RESEARCH ARTICLE

Organizational Cognitive Neuroscience and Its Applications in the Workplace: An Analysis of the Perception of Leaders

Heriton Mascarelo Duarte[1], Patricia Martins Fagundes Cabral[1], Jose Carlos da Silva Freitas Junior[1], Gabriel Sperandio Milan[1], Cintia de David[1]

[1]Universidade do Vale do Rio dos Sinos, Porto Alegre, Brazil

*Corresponding author: Cintia de David: cintiadedavid@gmail.com

Abstract:

This paper analyzes the perception of leaders about the discoveries of organizational cognitive neuroscience (OCN) and their practical applications in the work environment, as well as identifying gaps and distortions of knowledge that leaders have about this area of study. Based on a study with the participation of one hundred and thirty-six respondents, of which part consider themselves in leadership positions, conducted in two stages, using a quantitative and qualitative method, it was possible to highlight the perception of such leaders about the practices currently used in their companies, even though they are unaware of the neurological factors and reflexes that trigger them. The results also made it possible to propose initiatives and actions for leaders regarding the expansion of knowledge about NCO. Finally, this research presents recommendations for including or changing internal and external leadership training programs on the topics covered in Organizational Cognitive Neuroscience.

Introduction

I think; therefore I am. This phrase was originally coined in French "Je pense, donc je suis" by René Descartes in his book Discourse on Method (1637), in which he depicted the duality of human nature being the Soul responsible for intellectuality, reason, consciousness/mind and the Body being only a material substrate. A way to counter this idea of duality is assigned to Friedrich Nietzche "I am; therefore I think", which is reinforced by the work of the neuroscientist Antônio Damásio entitled "Descartes' Error: Emotion, Reason, and the Human Brain" that details the neuroanatomical structure of the brain and its intimate relationship with the functioning of the mind, enabling the exit from the field of philosophy to enter the field of applied neurological science, thus helping to understand human behavior through the lens of neuroscience (Damásio, 2012).

In organizations, leaders rarely consider the biological factors that are involved in the process and that have a major influence on our behavior (Damásio, 2012), either for lack of education or knowledge. Damásio (2015, p. 353) quotes that "emotions cannot be known by the individual who has them before there is consciousness", therefore a feeling is

nothing more than an emotion that has become conscient and that we are not thinking beings capable of feeling, but emotional beings able to think, which indicates that there are many biological factors influencing our emotions and consequently our feelings. In this same line of reasoning, rational thinking is sometimes in the background.

The advance of brain activity mapping technologies for the past two decades has allowed a more accurate comprehension in the field of Neuroscience on the brain's internal functioning and its connections (Bickle, 2006; Lieberman, 2007). Organizational Cognitive Neuroscience (OCN), the focus of study of this research, aims at understanding how the biology (neuro-biochemical processes) and physiology of human beings impact their actions and decisions, either rational or irrational, in the organizational environment (Kahneman, 2011).

Organizational cognitive neuroscience (OCN) is based on the idea that the brain is the center of command for our actions and that the way it processes information directly impacts our behavior. Advances in brain mapping technologies in recent decades have enabled a more thorough understanding of the inner workings of the brain and its connections (Rock & Schwartz, 2007). This new understanding of brain function has opened doors for the application of neuroscience in different areas, such as marketing, economics and human resource management, enabling the application of this knowledge within organizations, such as, for example, by assessing how people form judgments and react to situations of justice or injustice (through behavioral, cognitive, emotional and neural levels)(Beugré, 2010).

Armour (1994) introduced the concept of "channel" as a way to express human emotions. This channel allows people to connect with their feelings and express them more authentically and naturally. According to Armour, emotions are like rivers that flow through a channel, and the channel represents the way people connect with their feelings and express them. Advances in neuroscience have enabled a deeper study of the brain structure and its relation to emotions. From this perspective, areas of study related to neuroscience emerged, such as Neuropsychology, which seeks to understand the dynamics of the brain versus behavior; Neuroleadership, which seeks to link the discoveries of neuroscience to internal/external leadership in organizations, and finally, in Organizations (Organizational Neuroscience - NO or Organizational Cognitive Neuroscience - OCN, the latter term being used throughout this work) which seeks to understand the neurological factors and their impact within companies (Becker; Cropanzano & Sanfey, 2011), the latter being the focal area of study of this research.

OCN is a promising field with the potential to revolutionize the way organizations function. By understanding how the human brain works, leaders can make more effective decisions, build stronger teams, and create healthier work environments. Research in OCN can also help identify the factors that drive human behavior and create strategies to deal with challenges and opportunities more effectively. Advances in organizational cognitive neuroscience (OCN) have driven research in a variety of areas related to human behavior, such as the study of decision-making, motivation, leadership, communication, and interaction among individuals. (Rock, 2008).

Unfolding these objectives, it is studied, for example, the management of people through a psychological perspective (Baumeister & Leary, 1995), social or philosophical (human relations and behavioral school), it is necessary to enter the concepts explored by Neuroscience to complement the existing knowledge. The purpose of this study was to deepen the discoveries of neuroscience and show how they are perceived by leaders in the behaviors of individuals inside the organizations (Becker & Cropanzano, 2010). Unfolding these objectives: a) To identify the knowledge the leaders have about Organizational Cognitive Neuroscience or Organizational Neuroscience, as well as its gaps and misrepresentations; b) To propose initiatives and actions for leaders regarding the expansion of knowledge about the aforementioned factors, c) To provide recommendations for inclusions or changes in internal and external leadership training programs for organizations on the topic of organizational cognitive neuroscience.

From the perspective of people management, this study contributes through the reflection and dissemination, which is still initial on the related contents to OCN. It provides data that allows the identification of knowledge gaps and the instigation of bigger research or the creation of tools to disseminate the knowledge or the practical application of the concepts. This article is structured as follows: after this introduction, the theoretical

review is presented in item 2, followed by the method in item 3, the analysis and discussion of results in item 4, and to conclude, the final considerations in item 5.

Theoretical review

Organizational cognitive neuroscience

According to Becker and Cropazano (2010, p. 1055), "neuroscience is an interdisciplinary field of study, which seeks to understand the behavioral phenomenon in terms of mechanisms and brain interactions that produce cognitive processes and behaviors". Several brain processes have evolved over millennia for specific purposes, being biologically programmed and often automatic (Lieberman,2007). Ventura (2010, p. 123) describes that Neuroscience "... comprises the study of the nervous system and its connections with the entire physiology of the body, including the relationship between brain and behavior" and complementing that it also covers "...the mechanisms of attention and memory, learning, emotion, language, and communication".

In Brazil, researches on this field are represented, mainly by the Brazilian Society of Neuroscience and Behavior (SBNeC), but there are still similar researches in the Psychology, Pharmacology, Physiology, and Biochemistry national societies. Whereas in the clinical area, the representation is done by the national societies of Neurology, Psychiatry, and Neuropsychology societies (Ventura, 2010). In Brazil, the area of study about neuroscience has significant relevance, counting on fully consolidated societies and professionals engaged in research and knowledge dissemination.

