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Mental stress; brain's complexity resolution dilemma

Abstract

Mental stress is a vague though familiar concept that accounts for an agency of the good, the bad and the ugly, which operates in beings as a result of exposure to environmental stressors; a life saver of various degrees, at its best, and cause of much mental anguish and the likely cause of costly physiological and psychological adversities, at its worst. While much is known about the physiologic processes that may ensue as results of enduring stressors, the underlying phenomenon for the engagement of the nervous system that triggers them has seemingly remained unknown. In this work we propose a hypothesis for the mechanism of the brain engagement, with stressors, delineating *sensation of stress* as the *mental perception of unease*, caused by intense (abnormal), resource taxing, operations of the brain which follows Beings exposure to uncommon or unexpected complexities; the stressors; Such engagements, being of computational nature, are brain's autonomous involvements in solving complexities; lasting long or taking a short while, depending on the availability of neuronal solutions (patterns): Being' familiar fight or flight response, to a physical threat, happens when the evolutionary readymade solution is executed; however, in cases where no immediate solution, to the perceived complexity, is available, or can easily be worked out, *continuous brain engagement* renders enduring or chronic *stress sensation*, while *adversely affecting the biologic systems due to abnormal neural triggers*. The schema presented in Figure 1 lays out brain's conceptual operational flow, for the development of mental stress, in the context of its computational complexity resolution/ solution procedures.

Keywords: Stress, Stressor, Neuronal Network, Computation, Schema, Homeostasis

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Jahan N Schad
Lawrence Berkeley National Laboratory (LBNL), University of California, USA

Correspondence: Jahan N Schad, PhD, Retired LBNL (UCB) Scientist, Lawrence Berkeley National Laboratory (LBNL), University of California, 376 Tharp Drive, Moraga, CA 94556, USA, Tel 925-376-4126, Email jaschadn@gmail.com

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Introduction

Mental stress in humans, on the face of it, is the perception of unease, of various degrees, in response to stressors, such as, threats, emotional, economic, socioeconomic and political instabilities, and other conditions- some due to geopolitical conditions and some emblematic of modern times- which create intense and/or difficult brain engagements. However, since such perception, besides serving as the alarm phase, could also be indicative of other, and often adverse, physiological effects, it has been the subject of much research since the early decades of last century.[1-5] These efforts, which have resulted in a vast body of the very valuable scientific findings, revolve around the physiological processes that *stressors prompt* in the biologic system; and how they affect its equilibrium, i.e., its homeostasis. But how the physiological processes are triggered through involvement of sympathetic nervous system and the HPA axis, as well as other systems- *the underlying cause of what can be considered the over-drive engagement*s of these systems- has seemingly escaped scientific scrutiny and remains unanswered; perhaps because it does not have much bearing on the medical treatments of the ensuing effects of sustained (chronic) stress sensation, and also mainly because much about the details of brain processing of sensory data has not been clearly figured out, though the role of the brain in perception of the world, and life as a whole, has been widely recognized since the enlightenment era; early 17th century. However progress, in last few decades, in understanding modus operandi of the brain, has led to further recognition of the fact that much of the brain operations are computational in nature: It is inferred that brain, and the rest of the nervous system, comprise extensive computational machinery that process all sense-relayed information; using its innate (evolutionary-formulated) instructions, imbedded in its constructs (as patterns), for analyzing events and creating perceptions. In the context of such idealization of the operation of the brain,[6] this work is an attempt to throw some light on the puzzle of stress; suggesting a mechanism for creation of its sensation, and the prompting of the physiologic effects.

Hypothesis

"This new science of mind is based on the principle that our mind and our brain are inseparable. The brain is a complex biological organ possessing immense computational capability: it constructs our sensory experience, regulates our thoughts and emotions, and controls our actions. It is responsible not only for relatively simple motor behaviors like running and eating, but also for complex acts that we consider quintessentially human, like thinking, speaking and creating works of art. Looked at from this perspective, our mind is a set of operations carried out by our brain. The same principle of unity applies to mental disorders". Eric R Kandel (Nobel Laurite); the New York Times, Sunday Review, Opinion Page (12/1/2013).

