculations unquestionably require a great deal of cognitive skill. However, recognizing that a face is 'sad' or 'happy', for example, is very different from *experiencing* the profound feelings of sadness that overcome us when we are depressed, or the terror that overcomes us when we are anxious. It appears that the *cortical* systems are associated with the more cognitive aspects of the emotional state, whereas the visceral *experience* of those emotions are mediated by phylogenetically ancient subcortical systems. The neurobiological basis of these systems is the basis of the review above (see also Panksepp, 1998; Panksepp and Biven (Chapter 9), this volume).

Emotion regulation

In this chapter we will focus on some of these cortical aspects of emotion, and especially the way in which emotion might be managed or controlled. Thus, the interaction between these subcortical emotion systems and, for example, prefrontal cortex is potentially of great interest. Research by our group (Fotopoulou et al., 2004; Nardone et al., 2007; Tondowski et al., 2007; Turnbull et al., 2002, 2004a,b, 2005a) and others (e.g. Feinberg, 2001; Ramachandran and Blakslee, 1998) has suggested that there are at least two classes of cortical systems that are important for managing emotion, both of which appear to produce false beliefs when damaged.

However, before reviewing this material, it seems appropriate to discuss the approach that most cognitive neuroscientists have adopted towards emotion regulation. This speaks to the question of having a 'common language', which forms the central theme of the present book: how one might reach out from the psychodynamic perspective to cognitive neuroscience colleagues, to make the language of the two fields more compatible. One area of common ground is the management of emotion. Cognitive neuroscientists not only clearly understand the importance of cognition, but they also recognize the *existence* of emotion—including, to some extent, its anatomical and pharmacological basis (Lane and Nadel, 2000). By and large, they do not deny the existence of emotion, in the way that th[illegible]haviourists might once have done (see Skinner, 1953).

When one discusses emotion with the cognitive community, they also understand at least many aspects of emotion *regulation* and its importance in mental life (see Koole, 2009, for review). One would particularly think, for example, about work with children: the way in which powerful childhood events are experienced, and that it is very difficult for children to be able to manage and regulate their emotions appropriately (Buss and Goldsmith, 1998; Guttentag and Ferrell, 2008; Mangelsdorf et al., 2008). Neurologically and psychiatrically intact adults have, of course, a much greater capacity of to experience emotion in a regulated manner—and the developmental psychology literature has a clear awareness of this issue. However, many cognitive neuroscientists appear to disagree with the psychodynamic community on the *relative* importance of emotion and cognition as systems. Some imagine, for example, that emotion and cognition are relatively independent in their operation (Leventhal and Scherer, 1987; Zajonc, 1980, 1984). Alternatively, some hold the opinion that cognition is the 'dominant' system of the two, for example, Frijda et al. (2000) discuss the role of cognition and emotion through 'cognitive emotion theory' (e.g. Lazarus, 1991). For example:

> Emotions *result from* how the individual believes the world to be, how events are believed to have come about, and what implications events are believed to have. Beliefs thus are regarded as one of the major *determinants* of emotion, and therefore an important part of the study of emotion can properly be seen as falling *under the umbrella* of cognitive psychology. Oddly enough, however, the reverse direction of influence in the relation between emotion and cognition has received scant attention.
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> Frijda et al. (2000, p. 1, emphasis added)

The approach that emotion is 'determined' by belief (and not vice versa) would be regarded as extraordinary by anyone viewing the question of emotion and cognition from a psychodynamic perspective. One reason for this unusual perspective may be that the roots of cognitive psychology are in work with adults, with people who are emotionally well adjusted, with people who have intact levels of executive function, and of course in situations that are not powerfully emotionally charged. The average laboratory setting does not typically involve the sorts of powerful affective states that human beings commonly find themselves in, and which of course have very important influences on the mind. For mainstream cognitive psychology there has been little investigation of thinking in settings of powerful feelings of love, hate, fear, or despair—though these are central to our experience of being human. Indeed, for the psychotherapy which most directly developed from this perspective, cognitive behavioural therapy (CBT), cognitive states determine emotions (Beck, 1976; Butler et al., 2006). The psychodynamic perspective holds the opposite position, and it is this issue of the 'primacy of affects' that one would most want to persuade 'cognitive' theorists of (Turnbull and Solms, 2007).

The 'primacy of affects' is made most clear under two classes of circumstance. The first, as suggested above, are situations where emotions are extremely powerful, and second in situations where we have poor executive control—poor management of these affective states. This is the claim which we aspire to have our neuroscientific colleagues move towards, and which we are attempting in the literature to persuade them of (Fotopoulou et al., 2004; Nardone et al., 2007; Tondowski et al., 2007; Turnbull and Solms, 2007; Turnbull et al., 2002, 2004a,b, 2005a). That is, in circumstances where *powerful* affective states might overwhelm 'normal' cognition, or situations where executive functions are impaired—we appear to be able to 'use' our intellectual capacities wisely in the service of correctly perceiving reality (Westen, 2007). Indeed, there are times when we not only *allow* the perception of reality to be distorted, but there are also times in which we use our intellectual resources to actively conspire *against* a clear understanding of reality. Thus, those with more substantial cognitive capacity are (in some respects) *better* at holding false beliefs than people with more modest cognitive abilities, because they have more 'intellectual horsepower' to deploy in settings where there is something in which they really *want* to believe, for powerful emotional reasons (see Shermer, 2007).

In affective neuroscience and neuropsychoanalysis we have been able to focus with some success on the core emotions (for reviews, see Panksepp, 1998, 1999; Solms and Nersessian, 1999; Panksepp and Biven (Chapter 9), Watt (Chapter 6), and Pfaff and Fisher (Chapter 5), this volume). We are on perfectly legitimate grounds in doing so, because basic emotions remain a centrally important question in our understanding of the architecture of the mind. However, we would also like to emphasize the importance of emotion *regulation* in any coherent model of mental life (Koole, 2009). A primary reason for this emphasis is that the entire question of 'emotion distorting cognition' speaks to the issue of *conflict* in the mind. One suspects that everyone who has a psychodynamic perspective on mental science understands that the issue of conflict, and the difficulty in managing *competing* mental demands, is central to mental life (Freud, 1911). Successful management of the conflict between drives and reality is vital for maintaining reasonable mental health, and its dysregulation forms the basis of neuroses, and for a variety of false-belief states. Indeed the existence and nature of our civilization is (arguably) underpinned by the fact that we are able to manage and control our feelings (Freud, 1930)—a point also made by a number of later analytic theorists.

A further reason for stressing the importance of emotion regulation relates to the issue of treatment. The last century of work in the treatment of mental health has been sharply polarized between pharmacological treatments (of 'neurochemical imbalances'), and treatments focusing on psychologically driven approaches to dealing with distress and dysfunctional personal circumstances.

This has led to virtually parallel streams of treatment for disorders of mental health (which can, of course, take many forms). The psycho-pharmacological (organic psychiatry) approach has clearly gained substantial success through the pharmacological modification of the basic emotion systems discussed above (Panksepp, 1998). However, it is likely that the *management* of emotion systems will always be intractable to pharmacological interventions, which serve only to up- or down-regulate basic emotion systems.

In contrast, it seems likely that the primary mechanism by which the psychotherapies treat mental distress, in its various forms, is through the modification of *cortical* systems, and more generally the dynamic management of emotion. This is, of course an argument that may well apply to other forms of psychotherapy (CBT, dialectical behaviour therapy, acceptance and commitment therapy, mindfulness) as well as psychoanalysis. Indeed, it is likely to be true not only for the psychotherapies, but also for all other classes of psychosocial intervention, such as activities to enhance play opportunities in children (Panksepp, 2002, 2007), and improved training in emotion ~~management of~~ children ~~by their parents and/or teachers~~ (Bywater et al., 2009; Hutchings, 1996; Hutchings et al., 2004, 2007). In sum, it is important to understand the notion of emotion regulation and its neurobiological basis—but a sound understanding of the neuroscience of such issues remains a substantial topic for future research. The extent to which cortical emotion-regulatory systems are involved in psychotherapies remains wide open for future research. This research domain will also be able to address the ways in which various forms of psychotherapy differ in their regulatory mechanisms. To take one, rather polarized, example, the psychoanalytic approach versus that of CBT differ strikingly in terms of their focus on emotion, and also on the role of conscious awareness and voluntary action in treatment (e.g. Beck, 1976; Lemma, 2003; Roth and Fonagy, 2005).

This chapter addresses the way in which two different approaches have tackled the question of emotion regulation in mental science. Bearing in mind that there is only one mental apparatus to study, it is of some interest to observe whether cognitive psychologists have identified concepts that are relevant for psychoanalysis in this domain. In a brief survey, this chapter offers four domains in which there is potential overlap on the issue of how emotional life interacts with high-level cognition.