The term Organizational Cognitive Neuroscience was introduced in 2007 (Butler, 2017) in a special edition of the Annals of the New York Academy of Sciences. It is sometimes referred to as Organizational Neuroscience. The OCN opens the possibility of dissecting social processes at the neurobiological level and analyzing specific issues of organizational environments (Senior, Lee, & Butler, 2011). In accordance with Becker, Cropanzano, and Sanfey (2011, p. 934), organizational cognitive neuroscience is better conceptualized as a paradigm or an interpretive framework that seeks to explain and highlight problems that otherwise might not be considered, helping in the understanding of the behavior from the unconscious, while most of the current organizational behavior theories concentrate in conscious choices of the individuals.

For Senior et al. (2011), the investigative research in organizational environments can help neuroscientists on the expansion of the studies on brain function, bringing the organization closer to the way that human beings behave in such settings. According to Waldman, Ward, and Becker (2017, p. 428) "[...] the researchers can check if the decisions and behaviors are the product of conscious deliberation or a more visceral emotional response of which the participant may or may not be aware".

Neuroscience and potential contributions to people management in organizations

There are many contributions of OCN to people management, both in the theoretical field, as in the research of Bagozzi, Verbeke, Dietvorst, Belschak, van den Berg, & Rietdijk (2013), Waldman, Wang, and Fenters (2019) and Senior et al. (2011), and in the practical one. The studies that are described in the following topics deserve to be emphasized because they indicate the possibility of the practical application of the findings of neuroscience within organizations. Based on these, eleven premises were listed and later used in the conduction of the research of the present study, they are synthesized in Table 1.

Table 1 - Theoretical Premises on Organizational Cognitive Neuroscience

Theoretical topic	References
Premise (s)	
Individual's ability to multitask	(Pashler, 1993); (Pashler, 1994); (Just et al., 2001); (Schubert & Szameitat, 2003); (Paridon & Kaufmann, 2010); (Medina, 2011);
Premise 1: The brain cannot perform multiple complex cognitive activities simultaneously.	
Hunger and rest breaks - effects on rationality	(Kosfeld et al., 2005); (Malik et al., 2008); (Danziger et al., 2011)
Premise 2: There is evidence that breaks allow cortisol to be reduced and consequently induce a reduction in stress levels in addition to restoring mental fatigue. Premise 3: There is evidence that eating can reduce an individual's state of stress, allowing decisions to be made based on rationality rather than non-rational factors.	
Relaxation and the effect on oxytocin and cortisol levels	(Kosfeld et al., 2005); (Turner et al., 1999); (Catarina & Campos, 2010); (Nickel et al., 2005)
Premise 4: There is evidence that massage increases the level of oxytocin, consequently decreasing the level of anxiety, improving cortisol levels, and inducing calm. Premise 5: There is evidence that regular breaks increase the level of oxytocin, consequently decreasing the level of anxiety, improving cortisol levels, and inducing calm.	
Positive feedback	(Jack et al., 2013); (Waldman et al., 2017); (Baumeister et al., 2001); (De Kok et al., 2018)
Premise 6: There is evidence that feedback reinforcing the positive aspects is more meaningful to the individual than feedback reinforcing the negative ones. Premise 7: There is evidence that feedback reinforcing negative aspects is less meaningful to the individual than feedback reinforcing the positive ones.	
Inspiring messages and collective-oriented speeches	(Molenberghs et al., 2017); (Waldman et al., 2017)
Premise 8: There is evidence that inspiring messages and collective-oriented speeches by leaders generate more engagement of the subordinates.	
Mirror-neuron and empathy	(Goleman, 2012); (Becker, Cropanzano, & Sanfey, 2011); (Gallese & Goldman, 1998)
Premise 9: There is evidence that pairing an individual's gestures allows for a greater socially affective approximation to him/her.	
Loss aversion	(Baumeister et al., 2001)
Premise 10: There is evidence that losses are much more significant to individuals than gains.	
Psychological pain and its similarity to physical pain	(Butler, & Senior, 2007); (Bailey, 2007); (De Kok et al., 2018)
Premise 11: There is evidence that psychological pain arising from negative social situations has the same effect as physical pain.	

Source: Developed by the author

Individual's inability to multitask - Studies in this direction are not recent; research such as Pashler's (1993, 1994) demonstrated this inability. More recent research using fMRI (Functional magnetic resonance imaging) indicates that different regions of the brain are triggered to perform different activities (Schubert & Szameitat, 2003), causing the ability to focus to be reduced (Just, Carpenter, Keller, Emery, Zajac, & Thulborn, 2001) and consequently meeting Medina's arguments (2011) that mentions the brain's inability to focus on more than one task with high-level of cognitive effort at the same time, enabling just going from one task to another with more or less speed, but never doing both simultaneously. Therefore, in corporative environments in which a multitasking culture is encouraged, people have an error propensity of approximately 50%, besides taking more

time to fulfill a single task (Medina, 2011). These interferences were also proven in the fMRI study performed by Herath, Klingberg, Young, Amunts, and Roland (2001) and Paridon and Kaufmann (2010).

Hunger and rest breaks - effects on rationality - The research conducted by Danziger, Levav and Avnaim-pesso (2011) indicated that some judicial deliberations are not completely rational, there are odd variables that should not have an influence on legal decisions and would condition the decision making of experient judges. In the study, it was found that the percentage of favorable decisions has fallen gradually from ± 65% to almost zero, returning abruptly to ± 65% after a break. There is evidence that mental function can be restored, and mental fatigue overcome, in part, by interventions such as viewing nature scenes, taking a brief rest, experimenting with positive mood, and increasing body glucose levels (food intake) (Danziger et al., 2011).

Relaxation and the effect on oxytocin and cortisol levels - Oxytocin is a neuropeptide that triggers reactions in the individual's behavior, just as actions performed by the individual that can influence the levels of this hormone. In the study of Kosfeld, Heinrich, Zak, Fischbacher e Fehr (2005, p. 673), it was shown that a higher level of oxytocin "caused a substantial increase of the trust between human beings, thus boosting the benefits of social interactions" and, the authors complement "[...] oxytocin affects specifically the individual's disposal to accept the social risks resulting from the interpersonal interaction." (Kosfeld et al., 2005, p. 673)

According to Catarina and Campos (2010), some researchers hold that the oxytocin levels go up when the individual undergoes a massage session or when there is an induction of positive emotions, these techniques are corroborated by Turner, Altemus, Enos, Cooper, and McGuinness. (1999). A study conducted by Nickel Lahmann, Tritt, Loew, Rother and Nickel (2005) measured the efficiency of the progressive muscle relaxation for anger, testing the salivary cortisol concentration. There was evidence that the relaxing techniques are effective in treating the side effects of stress (increasing vitality and improving social activities and emotional problems) or for individuals who have relatively intense feelings of anger, as well as they seemed to influence the intensity of the feeling of anger perceived by the individuals themselves (Nickel et al., 2005).

