Evolutionary Psychology and psychopathology

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Purpose of review

In recent years, there has been a surge of interest in evolutionary approaches to the understanding of human nature. Although there are many different approaches to the evolutionary study of mind and behaviour within mainstream academic psychology, Evolutionary Psychology is one that has developed a theoretically rigorous research programme. Thus far, evolutionary studies of psychopathology have not produced a coherent, unifying model. This review is intended both to assess recent research on evolutionary psychopathology, and to consider structuring such research by bringing Evolutionary Psychology and evolutionary psychopathology closer together.

Recent findings

Modern evolutionary psychopathology is a young field, and conceptual issues are much debated: there is still clear resistance to the adoption of an evolutionary perspective. Also, most evolution-oriented research on psychopathology is mainly theoretical, generating hypotheses, few of which are being empirically tested. Nonetheless, this theoretical work is very interesting and creative, based, in most cases, on general, scientifically sound biological theories. There also seems to be a trend toward empirical studies.

Summary

Research on psychopathology from an evolutionary perspective is generating many interesting hypotheses, and promises to integrate data and theories from biological psychiatry, cognitive neuroscience and clinical psychology in a truly biopsychosocial theory. A few theoretical points are already making their way into clinical practice in the form of clinical heuristics; alas, this is probably premature from a strictly empirical viewpoint. The efficacy of these interventions will need to be documented. The potential of this research at present is mainly to broaden our theoretical understanding of human nature, including the nature of psychopathology.

Keywords

adaptationism, biopsychosocial approach, Darwinian psychiatry, Evolutionary Psychology, evolutionary psychopathology, psychopathology

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Abbreviation

EPP evolutionary psychopathology

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Introduction

Evolutionary Psychology is a potentially unifying paradigm for the science of psychology [1,2••,3•] or the study of human nature in general, including psychopathology. Recently, there has been a surge in evolutionary approaches to psychopathology, though these have often not been subject to the discipline of a common rigorous research programme or theory. This review attempts to present literature on the fundamentals of evolutionary psychopathology (EPP). Further, it reviews recent research on EPP, before presenting a comprehensive model of psychopathology from an Evolutionary Psychology perspective.

Evolutionary Psychology

Mainstream Evolutionary Psychology may be defined through the major empirical and theoretical contributions of Leda Cosmides and John Tooby [4–11]. Other fundamental studies include the work of Daly and Wilson [12] on homicide and David Buss' [13] work on mate selection [see 14].

In this theory of the evolution of human nature, the mind is conceptualized as consisting of a mosaic of species-specific mental mechanisms, achieved through the process of natural selection – i.e. adaptations, and designed to allow our human ancestors to adapt to the hunter–gatherer environment within which our species evolved. This environment is called the environment of evolutionary adaptedness (EEA). The EEA is defined as a statistical composite of the adaptation-relevant properties of the ancestral environments encountered by members of ancestral populations, weighted by their frequency and fitness-consequences [7, pp. 386–387]. The focus, thus far, has been on human universals, although recent work seeks to develop approaches that consider species-specific variations (e.g. personality) [15].

Other approaches to the evolutionary study of mind and behaviour exist, ranging from broader academic research and theoretical studies, e.g. on human ethology and sociobiology, to more popular presentations [14]. All have had problems uniting on a single model of the mind that might foster the rigorous development and integration of a united theory. I would expect future developments to move towards integrating the most prominent sub-theories developed within these perspectives with mainstream Evolutionary Psychology.

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Evolutionary psychopathology

EPP is a collection of diverging evolutionary approaches to the study of psychopathology in general or specific mental disorders. This is not a new approach: Sigmund Freud may be viewed as having been an evolutionary psychopathologist [3•].

Modern EPP was formulated by different researchers in the late 1980s, and a general call for evolutionary theory as a basic science in psychiatry was made by McGuire, Marks, Nesse and Troisi [16]. In the same period, Darwinian medicine – a general approach to all pathology based on evolutionary insights, often discarded within mainstream medical conceptualizations – was formulated by Randolph Nesse and George Williams [17,18]. Baron-Cohen [19] collected several of the most important papers on EPP. The *British Journal of Psychological Medicine* published a special edition on EPP, featuring several of the field's leading researchers [20–29]. In recent years, several general formulations of EPP have been published, the two most influential being McGuire and Troisi's *Darwinian Psychiatry* [30] and Stevens and Price's *Evolutionary Psychiatry* [31]. Alas, all these approaches differ in many ways, and none is fully compatible with Evolutionary Psychology.

