Customization of psychosocial stress effects on human health: an intrapersonal conflict perspective

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ABSTRACT

From etiologic, clinical or public health perspectives, differences in psychosocial stress responses remain a huge scientific and medical challenge. We address the customization of psychosocial stress responses in humans by considering our dual character of independent organisms and interdependent social group members as a source of intrapersonal conflicts. By challenging our subjective representations on our social identity, psychosocial stress triggers or exhibits intrapersonal conflicts and may enhance divergence between physiologically-driven and psychosociologically-driven internal forces. In this perspective, our individual-specific brain development constitutes a major cause of interindividual variability since it impacts the overall stress-to-disease links.

We propose a two-step stress-to-disease etiological chain: i) stress perception and appraisal and ii) response to actually perceived stress. We argue that the first step of stress perception and appraisal is more affected by interindividual variability than the second step of response to actually perceived stress. A psycho-cognitive approach correlating symptoms with actually perceived stress is proposed to address the epidemiology of psychosocial stress effects. The ability of this approach to reduce interindividual variability biases is discussed.

From this perspective, pathological effects of psychosocial stress might be questioned as possible conflict responses internally emerging as the lesser evil, thus corresponding to adaptation attempts.

Keywords: Stress response customization, Intrapersonal conflicts, Solitary versus social duality, Stress-related diseases, Interindividual variability, psycho-cognitive epidemiology
INTRODUCTION

Psychosocial stress is acknowledged as a major cause of mental and physical diseases and its role is still reinforced by recent evolution in western lifestyles (Holmes and Rahe, 1967; Thoits, 2010; Dallman, 2010). Stress research remains however very recent in regard to over-two-thousand years of medicine history. Walter Cannon first linked the adrenal activity with major emotions and pain and discussed their role in animal life (Cannon, 1914). The contribution of Hans Selye’s to the elucidation of the role of the HPA axis in the stress response has also to be noticed. He introduced the concept of ‘diseases of adaptation’ to signify that if it is maintained for too long, the stress response may become detrimental to the organism (Selye, 1946). Since these early times, progresses in knowledge and instrumentation allowed significant advances in the understanding of stress mechanisms. The concepts of ‘allostasis’, ‘allostatic load’ and ‘stress response system’ were introduced and explored at both physiological and behavioral levels (McEwen and Stellar, 1993; Korte et al., 2005; Ellis et al., 2006). An ever-increasing number of molecules have been identified to play an active role in the neuro-symphony of stress (Joëls and Baram, 2009). Stress is also known to affect several generations of individuals through epigenetic mechanisms of which contribution to adaptation and evolution comes into question (Richards, 2006; Jablonka and Raz, 2009).

The causes of individual differences in stress responses remain a major challenge in the field despite the contributions of both genetic and environmental factors across the lifespan have been considered (McEwen and Stellar, 1993; Ellis et al., 2006; Semmer, 2003; Dolinoy et al., 2007). Most attention was however paid to the worthwhile elucidation of the elementary physiological processes triggered by stress exposure. Corticosteroid hormones were thus the subject of in-depth studies and are now considered as biomarkers of the stress level (Romero, 2004). Much less attention was paid to the mechanisms of stress perception and appraisal involving not only the autonomic nervous system (ANS) of individuals but their overall cognitive abilities (McEwen and Sapolsky, 1995; Henderson et al., 2012). We consider this state of fact as a major cause of our poor understanding of differences in stress responses (Engel, 1977).

This paper addresses differences in psychosocial stress responses from a systemic perspective based on intrapersonal conflicts. As member of a social species, each human being has a dual status of independent organism and of interdependent social group member. This duality is intrinsic to the human condition and constitutes a source of intrapersonal conflicts. As an external force applied to the individual functioning, psychosocial stress can act as a trigger or exhibitor of intrapersonal conflicts and its effects on human health are considered in this perspective. Stress-induced intrapersonal conflicts are highly-customized because of the influence of unshared environment and life experiences on brain development.

We propose to model the action of stress on human health by a two-step process; i) stress perception and appraisal and ii) response to actually perceived stress. We then argue that the relative degrees of interindividual variability of these two steps are different and propose a psycho-cognitive epidemiological approach that would correlate symptoms with actually perceived stress rather than with external stress exposure. Finally, the adaptive value of stress responses is questioned in light of the proposed intrapersonal conflict perspective.

