Neuropsychiatr Invest. 2023;61(4):117-121

Review
10.5152/NeuropsychiatricInvest.2023.23010

The Relationship Between Emotional Intelligence and Decision-Making

Selin Yilmaz

Department of Psychology, Adana Alparslan Türkeş Science and Technology University, Faculty of Humanities and Social Sciences, Adana, Turkey

ABSTRACT

It is noteworthy that individuals mostly make intuitive and quick choices in complex situations. It is also well established that affective processes play an essential role in decision-making under uncertainty and risk. The recent literature has focused on the contribution of emotional intelligence domains to individuals' effective decision-making skills. The current review study aimed to draw attention to neuropsychological studies investigating a possible link between emotional intelligence and decision-making performance in clinical and nonclinical samples. In addition, decision-making and emotional intelligence were discussed within the framework of the somatic marker hypothesis and dualprocess theory. This review also explored the brain regions associated with decision-making and emotional intelligence, as well as the impact of emotional intelligence training programs on decision-making performance. In line with the literature, it can be concluded that an individual's ability to make effective decisions can be enhanced through increasing emotional intelligence skill training program.

Keywords: Dual process theory, somatic marker hypothesis, Iowa gambling task, emotion regulation, ambiguity preferences, risky decision

INTRODUCTION

Decision-making is a high-level cognitive process and can enable individuals to make selection of one choice among several possible options.[1] Individuals constantly set short-term and long-term goals and make decisions in many areas, such as work/school, family life, social life, personal development, and economy. Decisions in many such areas can be difficult and complex, with unintended or risky consequences. Particularly since high uncertainty lead to increased cognitive load, automatic emotional appraisal can be the main determinant of many judgments and behaviors.[2] In order to cope with the complex flow of information, individuals often need to quickly decide which of the information in their long-term memory is appropriate to the situation. Therefore, it is thought that cognitive skills and emotional processes come into play when investigating the causes of events and behaviors. The relative role of emotional and cognitive processes in guiding reasoning and decision-making in many aspects of an individual's daily life remains an important topic in empirical studies.[3] In this context, it is important to clarify the role of emotional intelligence, considered as a combination of emotion and cognition, in decision-making.

Corresponding author:
Selin Yilmaz

E-mail:
yilmaz-selin@outlook.com

Received: June 14, 2023
Accepted: December 04, 2023
Publication Date: December 28, 2023

Cite this article as: Yilmaz S. The relationship between emotional intelligence and decision-making. *Neuropsychiatr Invest.* 2023;61(4):117-121.

Emotional intelligence, known as a separate construct from personality, is a cognitive ability involving the cognitive processing of emotional information.[4] Emotional intelligence is conceptualized as the ability to monitor and regulate one's own and others' emotions, to distinguish between them, and to think and act accordingly.[5] It is emphasized that it is a type of social intelligence that can be developed through experience and interactions and involves the use of emotional content in problem-solving. Taken separately, emotion represents the interpersonal transmission of information, and intelligence corresponds to making a valid inference from them.[5]

There are different measurements of emotional intelligence based on various theoretical models. Ability model of emotional intelligence is relevant to actual capability and measured via performance test. Trait emotional intelligence model refers to behavioral tendency and is measured through a self-report test.[6] The former consists of the ability to perceive, facilitate, understand, and manage oneself and others.[7] The latter reflects emotional self-perception and includes various domains, such as emotional awareness, emotion regulation, stress management, empathy, and optimism.[8] Therefore, neuropsychological studies examining decision-making behavior have examined the effect of decision-making behavior by utilizing emotional intelligence measures based on these models. In particular, as both cognitive skills and emotions can be important components of the decision-making process, the number of emotional intelligence studies in clinical and non-clinical samples has gradually increased.

The goals of the present review study were to (i) understand whether there is a relationship between emotional intelligence and decision-making skills in clinical and non-clinical samples and (ii) discuss a possible link between emotional intelligence and decision-making performance within the framework of the somatic marker hypothesis (SMH) and dual process theory. Identifying the role of emotional intelligence on decision-making performance through different theoretical approaches could yield important implications for the creation of intervention programs to enhance decision-making problems in healthy individuals and decision-making deficiencies related to psychiatric or neurological disorders.

