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Critical Appraisal of Neurozone®'s Framework for Enhancing Resilience and 'Unlocking High Performance'

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Neurozone®'s core offering is the provision of ways to simultaneously prevent burnout, build resilience, and unlock the capacity for high performance—as backed by established, up-to-date neuroscientific research. This paper consults interdisciplinary literature and scientific evidence to explore the claims of and theoretical premises underneath this offering. In particular, the following require explication: (1) Neurozone®'s conceptualizations of resilience, burnout, and high performance and how they relate (or not) to each other, (2) the psycho-behavioral factors that have been demonstrated to enhance or diminish both resilience and the capacity for high performance, and whether the Neurozone® system adequately addresses them, and (3) the neuroanatomical mechanisms supporting Neurozone®'s perspective on the nature of the system of the embodied mental apparatus, so as to account for points (1) and (2). In order to stand on strong conceptual legs, these three elaborations should align with existing evidence, exhibit internal consistency, and offer up testable hypotheses (Shaw & Costanzos, 1982). This paper concludes that, ultimately, they do.

Concepts and their Relations: Resilience, Burnout, and 'High Performance'

Various definitions of **resilience** amount to one broad conceptualization: the capacity to cope successfully in the face of stressors or adversity (Miceli et al., 2021; Murali et al., 2018; Oken et al., 2015; Southwick et al., 2014; Tabibnia, 2020; Tabibnia & Radecki, 2018; Wu et al., 2013; Yao & Hsieh, 2019). Successfully coping with stressors carries two interpretations, which Miceli et al. (2021) call 'absorption' and 'adaptation'. Regarding absorption, the human system 'bounces back' to arrive at and maintain the same state of functioning it was in before it encountered the stressor. With adaptation, the system actually learns and evolves in the process of recovering from the encounter and 'bounces forward', becoming more adept at facing future changes. Neurozone® takes both interpretations into account. In the development and validation of their Resilience Index (van Wyk, Lipinska, et al., 2022), the authors conceptualize resilience as a capacity to restore healthy functioning after encountering stressors (absorption) and, in the process, to enhance the resources with which to deal with future stressors (adaptation).

Because encountering stressors is built into the definition of resilience, it follows that a resilient system is one that is more robust against the development of stress-related physical and mental illnesses (Ask et al., 2018; Oken et al., 2015). Indeed, some authors (e.g., Tabibnia, 2020; Tabibnia & Radecki, 2018) posit that indicators of resilience include higher subjective quality of life and wellbeing, physical and psychological health, and longevity. In accordance with this, Neurozone® (2017) firstly demonstrated that their measure of resilience correlates significantly and negatively with an indicator of physiological stress: stable blood levels of cortisol, the major stress hormone (Oken et al., 2015). Secondly, the concurrent and incremental validity testing of their Resilience Index revealed that the measure also correlates significantly in the negative with established measures of trait anxiety, posttraumatic stress disorder, depression, and sleep disruption (van Wyk, Lipinksa, et al., 2022). Neurozone®'s valid and reliable measure of resilience thus evinces a dependable relationship with these physical and psychological health states.

One negative health state resulting from chronic stress exposure is the syndrome of **burnout** (Maslach et al., 2001). Although the opposite of burnout is not resilience but engagement (Maslach et al., 2001), resilience has demonstrated a strong negative association with burnout and can be regarded as a protective factor against it (Murali et al., 2015; Rushton et al., 2015).

While the Neurozone® assessment does not use the Maslach Burnout Inventory (MBI) itself—a robust and highly popular burnout measure—it has formulated its own questions around the three key features of the burnout syndrome: exhaustion, inefficacy, and cynicism (Maslach et al., 2001). Therefore, this burnout measure is able to be tested and compared statistically both to the MBI and to the Resilience Index. Moreover, the Neurozone® assessment asks its takers to report on their levels of engagement at work, and so this 'opposite' of burnout can be included in tests of statistical and conceptual congruence.

Conceptually, the condition of burnout is antithetical to the capacity to perform highly both at work and in one's personal life (Maslach et al., 2001; Murali et al., 2018). Thus, it follows that lowering an individual's risk for burnout may increase the likelihood that they 'unlock high performance' (i.e., increase their capacity to perform highly in a holistic sense), as Neurozone® claims. Put differently, enhancing an individual's resilience may strengthen their ability to perform highly in all areas of life (Sarkar & Fletcher, 2014). This raising of one's holistic performance levels is synonymous with the construct of thriving (Sarkar & Fletcher, 2014).

