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REVIEW ARTICLE

The Impact of Organizational Neuroscience and Self-determination Theory on Neuro-Leadership Theory

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ABSTRACT

This article illustrates the way in which the fields of organizational neuroscience (ON), psychology, and leadership can be brought together to address how leadership skills in a business environment can be improved and leadership behavioural patterns can be shaped. This conceptual paper explores how Neuro-leadership will serve as a link between psychological theories and organizational neuroscience. ON studies also enhance opportunities to extend the leadership approach by applying a new-found understanding of neural activation pathways to decision-making. Self-Determination Theory (SDT) offers a detailed explanation of intrinsic motivational factors that are the key to the success of leaders. The neuro-leadership approach uses the SDT factors of autonomy, relatedness, and competence to improve upon leadership theories. In addition, the importance of emotion regulation for leaders is expressed.

Keywords: Organizational neuroscience, Social cognitive and affective neuroscience, Self-determination theory, neuro-leadership.

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Introduction

Recent technological advances in the field of brain research have facilitated the investigation of the relationship between the changes in context and the nature of behaviour in organizations (Rock and Schwartz, 2006). Organizational neuroscience (ON) has an enormous potential to play an important role in human resources research by filling the gaps in what is known about the connection between human behaviour and the decision-making process. ON encompasses the areas of management and organizational psychology and delves into the role of the brain in the behavioural patterns exhibited by employees. ON is mainly interested in the functions of neurons in their relationship to social, cognitive, and affective phenomena in organizations. Neuroimaging technologies such as EEG (Electroencephalography), fMRI (functional magnetic resonance imaging), and eye-tracking have been used to examine leadership behaviours (Lindenbaum and Zundel, 2013). Balthazard et al. (2012) conducted research to verify that neurological imaging technology could be used to classify leaders into transformational and non-transformational types. They also used psychometric assessment tools to identify the leadership styles of the subjects. They found that transformational and non-transformational leaders can be distinguished via qEEG (quantitative EEG) data. Neuroscience has great prospects for providing meaningful insights into the working mechanisms of leaders' brains as well as what their decision-making patterns look like in business settings.

Variations in human behaviour in the workplace are thought to mainly stem from differences in perception of environmental stimuli and personal motivational styles (Angrave et al., 2016). Failing to appreciate these variations may create problems that will eventually lead to organizational changes, loss of key employees, and elimination of some capabilities. Accordingly, the central objective of this article is to understand how particular aspects of psychology (e.g., intrinsic motivation) and social cognitive and affective neuroscience can be integrated in the light of ON to explain the added value of neuro-leadership for the well-being of the business environment.

Leadership studies still have a long way to go in analysing the implicit stages of followers' needs and leaders' responses to them. The Self-Determination Theory (SDT) (Deci and Ryan, 1985) may serve as a bridge between leadership studies and ON. Without psychological theories behind the leadership approach, it might not be possible for ON to explain organizational behaviour and contribute to the expansion of knowledge in future leadership theories. The aim of this article was to combine what is known in

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the field of ON with existing leadership theories by discussing the crucial contributions made by SDT (Deci et al., 1989) to the neuro-leadership approach.

SDT focuses on the fascinating ways in which the internalization of motivation occurs in human beings. Deci and Ryan (1985) offered two influence mechanisms for this internalization process: self-regulation and the social context. According to SDT, different forms of motivation have the potential to result in different attitudes and behaviours (Deci and Ryan, 2000; Levesque et al., 2008). Non-consciously determined regulations coming from unconscious triggers may result in researchers and professionals misinterpreting workplace behaviours and their explanations for them (Levesque et al., 2008). In this regard, since neuroscience provides an understanding of the network systems of the brain, the application of neuroscience in organizations can be extremely useful for studying workplace behaviours. Neuroscience can unlock the implicit mechanisms inside the brain originating in its primal parts (Becker, Cropanzano, and Sanfey, 2011). Waldman and colleagues (2017) offered a model that integrates neuroscience and moral psychology to explicate the moral reasoning of ethical leaders. Understanding the leadership approach through neurological studies is expected to clarify the intrinsic motivation and internalization that SDT explains and is mostly used by the neuro-leadership approach (Rock, 2011). This approach encompasses the competence, relatedness, and autonomy dimensions of SDT. Competence is related to cognitive motor and social growth. Relatedness is a state that increases motivational sources for internalization and guarantees a more effective transmission of group knowledge which, in turn, helps to create a more cohesive social organization. Lastly, is autonomy, which is the propensity toward self-regulation of action and coherence in the individual's behavioural aims (Deci and Ryan, 2000).