INTRAPERSONAL CONFLICTS AS NATURAL HUMAN ATTRIBUTES

Internal conflicts appear naturally in complex structures made of sub-elements that become interdependent on each other despite potentially divergent interests. Such internal conflicts were successfully explored in different species and configurations (Trivers, 1974; Haig, 2006a; Del Giudice, 2012). The human species is exposed to such internal conflicts that exist at various levels, from the intragenomic level to the inter-community level. Those opposing
Figure 1. Different levels of human organization. Human beings exist simultaneously in both physiological and psychosocial spaces.

As depicted in Fig. 1, human functioning involves a cascade of three main organization levels: cellular, organismic and social. The figure emphasizes on the fact that human beings exist simultaneously within two distinct spaces; respectively physiological and psycho-sociological, whereas the cellular and social organization levels exist in a single space. This specificity of the organismic organization level is a source of intrapersonal conflicts opposing different dimensions of ourselves; i.e. solitary organisms versus interdependent social group members. The resulting solitary versus social duality was inherited from life evolution and exists in diverse social species. It is however paramount in the human species since we present the most sophisticated pattern of interindividual interaction. A formal acknowledgment of the existence of this solitary versus social duality can be found in the diverse meanings attributed to the word self: the immune self...
representative of our body and the psycho-cognitive self (PCS) representative for our embedded social identity. Some analogy with Dawkins’ distinction between the concepts of genes and memes could also be drawn (Dawkins, 2006).

From an evolutionary biology perspective, both solitary and social human characters can be related to an optimal rate of gene replication but to different extents however. In the solitary case, gene replication is only considered through individual’s survival and reproductive success as in the case of solitary animals. In the social case, the possibility of gene replication via the reproductive success of relatives is considered, the importance of individual’s survival and reproduction is thus decreased (Queller and Strassmann, 1998; Clutton-Brock, 1988). We have however to bear in mind that evolutionary biology applies to long-term statistics based on populations and that unadaptive options occur at the level of a single individual’s life. Furthermore, as described by Haig, adaptive solutions may lack in response to new kinds of environmental challenges (Haig, 2006b).

As the main regulation center of human beings, the human brain is the privileged locus of this solitary versus social duality. Our brain cumulates indeed two simultaneous but clearly different functions: i) As in our solitary animal ancestors, our brain is the systemic coordinator of cell activity ensuring the harmonious functioning of the whole organism. At this physiological level, individuals are expected to function to the best of their own interests as independent beings; i.e. driven primarily by survival and reproduction forces. ii) As members of a social species, our brain is also involved in the coordination of social interactions. At this psycho-sociological level, individuals are expected to function to the best of their own interests as social group members; i.e. favoring primarily subjective social-identity forces. At every moment of one’s life, his brain has to trigger the optimal regulation mechanisms to fulfill at best his dual function. This double responsibility of the human brain is the functional correlate of the solitary versus social duality discussed above. The interdependence of the different brain areas, especially the ANS and the CNS, is consistent with this brain function to match physiological and psycho-sociological processes with one another (Damasio, 2012). This dual function of the human brain is also consistent with the “Social Brain Hypothesis” that attributes the large brain volume of primates, especially that of the neocortex, to the wide social abilities that it provides (Dunbar, 1998; Adolphs, 2009).

One comment is necessary at this point: the word “brain” is used here with a generic meaning. This denomination hides the huge complexity of neurological processes, including for instance the fine interactions between the endocrine, immune and central nervous systems or gut-brain communications (Damasio, 2012; Edelman, 1992; Ader et al., 1995; Mayer, 2011).

DIFFERENCES IN PSYCHOSOCIAL STRESS RESPONSES

Psychosocial stress is unable to harm our body directly and its effects on human health are necessarily indirect; resulting from some kind of body response to the external adversity experienced. The effects of psychosocial stress on human health have thus to be considered as a two-step process as depicted in Fig. 2.