EMOTIONAL INTELLIGENCE AND DECISION-MAKING

Theoretical Approaches to Decision-Making and Emotional Intelligence

Somatic Marker Hypothesis: The SMH, which is one of the important theoretical approaches to clarify decision-making behavior, suggests that somatic markers (skin conductance response, blood pressure, heart rate, etc.) have a key role in the decision-making process.[9] These emotion-based signals play a protective role in negative cases while playing an encouraging role in positive cases and can hence assist to make wiser choices. It was postulated that somatic markers and cognitive processes, such as attention and working memory, interact with each other and, hence cause us to make rational or irrational decisions.[9] Empirical testing of SMH began with the use of Iowa Gambling Test (IGT) to evaluate the decision-making dysfunction of patients with ventromedial prefrontal cortex (VmPFC) damage.[10] This test comprises 4 card decks (A, B, C, D). In the C and D advantageous decks, losses are smaller than gains, leading to overall long-term gains. On the contrary, A and B disadvantageous decks offer high losses, leading to overall long-term losses. Especially, patients with VmPFC damage showed more deck A and B selections and fewer deck C and D selections than healthy people.[11] As a result, the understanding of the role of the VmPFC in decision-making, also known to have an essential role in the processing of emotional feedback, might led to the use of IGT as an important decision-making task in various future studies.

In essence, VmPFC-damaged patients had difficulties in personal and interpersonal decision-making despite having normal intellectual capacities, such as cognitive intelligence, memory, and language. This has led to serious functional impairment in these people due to disruption to family and social lives, personal distress, and a poorer work–life balance. It was also found that only patients with lesions in the somatic marker circuitry (i.e., VMPFC, amygdala, and insular cortices) had impaired social functioning and decision-making, as well as low emotional intelligence, despite a normal level of cognitive intelligence (IQ).[12] They proposed that the neural systems promoting somatic state activation in the decision-making process might overlap with neural circuitry supporting emotional intelligence.[12] Thus, this model of emotional intelligence based heavily on SMH predictions may have formed the basis of many subsequent studies examining the relationship between emotional intelligence and IGT.

Dual Process Theory: According to dual process theory, 2 distinct cognitive systems have a key role in decision-making: intuitive system 1 and deliberate system 2.[3] Especially, system 1 thinking is considered to become automatic, fast, effortless, emotional, and difficult to control and change; however, system 2 is more likely to be consciously controlled and monitored, as it is slower, effortful, and controlled. The way to avoid intuitive decisions is that the output of system 1 is found out and controlled by system 2.[13,14] These 2 thought systems are known to produce activations in different parts of the brain. Accordingly, it is thought that the prefrontal and frontal cortical areas play a dominant role in the functioning of system 2, while the limbic areas and VmPFK play a dominant role in the functioning of system 1.[15,16] Through functional interrelationships between these brain regions, 2 distinct thought systems mutually influence each other. On the other hand, in the presence of high ambiguity and increased cognitive load, automatic affective evaluation (system 1) may be the main determinant of many decisions. Dual process theory pointed out that individuals' ability to evaluate emotional states is utilized as the information source to decision-making behavior.[17] Within the framework of this theory, it can be said that individuals can understand emotions effortlessly and without conscious awareness. Highly emotionally intelligent individuals might be more skilled at accurately recognizing emotional cues and using emotional responses only when they are necessary. In other words, the rapid identification of emotional stimuli might be the automatic processes and using automatically emotional process might facilitate the thought.[18]