The disorder that has been the target of most attention within EPP is depression: almost all of the most prominent researchers within EPP have focused on this condition, generating competing and original hypotheses. Gilbert [32] provided one of the best expositions of psychological theories of depression, disciplined by a critical evolutionary approach. Nesse [33] presented EPP to the general psychiatric community through his discussion of depression as an adaptation. Depression is well covered in Baron-Cohen's collection [19]. Recently, Sloman and Gilbert [34] presented a collection of chapters in which depression is considered as a mechanism for involuntary submission [35]. Wolpert [36,37] has challenged the notion that depression may be an adaptation, though the argument that depression is too painful and too serious in terms of its complications (if left untreated) to be considered adaptive is not convincing. The same can be said of physical pain, which is most definitely an adaptation, and all other evolved defences [17,18]. These sources may function as good introductions to evolutionary reasoning within the study of specific disorders.

Very little of the research within EPP is inspired by the Evolutionary Psychology research programme. The most obvious example would be Simon Baron-Cohen's ground-breaking work on autism [38]. Also, Cosmides and Tooby [39,40] have occasionally written on the subject of psychopathology.

In the last few years, general introductions to EPP have been published all over the world and in leading journals. It is therefore timely to consider the recent research within this field.

Review of recent research

There is growing interest in evolutionary approaches to the study of psychology and psychopathology. Recent research in evolutionary psychopathology can be divided into two major categories: conceptual issues, and research on specific disorders. Most of the work is still theoretical. A general criticism is that the field needs empirical investigations of the testable hypotheses generated. The creative and fruitful generation of testable hypotheses is one of the major strengths of this approach. As mainstream psychiatric research has in recent years turned to natural science and biology, it has also become wary of grand (psychological) theories. Evolutionary theory, and especially Evolutionary Psychology, provide a unifying biopsychosocial natural science theory [9] to the field of psychopathology research.

Conceptual issues

At a very basic level lies the question of how to study and conceptualize human nature. There has been great opposition, since Wilson's *Sociobiology* [41] and Dawkins' *Selfish Gene* [42], and even now [43,44], to the view that human nature is a result of evolution, and to the view that human nature can be studied from a natural science perspective.

Steven Pinker [45••] provides a thorough, but nonetheless controversial, exposition of the myths of the old paradigm of human nature. Although he does not focus on psychopathology, his work is still worth mentioning, as his arguments are also applicable to mental disorders. Kennair *et al.* [46•] provide a similar analysis, focusing on psychopathology and pointing out that natural science perspectives (such as Evolutionary Psychology) on human nature, including psychopathology, have proved fruitful.

Nesse [47••] presents a short, updated general introduction to EPP, restating that evolutionary biology is fundamental to the study of psychiatry. His view is that proximate explanations (how things happen in the individual organism, here and now) and ultimate explanations (why things work the way they do, because of evolutionary history) are complementary, not competing, perspectives. The hope is that an understanding of evolutionary function will stimulate advances in psychiatric research.

Troisi and McGuire [48••] address the question of what constitutes psychopathology, calling for conceptualiza-

tion of pathology based on an analysis of the individual's ability to achieve biological goals in that individual's specific environment. The most problematic feature is a seemingly premature conclusion as to what is, and what is not, an adaptation when advising patients what to seek treatment for. I would call for more consideration of such matters, although I am willing to concede that these authors raise important points, in theory, in their criticism of the focus on subjective suffering, deviance from the norm, and lesion as a basis for defining all that we call psychopathology.

Brüne [49•] – a proponent of the functional approach to mental disorders – includes elements of both of the latter papers and shares the view common to all pro-EPP papers, i.e. that evolutionary studies ought to be a basic science in psychiatry.

Crawford and Salmon [50•] focus on the different levels of analysis offered by evolutionary and genetic perspectives – something that is not always appreciated by those outside behavioural genetics and Evolutionary Psychology, though the gap between these two perspectives is starting to be bridged [15,51]. The question of whether disorders are malfunctions or adaptations is addressed [33]; this is the major contribution of functional hypotheses. It is the most provocative area, too, including the ideas that psychopathology may have a genetic base and that mental disorders and their treatment may be studied from a natural science perspective [46•].

