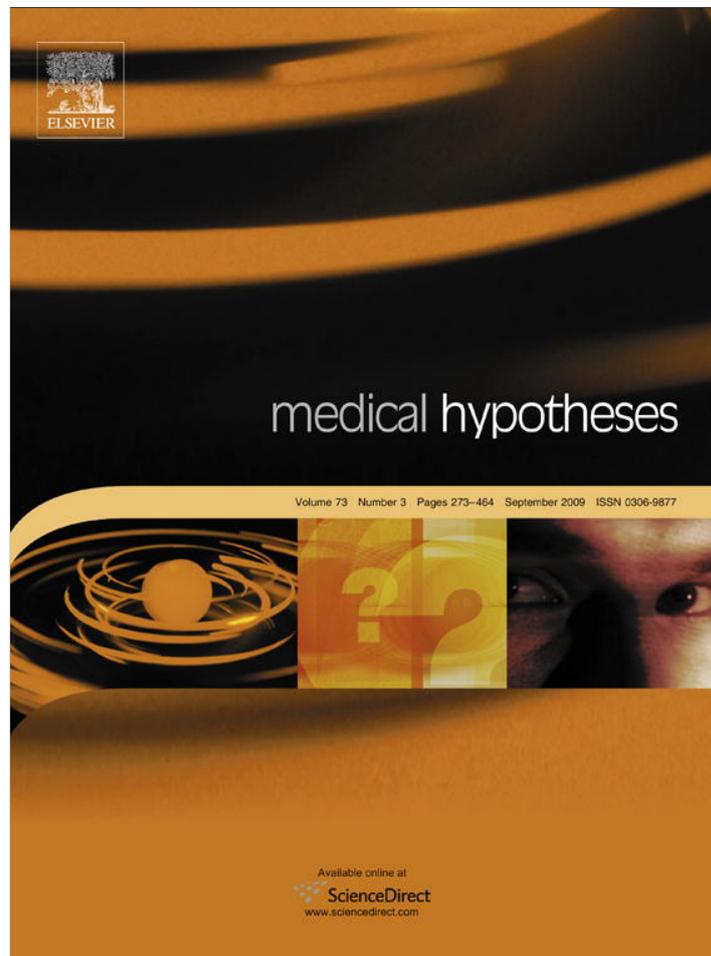


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### Borderline personality disorder: A review and reformulation from evolutionary theory

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#### SUMMARY

A number of authors have provided a useful evolutionary perspective on personality disorders, arguing that personality traits can be conceptualized in terms of evolutionary strategies. If we consider personality traits not as illnesses but as stable evolutionary strategies, the characteristic features of borderline personality disorder may respond to a behavioral pattern which, although deviating from the norm, would be in the service of survival of the species. Early environments involving factors such as childhood physical/sexual abuse may prove useful for explanation of personality traits based on gene-environment interaction, potentially providing a model for understanding borderline personality traits. We also review the question of whether personality traits exist in animals to also provide a translational perspective. We propose that certain traits in borderline personality disorder may derive from evolved mechanisms which in the short-term serve to help respond to adversity, but which when activated in an ongoing way prove maladaptive.

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#### Personality disorders from an evolutionary perspective: stable evolutionary strategies

From early work such as that of Millon on evolutionary approaches to the study of personality [1], to more recent research such as that of Paris on the heritability of different evolutionary strategies [2], the literature reflects an increasing interest in considering personality disorders (PD) from an evolutionary perspective. This model offers, in our view, not only an attractive framework for approaching the concept of PD [3], but also a stimulus for reflecting on clinically important phenomena such as borderline personality disorder, and on the management of key traits in patients with this diagnosis.

Darwin emphasized that emotions have an important function in social interactions, serving, for example, to enhance communication between mother and child [4,5]. Affective expression in adulthood may be based on early experience of such social communication, modelling parental behavior. Emotional expression regulates social interactions, giving information about actual

emotions and others' intentions. And it provokes a response in others, which guides reactions in relevant social situations.

Emotions are fundamental in the establishment of attachment relations during childhood and afterwards. If there are emotional disturbances, as in borderline personality disorder (BPD), then these will also appear in interpersonal relationships. A failure in emotional bonding during childhood has very negative effects on mental health and relationship capacity. And such a failure increases the probability of manifesting externalizing symptoms [6].

Fodor hypothesized that man's adaptation to his environment occurs through selection of neural modules that are responsible for behavioral strategies which resolve specific evolutionary problems [7]. Some of these modules are organized as innate premotor patterns, integrating genetic information and information derived from experience. Other authors, such as Panksepp [8], have emphasized that neural modules with adaptive advantages are similar across species and propose that sophisticated social-modulating functions are simply due to emergence from basic structures. He has emphasized that complex human functions appear due to the utilization of very old emotional capacities working in concert with newly evolved inductive abilities supported by vast general

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purpose neocortical association areas. At the present time, our vast linguistically based foresight and hindsight abilities are the only massive cortical modules we can be certain of.