The main purpose of this article is to clarify the contributions of ON to understanding human behaviour and then to use these findings to improve the neuro-leadership approach while at the same time retaining SDT to explain intrinsic human motivation factors in the business environment. Therefore, first, the core concepts of ON, social cognitive and affective neuroscience, and neuro-leadership are described and what is meant by cognitive and affective neuroscience in organizational settings is clarified. Second, the main motivational factors of successful leadership approaches as seen through the lens of SFT theory are explained so as to understand how the neuro-leadership approach can use SDT to improve leadership theories. Neuro-leadership will be a way of combining psychological theories and organizational neuroscience. Overall, this article makes a contribution to the development of a new leadership approach in the field of neuro-leadership.

Theoretical Background

To provide theoretical clarity to organizational neuroscience as a form of predicting and modifying behaviours, the core concepts of organizational neuroscience, social cognitive and affective neuroscience, Self-Determination Theory, and neuro-leadership are explained and discussed.

Organizational Neuroscience

Neuroscience explicates the network systems of the brain and how the brain functions because of them. Combining the study of neuroscience with that of organizations creates a highly attractive domain for the examination and investigation of workplace behaviours. The essential part of its attractiveness comes from its ability to clarify intrinsic mechanisms inside the brain originating from the primal parts therein. To illustrate neuroscience's role in human behaviour, Hughes and Zaki (2015) use it to understand the role of motivation in cognition as it affects self-perception, perception of others, and intergroup relations. In addition, Becker, Cropanzano, and Sanfey (2011) indicated that the investigation of the human brain's cognitive systems, which shape especially the intrinsic mechanisms behind human behaviour, will significantly expand the knowledge of organizational behaviour and industrial psychology. Organizational neuroscience is a multidisciplinary field that combines brings together neuroscience, organizational and cognitive psychology, management science, and neuro-economics. According to Becker et al., 2011, combining neuroscience and organizational behaviour as a research area will help management scholars to understand the primary reasons for employee behaviours by clarifying the neuron's activation process. In this regard, neuroscience provides greater details about the network systems of the brain. Neuroscience has an important role to play in studying and understanding workplace behaviours, and in explaining the relationship between cognition and behaviour.

Social cognitive and affective neuroscience

Developments in neuroimaging have made it possible to better understand the neural bases of behaviour and how decision-making occurs in the brain. Social cognitive and affective neuroscience (SCAN), while a new research area, it is not quite a discipline distinct from social cognitive neuroscience. Its utility lies in its adding the "affective" behavioural aspect in emotion regulation and self-control. As pointed out by Hassin, Ochsner, and Trope (2010), SCAN aims to elucidate the psychological facets

of human behaviour by taking into consideration the social aspects of behaviour, the cognitive features of the mental process, and the neural bases of the behaviour in question. The social component of behaviour takes into account the question of why there are differences in self-control in different types of personalities and situations. The cognitive element is concerned with information processing within the framework of how psychological processes, including memory, attention, emotion, and attitude, initiate social-level processes. The main objective of SCAN researchers is to understand how a person exercises self-control over his emotional response while cognitively reinterpreting his feelings by changing the reasoning behind the behaviour (Hassin et al., 2010).

Scholars have been focusing not only on the cognitive but also the affective aspect of human behaviour. Beugre (2018) described organizations as arenas of affect production. In these arenas, employees interact with one another with the objective of working together or for other people. While employees interact with each other, they experience a variety of emotional states. Emotions will determine their immediate reactions, long-term attitudes, and behaviour towards co-workers, subordinates, or top managers. The field of affective neuroscience, which focuses on the neural basis of emotions and the effects of brain structure on emotions and emotional regulations, emerged at the beginning of the 21^{st} century (Davidson et al., 2000; Phan et al., 2005; Vul et al., 2009). Since emotions at work are a very crucial concept for organizational behaviour research, several studies have focused on the reasons for the human emotions that affect attitudes and actual behavioural patterns in the work environment (Hatfield et al., 1993; Waldman and Reina, 2014).