Positive feedback - In the research of Jack, Boyatzis, Khawaja, Passarelli and Leckie (2013) the effects of inspirational training (focus on the positive aspects (strengths) of the individual) and non-inspirational training (focus on the negative aspects (weaknesses) of the individual) were explored through functional magnetic resonance imaging (fMRI). According to the authors, the inspirational training increased brain processing in the bilateral occipital areas and in the posterior temporal lobe, which indicates an emotional approach and the individual's openness to the training. The non-inspirational perspective produced an excitement of the sympathetic nervous system and greater activation in the insula, these are generally associated with negative affections, reduced attention, and blocking actions to the training. This way reinforcing, the benefits of training with a focus on strengths (Waldman et al., 2017). In this sense, there is an inversely proportional result when using the approach centered on emphasizing external forces and restrictions imposed on the individual (De Kok, Boyatzis, & Jack, 2018).

Inspiring Messages and collective-oriented speeches - In the study of Molenberghs, Prochilo, Steffens, Zacher and Haslam (2017), the individuals underwent functional magnetic resonance imaging (fMRI), in which they assessed collective-oriented statements and others leader-oriented ones. The results indicated that the subordinates had greater semantic processing when leaders delivered inspiring messages oriented to the collective, activating areas of the brain associated with cognitive control, working memory, and emotion (ventral prefrontal lobes and lower parietal lobes) (Molenberghs et al., 2017). The research of Molenberghs et al. (2017) suggested that the individuals paid more attention to and considered more meaningful the collective-oriented messages than when the leaders used self- oriented messages (self-aggrandizement). The research participants showed greater activation in the brain areas associated with the cognitive deliberation when the leader made a speech that did not emphasize the collective, referring in this way, that such people were evaluating the leader's intentions more than paying attention to the arguments (Waldman et al., 2017).

Mirror-neuron and empathy - The concept of mirror-neuron was coined in 1990 by Giacomo Rizzolatti, Vittorio Gallesw and Leonardo Fogasi. It is responsible for mimetic

imitation of human behavior, enabling the learning and being activated when viewing the action of the other individual, in addition to triggering brain regions that would be activated if the individual was performing the action (Gallese & Goldman, 1998). According to Goleman (2012), the mirror neurons make the emotions to be "contagious", causing the observed feelings to flow through the individual and helping in the emotional synchrony. For Becker et. al, (2011), the studies performed with individuals whose attitudes and mannerism were imitated suggested that the mirror-neuron has great influence over how people perceive and relate to others, once the participants described connecting more to the other person when they had their manners imitated in relation to a control group which was not subjected to the same approach (Gallese & Goldman, 1998).

Loss aversion - Negative emotions generally produce more cognitive processing than positive emotions, the individuals have a wider perception about the loss of a value than about the gain in similar quantity (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). Baumeister et al. (2001) claim that a person would feel more anguished by losing U$ 50,00 than happy if winning the same value. These same authors say that the motivation to avoid the loss of something is much bigger than the one to win something. They also highlight that bad mood and negative emotions have stronger effects than positive in cognitive processing and a major part of the efforts of affectation regulation is directed to escape bad mood in opposition to promote or prolong good mood (Baumeister et al., 2001).

Psychological pain and its similarity to physical pain - The social exclusion or everyday situations that imply embarrassing occasions to the subordinates can trigger unwanted sensations and generate suffering, the relation between the physical and social pain does not seem only metaphorical. According to (Butler, & Senior, 2007, p. 5) "there are sometimes processes that rely on the same mechanisms. An example is social pain resulting from being socially excluded, which produces activity in a similar network of brain regions as the experience of physical pain". Threats to our social attachments induce a negative limbic valence that can produce jealousy, anger, violence and can establish domain hierarchies, and this negative valence seems to correlate with increased amygdala activity (Bailey, 2007). Social distancing also unleashes grief-related syndromes, increased stress hormones, attenuated memory, reduced cognition, anxiety, and depression, sometimes leading to anger and aggression (Bailey, 2007).

Method

A mixed, quantitative, and qualitative, exploratory research was conducted within the inductive logic and in the field (Remler, & Van Ryzin, 2014). The data were collected by Survey (Fowler Jr., 2014) (sociodemographic information and knowledge about OCN) and semi-structured interviews (Gubrium, Holstein, Marvasti, & Mckinney, 2012). The population was formed by authorized leaders in activity, and the data collection happened between April and September of 2020 with respondents from all regions of the country. In total, the study had 113 respondents for the quantitative stage and 7 for the qualitative part.

The survey had eleven objective questions, which were formulated from the premises listed in Table 1, on a Likert scale with scores from 1 to 5. There was a range of ages (25 to 61 years old), with 66% men and 34% women, 89% from the South, 6% from the Southeast, and 5% from other regions. Among the segments of respondents, the following stood out: Information technology and communication (30.08%); Banking sector, financial intermediation (17.69%); Human health and social assistance (10.61%); Manufacturing industry (10.61%); and the remaining nineteen added together corresponded to 30.97%. Regarding the hierarchy level, 31% work in operational technical leadership, 41% in intermediate leadership, and 28% in strategic leadership. 73.45% have worked from 1 to 15 years in leadership positions. 83% had completed higher education with a MA/MFA/MBA and incomplete or complete Ms/MSc or PhD. Respondents from the area of medicine/neuroscience were disregarded, in order to prevent their specialized knowledge due to their training from influencing the data. The data, in the quantitative phase, were analyzed using ANOVA (Hair Jr., Black, Babim, & Anderson, 2018).

For the qualitative stage, participants who demonstrated greater and lesser knowledge about the established premises were selected. The interviews lasted approximately 45

minutes per person; ages ranged from 32 to 59 years. Five were from the southern region, and three from other regions of Brazil, being 5 men and 2 women. Two were strategic leaders, three were intermediate leaders and two were technical-operational leaders. The least experienced has worked between 6 and 10 years and the most experienced between 21 and 25 years; all of them occupy different positions and have completed postgraduate education (MA/MFA/MBA) or higher, with the exception of one respondent with only the higher education completed. Quantitative analysis was performed with descriptive statistics using the IBM® SPSS® Statistics Package for the Social Sciences version 20 software.

Qualitative data were treated by Content Analysis (Schreier, 2012; Krippendorff, 2013) and analyzed using the NVivo software, with floating attention to the identification and separation of text fragments, which were classified according to the categories found (eleven nodes defined a priori) and the respective subcategories (sub-nodes) emerging in the analysis. The categorization was based on the analysis of the empirical content, considering the theoretical premises defined in Table 1.

A mixed, quantitative, and qualitative, exploratory research was conducted within the inductive logic and in the field (Remler, & Van Ryzin, 2014). The data were collected by Survey (Fowler Jr., 2014) (sociodemographic information and knowledge about OCN) and semi-structured interviews (Gubrium, Holstein, Marvasti, & Mckinney, 2012). The population was formed by authorized leaders in activity, and the data collection happened between April and September of 2020 with respondents from all regions of the country. In total, the study had 113 respondents for the quantitative stage and 7 for the qualitative part.

