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Beyond cold control. A neuroscientific perspective on hot executive functions in gambling and gaming disorder

Victoria Marino[1] - Laura Angioletti[2,3]

[1] Università degli Studi di Milano Bicocca, Milan, Italy
[2] International research center for Cognitive Applied Neuroscience (IrcCAN), Università Cattolica del Sacro Cuore, Milan, Italy
[3] Research Unit in Affective and Social Neuroscience, Department of Psychology, Università Cattolica del Sacro Cuore, Milan, Italy

DOI: https://doi.org/10.7358/neur-2026-040-mari victoria.marino01@icatt.it

ABSTRACT

Research on executive functions (EFs) in behavioural addictions (BAs) has predominantly focused on the cold domain, whereas the hot domain has received comparatively limited attention. This theoretical contribution examines Gambling Disorder (GD) and Internet Gaming Disorder (IGD), arguing that the social dimension of hot EFs represents a major gap in current research and intervention approaches for BAs. We discuss the strengths and limitations of existing interventions and highlight the need for a more socially grounded perspective. Furthermore, because traditional neuroscience paradigms often isolate individuals from their social environment—despite the central role of social interactions in hot EFs—we discuss the promise of socially situated decision-making scenarios and a hyperscanning approach as a possible answer to investigating the social dimension in this field of study. This perspective may provide a more ecologically valid assessment of EFs and inform the development of innovative neuroenhancement interventions for individuals with GD and IGD.

Keywords: behavioural addictions; hot executive functions; social context; hyperscanning

1. Assessment and neuroenhancement of hot EF in behavioural addictions: state of the art, critical issues and future directions

Over the past two decades, neuroscience research on the neurocognitive correlates of Gambling Disorder (GD) and Internet Gaming Disorder (IGD) has grown. Among the main neurocognitive domains implicated in the onset and maintenance of these behavioural addictions (BAs), executive functions (EFs) are a primary focus of inquiry (Balconi & Angioletti, 2022a).

EFs are not a single, unitary process: some authors have differentiated between cold EFs, which involve purely cognitive information processing, and hot EFs, which sustain cognitive processes charged with emotion, motivation, reward, punishment, and social salience (Salehinejad et al., 2021). Cold EFs support goal-directed behaviours independently of an emotional context, whereas hot EFs operate when choices are framed in a motivationally and emotionally loaded environment (Zelazo & Carlson, 2012). For example, hot EFs come into play when we have to deliver a public speech in front of a large crowd, and it is necessary to downregulate our emotional response in order to successfully complete the task. These two constructs are partly dissociable at the neural level: cold EFs are associated with lateral prefrontal cortex (PFC), notably the dorsolateral PFC and the ventrolateral PFC, and with the dorsal anterior cingulate cortex; whereas hot EFs recruit orbital and medial PFC, including the orbitofrontal cortex and the ventromedial PFC, and also the posterior cingulate cortex and the ventral anterior cingulate cortex (Salehinejad et al., 2021).

For the purposes of this contribution, it is helpful to make explicit how these constructs relate to one another. Hot EFs are considered here as the set of top-down processes that operate on motivationally and emotionally salient information, with emotion regulation as a core component of this domain (Zelazo & Carlson, 2012). Empathy and mentalizing, which some taxonomies also place within the hot domain (Salehinejad et al., 2021), are conceived as distinct but closely interacting processes that provide the representational input (others' emotions, intentions and beliefs) upon which EFs operate in interpersonal contexts (Hurel, Grall-Bronnec, Bouillard, et al., 2023; Hurel, Grall-Bronnec, & Challet-Bouju, 2023). Social decision-making is itself considered a hot EF (Salehinejad et al., 2021); it engages both the affective and motivational processes of the hot domain and the social-cognitive representation of others' intentions (Rilling & Sanfey, 2011). The social-cognitive alterations discussed below are therefore considered interacting processes, rather than mere consequences of hot executive dysfunction.