In this regard, it is essential to describe the function of the amygdala in the brain. The amygdala is part of the limbic system of the brain and plays an important role in shaping a person's attitudes, perceptions, emotions, and stereotyping. The reactions of the amygdala, especially to emotional stimulus, are extremely rapid, without taking into consideration any objective or rational aspect of the existing circumstances. Hence, emotions will have a critical impact on the decision-making process and a person's reactions toward other people. In addition, emotions will change people's thinking patterns about specific subjects. For example, when a person is calm, the frontal lobes, which govern rational thinking, will slow down the decision-making process. In contrast, when a person is angry, stressed, or scared, the amygdala takes over and accelerates decision-making. Behaviours are generated using only a small amount of information that is based on feelings. These types of quickly made decisions are generally off the mark or inappropriate. As indicated by Phelps (2006), a person's ability to regulate his emotional responses is a very important competency skill enabling formal social function in an environment and adaptive interactions in society.

The neuro-leadership approach is based on the idea that the success of leaders depends on how they regulate their emotions as well as those of the other employees. So, understanding emotions in a work environment will help regulate and control those emotions.

Self-determination theory

Leadership research has been based on quite different perspectives. Such theories of leadership as transactional leadership, servant leadership, and resonant leadership are grounded on a primal human factor called satisfaction of psychological needs. The satisfaction of psychological needs will mainly result in job satisfaction, motivation, and employee well-being. Gomez-Baya and Lucia-Casademunt (2018) stress that the inner resources of an individual, such as his potentialities, capacities, and sensibilities, are crucial to his improvement, integration with a group, and involvement in the challenging tasks faced in the work environment. Therefore, the inner potentials of a person and the satisfaction of his basic needs are essential to creating successful business environments. The foremost mentioned theory on need satisfaction is Self-Determination Theory, which has begun to acquire greater importance in improving work efficiency in a business environment.

Deci, Connell, and Ryan (1989) also argued that the satisfaction of people's psychological needs of competence, autonomy, and relatedness is critical for optimal human development.

Moreover, Self-Determination Theory maintains that these psychological needs are universal. According to Deci & Ryan (2000, p. 229), "SDT regards needs as specific innate psychological nutriments that are essential for ongoing psychological growth, integrity, and well-being." The neglect of any of these psychological needs will have a very significant effect on life. Similarly, Deci and Ryan (2000) highlight that on the basis of SDT, if the psychological needs of competence, relatedness, and autonomy are not met, the deeper needs of human psychology, such as reaching effectiveness, connectedness, and coherence can be compromised.

Gagne and Deci (2005) point out that the roots of SDT extend to the main natural processes that work with basic psychological needs for intrinsic motivation and internalization. Gagne and Deci (2005, p.6) stated that "people need to feel competent and autonomous to maintain their intrinsic motivation." They add that the satisfaction of the need for relatedness is also vital for the internalization of values or tasks.

STD considers competence to be a psychological need that can galvanize human activity. Relatedness is described as a person's desire to feel connected to other people. This concept includes giving and receiving love and caring and being cared about

(Baumeister and Leany, 1995). Autonomy refers to the desire for self-organized experiences and behaviours. These experiences are integrated with a sense of self (Ryan, Connell, and Ryan, 1989; Sheldom and Elliot, 1999). SDT explains that competence is imperative for optimal challenges, practical achievement, and approval in social settings. Relatedness has to do with looking for attachment, feelings of security, and belongingness to a group. These are mainly the result of seeking intimacy with others. Autonomy is to be self-organized and preferred to having one's behaviour controlled from the outside. These psychological needs will assist people in becoming more competent in fulfilling their tasks and more socialized with other people within an organizational setting or in their social lives.

SDT Theory and Neuro-leadership

How can SDT contribute to the development of neuro-leadership studies? The answer lies in two separate mediums: leader behaviour and follower motivation. The motivational processes and the tenets of SDT both focus on conscious and unconscious mechanisms (Deci and Ryan, 2000). Gagne and Deci (2005) also explained that the satisfaction of the needs for relatedness and competence are crucial to the internalization of value and regulations. However, the degree of satisfaction of autonomy will determine how effectively a person will achieve this internalization. Accordingly, the level of autonomy developed by a person, along with his/her level of internalization, can be further understood by using neuroscientific methods.

