Models of change in the psychotherapy of borderline personality disorders

Roberto Viviani,* Horst Kächele[§]
*Department of Psychiatry III,
[§] Department of Psychosomatic Medicine and Psychotherapy,
University of Ulm

Abstract

Patients suffering from borderline personality disorders are often difficult to treat, and require specific psychotherapeutic techniques. In current neurobiological models of borderline personality disorder, temperamental factors such as increased emotional reactivity and diminished attentional control figure prominently, and account for the psychopathology of this disorder. Here, we follow a different approach and ask the question of how a model of this disorder may account for the modifications of psychotherapy technique that have proven effective in this class of patients. The psychotherapy of this disorder emphasizes work on enriching the semantic repertoire of patient in interpreting their own emotion and other people's motivation for their action. Based on current psychometric research on distinct factors contributing to individual effectiveness in attentional control (working memory capacity), we propose that the organization and use of semantic processes may constitute an important and neglected aspect of a neurobiological model of this disorder. Furthermore, we propose that impulsivity and emotional dysregulation resemble the long-term effects of habitual strategies of problem solving, which cognitive studies have characterized in terms of the interplay of attentional control capacity, cognitive and emotional load, and semantic organization. After mapping these notions onto specific psychotherapeutic interventions, we propose a model through which specific technical strategies result, in the long term, in structural change.

Technical Report 0907, February-July 2009

Models of change in the psychotherapy of borderline personality disorders

Introduction

Even if patients suffering from borderline personality disorder (BPD) are often aware of their problem and may be motivated to seek help, the treatment of this disorder is consensually considered by clinicians to be difficult. Recently, several approaches to the treatment of BPD have been developed, whose efficacy has been empirically validated (Linehan 1993, 2000; Bateman and Fonagy 1999; Giesen-Bloo et al. 2006; Clarkin et al. 2007). Although starting from different theoretical premises, all these treatment programmes share a pragmatic approach towards what works and does not work in these patients, modifying and specifically adapting existing techniques to the needs of the BPD patient.

Our purpose here is to look at the specific aspects of the psychotherapy of BPD to understand and formulate the nature of both this disorder and the therapeutic process using current models of the mind taken from psychometric approaches and cognitive neuroscience. Relative to existing neurobiological models of BPD, we focus here more on the implications of psychotherapeutic technique than on the psychopathological picture. Is there a model of PBD that accounts not only for its symptoms, but also for the specific modifications of technique that have been found useful in this disorder? One motivation for asking this question is that a model of BPD may be more plausible and accurate if accounting for what has proven to be effective in its treatment. Another is that a model explicitly encompassing psychotherapeutic interventions may provide a framework in which empirical research may investigate changes promoted by therapy more directly, and ideally clarify the essential aspect of BPD-specific psychotherapies.

After briefly reviewing some well-known approaches to the therapy of BPD, we will introduce the notions used in neurobiological models of BPD, and discuss how psychotherapy interventions may map onto these models. Our contention will be that current models, based on notions of attentional control and automatic reactivity, do not fully account for those aspects of treatment that focus on how semantic memory is organized and used in these patients. We will discuss how the role of semantic repertoires may be integrated in a revised model of this disorder, impacting on the patient's capacity to implement control strategies in the interpersonal interaction, and accounting for the modifications of techniques that have been proposed for the treatment of BPD.

Dialectical behaviour therapy

Dialectical behaviour therapy (DBT, Linehan 1993) arose as a modification of existing cognitive-behavioural approaches, which were found to be difficult to apply to this group of patients. In DBT, emotional dysregulation and the tendency of borderline individuals to oscillate between extremes of affect and between idealization and devaluation of others is formulated as a failure of a dialectical process. Dialectics is the reconciliation of opposites in a continual process of synthesis. The same phenomenon may be often observed in the therapeutic team handling difficult patients. Therefore, the overarching aim of therapy is to teach patients to move from polarized to dialectical modes of thinking and feeling.

Also the therapeutic strategy of DBT finds a formulation in terms of a dialectical process synthesizing the opposites of acceptance and change of the current state. On the side of acceptance is a whole set of interventions collectively referred to as 'validation'. On the side of change are skill training and cognitive restructuring interventions specifically targeting the tendency of splitting and all-or-nothing thinking of patients.

In validation, the therapist seeks the kernel of truth in the emotional, behavioural and ideational reactions of the patients in situations of crisis in or outside therapy, and formulates it in the intervention. Communication to the patient of the validity of her reaction is the end stage of a preparatory phase, named 'reflection', in which the patient is helped identify, describe, and label her own responses. With the progression of therapy, the patient should acquire the capacity to be 'self-validating'. To this end, validation should be understood as a collaborative process in which the patient is encouraged to play a progressively active role, instead of relying only on the therapist. For this reason, validation entails teaching emotion observation and labelling skills, as well as the capacity to read emotion in oneself and others. DBT emphasises the capacity of validation to foster a good empathic relationship between therapist and patient, and simultaneously fostering the coalescence of a nuclear self of emotions and motivations whose legitimacy is interpersonally acknowledged. To this end, it is especially important that the therapist be able to believe in the patient's strengths.

The skills practiced in therapy include a set meditation techniques that should directly promote a dialectical style of functioning, instead of impulsive reaction and emotional dysregulation, called 'mindfulness'. Mindfulness entails recruitment of attentional control in everyday's functioning, with active observation and description on one's own behavioural responses. In Linehan's account, this is the same kind of attentional control one exerts while learning a new activity, like playing the piano. With increasing practice, demands on attention decrease as good performance is possible based on automatic motor schemes. In 'participation without self-consciousness', however, there remains an element of controlled flexibility, even if behaviour is mostly based on assimilated automatisms; hence, while mostly automatic, experience and reactions are 'mindful'.

DBT differs from standard cognitive-behavioural therapies in several respects, but most notably in the attention to the quality of the relationship between patient one the one hand and therapist and team on the other (i.e., the transferential aspects of therapy) and the emphasis on validation. In Linehan's own account of DBT, the importance of validation is revealed by the notion that without it a standard cognitive-behavioural intervention is invalidating in this class of patients, and therefore potentially damaging (Linehan 1993, pp. 221-226). The same view is applied to interventions sponsoring control or urging the patient to exert self-control outside a validating context. However, in Linehan's dialectical approach also therapies emphasizing unlimited empathy and acceptance may lead to therapeutic failure, because their validating element is not balanced by a tension towards change.