NEUROANATOMY OF DECISION-MAKING

A few studies have shown that the frontal lobe (and especially the prefrontal cortex) has a crucial role in decision-making. These studies investigated decision-making behavior in real life by using the IGT and generally indicated that patients with VmPFC damage made more disadvantageous choices compared to the healthy control groups.[19-23] Moreover, brain regions relevant to decision-making studies were examined via neuroimaging. During a decision-making task, VmPFC, medial orbitofrontal cortex (OFC), and anterior cingulate activation were reported, and activations also emerged in the lateral OFC and in the insula during a risky decision-making process.[24] The dorsolateral prefrontal cortex (DLPFC) is known to be an important area in terms of executive functions in the prefrontal

cortex, and it also seems to be an important area for decision-making.[25,26] In a study conducted with 9 patients with VmPFC damage, 11 patients with DLPFC damage, and a healthy control group, both clinical samples revealed poorer IGT performance compared with the healthy control group.[21] In addition, limbic areas, particularly the amygdala, insula, OFC, and anterior cingulate, were activated in decision-making.[27-32] The skin conductance response level to reward and punishment was lower in patients with amygdala damage than in healthy controls.[11] Accordingly, it has been emphasized that the amygdala is a crucial region in a reward-and-punishment-based decision-making process. In addition, the dorsal anterior cingulate cortex is important for reward-based decision-making, and the anterior cingulate is especially seen as a mechanism that evaluates the results by making a profit-and-loss analysis.[33] Moreover, structures such as the prefrontal areas including the dopaminergic neurons are responsible for the reward system, and the basal ganglia (striatum and pallidum) are crucial for the evaluation of short- and long-term benefits and final decisions.[34]

NEUROANATOMY OF EMOTIONAL INTELLIGENCE

The neural substrates of emotional intelligence are not well established, but lesion studies have shown that the prefrontal cortex and limbic structures may have an important role in this ability.[35-42] Based on that, different sub-regions of the prefrontal cortex are thought to serve different competencies of emotional intelligence. For instance, damage to the VmPFC, which is linked to limbic structures, reduces the understanding and managing of emotional information.[12] On one hand, DLPFC, interconnected with the sensory neocortex, damage impairs perception and use of emotional information.[43] Another study also showed that patients with right DLPFC tumors had impaired emotional intelligence and IGT performance.[44] Moreover, the primary auditory cortex has strong connections with the amygdala, hippocampus, and parahippocampal gyrus and collects substantial somatic, sensory, affective, and memory-related information, which is related to emotional intelligence.[45]

EMOTIONAL INTELLIGENCE AND DECISION-MAKING UNDER UNCERTAINTY AND RISK

Most studies seeking the relationship between emotional intelligence and decision-making under uncertainty have compared the IGT performance of individuals with different levels of emotional intelligence. The necessity of understanding the role of emotional intelligence in the decision-making process through neuropsychological studies has become even more important, especially because neuroimaging studies reveal that the 2 processes activate similar neural mechanisms. It has been a matter of curiosity whether emotional intelligence or cognitive intelligence plays a more decisive role in decision-making. When the role of crystallized intelligence, which is called the capability to apply learned knowledge and acquired acquisitions,[46] and emotional intelligence in IGT performance in healthy adults is examined, it was found that crystallized intelligence is a stronger predictor of decision-making compared to emotional intelligence.[47,48] Another study conducted with children reported that fluid/analytical intelligence, which is known as the ability of individuals to solve newly encountered problems independently of former experiences and formal education,[49] is a stronger predictor of IGT performance compared to emotional intelligence.[50] The general point of view of these studies is that cognitive capacities rather than emotional abilities may relatively support decision-making task performance. These results are consistent with Dual-Process Theory's view that system 2, including analytical thinking supports effective decision-making behavior.[13,14] On the other hand, in the presence of high ambiguity and risk automatic affective evaluation (system 1) may be the main determinant of many decisions. The way to make good decisions is that the error of system 1 is detected and monitored by system 2. In brief, these 2 systems should mutually support each other.[13] Thus, the role of emotional intelligence, which is thought to be a part of system 1,[18] in decision-making should not be ignored. In fact, several subsequent studies have demonstrated the importance of emotional intelligence in decision-making.[51-53] Indeed, it is argued that these contradictory results may be due to the fact that emotional intelligence is measured based on different models (ability or trait emotional intelligence models).