So far BA research has mainly targeted cold EFs, underlining alterations in attention processing, inhibition, flexibility and decision-making (Peixoto et al., 2025), but also verbal memory (Crivelli et al., 2025). Yet GD and IGD are

clinical manifestations of behaviours that emerge under conditions of choice involving reward and uncertainty, and both are closely linked to hot EFs. Evidence of hot EF impairment has accumulated in both disorders, though unevenly.

Gamblers typically show disadvantageous performance on the Iowa Gambling Task (IGT; Kovács et al., 2017) – displaying the so-called myopia for the future (Bechara, 2005) – steeper delay discounting of monetary rewards (Wölfling et al., 2020), and altered reward and loss processing consistent with neuroimaging evidence of dysregulation in ventral striatum and orbital/lateral PFC (Clark et al., 2013).

In IGD the results are more heterogeneous: some studies report impaired decision-making under risky conditions on the Game of Dice Task (GDT; Pawlikowski & Brand, 2011). However, a recent meta-analysis found only a small effect size across reward-related decision-making paradigms (Yao et al., 2021), and direct comparisons suggest that IGD patients, compared to GD patients, are able to shift toward more advantageous decision-making over the course of the IGT (Wölfling et al., 2020). These inconsistencies could reflect a problem of construct validity.

First, the IGT, GDT, and delay discounting tasks were designed around monetary reinforcement and are appropriate for GD, because in this addiction money is the primary reward. In IGD, however, rewards are achievement-based, social, immersive, and instrumental in escaping aversive affective states (Wang & Cheng, 2022). One relevant hot EF construct in this scenario is emotion regulation, the ability to modulate positive and negative affects without relying on maladaptive avoidance. Standard decision-making tasks do not assess this capacity (Angioletti, 2023).

Second, another limitation of these tasks is that they are individual, stripped of social context. Yet social context is the domain in which emotion regulation demands are highest. Both GD and IGD have well-documented social alterations (Hurel, Grall-Bronnec, & Challet-Bouju, 2023), and they are both situated in socially embedded online environments. If affective dysregulation in these disorders is partly driven by interpersonal dynamics (e.g., social pressure, fear of exclusion, peer-contingent reward, fear of missing out), then individual laboratory paradigms would underestimate the hot EF deficits. This has a methodological implication: dyadic or small-group designs that consider decision-making in social and affective contexts are needed to assess hot EFs under ecologically valid conditions. To this end, the methods and tools of social neuroscience are valuable.

The literature on neurocognitive interventions for BAs reflects the same imbalance. Hot EFs are rarely a direct therapeutic target: neuromodulation research in GD and IGD has concentrated almost exclusively on the dorsolateral PFC, an established substrate of cold EFs (Stanković et al., 2023). An alternative

intervention is neurofeedback (NF), which could train the self-regulation of the affective and reward-related activity more relevant to hot EFs. To date, this technique has been applied mostly in substance use disorders (SUD) with demonstrated potential therapeutic effects (Wan et al., 2025): its extension to GD and IGD remains a plausible but largely untested translation.

Regarding BAs, the evidence base is heterogeneous and preliminary. Wan and colleagues, in a recent meta-analysis, investigated the therapeutic effects of EEG-NF across addiction disorders and found stronger effects on SUD than on BAs (Wan et al., 2025). The literature on the use of neurofeedback in BAs is still at the beginning, with very few studies addressing GD or IGD directly (Allegrini et al., 2025; Gu et al., 2025), and future research is needed to develop disorder-specific NF protocols.

Given these premises, it becomes evident that making hot EFs a direct target of assessment and intervention is a priority in the field of neuroscience of addiction. To this end, this theoretical paper outlines, at a conceptual level, how future research could operationalize a socially grounded study of hot EFs in these specific disorders.