Psychodynamic therapies of BPD

In the psychodynamic system, two important therapeutic models have been proposed for BPD: transference-focused psychotherapy by Clarkin et al. (1999), and mentalization-based therapy by Bateman and Fonagy (2004). These psychotherapies, like others that have emerged in the psychoanalytic tradition and that we do not treat in detail here (Gabbard 2000, Gunderson 2001, Meares 1993, Rudolf 2008), are characterized by modifications of technique aimed at avoiding the problems experienced in patients suffering from severe personality disorders like the borderline. Explicitly proscribed are interpretations reconstructing the events of the psychotherapeutic interaction in terms of childhood experiences of the patient (Rudolf 2008). Instead, emphasis is given to the 'here and now' of the interaction, with a special sensibility to the level of sophistication with which aspects of this interaction may be

presented to the patient in the intervention. Our aim here is not to be exhaustive, but to focus on some important point raised by these approaches.

Transference-focused psychotherapy

Transference-focused psychotherapy was formulated within the framework of Otto Kernberg's (1967, 1984) psychoanalytic theory of borderline personality. In this account, individuals suffering from BPD are characterized by a general weakness of ego-function. These individuals preferentially adopt primitive defenses based on splitting and projective identification to give coherence to contradictory and intense feelings of hate and love in relationships. The adoption of these primitive defenses may have a multifactorial origin, but an important role is played by a temperament in which high levels of aggression are present (Klein 1957). When predisposed to respond to frustration with aggression, an individual may also tend to disown or deny this aggression in the relationship with important others. This tendency favours the establishment of relationship styles in which the important other is rarely perceived realistically as someone who may be a constant partner notwithstanding his or her failures, giving rise to polarization between the extremes of idealization and devaluation. Systematic externalization of aggression also opens the way to antisocial tendencies and the justification of exploitation.

The strategic objective of transference-focused psychotherapy is fostering more integrated representations of the significant other, and to tolerate the other's and one's own failures without jeopardizing the relationship. In so far as the tendency for aggression determines the clinical picture, this objective also involves the capacity to be aware of and own up to one's emotions of hatred. These capacities evolve within the context of the relation with the therapist. To enable the evolution of these capacities, it is important to define a contractual framework for therapy to make it resistant to the patient's aggression, and allow it to become a safe place in which the dynamics of defensive maneuvers and underlying motivations are reconstructed. Transference-focused psychotherapy contains a detailed specification of the rules that define the therapeutic contract, and the consequences of their infraction.

The core interventions of transference-focused therapy are the interpretation of the patient's defenses and the clarification of internal experiences as they unfold in the relationship with the therapist. Clarification consists in inviting the patient to be explicit about his motivation for behaviour and experience. Transference-focused therapy maintains an important characteristic of psychoanalytic psychotherapy: focus on the instantiation of typical relational patterns in the transference relation, and its interpretation (Luborsky and Crits-Christoph 1998). One way of looking at the reasons for the mutative effect of these interventions is the reduction of the distortions of emotional reality in internal experience and in interactions. A crucial function of the therapist is the capacity to be reflective and think about the interaction, instead of being overwhelmed by the mindless emoting introduced by the patient. With this in mind, an important aspect of clarifying and interpreting is given by the implicit reflectiveness on the reality of the interaction communicated to the patient (Levy et al. 2006). This perspective is emphasized even more in mentalization-based psychotherapy, to which we now turn.

Mentalization-based psychotherapy

In their concept of psychotherapy for BPD, Bateman and Fonagy (2004) propose that the hallmark of this disorder is a deficit in a specific cognitive-emotional function termed 'mentalizing capacity'. Mentalization is the mental process by which one's own and other people's actions are understood as the consequence of intentional mental states such as personal desires, needs, feelings, beliefs. The aim of mentalization-based treatment is not only

that of temporarily supplementing the mentalizing deficit of the patient with the therapist own 'ego function', but that of helping the patient acquire permanent autonomous mentalizing capacities. In this sense, the therapy may be genuinely conducive to structural change and not simply supportive. This claim is substantiated by the empirical evidence for lasting beneficial effects of therapy (Bateman and Fonagy 2008).

Mentalization-based psychotherapy emphasises that interventions should be framed as a cooperative attempt to discover the reasons of the patient's experience and behaviour (Bateman and Fonagy 2006). Explicit warnings are issued against the therapist's attempts to directly provide the patient with a reconstruction for his impulsive actions. The focus, at least initially, is on helping the patient think about the affect that accompanied action, leaving open what this affect may have been. It may be easier for the patient to start with external events brought in therapy. With the progression of therapy, the patient should become able to explore his affect in relation to the therapist ('mentalizing the transference') without fearing to be overwhelmed or a breakdown of the relationship. Progressively, therapy explores parallels between the affects and emotional reactions elicited in therapy and those elicited by external relationships. After the patient has accepted as meaningful the exploration of subjective experience as a search of the associated affect, it is possible to offer and explore in therapy alternative explanations of accounts ('interpretive mentalizing'). Here, the focus is not on having the patient recognize his being defensive or understand the reasons for this defensiveness, but on increasing the patient's range of possible subjective experience. Advances in the capacity to formulate and understand reasons for actions are extended to improvements in social competence and capacity for empathy for others in group sessions.

Between mentalization-based psychotherapy and transference-focused therapy there are some differences to note. In emphasizing the defensive character of the patient's behaviour, transference-focused therapists may attribute agentive thinking to patients where the mentalization-based therapist sees externalizations of aspects of the self that cannot be subjectively experienced because the necessary appraisal is missing. Mentalization-based therapy aims to equip the patient with the means of this appraisal, and insight on defences is not emphasized. Transference-focused therapy is more explicit on the existence of aggressive impulses whose existence is disowned and distorted by the patient, while mentalization-based therapy relies on the effect of improvements in the patient's capacity for empathy to defuse triggers of aggression.

With respect of DBT, there are important points of contact notwithstanding the different theoretical frameworks. In particular, validation and mentalization interventions occupy structurally similar roles because of their importance as specific modifications of the respective techniques, without which therapy risks failing. Another similarity consists in the 'reflection' component of validation, in which the therapist's task is that of "helping the patient identify, describe, and label her own response patterns" by discussing them with the patient in a nonjudgmental way (Linehan 1993, p. 224). True to this role, they are both thought to address core aspects of this disorder, as we discuss in the next section.