The survey had eleven objective questions, which were formulated from the premises listed in Table 1, on a Likert scale with scores from 1 to 5. There was a range of ages (25 to 61 years old), with 66% men and 34% women, 89% from the South, 6% from the Southeast, and 5% from other regions. Among the segments of respondents, the following stood out: Information technology and communication (30.08%); Banking sector, financial intermediation (17.69%); Human health and social assistance (10.61%); Manufacturing industry (10.61%); and the remaining nineteen added together corresponded to 30.97%. Regarding the hierarchy level, 31% work in operational technical leadership, 41% in intermediate leadership, and 28% in strategic leadership. 73.45% have worked from 1 to 15 years in leadership positions. 83% had completed higher education with a MA/MFA/MBA and incomplete or complete Ms/MSc or PhD. Respondents from the area of medicine/neuroscience were disregarded, in order to prevent their specialized knowledge due to their training from influencing the data. The data, in the quantitative phase, were analyzed using ANOVA (Hair Jr., Black, Babim, & Anderson, 2018).

For the qualitative stage, participants who demonstrated greater and lesser knowledge about the established premises were selected. The interviews lasted approximately 45 minutes per person; ages ranged from 32 to 59 years. Five were from the southern region, and three from other regions of Brazil, being 5 men and 2 women. Two were strategic leaders, three were intermediate leaders and two were technical-operational leaders. The least experienced has worked between 6 and 10 years and the most experienced between 21 and 25 years; all of them occupy different positions and have completed postgraduate education (MA/MFA/MBA) or higher, with the exception of one respondent with only the higher education completed. Quantitative analysis was performed with descriptive statistics using the IBM® SPSS® Statistics Package for the Social Sciences version 20 software.

Qualitative data were treated by Content Analysis (Schreier, 2012; Krippendorff, 2013) and analyzed using the NVivo software, with floating attention to the identification and separation of text fragments, which were classified according to the categories found (eleven nodes defined a priori) and the respective subcategories (sub-nodes) emerging in the analysis. The categorization was based on the analysis of the empirical content, considering the theoretical premises defined in Table 1.

Analysis and discussion of results

Quantitative results

The questions for the quantitative stage, which were pertinent to the premises of this study, are in table 2 and from now on are referred to as Q1 to Q11. Table 3 shows the percentage of respondents on each question. Overall, disregarding question Q7, there was a greater number of respondents who indicated partial or total agreement for the 11 questions.

Table 2 - Questions on OCN for the quantitative stage

Questions on OCN for the quantitative stage
Q1 - I consider that, if the person is engaged, he/she can perform multiple complex activities simultaneously
Q2 - If an employee tells me that he/she needs to have a break during working hours so that his/her levels of stress and mental fatigue are reduced, I consider this break to have positive effects on the employee
Q3 - When the employee has not eaten for a long time, I understand that his/her decisions in the workplace are affected
Q4 - If the company has a workplace massage program available, I encourage the employees to get it during working hours
Q5 - When an employee has regular breaks during working hours, his/her anxiety levels are reduced, and the calmness level increases
Q6 - I consider that the feedback practice with employees has better results when the individual's strengths are highlighted
Q7 - I consider that the feedback practice with employees has better results when the individual's weaknesses are highlighted
Q8 - When a leader speaks (or make a speech) focusing on the benefits that employees will have for their engagement, instead of focusing only on the goals that should be achieved, I consider that there is a greater engagement of the people
Q9 - I understand that when a person imitates, even subtly, the moves and actions of another in a meeting, there is a bigger connection between these individuals, making the negotiation easier
Q10 - In the workplace, people perceive the gains (or positive occurrences) more meaningfully, giving it more value to these gains than when there are losses (or negative occurrences)
Q11 - I consider that an employee that passes through a bad situation (for example, to be embarrassed in front of others) has a bad sensation as he/she would have if he/she suffered a physical accident

Source: Developed by the author

Table 3 - Number and percentage of respondents per question

	Totally disagree	%	Partially disagree	%	Nor disagree, nor agree	%	Partially agree	%	Totally agree	%
Q1	10	8.85	18	15.93	3	2.65	59	52.21	23	20.35
Q2	0	0.00	0	0.00	3	2.65	31	27.43	79	69.91
Q3	1	0.88	1	0.88	3	2.65	23	20.35	85	75.22
Q4	0	0.00	1	0.88	14	12.39	34	30.09	64	56.64
Q5	0	0.00	3	2.65	9	7.96	53	46.90	48	42.48
Q6	1	0.88	5	4.42	4	3.54	52	46.02	51	45.13
Q7	25	22.12	36	31.86	6	5.31	32	28.32	14	12.39
Q8	1	0.88	4	3.54	4	3.54	53	46.90	51	45.13
Q9	5	4.42	8	7.08	28	24.78	52	46.02	20	17.70
Q10	10	8.85	29	25.66	11	9.73	46	40.71	17	15.04
Q11	5	4.42	11	9.73	21	18.58	41	36.28	35	30.97

Gender - After performing the T test analysis of independent samples on the responses of different genders, it is proved that there is a significant difference in the answers to questions Q2 with a significance of .000 and Q4 with a significance of .078, while the others that presented significance above .170. Corroborating that there is a difference in the perception of male and female respondents (greater agreement for females) regarding breaks during working hours and their effects on stress and mental fatigue, and on the encouragement of workplace massage. Overall, disregarding the questions with greater individual differences between genders, agreement with the remaining questions is shared between male and female respondents.

Hierarchy levels – After analyzing the significance[1], it was found that the question Q1 has a significance of .026 and question Q2 a significance of .008, all other questions had significance above .151 (Q1 = .026 | Q2 = .008 | Q3 = .165 | Q4 = 437 | Q5 = .411 | Q6 = .483 | Q7 = .655 | Q8 = .706 | Q9 = .707 | Q10 = .763 | Q11 = .151). Exposing that in the sample, there are different understandings about the multitasking abilities of individuals and that breaks can have positive effects on the subordinates.

When performing multiple comparisons[2], it was found that there are significant differences in question Q1, for the levels of operational technical leadership versus intermediate leadership (significance of .020) and Q2, between the levels of technical operational leadership versus intermediate leadership (significance of .068) and technical operational leadership versus strategic leadership (significance of .007). It can be inferred that the operational technical leadership, being closer to the individuals, disagrees to a greater degree about the multitasking capabilities of the subordinates and agrees to a greater degree with breaks in order to reduce the mental fatigue of the subordinates, than the intermediate and strategic leadership.

Time in leadership positions - Respondents were segmented by length of experience in leadership positions, in the following groups: Up to 5 years; from 6 to 10 years; from 11 to 15 years and over 16 years. The correlation between time of leadership and the influence on the agreement or disagreement of the questions was analyzed. The significance analysis[1] found that only question Q1 had a significance of .004, and all other questions had a significance greater than .126 (Q1 = .004 | Q2 = .669 | Q3 = .593 | Q4 = 968 | Q5 = .277 | Q6 = .255 | Q7 = .127 | Q8 = .541 | Q9 = .385 | Q10 = .991 | Q11 = .492).