Links between cognitive science and psychoanalysis

First, there is a developing literature on emotion regulation that is not driven by the psychodynamic literature, but by cognitive psychologists who are migrating towards studying emotion. One example is the growing interest on the way in which emotions are hidden in social circumstances so as to better serve us in the interpersonal world (see Butler and Gross, 2004, for a review). Examples might include avoiding breakdowns of intimacy and enhancing long-term marital satisfaction (Gottman and Levenson, 1992), and the interpersonal advantages of deception (Hrubes et al., 2004; Shiota et al., 2004). This includes a substantial literature on self-deception (e.g. Gur and Sackeim, 1979; Robinson et al., 2009; Tavris and Aronson, 2007; Trivers, 2000), which will be discussed later in the chapter. There is also a growing interest in the neurological basis of social pain (social loss) and rejection, including evidence that physical and social pain share the same neural circuitry (Eisenberger, 2006; Eisenberger and Lieberman, 2004; Eisenberger et al., 2003, 2006; Panksepp, 1998).

A related domain of cognitive research on the relationship between emotion and cognition is that of cognitive dissonance, in many ways related to the psychoanalytic concept of defence—psychological processes that organize and maintain mental life in a way that protects the individual from aversive emotional experiences (Aronson, 2007; Greenwald and Ronis, 1978;

Pyszczynski et al., 1993; Sherwood, 1981). Festinger's (1957) original argument relates to holding two contradictory 'cognitions': the classic example being the Aesop's fable of the fox and the grapes, where the grapes seem tempting ('cognition 1' as Festinger would describe it), but as soon as the fox realizes that he cannot access them (cognition 2), they are dismissed as being sour. The fox thus deploys a classic rationalization. There has been a substantial literature on cognitive dissonance (e.g. Cooper, 2007; Egan et al., 2007; Elliot and Devine, 1994; Festinger, 1957; Greenwald and Ronis, 1978; Harmon-Jones and Mills, 1999; Kay et al., 2002; Pyszczynski et al., 1993; Tavris and Aronson, 2007), and there is clear potential for overlap between a psychodynamic and a cognitive perspective. However, there is an important difference in the interpretation of the findings. In the cognitive dissonance literature there is far less focus on motivation, and the *emotional* consequences of a thought—where (psychodynamically) the 'sour grapes' worldview protects the fox from feelings of loss.

Emotions also influence mental life in various other ways, which have been investigated by psychologists through a literature, social psychology, that is far distant from that of emotion regulation and the defences. Nevertheless, in the social psychology literature on stereotyping, one can see a similar trend towards understanding the way in which emotion can shape beliefs. Stereotypes are, of course, *generalized* beliefs about the psychological characteristics of a specific group or class of people, that might not be accurate of that person. For example the effects of being blonde, black, gay, or tattooed (Burns et al., 2008; Sinclair and Kunda, 1999; Swami and Furnham, 2007; Takeda et al., 2006; Weir and Fine-Davis, 1989).

We also know that forming stereotypes is a commonplace activity, which *all* humans engage in, often occurring outside of conscious control (Aronson, 2007, Devine and Monteith, 1999; Macrae and Bodenhausen, 2000; Operario and Fiske, 2001). This is especially true under situations of conflict (Sinclair and Kunda, 1999). For example, Kunda et al. (2002) found that when white participants were in disagreement with black individuals, these participants would perform faster on a reaction time task when stereotypical words (e.g. rap, crime, drugs) were presented. There are many theories on why humans use stereotypes, including their use as a time-reducing cognitive process to help us to simplify and categorize the world we live in (Aronson, 2007; Macrae and Bodenhausen, 2000), or to support goal-directed actions by building self-justification or self-esteem (Fein and Spencer, 1997; van den Bos and Stapel, 2009).

Given the prevalence of emotional reactions that accompany stereotyping, it is not surprising that there exists a body of research examining how *emotion* might be involved in the formation of stereotypical behaviour (e.g. Davies, 2008; Esses and Zanna, 1995; van den Bos and Stapel, 2009). For instance, emotional stress has been shown to activate stereotypes (e.g Maner et al., 2005), and stereotyping also plays a role in 'self-enhancement' (see van den Bos and Stapel, 2009 for a review). However, the link between emotion and stereotyping has never been a *core* topic of investigation for the social psychology literature. Nevertheless, there are several lines of evidence to support the link. Notably, neuroscientists have begun to map the brain correlates associated with perceiving and applying stereotypes, showing substantial right frontal activation (Mitchell et al., 2008; Quadflieg et al., 2008). A related finding comes from the Harris and Fiske (2006) study, which demonstrated medial frontal activation when viewing others for whom there was empathy, but showing no activation for 'out-groups' such as the homeless (i.e. perhaps suggesting that the viewers do not regard such out-group members as fully 'human'). These findings are consistent with an emotion-orientated view of stereotyping, given the role of the medial and right frontal cortex in emotion and emotion regulation (Kim and Hamann, 2007; Solms and Turnbull, 2002).

A further topic of 'common ground' between the analytic and cognitive literature is the substantial literature built up from the 1970s on the nature of decision-making biases (e.g. Kahneman, 2003;

Kahneman and Tversky, 1979; Tversky and Kahneman, 1974). Again, many of these so-called 'cognitive' biases probably have their basis in powerful affective states. To take one example, 'post-purchase rationalization' (Aronson, 2007; Cohen and Goldberg, 1970) focuses on the way in which the purchaser seeks to argue (after the fact) that they have made a financially sound decision. This is typically cited as a 'cognitive' bias, but of course speaks powerfully to motivational issues: where the emotional consequences of believing that you wasted your money, make it in your best interests to deploy intellectual resources explaining why this may have actually been a very good decision. Importantly for psychoanalysis, the cognitive literature on this topic suggests strong evidence that many motivational states have their origins generated outside of conscious awareness (Bos et al., 2008; Custers and Aarts, 2005, 2007, 2010; Dijksterhuis and Aarts, 2010).

A further example of topics outside psychoanalysis that may be of relevance is the literature on self-deception. There is, for example, sound evidence that we are unexpectedly poor in making judgements about ourselves—for example from non-verbal cues (Hofmann et al., 2009). One strand of this work comes from evolutionary psychology, most notably the work of Robert Trivers (Trivers, 2000, also see Mele, 1997), which emphasizes the possible evolutionary advantages of self-deception. Trivers' argument has been that if we can find a way in which we can convince *ourselves* of a lie (so that we ourselves think that it is true), then this confers a powerful evolutionary advantage, in that we are better able to deceive others. Again, we think there is an interesting opportunity here for the world of self-deception in evolutionary psychology to map onto things that are of interest to the psychoanalytic community.

These examples cited above show how the cognitive literature is relevant, but limited, in its applicability and usefulness to psychoanalysis. Any limitations are primarily because of the focus on *cognitive* accounts, and avoidance of psychoanalytically common terms such as 'defence', with its implications of reality distortion for *emotional* gain. There are further limitations to the relevance of the cognitive psychology literature for neuropsychoanalysis, in that cognitive psychology has been mapped imperfectly onto its neurobiological foundation. It is therefore worthwhile for us to consider why a neuroscientific perspective might add value to work in the psychological sciences.

The benefits of neuroscience

Neuroscience has a history of being helpful in psychological science for at least two reasons. First, because neuroscience offers a second 'viewpoint' (c.f. Solms and Turnbull, 2002) on all psychological issues, from memory to language. Importantly, *all* of the mind is mediated by brain processes—so that brain injury can disrupt psychological abilities that may not have been 'fashionable' for psychological scientists to investigate, uncovering material that the field had not previously encountered. For example, the literature on semantic memory remained relatively obscure until work in the 1970/1980s on patients with loss of semantic knowledge (especially 'semantic dementia') transformed the field (Hodges et al., 1992; Snowden et al., 1989; Warrington, 1975). Similarly, the fields of decision making and problem solving have been (and are being) transformed by the study of patients with frontal lobe lesions, which make it clear that a substantial fraction of the forebrain is dedicated to executive functions (Daum and Mayes, 2000; Rodrigues Gouveia et al., 2007). However, the early history of cognitive science shows that there was a disproportionate interest in 'foundational' skills such as language and episodic memory—with limited emphasis on synthetic/executive ability (see Finger, 1994 for a review). Moreover the study of neurological patients makes it clear that executive function is a multi-component and fractionable skill (Baddeley, 1998, 2002; Baddeley and Della Sala, 1996; Baddeley et al., 1986; Shallice, 2002), including processes which the cognitive literature had not previously focused on,

such as action initiation (as lost in patients who are profoundly adynamic), and the capacity to shift-set (as in patients with perseveration) (Kimberg et al., 1997; Rolls, 2002).

More importantly neuroscience (and neuropsychology in particular) is useful because it provides scientific clarity by the investigation of 'extreme' cases. Thus, studying patients with selective deficits, in which the disorder suffered by the patient is strikingly obvious in comparison with preserved psychological abilities (Shallice, 1988), reduces the reliance on subtle reaction-time effects to make a phenomenon clear. One obvious example is the case of H.M. (Scoville and Milner, 1957), whose profound recent episodic memory impairment (with intact procedural and immediate memory) greatly clarified the extent to which several independent memory systems exist in the brain, and transformed memory research (see Schacter and Scarry, 2000 for a review).

