



Clinical and Cognitive Metacognition in Gaming and Gambling Disorder: A Narrative Review

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Abstract

Purpose of this review To review and reconcile the methodologies and understandings of metacognition from both cognitive science and psychopathology in Gaming Disorder and Gambling Disorder to enhance interdisciplinary communication and methodological exchange.

Recent findings While clinical metacognition research in gaming and gambling disorders is established, exploration into specific metacognitive mechanisms within these domains is still nascent.

Summary This review delineates various forms of metacognition and clinical measurements of metacognition in Gaming Disorder and Gambling Disorder. The discussion presents a new integrated model of metacognition in behavioural addictions that generates a research agenda to understand and target these addictions with more effective interventions.

Keywords Metacognition · Confidence · Internet Gaming Disorder · Gambling Disorder · Metacognitive Therapy · Metacognitive Training

Introduction

Metacognition is defined as “thinking about thinking” [1] and describes the ability to monitor and control one’s cognitive processes [2]. It has been shown to play an important role in many areas of life, including learning, education and mental well-being. Indeed, in clinical therapeutic settings, metacognition has been conceptualized and targeted as a key factor in the escalation and maintenance of psychological distress [3, 4]. Research on metacognition in psychopathology has led to the development of disorder-specific formulations and treatments which center on the modification of metacognitive processes, including in behavioural addictions such as Gaming Disorder and Gambling Disorder [5, 6].

While gambling disorder is recognised as a behavioural addiction in the DSM as well as in the ICD, a debated behavioural addiction is Gaming Disorder, which is recognised by the ICD 11 as a disorder [7], but not yet fully by the DSM-5-TR [8]. Whether or not Gaming Disorder is officially recognised as a clinical disorder, excessive gaming have been associated to increased levels of loneliness, reduced self-esteem, and emotional distress [9, 10], stressing the need to understand the aetiology of such behaviours and develop effective interventions to reduce their negative impact.

While clinical-oriented metacognition research in the behavioural addictions has now been established for over a decade [5], studies on metacognitive mechanisms underlying addictive behaviours remain limited [6, 11]. Yet, cognitive studies into metacognitive mechanisms show promise in distinguishing differential profiles in varying psychiatric disorder and symptom clusters [12–14] and in how metacognitive training may be effective in treating psychiatric symptoms [15, 16]. Indeed, there are significant differences in the manner (and techniques used) in which cognitive scientists study metacognition relative to their counterparts in psychopathology. While the former investigate metacognition via behavioural tasks, the latter tend to rely on self-reported questionnaires or interviews. Therefore, the extent to which these different operationalisations of

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metacognition match, reflect or build on the same processes remains unclear. As a result, the external validity of methodologies used in cognitive science is limited, while metacognition research in psychopathology wants a mechanistic cognitive understanding (papers discussing this in regard to the field of educational science and psychiatry are [17, 18], respectively).

In this paper, we argue that a better understanding of the differences between the two approaches to research in metacognition will ease inter-communication. Importantly, it will help the theoretical and methodological exchange between the two disciplines, underpinning cognitive scientific research in terms of ecological validity and bringing mechanistic understanding to clinical contexts. The hope is that this understanding will provide further targets to potentiate the effectiveness of interventions.

The following sections will describe the definitions of various forms of metacognition, followed by a quick overview of the literature on clinical metacognition measurements in Gaming Disorder and Gambling Disorder (for systematic and meta-analytic studies, please see [6, 11, 19]). Since there are currently no cognitive metacognitive studies in Gaming Disorder, an overview of cognitive metacognitive research in Gambling Disorder will be presented. In the discussion, we will provide a new integrated model of metacognition and describe what future studies are need to further understand behavioural addictions and pinpoint targets for more effective interventions for Gaming Disorder and Gambling Disorder.