There are also critical voices. The most prominent is that of Steven Rose (in letters published in the *British Journal of Psychiatry* and elsewhere [43,52–54]), though in my opinion most attacks of this kind stem from poor reading of the original literature and odd conceptions of theoretical positions that have been clarified by researchers and authors time and again [55•].

Dubrovsky [56•] also provides a critical analysis, which also, unfortunately, is based on a rather debatable conception of adaptationist evolutionary theory and Evolutionary Psychology. The argument that evolutionary adaptationist studies are teleological is no longer considered relevant [3•,57–59]. Dubrovsky is more up to date on neurological issues; it is essential to combine neuroscientific and evolutionary approaches [60–62].

It is important to note that many of these general conceptual papers [48••,49•,50•,56•] address the categorization of mental disorders, thus continuing an already established trend [40,63]. An important feature of an ultimate functional approach is a willingness to go beyond proximate descriptive categories. Thus, evolution-oriented researchers are making important contributions to the literature on how to classify (and what constitutes) mental disorder.

Analytical psychology

Kennair [3•] provides a short review of evolutionary biological approaches to Freud and his work, placing Freud among the very first Evolutionary Psychologists, though not necessarily categorizing him as a mainstream Darwinian psychologist.

A recent exchange in *Analytical Psychology* provides an interesting glimpse into the modern application of evolutionary theory and artificial intelligence within Jungian theory. Maloney [64•] advocates, to a large degree, the typical Evolutionary Psychology and EPP position, i.e. that there is a genetic basis to archetypes. Hogenson [65•] is wary of what he perceives as extreme innateness, his worry being that progress within robotics and dynamic systems theory is continuously casting doubt on the Evolutionary Psychology meta-theory. Like Freud, who was let down by Lamarckism, Hogenson does not want to be let down by a false biology and cognitive science.

As behavioural genetics becomes a more familiar field, such discussions might focus more on what genetic structures exist, and how they develop, rather than on whether or not there are genetic structures. Although some working within the EPP field (e.g. Stevens, Price, and even Gilbert) use Jungian terminology, I am not sure that this conceptualization has greater explanatory power than the mental module or mental mechanism described within mainstream Evolutionary Psychology.

Family therapy

Sloman *et al.* [66•] have introduced the evolutionary perspective into the family therapy field. Whilst I support the approach of considering families in the context of evolution, and believe that insights on hierarchy processes and comparative studies may be relevant, I am less certain that treatment interventions can be recommended on the basis of current knowledge. Kennair [35] has warned that psychology, and family therapy theory in particular, has a tendency to turn borrowed scientific insights into mere metaphor, and thereafter base interventions on the metaphoric understanding of this science; I fear this is still the case.

Specific disorders

The disorder that has received most attention recently from an evolutionary perspective is depression: most of the key researchers within EPP are involved in the study of this disorder. Within the review period covered here, papers on depression stand out as most ground-breaking, and probably provocative, though developments within

the fields of anxiety and schizophrenia are also exciting, and are reviewed below.

Depression

Ever since Nesse's [33] paper on the possibility that depression is an adaptation, this question has been addressed repeatedly. It is a very important aspect of all EPP research, and is a focus for all those who oppose evolutionary descriptions of human nature in general. McLoughlin [67•] presents a critique of Nesse. The criticisms offered are fully addressed by Nesse in the target article and elsewhere. Despite this, it is important to disseminate the EPP perspective widely, and, as such, McLoughlin's article may serve to communicate this perspective to the academic mental health nursing community.

Brown [68•] presents a summary of his theoretical work on aetiological factors of depression, focusing on the impact of 'negative' life events. Brown is a much-cited author within EPP; as such, this summary may have an impact on future research. Brown's own perspective is one that supports the notion of a universal human nature, and favours some evolutionary perspectives, but Brown also warns against too great a focus on innate mechanisms.

In the research on depression reviewed here, two trends were apparent: (1) a greater tendency towards empirical testing of evolutionary hypotheses; and (2) the establishment of a new evolutionary model of depression.