According to Brown et al. (2017), **thriving** represents a capacity to "grow or develop well and vigorously, and… [to] prosper and be successful" (p.167). Put differently, thriving is *"the joint experience of development and success"* (p. 168, emphasis in original). This builds on previous work by Spreitzer et al. (2005) and Porath et al. (2007) who conceptualize thriving as entailing a subjective (psychological) sense of vitality and learning. According to Brown et al. (2017), these factors may only reflect the "development" component of thriving, hence these authors' incorporation of the sense of achievement into it.

What is striking about other explanations of thriving is that they seem to include the concept of resilience. For example, Spreitzer and Sutcliffe (2007) described thriving organizations as those with a "capacity to cope with obstacles, challenges, setbacks, and failures and to persist in their efforts" (p. 81). As another example, Kleine et al.'s (2019) review led them to define individual thriving as "a dynamic process of adaptation to physical, psychological, or social adversity, leading to positive outcomes such as personal growth and enhanced functioning" (p. 973). Some core components that they identified as enabling thriving include a sense of self-efficacy and a positive affective orientation—which are not unlike two core components of the Resilience Index: Positive Affect and Stress Mastery (whereby overcoming stressors improves one's sense of self-efficacy; van Wyk, Lipinska, et al., 2022). In fact, Sarkar and Fletcher (2014) posit that resilient qualities are essential components for one to thrive in pressured contexts.

However, it would be incorrect to state that resilience and thriving are the same thing (Brown et al., 2017). It is clear from the above explanations that thriving includes both the absorption and adaptation aspects of resilience, but while these are necessary, they are not sufficient for thriving (Miceli et al., 2021). What differentiates the two is, firstly, that thriving places a key emphasis on an "elevated level of functioning" (Brown et al., 2017, p. 169), and "moving beyond homeostasis" (Epel et al., 1998, p. 302), and so it particularly indicates a highly optimized or upper end of the adaptional/learning aspect of resilience (Sakar & Fletcher, 2014). Secondly, encountering a stressor or adversity is integral to demonstrating resilience, but it is not necessary in order to experience thriving (Brown et al., 2017; Kleine et al., 2019; Spreitzer et al., 2005). It is indeed possible to thrive in the aftermath of adverse experiences—and in such cases, a good degree of resilience has been shown as necessary for this transition (see Brown et al. (2017) for reviews)—but it is equally possible to move into a thriving state when confronting an opportunity, without encountering setbacks.

Still, there are other features of 'thriving' that resemble those of resilience. For one, the vitality aspect of thriving also correlates negatively with mental illnesses such as anxiety and depression, as well as with physical illness or adversity (Miceli et al., 2021). For another, it is possible to thrive in one domain of life but not another (e.g., professional but not personal life; Brown et al., 2017; Epel et al., 1998; Miceli et al., 2021). This is also true of resilience (Southwick et al., 2014), and was acknowledged in the development of the Resilience Index (van Wyk, Lipinska, et al., 2022). Furthermore, Sarkar and Fletcher (2014)—who investigated the relationship between resilient qualities and thriving among high performers from diverse professions—claim that "resilience is a pivotal capacity not only for individuals reacting to potentially traumatic events, but also for those who choose to operate in demanding environments" (p. 48). They found support for Coutu's (2002, p. 47) assertion that "a person's level of resilience will determine who succeeds and who fails"—in other words, will determine the size, availability, or '(un)lockedness' of their capacity to perform highly.

From the above conceptual overlaps, it is therefore quite possible that an increase in resilience, as measured by the Resilience Index, will correlate with an increase in the capacity to perform highly, or thrive. This could be tested, in part, by comparing scores with Porath et al.'s (2007) thriving measure—bearing in mind it does not tap into the success component of thriving (Brown et al., 2017). Yet, promisingly, Neurozone® has also demonstrated that higher resilience correlates significantly with higher success among university students (van Wyk, Mason, et al., 2022).

Thus, it appears *not unsound* that resilience and the capacity for high performance—synonymous with that for thriving—may increase or decrease in tandem (and in a negative relationship with burnout risk) in the Neurozone® system. The whole dynamic may best be represented by the Venn diagram in Figure 1 below:

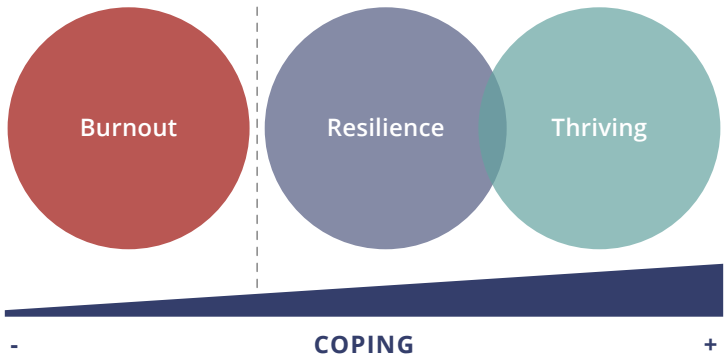

Figure 1:
Relationship between Burnout, Resilience, and Thriving

A positive (rightward) trajectory in this relationship may in part be dependent on whether the user makes use of the psycho-behavioral recommendations that the Neurozone® system offers for enhancing resilience and unlocking high performance (or thriving). The next section reviews the research identifying these behavioral areas for each respective term, so as to more deeply assess the extent of their overlap.

Psycho-behavioral Recommendations for Enhancing Resilience and the Capacity for Thriving/High Performance

Both resilience (Tabibnia, 2020; Tabibnia & Radecki, 2018) and thriving (Brown et al., 2017; Kleine et al., 2019) can be enhanced through the adoption (or reduction) of certain behaviors, psychological states or traits[1], and environmental conditions. A non-exhaustive list of learnable factors that enhance resilience is provided in Table 1, while a similar list for learnable factors that enhance thriving is provided in Table 2.

Table 1:
Learnable Factors that Enhance Resilience

Factors	Authors
Agentic capability (e.g., active coping, self-efficacy, sense of control)	Steinhardt and Dolbier (2008); Tabibnia (2020); Tabibnia & Radecki (2018)
Cognitive reappraisal (e.g., a threat into a challenge, the negative into the more positive, a fixed mindset into a growth mindset)	Epel et al. (1998); Southwick and Charney (2012); Tabibnia (2020); Tabibnia and Radecki (2018); Yao & Hsieh (2019)
Emotion regulation (incl. emotion disclosure and affect labeling)	Hemenover (2003); Tabibnia (2020); Tabibnia and Radecki (2018)
Stress inoculation (i.e., exposure to a manageable amount of stress which 'toughens up' the system)	Epel et al. (1998); Oken et al (2015); Southwick and Charney (2012); Tabibnia (2020); Tabibnia and Radecki (2018)
Cultivating positive affect (e.g., optimism, gratitude, cognitive bias modification)	Alexander et al. (2021); Oken et al. (2015); Tabibnia (2020); Tabibnia and Radecki (2018); Yao and Hsieh (2019)
Promoting physical health (e.g., optimal sleep, nutrition, exercise)	Nagahara and Tuszynski (2011); Tabibnia (2020); Tabibnia and Radecki (2018)
Social connectedness (particularly incl. supportive and meaningful relationships)	Brown et al. (2017); Kleine et al. (2019); Niessen et al. (2012); Spreitzer et al. (2005); Spreitzer and Sutcliffe (2007)
Mindfulness (incl. mind-body focus, present awareness, transcending the self)	Creswell and Lindsay (2014); Oken et al. (2015); Tabibnia (2020); Tabibnia and Radecki (2018)

1 According to Oken et al. (2015), 'state' and 'trait' are distinct from one another only artificially, on the grounds that they merely indicate different points on the timescale of presence of an attribute influencing the system (shorter and longer, respectively). We use them together though not quite interchangeably to account for the contention over their distinctness.

Table 2:
Learnable Factors that Enhance Thriving

Factors	Authors
Agentic capability (e.g., sense of control, self-efficacy)	Epel et al. (1998); Brown et al. (2017); Kleine et al. (2019); Sarkar and Fletcher (2014)
Cultivating positive affect (e.g., optimism, hope)	Alexander et al. (2021); Brown et al. (2017); Kleine et al. (2019); Sarkar and Fletcher, (2014); Spreitzer et al. (2005); Spreitzer and Sutcliffe (2007)
Social connectedness (e.g., trust and attachment; support in personal and professional life)	Brown et al. (2017); Kleine et al. (2019); Paterson et al. (2014); Sarkar and Fletcher, 2014; Spreitzer et al. (2005); Weine et al. (2013)
Learning (incl. staying current with knowledge, being creative, being curious/ explorative)	Brown et al. (2017); Kleine et al. (2019); Niessen et al. (2012); Sarkar and Fletcher, (2014); Spreitzer et al. (2005); Spreitzer and Sutcliffe (2007)
Internal drive for mastery (e.g., intrinsic motivation, autonomy, proactivity)	Benson and Scales (2009); Brown et al. (2017); Kleine et al. (2019); O'Leary and Ichovics (1995); Sarkar and Fletcher, (2014); Spreitzer et al. (2005)
Organizational encouragement (e.g., organization-wide support, empowering and transformative leadership, collective learning and information sharing)	Brown et al. (2017); Kleine et al. (2019); Paterson et al. (2014); Spreitzer and Sutcliffe (2007)