Etiological models of BPD

Existing etiological models of BPD attempt to explain the psychopathology of this disorder as the interaction between a temperamental disposition and a facilitating environment. In so far as this interaction unfolds in the patient's early experience, these models describe a disturbed development. The first model we describe was formulated in cooperative work undertaken jointly by Michael Posner and Otto Kernberg (Posner et al. 2002), and is also discussed in Bateman and Fonagy (2004). This model posits the disturbed development of attentional and control capacities as the core deficit of borderline personality. A second model, described by Linehan (1993), emphasizes the role of reinforcement and operant conditioning. We will

argue, however, that a third model may be described, based on examining what psychotherapists claim to be doing with BPD patients, and on what implicitly emerges from technical prescriptions. In contrast with the previous models, this model focuses on the effect of the organization of semantic memory on learning and control capacities.

Disturbed development of attentional and control capacities

In the version espoused by mentalization theorists, this model is rooted in the forming role of the mother-child relationship as characterized by attachment theory (Fonagy et al. 1995). In this account, the mother empathically reflects the child's distress by acknowledging it at the preverbal interaction level, and her response constitutes a containment of this distress. In the interaction, the child internalizes the capacity for containment of the mother, which constitutes the initial nucleus of his capacity to experience and reflect on his own emotions without being overwhelmed by them. In contrast, the neglectful or overwhelmed mother fails to provide the child with this formative experience.

In this model of mentalizing, the core aspect of this function is one of emotional control, and the hallmark of its absence is not only mindless emoting but, more specifically, impulsivity and dysregulation of arousal. Its essential constituent is identified with attentional control. Empirical research has demonstrated the coincidental timing of development of attentional and behavioural control (Posner and Rothbart 2000). Furthermore, individual differences in executive function capacity are predictive of psychosocial and behavioural performance in adolescents (Ellis et al. 2004). In so far as self-reflection is based on the capacity for inward attention (Posner and Rothbart 1998), then its disruption also accounts for the observed lack of a stable self-representation in BPD patients.

Kernberg and Clarkin endorse a close version of this model of BPD, in which a predisposing condition of enhanced temperamental reactivity to emotional stimuli is combined with an attentional deficit (Posner et al. 2002, 2003). The emotional dysregulation of BPD results from the confluence of increased reactivity to emotional stimuli of bottom-up, automatic processes active during emotional appraisal, and the failure of top-down, controlled attentional processes in selecting the appropriate stimulus for elaboration and response and inhibiting inappropriate inputs.

There is considerable knowledge in cognitive neuroscience about the neurobiological basis of attentional control (Corbetta et al. 2008, Kane and Engle 2002, Jonides et al. 2005, Miller and Cohen 2001). Recruitment of executive attention in cognitive tasks is accompanied by recruitment of dorsal prefrontal areas, among others. In contrast, bottom-up, automatic processing of external stimuli is localized in posterior cortical areas and in the temporal lobes (Figure 1). Prefrontal areas are also involved in tasks where self-reflective capacity is elicited (Lane et al. 1998). Hence, Bateman and Fonagy (2004) conclude that mentalizing "depends substantially on optimal pre-frontal cortex functioning" (p. 80). Based also on data on the related condition of posttraumatic stress disorder, Posner et al. (2003) tentatively localize the defect of BPD in the medial part of the prefrontal cortex.

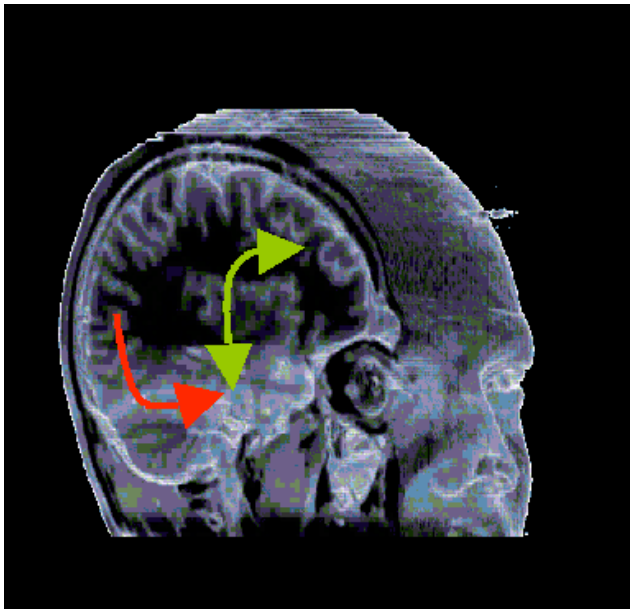

Figure 1. The red arrow schematically represents the bottom-up flow of external information from occipital and posterior temporoparietal areas towards the semantic areas in the temporal lobe located more anteriorly. The green arrow represents the interaction with a controlling instance localized in the prefrontal cortex.

Reinforcement of emotional dysregulation and the invalidating environment

Like the attentional model, the behavioural model of BPD (Linehan 1993) assumes the existence of a temperamental basis of emotional vulnerability combined with inability to regulate emotions of biological origin. Instead of emphasizing the role of the early mother-infant interaction, however, the behavioural model describes the progression of a vicious reinforcing circle taking place in the interaction between the child and the family at later stages of life. At the origin of this vicious circle is the invalidating environment, in which the expression of private experiences by the child is often punished or trivialized. The child's own interpretation of her own behaviour and motivations is dismissed. Furthermore, this environment may also attribute the child's behaviour to socially unacceptable traits, as when confronted with displays of negative affect, instead of acknowledging its possible basis on a realistic limitation of the capacity of the child to cope.

Within an invalidating environment, extreme emotional displays from the child may be required to evoke a helpful response. Alternatively, progressive frustration and punishment from the caregiver may lead to increasing negative affective displays in the child. These extreme emotions often succeed in terminating punishment by creating such aversive conditions for the caregivers that they stop any attempt to control the child. As a result, extreme emotional behaviour is unwittingly reinforced, while emotionally modulated behaviour is extinguished by ignoring its communicational value. It becomes clear why validating interventions address central issues in the functioning of borderline individuals.

A proposal for a semantic model of BPD

As when comparing them at the level of technical prescriptions, it is possible to notice similarities between the psychodynamic and DBT models of BPD, notwithstanding the existence of important differences. In particular, both system agree on the interpersonal origin of a nuclear sense of one's own feelings, and attribute the failure of its emergence in the features of the interpersonal experience with a significant other, be it the mother or the invalidating environment. Hence, validation and mentalization interventions are justified not

only on the ground of their practical effectiveness, but also on the basis of this etiological theory. However, we contend that when the rationale for validation and mentalization interventions is scrutinized, a more complex picture of the core deficit of BPD emerges that cannot be limited to the combined effect of attentional deficit and increased reactivity. This motivates us to propose the integration of existing models with the effects of a deficitary semantic process.[1]

To a considerable extent, the importance of a semantic component can already be found in the existing literature. In the mentalization-based theory of BPD, "in order to be able to think about mental states, say fear, we have to develop concepts that correspond to and integrate the actual internal experiences that constitute that state. The concept of fear is a 'second order representation of fear' that relates physiological, cognitive, and behavioural experiences, just as the concept 'table' labels and thus integrates our actual experiences of tables" (Bateman and Fonagy 2004, p. 63). In this passage, mentalization is unequivocally characterized as a semantic process and good mentalizing capacities as the possession of a network of sufficiently articulated semantic nodes.