Interestingly, neuro-leadership, which was developed by Dr. David Rock (2008), is rooted in SDT. The neuro-leadership approach of David Rock is mainly explained by the SCARF model. This model contains components of SDT, e.g., competence, relatedness, and autonomy (Deci and Ryan, 2000). Expanding the components of SCARF:

- S for Status: Individuals pay more attention to determining their social status in the social environment so as to be able to understand their social influence vis-à-vis others. Social status will determine the strength of their influence and the respect others have for them in society or the work environment. Ringleb, Rock, and Ancona (2013) discussed an FMRI experiment that measured brain activities in the ventral striatum, which is responsible for value and reward processing. In this experiment, participants having dissimilar social statuses were exposed to different information coming from somebody having a relatively higher or lower status. This study showed that individuals pay more attention and respect to information coming from people with higher status. So, it can be said that a person would like to improve and not lose his/her social status in society. Having a higher status improves their intrinsic motivation to enhance their cognitive and social skills in order to be a more respected person. This can be explained by the competence part of SDT.
- C for Certainty: People need clarity and predictability while avoiding ambiguity, which activates the threat circuitry in the brain. Rock (2008) states that the brain looks for familiar situations in order to conserve brain energy. The human brain prefers to be on an auto-pilot by using already wired neural connections for similar situations. In contrast, ambiguity will create a threat response, which stops a person in his tracks and makes him focus all his attention on a new situation. The novel situation may encourage a person to find creative solutions for any problems arising, but excessive, long-lasting uncertainty will decrease performance and make people anxious. This will lead a person to make poor decisions, mainly based on pre-existing prejudices (Ringleb, Rock, and Ancona, 2013), and past experiences. This is a basic need of human beings that must be satisfied.
- A for Autonomy: Autonomy enables a person to establish a sense of control over events. Thus, it reflects an individual's power over other people and his ability to make their own decisions as they related to his personal life (Inesi et al., 2011). In addition, autonomy activates the ventral striatum, which is key to the brain's reward system (Leotti and Delgado, 2011). By providing response options to a situation or event, autonomy makes people feel more confident and less stressed. This is consistent with SDT's approach towards propensities in the area of self-regulation of action and coherence in the organism's behavioural aims.
- R for Relatedness: A basic human need is to be a part of a social environment. People continually seek a sense of safety while interacting with others and try to understand whether the person they encounter is a "friend" or "foe" (Ringleb, Rock, and Ancona, 2013). Kogan et al. (2011) stated that a person will decide whether a stranger is trustworthy, kind, or compassionate within 20 seconds of meeting him. In the business setting, developing teams place a high priority on improving relatedness among team members. As put forth by SDT, relatedness improves belongingness and enhances motivation among team members. Moreover, relatedness among team members facilitates the transmission of knowledge to others in the group; it enables it to become a more cohesive social organization through trust among team members.
- F for Fairness: Fairness has to do with a person's perception of how available sources are distributed among the other members of the group to which he belongs. A perception of unfairness results in hostile behaviours and a lack of collaboration among the team members. Research done by Ringleb, Rock, and Ancona (2013) showed that emotions become intense when an unfair situation is perceived and that the amygdala takes control over both the emotions and the decision-making process. In contrast, the prefrontal cortex, which mainly controls rational decision-making, becomes inactive. The transparency of information is essential to developing a perception of fairness and certainty.

In short, fairness will improve trust and relatedness among team members. This will enhance the autonomy in making decisions. Finally, a person is more likely to have better internal motivation to acquire new skills and abilities so as to achieve a better status in society. Neuro-leadership shows how the fields of psychology, neuroscience, and leadership are interlaced in management studies. However, in addition to SDT, outcomes of organizational neuroscience studies have shown that another fundamental approach to the development of leadership skills may be focusing on emotions.

Discussion

The leadership approach has been studied for decades from different perspectives, including transformational leadership (Bass and Avolio, 1993; Eisenbach et al., 1999), charismatic leadership (Conger and Kanungo, 1994), and resonant leadership (Boyzatzis and Mckee, 2006). Future leaders are expected to be more responsive, flexible, and adaptive while accomplishing company targets. A new direction in leadership studies has arisen with the recent advances in brain research, which aims at finding a relationship between the changes in context and organizational transformation (Rock and Schwartz, 2006).