The fact that cognitive processes (for example, memory and executive function) have been greatly clarified by the study of brain-lesioned patients, stands in clear analogy to phenomena of psychoanalytic interest, such as studying the experience of strong emotion, and the way that is managed. Thus, for example it has been possible to study the selective loss of particular cases of emotion (Calder et al., 2001; Damasio, 1999, pp. 62–67). Also it has been possible to demonstrate preservation of emotion and emotion-based memory in patients with profound episodic memory impairments (Claparede, 1951; Evans-Roberts and Turnbull, 2011; Tranel, and Damasio, 1993; Turnbull and Evans, 2006; Turnbull et al., 2006). In addition, it is important also to identify which brain areas can be damaged and yet still underpin important psychological processes. For example, the demonstration of preserved patterns of emotional experience after right convexity lesions (Tondowski et al., 2007; Turnbull et al., 2002, 2005a) demonstrate that cortical brain areas sometimes cited as being important for emotion (Borod, 2000; Davidson, 2001; Davidson and Irwin, 1999) are not centrally involved in emotional *experience* (which is, as discussed above, likely to be mediated subcortically—Damasio et al., 2000; Panksepp, 1998; Watt, 2000). Recent findings of this sort suggest that the capacity to 'carve cognition at its seams' (McCarthy and Warrington, 1990, p. 20) also applies to the emotional world. Thus, the move which psychoanalysis has been making towards neuropsychology offers it all sorts of opportunities for verifying and identifying the building blocks of the parts of the mental apparatus that have long been of interest to psychoanalysis.

Emotion in decision making

We finish this section by focusing on some of the examples in which researchers have studied the neurobiology of disorders to understand the way in which they change or distort the mind. A range of settings in which emotion influences decision making have been investigated (Bechara et al., 1994, 2000; Bowman and Turnbull, 2004; Dunn et al., 2006; Turnbull et al., 2005b). These findings clarify the important role of emotion in mental life, which has long been central to psychodynamic thinking (Freud, 1911).

Of course, for the past several thousand years, philosophers have informed us that in order to make good choices we need to be entirely rational, and exclude emotions from the decision making process (Kant, 1781/2004; Plato, 360BC/1956). However, over the past two decades, research has shown us that emotion is often fundamental for human decision making (Bechara et al., 2000; Koole, 2009; Turnbull and Solms, 2007). This is especially true under two clear settings: situations of high levels of complexity, and circumstances which are rather uncertain, ambiguous, or unpredictable (Bechara et al., 2000; Kahneman, 2003; Turnbull and Evans, 2006; Turnbull et al., 2007). Under these circumstances, if emotion is *not* involved in decision making, humans tend to make poor choices, and often make catastrophically unfortunate errors. Indeed, it has become increasingly clear that inaccuracies/biases in decision making result from the influence of

emotion-related brain areas (De Martino et al., 2006; de Gelder et al., 2005; Pessiglione et al., 2007, 2008.

The classic examples of these phenomena comes from the neuropsychological literature of patients who have lesions to the ventromesial frontal lobes, key to the way in which emotion influences high-level cognition. The prototype example is that of Phineas Gage (Harlow, 1848), who suffered an extraordinary injury that damaged, probably bilaterally (Damasio et al., 1994), the ventromedial surfaces of his frontal lobes. Like all the modern cases of patients with similar lesions, Gage experienced three noticeable classes of change after his brain injury. First, like many such patients, he made very poor real-world decision choices. He struggled to hold down a job, managed his finances poorly, and operated poorly in the interpersonal world (Harlow, 1868; Macmillan, 2000, 2004). Second, like many of these patients, he also remained by and large intellectually 'intact'. Several such modern patients perform well on measures of conventional cognitive function (Bechara et al., 1997, 2000; Clark et al., 2003, 2004; Eslinger and Damasio, 1985). Certainly they often perform well in the structured settings of many intelligence tests, for example, probably because they do not require the sorts of knowledge that emotions add to the decision-making process—given that many task decisions are not inherently complex or uncertain. Finally, of course, such patients show substantial personality change. In the classical case of Phineas Gage, his physician described him as 'no longer Gage' (Harlow, 1868, p. 327)—he had become a different person. Presumably this is because the interpersonal world is the most complicated and uncertain of all of the settings in which we find ourselves in.

Dreams and psychosis

An additional literature, in relation to the question of affect and our perception of reality, relates to the role of emotion in dreams. Here work with brain-lesioned patients has been seminal in transforming the dream literature, making it abundantly clear that emotion has a role to play in the delusional beliefs seen in these sleeping states (see especially Solms, 1997, 2000, 2002). Notably, lesions to the medial parts of the frontal lobe appear to completely terminate the dream process, primarily because such lesions disrupt a core emotion system, mediated by dopamine. Dopamine pathways, which travel from the upper brainstem to a range of ventral and mesial frontal forebrain sites, are the substrate for a l[illegible]motion system (Panksepp, 1985; Robbins and Everitt, 1992). Variously referred to over the years as a 'reward' (Schultz, 2001), a 'preparation'(Hobel, 1997), or a 'SEEKING' system (Ikemoto and Panksepp, 1999), whose chemistry appears to consistently activate ventromesial frontal structures during tasks involving reward and punishment (Dias et al., 1996; O'Doherty et al., 2001; Schultz, 2001; Turnbull et al., 2007). It appears especially apt to motivate us to *investigate* the environment, search for rewards (e.g. Robbins and Everitt, 1992), and to construct causal relationships between events in the perceived world (Schultz, 2001).

What then of a quite different set of findings relating to dopamine? It has been known since Arvid Carlsson's work in the 1960s, and especially since the 1970s (see Snyder, 1976), that pharmacological management of the positive symptoms of schizophrenia (the delusions and hallucinations) targets one or more of these dopamine systems in the brain. This 'dopamine' theory of schizophrenia remains (through a range of modifications) by far the most robust account of the neurochemical basis of the disorder—originally emphasizing the simple overactivation of the dopamine system, but more recently uncovering roles for other members of the D2 dopamine family, and revealing the extent to which cortical mechanisms regulate these forebrain dopamine systems (see Carlsson and Carlsson, 1990; Egan and Weinberger, 1997; Moore et al., 1999 for a review).

Most intriguing is the observation that dreaming stops completely when fibres in the ventromesial frontal lobes are severed (Solms, 1997, 2000); a symptom that coincides with a general reduction

in motivated behaviour. The lesion producing this syndrome is the same as that which was deliberately produced in prefrontal leucotomy (see Solms, 1997), which was of course replaced in the 1960s by drugs that dampened activity in the same dopaminergic pathways discussed above in relation to schizophrenia.

There is therefore robust support for the claim that the system that mediates powerful positive emotions (Berridge, 2003; Panksepp, 1998; Schultz, 1998, 2001), and is *also* centrally implicated in hallucinations and delusions (Silbersweig and Stern, 1996; Silbersweig et al., 1995), is at the heart of the 'false-belief' states that generate the dream process (Solms, 1997, 2000, 2002). Thus, dreams—the delusional beliefs we *all* experience, appear to have a shared neurobiological basis with the psychotic states seen in psychiatric disorders, suggesting that emotion is to be centrally placed in any argument about the casual basis of delusional beliefs.

Confabulation

Emotion also appears to be centrally involved in delusional ideation in the false beliefs of neurological patients who confabulate (where confabulate refers to a false-belief state in neurological patients—who believe, for example, that they are living in a hotel not a hospital, or that their spouse is an imposter). Such delusional states are found in patients who suffer large bilateral medial frontal lesions (Schnider, 2001, 2003). However, the cognitive psychology literature has tended to ignore the issue of motivation in such cases (Fotopoulou et al., 2004; Turnbull et al., 2004a,b) and focus mainly on cognitive issues.

In particular, the cognitive literature appears to regard impairments of general *executive* function as being at the core of these patients' confabulations (Baddeley and Wilson, 1986; Benson et al., 1996; Kapur and Couchlan, 1980; Papagno and Baddeley, 1997; Stuss et al., 1978). However, the argument that impairments of executive function are the sole cause of confabulation appears to be flawed, for a number of reasons (see Turnbull and Solms, 2007, for a review). Most importantly, such patients can have substantial impairments of general executive function without becoming confabulatory—neurological wards contain many patients with substantially impaired executive functions, but confabulation is actually rather rare. Confabulation is also rather selective in its nature. Most notably, when you speak to a patient who confabulates, they are typically sensible with regard to most issues, but have areas in their mental life, often associated with family or work issues, in which they suddenly become rather delusional (some notable examples are Burgess and McNeil, 1999; Conway and Tacchi, 1996; Villiers et al., 1996). More recent accounts of confabulation seek to explain such specificity by focusing on alternative cognitive explanations, such as monitoring errors (Gilboa et al., 2006; Schnider, 2003).