Also this implicitly semantic account of mentalization deficits includes the causal role of a constitutive mother-child interaction. According to Bateman and Fonagy, the child develops a signifier for his own internal experience through the experience of the mother's empathic reaction to it. These signifiers, which interestingly may also be preverbal, originate as 'second order representations' of the repeated experience of the mother's reaction, and become the organizers of a self-state.

The account of BPD given by the dialectical-behavioural approach also includes semantic aspects. The invalidating environment "does not teach the child to label private experiences, including emotions, in a manner normative in her larger social community." Furthermore, the child is not helped to understand when "to trust her own emotional and cognitive responses as reflections of valid interpretations of individual and situational events" (Linehan 1993, p. 51).

Concerning BPD's clinical picture, if patients have difficulties in categorizing the other's mental state, then they may have an inadequate appraisal of social interactions. Lacking refinement, the resulting emotions quickly become just bad or good. This gross appraisal may even lead to difficulties in differentiating between one's own and the other's emotions. The extreme oscillation of one's internal and interactional experience sponsors the adoption of defensive strategies based on externalization in order to maintain the coherence of the self, i.e. a coherent account of one's own motivations and experience. Thus, also Kernberg and colleagues (Clarkin et al. 2006) note that lack of differentiation of internal representations of self and others may be the primary factor leading to emotional instability.

In the semantic account we are articulating, the problem may primarily be not an insufficient controlling instance, as rather the lack of representations on which controlling processes may act on. The mentalization deficit may not be the lack of a cognitive function specialized in computing the mental state of others, as is the case in current accounts of 'theory of mind' deficits (Baron-Cohen 1995), as rather the lack of contents with which a theory of the other mind may be filled. The BPD patient does indeed appear to have a theory of mind of the other, but this theory tends to be filled with simplistic and extreme (idealizing or persecutory) images of what the other is doing.

[1] We use the word 'semantic' here to refer to the aggregate traces of individual past experience, in opposition to process such as attention, which in principle are not defined in terms of individual experiences or content. It is not our intention to refer to specific forms of memory at exclusion of others: our notion of 'semantic' includes what is known in cognitive science as 'semantic memory', but is less restrictive, and also considers the constitutive role of semantic repertoires in shaping current experience, especially of interpersonal interactions ('semantic process').

From the perspective of attachment theory as a causal account, there may be little need to differentiate semantic from attentional models of the self-organizing process developing in the mother-child relationship. The same may perhaps be said of the related evidence supporting the existence of an association between mother-child attachment and developmental disturbances. However, for the purpose of the definition of the mentalizing deficit in the adult patient, these two models create an interesting contrast. There is hardly any doubt that semantic elaboration, both for purely cognitive material (Deutsch and Deutsch 1963) and in emotional appraisal (Lazarus 1991), is an automatic process that can take its course without recruitment of executive attentional components. In contrast, executive attention, i.e. the form of attention that is involved in explicit control and inhibition, is an entirely different process characterized by effortfulness and limited capacity (Posner and Petersen 1990, Baddeley 2007). Furthermore, from a neurobiological standpoint, semantic representations are localized in temporal and parietal areas, rather than in the prefrontal cortex (Figure 1). If one looks at how mentalization-based therapists describe their practice, then it is the semantic deficit model that is the most fitting. In contrast, the attention-based model of impulsivity logically leads to interventional strategies aiming at training the central executive directly (Posner and Rothbart 2005, Rueda et al. 2005).

A further argument for the importance of a semantic account of BPD is the possibility of differentiating models for conditions that are widely held to be heterogeneous from a clinical perspective. If one identifies the pathology of BPD in a dysfunction of attentional processes located in prefrontal regions, and further views the lack of coherence of self-representations as dependent on related executive processes similarly localized, then it appears that the psychopathology of primarily attentional deficits (which certainly exist), of difficulties in computing a theory of mind as in child autism, and of the emotional dysregulation of BPD, should conflate.

One question facing the semantic account is why the psychopathology of BPD is characterized by impulsivity, which appears to directly involve lack of control and/or enhanced reactivity. This is one reason not to loose sight of the possible role of prefrontal circuits/control processes. Firstly, clinical conditions encountered in practice may be characterized by some degree of heterogeneity. The notion that an attentional deficit may lead to difficulties in emotion regulation is a plausible one. Secondly, and more importantly, both attentional and semantic deficits may interact and enhance each other in producing a comprehensive deficit of emotional regulation and coherence of self-representations. One may wonder on the long-term consequences of insufficient attentional processes on the structure of semantic storage, and conversely on the effects of lack of differentiation of this latter on attentional performance. To clarify this aspect of the theory, we will address in the next section the issue of the interaction between semantic and control processes and, to capture the developmental context, the role of this interaction in learning.

A process account of BPD

Dual-process accounts of the mind

The attentional account of BPD belongs to a more general class of accounts of normal and pathological functioning, based on the duality of controlled and automatic processes (Barrett et al. 2004). When referring to controlled processes, one invokes a specific notion of attention, also variously known as top-down, goal-directed, endogenous, or executive attention. Executive attention processes are required to monitor, maintain or suppress representations in accordance with the task at hand, especially in the face of conflicting or potent environmental distractors. For example, when listening to a patient, a therapist must remain focused on the patient's account and maintain a model of the interaction, without

letting the noises of the recently opened nearby construction work capture her attention. Her success in doing so depends one the one hand on the loudness of the noises, and on the other hand on her own capacity to inhibit irrelevant inputs. Similarly, the attentional account of BPD posits the existence of a temperamentally enhanced reactivity to emotional stimuli, compounded by a deficit in the capacity to inhibit them. The emotional impulsivity of the BPD patient is modelled as a proneness to be driven by external stimuli, and a general difficulty in inhibiting automatic reactions when elaborating response.