Previous management studies focused on left brain and right brain differences. They included, for example, research on "planning on the left side and managing on the right side" Mintzberg (1976), "left brain/right brain mythology and implications for management and training" Hines (1987), and "how hardwired is human behaviour?" Nicholson (1998). Analyses of leadership behaviours began to use new technologies in the field of neuroscience, such as EEG (Electroencephalography), fMRI, and eye-tracking. For example, Edison, Juhro, Avlia, and Widiasih (2018), pointing to the expectation that future leaders be more agile while accomplishing the company targets, investigated aspects of leadership together with cognitive functions and brain activity patterns. They looked at the impact of neurofeedback on brain activities and concluded that leadership style was related to a person's brain activity pattern.

In addition, cognition and emotion were theorized and examined concurrently in order to fully understand the neurological basis of effective leadership. For example, Waldman, Balthazard, and Peterson (2011) were interested in finding out whether neuroscience could provide data relevant to underlying brain patterns associated with inspirational leadership. Their research demonstrated that right frontal coherence was positively associated with an improvement in socialized vision. If the coherence of socialized vision is high, followers may perceive leaders as inspirational or charismatic leaders. Overall, the high neurological coherence with respect to socialized vision will be an indication of "effective leadership." Therefore, neuroscience may prove useful in uncovering how a leader's brain is working and how he is going to make decisions in business life.

Furthermore, using what is discovered about brain functioning in the domain of management and organization has the potential to simplify and reduce explanations of human behaviours to molecular, hormonal, or neural levels (Becker et al., 2011). Thibault and colleagues (2015) drew attention to the placebo effects of neurofeedback, which means providing real-time illustrations to shed light on the activities of the brain when there are stimuli. Thus, while neuroscience has the potential to add a complementary level to organizational analysis to explain the relationship between cognition and behaviour, this article aimed at extending this to the leadership domain through the addition of Self-Determination Theory.

Many leadership perspectives, for example, transformational leadership, address such variables in the workplace as motivation, employees' self-identification with the group, improvement in self-efficacy, and combination of work values with follower's values (Shamir, Zakay, Breinin and Porpper, 1998). As shown in the previous sections, the theory put forth in this article uses STD theory to improve work efficiency in business settings. In order to increase people's inner motivation to learn and grow, basic psychological needs (e.g., competence, autonomy, and relatedness) should be satisfied. According to SDT, open-mindedness, interest in the environment, and keenness to learn are key to a person being able to better adapt to new, constantly changing conditions. When people do not get satisfaction from learning new things on their own, they will be less likely to use their own potential to develop new skills to adapt to new environmental conditions (Deci and Ryan, 2000).

David Rock (2011) maintained that strong analytical thinking and intelligence are not enough for effective management. Social interaction is much more important than technical skills and mental capacity. Recent developments in technology within the field of organizational neuroscience have helped throw light on how human brains perceive situations. As Liberman and Eisenberger (2008) have shown, many social experiences share the same brain connections to maximize reward and minimize threats in order to stay alive. Hence, the brain sees social threats in much the same way as it does threats to satisfying such essential needs for food and water. David Rock (2008) created what is referred to as the SCARF model to clarify common factors that will lead to generating a reward or threat response in a business situation. While the SCARF model comes from social neuroscience, it uses SDT to explain which psychological needs must be met to ensure effective leadership capability. These universal psychological needs can be observed in any business entity in the world. The SCARF model details how status, certainty, relatedness, autonomy, and fairness will trigger either primal reward or primal threat responses in the brain. Effective management relies on an environment

where situations are easily understood, remembered, and recognized in order to organize employees in such a way that they work more efficiently and are more motivated to achieve business goals.