The potential role of emotion has long been noted anecdotally, but has now been studied more systematically in confabulatory patients. In a series of studies (Fotopoulou, 2010; Fotopoulou et al., 2004, 2008b; Turnbull et al., 2004a,b) we demonstrated that the vast majority of delusional beliefs experienced by these patients are positively biased. Naturally, it is difficult to classify people's false beliefs in terms of valence, as the experimenter cannot always be certain whether the situation being described would be pleasant or pleasurable for that individual; an obvious example is of Capgras delusions (Ellis and Young, 1990), where the patient believes that a family member (say her husband?) is an imposter—who looks, sounds, and dresses like her actual husband. Whether this delusion is pleasurable or not depends entirely on how she feels about her husband. If he was a charming and much-loved partner, the delusion has unpleasurable consequences. If he was nasty and uncaring, the delusion is potentially an ingenious method for distancing the patient from this difficult man.

In summary, it is virtually impossible to be certain about the question of emotional valance for false beliefs about a *person*. However, one way of studying this issue is to investigate confabulations

about *place*. In doing so the experimenter can study with relative certainty the pleasantness of the confabulations, as they know both where the patient *is* in reality, and the *confabulated* location. These locations can then be independently rated with greater certainty. Turnbull et al. (2004a) investigated the pleasantness of confabulations in this manner in the cases of the 16 patients reported in the neuroscientific literature between 1980 and 2000, who provided *actual* and *confabulated* locations. They found that individuals universally believed themselves to be in *more* affectively positive situations than in reality. The confabulated locations are themselves psychoanalytically interesting. One substantial group (roughly half of the cases) goes to very 'exotic' locations, for example, a bistro in the south of France, or a ferry in the Caribbean. The other class of confabulators do not go to exotic locations but to 'safe' places. These confabulators go home, to their parents' home, or to their old university. The sorts of personality predisposition that might predict this choice is incompletely understood, but the work of our group suggests that patients in low mood states are more likely to produce positive confabulations, that is, delusional beliefs serve as a form of defence (Fotopoulou et al., 2007a,b, 2008a,b; Turnbull et al., 2004b).

Anosognosia

Another interesting class of neurological patients with false beliefs includes the anosognosics—who hold striking delusional beliefs, typically about their bodies, and denying that they are disabled. Prototypically, they tend to be paralysed on the left side of their body, after large right-sided strokes. In extreme cases, for example, the patient denies they are in any way paralysed, and produces bizarre arguments to counter the questions of the examiner—for example, if 'a patient who claims that she is able to run is asked why she is in a wheelchair, she might respond: "There was nowhere else to sit." If asked why she was not moving her left arm, she may say something like: "I exercised it a lot earlier today, so I'm resting it."'(Solms and Turnbull, 2002, p. 262). Nevertheless they appear to not be aware that they are paralysed. There is a growing literature (primed by Kaplan-Solms and Solms, 2000, Chapter 8) on the fluctuating nature of these patients' delusions, and the way in which psychological variables can change the presentation of these patients (Marcel et al., 2004; Nardone et al., 2007; Tondowski et al., 2007; Turnbull et al., 2002, 2005a). That is, they deny their disorder under *most* circumstances, especially when they are formally asked to say whether they are paralysed or not. However, if one discusses things in a safer setting, they tend to become far more aware of their disorder. Indeed, this awareness often leads to episodes of sadness, as they begin the process of mourning their disability. There are also reports of patients making quite a striking recovery of awareness (e.g. Fotopoulou et al., 2009)—which may have substantial effects on the patient's mood.

In more rigorous experimental investigations of the extent of their awareness, it can be demonstrated that these patients *do* have some implicit knowledge of their paralysis, even if they formally deny this (Fotopoulou et al., 2010). Nardone et al. (2007) found that the patients who showed the *greatest* magnitude of denial of deficit were also those who found their attention best captured by deficit-related words (e.g. paralysis). An illuminating clinical example of the fluctuating nature of these delusional states is a patient who was paralysed (but denied paralysis) described by Ramachandran and Blakslee (1998, p. 151), in whom the denial deficit could be completely removed by offering a circumstance in which the patient could be paralysed without it being emotionally threatening. To produce such a situation, Ramachandran spoke to the patient, saying that he was terribly sorry about troubling them, but as part of the neurological examination he needed to deliver an injection into their arm. This would be a slight inconvenience as he presented it, for it meant that for a few minutes their left arm would be paralysed. Naturally, Ramachandran gave the patient a *saline* injection, with no paralysing effect. However, after the injection they

patient was asked about their arm and they reported 'it doesn't seem to want to do anything . . . it's not moving' (Ramachandran and Blakslee, 1998, p. 151). Under these circumstances, the patient has of course had the same neurological deficit (paralysis) as a few minutes earlier, but now without the catastrophic negative emotional consequences. However, the lack of movement is now explained as being simply a result of a temporary injection—an idea with much more modest emotional consequences, and it now appears that the patient is quite able to tolerate the paralysis.

Naturally, from a psychoanalytic perspective it is fascinating that psychological variables of this sort should be able to distort the patient's perceived reality so dramatically. Indeed, Ramachandran does not hesitate to describe these phenomena as classic defence mechanisms: including rationalization, projection, and even reaction formation (Ramachandran and Blakslee, 1998). To better understand the fluctuating emotional presentation, we have studied the emotional range of these patients, which is the same as in non-anosognosic patient controls (Tondowski et al., 2007; Turnbull et al., 2002, 2005a). However, the *object* to which the patients direct these powerful emotions seems entirely different. They tend, almost exclusively to feel (for example) great sadness at the loss of their spectacles, or the disability of others, but are remarkably indifferent or stoic about their own difficulties—in a phenomenon akin to projection (Turnbull et al., 2002, 2005a).

Conclusion

This chapter has discussed a vast literature (see also Turnbull and Solms, 2007 for a review) suggesting that there are a wide range of psychological processes, from stereotyping to false-belief states, which have been investigated by the cognitive psychology, social psychology, and neuropsychological communities, and are also potentially of enormous importance to the psychoanalytic community, especially because they speak directly to the question of emotion and motivation in mental life, which is of course what psychoanalysis, and related psychotherapies, are centrally concerned with. These findings in particular suggest that the 'balance of power' between emotion and cognition is such that emotion appears capable of acquiring the 'upper hand' quite readily, at least in certain circumstances. This is perhaps clearest when we experience powerful emotional states, and where a great deal is at stake for the individual. In such situations we appear to have our cognitive processes distorted, or 'hijacked', by these powerful motivational states. Nevertheless, this 'balance of power' issue, with emotion in the ascendant, is one domain which seems especially difficult for neuroscientific colleagues to accept (Turnbull and Solms, 2007) and appears to be a central stumbling block in the narrowing gap between topics of interest to neuroscience and psychoanalysis.

The relationship between psychoanalysis and neuroscience has, of course, been difficult for much of the [illegible]ntury (Kandel, 1998). It has meant having an almost entirely separate literature for psychoanalysis, which often appeared to be independent of neuroscientific publications. Naturally, this is a non-optimal situation for any science. The fact that psychoanalysis has a professional terminology that can seem rather obscure to neuroscientific colleagues has not always helped with this divide. There has also been a good deal of speculation-without-data in the field and probably too much emphasis on clinical work in psychoanalysis rather than on research (Kandel, 1998). This is not to suggest that clinical work is unimportant. It is extremely important—but the field of psychoanalysis would be well served to dedicate resources to the question of research as well.

Nevertheless, in spite of these difficulties, there are enormous prospects associated with bringing together the two fields. It needs, of course, for the neuroscientific world to take emotion, and the extent to which emotion can distort cognition, seriously. In contrast, the psychoanalytic

Box 11.2 Questions for future study/research

1. To what extent are cortical emotion-regulatory systems involved in psychotherapies? This research domain will also be able to address the ways in which various forms of psychotherapy differ in their regulatory mechanisms.
2. Can psychoanalysis better understand the neurobiological basis of core psychoanalytic concepts such as [illegible]ce with the knowledge neuroscience can now offer?
3. How do psychoanalytic concepts of emotion-regulation differ from those of neuroscience? How does emotion regulation develop through the lifespan?

world should reach out to the neuroscientific community, and to be able to play according to the rules of the game of mainstream science. This means publishing papers in neuroscientific journals, and generating the kinds of experimental work that can survive peer review. Under these circumstances, neuroscientists are (in our experience) not resistant to engaging in communication on topics of mutual interest (Turnbull and Solms, 2007), when you can demonstrate to them that data have been collected using all of the conventional methods associated with experimental science, and published in journals that they trust. Under these circumstances, the gap between the two fields is narrowed enormously. Indeed there is more goodwill among neuroscientists towards psychoanalysis than psychoanalysts may be aware of (Kandel, 1998), and not quite as much resistance as we think we may fear.

References

Aronson, E. (2007). *The Social Animal*, 10th edn. New York, NY: Worth/Freeman.

Baddeley, A. (1998). The central executive: A concept and some misconceptions. *Journal of the International Neuropsychological Society*, **4**, 523–526.