Computational neurosciences, as well as general consensus in all other related fields,[6-10] are in unison that, one way or other, brain does calculations, presumably along the lines of what is understood from the operation of today's computers, and yet in vastly more powerful, and in different ways; and it is the neuronal network of the brain that owns this advantage. The brain construct inspired scientific neural networks, which have demonstrated capabilities in solving complex problems, with no need for logical formalisms- unlike traditional digital computers that depend on it-, provide only glimpses into the brain's computational system. The extent of its operations, having to do with the (unconscious) maintenance of life on the one hand, and (mostly unconscious) management of beings interactions with the external world,[11] on the other hand, requiring engagement in resolution and solution (i.e., development of neuronal patterns) of unimaginable complexities they pose, are indicative of the power and immensity of the computational machinery of the brain, and the rest of the nervous system, understanding of which, despite massive scientific efforts, to gain detailed insights into its operation, and perhaps to mimic human knowledge and intelligence, will remain mostly, in the foreseeable future, the enigma it has ever been.

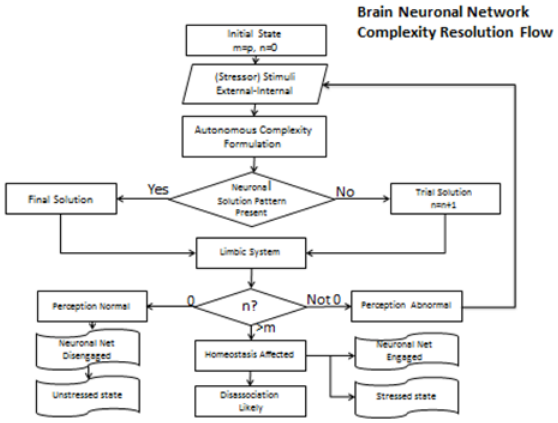

Figure 1 Conceptualization of Brain Computational Flow.

To sum up, this hypothesis suggests that it is the engagement of being's computational brain with the overall environment stressors, and the resulting disruption of its normal operations, that triggers body's improper physiological responses, which are ascribed to stress. The immediate response of the limbic system, which we are capable of feeling, defines perception of stress. Continued prompting of the rest of the systems, under such circumstances, instigates physiologic processes that ultimately adversely affect health and well being of stressed individuals.

However, based on what is learned initially from the operation of the scientific neural nets, and later from intense scientific research on the neuronal systems and nature of neurons' data communications, all summarized in the quote above, the complexity solution processes of the brain, would likely (autonomously) involve tow steps: First, an inherent implicit resolution (algorithmization) of complexities; and second, a trial-and- error solution approach deploying feedback from the rest of nervous system,[12] to render perceptions. Upon brain's exposure to complexity, autonomous attempts at solution begins; and depending on the intensity of the computational task, which can keep brain at bay, at times, creates what is felt as *stress sensation*, the perception of mental unease. Enduring *stress sensation* is very likely due the unavailability of proper existing solution neuronal patterns, or inadequacy of the topological resolution, a preamble to solution, both indicative of continued brain engagement.

Clearly, the power, capacity and readiness of the deployed gray matter, in processing of complexities- computational engagement of various neuronal net's modalities (sub-circuitries)-, are much in tune with the computational demands, defined by conditions "normal" to species natural environmental settings. This has hardly changed in humans, in spite of the complexities brought about during the eye-blink period of emergence of societal life, culture and civilization; only a couple of millennia long. As such, species brains in general, having evolved in the natural environment, are configured to handle natural life stressor complexities, and the allostatic load thereof, in orders to ensure their biological sustenance. The, neuronal pattern (solution) availability, allows them to grope along the evolutionary path of survival of the fittest. A well-known example of this work of nature is in the fight or flight response of species to a physical, or life threatening, exposure, which engages brain heavily, though generally temporarily, rendering perception of unease, that is, stress sensation, and on setting of the underlying physiological processes in the biologic system. While humans also expectedly benefit from such solution imprints, as neuronal patterns in their brain, they remain in very precarious situation; mostly unable to resolve the stream of complexities brought about by some of the earlier mentioned characteristics of the civilized life, specifically in the modern era, which burden their brains over and beyond its natural (evolutionary) computational capacity- on a continual basis. This situation could lead to irregular or incomplete solutions of pending problems; engaging brain for long periods, due to erratic physiologic feedbacks, thus creating enduring (chronic) stress sensation scenarios, possibly limiting brain processing power, which can hamper accomplishment of other brain regulated biologic system tasks, as well. Imbalance or disruptions in operations of brain explains perception of unease, or abnormal feeling, the sensation of stress, a natural alarm serving as a sign (a feeling biomarker- not to be confused with known biomarkers) indicative of possible physiological effects instigated by stressors.