Comparison between the factors in the Tables lends further credence to the partial overlap between resilience and thriving as identified by their conceptualizations (and as represented by Figure 1). At their point of overlap, resilience and thriving are both enhanced, firstly, by a sense of agentic capability, a term deployed here to encompass things such as a healthy sense of self-efficacy and control over one's environment. In Table 1, 'active coping' is included, which refers to making use of psycho-behavioral strategies to confront a stressor directly so as to minimize or recover from its disruptive impact (Steinhardt & Dolbier, 2008). Active coping may not be mentioned in the thriving literature because it deals with stressors specifically, and hence is pertinent to resilience-building but not essential to the cultivation of thriving (Brown et al., 2017).

Secondly, both resilience and thriving—and wellbeing in general (Alexander et al., 2021)—are enhanced by the strengthening of social connectedness and support. Thirdly, they are both increased by the cultivation of positive affect, such as optimistic and grateful outlooks. Related to cultivating positive affect is the strategy of emotion regulation. While this is listed

by several authors as a key factor for enhancing resilience, Judge et al. (2004) and Kleine et al. (2019) explain that a robust degree of emotion regulation improves one's core self-evaluations, and in this way enhances one's capacity for thriving. The latter authors also emphasize that making use of challenge appraisals—as opposed to threat appraisals—increases the likelihood of thriving, and so they draw ties to the 'cognitive reappraisal factor' that enhances resilience, too.

In their (seemingly) non-overlapping areas, the factors that enhance resilience and thriving are related to components unique to their respective definitions. For resilience, that component is increasing the capacity to deal well with stressors. Hence, Table 1 lists the following:

- stress inoculation, since stress has a U-shaped utility for a biological system in which some stress is better than too much or none at all (Oken et al., 2015). However, Sarkar and Fletcher (2014) also identified stress inoculation practices—such as actively pursuing challenging situations—as enabling higher performance/thriving.
- cognitive reappraisal techniques (and cognitive bias modification) which focus on reinterpreting negative events in a more positive light (or reducing the tendency to over-attend to negative features of an ambiguous event). It is well-noted that the subjective evaluation of an event (as negative or positive) has not just a bearing on a person's physiological state (Epel et al., 1998) but is also more predictive of their wellbeing outcomes following the event than the objective nature of the event itself (Oken et al., 2015).
- physical health improvements, such as through optimal sleep, nutrition, and exercise. Sleep assists with the maintenance of various physical (e.g., metabolic) and psychological (e.g., emotionally regulative) processes, and both dietary restriction and exercise can increase the production of brain-derived neurotrophic factor, which tends to boost neurogenesis, neuroplasticity, learning, stress regulation, and longevity (Nagahara & Tuszynski, 2011; Tabibnia & Radecki, 2018). Moreover, Thurgood (2019) posits that these physiological factors optimize the energy that is the key to maintaining high performance.
- mindfulness exercises, since these help provide biofeedback that decreases (especially negative) emotionally activated states and increases the ability to return to baseline following a stressor (see Tabibnia & Radecki (2018) for a review).

For thriving, the unique component relates to the subjective senses of development (learning, vitality) and success. Hence, Table 2 lists the following:

- learning on both an individual and collective/organizational level, including the capacities for innovation (creativity) and collaboration (information-sharing).
- internal drive for mastery, such as having intrinsic motivation, a good sense of autonomy, and proactivity (an approach-to-challenge orientation; Kleine et al., 2019; Sarkar & Fletcher, 2014). Note that the 'energy' related to this internal drive resembles the positive affective charge entailed in vitality (Spreitzer & Sutcliffe, 2007).
- organizational encouragement, which includes support from leadership and the organization at large that enables an employee to drive the development of their own competencies (Kleine et al., 2019).

Regarding the Neurozone® system, the psycho-behaviors that are recommended to improve resilience and unlock high performance encompass all of the above factors. Table 3 provides a sample of these recommendations, arranged by the categories (called 'High Performance Domains') that they fall into in the current Neurozone® system.