Baddeley, A. (2002). Fractioning the central executive. In D.T. Stuss and R.T. Knight. (eds) *Principles of Frontal Lobe Function*, pp. 246–260. Oxford: Oxford University Press.

Baddeley, A.D. and Wilson, B. (1986). Amnesia, autobiographical memory and confabulation. In D.C. Rubin (ed.) *Autobiographical Memory*, pp. 225–252. New York, NY: Cambridge University Press.

Baddeley, A. and Della Sala, S. (1996). Working memory and executive control. *Philosophical Transactions of the Royal Society of London B*, **351**, 1397–1404.

Baddeley, A.D., Bressi, S., Della Sala, S., Logie, R., and Spinnler, H. (1986). Dementia and working memory. *Quarterly Journal of Experimental Psychology*, **38A**, 603–618.

Bechara, A., Damasio, A.R., Damasio, H., and Anderson, S.W. (1994). Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition*, **50**, 7–15.

Bechara, A., Damasio, H., Tranel, D., and Damasio, A.R. (1997). Deciding advantageously before knowing the advantageous strategy. *Science*, **275**, 1293–1294.

Bechara, A., Damasio, H., and Damasio, A.R. (2000). Emotion, decision making and the orbitofrontal cortex. *Cerebral Cortex*, **10**, 295–307.

Beck, A.T. (1976). *Cognitive Therapy and the Emotional Disorders*. New York, NY: International Universities Press.

Benson, D.F., Djenderedjian, A., Miller, M.D., Pachana, N.A., Chang, M.D., Itti, L., and Mena, I. (1996). Neural basis of confabulation. *Neurology*, **46**, 1239–1243.

Berridge, K.C. (2003). Pleasures of the brain. *Brain and Cognition*, **52**, 106–128.

Borod, J.C. (1992). Interhemispheric and intrahemispheric control of emotion: A focus on unilateral brain damage. *Journal of Consulting and Clinical Psychology*, **60**, 339–348.

Borod, J.C. (2000). *The Neuropsychology of Emotion*. Oxford: Oxford University Press.

Borod, J.C. and Caron, H.S. (1980). Facedness and emotion related to lateral dominance, sex, and expression type. *Neuropsychologia*, **18**, 237–242.

Borod, J.C., Koff, E., and White, B. (1983). Facial asymmetry in posed and spontaneous expressions of emotion. *Brain and Cognition*, **2**, 165–175.

Bos, M.W., Dijksterhuis, A., and van Baaren, R.B. (2008). On the goal-dependency of unconscious thought. *Journal of Experimental Social Psychology*, **44**, 1114–1120.

Bowman, C.H. and Turnbull, O.H. (2004). Emotion-based learning on a simplified card task: the Iowa and Bangor gambling tasks. *Brain and Cognition*, **55**, 277–282.

Bruce, V. and Young, A. (1986). Understanding face recognition. *British Journal of Psychology*, **77**, 305–327.

Burgess, P.W. and McNeil, J.E. (1999). Content-specific confabulation. *Cortex*, **35**, 163–182.

Burns, K.C., Isbell, L.M., and Tyler, J.M. (2008). Suppressing emotions toward *stereotyped* targets: The impact on willingness to engage in contact. *Social Cognition*, **26**, 276–287.

Buss, K.A. and Goldsmith, H.H. (1998). Fear and anger regulation in infancy: effects on the temporal dynamics of affective expression. *Child Development*, **69**, 359–374.

Butler, E.A. and Gross, J.J. (2004). Hiding feelings in social contexts: out of sight is not out of mind. In P. Philippot and R.S. Feldman (eds) *The Regulation of Emotion*, pp. 101–126. Mahwah, NJ: Lawerence Erlbaum Associates.

Butler, A.C., Chapman, J.E., Forman, E.M., and Beck, A.T. (2006). The empirical status of cognitive-behavioral therapy: A review of meta-analyses. *Clinical Psychology Review*, **26**, 17–31.

Bywater, T., Hutchings, J., Daley, D., Whitaker, C., Yeo, S. T., Jones, K., Eames, C., and Tudor-Edwards, R. (2009). Long-term effectiveness of a parenting intervention in sure start services in Wales for children at risk of developing conduct disorder. *British Journal of Psychiatry*, **195**(4), 318–324.

Calder, A.J., Lawrence, A.D., and Young, A.W. (2001). Neuropsychology of fear and loathing. *Nature Neuroscience*, **2**, 352–363.

Carlsson, M. and Carlsson, A. (1990). Schizophrenia: A subcortical neuro-transmitter imbalance syndrome. *Schizophrenia Bulletin*, **16**, 425–432.

Claparede, E. (1951). Recognition and 'me'ness. In D. Rapaport (ed.) *Organisation and Pathology of Thought*, pp. 58–75. New York, NY: Columbia University Press (Reprinted from *Archives de Psychologies*, 1911, 11, 79–90).

Clark, L., Manes, F., Autoun, N., Shakian, B.J., and Robbins, T.W. (2003). The contributions of lesion laterality and lesion volume to decision-making impairment following frontal lobe damage. *Neuropsychologia*, **41**, 1474–1483.

Clark, L., Cools, R., and Robbins, T.W. (2004). The neuropsychology of ventral pre-frontal cortex: Decision-making and reversal learning. *Brain and Cognition*, **55**, 41–53.

Cohen, J.B. and Goldberg, M.E. (1970). The dissonance model in post-decision product evaluation. *Journal of Marketing Research*, **11**, 315–321.

Conway, M.A. and Tacchi, P.C. (1996). Motivated confabulation. *Neurocase*, **2**, 325–338.

Cooper, J.M. (2007). *Cognitive Dissonance: 50 Years of a Classic Theory*. London: Sage Publications.

Custers, R. and Aarts, H. (2005). Positive affect as implicit motivator: on the nonconscious operation of behavioral goals. *Journal of Personality and Social Psychology*, **89**(2), 129–142.

Custers, R. and Aarts, H. (2007). In search of the nonconscious sources of goal pursuit: Accessibility and positive affective valence of the goal state. *Journal of Experimental Social Psychology*, **43**, 312–318.

Custers, R. and Aarts, H. (2010). The unconscious will: how the pursuits of goals operates outside of conscious awareness. *Science*, **329**, 47–50.

Damasio, A. (1999). *The Feeling of What Happens: Body and Emotion in the Making of Consciousness*. London: William Heinemann.

Damasio H., Grabowski, T, Frank, R, Galaburda, A., and Damasio, A. (1994) The return of Phineas Gage: the skull of a famous patient yields clues about the brain. *Science*, **264**, 1102–1105.

Damasio H., Grabowski, T, Bechara, A., Damasio, H., Ponto, L.L.B., Parvisi, J., and Hichwa, R.D. (2000). Subcortical and cortical brain activity during the feeling of self-generated emotions. *Nature Neuroscience*, **3**, 1049–1056.

Daum, I. and Mayes, A.R. (2000). Memory and executive function impairments after frontal or posterior cortex lesions. *Behavioural Neurology*, **12**(4), 161–173.

Davidson, R.J. (1993). Cerebral asymmetry and emotion: conceptual and methodological conundrums. *Cognition and Emotion*, **7**, 115–138.

Davidson, R.J. (2001). Toward a biology of personality and emotion. *Annals of the New York Academy of Sciences*, **935**, 191–207.

Davidson, R.J. and Irwin, W. (1999). The functional neuroanatomy of emotion and affective style. *Trends in Cognitive Science*, **3**, 11–21.

Davies, J.L. (2008). *Emotion and Prejudice in Complex Decision-Making*. Unpublished doctoral dissertation, Bangor University, UK.

de Gelder, B., Morris, J.S., and Dolan, R.J. (2005). Unconscious fear influences emotional awareness of faces and voices. *Proceedings of the National Academy of Sciences of the United States of America*, **102**(51), 18682–18687.

De Martino, B., Kumaran, D., Seymour, B., and Dolan, R.J. (2006). Frames, biases, and rational decision-making in the human brain. *Science*, **313**, 684–687.

Devine, P.G. and Monteith, M.J. (1999). Automaticity and control in stereotyping. In S. Chaiken and Y. Trope. (eds) *Duel-Process Theories in Social Psychology*. New York, NY: Guilford.

Dias, R., Robbins, T.W., and Roberts, A.C. (1996). Dissociation in prefrontal cortex of affective and attentional shifts. *Nature*, **380**, 69–72.

Dijksterhuis, A. and Aarts, H. (2010). Goals, attention, and (un)consciousness. *Annual Review of Psychology*, **61**, 467–490.

Dunn, B.D., Dalgleish, T., and Lawrence, A.D. (2006). The somatic marker hypothesis: A critical evaluation. *Neuroscience and Biobehavioral Reviews*, **30**, 239–271.

Egan, L.C., Santos, L.R., and Bloom, P. (2007). The origins of cognitive dissonance: Evidence from children and monkeys. *Psychological Science*, **18**(11), 978–983.