Metacognition in Clinical Context and Gaming and Gambling Disorder

Metacognition has proven valuable in addressing psychological distress within clinical therapeutic contexts. Introduced by Wells and Matthews (1994), the Self-Regulatory Executive Function (S-REF) model emphasizes metacognition as a critical factor in psychological dysfunction. Initially designed for emotional disorders, this transdiagnostic model unveils how metacognitions (beliefs about thinking and how to control it) influence maladaptive coping styles, ultimately leading to psychological dysfunction [6]. These styles encompass cognitive patterns like active worrying, rumination, desire thinking, thought suppression, and coping behaviors such as avoidance or substance use. Driven by their perceived utility in regulation cognition, these coping styles, activated and maintained by metacognitions, become entrenched and consistently applied, resulting in heightened self-focused attention, decreased cognitive efficiency, self-beliefs activation, attentional bias, and capacity constraints [4]. Metacognitive Therapy (MCT: [20] strives to empower patients by questioning metacognitions and interrupting maladaptive coping styles and is recognized as an effective

treatment for a variety of psychiatric disorders [21], including depression, Generalised Anxiety Disorder, Obsessive Compulsive Disorder, Post-traumatic Stress Disorder and schizophrenia [21, 22].

Problematic metacognitions can take on positive or negative forms. Positive metacognitions encompass thoughts and beliefs that highlight the benefits of certain behaviors for cognitive and emotional regulation [23]. For instance, a positive belief is that a specific action enhances one's mood. Conversely, negative metacognitions revolve around the uncontrollability and hazards of behaviors, such as the belief that thoughts may trigger unfavourable self-regulation outcomes. These negative metacognitions are pivotal in perpetuating behaviours, eroding control over one's mental events [5, 19]. Over time, these beliefs can lead to internal conflict, hindering attempts to halt these behaviours [24]. Research frequently employs self-report scales like the Metacognitions Questionnaire (MCQ) and its abbreviated version, the Metacognitions Questionnaire 30 (MCQ-30) [25, 26]. Specific metacognitions that differ across disorders are also explored, such as one for gambling [27] and gaming [28].

Concerning generic metacognitions in addictive disorder, certain beliefs, such as the imperative to control thoughts, apprehensions of danger, uncontrollability, and deficits in cognitive confidence, are consistently linked to alcohol and nicotine use, gambling, gaming and internet use [19]. In a healthy population study, distinct correlations emerged between all five primary metacognitions and Gaming Disorder scores [29]. Notably, beliefs centred on worry benefits, the perilous nature and uncontrollability of thoughts, combined with weakened cognitive confidence, were distinctly correlated with Gaming Disorder inclinations [30, 31]. Efrati et al., [32] also discerned that these metacognitions correlated with elevated impulsiveness, subsequently intensifying Gaming Disorder severity.

Specific Metacognitions within Gaming and Gambling Disorder

Spada and Wells [33] (focused on problematic alcohol use) and Spada, Caselli and Wells [5] introduced a three-phase metacognitive model for understanding addictive behaviours which highlights three distinct phases: pre-engagement, engagement, and post-engagement and have tested this model in gaming too. Caselli et al. [23] noted that, after gaming, negative beliefs about the activity as both uncontrollable and perilous may possibly intensify negative feelings that then act as catalysts for more gaming sessions. Consequently, the post-engagement phase is marked by self-reproach and withdrawal symptoms, amplifying these negative beliefs and paving the way for positive metacognitions such as “analyzing my feelings will help me understand my addictive behaviour” [5]. These beliefs may drive the

activation of further maladaptive forms of coping such as rumination and worry that will result in an escalation of negative cognitive-affective states and a greater likelihood of returning to use/engagement. Caselli, Spada and colleagues have argued that this triphasic model is likely to be transdiagnostic, with evidence suggesting that the phases identified (and associated metacognitions) are common across behavioural addictions [5, 34, 35].

In 2017, Spada and Caselli, pioneered the investigation into specific metacognitions related to online gaming by developing the Metacognitions about Online Gaming Scale (MOGS) [28]. See Table 1. This self-report questionnaire gauges specific metacognitions about online gaming, particularly pinpointing positive beliefs about gaming, as well as negative ones centred on its uncontrollability and potential hazards. Their findings highlighted that these metacognitions were positively correlated with both weekly gaming hours and Gaming Disorder scores, suggesting they can predict tendencies towards excessive and problematic gaming behaviour. A study by Bonner and colleagues [36] in an Gaming Disorder group found that these positive beliefs lead to more dysfunctional thoughts, weakening control and creating a feeling of reduced cognitive confidence. Additionally, they found that motivations for gaming, such as escape or skill development, intensify these positive beliefs, leading to a more favourable view of gaming-related desire thinking, and increasing the adoption of beliefs that drive dysfunctional thinking [36].

