



Editorial

Linkage Among Cognition, Emotion and Behavior: An Interdisciplinary Perspective

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The Special Issue “Linkage among Cognition, Emotion and Behavior” offers a comprehensive exploration of the dynamic relationships between the emotional, cognitive, and behavioral domains. The contributions in this collection collectively highlight the crucial role of emotional and cognitive processes in shaping human behavior across clinical, educational, and social contexts.

Several of the contributions explore the biological underpinnings of emotional and cognitive processes. Vega-Rosas et al. (Contribution 1) report that higher levels of enriched environments are associated with increased serum brain-derived neurotrophic factor (BDNF) levels in patients with Major Depressive Disorder, reinforcing the role of environmental stimulation in promoting neuroplasticity. Complementarily, prior research has pointed out other methods of effectively inducing neuroplasticity for clinical/therapeutic purposes, such as non-invasive brain stimulation [1–10] and exposure therapy [11–14].

In the domain of emotional and cognitive flexibility, Feng et al. (Contribution 2) highlight that “freely moving mind wandering” (FMMW) supports post-incubation creative performance, emphasizing the importance of dynamic internal cognition for creativity. Relatedly, Binsaeed et al. (Contribution 3) show that emotional and cultural intelligence are critical predictors of innovative work behavior in the healthcare sector, further illustrating how emotional competencies can scaffold cognitive and behavioral adaptability.

Emotion regulation and empathy are also central themes in this Special Issue. Imajo et al. (Contribution 4) demonstrate that allowing individuals to choose their own emotion regulation strategies enhances stress reduction, while Lee et al. (Contribution 5) show that activating facial muscles enhances empathic pain, in line with the facial feedback hypothesis. These findings resonate with theoretical discussions on the neurobiological roots of moral behavior [15–17], suggesting that emotional self-regulation and embodied emotional experiences—which can be altered by several factors, including addiction [18,19], and be related to individual variables [20,21]—play a key role in ethical and prosocial behaviors.

Moral cognition is specifically addressed by Lin et al., (Contribution 6) who apply drift–diffusion modeling to show that moral evaluations are primarily driven by emotional intuitions, supporting the social intuitionist model of morality proposed by previous theoretical and experimental investigations in this field [22,23]. The strong emotional basis of moral reasoning is an important theme for understanding not only everyday ethical judgments but also clinical alterations in emotional–moral processing [24,25].

Educational and developmental contexts are represented by Taniguchi et al., (Contribution 7) who found that metacognitive skills and personality traits predict mental well-being



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in students enrolled in therapy programs. These findings align with emerging educational tools, such as virtual reality applications, which are being explored for their potential to foster cognitive and emotional skills [26–33].

Several papers in this Special Issue also address the clinical and psychopathological implications of emotional–cognitive linkages. Grażka and Strzelecki (Contribution 8) provide a systematic review highlighting how early maladaptive schemas relate to suicidality, while Tortora et al. (Contribution 9) emphasize the serotonergic modulation of fear learning and memory, consolidating evidence that neurotransmitter systems underlie critical emotional–cognitive behaviors.

Attentional mechanisms and emotion-driven salience are addressed by Li et al., (Contribution 10) who reveal that the prioritized detection of fearful eyes during attentional blink is not automatic, highlighting the limits of rapid emotional processing under cognitive load. Related investigations into cognitive dissonance and memory in aging [34–39] further stress the dynamic adjustments between cognition and emotional preferences across the human lifespan.

In summary, this Special Issue offers a heterogeneous and integrative set of studies that expand our understanding of the intricate relationships between cognition, emotion, and behavior. It also connects with broader fields such as clinical neuroscience, educational innovation, and moral psychology, opening avenues for future research and interdisciplinary collaboration.

Conflicts of Interest: The authors declare no conflicts of interest.

