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Neurocognitive selfempowerment in occupational and managerial contexts: contribution of mindfulnessbased neurofeedback protocols

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Abstract

Over the past few years, the importance of applied neuroscience to organizational and professional contexts has grown. The term "neuromanagement" is used in literature to describe this research area. To enhance and/or modify the attitudes and motivations of the diverse professionals working within organizations, neuromanagement took, during the years, the form of a discipline aimed at understanding all those cognitive processes. To distinguish and compare the various neuropsychological peculiarities and identify the individual-specific factors determining the optimization of performance, this paper initially aims to highlight the significance of implementing multi-factorial evaluation procedures. Furthermore, evaluate the contribution of mindfulness-based neurofeedback protocols, considering recent neuroscientific research, and emphasize their use in highlevel professional contexts.

Keywords: neuroscience; neuromanagement; neurofeedback; empowerment

1. COGNITIVE NEUROEMPOWERMENT AND NON-INVASIVE NEUROFEEDBACK TECHNIQUES

In the last decades, neurocognitive empowerment has become a topic of relevant interest; indeed, the contexts in which the research is applied to explore the potentialities of this method, are increasingly diversified.

One of the first initial conceptualizations of neurocognitive empowerment refers to the qualitative and quantitative improvement of specific cognitive or affective abilities and sets of modulated cognitive functions using various neuroscientific techniques (O'Connor & Nagel, 2017). Underlying the concept of neuroenhancement, concerning the neuroscientific fundamental, it is possible to highlight how the scientific evidence suggests a positive relationship between neuroplasticity and the application of neurocognitive training (Gangemi et al., 2017). According to this, the scientific principle of neuroempowerment is to act, across the lifespan, on brain structures, neural networks, and brain plasticity, to modulate brain activity during a specific task and, consequently, improve information processing, optimize the functionality of the perceptual, educational, and cognitive systems, and make them work more adaptively, flexibly, and efficiently (Balconi & Crivelli, 2019). Considering, therefore, the multi-component nature of cognition as a set of processes and functions, neurocognitive enhancement interventions can be aimed at improving one or some of the specific abilities, but also at improving and enhancing a particular cognitive function or certain cognitive strategies (Chapman & Mudar, 2014).

Cognitive neuroenhancement has been also interpreted in terms of improving individual well-being in different contexts; furthermore, it has been emphasized how the purpose of neurocognitive enhancement interventions can be extended to the promotion of flexible and adaptive behaviors towards the external environment (Balconi et al., 2020, 2021; Crivelli et al., 2019, 2022; Earp et al., 2014; Johnson, 2012; Savulescu et al., 2014). Specifically, there are several techniques normally used to promote brain plasticity in occupational, managerial, and high-performance contexts, including non-invasive neurofeedback techniques. Neurofeedback (NF) can be defined as "a brainwave biofeedback" (Hammond, 2007), as well as "a method that helps subjects consciously control their brain waves" (Marzbani et al., 2016). Specifically, regarding the active role of the individual, it is possible to state how cognitive training is particularly effective in the process of neuroenhancement, and, among this, the literature highlights the role of meditation and mindfulness, which are increasingly integrated into wearable NF technology. It has been shown that the combination of traditional mental training approaches with non-invasive devices is a frontier of particular interest in research on subjective well-being and self-improvement (Balconi, Fronda, et al., 2017; Balconi & Crivelli, 2019; Sliwinski et al., 2017). Wearable technology can track a variety of changes in body activity and provide feedback to the user almost instantly; this, according to various evidence studies, enhances several practitioner skills, including a greater understanding of the automatic physiological responses brought on by various situations or events (Balconi, Fronda, et al., 2017). By increasing awareness, these practices can directly promote the subject's ability to regulate this physiological reaction and, finally, "to optimize coping responses to contextual challenges and requests" (Balconi et al., 2019). Consistently, by making stress management skills more effective, it seems possible to improve neurocognitive efficiency, which is critical for performance optimization in high-level contexts, such as managerial ones (Crivelli et al., 2019).