Another study by Marino and colleagues [37] looked into metacognitions about online gaming and Gaming Disorder among heavy gamers. Their aim was to understand the impact of factors like social anxiety, online interaction preferences, reasons for gaming, and beliefs about gaming on Gaming Disorder. Their results showed that negative beliefs about online gaming were the main link between social anxiety and Gaming Disorder. Interestingly, they found that common beliefs associated with social anxiety

can activate these negative beliefs about gaming's uncontrollability, which might cause individuals to continue gaming as a way to cope, even when they recognize its negative effects [37].

As also recently summarized in a meta-analysis on metacognitive studies in gambling disorder (GD) [11], there are currently five studies that have assessed clinical metacognitive beliefs related to GD. Caselli et al. (2018) developed the Metacognitive about Gambling Questionnaire (MGQ) and found that both negative and positive metacognitions are correlated with GD severity, although only negative metacognitions predict symptoms [27]. Lindberg et al. (2011) found that negative metacognitive beliefs to be positively correlated to adverse outcomes in GD, while “cognitive confidence” was associated with more gambling problems [38]. Jauregui et al. (2016) observed significant correlations between GD and most variables of the Metacognitions Questionnaire-30 (MCQ-30), except for “Cognitive Confidence” and “Cognitive Self-Consciousness” Similarly, Mansueto et al. (2016) reported positive correlations between gambling severity and MCQ-30 scores, except for the “Cognitive confidence” dimension. Spada and Roarty (2015) also identified significant correlations between several MCQ-30 subscales and problem gambling severity, pinpointing “Beliefs about the need to control thoughts” as a key predictor of GD severity.

In conclusion, the relationship between metacognition and Gaming and Gambling Disorders is evident, with both specific and generic metacognitions influencing gaming and gambling severity. Interestingly, 2 of the five studies in gambling found no relation between cognitive confidence and gambling severity, whereas 1 did find a positive correlation. While self-report questionnaires are commonly used due to their simplicity, their correlation with actual metacognitive ability, as also pointed out by Fleur, Bredeweg, and van den Bos [17], remains uncertain.

Table 1 Examples of metacognitive dimensions and questions

Generic Metacognitive dimension as measured with MCQ-30	Specific question:
Cognitive confidence	“I have little confidence in my memory for words and names”
Positive beliefs	“Worrying helps me to get things sorted out in my mind”
Cognitive self-consciousness	“I pay close attention to the way my mind works”
Uncontrollability and danger	“When I start worrying I cannot stop”
Need to control thoughts	“It is bad to think certain thoughts”
Specific Gaming or Gambling metacognitive dimensions as measured with MOGS	Specific question:
Positive metacognitions: controlling cognition	“online gaming stops my worry”
Positive metacognitions: controlling emotion	“online gaming reduces my anxious feelings”
Negative Metacognitions: the uncontrollability of online gaming	“I cannot control my online gaming.”
Negative Metacognitions: the dangers of online gaming	“Thoughts about online gaming interfere with my functioning”

The current lack of longitudinal studies further limits our understanding of the causal role metacognitive constructs play in Gaming and Gambling Disorder.

Metacognition in Cognitive Context

In the realm of cognitive neuroscience, the study of metacognition was founded by Flavell [1] and further developed by others, such as Nelson and Narens [2]. They differentiate between ‘meta-knowledge’—the flow of information from the basic cognitive level (object-level) to a higher awareness level (meta-level)—and ‘meta-control’—the flow from the higher awareness level back to the basic cognitive level. Modern theories emphasize the interplay between these two levels in influencing behaviour [18, 39]. The primary focus has been on ‘meta-knowledge.’ This involves examining the

foundation of our introspective judgments about our own thought processes, commonly referred to as metacognitive or ‘confidence’ judgments. Research in the realm of ‘metacognitive control,’ particularly in the behavioural addictions, is still nascent. Our paper, therefore, only discusses metacognitive/confidence judgment studies.