Table 3:
A Sample of the Neurozone® System's Assessed and Recommended Psycho-behaviors

'Domains'	Examples of (Types of) Behaviors and Constructs
Rhythms	Nutrition-, sleep-, mindfulness-, & exercise-related constructs
Connectors	Trust, identity, meaning, & belonging in personal and work life
Energy	Optimism, gratitude, & negative thought pattern reduction
Transformers	Social and cognitive diversity, emotion regulation, & fear filter
Innovators	Executive function, divergent thinking, & daydreaming avoidance

Note, firstly, that these categories/Domains are intended as a parsimonious framework with which a user can organize how the vast collection of psycho-behaviors relate to one another. The Domains do not claim to have distinctions based on neuropsychological nomenclature or statistical derivation. Note, secondly, that this document does not assess the comprehensive list of recommendations in the Neurozone® system, but instead only addresses as many as necessary to appraise the key points of the framework.

Moving left to right through the positive coping section of Figure 1 takes a similar direction to reading Table 3 from top to bottom. The Rhythms Domain focuses on resilience-enhancing factors, since they encompass the physical health-related recommendations (sleep, nutrition, and exercise) as well as mindfulness practices. Then, the Connectors, Energy, and Transformers Domains capture both resilience- and thriving-enhancing factors. Connectors involve the optimization of social connectedness and support in both one's personal and professional life (on team and organizational levels). The Energy Domain recommendations focus on factors that increase positive affect, subjective sense of reward, and even internal drive, as well as on those that downregulate negative affect (Tabibnia, 2020; Tabibnia & Radecki, 2018). Transformers include perspective-adjusting (and thereby stress-moderating) factors such as emotion regulation and 'fear filter' (a recommendation similar to cognitive bias modification). They also include recommendations which result in increased appreciation of social and cognitive diversity, thereby improving cultural competence and information-sharing, which enhance thriving at work (Brown et al., 2017; Sarkar & Fletcher, 2014). Finally, recommendations in the Innovators Domain focus on the enhancement of thriving through the optimization of learning and creative problem-solving skills (Tabibnia, 2020).

The Neurozone® system therefore accounts for recommendations that have separately been evidenced as improving both resilience and thriving. Taking it further, the data Neurozone®

has been collecting may point to an even greater surface area of overlap between thriving and resilience. This is because all of the psycho-behaviors that Neurozone®'s comprehensive assessment recommends to its users are demonstrating significant statistical correlations (in some cases, predictions) with increases on the Resilience Index. This is true even for those psycho-behaviors which, as explored above, have only been demonstrated and argued to improve thriving, not resilience.

Additionally, the Neurozone® system makes use of other techniques that can facilitate the enhancement of resilience. For one, the provision of neuroscientific explanations of psychological phenomena (which Neurozone® does for its users) makes adoption of behavioral change more likely (Tabibnia & Radecki, 2018). For another, the Neurozone® system provides commendations (i.e., indication of which psycho-behaviors correlating with resilience the user is already doing well) alongside recommendations. Provision of commendations may serve as empowering attempts to support or highlight the user's self-efficacy. Further, it could be said that the Neurozone® system encourages a users' senses of control and autonomy by providing them with choice—not prescription—among their list of recommended psycho-behaviors. Indeed, Neurozone® emphasizes flexibility and the user's personal preference on their journey to building their resilience and unlocking their high performance (or capacity to thrive). These core principles underlying the Neurozone® system—flexibility, overlap, and neuroscientific insight—are explored further in the final section below.

Neuroscientific Support for Neurozone®'s Perspective on the Embodied Mental Apparatus

Neuroanatomical Mechanisms Underlying Resilience and Thriving

Bearing in mind that, as a concept, resilience refers to successfully coping with stressors, it follows that the neurological structures and mechanisms underlying resilience are those involved with the successful regulation of neurophysiological stress responses. In broad brushstrokes, resilience appears to reflect a balance in (or optimal relations of) activity between prefrontal cortical structures underlying higher-order, deliberative, reflective functions and subcortical (limbic) and autonomic structures underlying instinctual, spontaneous, reflexive functions (Oken et al., 2015; Tabibnia, 2020; Tabibnia & Radecki, 2018; Yao & Hsieh, 2019). Tabibnia and Radecki (2018) refer to these as the C-system and the X-system (refleCtive and refleXive) respectively, but in this paper (as explained in the next subsection), they are rather dubbed the C- and X-*sub*systems.