Several models of controlled processes have been proposed in the literature, but a widely accepted model, sufficient for the present purposes, links executive attention to the executive component of working memory (Baddeley 2007, Engle and Kane 2004, Engle 2002). One may think of working memory as consisting of the activation of memory units coding phonological, visuospatial, or semantic pieces of information, under the supervision of the executive component. The executive component is especially important in the presence of environmental distractors. Loss of goal maintenance and inability to implement control, however, can also be observed in the presence of distracting representations of internal origin or memory traces of stressful events (Klein and Boals 2001, Wegner 1994). Hence, dual process models are applicable not only when the distractor is purely cognitive and external, but also to more general situations where control is lost in the face of internal representations that may be emotionally coloured (Wenzlaff et al. 1988).

The second class of processes are those characterized as automatic. Among these, there are those that originate in the processing of perceptual stimuli. One refers to bottom-up, stimulus-driven, or exogenous processes. Some theorists, however, emphasize the extent to which the organization of memory nodes, i.e. the schematic content of semantic storage, is capable to determine not only the representation of the environment in the input channel, but also response in the absence of controlled processing (Bargh and Ferguson 2000). This body of empirical research is relevant here because it documents the existence of a mode of functioning in which complex aspects of response are determined without the intervention of attentional processes.

Role of controlled processes in learning

The application of top-down control to representations evoked by environmental stimuli should not be considered as a static process. When regulating the activation of memory units relevant for the task at hand, working memory activity may result in small, gradual, but also lasting influences on the organization of the semantic network and response schemas of long-term memory. The repeated application of top-down control gradually induces a change in the memory traces automatically activated by the stimulus, so that the new semantic representations of the novel stimulus are brought to be consistent with the desired response, even when previously there was conflict (Cohen et al. 1992). Automatic responses, therefore, may be the sediment of previous episodes of learning to respond to an initially novel stimulus (Logan 1988).

Neuroimaging investigations have provided evidence on the neurobiological substrate of the interaction between controlled and semantic processes. Studies have shown that the activation of specific prefrontal areas in cognitive tasks varies in association with demands for controlled retrieval of appropriate semantic content from memory (Badre et al. 2005, Fletcher et al. 2000) or for memory encoding processes required to keep online complex information (Rypma et al. 1999). One observes recruitment of prefrontal and dorsal areas when faced with a novel task, areas indicative of activation of executive attentional processes. With increasing practice, however, this recruitment progressively decreases, suggesting a transfer of computations from executive to overlearned, automatic processes (Raichle et al. 1994).

In the dual process framework, therefore, there are two ways in which the quality of semantic storage may influence not only automatic processing, but also affect the effectiveness of controlled processes through a mechanism of reciprocal interaction. The first is that, in so far as executive attention operates by activating units residing in semantic memory, the grade of sophistication of semantic representations may be important in determining the selectiveness of control. The second is that, the more often executive processes are invoked to select and inhibit memory units, the larger the influence of controlled processes on the organization in semantic storage and its degree of sophistication. This will be so to the extent that semantic memory is not simply a passive memory trace of experience, but reflects aspects of the sensory world to which the individual has attended to (Chun and Turk-Browne 2007).

In the psychometric literature, the importance of the interaction between semantic and controlled processes is supported by the notion that individual differences in executive attention capacities load on two main dimensions (Unsworth and Engle 2007). The first dimension is the individual capacity to inhibit a prepotent representation supported by a salient stimulus in the input channel, and to resolve its conflict with the desired goal. The capacity to disregard the noise in the street while listening to our patient is an instance where this capacity is particularly important. The failure of attentional resources in BPD posited by the attentional account refers to this kind of individual difference in executive attention capacities. The second dimension concerns the individual capacity to encode the features of representations in sufficiently fine semantic codes to be able to efficiently resolve situations in which interference between similar representations is apt to increase conflict. In this category may belong the capacity to distinguish between representations that were appropriate in the past, and are no longer appropriate in the present (Friedman and Miyake 2004). Stimulus sets with sufficient similarity to old learned responses may activate semantic storage that is no longer appropriate (proactive interference), and the capacity to institute a new response depends on the capacity to encode the differences between the old and the new. This encoding capacity depends on the intervention of executive processes not only simply to suppress irrelevant representations, but also to organize semantic storage effectively. Hence, this second dimension is also concerned with the operation of controlled processes in the internal environment created by the representational world of the experiencing subject.

Because of the interaction between controlled processes and memory traces, individual differences in working memory capacity create styles of response in which the tendency to resort to top-down control is varying (Barrett et al. 2004). When faced with tasks of increased complexity, individuals with lower working memory capacity may abandon strategies based on recruitment of executive functions. In the presence of additional load to controlled processes, or when emotional stress is high, the threshold to rely more on automatic responses is reached earlier (Unsworth et al. 2005). These different types of responses may be seen as different strategies which are chosen according to environmental demands and the tendency of the individual to employ top-down controlled cognition. However, while there may be an element of biological disposition in the individual endowment of working memory capacities, it is also conceivable that a habitual tendency to adopt automatic response strategies creates a reinforcing loop. The use of controlled processes may be ineffective and costly because semantic storage at a low organization level is hard to be configured by top-down control, and by not being configured semantic storage remains at low organization levels. Therefore, the existence of individual differences in propensities to select controlled or automatic response strategies may reflect a complex developmental history above and beyond original dispositional differences of biological origin.

A process model of the semantic deficit in BPD

While the empirical evidence on individual differences in working memory capacity and the role of encoding sophistication has been gathered in the cognitive domain, the mechanism outlined for strategies with low controlled processing may be relevant to understand the effects of low mentalization capacities. A tendency to avoid reflection on interactional, emotional, and motivational aspects of the relationship may contribute to keeping semantic storage at a primitive level of sophistication, because no learning processes guided by reflective, executive attentional components exerts its influence on the institution of new semantic nodes or the refinement of existing ones. Hence, in an individual whose tendency to adopt reflected, controlled strategies to respond to stimuli is low, episodes in which memory traces of interpersonal interaction are reorganized by reflective thinking are comparatively rare. If interactions are classified wholesale as good or bad, it may become more difficult to resist the implications of frustrating aspects of the relationship while allowing positive aspects to determine response. Hence, the low organization of semantic memory in turn discourages the adoption of more controlled strategies.

The overall tendency to respond impulsively in structural pathology (the 'ego weakness') may be more appropriately modelled as an effect of habitual and comprehensive strategies in the use of automatic and controlled processes, than an effect of temperamentally increased bottom-up reactivity compounded by top-down attentional deficits. There are several differences between the two accounts, all fundamentally related to the role of the notion of habitual response strategy in summarizing the long-term impact of controlled processes in the sophistication and structure of semantic storage. Increased reactivity and attentional deficits are generic shortcomings that affect bottom-up and top-down processes indiscriminately, i.e. in a wide range of situations. In contrast, the involvement of semantic processes in the model allows formulating the impact of developmental histories for specific pathologies and specific semantic domains. Importantly, the involvement of semantic processes in the account offers a framework in which psychotherapeutic work focusing on specific subjective experience, personal history, and defensive schemas may be accommodated. The problems of low differentiation in the semantics of emotional appraisal are compounded by its being in the service of disguising maneuvers about the responsibility for aggressive impulses, or by encoding the message of the lack of worth of the individual as a whole.