2. Beyond the individual: social context and hyperscanning paradigm

A possible direction for the assessment and neuroenhancement of BAs comes from the observation of where these conditions occur. Contemporary gambling and internet gaming do not occur in a social vacuum, but in massively multiplayer online role-playing games (MMORPGs), team-based competitive titles, social-casino applications, peer-to-peer sports betting, and virtual communities for both gamblers and gamers (Sirola et al., 2021).

The fact that these disorders have a social facet is not neutral. Belonging to gambling communities with a positive attitude toward gambling is a risk factor for pathological gambling behaviour, and this effect is particularly relevant among gamblers who report higher levels of loneliness; virtual gaming communities normalize gaming behaviours and influence intentions to continue gaming (Sirola et al., 2021).

Social cognition deficits are also documented in both conditions. In GD, an alteration of emotion identification abilities has been documented (Hurel, Grall-Bronnec, & Challet-Bouju, 2023); Zhou and Wu (2024) found that cognitive empathy was negatively associated with GD severity, and that this effect was mediated by reduced risk aversion and less responsible gambling attitudes. Ciccarelli and colleagues (2021) showed that mentalizing failures and

difficulties in regulating behaviour under negative affect contributed significantly to problematic gambling in adolescents.

In IGD, the evidence is broader: a systematic review of neuropsychological assessment of social cognition highlighted alterations across facial emotion processing and theory of mind, with cerebral changes in emotion processing linked to problematic gaming (Hurel, Grall-Bronnec, Bouillard, et al., 2023). Alexithymia, the reduced capacity to identify and describe one's own emotional states, is highly prevalent in IGD patients and is a predictor of IGD severity (Pape et al., 2022).

At the functional level, both disorders carry social costs. GD is associated with relationship breakdown, marital instability, and financial deception toward family members (Syvertsen et al., 2023). IGD presents a complex social profile: many players with IGD report greater loneliness, social anxiety, and reduced face-to-face social competence compared to non-disordered gamers (Yu et al., 2022). Social exclusion from offline contexts has been proposed as a maintaining factor: the compensatory theory of internet addiction postulates that online environments serve as substitutes for unmet offline social needs (Kardefelt-Winther, 2014).

Despite the alterations in social functioning and social cognition, BAs have been studied almost exclusively with individual tasks. Social decision-making is largely neglected in the assessment and neuroenhancement of IGD and GD, with very few studies addressing it (Hurel, Grall-Bronnec, & Challet-Bouju, 2023; Rabinovitz & Nagar, 2026; Su et al., 2018). Social decision-making is defined as decision-making whose outcomes are jointly determined by the interacting choices of two or more agents (Rilling & Sanfey, 2011). It can be assessed by using economic game paradigms derived from game theory, in which participants must allocate resources between themselves and others under predefined rules that engage both rational calculation and affective processing.

These paradigms have proven sensitive to social decision-making alterations across a range of psychiatric populations. A systematic review of Ultimatum Game experiments documented alterations in social decision-making in patients with schizophrenia, affective disorders, frontotemporal dementia, and SUD (Hinterbuchinger et al., 2018). The existing evidence on social decision-making in IGD and GD is sparse but informative. Su and colleagues (2018) conducted the first investigation of cooperative behaviour in IGD using the Prisoner's Dilemma and the Chicken Game across partners at different social distances. Individuals with problematic internet game use showed lower cooperation in the Chicken Game compared to controls. They also showed higher cooperation with game-mates than with strangers, a pattern not observed in healthy users (Su et al., 2018). The authors interpreted these findings as evidence that IGD patients display riskier preferences that extend to social decision-making; in particular, in this economic game, defection is both