A prevalent method to study metacognition is to ask participants about their confidence in a decision they’ve made. The accuracy of these confidence levels can be assessed by comparing them with the actual outcome of a task (Fig. 1). Confidence is considered accurate when higher confidence levels correspond to correct decisions, and the average confidence level aligns with the average performance. However, these confidence ratings can sometimes be misleading due to changes in basic performance. Consequently, newer, bias-free measures rooted in signal detection theory—like

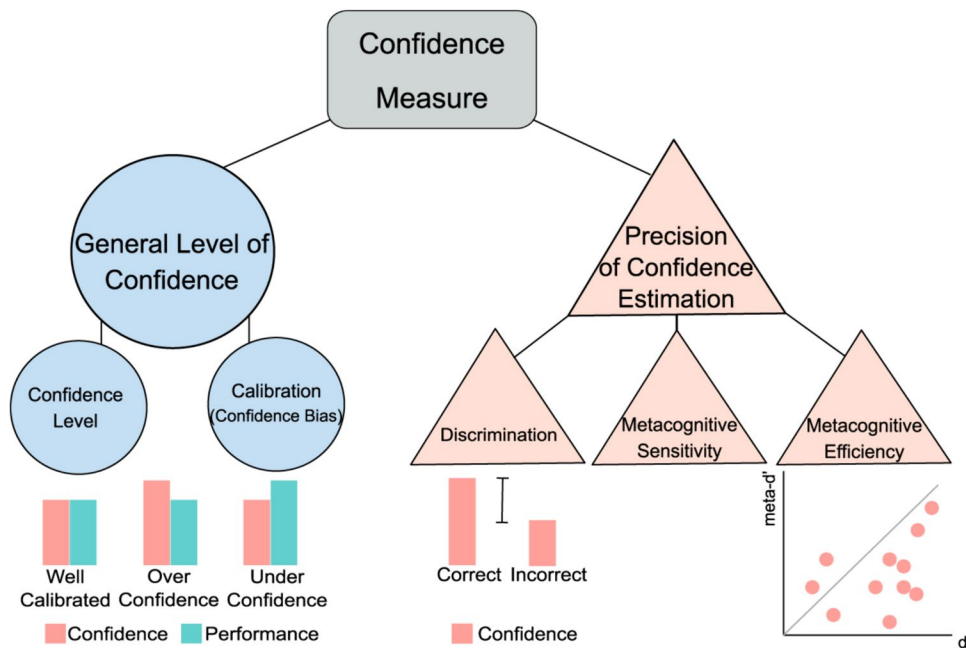


Fig. 1 Copied with permission from Hoven et al., 2019. Confidence measures can be divided into general measures of confidence level and precision measures of confidence estimation. To assess someone’s general level of confidence, confidence level or calibration can be analyzed. Calibration (or confidence bias) is usually calculated as the difference between mean task performance and confidence. This results in overconfidence when confidence levels are higher than performance levels, and underconfidence vice versa. To assess someone’s precision of confidence estimation, confidence discrimination, metacognitive sensitivity or metacognitive efficiency can be analyzed. Confidence discrimination refers to the difference in confidence levels between correct and incorrect choices. The larger this difference, the higher the discriminatory accuracy of confidence, signaling an increased ability to recognize accurate from inaccurate performance by using one’s metacognitive report. Confidence discrimination is sometimes referred to as ‘the confidence gap’. Confidence bias and discrimination are two independent aspects of metacognition: an individual might be underconfident, but still be highly sensitive to dis-

criminate between accurate and inaccurate performance with their confidence. Similar to discrimination, metacognitive sensitivity, also referred to as parameter meta-d’, aims to measure the ability of a metacognitive observer to discriminate between correct and incorrect trials with their confidence judgments. Yet, it uses a more sophisticated calculation that is bias free, and controls for performance confounds. On the other hand, metacognitive efficiency, referred to as meta-d’/d’, indicates how well perceptual information (d’) is used to form a metacognitive report (meta-d’). When meta-d’/d’, or the M-ratio, equals 1 (i.e. indicated by the line in the graph), this signals a metacognitively ideal observer that uses all perceptual information captured in d’ for the formation of a metacognitive report. When meta-d’/d’ < 1, not all information was used to form a metacognitive report, corresponding to lower metacognitive efficiency. When meta-d’/d’ > 1, the observer retrieved additional information to form a metacognitive report, corresponding to higher metacognitive efficiency