Neuroimaging studies on the neurobiological basis of BPD have shown increased activity in the amygdala (Beblo et al. 2006, Donegan et al. 2003, Herpertz et al. 2001), a structure of the limbic system that is activated by stimuli of emotional relevance (Morris et al. 1996). There are two pathways relaying input to the amygdala: a subcortical pathway bypassing cortical processing entirely (Morris et al. 1998, Morris et al. 1999) and probably processing very rough aspects of the visual scene (Vuilleumier et al. 2003). The second pathway goes through primary and secondary visual areas in the cortex (Adolphs and Spezio 2006, Davis and Whalen 2001, Dolan and Vuillemier 2003) and is sensitive to semantic processes such as contextual modulation (Kim et al. 2004). Hence, while increased amygdalar activation to emotional stimuli may reflect a component of dispositional reactivity, it may also be compounded by insufficient semantic elaboration of the stimulus, followed by reduced recruitment of prefrontal control areas.

From a neurobiological perspective, the semantic account leads to the prediction that not only limbic or prefrontal, but also temporal or parietal areas where semantic representations are stored are involved in the pathology of BPD. Some studies have provided evidence of reduced perfusion in memory areas when activating autobiographic memory in individuals with BPD, especially in connection with traumatic events (Schmahl et al. 2003). A study using a story production task (AAP) found the largest differences between BPD

participants and controls in the temporal region, and these differences were more pronounced in the semantic context alluding to being alone than within a dyadic relationship (Buchheim et al. 2008). In the semantic account of BPD, memory traces created during traumatic events constitute a form of learning antithetical to learning sponsored by controlled processes, and therefore contribute to a legacy of semantic representations that are not amenable to control. This would account for the reduced recruitment of medial prefrontal control areas in participants exposed to accounts of traumatic autobiographical evens (Bremner et al. 1999, Shin et al. 1999).

Discussion

In formulating a model of the psychological processes on which psychotherapeutic interventions act, one may distinguish interventions that belong to the system in which different approaches emerged, and interventions that were formulated specifically for the BPD patient. Of particular interest are those disorder-specific interventions that, in the account of their proposers, are important for the therapy to have good chances of success, since they may capture important aspects of BPD pathology and progression of therapy.

Interventions of the first group (not disorder-specific) appear to act on several processes at the same time. First, we may expect that techniques aimed at increasing the engagement of controlled processes in interactions promote the adoption of a more reflexive cognitive strategy. This may help breaking the vicious circle through which the capacity to analyse and appraise the interaction remains low. Examples of these techniques are aspects of exposure emphasizing effortful control in resisting the urge to act impulsively ('blocking action and expressive tendencies associated with problem emotions', Linehan 1993). Second, reducing reactivity may also promote change by helping the patient not to give up the controlled strategy. In this group belong interventions aimed at desensitising the patient to situations that are apt to elicit an impulsive response, such as exposure techniques (Linehan 1993), and psychopharmacological interventions. Another group of techniques aim at changing appraisal of one's own and the other's intentions and emotional reactions, be it through interpretation or cognitive restructuring. These techniques act on the schemas of semantic memories, i.e. attempt to change the content guiding automatic analysis of input and generation of response in interactions. However, the patient may often be unable to profit from these interventions: they may not be understood, or may be appraised as invalidating (Linehan 1993, Bateman and Fonagy 2008).

When one looks at interventions in the second group (disorder-specific), one finds a picture in which achievement of better control is reached through gradual refinement of the emotional semantic repertoire of the patient. A common element in the modifications of technique that many groups have proposed is the use of interventions focusing on the here-and-now interaction of the patient with significant others, including the therapist, that coach the patient in moving from an automatic to a more controlled response strategy through the progressive refinement of the semantic representations that encode one's inner experience and human interactions. The emphasis is less on hitting the right interpretation, than on stopping, thinking about feelings and interactions, and finding words for them. Importantly, the work facing the therapist is not just of substituting one unconscious representation with another, or with restructuring a maladaptive schema. The therapeutic programme rather involves a change of cognitive strategy, and the progressive reorganization of a vast area of semantic nodes representing human feelings and interactions. In this respect, the focus on the reorganization of higher-order semantic repertoires to classify feelings and interactions so as to achieve better control may reflect an essential aspect of the BPD-specific modifications of therapy. This has implications for the time required by these treatment programmes, which may not be expected to succeed in a few months of treatment alone.

Another implication of our model of change in BPD is that current studies investigating its neurobiological substrate may be fruitfully integrated with further studies attempting to capture the interaction between semantic repertoires and attentional processes. One possible relevant set of findings is that related to parts of the prefrontal lobe involved in shaping and controlling internal representations, as opposed to the more often investigated setting where control is exerted against an external distractor. This distinction corresponds to the existence of separate factors in the individual capacity to resist internal and external distractors, as reported by psychometric studies (Friedman and Miyake 2004). Studies in which the shaping and control of internal representations have been specifically targeted suggest the involvement of polar areas of the prefrontal cortex and the anterior insula (Christoff et al. 2001, 2003, Bunge et al. 2001, Konishi et al. 2005, Garavan et al. 2006). However, the findings that might be more directly relevant to mentalization are those concerned with the role of memory and semantic areas as intermediaries of attentional processes (Chun and Turk-Browne 2007). Of particular interest is also the finding that networks involved in social cognitions overlap with those involved in spatial orienting (Corbetta et al. 2008, Mitchell 2007), which is also sensitive to previously memorized representations (Summerfield et al. 2006).

We have proposed that the interaction between memory and controlled processes that these techniques embody has equivalents in the cognitive domain that may help formalizing the type of psychological processes involved. It may be of interest to formulate the effect of psychotherapeutic interventions directly in terms of these individual processes, instead of monitoring the global psychopathological picture.