the riskier and the less prosocial option. This tendency was modulated by social identity: the gaming relationship boosted cooperative responding only in the IGD group, suggesting that this pattern was driven by social norms of the in-group, rather than prosociality per se. The eSMILE study (Hurel, Grall-Bronnec, & Challet-Bouju, 2023), which administered a Chicken Game to both gamblers and gamers online, found no significant association between addiction severity and cooperation, though gamblers with higher GD severity showed pre-task overconfidence. This paradigm did not manipulate social distance, which may partly account for the absence of group effects. In GD, Rabinovitz and Nagar (2026) provided the first evidence that social exclusion triggers utilitarian decision-making only among GD individuals, which means that rejection alters gamblers' social decision-making processes. In this study, after a Cyberball exclusion paradigm, problematic gamblers, but not low or moderate risk individuals, accepted significantly more unfair offers in the Ultimatum Game, suggesting that rejection triggered a shift toward a utilitarian mindset at the expense of fairness norms (Rabinovitz & Nagar, 2026).

Social neuroscience can enrich this framework by using economic game paradigms together with neurophysiological measures, including EEG and neuroimaging techniques, within a neuroeconomic approach (Rilling & Sanfey, 2011). Neuroeconomic paradigms engage a social-decision network in which prefrontal regions (ventromedial, dorsolateral and dorsomedial PFC) support goal valuation, cooperation, cognitive control and trust learning, while the anterior insula, amygdala and ventral striatum encode the affective and motivational dimensions of social interaction (Rilling & Sanfey, 2011).

Beyond single-brain neuroimaging, social neuroscience now offers hyperscanning, which allows the simultaneous recording of the neurophysiological activity of two or more interacting individuals (Montague et al., 2002). Hyperscanning makes it possible to quantify inter-brain synchronisation and social adaptation during real dyadic and group interaction. EEG and functional Near Infrared Spectroscopy (fNIRS) implementations can be applied to cooperation and competition tasks related to decision-making (Balconi & Vanutelli, 2017), also by modifying the tasks' social frame (Angioletti & Balconi, 2022; Balconi & Angioletti, 2023), in order to explore how the social context modulates decision-making at the behavioural and neurocognitive level, a dimension still underexplored in BAs.

As in Su et al. (2018), it would be useful to assess social decision-making with an economic paradigm such as the Prisoner's Dilemma or the Chicken Game, while also modulating the social distance between participants (friend, game-mate, stranger). The key addition is EEG or fNIRS hyperscanning, which would index inter-brain synchronisation during the interaction: where behavioural choice may appear intact, synchrony can reveal whether the

underlying process of interpersonal cooperation is dysregulated. This would be complemented by behavioural social-decision indices and autonomic measures, with non-interactive pseudo-pairs controlling synchrony driven by shared visual input rather than genuine social coupling.

The existing social-decision literature in BAs is still scarce and fragmentary, with small samples. Its early findings are nevertheless encouraging for the study of social cognition in psychiatric populations. Assessment in BAs should include the social dimension, by using socially situated paradigms, for instance interactive, multiplayer, in-group-versus-out-group neuroeconomic tasks, ideally combined with hyperscanning methodologies. The same logic extends to intervention. If pathological online gaming and gambling are inherently social, then the neuroenhancement of hot EFs should target decision-making and emotion regulation under conditions of social interaction and affective load, rather than in the context of individual performance.

3. Conclusions

Without claiming to be exhaustive, this contribution highlighted why and how the assessment and neuroenhancement research in GD and IGD should refocus toward hot EFs, and specifically toward their social and affective dimensions. The dominant paradigms in this field are built around monetary reinforcement and individual performance, however this does not seem sufficient for a complete description of the phenomena. Regarding the neuroenhancement perspective, neuromodulatory interventions have concentrated on the DLPFC, a cold EF substrate, leaving out the orbital and medial prefrontal systems that support hot EFs. Moreover, GD and IGD are socially situated disorders, and for this reason, an integrated assessment of cold and hot EFs, as well as socially enriched intervention paradigms are needed.