When performing multiple comparisons[2], it was found that there are significant differences in the questions: Q1, between respondents who have up to 5 years in leadership positions versus respondents who have more than 16 years in leadership positions (significance of .002) and respondents who have 11 to 15 years in leadership positions versus respondents who have more than 16 years in leadership positions (significance of .098); and Q7 between respondents who have up to 5 years in leadership positions versus respondents who have 6 to 10 years in leadership positions (significance of .091).

Thus, it is found that the longer the time of experience in leadership positions, the greater the assimilation that the subordinate can perform two complex functions

simultaneously, and that leaders who have worked for between 6 and 10 years in leadership positions tend to agree with greater emphasis that the reinforcement of the negative points of their subordinates guarantee better results when compared to leaders with less and longer experience in this type of position.

Qualitative results

Multiple complex activities simultaneously - The premise P1 was formulated with a connotation of the volitional and rational action in the term "being engaged", which was proven in Medina's research (2011) not to be possible even if there is a rational desire to this. Some interviewees have understood this affirmation as the execution of multiple complex activities performed at the same time synchronously, which is change from one another quickly. When the clarification about the simultaneous execution and faster transition between activities was made, everyone disagreed with the statement. From the interviews, some factors arose, such as lack of focus, confirmed by the study of (Just et al., 2001), and inability to perform two activities simultaneously, supported by the research of Paridon and Kaufmann (2010). Therefore, the information of the qualitative stage complements the consolidated results on the quantitative one, indicating that the understanding of the interviewees shows that the leaders are conscious about the impossibility of their subordinates performing two complex activities simultaneously, even if this finding is justified only empirically and not by OCN verified justifications.

Breaks and reduction of stress and mental fatigue - The premise P2 claims that the breaks allow cortisol reduction and, consequently, induce the reduction of stress level in addition to restoring mental fatigue. The answers presented on the interviews indicated the ordinary agreement of the interviewees on the breaks and their effects on stress levels and the change of the emotional state of the employee. Elements related to the encouragement of breaks also emerged due to the exploratory nature of the interview, such as: Creativity Improvement; Emotional balance recovery; Motivation and engagement. It is important to highlight that the breaks are not good for stress reduction, which is the main evidence on the research of Danziger et al. (2011), but there is also reference to the increase of productivity, a factor that is not proven based on the neuroscientific studies. The context for the breaks also appeared as being important for the beneficial effect, inducing the desired state. There was no relation in the interviews that referred to the knowledge about neuroscientific factors of the practice, such as variation in the oxytocin or cortisol levels, being the leaders' arguments supported just by empirical observations.

Eating and decision making - The premise P3 observes that eating and the feeling of satiety reduce the stress and allow the individual to make decisions more complacently than when he/she is feeling hungry. The answers for this question indicated a consensus about the relation of these feelings and the productivity of the individual, mainly when relating the necessity of energy to perform the daily activities and the psychological factors associated. These results are in line with the studies of Malik, McGlone, Bedrossian and Dagher (2008), in which the effects of the Ghrelin hormone over the hunger feeling, as well as the mood swings proportional to this feeling and tendency to greater irritability to emerge as justification of some interviewees' agreement, these factors are also highlighted in the research of Danziger et al. (2011). One of the interviewees identifies a direct reference to studies that link the hunger feeling and its influence on decisions, citing the research by Danziger et al. (2011). It was found that the majority of the interviewees considered as true the affirmation that eating affects the decisions in the workplace, some of them even brought references to knowledge about physical, biological, and emotional factors triggered in the individuals.

Encouragement to workplace massage - The P4 premise claims that workplace massage increases the oxytocin levels bringing an improvement in the anxiety status and modifying the cortisol levels, which induces calmness. Some of the interviewees encourage the practice, combined with the perception of benefits to him/herself that was observed after the completion of massages during work hours. The justifications are aligned with the associations made by Catarina and Campos (2010), Turner et al. (1999), and Nickel et al. (2005). However, it is essential to point out that there was an elevated number of undecisive respondents. When carrying out more in-depth interviews, it was found that the

indecisiveness happened not due to the lack of knowledge, but because of external factors - the interviewees reinforced the existence of prejudice against this practice - the action is considered as "controversial". It was not possible to detect a gender bias in the responses of the interviewees, nor its greater or lesser level of acceptance of this premise, though it is important to mention that in the quantitative stage, there was a bigger tendency for the practice encouragement from the female gender respondents. This fact suggests an opportunity for future studies about this issue. There still appears to exist concern of embarrassment or prejudice in relation to the practice of the male gender.

Regular breaks, anxiety reduction and calmness increase - The P5 premise establishes that regular breaks increase the oxytocin levels, which consequently leads to a reduction of anxiety and induce calmness. The context in which these regular breaks happen was perceived in the speech of some interviewees, emphasizing the fact that such movements should be necessarily focusing on a different activity that allows the individual to get out from the problem he/she is dealing with, and consequently making the break moments beneficial for the emotional state. Among the interviewees, there are also perceptions that such regular breaks and the benefits they generate depend on the individuals' maturity level, as shown in the following excerpt. Thus, it is evidenced by the interviewees' understanding that the breaks, when implemented regularly, can benefit both the emotional aspects of the individual and the productivity-related aspects, as well as them emerge some elements that such practice should be done preserving the proper context and the maturity of the subordinates. Although, there are no references to neuroscientific conclusions about the practice.

Positive and negative feedback - The P6 premise indicates that the reinforcement of strengths is more meaningful than reinforcing the weaknesses while the premise P7 affirms the exact opposite. Among the interviewees, there is the point of view that when reinforcing the positive aspects, there will be greater benefits due to the reinforcement of the individuals' best characteristics, allied to the justification of emotional comfort and motivation, positioning that agrees with both premises. These findings are in line with the research conducted by Jack et al. (2013) and De Kok et al. (2018) that demonstrate a bigger commitment to the parasympathetic system (responsible for inducing the body to an emotional state of stability and calmness) when individuals were submitted to coaching sessions which reinforced the individual's positive aspects.

Among the respondents, it was identified a perception that reinforcing negative aspects is more destructive for the individual, such observation is in accordance with the hypotheses from the studies of Jack et al. (2013) and De Kok et al (2018) that demonstrated more participation of the sympathetic system (responsible for the organism preparation for dealing with stress and emergence situation) when individuals were submitted to coaching sessions which reinforced the individual's negative aspects. There were positions that considered the profile of each person and his/her respective openness and maturity to receive negative feedback without considering it effectively destructive or demotivating, as well as the reference to be mentally better when positive aspects are highlighted, this understanding is aligned with the established premises. However, elements that negative feedback also have effects on the individual were identified, these are more related to the long-term evolution than necessarily with immediate physical effects.

It is important to emphasize that the prominence of the individual's perception of negative aspects is more emotionally shocking and lasts longer than the individual's perception of the positive aspects that the leader highlights, this way the act of stressing the weaknesses of the individual goes against the studies conducted by Waldman et al. (2017) and Baumeister et al. (2001). Thus, it is clear that there is a division in the understanding between the leaders, whereas some consider it important to reinforce the positive aspects to a greater degree, and others believe the balancing to be a natural feature of feedback. It is also noticed that, by leaning to a greater degree to highlight the positive points, the respondents presented arguments considering the final emotional state of the individual resulting from such an approach, with no arguments referring to the OCN.