References

Adolphs R, Spezio M (2006). Role of the amygdala in processing visual social stimuli. Prog Brain Res 156:363-378

Baddeley AD (2007). Working Memory, Thought, and Action. Oxford: Oxford Universtiy Press

Badre D, Poldrack RA, Paré-Blagoev EJ, Insler RZ, Wagner AD (2005). Dissociable controlled retrieval and generalized selection mechanisms in ventrolateral prefrontal cortex. Neuron 47:907-918

Bargh JA, Ferguson MJ (2000). Beyond behaviourism: On the automaticity of higher mental processes. Psychol Bull 126:925-945

Baron-Cohen S (1995). Mindblindedness: An Essay on Autism and Theory of Mind. Cambridge (Mass.): The MIT Press

Barrett LF, Tugade MM, Engle RW (2004). Individual differences in working memory capacity and dual-process theories of mind. Psychol Bull 130:553-573

Bateman AW, Fonagy P (1999). Effectiveness of partial hospitalization in the treatment of borderline personality disorder: A randomized controlled trial. Am J Psychiatry 156:1563-1569

Bateman AW, Fonagy P (2004). Psychotherapy for Borderline Personality Disorder: Mentalisation-Based Treatment. Oxford: Oxford University Press

Bateman AW, Fonagy P (2006). Mentalization-Based Treatment for Borderline Personality Disorder: A Practical Guide. Oxford: Oxford University Press

Bateman AW, Fonagy P (2008). 8-year follow-up of patients treated for borderline personality disorder: Mentalization-based treatment versus treatment as usual. Am J Psychiatry 165:631.638

Beblo T, Driessen M, Mertens M, Wingefeld K, Piefke M, Rulkotter N, Silva-Saavedra A, Mensenbach C, Reddemann L, Rau H, Markowitsch HJ, Wulff H, Lange W, Berea C,

Ollech I, Woermann FG (2006). Functional MRI correlates of the recall of unresolved life events in borderline personality disorder. Psych Med 36:845-856

Bremner JD, Narayan M, Staib LH, Southwick SM, McGlashan T, Charney DS (1999). Neural correlates of childood sexual abuse in women with and without posttraumatic stress disorder. Am J Psychiatry 156:1787-1795

Buchheim A, Erk S, George C, Kächele H, Kircher T, Martius P, Pokorny D, Ruchsow M, Spitzer M, Walter H (2008). Neural correlates of attachment trauma in borderline personality disorder: A functional magnetic resonance imaging study. Psych Res Neuroimaging 163:223-235

Bunge SA, Ochsner KN, Desmond JE, Glover GH, Gabrieli JDE (2001). Prefrontal regions involved in keeping information in and out of mind. Brain 124:1074-1086

Christoff K, Prabhakaran V, Dorfman J, Zhao Z, Kroger JK, Holyoak KJ, Gabrieli JDE (2001). Rotstrolateral prefrontal cortex involvement in relational integration during reasoning. NeuroImage 14:1136-1149

Christoff K, Ream JM, Geddes LPT, Gabrieli JDE (2003). Evaluating self-generated information: Anterior prefrontal contributions to human cognition. Behav Neurosci 117:1161-1168

Chun MM, Turk-Browne NB (2007). Interactions betwen attention and memory. Curr Opin Neurobiol 17:177-184

Clarkin JF, Kernberg OF, Yeomans FE (1999). Psychotherapy for Borderline Personality. NewYork: John Wiley & Sons

Clarkin JF, Levy KN, Lenzenweger MF, Kernberg OF (2007). Evaluating three treatments for borderline personality disorder: A multiwave study. Am J Psychiatry 164:922-928

Clarkin JF, Yeomans F, Kernberg OF (2006). Psychotherapy of Borderline Personality: Focusing on Object Relations. Washington (DC): American Psychiatric Press

Cohen JD, Servan-Schreiber D, McClelland JL (1992). A parallel distributed processing approach to automaticity. Am J Psychol 105:239-269

Corbetta M, Patel G, Shulman GL (2008). The reorienting system of the human brain: From environment to theory of mind. Neuron 58:306-324

Davis M, Whalen PJ (2001). The amygdala: Vigilance and emotion. Mol Psychiatry 6:13-34

Deutsch JA, Deutsch D (1963). Attention, some theoretical considerations. Psychol Rev 70:80-90

Dolan RJ, Vuillemier P (2003). Amygdala automaticity in emotional processing. Ann N Y Acad Sci 985:348-355

Donegan NH, Sanislow CA, Blumberg HP, Fulbright RK, Lacadie C, Skularski P, Gore JC, Olson IR, McGlashan TH, Wexler BE (2003). Amygdala hyperreactivity in borderline personality disorder: Implications for emotional dysregulation. Biol Psychiatry 54:1284-1293

Ellis LK, Rothbart MK, Posner MI (2004). Individual differences in executive attention predict self-regulation and adolescent psychososcial behaviours. Ann N Y Acad Sci 1021:337-340

Engle RW (2002). Working memory capacity as executive attention. Curr Directions Psychol Sci 11:19-23

Engle RW, Kane MJ (2004). Executive attention, working memory capacity, and a two-factor theory of cognitive control. The Psychology of Learning and Motivation Vol. 44:

Fletcher PC, Shallice T, Dolan RJ (2000). "Sculpting the response space" - An account of left prefrontal activation at encoding. NeuroImage 12:404-417

Fonagy P, Leigh T, Kennedy R, Mattoon G, Steele H, Target M, Steele M, Higgit A (1995). Attachment, borderline states and the representation of emotions and cognition in self and other. In: Cicchetti D, Toch S (eds). Rochester Symposium on Developmental Psychopathology: Emotion and Cognition. Rochester (NY): University of Rochester Press

Friedman NP, Miyake A (2004). The relations among inhibition and interference control functions: A latent-variable analysis. J Exp Psychol., Gen 133:101-135

Gabbard GO (2000). Psychotherapy for Personality Disorders. Washington (DC): American Psychitric Press

Garavan H, Hester R, Murphy K, Fassbender C, Kelly C (2006). Individual differences in the funtional neuroanatomy of inhibitory control. Brain Res 1105:130-142

Giesen-Bloo J, Van Dyck O, Spinhoven P, Van Tilburg W, Dirksen C, Van Asselt T, Kremers I, Nardort M, Arntz A (2006). Outpatient psychotherapy for borderline personality disorder: Randomized trial of schema-focused therapy vs. transference-focused psychotherapy. Arch Gen Psychiatry 63:649-658

Gunderson JG (2001). Borderline Personality Disorder: A Clinical Guide. Washington (DC): American Psychitric Publishing

Herpertz SC, Dietrich TM, Wenning B, Krings T, Erberich SG, Willmes K, Thron A, Sass H (2001). Evidence of abnormal amygdala functioning in borderline personality disorder: A functional MRI study. Biol Psychiatry 50:292-298

Jonides J, Lacey SC, Nee DE (2005). Processes of working memory in mind and brain. Curr Directions Psychol Sci 14:2-5