To conclude, the evidence suggests that hot EFs should be more central to the assessment and neuroenhancement of BAs, and future research could prioritize "social paradigms" paired with neurophysiological measures that are able to capture neural dynamics during interactions. Existing addiction-specific instruments, such as the Battery for Executive Functions in Addiction (BFE-A; Balconi et al., 2022), could then be expanded with hot EF measures, to allow a more fine-grained profile of patients with SUD and BAs. The integration of neuroscientific tools would represent a further added value, since neurophysiological markers can capture neurocognitive correlates that behavioural performance alone cannot detect, supporting both the characterisation of these disorders and the monitoring of intervention outcomes (Balconi & Angioletti, 2022a, 2022b; Balconi et al., 2024).

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References

Allegrini, G., De Rossi E., De Blasi, A., Scoma, L., Paulis, A., Salvati, A., Nicoli, M.S., Farina, B., Imperatori, C., Zarfati, A. (2025) Is theta/beta Neurofeedback effective for gambling disorder treatment? Insights from a case report. *Rivista di Psichiatria*, *60*(1), 38–42. https://doi.org/10.1708/4437.44267

Angioletti, L. (2023). Why we need to assess dysfunctional decision-making process in addictions within a comprehensive framework. *Neuropsychological Trends*, (33), 51–65. https://doi.org/10.7358/neur-2023-033-angi

Angioletti, L., & Balconi, M. (2022). The increasing effect of interoception on brain frontal responsiveness during a socially framed motor synchronization task. *Frontiers in Human Neuroscience*, *16*, 834619. https://doi.org/10.3389/fnhum.2022.834619

Balconi, M., & Angioletti, L. (2022a). Criticalities of executive functions (EFs) research in gambling disorder: Between the behavioural and neurophysiological markers. *Neuropsychological Trends*, (32), 55–66. https://doi.org/10.7358/neur-2022-032-balc

Balconi, M., & Angioletti, L. (2022b). Neurophysiology of gambling behavior and internet use vulnerability: A comparison between behavioral and EEG measures. *Clinical EEG and Neuroscience*, *53*(4), 268–277. https://doi.org/10.1177/15500594211038469

Balconi, M., & Angioletti, L. (2023). Inter-brain hemodynamic coherence applied to interoceptive attentiveness in hyperscanning: Why social framing matters. *Information*, *14*(2), 58. https://doi.org/10.3390/info14020058

Balconi, M., Angioletti, L., & Crivelli, D. (2024). Integrating EEG biomarkers in the neurocognitive screening of executive functions in substance and behavioral addiction. *Frontiers in Psychiatry*, *15*, 1472565. https://doi.org/10.3389/fpsyt.2024.1472565

Balconi, M., Losasso, D., Balena, A., Crivelli, D. (2022). Neurocognitive impairment in addiction: A digital tool for executive function assessment. *Frontiers in Psychiatry, 13*, 955277. https://doi.org/10.3389/fpsyt.2022.955277

Balconi, M., & Vanutelli, M. E. (2017). Cooperation and competition with hyperscanning methods: Review and future application to emotion domain. *Frontiers in Computational Neuroscience, 11*, 86. https://doi.org/10.3389/fncom.2017.00086

Bechara, A. (2005). Decision making, impulse control and loss of willpower to resist drugs: A neurocognitive perspective. *Nature Neuroscience, 8*(11), 1458–1463. https://doi.org/10.1038/nn1584

Ciccarelli, M., Nigro, G., D'Olimpio, F., Griffiths, M. D., & Cosenza, M. (2021). Mentalizing failures, emotional dysregulation, and cognitive distortions among adolescent problem gamblers. *Journal of Gambling Studies*, *37*(2), 283–298. https://doi.org/10.1007/s10899-020-09967-w

Clark, L., Averbeck, B., Payer, D., Sescousse, G., Winstanley, C. A., & Xue, G. (2013). Pathological choice: The neuroscience of gambling and gambling addiction. *Journal of Neuroscience*, *33*(45), 17617–17623. https://doi.org/10.1523/jneurosci.3231-13.2013