Neurological patients were found to have low emotional intelligence, as well as impaired decision-making performance.[12,44] Moreover, emotional intelligence was determined to affect IGT performance in clinical groups with frontal lobe lesions. Both emotional intelligence and decision-making performances were low in people with damaged somatic marker function. Poor decision-making strategies appear to be linked to inaccurate self-awareness and inability to cope with environmental and social demands. In other words, it can be thought that people demonstrating ineffective decision-making skills might have weak ability to recognize and express emotions, establish healthy interpersonal relationships, and solve personal and interpersonal problems, and thus create positive affect.

Some studies also sought the relationship between emotional intelligence and decision-making under uncertainty in non-clinical samples. According to the studies conducted in healthy young adults, there was a significant association between higher emotional intelligence and rising number of advantageous choices during IGT.[54-57] Particularly, individuals with higher emotional awareness were good at avoiding insisting on selecting disadvantageous decks.[54] When IGT performance was analyzed separately in high and low emotional intelligence conditions, the high emotional intelligence group showed better IGT performance.[55] Furthermore, people with higher levels of emotional regulation and optimism, domains of emotional intelligence, made less disadvantageous choices.[56] Another research finding revealed that emotional intelligence components, such as emotion recognition, emotion understanding, and emotion regulation, moderate the relationship between somatic markers and IGT performance.[54] That is, the power of somatic markers to encourage decision-making performance may increase with higher levels of emotional intelligence. In addition, it was emphasized that IGT performance increased with increasing emotional intelligence levels in older adults.[58] In detail, healthy older adults with high emotional intelligence quickly learn to avoid bad decks and make more choices from decks compared to individuals with low emotional intelligence. Although cognitive intelligence declines with aging, it is thought that emotional intelligence domains and competencies can support optimal decision-making skills. Additionally, it is also known that emotional intelligence is an important predictor of IGT performance in children.[59] In particular, emotion regulation, as a facet of emotional intelligence, might be partly responsible for poor performance in the early learning stages of IGT. Ultimately, a possible link between emotional intelligence and decision-making in different age groups suggests that training programs centered on enhancing emotional intelligence domains may be necessary for improving decision-making ability.

When it comes to decision-making behavior under risk, it is known that emotional intelligence is directly or indirectly related to risky choices.[56,57,60,61] Specifically, people with higher emotional intelligence might make less risky decisions when in a negative mood, while people with lower emotional intelligence may be susceptible to risky decision-making behaviors.[62] Moreover, emotion regulation ability decreases risk aversion in the balloon analogue risk task and is correlated with increased performance in the early stages of IGT.[60] Similarly, another study confirmed that emotion regulation strategies, especially reappraisal, were correlated with reduced risk aversion in balloon analogue test and more adaptive decision-making strategies in early periods of IGT.[63] Studies generally emphasized that the ability to manage emotions might be protective against risky decisions.[60,61]

THE ROLE OF EMOTIONAL INTELLIGENCE TRAINING IN DECISION-MAKING PERFORMANCE

Recently, it has been noted that tolerance to uncertainty and emotional intelligence can be important determinants of high-quality decision-making.[64,65] Intolerance to uncertainty may inhibit the perception of choice errors in the first trials of decision tasks and the productive development of probability expectations and risk aversion. Increase in emotional intelligence skills can increase tolerance to uncertainty and hence, improve decision quality. It has been found that emotional intelligence training programs have been found to simultaneously enhance both emotional intelligence skills and the quality and effectiveness of decision-making abilities.[66,67] The emotional intelligence training programs are mainly designed to improve the components of the 4-branch model of emotional intelligence, which consists of self-awareness, social awareness, self-management, and relationship management.[68,69] These 4 elements also include different behavioral competencies such as, emotional self-awareness, empathy, accurate self-assessment, self-control, conscientiousness, adaptability, communication, conflict management, building bonds and teamwork, and collaboration. As a result, relatively successful results from emotional intelligence training programs[66,67] support the idea that emotional intelligence is a skill that can be developed rather than being innate.[68]

CONCLUSION

The aim of the present review is to scrutinize research findings regarding the relationship between emotional intelligence and decision-making. The possible link between the 2 variables is presented in the framework of SMH and dual process theory. This review also includes research examining the underlying neural basis of emotional intelligence and decision-making. It is concluded that emotional intelligence domains and decision-making share similar neural mechanisms, and therefore emotional intelligence might be a substantial part of human decision-making. Accordingly, several studies specifically address that people can make effective decisions by enhancing their emotional intelligence skills.