Egan, M.F. and Weinberger, D.R. (1997). The neurobiology of schizophrenia. *Current Opinion in Neurobiology*, **7**, 701–707.

Eisenberger, N.I. (2006). Identifying the neural correlates underlying social pain: Implications for developmental processes. *Human Development*, **49**, 273–293.

Eisenberger, N.I. and Lieberman, M.D. (2004). Why rejection hurts: a common neural alarm system for physical and social pain. *Trends in Cognitive Sciences*, **8**(7), 294–300.

Eisenberger, N.I., Lieberman, M.D., and Williams, K.D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science*, **302**, 290–292.

Eisenberger, N.I., Jarcho, J.M., Lieberman, M.D., and Naliboff, B.D. (2006). An experimental study of shared sensitivity to physical pain and social rejection. *Pain*, **126**, 132–138.

Elliot, A.J. and Devine, P.G. (1994). On the motivational nature of cognitive dissonance: Dissonance as psychological discomfort. *Journal of Personality and Social Psychology*, **67**, 382–394.

Ellis, H.D. and Young, A.W. (1990). Accounting for delusional misidentification. *British Journal of Psychiatry*, **157**, 239–248.

Eslinger, P.J. and Damasio, A.R. (1985). Severe disturbance of higher cognition after bilateral frontal lobe ablation: patient EVR. *Neurology*, **35**, 1731–1741.

Esses, V.M. and Zanna, M.P. (1995). Mood and the expression of ethnic stereotypes. *Journal of Personality and Social Psychology*, **69**, 1052–1068.

Evans-Roberts, C.E.Y. and Turnbull, O.H. (2011). Remembering relationships: preserved emotion-based learning in Alzheimer's disease. *Experimental Aging Research*, **37**, 1–16.

Fein, S. and Spencer, S.J. (1997). Prejudice as self-image maintenance: affirming the self through derogating others. *Journal of Personality and Social Psychology*, **73**, 31–44.

Feinberg, T.E. (2001). *Altered Egos: How the Brain Creates the Self*. Oxford: Oxford University Press.

Festinger, L. (1957). *A Theory of Cognitive Dissonance*. Stanford, CA: Stanford University Press.

Finger, S. (1994). *Origins of Neuroscience*. New York, NY: Oxford University Press.

Fotopoulou, A. (2010). The affective neuropsychology of confabulation and delusion. *Cognitive Neuropsychiatry*, **15**, 38–63.

Fotopoulou, A., Solms, M., and Turnbull, O.H. (2004). Wishful reality distortions in confabulation. *Neuropsychologia*, **42**, 727–744.

Fotopoulou, A., Conway, M.A., Griffiths, P., Birchall, D., and Tyrer, S. (2007a). Self-enhancing confabulation: revisiting the motivational hypothesis. *Neurocase*, **13**, 6–15.

Fotopoulou, A., Conway, M.A., and Solms, M. (2007b). Confabulation: motivated reality monitoring. *Neuropsychologia*, **45**, 2180–2190.

Fotopoulou, A., Conway, M.A., Solms, M., Tyrer, S. and Kopelman, M. (2008a). Self-serving confabulation in prose recall. *Neuropsychologia*, **46**, 1429–1441.

Fotopoulou, A., Conway, M.A., Tyrer, S., Birchall, D., Griffiths, P., and Solms, M. (2008b). Is the content of confabulation positive? An experimental study. *Cortex*, **44**, 764–772.

Fotopoulou, A., Rudd, A., Holmes, P., and Kopelman, M. (2009). Self-observation reinstates motor awareness in anosognosia for hemiplegia. *Neuropsychologia*, **47**, 1256–1260.

Fotopoulou, A., Pernigo, S., Maeda, R., Rudd, A., and Kopelman, M. (2010). Implicit awareness in anosognosia for hemiplegia: unconscious interference without conscious re-representation. *Brain*, **133**(12), 3564–3577.

Freud, S. (1911). Formulations on the two principles of mental functioning. In J. Strachey. (ed.) *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, *Volume* **XII**, pp. 213–226. London: Haworth Press.

Freud, S. (1930). Civilization and its discontents. In J. Strachey. (ed.) *The Standard Edition of the Complete Psychological Works of Sigmund Freud*, *Volume* **XXI**, pp. 64–145. London: Haworth Press.

Frijda, N.H., Manstead, A.S.R., and Bem, S. (2000). *Emotions and Beliefs: How feelings Influence Thoughts*. Cambridge, UK: Cambridge University Press.

Gainotti, G. (1997). Emotion disorders in relation to unilateral brain damage. In T.E. Feinberg and M.J. Farah. (eds) *Behavioral Neurology and Neuropsychology*, pp. 691–698. New York, NY: McGraw Hill.

Gilboa, A., Alain, C., Stuss, D.T., Melo, B., Miller, S., and Moscovitch, M. (2006). Mechanisms of spontaneous confabulations: a strategic retrieval account. *Brain*, **129**, 1399–1414.

Gottman, J.M. and Levenson, R.W. (1992). Marital processes predictive of later dissolution: behavior, physiology, and health. *Journal of Personality and Social Psychology*, **63**, 221–233.

Greenwald, A.G. and Ronis, D.L. (1978). Twenty years of cognitive dissonance: case study of the evolution of a theory. *Psychological Review*, **85**, 53–57.

Gur, R.C. and Sackeim, H.A. (1979). Self-deception: a concept in search of a phenomenon. *Journal of Personality and Social Psychology*, **37**, 147–169.

Guttentag, R. and Ferrell, J. (2008). Children's understanding of anticipatory regret and disappointment. *Cognition and Emotion*, **22**(5), 815–832.

Harlow, J.M. (1848). Passage of an iron rod through the head. *Boston Medical and Surgical Journal*, **39**(20), 389–393.

Harlow, J.M. (1868). Recovery from the passage of an iron bar through the head. *Publications of the Massachusetts Medical Society*, **2**, 327–347.

Harmon-Jones, E. and Mills, J. (1999). *Cognitive Dissonance: Progress on a Pivotal Theory in Social Psychology*. Washington, DC: American Psychological Association.

Harris, L.T. and Fiske, S.T. (2006). Dehumanizing the lowest of the low: neuroimaging responses to extreme out-groups. *Psychological Science*, **17**(10), 847–853.

Hobel, B.G. (1997). Neuroscience and appetitive behaviour research: 25 years. *Appetite*, **29**, 119–133.

Hodges, J.R., Patterson, K., Oxbury, S., and Funnell, E. (1992). Semantic dementia: progressive fluent aphasia with temporal lobe atrophy. *Brain*, **115**, 1783–1806.

Hofmann, W., Gschwendner, T., and Schmitt, M. (2009). The road to the unconscious self not taken: Discrepancies between self- and observer-inferences about implicit dispositions from nonverbal behavioural cues. *European Journal of Personality*, **23**, 343–366.

Hrubes, D., Feldman, R.S., and Tyler, J.M. (2004). Emotion-focused deception: The role of deception in the regulation of emotion. In P. Philippot and R.S. Feldman. (eds) *The Regulation of Emotion*, pp. 227–249. Mahwah, NJ: Lawrence Erlbaum Associates.

Hutchings, J. (1996). Evaluating a behaviourally based parent training group: Outcomes for parents, children and health visitors. *Behavioural and Cognitive Psychotherapy*, **24**, 149–170.

Hutchings, J., Lane, E., Owen, R.E., and Gwyn, R. (2004). The introduction of the Webster-Stratton incredible years classroom dinosaur school programme in Gwynedd, North Wales: a pilot study. *Educational and Child Psychology*, **21**, 4–15.

Hutchings, J., Bywater, T., Daley, D., Gardner, F., Whitaker, C., Jones, K., Eames, C., and Edwards R.T. (2007). Parenting intervention in sure start services for children at risk of developing conduct disorder: pragmatic randomised controlled trial. *British Medical Journal*, **334**(7595), 678–682.

Ikemoto, S. and Panksepp, J. (1999). The role of nucleus accumbens dopamine in motivated behaviour: A unifying interpretation with special reference to reward seeking. *Brain Research Reviews*, **31**, 6–41.

Johnson-Laird, P.N. and Oatley, K. (2000) Cognitive and social construction in emotions. In M. Lewis and J.M. Haviland-Jones. (eds) *Handbook of Emotions*, pp. 458–475. London: The Gilford Press.

Kahneman, D. (2003). A perspective on judgment and choice. *American Psychologist*, **58**, 697–720.

Kahneman, D. and Tversky, A. (1979). On the interpretation of intuitive probability: A reply to Jonathan Cohen. *Cognition*, **7**, 409–411.

Kandel, E.R. (1998). A new intellectual framework for psychiatry. *American Journal of Psychiatry*, **155**, 457–469.

Kant, I. (2004). *Critique of Pure Reason*. (J.M.W. Meiklejohn, Trans.). Dover Publications: England.

Kaplan-Solms, K. and Solms, M. (2000). *Clinical Studies in Neuropsychoanalysis: Introduction to a Depth Neuropsychology*. New York, NY: Karnac Books.