List of Contributions

1. Vega-Rosas, A.; Flores-Ramos, M.; Ramírez-Rodríguez, G.B. Association Between the Enriched Environment Level and Serum Brain-Derived Neurotrophic Factor (BDNF) in Patients with Major Depressive Disorder. *Brain Sci.* **2024**, *14*, 1137. <https://doi.org/10.3390/brainsci14111137>.
2. Feng, Q.; Weng, L.; Geng, L.; Qiu, J. How Freely Moving Mind Wandering Relates to Creativity: Behavioral and Neural Evidence. *Brain Sci.* **2024**, *14*, 1122. <https://doi.org/10.3390/brainsci14111122>.
3. Binsaeed, R.H.; Yousaf, Z.; Grigorescu, A.; Condrea, E.; Nassani, A.A. Emotional Intelligence, Innovative Work Behavior, and Cultural Intelligence Reflection on Innovation Performance in the Healthcare Industry. *Brain Sci.* **2023**, *13*, 1071. <https://doi.org/10.3390/brainsci13071071>.
4. Imajo, N.; Matsuzaki, Y.; Kobayashi, A.; Sakaki, K.; Nouchi, R.; Kawashima, R. Self-Choice Emotion Regulation Enhances Stress Reduction: Neural Basis of Self-Choice Emotion Regulation. *Brain Sci.* **2024**, *14*, 1077. <https://doi.org/10.3390/brainsci14111077>.
5. Lee, S.; Yoo, Y.; Moon, H.; Lee, I.-S.; Chae, Y. Enhanced Empathic Pain by Facial Feedback. *Brain Sci.* **2024**, *14*, 5. <https://doi.org/10.3390/brainsci14010005>.
6. Lin, J.; Zhao, X.; Zhao, N.; Liu, T. Emotion-Driven Moral Evaluation: A Mechanistic Study Based on the Drift-Diffusion Model. *Brain Sci.* **2024**, *14*, 1005. <https://doi.org/10.3390/brainsci14101005>.
7. Taniguchi, K.; Maki, N.; Sakamoto, H.; Inuta, T.; Kim, B.; Oh, S.; Mayers, T. Metacognition-Associated Factors in Physical and Occupational Therapy Students: A Cross-Sectional Study. *Brain Sci.* **2024**, *14*, 1041. <https://doi.org/10.3390/brainsci14101041>.
8. Grażka, A.; Strzelecki, D. Early Maladaptive Schemas and Schema Modes among People with Histories of Suicidality and the Possibility of a Universal Pattern: A Systematic Review. *Brain Sci.* **2023**, *13*, 1216. <https://doi.org/10.3390/brainsci13081216>.
9. Tortora, F.; Hadipour, A.L.; Battaglia, S.; Falzone, A.; Avenanti, A.; Vicario, C.M. The Role of Serotonin in Fear Learning and Memory: A Systematic Review of Human Studies. *Brain Sci.* **2023**, *13*, 1197. <https://doi.org/10.3390/brainsci13081197>.
10. Li, S.; Hao, B.; Dang, W.; He, W.; Luo, W. Prioritized Identification of Fearful Eyes during the Attentional Blink Is Not Automatic. *Brain Sci.* **2023**, *13*, 1392. <https://doi.org/10.3390/brainsci13101392>.