2. NEUROSCIENCE APPLIED TO THE ORGANIZATIONAL CONTEXT: ROLE OF EXECUTIVE FUNCTIONS

Over the past thirty years, the digital revolution and global economic trends have profoundly and radically shaped the organizational and entrepreneurial environment, transforming it into a complex and highly competitive ecosystem. The goal of organizations is to increase the structuring of a corporate vision and mission that includes the improvement of organizational performance, by showing remarkable attention to the well-being of the worker and the reduction of work-related stress, recognizing the significant value of the wellbeing-performance combination. In fact, in this sense, organizations include in the organizational policy some interventions inherent, for example, issues related to the well-being of work (e.g., distress), thus legitimizing a whole series of possible secondary prevention interventions to raise work satisfaction levels and reduce the consequences, even serious, that could lead to maladaptive stress response (Balconi, Natale, et al., 2017; Little et al., 2007). Professionals holding high-level positions, such as managerial positions, seem to be more exposed to high cognitive-emotional loads and challenging demands, incurring more risks of work-related stress (Balconi & Angioletti, 2020).

The literature refers to this field of research as "neuromanagement", which is an offshoot of neuroscience that uses specific methodological approaches from the discipline and applies them to the specific topic of management. Throughout this context, the value of the neuroscience contribution is becoming increasingly important (Venturella & Crivelli, 2017). Specifically, organizational neuroscience has a wide range of methods useful for recording and investigating implicit attitudes (Camerer et al., 2005). These allow a thorough and empirical investigation of the relationship between attitudes and behavior, observing the involvement of certain brain regions in implicit or explicit processing processes. According to Balconi (2020), one of the causes of the organization's failure is the disregard for implicit attitudes,

which leads managers and researchers to overestimate people's capacity to adapt to change. Thus, it is evident how the contribution of neuroscience can bring significant changes in this context. The neuroscientific approach includes several methodologies intended to assess the mental processes underlying self-regulation, social skills, and high-level cognitive functioning, including in professional contexts, in addition to its contribution to the analysis of explicit and implicit behavior (Balconi & Salati, 2020). Thirdly, neuromanagement aims not only to evaluate, but also to intervene on distinct levels: increasing emotional regulation, relational skills, and cognitive performance. Cognitive neuroempowerment is one of the techniques that neuroscience can use to achieve these goals (ibidem). In this context, executive functions (EFs), defined as a set of top-down mental processes that promote behaviors aimed at achieving specific objectives (Balconi et al., 2020), appear to be of fundamental importance. EFs contribute significantly to achieving high work performance; in addition, different studies have shown that work success is directly proportional to optimal social, cognitive, and executive benefits (Bailey, 2007; Willoughby & Blair, 2016). EFs - such as planning, decision-making, reasoning, attentional focus, and problem-solving - are essential to regulate affective reactions, and suppress maladaptive habits, and nontargeted behaviors (Balconi & Salati, 2020). The management of interpersonal dynamics and the adaptive management of stress are two additional areas in which EFs are critical. This highlights the important function that they have in the maintenance of soft skills, like empathy and effective communication (Cacioppo & Cacioppo, 2020).

3. ENHANCING NEUROCOGNITIVE FUNCTION IN PROFESSIONAL SETTINGS

Considering this evidence and the role of EFs in high-level professional contexts, it is appropriate to highlight how the cognitive neuroenhancement protocols, focused on these functions, are particularly promising. It is essential to examine and contextualize executive functions in the aforementioned context in order to design robust and effective protocols. In this perspective, the literature is limited in models, but the one given by Balconi and colleagues (2020), is among the most noteworthy because of its multi-strategic and multi-integrated structure.