metacognitive sensitivity (meta-d')—have been introduced [40, 41]. These measures evaluate our ability to differentiate between right and wrong decisions using confidence levels, while adjusting for potential pitfalls. Furthermore, the concept of 'metacognitive efficiency' (represented as meta-d'/d') has been introduced. It evaluates the efficacy of using perceptual information to inform metacognitive assessments. A ratio close to 1 suggests optimal use of sensory evidence for metacognitive judgment. Conversely, a ratio below 1 indicates some sensory evidence was overlooked, signaling reduced metacognitive efficiency. It is essential to note that measures of bias and sensitivity operate independently. As an illustration, a person might generally be overly confident yet remain adept at distinguishing between correct and incorrect decisions based on their confidence. Using these methods, research has shown that accurate metacognition is crucial for advantageous decision-making [42], learning [43] and navigating future behaviour [44, 45]. If the monitoring of one's cognitive performance is not aligned with reality, discrepancies exist, which in turn could contribute to pathological decision-making as seen in various psychiatric disorders including addictions [46, 47].

Cognitive Metacognition in Gambling Disorder

Studies on cognitive metacognition in Gaming disorder are currently lacking. A recurring observation in Gambling Disorder is a disconnect between a person's confidence in their decisions and their actual performance accuracy, pointing to a metacognitive deficiency. For instance, people with subclinical Gambling Disorder symptoms show higher confidence despite poorer task performance when compared to non-gamblers [48]. In contrast, people without gambling problems exhibit less overconfidence than both people with subclinical and clinical Gambling Disorder symptom levels [49]. And a direct positive correlation has been identified between overconfidence and the severity of gambling [48–50].

In a study by Brevers et al. [51], people with Gambling Disorder had comparable confidence levels to non-gamblers on a specific task, but their performance was subpar, leading to overconfidence. This study also highlighted that the confidence of people with Gambling Disorder didn't fluctuate with their performance, marking insensitive metacognition. Additionally, Hoven and colleagues [52] found heightened confidence in people with Gambling Disorder, especially when potential monetary gains were involved. Notably, people with Gambling Disorder relied less on evidence from their correct decisions when forming confidence judgments, suggesting reduced metacognitive sensitivity. On a risky-decision making task, Gambling Disorder patients took more risks and held higher confidence in those risky decisions compared to a control group [53, 54]. Broadening the

scope, Hoven et al. [47] also found that individuals with high impulsivity and/or compulsivity levels (traits closely linked with Gaming Disorder and Gambling Disorder) exhibited overconfidence.

To summarize, cognitive research into metacognition in Gaming Disorder is currently lacking, and the literature suggests that Gambling Disorder presents with overconfidence and a misalignment between actual performance and confidence. Given the evident parallels between Gambling Disorder and Gaming Disorder, a hypothesis arises suggesting Gaming Disorder may also harbour similar overconfidence and metacognitive insensitivity as found in Gambling Disorder. This would align with circumstantial evidence provided by transdiagnostic studies showing that heightened impulsivity—a trait frequently linked to Gaming Disorder [55]—is related to overconfidence. Conversely, anxiety and depression symptoms, also present in Gaming Disorder [56] are related to underconfidence (Hoven et al., 2022), bringing forth an alternate hypothesis: perhaps Gaming Disorder manifests underconfidence in cognitive metacognitive evaluations. On the other hand, Gaming Disorder is also associated with symptoms of social anxiety [37], which haven't shown a direct relation to metacognitive abnormalities [14, 47] and some games have been empirically shown to enhance cognitive facets like attention and executive functioning [57]. Such enhancements might also positively impact metacognition sensitivity and reduce any possible miscalibrated confidence. This raises a third hypothesis: Gaming Disorder might not necessarily be tied to overconfidence, underconfidence, or any other cognitive metacognitive deficits. Studies are needed to ascertain whether Gaming Disorder is associated with abnormalities in cognitive metacognition.

Discussion

An area ripe for exploration is the intersection of clinical and cognitive metacognitive research. A new theoretical framework has emerged, posing that confidence manifests at various hierarchical levels of abstraction, from 'local' confidence judgments on a specific trial to more 'global' metacognitive constructs [18, 47, 58]. In this framework, local constructs are theorized to pertain to isolated choices. In contrast, global constructs are proposed to reflect beliefs formed over extended periods and integrate larger amounts of information. For instance, one can develop global confidence in one's ability to perform a certain task. These local and global constructs are likely related to even higher-order feelings of confidence about the self, which are relatively more stable over time and general than local confidence, which can be very task-specific [18, 59, 60]. How these various levels of confidence are related and how they relate to psychopathology are important open questions. Findings

from recent studies have started to answer these questions [47] indicating that local- and global- confidence were positively related to self-beliefs in the general population. This remained so in people scoring higher on anxiety and depression or social anxiety. Notably, however, individuals with elevated impulsivity and compulsivity (often seen in people with behavioural addiction) tended to exhibit enhanced local confidence but diminished self-beliefs, suggesting a disconnect between local and higher levels of confidence.