When encountering a stressor, the X-subsystem prompts a fast, fight-or-flight (fear) response via the autonomic (particularly sympathetic) nervous system and amygdala as well as a slower, cortisol-releasing (stress) response via the hypothalamic-pituitary-adrenal (HPA) axis (Oken et al., 2015; Tabibnia, 2020; Tabibnia & Radecki, 2018). The prefrontal cortex (PFC) provides top-down regulation of these structures to reduce their over-reactivity. It also facilitates learning related to these stressors so as to optimize responses to them in future (Oken et al., 2015). However, when the fear and stress responses are chronically (over)activated, it can lead to cell death in the PFC, compromising its cognitive and affective regulatory functions (Lupien et al., 2009). In fact, prolonged stress and fear activation also leads to abnormal cell growth in the amygdala (further heightening fear responses), damage to hippocampal neurons (impairing memory), and the development of physical (e.g., endocrine, immune, cardiovascular)

impairments and mental illnesses (e.g., depression, anxiety, PTSD; Oken et al., 2015; Tabibnia, 2020; Tabibnia & Radecki, 2018). Relatedly, Ask et al. (2018) propose that low trait prefrontal activity results in quicker cellular degeneration associated with dementias.

Thus, when the X- and C-subsystems are disproportionate in their activity (the X-subsystem is overactive and the C-subsystem is underactive), it decreases resilience and leads to a gradual implosion of the biological system. To prevent overactivation of the X-subsystem, the organism must return to its baseline relaxed physiological state as quickly as possible after its initial perturbation brought on by the appearance of a stressor (Oken et al., 2015). Resilience can also reflect that the organism does not too easily get moved out of this baseline state when facing stressors to begin with. According to Oken et al. (2015), the baseline state is not static but is rather a moving target. This is because the external and internal environmental shifts that occur for each organism over time adjust the parameters by which that organism needs to recalibrate to maintain homeostasis. The Neurozone® system uses these insights in its explanations of resilience as a dynamic state that requires continual reassessment.

Moreover, the Neurozone® system also makes use of the fact that there are many behavioral interventions that can strengthen the remain-in/return-to baseline prerequisite for resilient functioning. According to Tabibnia (2020), these kinds of strategies naturally include those that downregulate overactive fear and stress networks, but also those that upregulate an underactive reward network (boosting positive affect) and that modulate the activity of the default mode network (reducing rumination that can occur during task-less cognition). A more thorough explanation of how these interventions act on the neuroanatomical mechanisms of resilience is provided in the last subsection. What is important to note here is that thriving or 'high performance' seems to be supported by mechanisms similar to those outlined by Tabibnia (2020).

In particular, thriving is also enabled by decreasing the influence of stressors, or downregulating the fear/stress networks, in tandem with increasing motivating, positive affect, or upregulating the reward networks (Alexander et al,. 2021; Kleine et al., 2019; Spreitzer et al., 2005). These probably reflect enhancement of the vitality aspect of thriving and contribute to the subjective sense of success. It is also noted that increasing levels of cognitive control—as undergirded by the PFC—is necessary to improve performance on daily tasks (Alexander et al., 2021) and to enable psychological thriving (Epel et al., 1998). These PFC-related boosts are probably implicated in thriving's learning component, and perhaps also thriving's more objective focus on task-based success. It therefore seems that resilience and (the capacity for) thriving not only partially overlap regarding their conceptual definitions and behavioral interventions, but also their structural and functional brain mechanisms. It is thus Neurozone®'s contention that the terms do not—indeed, cannot—represent entirely distinct entities. This axiom of ultimate inseparability is further explained in the next, ontologically critical section.

The Importance of a Non-Dualist Perspective on the Brain

Although some authors might imply that two 'systems' of brain operation exist—almost as if these systems are separate entities (e.g., the X- and C-system; Tabibnia & Radecki, 2018)—Keren and Schul (2009) caution against such dualistic models of the brain. One criterion they outline for soundly establishing the distinctness of two systems is whether the characteristics that define each system truly exist as alienable, dichotomous features. Is it really the case that only the X-system operates unconsciously, automatically, and with emotional infusion

while only the C-system operates consciously, deliberatively, and with emotional diffusion? Are they really antagonistic systems (or characteristics), so that when one (set) is active, the other is not?

The authors provide compelling evidence against this proposition. Consider that through practice and learning, performance which is at first quite controlled and conscious can become more automatic and unconscious over time (for example, driving a car). The characteristics of "controlled" and "automatic", and of "conscious and unconscious", are not dichotomous, mutually exclusive options but rather represent points on a continuum (Keren & Schul, 2009). Even if these characteristics or systems share a third space (i.e., an associative network) where the cross-over occurs, that would not meet another criterion for a dualistic model: that the systems are isolable from each other (Keren & Schul, 2009).

Isolability requires that if one system should fail, the other system's functionality would not be compromised. The visual and auditory sensory systems exhibit this isolability (and brain localization): if sight (in the occipital cortex) goes, sound (in the temporal cortex) is not impacted, and vice versa. However, given resilience's functional assignment of monitoring the internal and external environment to respond to stressors in optimal ways, it is not the case that the C-system would function well without the X-system, or vice versa, to accomplish that assignment (Keren & Schul, 2009).