However, the SCARF model is not sufficient to handle all problematic situations that leaders face daily in their professions. The basic principle of minimizing danger and maximizing reward, as discussed by Gordon (2008), helps people stay alive by means of quick responses to environmental stimuli. This response is primarily handled via the amygdala, which is a part of the limbic system and responsible for emotional responses. When the human brain senses a threat from an outside situation, the functions of the prefrontal cortex decrease while the functions of the amygdala increase. Arnsten (1988) highlighted this negative relationship and said that there will be less oxygen and glucose available for the brain functions of working memory and conscious processing. This gives rise to the inhibition of the perception of important signals or information needed to solve the problem at hand. The amygdala usually pays more attention to a generalization of a situation while believing coincidental connections of details for it. Moreover, when the amygdala is activated, a person usually shows defensive reactions to a stimulus. For example, the non-smiling face of the boss may be perceived by an employee as a threat. This may result in the tendency to avoid risk taking by not meeting with the boss to ask questions. Ochsner (2008) stated that strong emotions may reduce the capacity for the self-regulation of emotional responses. The SCARF model will help to identify the main threat stimuli that may produce emotional responses and to label them in order to start reappraising situations as non-threat situations.

Although emotional regulation is usually associated with self-control in the fields of psychology and philosophy, cutting-edge neuroimaging technologies have enabled neuroscience researchers to investigate the neural basis of the emotional regulation process. Therefore, social cognitive and affective neuroscience assists in linking the social, cognitive, and affective processes that compromise a person's self-control and shows how the neural system works during this process. Neuroscience has been used in studies dealing with emotional regulation in educational settings (Martin and Ochsner, 2016), emotions, plasticity, context, and regulations (Davidson et al., 2000), and aversive emotion regulation via social buffering achieved through the neural process model (Bratec et al., 2020). Kross and Ochsner (2010) indicated that several different brain areas are engaged at the same time while forming emotions and detecting conflicts in a situation, within self-referential processing. These components work together as a person attempts to come to terms with his emotions. Researchers have looked at how reappraising negative emotions can affect neural systems and differentiate brain activities (Ochsner et al., 2002). Lang, Bradley, and Cuthbart (1990) conducted a study that dealt with how the cingulate and prefrontal cortex play important roles in assisting a person in reappraising stimuli and regulating responses resulting from negative emotions. They used fMRI imaging to study changes in neural paths during attempts at reappraisal aimed at increasing or decreasing negative emotions. The study results showed that in both strategies there was modulated activity in the left amygdala. Activation of the amygdala increased during attempts at increasing and decreased during attempts at decreasing (Ochsner et al., 2004). Kross and Ochsner (2010) showed that if people can change how they feel, they can direct themselves to think differently. So, in light of these studies, a new approach in leadership development studies should provide self-training in reappraising stimulus in a positive way while dealing with problems in the business environment instead of only dealing with standard leadership development training.

Therefore, organizational neuroscience has a significant potential to become a major part of organizational theory by using human brain functions to understand behaviour. This article aimed at demonstrating how the fields of neuroscience, psychology, and leadership studies can be combined to create a new way of understanding effective management behaviour under conditions of intense business competition. Psychological theories can be considered a bridge between leadership and neuroscience studies. In order to portray successful leadership attributes, psychological theories like self- determination theory should be well analyzed while explaining the effect of organizational neuroscience on contemporary leadership theories such as neuro-leadership. In addition, the critical impact of emotional regulation ability on leadership behaviour patterns should receive more attention in developing new leadership training programs.

Implications for HR

In today's world, businesses are faced with fast-moving changes on the economic, political, and environmental fronts. More recent HR studies have placed importance on such leadership capabilities as agility and adaptability. However, HR professionals have to bear in mind the results of the study done by Deci and Ryan (2000). They showed that if the basic psychological needs of competence, autonomy, and relatedness are not satisfied by management, employees will not pay attention to learning new skills to adapt to new conditions; they will unwillingly use their potential to solve the difficult problems suddenly faced due to very dynamic business conditions. HR professionals should pay more attention to understanding brain functions and the cognitive aspects of the decision-making process. Cognitive and affective neuroscience research points to critical aspects of brain function during specific behaviour in the business environment. These outcomes can help HR professionals understand the behavioural patterns of leaders and how to improve their specific leadership abilities. The neuro-leadership approach covers mostly the satisfaction of basic skills plus fairness. In addition to neuro-leadership, recognition of the need for emotional regulation is another critical concept that needs

to be incorporated into HR studies. Contemporary leadership training should cover self-training in reappraising environmental stimuli in a positive way while dealing with managerial problems in the business setting.

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