In 1998, McGuire and Troisi elaborated the concept of stable evolutionary strategies in order to refer to behaviors which are not modified by subjects' learning in their immediate circumstances [9]. A stable evolutionary strategy is adaptive when it achieves biological goals, even though the emotions may be distressing. Thus, some clinical symptoms, such as anxiety, would be, from the evolutionary psychiatric perspective, strategies that have survived because of their adaptive importance [10]. From the first year of life, children begin to alter their behavior based on their parents' emotions and the way these influence how they react to the world [11]. Many authors defend the idea that infant attachment type determines the style of adult relations. Bowlby thought attachment relations during childhood form a pattern that is maintained in subsequent relations throughout life [12]. Depending on these types of bonding relations children develop enduring ways of relating to others. A mental model is created that implies the predisposition to act in a specific way [13,14]. Schemas about relationships that are developed during childhood play an influence throughout life [15,16].

The dominant nosological approach to PD posits diagnostic entities made up of a set of stable perceptions, emotions and behaviors that cause significant distress and numerous problems over the life course [17]. The conceptual basis of these entities employs a range of different models (from the schizotypal one of medical-psychiatric nosology to the histrionic one of psychoanalysis). The underlying basis of key personality traits in BPD is unknown. Progress has been made in describing the proximal mechanisms underlying these traits. However, less work has been done using an evolutionary perspective. In this paper, we attempt to describe an evolutionary approach to understanding key personality traits in BPD, because these phenomena appear incomprehensible to others and frequently cause severe problems. We hypothesize that these disruptive traits may have a useful short-term function, insofar as they help patients to respond to environmental adversity and to obtain social aid, but that over time they prove maladaptive.

The current diagnostic criteria of the DSM-IV-TR [17] describe the personality traits which comprise BPD. Together with unstable intense relationships, impulsiveness, affective instability, anger, alteration of identity, feelings of emptiness, fear of abandonment and episodes of loss of contact with reality, suicidal behaviors are a key component of the diagnosis of this disorder.

Individual personality emerges from the first relational system that the person experiences. Individual adaptation to society is key for survival, and in a great part it depends on early relationships. Early adversity, in the form of sexual or physical abuse, may lead to adverse changes in personality, with the emergence of enduring rigid and maladaptive traits [18–23].

### Do personality traits exist in lower animals?

In the last decade there has been an important increase in the number of publications investigating animal personality [24–34]. Understanding the genetic and environmental factors which contribute to different personality traits in animals provides the basis for an integrated approach to understanding analogous phenomena in humans.

Three basic criteria have been formulated to operationalize the existence of personality traits [35]. First is that assessments have good inter-rater reliability; second, these assessments have to be useful in predicting behavior; and third recollected data have to be accurate.

Investigators of this topic include temperament as an essential component of the theory, and as closely related to personality traits. In human beings temperament has been defined as those inherited tendencies that appear early and endure throughout life, so contributing to personality. So, personality is considered as those individual characteristics that describe consistent ways of feeling, thinking, and acting [36]. Based on this definition, we can extrapolate to the animal context, and describe personality as a stable pattern of responding to the environment.

Investigation of animal personality is varied; we can emphasize studies that have demonstrated relationships between neurobiological factors (e.g. vasopressin and serotonin) and aggression, as well as relationships between early environments and aggression in animals [37–39]. In primates there are also studies of the influence of maternal relationships on temperament and cognition in chimpanzees [40]; French has identified individual differences in play in Japanese macaques [41], and Capitanio has related the early education experience to consequent social competence in Rhesus monkeys [42]. Animal personality has been investigated in other species: including individual differences in responses to aggression in lions [43], studies comparing defensive behavior in laboratory and wild rats [44]; studies of individual differences in nervousness in motherhood and behavior among chicken [45], research on inter-species and intra-species threat behavior in “garter” snakes [46] and behavioral differences among ants [47].

In human personality research one of the most accepted models now is the *Five Big Model*, with five factors: Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism. This model has been used to study animal personality too. Gosling and John reviewed 19 studies on 12 different species with this personality model [48]. They found that extraversion, neuroticism and openness dimensions were very frequent in animal personality. Responsibility has appeared a short time ago, from an evolutionary perspective, because it only can be observed in human beings, chimpanzees and gorillas [48].