In regard to intrapersonal conflicts discussed previously, we may say that psychosocial stress challenges human beings only at the level of their subjective social identity. The first phase of stress action corresponds thus to stress perception and appraisal by the individual and produces the actually perceived stress. The latter can be described as the internal strain due to mismatch between the external context appraisal and the subjective expectations peculiar to the individual’s PCS. This stress perception and appraisal phase is acknowledged by Sapolsky’s words: It’s not just the external reality; it’s the meaning you attach to it (Sapolsky, 2004). If the perceived stress is intense enough, some subconscious internal adjustments may occur and thus trigger the
second phase of response to the stress perceived. The actual effects of psychosocial stress on human health result thus from this second step of response to the internally perceived stress.

If a second step of response to the perceived stress is actually triggered, two cases can be distinguished: i) If internal adjustments affect the individual only at the level of its social functioning, stress effects will concern its psychological and mental health with minor physiological changes only. ii) If internal adjustments affect the individual at the wider level of its organismic versus social balance, stress effects will step across the psycho-sociological / physiological barrier and physiological outcomes will also appear. In this case, the constraint applied to the social regulation function of the brain is so important that the physiological regulation function of the brain is also disturbed.

Differences in psychosocial stress responses can be addressed from the relative interindividual variability of these two steps of stress action on human health.

At the stress perception and appraisal stage, external stress exposure is appraised relatively to subjective representations peculiar to the individual’s PCS. Let’s discuss the degree of interindividual variability tied to the progressive elaboration of the individual’s PCS during childhood. In accordance with Mahler’s description of the psychological birth of the human child, the newborn’s separation-individuation process is progressive, spreads over several years, and starts only 4 or 5 months after birth for its first sub-phase (Mahler et al., 1975). The child’s relationship with his surroundings, especially with his mother as the main attachment figure, provides his first social experiences from which he builds his own representations of what he can expect from others and how to best answer their expectations (Swain et al., 2007). Brain development thus allows the construction of the child’s PCS as well as the acquisition of customized knowledge about the world through interactions with his caregivers (Fonagy et al., 2007). M. Small even asserts: Societies raise their children so that they grow into adults who behave in a way valued by that society (Small, 1998)\(^1\). The customized sociocultural knowledge thus accumulated

\(^1\) cited by Sapolsky (2004)
during childhood is structurally "written" in the synaptic networks which establish and reinforce continuously following selective processes (Edelman, 1992; Pascual-Leone et al., 2005; Toga et al., 2006). As such a result of a long elaboration process intertwining genetic data with unshared socio-environmental experiences, the individual’s PCS presents a maximal degree of interindividual variability.

We argue that the second phase of response to the perceived stress presents a lower degree of interindividual variability because of several reasons: i) Internally perceived stress states can be related to some kind of negative emotions of which number is not infinite (Ekman, 1992; Barrett, 2012). ii) The number of actual psychosocial stress effects on human health; either physiological or psychological, is also limited. iii) Causality links associating specific perceived stresses with particular body responses were sorted out by natural selection across evolution, thus decreasing the remaining number of active cause-to-effect paths.

We thus defend the hypothesis that even if both steps of stress effects on human health contribute to differences in stress responses, the first phase of stress perception and appraisal is subject to a higher degree of interindividual variability than the second phase of response to actually perceived stress.

**EPIDEMIOLOGICAL PROSPECTS**

**Toward psycho-cognitive epidemiology?**

The distinction of two successive steps in the action of psychosocial stress on human health as well as the hypothesis of a lower interindividual variability for the second phase of response to actually perceived stress offer new epidemiological prospects. With the aim to obtain increased correlation levels, the idea consists in addressing a single step of the stress action process at once; the most interesting one corresponding to the second phase of response to actually perceived stress.

New psycho-cognitive epidemiology protocols can thus be thought of to explore possible causality between perceived stresses and particular diseases. In this aim, the new tools for brain activity observation now available could be used to compare the brain activation of people suffering from one disease with respect to a control population in response to a set of stressful stimuli. This set of stimuli would be elaborated to trigger specific internal states (or feelings, or emotions such as fear, danger, disgust, disappointment, loss, abandonment, exclusion, etc.). The purpose of such studies is to look for actual correlations between a disease and particular internal states that would be more easily excited and with higher magnitude in affected patients than in the control group. Less expensive instruments able to quantify internal stress markers, for instance heart rate variability (Thayer et al., 2012), could also be used in such psycho-cognitive epidemiology studies.