Gilbert *et al.* [69•] have studied anhedonia from an ethological social hierarchy perspective, and have found that how one perceives defeat is important in regulating low positive affect. O'Connor, Berry, Weiss and Gilbert [70•] have considered the role of guilt in depression, finding that depression and submissive behaviour may be regulated by altruistic concern for others. Both papers test evolutionary hypotheses empirically, and utilize psychological theories based on evolutionary biology to discuss and explain their results. This is important; if EPP were merely a generator of theories that were never tested empirically, it would be a dead science. The best argument against those who have theoretical objections to the application of evolutionary biology within mental health research is fruitful empirical testing of evolutionary hypotheses.

The second development within EPP depression research is a new model. Ed Hagen [71••,72•] and Watson and Andrews [73••] have, in the review period covered here, developed their own approach to depression as an alternative to the existing models (see above).

The approach of Watson and Andrews [73••], which goes much further than most other approaches, proposes two functions for depression. Depression is conceptualized as having both a social rumination function (making depressives better at reasoning about specific social circumstances) and a social motivation function (in which the individual uses evolutionarily costly, and thus honest, signals to cue significant others that they have to increase their investment – see below). Thus, these authors provide important, explicit, testable hypotheses. I am not convinced by their argument that depressed individuals are better at social problem-solving – it does not seem to fit with the clinical impression. On the other hand, their approach is creative and is a prime example of how an evolutionary approach to depression can inspire thinking beyond the mainstream framework. Further work is needed to test the hypotheses of these authors.

Hagen challenges the most typical evolutionary models of depression, and presents his own perspective [72•]. Hagen's view is based on a strategic modelling of the human evolutionary environment (the EEA) [5,7] and suggests that in certain situations where one's cooperation is costly to oneself, but where there is an evolutionary dependency between individuals, one may, by reducing one's own activity, increase the investment of others. By formulating specific hypotheses and empirically testing these, Hagen has produced a most interesting thesis of the function of postnatal depression [71••]. What I do not find convincing is Hagen's suggestion that his research on postnatal depression may be relevant to a general model of depression. As one of the most Evolutionary Psychology-oriented researchers within EPP, it is surprising that Hagen does not suggest that postnatal depression is a context-specific condition regulated by cue- and context-specific mental modules, only some of which are likely to be involved in other forms of depression.

All in all, current EPP approaches to depression offer good testable hypotheses. These are now beginning to be properly founded on a combination of evolutionary biology (as in identifying an adaptation) and empirical science. Perhaps it is the evidence-based approach to clinical practice that is falling behind, as different interventions based on these hypotheses are too eagerly applied. Thus, the efficacy of all clinical applications ought to be documented [46•]. Furthermore, it may be important to consider these different explanations as different taxonomic types of functional depression, rather than as competing theories for all forms of depression. Finally, Kennair [35] finds that there is reason to believe that there may be a fruitful collaboration between EPP theoretical approaches to depression and the more dustbowl empirical, evidence-based

treatment method of interpersonal psychotherapy (IPT) [74] or with the cognitive science approach of modern British cognitive behavioural therapy (CBT) [see, for example, 75].

Anxiety

For years, anxiety has been a prime example of predisposed abilities to learn, and one of the fatal blows against the principle of equipotentiality (i.e. the idea that any behaviour may be learnt by any species through the same rules and schedule of conditioning) within learning psychology. Associative approaches to phobia acquisition have dominated. In a special edition of *Behavior Research and Therapy* on the aetiology of anxiety, there is a most interesting debate on how anxiety is acquired. Rachman [76•] introduces the debate focusing on a target article by Poulton and Menzies [77••] with contributions by the field's leading authorities on associative learning, anxiety preparedness and evolutionary approaches to anxiety [78•,79,80•–84•; also see 85•]. The debate focuses on what constitutes a conditioning experience, whether non-specific is more appropriate than non-associative conditioning, and whether recall of aversive situations (or the lack thereof) is methodologically reliable. Most commentators support the associative position. It is to argue from the void to claim that unknown factors could condition anxiety – scientific psychology has to present the specific environmental factors involved in developmental psychopathology; so far, we know very few.

Finally, and most relevant to this review, evolutionary or genetic accounts are scientific and causal explanations, but all environmental factors need to be explained in evolutionary and genetic terms as well [83•]. I am not fully convinced by either the target article or the commentators, probably because I believe that there are multiple states and multiple causes, as described in the Evolutionary Psychology model of psychopathology below.