When the literature was examined, it was found that decision-making was commonly measured by IGT. Therefore, it is thought that further studies conducted with different decision-making tasks could enrich the literature. Finally, it is also proposed that cognitive rehabilitation programs concentrated on improving decision-making skills should focus on enhancing emotional intelligence in clinical samples.

Peer-review: Externally peer-reviewed.

Declaration of Interests: The author has no conflict of interest to declare.

Funding: The author declared that this study has received no financial support.

REFERENCES

1. Summerfield C, Koechlin E. Decision-making and prefrontal executive function. In: Gazzaniga MS, ed. *The Cognitive Neurosciences*. 2nd ed. Cambridge: MIT Press; 2009.
2. Kahneman D, Ritov I. Determinants of stated willingness to pay for public goods: a study in the headline method. *J Risk Uncertain*. 1994;9(1):5-37. [CrossRef]
3. Kahneman D. A perspective on judgment and choice: mapping bounded rationality. *Am Psychol*. 2003;58(9):697-720. [CrossRef]
4. Salovey P, Mayer JD. Emotional intelligence. *Imagin Cogn Pers*. 1990;9(3):185-211. [CrossRef]
5. Mayer JD, Salovey P. The intelligence of emotional intelligence. *Intelligence*. 1993;17(4):433-442. [CrossRef]
6. Petrides KV, Furnham A. Trait emotional intelligence: psychometric investigation with reference to established trait taxonomies. *Eur J Pers*. 2001;15(6):425-448. [CrossRef]
7. Mayer JD, Salovery P, Caruso DR, Sitarenios G. *Measuring Emotional Intelligence with the MSCEIT*. V2.0. Emot 2003; vol 3:97-105. [CrossRef]
8. Bar-On R. The Bar-On model of emotional-social intelligence (ESI)1. *Psicothema*. 2006;18(suppl):13-25.
9. Damasio A. *Descartes' Error: Emotion, Reason and the Human Brain*. New York: Grosset/Putnam; 1994.
10. Bechara A, Damasio AR, Damasio H, Anderson SW. Insensitivity to future consequences following damage to human prefrontal cortex. *Cognition*. 1994;50(1-3):7-15. [CrossRef]
11. Bechara A, Damasio H, Damasio AR, Lee GP. Different contributions of the human amygdala and ventromedial prefrontal cortex to decision-making. *J Neurosci*. 1999;19(13):5473-5481. [CrossRef]
12. Bar-On R, Tranel D, Denburg NL, Bechara A. Exploring the neurological substrate of emotional and social intelligence. *Brain*. 2003;126(8):1790-1800. [CrossRef]
13. Kahneman D. *Thinking, Fast and Slow*. New York: Farrar, Strauss, and Giroux; 2011.
14. Evans JSB, Stanovich KE. Dual-process theories of higher cognition: advancing the debate. *Perspect Psychol Sci*. 2013;8(3):223-241. [CrossRef]
15. Goel V, Dolan RJ. Explaining modulation of reasoning by belief. *Cognition*. 2003;87(1):B11-B22. [CrossRef]
16. McClure SM, Laibson DI, Loewenstein G, Cohen JD. Separate neural systems value immediate and delayed monetary rewards. *Science*. 2004;306(5695):503-507. [CrossRef]
17. Evans JSB. In two minds: dual-process accounts of reasoning. *Trends Cogn Sci*. 2003;7(10):454-459. [CrossRef]
18. Fiori M. A new look at emotional intelligence: a dual-process framework. *Pers Soc Psychol Rev*. 2009;13(1):21-44. [CrossRef]
19. Bechara A, Dolan S, Denburg N, Hindes A, Anderson SW, Nathan PE. Decision-making deficits, linked to a dysfunctional ventromedial prefrontal cortex, revealed in alcohol and stimulant abusers. *Neuropsychologia*. 2001;39(4):376-389. [CrossRef]
20. Clark L, Bechara A, Damasio H, Aitken MRF, Sahakian BJ, Robbins TW. Differential effects of insular and ventromedial prefrontal cortex lesions on risky decision-making. *Brain*. 2008;131(5):1311-1322. [CrossRef]
21. Fellows LK, Farah MJ. Different underlying impairments in decision-making following ventromedial and dorsolateral frontal lobe damage in humans. *Cereb Cortex*. 2005;15(1):58-63. [CrossRef]
22. Ouerchefani R, Ouerchefani N, Allain P, Ben Rejeb MRB, Le Gall D. Contribution of different regions of the prefrontal cortex and lesion laterality to deficit of decision-making on the Iowa Gambling Task. *Brain Cogn*. 2017;111:73-85. [CrossRef]
23. Ouerchefani R, Ouerchefani N, Allain P, Ben Rejeb MR, Le Gall D. Relationships between executive function, working memory, and decision-making on the Iowa Gambling Task: evidence from ventromedial