A supplementary interest of the proposed psycho-cognitive epidemiological approach is to minimize the voluntary human implication in protocols and thus to avoid some subjectivity biases. We finally note that even if our hypothesis of a lower variability for the second phase of response to perceived stress is false, the fact to consider a single step of the stress action process instead of both is already sufficient to reduce the variability rate and thus to expect improvements in the eventual rates of correlation.

**Adaptive value of psychosocial stress responses?**

At every life instant our brain has to select and trigger the most appropriate set of regulation commands. In the face of stressful conditions, this function may become problematic and human dysfunctions can be questioned from such an adaptation perspective (Jablonka and Raz, 2009; Haig, 2006b; Nesse, 2000). The acknowledgment of the existence of solitary versus social
intrapersonal conflicts intrinsic to the human condition sheds a new light on these questions. Individual’s health is not the only purpose of the human brain but is put in balance with conflicting, subconscious and customized social expectations. Trade-offs partly detrimental to the body can thus be expected, especially in response to psychosocial stress that challenges our subjective social representations. A harmful stress response can thus be questioned as the most appropriate option internally selected by the individual’s brain; i.e. subconsciously appraised as the lesser-evil conflict-outcome. Such a surprising possibility has however to be considered in regard to the following evolutionary pitfalls:

  1) Recent transformations in western lifestyle induce new situations for which no adaptive solution was acquired by our ancestors. As D. Haig says: Without doubt, our current environment presents us with novel challenges for which we lack specific adaptations... Retirement planning is a recent innovation for which we are unlikely to have evolved dedicated mechanisms. Instead, we employ general-purpose problem-solving machinery to make plans that come into conflict with more hard-wired responses (Haig, 2006b).

  2) The human brain is a complex structure combining different sub-elements that appeared progressively and successively across life evolution. This slow increase in complexity allowed improvements in the perception of the outside world with ever more details and differences. This refinement capability is paramount in humans, especially because of language that allows us almost infinite degrees of differentiation and abstraction. The effects of psychosocial stress on human health involve these refinement capabilities in the reverse direction; from the neocortex to more ancient brain areas; i.e. from the finer to the coarser. The associated semiotic regression is a possible source of mis-adjustment as already pointed out eighty years ago by Korzybski (Korzybski, 1933). Recently, Eisenberger and Cole reviewed the neurological mechanisms linking social ties with physical health. They suggest that: threats to social connection may tap into the same neural and physiological ‘alarm system’ that responds to other critical survival threats, such as the threat or experience of physical harm. Similarly, experiences of social connection may tap into basic reward-related mechanisms that have inhibitory relationships with threat-related responding (Eisenberger and Cole, 2012).

These observations suggest that beside stress physiology, some kind of stress cognition is desirable to elucidate how meaning propagates across the different brain areas. This further step appears necessary to progress in our understanding of human responses to psychosocial stress in regard to evolutionary-inherited adaptation processes and despite the huge difficulty raised by the customization of stress perception and appraisal. This cognitive challenge is included in the more general issue of the role of information in adaptation and evolution (Danchin, 2013; Laland et al., 2014).

**SUMMARY**

We discussed differences in psychosocial stress effects on human health from a systemic perspective based on intrapersonal conflicts. Such intrapersonal conflicts were already reported in humans and Haig pointed out clearly that humans are at once rational, cultural and instinctive beings (Haig, 2006b; Campbell, 1975). The strength of the proposed approach lays on the distinction between the solitary and social characters of human beings. From an evolutionary perspective, this distinction corresponds to the transition from solitary animals; interacting with their environment only, to social species; of which members interact with both environment and fellows. We also consider the social function of the human brain and observe that individual versus group conflicts trigger intrapersonal conflicts. The latter are highly customized because of postnatal brain development.

The action of psychosocial stress on human health is represented by a two-step process:  

  1)
stress perception and appraisal and ii) physiological response to actually perceived stress. We defend the hypothesis that the first step is more affected by interindividual variability especially because of unshared experiences during childhood. This hypothesis is in accordance with growing evidence for developmental origins of human health and disease (Dolinoy et al., 2007; Gillman, 2005).

We finally outline the possibility for psycho-cognitive epidemiological studies correlating symptoms with actually perceived stress. The cognition challenge raised by the propagation of meaning across the different brain areas is also pointed out.

Conflict of interest
The author declares no conflict of interest.

REFERENCES