We can conclude that analogues of at least three of the five criteria necessary to diagnose a person of a BDP can be identified in animals: emotional instability, impulsivity and anger.

Emotional instability has been found in many studies in animals. In Gosling and John's review of 19 studies, they found that neuroticism was one of the more frequent dimensions, including factors such as fear, excitability, emotional reaction and nervous instability. We can observe an analogue of this criterion of BPD in various species such as chimpanzees, in which emotional stability [49] and influences on development in infant chimpanzees [40] have been studied; in the gorilla, observing fear and nervousness [50]; rhesus monkeys, that suffer tension [51], fear [52] and excitability [53]; dogs, that present emotional reactions and nervous stability [54]; rats, where emotions have been observed [55]; and guppies, with the observation of a tendency to avoid fear [56]. All these studies are consistent with a notion of emotional instability in animals.

Secondly, impulsivity, though not evaluated directly in the reviewed studies, can be viewed as one of the principal factors found on the negative pole of the responsibility dimension, together with the lack of attention and the disorganized, erratic and unpredictable behavior. A number of species have been characterized as having impulsive traits, including chimpanzees, rhesus monkeys, and even dogs and cats.

Third, anger and aggression may also be found in animals. This is one of the principal factors that we can find on the negative pole of the openness dimension. This pole has been found in rhesus monkeys [51], dogs [54,57], pigs [58] and rats [55], though probably many more species have it.

### Survival strategies: aggressiveness and suicide in personality disorders

In considering personality disorder traits, an immediate question is how these could have survived if they are dysfunctional. In this regard, McGuire et al. [59] argue that heterosis (the adaptive use of abnormal traits) is an advantageous form of adaptation in certain circumstances. For example, although there may be a higher proportion of homeless people among individuals with schizotypal PD [60], this condition may provide a way for promoting survival on the basis of avoiding competition, and may permit individuals to obtain an advantage in an environment of isolation [61]. Of course, these deviant traits should not be so intense as to remove the possibility of reproduction.

The rapid changes our species has undergone mean that some useful evolutionary strategies are not adaptive for our current environment. For example, aggression has been widely studied by ethologists as a part of survival strategies. Thus, although fighting rituals in the animal world guarantee equitable sharing of resources at the same time as preserving the elimination of the individual, in developed human societies, where survival is guaranteed, aggressive behavior may become a negative value for the preservation of the species [62].

The PD with most propensity for pathological aggression are the affectless and explosive Schneiderian subtypes [63], corresponding to antisocial personality disorder and the impulsive-type emotional instability of BPD [64]. We know that antisocial disorder and BPD present greater early mortality through risk behaviors and suicidal behaviors [2,65]. On the other hand, however, the “minor” forms of these disorders can provide certain advantages. Those with antisocial traits may accumulate more resources [65], and among women with borderline traits there is a predominance of those that secure a job and ensure their economic survival over time [2]. Although after 15 years women who survive with a BPD continue to have problematic interpersonal relationships [66], their impulsiveness and manipulative behaviors may allow social functioning that is useful in the competitive struggle for resources as long as the risk behaviors are not excessively intense and in a highly competitive and unusual environment. Furthermore, although women with BPD have fewer partners, change partners more often and reproduce three times fewer than healthy women [66], the emotional dysfunction derived from interaction with their peers may lead, during the fertile period, to a sexual strategy in which conflictive intimate relationships are avoided [2]. This could be an advantageous strategy in particular circumstances, such as an environment where there is lots of trauma. Impulsive strategies – live hard, die young – may be advantageous, but only in some circumstances, when survival depends on a quick response, like during a fight or in the war. BDP traits are adaptive in these extreme circumstances and may then persist in some subjects. When susceptible people are exposed to extreme circumstances (as in cases of sexual or physical abuse), impulsive reactions may be adaptive and be maintained though they have lost their adaptive function [67,68].

Although it is problematic to specify the number of instincts in humans, instinctive life would appear to revolve around two: preservation of the individual and preservation of the species (biological egoism and altruism, respectively). Or, according to Dawkins' perspective of the “survival of the gene”, the egoism of the individual contrasted with the egoism of the genes [69]. The human preservation tendency leads human beings to exist with defence of themselves as units and of the world around them, and it is from the latter that aggressiveness and the defence instinct emerge, as an adaptive organization.

Studies on human aggressiveness show self-destructive behaviors to be widely dispersed. If we consider suicide attempts as a

behavior belonging to a stable behavioral strategy (though deviating from the norm) in the service of survival of the genes, on assumption that it has an adaptive function, we can understand some “imprudent” behaviors that have nevertheless permitted, for example, the expansion of the human being within its ecosystem. In BPD this strategy has become adaptive perhaps due to the role of early experiences such as child abuse: a strategy that may allow the individual to obtain various kinds of social aid.