patients, dorsolateral patients, and normal subjects. *J Neuropsychol*. 2019;13(3):432-461. [CrossRef]
24. Lawrence NS, Jollant F, O'Daly O, Zelaya F, Phillips ML. Distinct roles of prefrontal cortical subregions in the Iowa Gambling Task. *Cereb Cortex*. 2009;19(5):1134-1143. [CrossRef]
25. Duncan J, Owen AM. Common regions of the human frontal lobe recruited by diverse cognitive demands. *Trends Neurosci*. 2000;23(10):475-483. [CrossRef]
26. He X, Hu J, Qi Y, Turel O, Bechara A, He Q. Sex modulates the effect of HDtDCS over the prefrontal cortex on the Iowa Gambling Task. *Brain Stimul*. 2023;16(2):415-417. [CrossRef]
27. Jenni NL, Li YT, Floresco SB. Medial orbitofrontal cortex dopamine D1/D2 receptors differentially modulate distinct forms of probabilistic decision-making. *Neuropsychopharmacology*. 2021;46(7):1240-1251. [CrossRef]
28. Karimi S, Hamidi G, Fatahi Z, Haghparast A. Orexin 1 receptors in the anterior cingulate and orbitofrontal cortex regulate cost and benefit decision-making. *Prog Neuropsychopharmacol Biol Psychiatry*. 2019;89:227-235. [CrossRef]
29. Klein-Flügge MC, Bongioanni A, Rushworth MFS. Medial and orbital frontal cortex in decision-making and flexible behavior. *Neuron*. 2022;110(17):2743-2770. [CrossRef]
30. Nallapu BT, Alexandre F. Interacting roles of lateral and medial orbitofrontal cortex in decision-making and learning: a system-level computational model. *bioRxiv*. 2019:867515:3-24. [CrossRef]
31. Pelletier G, Fellows LK. Viewing orbitofrontal cortex contributions to decision-making through the lens of object recognition. *Behav Neurosci*. 2021;135(2):182-191. [CrossRef]
32. van Holstein M, Floresco SB. Dissociable roles for the ventral and dorsal medial prefrontal cortex in cue-guided risk/reward decision making. *Neuropsychopharmacology*. 2020;45(4):683-693. [CrossRef]
33. Bush G, Vogt BA, Holmes J, et al. Dorsal anterior cingulate cortex: a role in reward-based decision making. *Proc Natl Acad Sci U S A*. 2002;99(1):523-528. [CrossRef]
34. Pirtošek Z, Georgijev D, Gregorič-Kramberger M. Decision making and the brain: neurologists' view. *INDECS*. 2009;7:38-53.
35. Sawaya H, Johnson K, Schmidt M, et al. Resting-state functional connectivity of antero-medial prefrontal cortex sub-regions in major depression and relationship to emotional intelligence. *Int J Neuropsychopharmacol*. 2015;18(6):pyu112. [CrossRef]
36. Tronchin G, Akudjedu TN, Kenney JP, et al. Cognitive and clinical predictors of prefrontal cortical thickness change following first episode of psychosis. *Psychiatry Res Neuroimaging*. 2020;302:111100. [CrossRef]
37. Weber M, Webb CA, Deldonno SR, et al. Habitual 'sleep credit' is associated with greater grey matter volume of the medial prefrontal cortex, higher emotional intelligence, and better mental health. *J Sleep Res*. 2013;22(5):527-534. [CrossRef]
38. Halicka-Masłowska J, Szewczuk-Bogusławska M, Adamska A, Misiak B. Neurobiology of the association between non-suicidal self-injury, suicidal behavior, and emotional intelligence: a review. *Arch Psychiatry Psychother*. 2020;2:25-35. [CrossRef]