Since this debate, yet another contribution on the side of non-associative learning has appeared [86••]. Also, anxiety seems to be linked to genes that also cause somatic or joint anomalies [87•]; there are no clear theories within EPP or general approaches to anxiety as to why this is the case.

The next step must be to explain how non-adaptive behaviour, especially in the EEA, arises; even if fear were adaptive, it is not obvious why certain specific types of anxiety disorders should occur through natural selection. I believe the debates on anxiety and depression will be mutually illuminating, both in specifying functional hypotheses and in formulating a diverse taxonomy of types. Behavioural genetics, modern cognitive behavioural treatments for anxiety disorders, and new conceptualizations of anxiety within EPP need to be combined to guide further research.

Schizophrenia

Apart from depression, schizophrenia is the field in which the question of 'why' is most pertinent. Some neural pathways and transmitters involved have been described, answering some of the 'how' questions. But for many, the question of why such a condition exists – given the nature of natural selection, the reduced fecundity of the sufferers, and the clear genetic basis – is important and is a paradox that requires an evolutionary explanation [88•,89••]. It is too universal to have arisen recently, yet it ought to have been selected out of the gene pool if it simply were detrimental to fitness. Polimeni and Reiss [88•] present a review of evolutionary theories that deal with the schizophrenia paradox.

Given the focus of the articles published in the review period [88•,89••,90•], the work of Tim Crow [see also 91,92] on evolutionary perspectives in schizophrenia has generated much interest recently. The theory considers schizophrenia as the price of *Homo sapiens* speciation, which consisted of the evolution of language and thus also lateralization or specialization of this function.

Addiction

The journal *Addiction* published a special issue on evolutionary approaches to addiction. This is an area in which genetic or biological preparedness is generally accepted but in which social factors also are given importance. This opens up biopsychosocial and evolutionary perspectives. In seven articles and three short commentaries [93–97,98•,99•,100–102], most aspects of the evolutionary function of addiction, the emotional reward circuitry of the brain, and development, maintainance and intervention implications are addressed by prominent researchers with diverging approaches to the field. The guest editors, Hill and Newlin, who claim that evolutionary perspectives will enhance our understanding of addiction, sum up this theoretical research in an accessible introduction [103•], which also has an important caveat warning against erroneous presumptions about genetic determinism.

Erotomania

Erotomania is a good example of a specific behaviour for which a specific analysis can be made from an evolutionary perspective. This article was published outside the usual medical or psychological literature, but is nonetheless interesting. Brüne [104•] suggests that erotomania is a pathological form of a long-term mating strategy [see 2••]. Thus, women are more prone to erotomania, because of a higher degree of parental investment. Erotomania in males is, conversly, more

closely associated with excessive sexual jealousy and violence, as paternal certainty is a major adaptive problem. Thus, erotomania may be considered as an inappropriate coping strategy for solving adaptively significant problems.

A comprehensive model

To summarize different EPP approaches in one comprehensive model of the mind – based on behavioural genetics, evolutionary biology, developmental theories, and social and other environmental factors – the following model is suggested (Fig. 1) (also see L.E.O. Kennair, in preparation).

Part 1 of Fig. 1 covers the individual's genetic potential. The mind consists of mental adaptations (a) (e.g. the ability to see colour or to detect cheaters). However, not all the results of evolution are adaptations: some are merely mental by-products or 'spandrels' (b), i.e. mental abilities that are not selected for, but which arise as a result of the mind's adaptations (e.g. the ability to appreciate instrumental music or the ability to read). Also, every organism has different gene-copying errors that cause stochastic genetic differences (c).