Kapur, N. and Couchlan, A.K. (1980). Confabulation after frontal lobe dysfunction. *Journal of Neurology, Neurosurgery and Psychiatry*, **43**, 461–463.

Kay, A.C., Jimenez, M.C., and Jost, J.T. (2002). Sour grapes, sweet lemons, and the anticipatory rationalization of the status quo. *Personality and Social Psychology Bulletin*, **28**, 1300–1312.

Keltner, D. and Ekman, P. (2000). Facial expression of emotion. In M. Lewis and J.M. Haviland-Jones. (eds) *Handbook of Emotions*, pp. 236–249. London: The Gilford Press.

Kim, S.H. and Hamann, S. (2007). Neural correlates of positive and negative emotion regulation. *Journal of Cognitive Neuroscience*, **19**(5), 776–798.

Kimberg, D.Y., D'Esposito, M., and Farah, M.J. (1997). Frontal lobes: cognitive neuropsychological aspects. In T.E. Feinberg and M.J. Farah. (eds) *Behavioral Neurology and Neuropsychology*, pp. 409–418. New York, NY: McGraw Hill.

Koole, S.L. (2009). The psychology of emotion regulation: An integrative review. *Cognition and Emotion*, **23**, 4–41.

Kunda, Z., Davies, P.G., Adams, B.D., and Spencer, S.J. (2002). The dynamic time course of stereotype activation: activation, dissipation, and resurrection. *Journal of Personality and Social Psychology*, **82**, 283–299.

Lane, R.D. and Nadel, L. (2000). *Cognitive Neuroscience of Emotion*. Oxford: Oxford University Press.

Lazarus, R.S. (1991). *Emotion and Adaption*. New York, NY: Oxford University Press.

Lemma, A. (2003). *Introduction to the Practice of Psychoanalytic Psychotherapy: A Practical Treatment Handbook*. West Sussex: Wiley-Blackwell.

Leventhal, H. and Scherer, K. (1987). The relationship of emotion to cognition: A functional approach to a semantic controversy. *Cognition and Emotion*, **1**, 3–28.

Macmillan, M. (2000). Restoring Phineas Gage: a 150th retrospective. *Journal of the History of the Neurosciences*, **9**, 46–66.

Macmillan, M. (2004). Inhibition and Phineas gage: repression and Sigmund Freud. *Neuropsychoanalysis*, **6**, 181–192.

Macrae, C.N. and Bodenhausen, G.V. (2000). Social cognition: thinking categorically about others. *Annual Review of Psychology*, **51**, 93–120.

Maner, J.K., Kenrick, D.T., Becker, D.V., Robertson, T.E., Hofer, B., Neuberg, S.L., Delton, A.W., Butner, J., and Schaller, M. (2005). Functional projection: how fundamental social motives can bias interpersonal perception. *Journal of Personality and Social Psychology*, **88**, 63–78.

Mangelsdorf, S.C., Shapiro, J.R., and Marzolf, D. (2008). Developmental and temperamental differences in emotion regulation in infancy. *Child Development*, **66**(6), 1817–1828.

Marcel, A.J., Tegner, R., and Nimmo-Smith, I. (2004). Anosognosia for plegia: specificity, extension, partiality and disunity of bodily unawareness. *Cortex*, **40**, 19–40.

McCarthy, R.A. and Warrington, E.K. (1990). *Cognitive Neuropsychology: A Clinical Approach*. San Diego, CA: Academic Press.

McManus, C. (2002). *Right Hand, Left Hand: The Origins of Asymmetry in Brains, Bodies, Atoms, and Cultures*. London: Weidenfeld and Nicolson.

Mele, A.R. (1997). Real self-deception. *Behavioral and Brain Sciences*, **20**, 91–136.

Mitchell, J.P., Ames, D.L., Jenkins, A.C., and Banaji, M.R. (2008). Neural correlates of stereotype application. *Journal of Cognitive Neuroscience*, **21**, 594–604.

Moore, H., West, A.R., and Grace, A.A. (1999). The regulation if forebrain dopamine transmission: Relevance to the pathophysiology and psychopathology of schizophrenia. *Biological Psychiatry*, **46**, 40–55.

Nardone, I.B, Ward, R., Fotopoulou, A., and Turnbull, O.H. (2007). Attention and emotion in anosognosia: Evidence of implicit awareness and repression? *Neurocase*, **13**, 438–445.

O'Doherty, J.O., Kringelbach, M.L., Rolls, E.T., Hornack, J., and Andrews, C. (2001). Abstract reward and punishment representations in the human orbitofrontal cortex. *Nature Neuroscience*, **4**, 95–102.

Operario, D. and Fiske, S.T. (2001). Stereotypes: content, structures, processes, and context. In R. Brown and S.L. Gaertner. (eds) *Blackwell Handbook of Social Psychology: Interpersonal Processes*. Malden, MA: Blackwell.

Panksepp, J. (1985). Mood changes, pp. 271–285. In P. Vinken, G. Bruyn, and H. Klawans. (eds) *Handbook of Clinical Neurology*, volume **45**. Amsterdam: Elsevier.

Panksepp, J. (1998). *Affective Neuroscience: The Foundations of Human and Animal Emotions*. Oxford: Oxford University Press.

Panksepp, J. (1999). Emotions as viewed by psychoanalysis and neuroscience: an exercise in consilience. *Neuropsychoanalysis*, **1**, 15–38.

Panksepp, J. (2000). Emotions as natural kinds within the mammalian brain. In M. Lewis and J.M. Haviland-Jones. (eds) *Handbook of Emotions*, pp. 137–156. London: The Gilford Press.

Panksepp, J. (2002). ADHD and the neural consequences of play and joy: a framing essay for the following empirical paper. *Consciousness and Emotion*, **3**, 1–6.

Panksepp, J. (2007). Can play diminish ADHD and facilitate the construction of the social brain? *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, **16**, 57–66.

Panksepp, J. and Burgdorf, J. (2000). 50kHz chirping (laughter) in response to conditioned and unconditioned tickle-induced reward in rats: effects of social housing and genetic variables. *Behavioural Brain Research*, **115**, 25–38.

Papagno, C. and Baddeley, A.D. (1997). Confabulation and dysexecutive patient: implications for models of retrieval. *Cortex*, **33**, 743–752.

Parkin, A.J. (1996). *Explorations in Cognitive Neuropsychology*. Oxford: Blackwell.

Pessiglione, M., Schmidt, L., Draganski, B., Kalish, R., Lau, H., Dolan, R.J., and Frith, C.D. (2007). How the brain translates money into force: a neuroimaging study of subliminal motivation. *Science*, **316**, 904–906.

Pessiglione, M., Petrovic, P., Daunizeau, J., Palminteri, S., Dolan, R.J., and Frith, C.D. (2008). Subliminal instrumental conditioning demonstrated in the human brain. *Neuron*, **59**, 561–567.

Plato.(1956). *Plato's Phaedrus* (translated). Indianapolis, IN: Bobbs-Merrill.

Pyszczynski, T., Greenberg, J., Solomon, S., Sideris, J., and Stubing, M.J. (1993). Emotional expression and the reduction of motivated cognitive bias: evidence from cognitive dissonance and distancing from victims' paradigms. *Journal of Personality and Social Psychology*, **64**, 177–186.

Quadflieg, S., Turk, D.J., Waiter, G.D., Mitchell, J.P., Jenkins, A.C., and Macrae, C.N. (2008). Exploring the neural correlates of social stereotyping. *Journal of Cognitive Neuroscience*, **21**, 1560–1570.

Ramachandran, V.S. and Blakslee, S. (1998). *Phantoms in the Brain: Human Nature and the Architecture of the Mind*. London: Fourth Estate.

Robbins, T.W. and Everitt, B.J. (1992). Functions of dopamine in the dorsal and ventral striatum. *Seminars in the Neurosciences*, **4**, 119–128.

Robinson, M.D., Moeller, S.K., and Goetz, P.W. (2009). Are self-deceivers enhancing positive affect or denying negative affect? Toward an understanding of implicit affective processes. *Cognition and Emotion*, **23**, 152–180.

Rodrigues Gouveia, P.A., Dozzi Brucki, S.M., Fleury Malheiros, S.M., and Amodeo Bueno, O.F. (2007). Disorders in planning and strategy application in frontal lobe lesion patients. *Brain and Cognition*, **63**, 240–246.

Rolls, E.T. (1999). *The Brain and Emotion*. Oxford: Oxford University Press.

Rolls, E.T. (2002). The functions of the orbitofrontal cortex. In D.T. Stuss and R.T. Knight. (eds) *Principles of Frontal Lobe Function*, pp. 354–375. Oxford: Oxford University Press.

Roth, A. and Fonagy, P. (2005). *What Works for Whom: A Critical Review of Psychotherapy Research*. New York, NY: Guilford Press.

Sackheim, H.A., Gur, R.C., and Saucy, M. (1978). Emotions are expressed more intensely on the left side of the face. *Science*, **202**, 434–436.