39. Killgore WD, Weber M, Schwab ZJ, et al. Gray matter correlates of Trait and Ability models of emotional intelligence. *NeuroReport*. 2012;23(9):551-555. [CrossRef]
40. Kosonogov VV, Vorobyeva E, Kovsh E, Ermakov PN. A review of neurophysiological and genetic correlates of emotional intelligence. *IJCRSEE*. 2019;7(1):137-142. [CrossRef]
41. Zhang Y, Zhou W, Huang J, Hong B, Wang X. Neural correlates of perceived emotions in human insula and amygdala for auditory emotion recognition. *NeuroImage*. 2022;260:119502. [CrossRef]
42. Kerr KL, Ratliff EL, Cosgrove KT, Bodurka J, Morris AS, Kyle Simmons WK. Parental influences on neural mechanisms underlying emotion regulation. *Trends Neurosci Educ*. 2019;16:100118. [CrossRef]
43. Krueger F, Barbey AK, McCabe K, et al. The neural bases of key competencies of emotional intelligence. *Proc Natl Acad Sci U S A*. 2009;106(52):22486-22491. [CrossRef]
44. Zinchenko O, Enikolopova E. The impact of executive functions and emotional intelligence on Iowa gambling task performance: focus on right frontal lobe damage. *Arch Clin Neuropsychol*. 2017;32(8):1026-1036. [CrossRef]
45. Smith R, Killgore WDS, Alkozei A, Lane RD. A neuro-cognitive process model of emotional intelligence. *Biol Psychol*. 2018;139:131-151. [CrossRef]
46. Horn J, Noll J. Human cognitive capabilities: Gf-Gc theory. In: Flanagan D. P., Genshaft J. L., Harrison P. L., eds. *Contemporary Intellectual Assessment: Theories, Tests, and Issues*. New York: The Guilford Press; 1997.
47. Demaree HA, Burns KJ, DeDonno MA. Intelligence, but not emotional intelligence, predicts Iowa Gambling Task performance. *Intelligence*. 2010;38(2):249-254. [CrossRef]
48. Webb CA, DelDonno S, Killgore WD. The role of cognitive versus emotional intelligence in Iowa Gambling Task performance: what's emotion got to do with it? *Intelligence*. 2014;44:112-119. [CrossRef]
49. Carpenter PA, Just MA, Shell P. What one intelligence test measures: a theoretical account of the processing in the raven Progressive Matrices Test. *Psychol Rev*. 1990;97(3):404-431. [CrossRef]
50. Li D, Liu T, Zhang X, Wang M, Wang D, Shi J. Fluid intelligence, emotional intelligence, and the Iowa Gambling Task in children. *Intelligence*. 2017;62:167-174. [CrossRef]
51. Alzoubi HM, Aziz R. Does emotional intelligence contribute to quality of strategic decisions? The mediating role of open innovation. *JoITM*. 2021;7(2):1-20. [CrossRef]
52. Telle NT, Senior C, Butler M. Trait emotional intelligence facilitates responses to a social gambling task. *Pers Individ Dif*. 2011;50(4):523-526. [CrossRef]
53. Vaughan R, Laborde S, McConville C. The effect of athletic expertise and trait emotional intelligence on decision-making. *Eur J Sport Sci*. 2019;19(2):225-233. [CrossRef]
54. Pilárik LU, Sarmany-Schuller I. Emotional intelligence and decision-making of female students of social work in the Iowa Gambling Task. *Stud Psychol*. 2009;51:319-328.