Benefit-oriented speeches - The P8 premise claims that the speeches and inspiring talks of the leaders generate more engagement on the subordinates when they are oriented to the collective. Some respondents presented arguments related to the goal emphases but always allied to the argument that the speech oriented to the collective benefits results in more engagement, which supports the established premise and the research conducted by

Molenberghs et al. (2017). Among the answers, it is also essential to highlight the emergence of some elements indicating an emotional approach of the members of a group when certain goals are reached, even if such goals do not necessarily generate individual benefits.

Therefore, it is clear that leaders have a relative understanding of the benefits of speeches that are collective-oriented, corroborating with the research conducted by Molenberghs et al. (2017), which emphasizes through the studies of fMRI the activation of the areas associated with the cognitive control, working memory and emotion of individuals when such practice is adopted. Just as such speeches can reinforce emotional attractiveness in the subordinates towards their leaders (Waldman et al., 2017).

Gesture imitation - The premise P9 sets that pairing the gestures of an individual allows for greater social approximation. In the interviews, it was possible to perceive an indecision as to the effectiveness of this practice, based mainly on the argument that the imitation when performed in a perceivable way would be harmful to the relationship.

Some answers stood out for the agreement associated with a higher level of knowledge of the implicit mechanisms of the gesture imitation, as described by one of the interviewees that cites Rapport (a psychology concept that when used as a technique creates a connection of attunement and empathy with another person), being somehow aligned with the results found in Goleman's research (2012). Another interviewee mentioned knowledge of neurolinguistic programming (NLP), identifying that there is a certain level of knowledge of these factors by the leaders and that such contents are used within the organizations.

In this sense, it is important to mention that neurolinguistic programming is an approach with practices that needs evidence through methods commonly used in neuroscientific studies, it does not have, therefore, a replicable neuroscientific foundation. It is also important to note that neurolinguistics per se is an area of study that assesses brain regions and their interactions in language acquisition, research that are not carried out in NLP despite the term being part of the composition of the name of the practice. However, it was noticed during the interviews that this practice is used within the corporate environment. There is evidence that the practice of gesture imitation, from which there were investigated benefits in the studies of Goleman (2012) and Becker et al., (2011), is understood by a portion of the leaders, despite the need to better refer such knowledge to reliable and scientifically proven sources.

Gain and loss perception (positive and negative occurrences) - The P10 premise claims that the losses are much more meaningful for the individuals than the gains. There is a mutual understanding that negative occurrences or losses last longer than gains, which is in accordance with the research conducted by Baumeister et al. (2001). There is also a highlight among the responses for a correlation of the number of positive occurrences that are needed to overcome a negative one, with many positive events being needed to overcome the negative.

An interesting example reported in one of the interviews reinforces that a loss sensation, even the slightest, has a devastating emotional charge for the subordinate, even if such an individual has the characteristic of owning positive aspects and is recognized by them. Thus, there is an agreement of the interviewees to the premise, and, in a sense, the losses are more shocking to the individuals than the gains (Baumeister et al., 2001), just as such occurrences last longer in the memory of the subordinates.

Psychological pain versus physical pain - The premise P11 indicates that the psychological pain from negative social situations has the same effect on the individual as physical pain. Among the respondents, who have shown doubts about how to position themselves in this question, it is highlighted two that used the term "somatization" to justify the answer, nevertheless, both respondents indicated that this knowledge originated in the study of neurolinguistic programming.

It was identified also indecision and divergence among the interviewees when it came to positioning the two sensations in the same proportion or scale, distinct characteristics and justifications were presented for the positioning. Some respondents brought examples to corroborate with their justifications on the agreement with the affirmation, demonstrating the seriousness that such perception of psychological pain can cause in the subordinates and the consequences and reflections on the workplace.

Statements were also made in the sense that physical pain lasts for a certain period, whereas psychological pain lasts longer or even throughout the individual's life. Both have

a certain level of correlation or recursion, in which the physical pain can generate psychological one and the psychological can generate the physical (somatization). Despite the interviewees' difficulty in establishing the same scale between physical and psychological pain, the responses and perceptions of such leaders are in line with the premises and consequently with the research conducted by Butler and Senior (2007) that associate the same brain areas to the valence of physical and psychological pain, the study of Bailey (2007) relates negative social occurrences to emotional and physical reflexes as well as the research of De Kok et al. (2018), which reinforces the physical influence in the individual who is empathic with another individual.

Knowledge sources and reference searching - During the interviews, in addition to questioning about the eleven premises of this research, questions were asked regarding the level of knowledge about the study area of organizational cognitive neuroscience, just as the propensity of leaders to search for knowledge sources, and the proper validation of references that could be performed to prove the veracity of the information, which, by chance, can be found when researching on this topic.

The most common sources cited for knowledge searching, in case of interest for this field of study, were books, lectures, short courses, extension courses, official educational formation, specialized journals, and scientific articles. However, there is an understanding on the part of respondents that this topic is specifically more complex, and in a certain way, with more restrictions to scientific means.

There was an inclination of respondents to seek information from recognized educational institutions, as well as the area of people management. They do not refrain, however, from using the internet research to find both content and institutions that are references in the subject, even if not necessarily universities, but organizations that somehow address the content of interest.

When questioned about their tendency to search for references, when they might come across information about studies that link the behavior of subordinates to neuroscientific research, there were positionings that varied from a simple internet research by the name of the author/institution to deeper searches reaching the level of assessing the author's curriculum or previous publications of the institution. It is perceived that the interviewees have a high level of education, the majority with Ms/MSc or PhD, this factor can influence the importance attached to the search for the information reference. There is also the perception that, even with a reliable source, there is the need for a critical assessment of the content by the leaders.

Some reports link the difficulty of proving the information, precisely because it is a complex subject. The difficulty of proving the reference is also reported, even if the origin of such information is from people who have theoretically proven training in the area, as highlighted by EN_1 in the excerpt: "*Some even read the person's biography, the résumé, but if the person writes there that he/she has a Ph.D at Harvard, no one goes after it to validate, no one enters the Harvard website and searches if the person's name is there*".

When asked whether, in general, regardless of education level, leaders would seek proof of the veracity of information, there were perceptions that this practice still lacks importance. Some respondents link the carelessness of proving the source to factors such as lack of time or even the leader's interest, and some leaders choose to rely on the opinion or indication of acquaintances or even people who have already had contact with the information at some point.

The negligence reported in the search sources verification can also be caused by a kind of outsourcing of responsibility, and it is no longer performed when the company conducts the selection of lecturers or courses itself, transferring the trust to the sector of the company responsible for hiring courses and lectures. The act of not questioning or validating whether the exchanged information about neuroscience within the organization, and practices that can be adopted, tends to be harmful, once without scientific proof of the practices' effectiveness, the leaders can take actions on the subordinates that do not necessarily end in benefits.