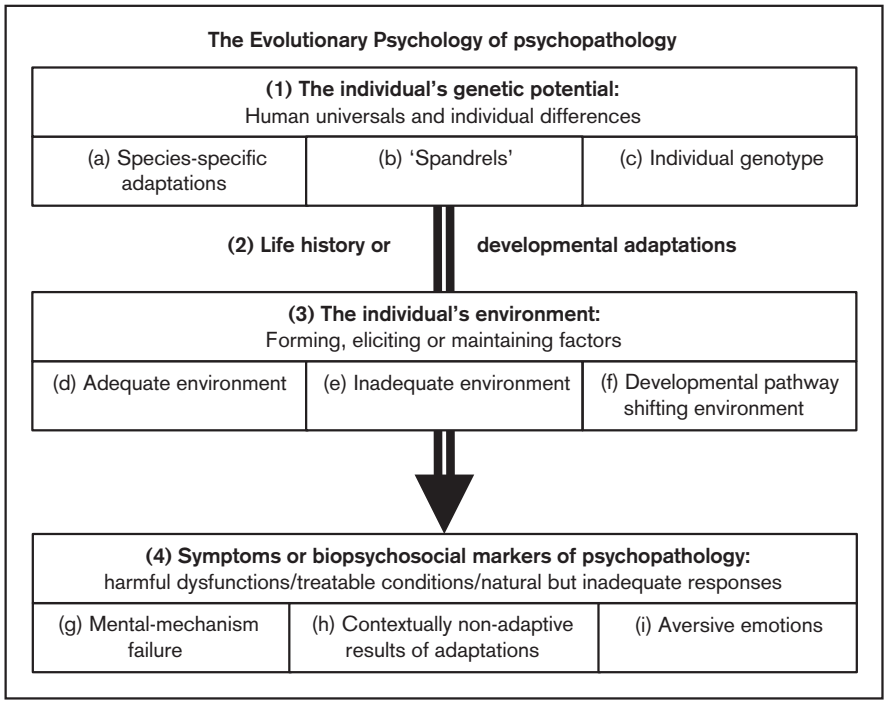
Part 2 of Fig. 1 represents the fact that every organism has a set of developmental adaptations ('Life history'). For each specific species, there are certain developmental problems to be solved, certain structures that need to develop at specific stages of development, and certain strategies that are more or less adaptive.

The environment (Fig. 1, Part 3) may or may not be such as to cause adaptation. If it is adequate, then adaptations will unfold more or less according to the genetic plan (Fig. 1d). If it is not, certain adaptations may not develop, or be distorted (Fig. 1e). An important theory for almost all evolutionary approaches to psychopathology is that of considering mismatch between the evolved adaptation and current environment (as opposed to the qualities of the EEA). A third aspect of the environment is very important: the environment can signal to the organism (which may have several adaptational pathways to choose from) as to the kind of environment in which the adult organism must be able to survive (Fig. 1f).

The resulting states/asymptoms may appear: mental mechanisms may be disturbed (Fig. 1g), because of major or minor genetic discrepancies, ontogenetic environmental inadequacy, or even injury due to trauma or infection. Because the demands of the current environment differ from those of the environment in which the adaptations were selected for, problems of adaptiveness may occur (e.g. extreme jealousy or child homicide) (Fig. 1h). Finally, aversive emotions (Fig. 1i) that are there, like pain, to control our motivation and actions unconsciously may be viewed as unwanted, pathological, or in some way requiring treatment, even

Figure 1. The Evolutionary Psychology of psychopathology

This figure illustrates how psychopathology can be considered to be the result of both normal and abnormal genetics resulting from developmental adaptations (rules of development and the species life history) arising from interaction with both adequate and inadequate environments. Therefore psychopathology is, from an evolutionary perspective, due to both functional aversive evolutionary adaptations, or adaptations that are mismatched to our modern environment, and mechanism malfunction. See the text for explanations of the concepts used.



though they are merely functioning as the adaptations they really are.

Conclusion

The primary problem is that not all of the theoretical research is genuinely informed by an evolutionary approach, such as the rigorous identification of adaptation. Also, there are too many different theoretical positions and perspectives, hampering integrative and accumulative theory development. I find that some pro-evolutionary clinicians apply their hypotheses in the form of therapeutic heuristics a little prematurely, and call for more prudence unless these interventions are studied and their efficacy documented, at the very least. Finally, there is a need for increased empirical investigation of the testable hypotheses generated by the theoretical research.

These criticisms are not unsurmountable, however, as current theoretical developments are very promising. The researchers involved have shown the ability to integrate different levels of theory and research within different fields, and the contributions are genuinely creative. The empirical work performed to date is promising. There is reason to believe that this research may cast new light on many questions relating to human nature and the essence of psychopathology.

Acknowledgements

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