Schacter, D.L. and Scarry, E. (2000). *Memory, Brain, and Belief*. Cambridge, MA: Harvard University Press.

Schiff, B.B. and MacDonald, B. (1990). Facial asymmetries in the spontaneous response to positive and negative emotional arousal. *Neuropsychologia*, **28**, 777–785.

Schnider, A. (2001). Spontaneous confabulation, reality monitoring and the limbic system—a review. *Brain Research Reviews*, **36**(2–3), 150–160.

Schnider, A. (2003). Spontaneous confabulation and the adaptation of thought to ongoing reality. *Nature Reviews. Neuroscience*, **4**, 662–671.

Schultz, W. (1998). Predictive reward signal of dopamine neurons. *Journal of Neurophysiology*, **80(1)**, 1–27.

Schultz, W. (2001). Multiple reward signals in the brain. *Nature Neuroscience*, **1**, 199–207.

Scoville, W.B. and Milner, B. (1957). Loss of recent memory after bilateral hippocampal lesions. *Journal of Neurology, Neurosurgery and Psychiatry*, **20**, 11–21.

Shallice, T. (1988). *From Neuropsychology to Mental Structure*. Cambridge: Cambridge University Press.

Shallice, T. (2002). Fractionation of the supervisory system. In D.T. Stuss and R.T. Knight. (eds) *Principles of Frontal Lobe Function*, pp. 261–277. Oxford: Oxford University Press.

Shermer, M. (2007). *Why People Believe Weird Things: Pseudoscience, Superstition, and Other Confusions of Our Time*. London: Souvenir Press.

Sherwood, G.G. (1981). Self-serving biases in person perception: A reexamination of projection as a mechanism of defense. *Psychological Bulletin*, **90**, 445–459.

Shiota, M.N., Campos, B., Keltner, D., and Hertenstein, M.J. (2004). Positive emotion and the regulation of interpersonal relationships. In P. Philippot and R.S. Feldman (eds) *The Regulation of Emotion*, pp. 127–155. Mahwah, NJ: Lawerence Erlbaum Associates.

Silbersweig D.A. and Stern E. (1996). Functional neuroimaging of hallucinations in schizophrenia: toward an integration of bottom-up and top-down approaches. *Molecular Psychiatry*, **1**, 367–375.

Silbersweig, D.A., Stern E., Frith, C., Cahill, C., Holmes, A., Grootoonk, S., Seaward, J., McKenna, P., Chua, S.E., Schnorr, L., et al. (1995). A functional neuroanatomy of hallucinations in schizophrenia. *Nature*, **378**, 176–179.

Sinclair, L. and Kunda, Z. (1999). Reactions to a black professional: motivated inhibition and activation of conflicting stereotypes. *Journal of Personality and Social Psychology*, **77**, 885–904.

Skinner, B.F. (1953). *Science and Human Behavior*. New York, NY: Macmillan.

Snowden, J.S., Goulding, P.J., and Neary, D. (1989). Semantic dementia: a form of circumscribed cerebral atrophy. *Behavioral Neurology*, **2**, 167–182.

Snyder, S.H. (1976). The dopamine hypothesis of schizophrenia: focus on the dopamine receptor. *American Journal of Psychiatry*, **133**, 197–202.

Solms, M. (1997). *The Neuropsychology of Dreams*. Mahwah, NJ: Lawrence Erlbaum.

Solms, M. (2000). Dreaming and REM sleep are controlled by different brain mechanisms. *Behavioral and Brain Sciences*, **23**, 843–850.

Solms, M. (2002). Dreaming: cholinergic and dopaminergic hypotheses. In E. Perry, H. Ashton, and A. Young. (eds) Neurochemistry of consciousness: neurotransmitters in mind. *Advances in Consciousness Research*, **36**, 123–131.

Solms, M. and Nersessian, E. (1999). Freud's theory of affect: questions for neuroscience. *Neuropsychoanalysis*, **1**, 5–14.

Solms, M. and Turnbull. O.H. (2002). *The Brain and the Inner World: An Introduction to the Neuroscience of Subjective Experience*. New York, NY: Other Press.

Springer, S.P. and Deutch, G. (1998). *Left Brain, Right Brain: Perspectives from Cognitive Neuroscience*. New York, NY: W.H. Freedman and Co.

Stearns, P.N. (2000). History of emotions: issues of change and impact. In M. Lewis and J.M. Haviland-Jones. (eds) *Handbook of Emotions*, pp. 16–29. London: The Gilford Press.

Stuss, D.T., Alexander, M.P., Lieberman, A., and Levine, H. (1978). An extraordinary form of confabulation. *Neurology*, **28**, 1166–1172.

Swami, V. and Furnham, A. (2007). Unattractive, promiscuous and heavy drinkers: Perceptions of women with tattoos. *Body Image*, **4**, 343–352.

Takeda, M.B., Helms, M.M., and Romanova, N. (2006). Hair color stereotyping and CEO selection in the United Kingdom. *Journal of Human Behavior in the Social Environment*, **13**(3), 85–99.

Tavris, C. and Aronson, E. (2007). *Mistakes Were Made (but Not by Me): Why We Justify Foolish Beliefs, Bad Decisions, and Hurtful Acts*. Orlando, FL: Harcourt.

Tondowski, M., Kovacs, Z., Morin, C., and Turnbull O.H. (2007). Hemispheric asymmetry, and the diversity of emotional experience in anosognosia. *Neuropsychoanalysis*, **9**, 67–81.

Tranel, D. and Damasio, A.R. (1993). The covert learning of affective valence does not require structures in hippocampal system or amygdala. *Journal of Cognitive Neuroscience*, **5**(1), 79–88.

Trivers, R. (2000). The elements of a scientific theory of self-deception. *Annals of the New York Academy of Sciences*, **907**, 114–131.

Turnbull, O.H. and Evans, C.E.Y. (2006). Preserved complex emotion-based learning in amnesia. *Neuropsychologia*, **44**, 300–306.

Turnbull, O.H. and Solms, M. (2007). Awareness, desire, and false beliefs: Freud in the light of modern neuropsychology. *Cortex*, **43**, 1083–1090.

Turnbull, O.H., Jones, K., and Reed-Screen, J. (2002). Implicit awareness of deficit in anosognosia: An emotion-based account of denial of deficit. *Neuropsychoanalysis*, **4**, 69–86.

Turnbull, O.H., Berry, H., and Evans C.E.Y. (2004a). A positive emotional bias in confabulatory false beliefs about place. *Brain and Cognition*, **55**, 490–494.

Turnbull, O.H., Jenkins, S., and Rowley, M.L. (2004b). The pleasantness of false beliefs: an emotion-based account of confabulation. *Neuropsychoanalysis*, **6**, 5–16.

Turnbull, O.H., Owen, V., and Evans, C.E.Y. (2005a). Negative emotions in anosognosia. *Cortex*, **41**, 67–75.

Turnbull, O.H., Evans, C.E.Y., Bunce, A., Carzolio, B., and O'Conner, J. (2005b). Emotion-based learning and central executive resources: an investigation of intuition and the Iowa gambling task. *Brain and Cognition*, **57**, 244–247.

Turnbull, O.H., Zois, E., Kaplan-Solms, K., and Solms, M. (2006). The developing transference in amnesia: Changes in inter-personal relationship despite profound episodic memory loss. *Neuropsychoanalysis*, **8**, 199–204.

Turnbull, O.H., Worsey, R., and Bowman, C.H. (2007). Emotion and intuition: does schadenfreude make interns poor learners? *Philoctetes*, **1**, 5–43.

Tversky, A. and Kahneman, D. (1974). Judgment under uncertainty: heuristics and biases. *Science*, **185**, 1124–1131.

van den Bos, A. and Stapel, D.A. (2009). Why people stereotype affects how they stereotype: the differential influence of comprehension goals and self-enhancement goals on stereotyping. *Personality and Social Psychology Bulletin*, **35**, 101–113.

Villiers, C.D., Zent, R., Eastman, R.W., and Swingler, D. (1996). A flight of fantasy: false memories in frontal lobe disease. *Journal of Neurology, Neurosurgery and Psychiatry*, **61**, 652–653.

Warrington, E.K. (1975). The selective impairment of semantic memory. *Quarterly Journal of Experimental Psychology*, **27**, 635–657.

Watt, D. (2000). The centrencephalon and thalamocortical integration; neglected contributions of periaqueductal gray. *Consciousness and Emotion*, **1**, 91–114.

Weir, S. and Fine-Davis, M. (1989). 'Dumb blonde' and 'temperamental redhead': rhe effect of hair colour on some attributed personality characteristics of women. *Irish Journal of Psychology*, **10**, 11–19.

Westen, D. (2007). *The Political Brain: The Role of Emotion in Deciding the Fate of the Nation*. New York, NY: Public Affairs.

Zajonc, R.B. (1980). Feeling and thinking: preferences need no inferences. *American Psychologist*, **35**, 151–175.

Zajonc, R.B. (1984). On the primacy of affect. *American Psychologist*, **39**, 117–112.