Finally, there is a tendency to associate the acronym "Neuro" or the word "Neuroscience" to contents that refer to verified neuroscientific studies. When the content of the training, news, lecture or course is accompanied by this acronym or word, in general, the leader hardly looks for scientific proof of the content being presented, perhaps due to the intrinsic complexity of studies in this area, being highlighted by some interviewees the

indiscriminate use of this term and similar ones, leading to the misunderstanding on the part of people that the term itself would be a "seal" that would attest to the scientific veracity of the information, even if such fact does not exist.

In general, leaders argue that the source of information, verification of data sources, and the proper scientific evidence are important when it comes to studies that link neuroscience to the behavior of individuals in the workplace. However, even the interviewees do not carry it out with due care.

Management recommendations

After an integrated analysis of quantitative and qualitative results of this research, management recommendations for preparing or reviewing corporate education strategies in organizations are listed, aiming at training leaders on OCN, as it opens the opportunity to support current perceptions with complementary information, since, at no point in the interviews, reliable sources were cited to justify the perceptions and practices currently adopted by the leaders regarding the subordinates. Just as the recommendations for the external programs provided by educational institutions, and for leaders, in their individuality, to seek for improving the leadership practices, considering for those studies in organizational cognitive neuroscience.

The multidisciplinarity that forms the study area of organizational cognitive neuroscience tends to constitute itself as a barrier that makes it difficult for leaders to understand practices that are applicable or not in the workplace, leading leaders, and companies not to question or validate with proper emphasis the sources and references of such practices. Thus, it is recommended that studies and publications in this area, when specifically aimed at the consumption of leaders, have a less technical language than that usually used in the academic environment, more focused on managerial practices and on a language that is easily understood by people in leadership positions, regardless of their education. However, it reinforces the need to maintain and emphasize the bibliographic references of the original research, if the individual wishes to go further into the intention of verifying the information he/she is receiving.

There is also a possible gap and distortion of knowledge about OCN that occurs due to practices that are erroneously associated with studies that are based on neuroscience techniques, as the case of Neurolinguistic programming, for example (NLP), in this sense, it is recommended that the educational institutions demonstrate in a clear form, in their capacitation programs and corporative education or through extension courses, which techniques and practices have neuroscientific verification, listing sources and references of studies, thus enabling leaders to be sure about the information they receive and to distinguish practices that demonstrably input benefits to the workplace. In this same sense, it is recommended that organizations identify and understand if their leaders have the knowledge and apply some practice in the work environment that theoretically have neuroscientific evidence, but they lack such proof, clarifying for leaders the need for such practices to be better studied by accredited researchers to only then allow their applications in organizational environments. Figure 1 consolidates the barriers, gaps, and pertinent recommendations to educational institutions, companies, and individuals.

It is also recommended that organizations review their leadership training programs, so that they reinforce the importance of the leader creating a critical view of content related to OCN. In this sense, creating the habit and ability of leaders to research sources and identify reliable and unreliable content that relates neuroscience to the work environment, avoiding content about OCN that has not been scientifically proven and replicated.

It is noteworthy that the recommendations listed here need to be aligned with intrinsic factors of the organizational culture, being necessary so that the organization to assess the applicability of the recommendations in its context. Identifying cultural values that, for example, refer to critical reflection for analysis and validation of sources, and on the adoption of OCN premises through managerial attitudes and organizational behavior, thus enhancing the studies, practices, and research in the area of OCN to resonate among people in the work context. Finally, the theoretical and practical contributions of this research were summarized in Figure 2, according to each level of coverage.

Final consideration

The general objective of this research was to analyze the perception of leaders about the discoveries of organizational cognitive neuroscience and its practical applications in the work environment. Through the integration of the findings of the quantitative and qualitative steps, it is possible to meet the research objectives regarding a) practices, based on assumptions that can be applied in the corporate environment and that rely on neuroscientific studies; b) leaders' perception of such assumptions; c) knowledge distortions around organizational cognitive neuroscience; d) knowledge gaps that can be better addressed in organizations about internal or external training programs. As well as the need for a better foundation on the knowledge sources and references of leaders is also evidenced so that they can support their perceptions from neuroscientific studies and research, especially directed to the area of organizational cognitive neuroscience.

As a theoretical contribution, this study makes it possible to advance in the field of organizational cognitive neuroscience, as well as in the areas of leadership, people management, and business management. Regarding its practical contributions, this research allows organizations to reflect on the actions that are taken by leaders in the workplace. Likewise, it enables the companies to distinguish between practices that can better induce the well-being of the subordinates, thus revising the policy of selection of lecturers, courses, and content about OCN considering the adequate sources and references, and even the redesign of training programs for leaders counting on scientific-based content. In relation to the individuality of the leader, this study allows the deepening in concepts and research about the subordinates' behavior understanding from a neuroscientific perspective, enabling a critical reflection on the involuntary factors triggered in subordinates by the leaders' actions.

Concerning the limitations of this study, it is highlighted the preponderance of respondents from the southern region of the country, the substantial number of respondents from the information technology sector, and the important level of education of the leaders who responded to both the quantitative and qualitative stages. For future research, it is recommended to enlarge the regional range and the sectors of the economy. It is as well recommended to investigate the effect of the use of the words such as "neuroscience" or the use of the acronym "neuro" in contents, lectures, and courses on the propensity of people considering the topics of these subjects as being true, without the proper scientific verification.

References

Armour J A (1994), Neurocardiology: Anatomical and Functional Principles, New York, NY, Oxford University Press: 3-19.

Bagozzi, R. P., Verbeke, W. J. M. I., Dietvorst, R. C., Belschak, F. D., van den Berg, W. E., & Rietdijk, W. J. R. (2013). Theory of Mind and Empathic Explanations of Machiavellianism: A Neuroscience Perspective. Journal of Management, 39(7), 1760–1798. https://doi.org/10.1177/0149206312471393

Bailey, C. E. (2007). Cognitive accuracy and intelligent executive function in the brain and in business. Annals of the New York Academy of Sciences, 1118, 122–141. https://doi.org/10.1196/annals.1412.011

Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad Is Stronger Than Good. Review of General Psychology, 5(4), 323–370. https://doi.org/10.1037/1089-2680.5.4.323

Baumeister, R. F., & Leary, M. R. (1995). The Need to Belong: Desire for Interpersonal Attachments as a Fundamental Human Motivation. Psychological Bulletin, 117(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497

Becker, W. J., & Cropanzano, R. (2010). Organizational neuroscience: The promise and prospects of an emerging discipline. Journal of Organizational Behavior, 31(7), 1055–1059. https://doi.org/10.1002/job.668

Becker, W. J., Cropanzano, R., & Sanfey, A. G. (2011). Organizational neuroscience: Taking organizational theory inside the neural black box. Journal of Management, 37(4), 933–961. https://doi.org/10.1177/0149206311398955

Bickle, J. (2006). Reducing mind to molecular pathways: Explicating the reductionism implicit in current cellular and molecular neuroscience. Synthese, 151(3), 411–434. https://doi.org/10.1007/s11229-006-9015-2

Butler, M. J. R. (2017). Organizational cognitive neuroscience – potential (non-) implications for practice. Leadership and Organization Development Journal, 38(4), 564–575. https://doi.org/10.1108/LODJ-07-2015-0163

Butler, M. J. R., & Senior, C. (2007). Toward an organizational cognitive neuroscience. Annals of the New York Academy of Sciences, 1118(0), 1–17. https://doi.org/10.1196/annals.1412.009

Catarina, D., & Campos, F. De. (2010). Oxitocina e comportamento humano. Revista de Enfermagem Referência, III Série (no 1), 125–130. https://doi.org/10.12707/rii1048

Damásio, A. (2012). O erro de Descartes: emoção, razão e o cérebro humano. Editora Companhia das Letras.