Indeed, the "Triadic model for the assessment of talent and neuropotentiation" is one of the models that describe the declinations that can occupy the EFs and other specialized skills in the assessment of professional performance. This category comprises the collection of abilities (e.g., logical reasoning) related to the specific function performed inside the organizational reality and the individual's academic, professional, and experiential background. This category also includes abilities that are not exclusively technical or niche, but rather useful to readily and efficiently fit in contexts and settings that require transversality (e.g., cognitive adaptability and attentional focus). Metacognitive competencies, which are connected to higher-order processes, are the second category of competencies (e.g., problem-solving, creativity, motivation, decision-making, and self-awareness). Relational skills are the final "skills cluster", which includes particular abilities like emotional empathy, which is the capacity to comprehend one's own and other's emotional states (Yan et al., 2020); cognitive empathy, which refers to the capacity to comprehend another person's intentions and differing points of view (ibidem); the perspective taking, which is the capacity for an individual to comprehend what a situation appears to be to another person and how that person is reacting (Cole et al., 2020); and self-regulation, the ability of the subject to control their emotions and behavior in accordance with the demands of the circumstance (Inzlicht et al., 2021).

Concluding, this model appears to be an important reference point for the design of neuro-enhancement protocols in various areas of application due to its multi-component and inclusive nature of several facets of relevant significance in highly specialized contexts.

Regarding the protocols, research conducted in the field of neuroscience has concentrated primarily on approaches that combine multiple techniques, like mindfulness-based training supported by biofeedback and NF systems (Balconi & Angioletti, 2020). Regarding the use of biofeedback in professional settings, studies conducted over the past 20 years have demonstrated that respiratory sinus arrhythmia biofeedback (RSA-BF) – a form of biofeedback that focuses on controlling cardiovascular and respiratory parameters – has been effective in encouraging healthy behaviors, restoring heart balance, reducing sympathetic hyperactivity typical of the maladaptive stress response, and improving vagal tone (Lehrer et al., 2007; Schwartz & Andrasik, 2003; Yucha & Montgomery, n.d.)

Research on NF protocols based on mindfulness has produced even more encouraging outcomes, especially in relation to age management, as defined by Walker and Taylor (1997). In fact, several studies have demonstrated that combining mindfulness with established scientific techniques, such as NF, is beneficial for reducing cortisol and C-reactive protein levels, lowering perceived and physiological stress, improving physical and behavioral performance, increasing emotional control and emotional self-regulation, and boosting neurocognitive efficiency (Balconi et al., 2021; Balconi, Natale, et al., 2017; Bhayee et al., 2016; Crivelli et al., 2019, 2022).

It has been extensively analyzed how individuals can regulate their stress levels optimally, self-regulate their dysfunctional emotional responses, and gain knowledge to use appropriate cognitive and relational strategies in everyday living scenarios by conscientiously controlling the activity of the physiological systems involved during the different stress conditions (Balconi, Fronda, et al., 2019); and, at the workplace, this is expected to be a necessary skill.

The evidence supports the use of these neuroenhancement techniques for

improving performance in a variety of professional settings and reinforces the necessity of implementing multi-factorial evaluation procedures that incorporate behavioral, autonomic, and neurophysiological measurements combined with observational and self-assessment measures evaluated through psychometric tests. Constructing and defining a complete neuropsychological profile in high-level professional settings, similar to those of the participants in the studies mentioned, and according to a qualitative and quantitative perspective of the factors and processes described above, allow one to come to conclusions about the overall functioning of cognitive and behavioral performance during the performance of complex tasks. This, according to a recent article on professional contexts and sports (Crivelli & Balconi, 2022), facilitates the ability to identify individual-specific factors that influence performance optimization.

4. CONCLUSION

The information presented until now demonstrates how neurocognitive empowerment protocols based on the NF technique can be adapted and revised to specific training; furthermore, their implementation could be a valuable tool, particularly in the development of preventive interventions of age management in high-level workplace settings and, generally, in all those contexts where the will is to enhance specific cognitive functions, such as working memory, attention, and memory (Balconi & Lucchiari, 2005; Balconi & Pozzoli, 2005; Sahakian & Morein-Zamir, 2007).

This last reason makes neurocognitive empowerment a practical choice in a wide range of circumstances. For this purpose, the use and diffusion of multi-integrated neuroscientific protocols based on a robust neuroassessment aimed at determining the subject's neuropsychological profile and providing for the implementation of techniques not invaded - like NF - could contribute significantly to the management of the physiological systems involved in the optimum management of stress, to the greatest feasible adaptive and emotional regulation, and the finest quality use of these strategies.

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