Crivelli, D., Losasso, D., Riccardi, S., Scaramuzzino, M.F., Zita, G. and Balconi, M. (2025). Verbal memory dysfunction in substance use and gambling addictive disorders: a comparative analysis of performance accuracy and error typologies. *Frontiers in Psychology 16*, 1677401. https://doi.org/10.3389/fpsyg.2025.1677401

Gu, A., Chan, C. L., Xu, X., Dexter, J. P., Becker, B., & Zhao, Z. (2025). Real-time fMRI neurofeedback modulation of dopaminergic midbrain activity in young adults with elevated internet gaming disorder risk: Randomized controlled trial. *Journal of Medical Internet Research*, *27*, e64687. https://doi.org/10.2196/64687

Hinterbuchinger, B., Kaltenboeck, A., Baumgartner, J. S., Mossaheb, N., & Friedrich, F. (2018). Do patients with different psychiatric disorders show altered social decision-making? A systematic review of ultimatum game experiments in clinical populations. *Cognitive Neuropsychiatry*, *23*(3), 117–141. https://doi.org/10.1080/13546805.2018.1453791

Hurel, E., Grall-Bronnec, M., Bouillard, O., Chirio-Espitalier, M., Barrangou-Poueys-Darlas, M., & Challet-Bouju, G. (2023). Systematic review of gaming and neuropsychological assessment of social cognition. *Neuropsychology Review*, *34*(3), 738–767. https://doi.org/10.1007/s11065-023-09599-y

Hurel, E., Grall-Bronnec, M., & Challet-Bouju, G. (2023). Online assessment of social cognition in a population of gamers and gamblers: Results of the eSMILE study. *Journal of Gambling Studies*, *39*(4), 1611–1633. https://doi.org/10.1007/s10899-023-10254-7

Kardefelt-Winther, D. (2014). A conceptual and methodological critique of internet addiction research: Towards a model of compensatory internet use. *Computers in Human Behavior, 31*(1), 351–354. https://doi.org/10.1016/j.chb.2013.10.059

Kovács, I., Richman, M. J., Janka, Z., Maraz, A., & Andó, B. (2017). Decision making measured by the Iowa gambling task in alcohol use disorder and gambling disorder: A systematic review and meta-analysis. *Drug and Alcohol Dependence, 181*, 152–161. https://doi.org/10.1016/j.drugalcdep.2017.09.023

Montague, P. R., Berns, G. S., Cohen, J. D., McClure, S. M., Pagnoni, G., Dhamala, M., Wiest, M. C., Karpov, I., King, R. D., Apple, N., & Fisher, R. E. (2002). Hyperscanning: Simultaneous fMRI during linked social interactions. *NeuroImage, 16*(4), 1159–1164. https://doi.org/10.1006/nimg.2002.1150

Pape, M., Reichrath, B., Bottel, L., Herpertz, S., Kessler, H., & Dieris-Hirche, J. (2022). Alexithymia and internet gaming disorder in the light of depression: A cross-sectional clinical study. *Acta Psychologica*, *229*, 103698. https://doi.org/10.1016/j.actpsy.2022.103698

Pawlikowski, M., & Brand, M. (2011). Excessive internet gaming and decision making: Do excessive World of Warcraft players have problems in decision making under risky conditions? *Psychiatry Research*, *188*(3), 428–433. https://doi.org/10.1016/j.psychres.2011.05.017

Peixoto, M., Dores, A., Monteiro, M., Marques, A., & Barbosa, F. (2025). Executive function in gambling disorder: A meta-analysis on neuropsychological evidence. *Journal of Gambling Studies, 41*(2), 449–488. https://doi.org/10.1007/s10899-025-10383-1

Rabinovitz, S., & Nagar, M. (2026). When rejection backfires: Social exclusion and economic decision-making in gamblers. *Journal of Behavioral Addictions, 15*(1), 515–523. https://doi.org/10.1556/2006.2025.00095