Damásio, A. (2015). O mistério da consciência: do corpo e das emoções ao conhecimento de si. Editora Companhia das Letras.

Danziger, S., Levav, J., & Avnaim-Pesso, L. (2011). Extraneous factors in judicial decisions. Proceedings of the National Academy of Sciences of the United States of America, 108(17), 6889– 6892. https://doi.org/10.1073/pnas.1018033108

De Kok, P., Boyatzis, R. E., & Jack, A. I. (2018). The neuroscience of coaching. Consulting Psychology Journal: Practice and Research, 70(1), 11. https://doi.org/10.17226/5985

Fowler Jr., F. J. (2014). Survey research methods. 5th edition. Thousand Oaks: Sage Publications.

Gallese, V., & Goldman, A. (1998). Mirror neurons and the simulation theory of mind-reading. Elsevier Science, 2(12), 1–9. Retrieved from papers3://publication/uuid/F4C9A60C-831E-408B-81C4- D57D919ADFE9

Goleman, D. (2012). Inteligência Social: o poder das relações humanas. Elsevier Brasil.

Gubrium, J. F., Holstein, J. A., Marvasti, A. B., & Mckinney, K. D. (2012). The sage handbook of interview research: the complexity of the craft. 2nd edition. Thousand Oaks: Sage Publications.

Hair JR., J. F., Black, W. C., Babim, B. J., & Anderson, R. E. (2018). Multivariate data analysis. 8th edition. Boston: Cengage.

Herath, P., Klingberg, T., Young, J., Amunts, K., & Roland, P. (2001). Neural correlates of dual task interference can be dissociated from those of divided attention: An fMRI study. Cerebral Cortex, 11(9), 796–805. https://doi.org/10.1093/cercor/11.9.796

Jack, A. I., Boyatzis, R. E., Khawaja, M. S., Passarelli, A. M., & Leckie, R. L. (2013). Visioning in the brain: An fMRI study of inspirational coaching and mentoring. Social Neuroscience, 8(4), 369– 384. https://doi.org/10.1080/17470919.2013.808259

Just, M. A., Carpenter, P. A., Keller, T. A., Emery, L., Zajac, H., & Thulborn, K. R. (2001). Interdependence of nonoverlapping cortical systems in dual cognitive tasks. NeuroImage, 14(2), 417–426. https://doi.org/10.1006/nimg.2001.0826

Kahneman, D. (2011). Thinking, fast and slow. Macmillan.

Kosfeld, M., Heinrichs, M., Zak, P. J., Fischbacher, U., & Fehr, E. (2005). Oxytocin increases trust in humans. Nature, 435(7042), 673–676. https://doi.org/10.1038/nature03701

Krippendorff, K. (2013). Content analysis: an introduction to its methodology. 3rd edition. Thousand Oaks: Sage Publications.

Lieberman, M. D. (2007). Social Cognitive Neuroscience: A Review of Core Processes. Annual Review of Psychology, 58(1), 259–289. https://doi.org/10.1146/annurev.psych.58.110405.085654

Malik, S., McGlone, F., Bedrossian, D., & Dagher, A. (2008). Ghrelin Modulates Brain Activity in Areas that Control Appetitive Behavior. Cell Metabolism, 7(5), 400–409. https://doi.org/10.1016/j.cmet.2008.03.007

Medina, J. (2011). Brain rules: 12 principles for surviving and thriving at work, home, and school. ReadHowYouWant. com.

Molenberghs, P., Prochilo, G., Steffens, N. K., Zacher, H., & Haslam, S. A. (2017). The Neuroscience of Inspirational Leadership: The Importance of Collective-Oriented Language and Shared Group Membership. Journal of Management, 43(7), 2168–2194. https://doi.org/10.1177/0149206314565242

Nickel, C., Lahmann, C., Tritt, K., Loew, T. H., Rother, W. K., & Nickel, M. K. (2005). Short communication: Stressed aggressive adolescents benefit from progressive muscle relaxation: A random, prospective, controlled trial. Stress and Health, 21(3), 169–175. https://doi.org/10.1002/smi.1050

Paridon, H. M., & Kaufmann, M. (2010). Multitasking in work-related situations and its relevance for occupational health and safety: Effects on performance, subjective strain, and physiological parameters. Europe's Journal of Psychology, 6(4), 110–124. https://doi.org/10.5964/ejop.v6i4.226

Pashler, H. (1993). Doing two things at the same time. American Scientist, 81(1), 48–55. https://doi.org/10.2307/29774820

Pashler, H. (1994). Dual-task interference in simple tasks: Data and theory. Psychological Bulletin, 116(2), 220– 244. https://doi.org/10.1037/0033-2909.116.2.220

Remler, D. K., & Van Ryzin, G. G. (2014). Research methods in practice: strategies for description and causation. 2nd edition Thousand Oaks: Sage Publications.

Rock, D. (2008). SCARF: A brain-based model for collaborating with and influencing others. NeuroLeadership journal, 1(1), 44-52.

Rock, D., & Schwartz, J. (2007). The neuroscience of leadership. Brain and Behavior, v. 16, n. 3,p. 10–17.

Schreier, M (2012). Qualitative content analysis in practice. London: Sage Publications.

Schubert, T., & Szameitat, A. J. (2003). Functional neuroanatomy of interference in overlapping dual tasks: an fMRI study. 17, 733–746.

Senior, C., Lee, N., & Butler, M. (2011). Organizational cognitive neuroscience. Organization Science, 22(3), 804–815. https://doi.org/10.1287/orsc.1100.0532

Turner, R. A., Altemus, M., Enos, T., Cooper, B., & McGuinness, T. (1999). Preliminary research on plasma oxytocin in normal cycling women: investigating emotion and interpersonal distress. Psychiatry, 62(2), 97– 113.

Ventura, D. F. (2010). Um retrato da área de Neurociência e comportamento no Brasil. Psicologia: Teoria e Pesquisa, 26(spe), 123–129. https://doi.org/10.1590/s0102-37722010000500011

Waldman, D. A., Wang, D., & Fenters, V. (2019). The Added Value of Neuroscience Methods in Organizational Research. Organizational Research Methods, 22(1), 223–249. https://doi.org/10.1177/1094428116642013

Waldman, D. A., Ward, M. K., & Becker, W. J. (2017). Neuroscience in Organizational Behavior. Annual Review of Organizational Psychology and Organizational Behavior, 4(1), 425–444. https://doi.org/10.1146/annurev-orgpsych-032516-1