55. Checa P, Fernández-Berrocal P. Cognitive control and emotional intelligence: effect of the emotional content of the task. Brief reports. *Front Psychol*. 2019;10:195. [CrossRef]
56. Hawthorne MJ, Chikeleze M. Trait Emotional Intelligence (TEI) & Decision making: an Exploration of TEI & Mood on Decision-making. *N Am J Psychol*. 2022;24:515-528.
57. Yip JA, Stein DH, Côté S, Carney DR. Follow your gut? Emotional intelligence moderates the association between physiologically measured somatic markers and risk taking. *Emotion*. 2020;20(3):462-472. [CrossRef]
58. Ramchandran K, Tranel D, Duster K, Denburg NL. The role of emotional vs. cognitive intelligence in economic decision-making amongst older adults. *Front Neurosci*. 2020;14:497. [CrossRef]
59. Li D, Wu M, Zhang X, Wang M, Shi J. The roles of fluid intelligence and emotional intelligence in affective decision-making during the transition to early adolescence. *Front Psychol*. 2020;11:574903. [CrossRef]
60. Heilman RM, Crişan LG, Houser D, Miclea M, Miu AC. Emotion regulation and decision making under risk and uncertainty. *Emotion*. 2010;10(2):257-265. [CrossRef]
61. Panno A, Anna Donati M, Chiesi F, Primi C. Trait emotional intelligence is related to risk-taking through negative mood and anticipated fear. *Soc Psychol*. 2015;46(6):361-367. [CrossRef]
62. Melillo G. The Effect of emotional intelligence on the relationship between negative mood and risk taking. *Psychology*. 2014;21:1-29.
63. Szasz PL, Hofmann SG, Heilman RM, Curtiss J. Effect of regulating anger and sadness on decision-making. *Cogn Behav Ther*. 2016;45(6):479-495. [CrossRef]
64. Kornilova TV, Chumakova MA, Kornilov SA. Tolerance and intolerance for uncertainty as predictors of decision making and risk acceptance in gaming strategies of the Iowa gambling task. *Psych Rus*. 2018;11(3):86-95. [CrossRef]
65. Vyatkin AV, Fomina LV, Shmeleva ZN. Empathy, emotional intelligence and decision-making among managers of agro-industrial complex. The role of tolerance for uncertainty in decision-making. In: *IOP Conf S Earth Environ Sci*. Bristol: IOP Publishing. 2019.
66. Alkozei A, Smith R, Demers LA, Weber M, Berryhill SM, Killgore WDS. Increases in emotional intelligence after an online training program are associated with better decision-making on the Iowa gambling task. *Psychol Rep*. 2019;122(3):853-879. [CrossRef]
67. Hess JD, Bacigalupo AC. Enhancing decisions and decision-making processes through the application of emotional intelligence skills. *Manag Decis*. 2011;49(5):710-721. [CrossRef]
68. Goleman D. Emotional Intelligence: perspectives on a Theory of Performance. In: Chermiss C., Goleman D., eds. *The Emotionally Intelligent Workplace*.San Francisco, CA: Jossey-Bass; 2001.
69. Boyatzis R, Goleman D, Rhee K. Clustering competence in emotional intelligence: insights from the emotional competence inventory (ECI). In: Bar-On R., Parker J.D.A., eds. *Handbook of Emotional Intelligence*. San Francisco, CA: Jossey-Bass; 2000.