References

1. Vicario, C.M.; Nitsche, M.A. Transcranial direct current stimulation: A remediation tool for the treatment of childhood congenital dyslexia? *Front. Hum. Neurosci.* **2013**, *7*, 139. [\[CrossRef\]](#)
2. Salehinejad, M.A.; Paknia, N.; Hosseinpour, A.H.; Yavari, F.; Vicario, C.M.; Nitsche, M.A.; Nejati, V. Contribution of the right temporoparietal junction and ventromedial prefrontal cortex to theory of mind in autism: A randomized, sham-controlled tDCS study. *Autism Res.* **2021**, *14*, 1572–1584. [\[CrossRef\]](#)
3. Goldsworthy, M.R.; Hordacre, B.; Ridding, M.C. Spaced noninvasive brain stimulation: Prospects for inducing long-lasting human cortical plasticity. *Neurorehabil. Neural Repair* **2015**, *29*, 714–721. [\[CrossRef\]](#) [\[PubMed\]](#)
4. Nitsche, M.A.; Paulus, W. Excitability changes induced in the human motor cortex by weak transcranial direct current stimulation. *J. Physiol.* **2000**, *527*, 633–639. [\[CrossRef\]](#)
5. Lefaucheur, J.P.; Aleman, A.; Baeken, C.; Benninger, D.H.; Brunelin, J.; Di Lazzaro, V.; Filipović, S.R.; Grefkes, C.; Hasan, A.; Hummel, F.C.; et al. Evidence-based guidelines on the therapeutic use of repetitive transcranial magnetic stimulation (rTMS): An update (2014–2018). *Clin. Neurophysiol.* **2017**, *131*, 474–528. [\[CrossRef\]](#) [\[PubMed\]](#)
6. Giordano, J.; Bikson, M.; Kappenman, E.S.; Clark, V.P.; Coslett, H.B.; Hamblin, M.R.; Hamilton, R.; Jankord, R.; Kozumbo, W.J.; Calabrese, E.J. Mechanisms and effects of transcranial direct current stimulation. *Dose-Response* **2017**, *15*, 1559325816685467. [\[CrossRef\]](#) [\[PubMed\]](#)
7. Polania, R.; Nitsche, M.A.; Ruff, C.C. Studying and modifying brain function with non-invasive brain stimulation. *Nat. Neurosci.* **2018**, *21*, 174–187. [\[CrossRef\]](#)
8. Hummel, F.C.; Cohen, L.G. Non-invasive brain stimulation: A new strategy to improve neurorehabilitation after stroke? *Lancet Neurol.* **2006**, *5*, 708–712. [\[CrossRef\]](#)
9. Ferrucci, R.; Mameli, F.; Guidi, I.; Mrakic-Sposta, S.; Vergari, M.; Marceglia, S.; Cogiamanian, F.; Barbieri, S.; Scarpini, E.; Priori, A. Transcranial direct current stimulation improves recognition memory in Alzheimer disease. *Neurology* **2008**, *71*, 493–498. [\[CrossRef\]](#)
10. Fregni, F.; Pascual-Leone, A. Technology insight: Noninvasive brain stimulation in neurology—Perspectives on the therapeutic potential of rTMS and tDCS. *Nat. Clin. Pract. Neurol.* **2007**, *3*, 383–393. [\[CrossRef\]](#)
11. Powers, M.B.; Halpern, J.M.; Ferenschak, M.P.; Gillihan, S.J.; Foa, E.B. A meta-analytic review of prolonged exposure for posttraumatic stress disorder. *Clin. Psychol. Rev.* **2010**, *30*, 635–641. [\[CrossRef\]](#)
12. Roberts, N.P.; Kitchiner, N.J.; Kenardy, J.; Bisson, J.I. Meta-analysis of psychosocial interventions for veterans and military personnel with PTSD. *Psychol. Med.* **2015**, *45*, 927–938. [\[CrossRef\]](#)
13. Crisanti, U. Supersizing Cognition in CBT Through Dual-Process Theories and 4E Cognition. *Prelim. Rep. Negat. Results Life Sci. Humanit.* **2024**, *1*, 2. [\[CrossRef\]](#)
14. Böhnlein, J.; Altegoer, L.; Muck, N.K.; Roesmann, K.; Redlich, R.; Dannlowski, U.; Leehr, E.J. Factors influencing the success of exposure therapy for specific phobia: A systematic review. *Neurosci. Biobehav. Rev.* **2020**, *108*, 796–820. [\[CrossRef\]](#)
15. Raine, A.; Yang, Y. Neural foundations to moral reasoning and antisocial behavior. *Soc. Cogn. Affect. Neurosci.* **2006**, *1*, 203–213. [\[CrossRef\]](#)
16. Yoder, K.J.; Decety, J. The neuroscience of morality and social decision-making. *Psychol. Crime Law* **2017**, *24*, 279–295. [\[CrossRef\]](#)
17. Moll, J.; de Oliveira-Souza, R.; Zahn, R. The neural basis of moral cognition: Sentiments, concepts, and values. *Ann. N. Y. Acad. Sci.* **2008**, *1124*, 161–180. [\[CrossRef\]](#)
18. D’Amico, G.; Pasinato, M.; Prior, M. Neuropsychological consequences, emotions, and length of alcohol abuse: A preliminary study. *Prelim. Rep. Negat. Results Life Sci. Humanit.* **2024**, *1*, 6–18. [\[CrossRef\]](#)
19. Stellern, J.; Xiao, K.B.; Grennell, E.; Sanches, M.; Gowin, J.L.; Sloan, M.E. Emotion regulation in substance use disorders: A systematic review and meta-analysis. *Addiction* **2023**, *118*, 30–47. [\[CrossRef\]](#)
20. Vicario, C.M.; Capodici, A.; Giunta, A.; Falzone, A.; Gangemi, A.; Pennisi, A. Preliminary Evidence of heightened discomfort tolerance in non-heterosexual individuals. *Prelim. Rep. Negat. Results Life Sci. Humanit.* **2024**, *1*, 2. [\[CrossRef\]](#)
21. Fumagalli, M.; Ferrucci, R.; Mameli, F.; Marceglia, S.; Mrakic-Sposta, S.; Zago, S.; Lucchiari, C.; Consonni, D.; Nordio, F.; Pravettoni, G.; et al. Gender-related differences in moral judgments. *Cogn Process.* **2010**, *11*, 219–226. [\[CrossRef\]](#) [\[PubMed\]](#)
22. Feinberg, M.; Willer, R. The moral roots of environmental attitudes. *Psychol. Sci.* **2013**, *24*, 56–62. [\[CrossRef\]](#)
23. Vicario, C.M.; Rafal, R.D.; di Pellegrino, G.; Lucifora, C.; Salehinejad, M.A.; Nitsche, M.A.; Avenanti, A. Indignation for moral violations suppresses the tongue motor cortex: Preliminary TMS evidence. *Soc. Cogn. Affect. Neurosci.* **2022**, *17*, 151–159. [\[CrossRef\]](#)
24. Vicario, C.M.; Kuran, K.A.; Rogers, R.; Rafal, R.D. The effect of hunger and satiety in the judgment of ethical violations. *Brain Cogn.* **2018**, *125*, 32–36. [\[CrossRef\]](#)
25. Fumagalli, M.; Priori, A. Functional and clinical neuroanatomy of morality. *Brain* **2012**, *135*, 2006–2021. [\[CrossRef\]](#)
26. Nucera, S. A Brief Analysis of the Educational Implications of Virtual Reality. *Prelim. Rep. Negat. Results Life Sci. Humanit.* **2024**, *1*, 1. [\[CrossRef\]](#)