If we consider PD not as illnesses but as stable evolutionary strategies, the personality traits of BPD would respond to a behavioral pattern which, although deviating from the norm, would be in the service of survival of the species by augmentation of quick responses in dangerous situations. We would then need to consider how paradoxically the survival of the individual is enhanced by such behaviors.

We want to emphasize the consideration of one clinical aspect that emerges from a reconceptualization of personality traits in BPD from the perspective of evolutionary theory; reformulating behavior as an adaptive strategy related to the role of child abuse as an early experience in BPD, from the diathesis-stress model.

### Borderline personality disorder: the role of early experiences in the diathesis-stress model

Having a negative emotional experience with caregivers during childhood precipitates the development of an abnormal mental model about relations, which continues manifesting during adulthood. Relationships with early caregivers decisively influences the way adults maintain relations afterwards. If these first contacts are insufficient or anomalous in some way, there will be repercussions in later social life [70–85].

In developing an integrative evolutionary approach, it is important to emphasize that evolution is not merely a matter of gene changes, but rather of co-evolution of genetic and environmental processes [86]. Furthermore, there is increasing acknowledgement of the value of gene-environment mediation of early programming [87]. Early environments may play an important role through their influence on psychobiological functions in adulthood [88,89], contributing information about the kinds of environment the organism will have to deal with in the future. Again, recent work has succeeded in delineating some of the specific psychobiological factors that underlie such programming, including both genetic and epigenetic mechanisms [90,91].

According to Sanjuán [92], there are multiple neurobiological results suggesting that early separation leads to a hyperresponse in the organism to cortisol, with subsequent release of oxytocin and vasopressin, which if not neutralized with restoration of the attachment generates an alteration of the hypothalamic-pituitary-adrenal system with permanently high response to cortisol [93]. There are experimental data suggesting that maintenance of the hyperresponse to cortisol in adults may have its basis in the expression of the genes of the glucocorticoid receptors [94]. Perhaps the most promising perspective is emerging from the research on the gene-environment relationship: Caspi [95] found that child abuse was more likely to lead to depression in adulthood if the child had the *ss* genotype of the serotonin transporter, which in turn is related to lower tolerance to stress [96]. In short, current research on affect underscores its importance in relation to the individual's normal neurodevelopment.

There are some studies relating some precise suicidal phenotypes and given genes [97]. It is possible that TPH1 (tryptophan hydroxylase gen 1) is associated with suicidal behavior in general, that serotonin (5-HT) transporter is associated with violent and repeated suicide attempts, and that monoamine-oxidase-A (MAOA) is associated with a shift in the suicidal phenotype towards a

violent act. These hypotheses may make it possible to define border line personality traits more precisely, thus helping clinicians to detect subjects at risk of particularly harmful progression. The clinical basis of susceptibility to suicidal behavior, for example, involves personality traits such as aggressive impulsiveness, neuroticism, and despair, that may be related to particular genes too.

## Conclusions

Evolutionary theory has been used in the past not only in a reductionist way, in the sense of not taking into account the environment, but also in a racist way, to the extent of justifying the extinction of individuals from the perspective of political power [98], so that some have advocated the total rejection of all its ideas [99]. Nevertheless, our hope here is that evolutionary psychiatry can be used in a non-reductionistic way, which focuses on its value as a theory that helps to explain some individual or group behavioral mechanisms by looking at similar behaviors that appear in the animal kingdom. This facilitates the idea of the adaptive value of some very little understood human behavior, especially in BPD patients.

Thus, for evolutionary psychiatry, some dysfunctions may be beneficial, and some evolved functions may have disturbing outcomes under particular circumstances [100]. From the point of view of evolutionary psychiatry, various personality traits in BPD can be conceptualized as a stable evolutionary strategy. This stable evolutionary strategy is adaptive when it attains sociobiological goals, even though the emotions may not be “comfortable”, in the same way that anxiety symptoms would be an alarm strategy (false alarms) that has survived due its adaptive importance [10]. BPD patients could have adopted this strategy during childhood and adolescence, as a way to flee from a painful situation and to obtain, as in female primates, aid from the environment, though during time this has become maladaptive.

Currently contested constructs (such as evolved mental modules and the environment of evolutionary adaptedness) may well undergo significant modification as a more mature science of evolutionary psychiatry is fashioned [86]. In spite of the difficulties of applying evolutionary theory to the concept of PD, we remain hopeful that further progress will occur in the future. Early environments involving factors such as childhood physical/sexual abuse may prove useful for explanation of the PD concept based on gene-environment interaction, potentially providing a model for understanding border line personality traits.

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