It is certainly to be noted that all the elements of the biological systems, affected by the consequences of the nervous system abnormal signals, most probably have wide enough range of safe operations that can tolerate certain bandwidth of it; and, for sure, for short periods of the wrong instruction (commands) such signals may engender. However it is the continuation of the latter that wreak havoc in the body, possibly adversely affecting its immune system and it operations.

The overall schema of the hypothesis is shown in Figure 1. In this depiction, senses pick up (stressor) stimuli from internal and/ or external sources; and whatever complexity they represent is exposed to the neuronal net; a solution either final, or a trial one, is issued to the biologic system and its interfaces, wherein the latter case, due to improper feedback, a non-convergent operation loop continues, causing malfunctions in the physiological processes of the systems. It is also in the latter situation where a sizable portion of the computational capacity of the neuronal net is engaged, possibly impeding, and / or degrading, other needed operation, as results of which malfunctions of biologic entities, or mental abilities, can occur. The well-known phenomenon of psychological disassociation is perhaps due to limited capacity of the thought Interface,[12] as it is overwhelmed with continued downloads of new perceptions. The proposed schema may have other implication in related fields of Sciences and Humanities.

Conclusion

Role of mental stress in being's lives, specifically among humans, has always been recognized and much understanding of its physiological impact on health and well being of individuals has been gained through rigorous research conducted since the early decades of the last century. However, the mechanisms by which physiological processes are prompted to affect the biologic system, as well as rendering of stress sensation, have escaped scientific scrutiny; perhaps partly due to the fact that it would not have had any impact on *medical addressing* of problems which are ascribed to stress.

This work suggests a plausible theory, in the context of brain's computational complexity resolution and solution apparatus, formulated in a schema, which clarifies development of sensation of stress, and suggests the triggering mechanism for the onset of the physiological processes, which may ensue perception of stress- mostly known and some recently claimed.[13]

Such understanding supports the long standing believes in the Mind-Body relationship!

Author's information

Author is a UC Berkeley PhD graduate in Engineering Sciences, and an early retiree of Lawrence Berkeley National Laboratory, with 30 years of experience in applied physics simulations involving multi

phenomena computations. He has authored and co-authored 50+ peer reviewed publications. Present work is the result of his long held keen interest and study in the fields of philosophy, psychology, cognition, neural computation, artificial intelligence, and evolutionary biology.

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None.

Conflicts of interest

None.

References

1. Selye H. Stress and disease. *Science*. 1955;122(3171):625–631.
2. Dantzer R, Kelley WK. Stress and immunity: an integrated view of relationships between the brain and the immune system. *Life Sci*. 1989;44(26):1995–2008.
3. de Kloet ER, Joëls M, Holsboer F. Stress and the brain from adaptation to disease. *Nat Rev Neurosci*. 2005;23(6):463–475.
4. Sapolsky RM, Krey LC, McEwen BS. The neuroendocrinology of stress and aging: the glucocorticoid cascade hypothesis. *Endocr Rev*. 1986;7(3):284–301.
5. Sapolsky RM. *Stress in The Wild*. Sci Am. 1990;262(1):106–113.
6. Arbib AM. *The metaphorical brain 2, neural network and beyond*. John Wiley & Sons, New York, USA. 2009.
7. Juyang W. Natural and Artificial Intelligence: *Introduction to computational brain*. BMI Press, USA. 2012.
8. Edelman G. *Neural Darwinism*: The theory of neuronal group selection. Basic Books, New York, USA. 1987.
9. Bostrom N. Are You Living In a Computer Simulation? *Philosophical Quarterly*. 2003;53(211):243–255.
10. Kandel ER, Schwartz JH, Jessell T. Principles of Neurosciences. (4th edn), McGraw–Hill, New York, USA. 2000.
11. Mlodinow L. *Subliminal*: How your unconscious mind rules your behavior. Pantheon Random House, New York, USA. 2011.
12. Schad J. Unraveling of Perceptions; Vision and Thought, the Brain Computational Outputs at the Motorsensory Neural Interface. Journal of Hypothesis. [Article under Review]. 2015.
13. Schad JN. Stress caused adverse entanglement of the nervous and immune systems: a case for MS. *Med Hypotheses*. 201380(2):156–157.