Rilling, J. K., & Sanfey, A. G. (2011). The neuroscience of social decision-making. *Annual Review of Psychology*, *62*(1), 23–48. https://doi.org/10.1146/annurev.psych.121208.131647

Salehinejad, M. A., Ghanavati, E., Rashid, M. H. A., & Nitsche, M. A. (2021). Hot and cold executive functions in the brain: A prefrontal-cingular network. *Brain and Neuroscience Advances, 5*, e23982128211007769. https://doi.org/10.1177/23982128211007769

Sirola, A., Savela, N., Savolainen, I., Kaakinen, M., & Oksanen, A. (2021). The role of virtual communities in gambling and gaming behaviours: A systematic review. *Journal of Gambling Studies, 37*(1), 165–187. https://doi.org/10.1007/s10899-020-09946-1

Stanković, M., Bjekić, J., & Filipović, S. R. (2023). Effects of transcranial electrical stimulation on gambling and gaming: A systematic review of studies on healthy controls, participants with gambling/gaming disorder, and substance use disorder. *Journal of Clinical Medicine*, *12*(10), 3407. https://doi.org/10.3390/jcm12103407

Su, W., Potenza, M. N., Zhang, Z., Hu, X., Gao, L., & Wang, Y. (2018). Do individuals with problematic and non-problematic internet game use differ in cooperative behaviours with partners of different social distances? Evidence from the Prisoner's Dilemma and Chicken Game. *Computers in Human Behavior*, *87*(3), 363–370. https://doi.org/10.1016/j.chb.2018.05.040

Syvertsen, A., Leino, T., Pallesen, S., Smith, O. R. F., Sivertsen, B., Griffiths, M. D., & Mentzoni, R. A. (2023). Marital status and gambling disorder: A longitudinal study based on national registry data. *BMC Psychiatry*, *23*(1), 697. https://doi.org/10.1186/s12888-023-04697-w

Wan, H., Chen, B., Li, X., & Bu, J. (2025). Effect of EEG neurofeedback therapy on addiction disorders: A systematic review and meta-analysis. *Addiction, 121*(2), 225–238. https://doi.org/10.1111/add.70164

Wang, H. Y., & Cheng, C. (2022). The associations between gaming motivation and internet gaming disorder: Systematic review and meta-analysis. *JMIR Mental Health, 9*(2), e23700. https://doi.org/10.2196/23700

Wölfling, K., Duven, E., Wejbera, M., Beutel, M. E., & Müller, K. W. (2020). Discounting delayed monetary rewards and decision making in behavioural addictions – A comparison between patients with gambling disorder and internet gaming disorder. *Addictive Behaviors*, *108*, 106446. https://doi.org/10.1016/j.addbeh.2020.106446

Yao, Y. W., Zhang, J. T., Fang, X. Y., Liu, L., & Potenza, M. N. (2021). Reward-related decision-making deficits in internet gaming disorder: A systematic review and meta-analysis. *Addiction, 117*(1), 19–32. https://doi.org/10.1111/add.15518

Yu, Y., Mo, P. K. H., Zhang, J., Li, J., & Lau, J. T. F. (2022). Maladaptive cognitions, loneliness, and social anxiety as potential moderators of the association between internet gaming time and internet gaming disorder among adolescent internet gamers in China. *Addictive Behaviors*, *129*, 107239. https://doi.org/10.1016/j.addbeh.2022.107239

Zelazo, P. D., & Carlson, S. M. (2012). Hot and cool executive function in childhood and adolescence: Development and plasticity. *Child Development Perspectives*, *6*(4), 354–360. https://doi.org/10.1111/j.1750-8606.2012.00246.x

Zhou, H., & Wu, A. M. S. (2024). The protective effects of cognitive empathy and emotional empathy on gambling disorder are mediated by risk aversion and responsible gambling attitude. *BMC Psychiatry*, *24*(1), 63. https://doi.org/10.1186/s12888-024-05509-5