Hence the rephrasing here of "X" and "C" as *sub*systems, because they are actually in the service of a single hybrid, dynamic, multidimensional mental machine (Keren & Schul, 2009). Further evidence for a hybridization of the two subsystems exists. Eitam et al. (2008) provide empirical demonstration of 'automatic goal pursuit', which combines flexible intentionality with unconscious monitoring—in other words, characteristics of the C- and X-subsystems (respectively). Moreover, Feldman Barrett et al.'s (2007) review posits that conscious processes ('belonging' to the C-subsystem) can alter the subjective experience of emotion ('belonging' to the X-system). Alexander et al. (2021) also remind us that singular brain structures cannot be considered inherently detrimental to resilience if active: for example, the amygdala does not only facilitate fear activations but reward ones too. Therefore, it is not that there are two separable systems responsible for resilience-enabling or -hindering processes. Rather, the highly complex but unitary mental apparatus shifts mental states and levels of awareness as it deals with different tasks, circumstances, and constraints (Keren & Schul, 2009; Yao & Hsieh, 2019).

Moreover, there is compelling evidence that decision-making—of both the adaptive (resilient) and occupational performance (workplace thriving) kind—is influenced by neural complexes *other than the brain*. According to Soosalu et al.'s (2019) review, these are the intrinsic cardiac neural plexus and the enteric neural plexus—or "heart brain" and "gut brain", respectively. These have been called separate "brains" because their highly complex neural circuitry allows these organs to operate independently of the cranial brain. Additionally, the authors collate research identifying the bottom-up influence of these two abdominal "brains" on many higher order mental processes—some of which appear germane to resilience and thriving. For example, gut-based neural activity has been identified as a key afferent indicator of physiological stress and fear (Meyer, 2014; Riezzo et al., 1996), and so gut-brain health may influence biological resilience. Also, low heart-brain interoceptive emotional awareness (and sole reliance on cranial-brain deliberative reasoning) begets greater unethical conduct and lower altruism (Zhong, 2011), thereby compromising social safety and collaborative success.

It was also initially believed, according to Sosalu et al. (2019), that decision making could be represented by a dual-process, dichotomous model. In it, *either* deliberative reasoning (supported by the C-subsystem) or intuitive, experiential processing (supported by the X-subsystem) were regarded as responsible for the making of a decision. Another shortcoming: the heart brain and gut brain were conceptually conflated in these models' accounts of intuitive processing, despite the structural and functional distinctness of these abdominal brains (Soosalu et al., 2019). However, per the above review, up-to-date neuroscientific research indicates that the decision-making process is neither dual (because influenced by at least three distinct neural complexes) nor mutually exclusive (because all three provide ongoing bidirectional signals through the central nervous system). Indeed, though separate, the neural systems of the head brain, heart brain, and gut brain are "interconnected and interdependent" (Soosalu et al., 2019, p. 5).

This elaboration has been necessary to account for some of Neurozone®'s postulations. For example, Neurozone® talks about "the brain-body system" (a singular unit), thus acknowledging that (1) subsystem hybridity exists even on a more macroscopic layer, as systems science perspectives advocate (Yao & Hsieh, 2009), and (2) the neural networks involved in resilience and thriving may not be confined to the cranium (Soosalu et al., 2019). Neurozone® also recommends its users put faith in the brain's "unconscious problem-solving" ability (a phrase that combines features of X- and C-subsystems). Another recommendation is that users bring embodied, interoceptive awareness to their initial reactions in mindful ways, so as to respond more optimally—a recommendation aligned with the possibility of consciously influencing automatic emotional experience (Feldman Barrett et al., 2007) and with the importance of paying attention to heart (emotional) and gut (intuitive) signals (Soosalu et al., 2019).

Neurozone® therefore demonstrates empirical and theoretical backing on not just the neurological mechanisms underlying resilience, but also on the very nature of the system in which those mechanisms operate. As finally explored below, Neurozone® further reflects its accordance with established science by highlighting the neuropsychological interconnectedness of resilience-enhancing behavioral recommendations.