Kane MJ, Engle RW (2002). The role of prefrontal cortex in working-memory capacity, executive attention, and general fluid intelligence: An individual differences perspective. Psychon Bull Rev 9:637-671

Kernberg OF (1967). Borderline personality organization. Am J Psychoanal Ass 15:641-685

Kernberg OF (1984). Severe Personality Disorders: Psychotherapeutic Strategies. New Haven, Lodon: Yale University Press

Kim H, Somerville LH, Johnstone T, Polis S, Alexander AL, Shin LM, Whalen PJ (2004). Contextual modulation of amygdala responsivity to surprised faces. J Cognitive Neurosci 16:1730-1745

Klein K, Boals A (2001). The relationship of life event stress and working memory capacity. Appl Cognit Psychol 15:565-579

Klein M (1957). Envy and Gratitude. A Study of Unconscious Sources. New York: Basic Books

Konishi S, Chikazoe J, Jimura K, Asari T, Miyashita Y (2005). Neural mechanisms in anterior prefrontal cortex for inhibition of prolonged set interference. Proc Natl Acad Sci USA 102:12584-12588

Lane RD, Reiman EM, Axelrod B, Yun L-S, Holmes A, Schwartz GE (1998). Neural correlates of levels of emotional awareness: Evidence of an interaction between emotion and attention in the anterior cingulate cortex. J Cognitive Neurosci 10:525-535

Lazarus RS (1991). Emotion & Adaptation. Oxford: Oxford University Press

Levy KN, Clarkin JF, Yeomans FE, Scott LN, Wasserman RH, Kernberg OF (2006). The mechanisms of change in the treatment of borderline personality disorder with transference focused psychotherapy. J Clin Psychol 62:481-501

Linehan MM (1993). Cognitive-Behavioral Treatment of Borderline Personality Disorder. New York: The Guilford Press

Linehan MM (2000). The empirical basis of Dialectical Behaviour Therapy: Development of new treatments versus evaluation of existing treatments. Clin Psychol Sci Practice 7:113-119

Logan GD (1988). Toward an instance theory of automatization. Psychol Rev 95:492-527

Luborsky L, Crits-Christoph P (1998). Understanding Transference. New York: Basic Books

Meares R (1993). The Metaphor of Play: Disruption and Restoration in the Borderline Experience. Northvale (NJ): Jason Aronson

Miller EK, Cohen JD (2001). An integrative theory of prefrontal cortex function. Annu Rev Neurosci 24:167-202

Mitchell JP (2007). Activity in right temporo-parietal junction is not selective for theory-of-mind. Cereb Cortex doi:10:1093/cercor/bhm051

Morris JS, Frith CD, Perett DI, Rowland D, Young AW, Calder AJ, Dolan RJ (1996). A differential neural response in the human amygdala to fearful and happy facial expressions. Nature 383:812-815

Morris JS, Öhman A, Dolan RJ (1998). Conscious and unconscious emotional learning in the human amygdala. Nature 393:467-470

Morris JS, Öhman A, Dolan RJ (1999). A subcortical pathway to the right amygdala mediating "unseen" fear. Proc Natl Acad Sci USA 96:1680-1685

Posner MI, Petersen SE (1990). The attention system of the human brain. Annu Rev Neurosci 13:25-42

Posner MI, Rothbart MK (1998). Attention, self-regulation and consciousness. Phil Trans R Soc Lond B Biol Sci 353:1915-19127

Posner MI, Rothbart MK (2000). Developing mechanisms of self-regulation. Dev Psychopathol 12:427-441

Posner MI, Rothbart MK (2005). Influencing brain networks: Implications for education. Trends Cogn Sci 9:99-103

Posner MI, Rothbart MK, Vizueta N, Levy KN, Evans DE, Thomas KM, Clarkin JF (2002). Attentional mechanisms of borderline personality disorder. Proc Natl Acad Sci USA 99:16266-16370

Posner MI, Rothbart MK, Vizueta N, Thomas KM, Levy KN, Fossella J, Silbersweig D, Stern E, Clarkin J, Kernberg O (2003). An approach to the psychobiology of personality disorders. Dev Psychopathol 15:1093-1106

Raichle ME, Fiez JA, Videen TO, MacLeod AMK, Pardo JV, Fox PT, Petersen SE (1994). Practice-related changes in human brain functional anatomy during nonmotor learning. Cereb Cortex 4:8-26

Rudolf G (2008). Strukturbezogene Psychotherapie: Leitfaden zur psychodynamischen Therapie struktureller Störungen. Stuttgart: Schattauer

Rueda MR, Rothbart MK, McCandliss BD, Saccomanno L, Posner MI (2005). Training, maturation, and genetic influences on the development of executive attention. Proc Natl Acad Sci USA 102:14931-14936

Rypma B, Prabhakaran V, Desmond JE, Glover GH, Gabrieli JDE (1999). Load-dependent roles of frontal brain regions in the maintenance of working memory. NeuroImage 9:216-226

Schmahl CG, Elzinga BM, Vermetten E, Sanislow C, McGlashan TH, Bremner DJ (2003). Neural correlates of memories of abandonment in women with and without borderline personality disorder. Biol Psychiatry 54:142-161

Shin LM, McNally RJ, Kosslyn SM, Thompson WL, Rauch SL, Alpert NM, Metzger LJ, Lasko NB, Orr SP, Pitman RK (1999). Regional cerebral bood flow during script-driven imagery in childhood sexual abuse-related PTSD: A PET investigation. Am J Psychiatry 156:575-584

Summerfield JJ, Lepsien J, Gitelman DR, Mesulam MM, Nobre AC (2006). Orienting attention based on long-term memory experience. Neuron 49:905-916

Unsworth N, Engle RW (2007). The nature of individual differences in working memory capacity: Active maintenance in primary memory and controlled search from secondary memory. Psychol Rev 114:104-132

Unsworth N, Heitz RP, Engle RW (2005). Working memory capacity in hot and cold cognition. In: Engle RW, Sedek G, Hecker U, McIntosh DN (eds). Cognitive Limitations in Aging and Psychopathology. Oxford: Oxford University Press

Vuilleumier P, Armony JL, Driver J, Dolan RJ (2003). Distinct spatial frequency sensitivities for processing faces and emotional expressions. Nat Neurosci 6:624-631

Wegner DM (1994). Ironic processes of mental control. Psychol Rev 101:34-52

Wenzlaff RM, Wegner DM, Roper DW (1988). Depression and mental control: The resurgence of unwanted negative thoughts. J Personality Soc Psych 55:882-892