27. Lucifora, C.; Schembri, M.; Poggi, F.; Grasso, G.M.; Gangemi, A. Virtual reality supports perspective taking in cultural heritage interpretation. *Comput. Hum. Behav.* **2023**, *148*, 107911. [\[CrossRef\]](#)
28. Lucifora, C.; Schembri, M.; Asprino, L.; Follo, A.; Gangemi, A. Virtual Empathy: Usability and Immersivity of a VR System for Enhancing Social Cohesion through Cultural Heritage. *ACM J. Comput. Cult. Herit.* **2024**, *17*, 1–11. [\[CrossRef\]](#)
29. Parsons, T.D.; Gaggioli, A.; Riva, G. Extended reality for the clinical, affective, and social neurosciences. *Brain Sci.* **2020**, *10*, 922. [\[CrossRef\]](#)
30. Maggio, M.G.; Benenati, A.; Impellizzeri, F.; Rizzo, A.; Barbera, M.; Cannavò, A.; Gregoli, V.; Morone, G.; Chirico, F.; Quartarone, A.; et al. Impact of cognitive VR vs. traditional training on emotional self-efficacy and cognitive function in patients with multiple sclerosis: A retrospective study focusing on gender differences. *Brain Sci.* **2024**, *14*, 1227. [\[CrossRef\]](#) [\[PubMed\]](#)
31. De Luca, R.; Bonanno, M.; Marra, A.; Rifici, C.; Pollicino, P.; Caminiti, A.; Castorina, M.V.; Santamato, A.; Quartarone, A.; Calabrò, R.S. Can virtual reality cognitive rehabilitation improve executive functioning and coping strategies in traumatic brain injury? A pilot study. *Brain Sci.* **2023**, *13*, 578. [\[CrossRef\]](#)
32. Sokółowska, B. Being in virtual reality and its influence on brain health—An overview of benefits, limitations, and prospects. *Brain Sci.* **2024**, *14*, 72. [\[CrossRef\]](#) [\[PubMed\]](#)
33. Calabrò, R.S.; Naro, A. Understanding social cognition using virtual reality: Are we still nibbling around the edges? *Brain Sci.* **2019**, *10*, 17. [\[CrossRef\]](#) [\[PubMed\]](#)
34. Reale, M.L.; Turriziani, P.; Oliveri, M.; Mangano, R. Shaping preferences through memory: Age-related mechanisms in dissonance reduction. *Prelim. Rep. Negat. Results Life Sci. Humanit.* **2024**, *1*. [\[CrossRef\]](#)
35. Ito, A.; Kawachi, Y.; Kawasaki, I.; Fujii, T. Effect of aging on choice-induced cognitive conflict. *Behav. Brain Res.* **2019**, *363*, 94–102. [\[CrossRef\]](#)
36. Cooper, J.; Feldman, L.A. Does cognitive dissonance occur in older age? A study of induced compliance in a healthy elderly population. *Psychol. Aging* **2019**, *34*, 709–713. [\[CrossRef\]](#)
37. Coco, M.; Buscemi, A.; Cavallari, P.; Massimino, S.; Rinella, S.; Tortorici, M.M.; Maci, T.; Perciavalle, V.; Tusak, M.; Di Corrado, D.; et al. Executive Functions During Submaximal Exercises in Male Athletes: Role of Blood Lactate. *Front Psychol.* **2020**, *11*, 537922. [\[CrossRef\]](#) [\[PubMed\]](#)
38. Rinella, S.; Buscemi, A.; Massimino, S.; Perciavalle, V.; Tortorici, M.M.; Tomaselli, D.G.; Perciavalle, V.; Di Corrado, D.; Coco, M. Risk-taking behavior, the second-to-fourth digit ratio and psychological features in a sample of cavers. *PeerJ* **2019**, *7*, e8029. [\[CrossRef\]](#)
39. Devitt, A.L.; Schacter, D.L. False memories with age: Neural and cognitive underpinnings. *Neuropsychologia* **2016**, *91*, 346–359. [\[CrossRef\]](#)

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