'Everything Affects Everything': Interventional Interconnectedness

Given that there is elaborate interconnectedness and various bidirectional influence between the X- and C-subsystem structures involved in resilience processes, it follows that the vast array of behavioral interventions recommended to enhance resilience, however different, should all recruit some of those structures in some way. There is evidence that certain recommendations recruit one subsystem. For example, exercise has been found to boost plasticity and connectivity in the hippocampus (Nagahara & Tuszynski, 2011), and gratitude tends to enhance activity of the medial prefrontal cortex (mPFC; Kini et al., 2016). Yet, many more behavioral interventions appear to optimize the *connectivity and relations between* the subsystems, particularly so that the PFC is better at regulating the activity of the amygdala. Such behavioral interventions include:

- Active coping (which recruits the mPFC to suppress the amygdala; Tabibnia & Radecki, 2018)
- Correcting sleep deprivation (which involves the HPA axis and mPFC-to-amygdala circuit; Tabibnia & Radecki, 2018)

- Social support and connectedness (which affects the HPA axis, amygdala, and mPFC; Tabibnia & Radecki, 2018)
- Emotion regulation (which activates prefrontal regions to modulate the HPA axis and amygdala; Tabibnia & Radecki, 2018)
- Cognitive reappraisal (which activates lateral PFC and mPFC and decreases amygdala activation; Yao & Hsieh, 2019)
- Mindfulness (which results in structural and functional changes to the amygdala-to-PFC circuit; Guendelman et al., 2017)
- Adopting a growth mindset (which shows greater functional connectivity of the striatum with the dorsolateral PFC; Myers et al., 2016), and
- Increasing a sense of self-efficacy (which produces greater activation in mPFC and reward circuitry; Cascio et al., 2016).

There are thus many roads to take to optimize the relationships and activity between the PFC and limbic structures, and as a result, to enhance resilience. Tabibnia and Radecki (2018) note that resilience-enhancing factors can operate in an additive way, so that use of more than one strategy may result in a larger enhancement to resilience (perhaps because of another source of input for strengthening these shared neural networks). Moreover, regarding the three brains model, Soosalu et al. (2019) summate several studies' assertions that making optimal decisions requires a conscious, integrated balance from all three sources. Deepening one's awareness of the preferential influence of one or more of these neural plexuses on one's decision making allows more precise and effective changes to be made so that higher order processing can be best enhanced (Soosalu et al., 2019). These points lend more credence to Neurozone® presenting its users with multiple psychobehavioral recommendations (that may also tap into heart- and gut-based activity) to choose from.

Another suggestion Neurozone® provides is that "everything affects everything", meaning one behavioral recommendation can – resultantly or simultaneously – enhance other behavioral recommendations (or bring about their effects) as well. This axiom is derived from the evidence that any one region of a network in the brain is connected with other regions both in and outside that network, making neutral activity influential in many directions (Tabibnia, 2020). In more specific support, the following resilience-enhancing behavioral interventions have been found to enhance each other:

- Daytime exercise tends to enhance sleep (Tabibnia & Radecki, 2018)
- Gratitude enhances brain regions involved in emotion regulation and social reward (Tabibnia & Radecki, 2018)
- Mindfulness meditation improves executive function, positive emotions and subjective well-being, and quality of social relationships (Brown et al., 2007)
- Learning contributes to improved physical health (Spreitzer & Sutcliffe, 2007)
- Positive emotions predict adherence to meditation (Cohn & Fredrickson, 2010) and physical exercise (Rhodes & Kates, 2015) routines, and
- Improved working memory is associated with better emotion regulation (Hendriks & Buchanan, 2016).

As such, Neurozone®'s axiom about the interconnectedness of behavioral interventions appears to hold true. There are indeed many paths towards higher resilience, and it is possible that taking one of these paths also, in effect, resembles taking more than one. Arguably, this further strengthens the notion (explored in many ways above) that taking one or more resilience-enhancing path(s) may also mean, in effect, taking paths to enhance one's capacity for thriving or 'high performance' as well.

Conclusion

This critical appraisal can conclude that the framework underlying Neurozone®'s core offering—the simultaneous prevention of burnout, enhancement of resilience, and release of the capacity for high performance—exhibits adequate theoretical soundness. At the very least, their claim appears congruent with established evidence and neuroscientific literature, displays internal consistency among its premises, and offers up testable hypotheses (Shaw & Costanzos, 1982). There is theoretical and empirical backing that (1) resilience and the capacity for high performance (synonymous with that for thriving) are partially overlapping (and both antithetical to burnout) at a conceptual level, (2) many psycho-behavioral recommendations for increasing resilience and for enhancing thriving also overlap at a demonstrated interventional level, and (3) the neuroanatomical mechanisms, networks, and operations underlying resilience and the factors that hinder or enhance it seem to account for this overlap to a significant degree. Therefore, there is credence to the claim that Neurozone® simplifies science to future-proof people against life's uncertainties and to unlock their capacity for holistic high functioning.

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