Remarkably, the current review of the clinical metacognitive literature on Gaming Disorder, suggests that there is a connection between cognitive confidence — which represents one’s overall trust in their cognitive abilities — and symptom severity of Gaming Disorder; in such a way that with more symptoms, people report lower cognitive confidence [29, 31]. While this concept of cognitive confidence seems to be the most pertinent when merging clinical and cognitive metacognitive evaluations, research focusing on specific clinical metacognitive concepts in patients with Gaming Disorder does not find this relation [28, 36]. Similarly, such correlation is absent in the context of Gambling Disorder [11]. This is fitting with the above-described

disconnect between local and higher levels of confidence in people with impulsive and compulsive tendencies [47]. Intriguingly, as reviewed above, Gambling Disorder is marked by confidence miscalibration and inaccurate cognitive metacognition. Hence, Gambling Disorder patients seem to have a diminished ability to self-reflect, which can lead to an obliviousness to this shortfall when reporting this in a clinical setting, as also suggested by Rogier et al. [11]. Therefore, metacognitions and actual abilities may be specifically disjointed (e.g., missing correlation) in the behavioural addictions.

Let us suppose that behavioural addictions are indeed associated with cognitive metacognitive deficits. In that case, this can pose challenges for clinical assessments of metacognitions and potentially hinder the effectiveness of metacognitive therapeutic strategies as used in therapies for depression, anxiety and OCD. Notwithstanding this, metacognitive training, as developed, used and shown effective in Schizophrenia treatment [61], specifically focuses on restoring the alignment of object-level experiences and meta-level interpretations, which might be especially effective in treating behavioural addictions as well. Knowing whether

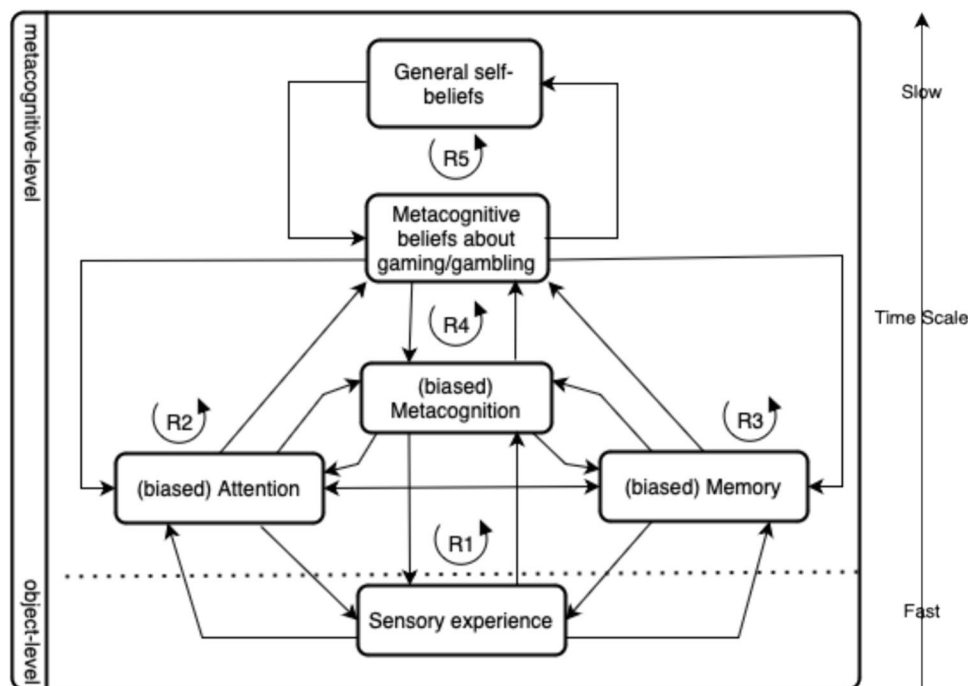


Fig. 2 Integrating and extending the existing clinical RE-F model by Wells & Matthews (1994) and cognitive metacognition model by Nelson & Narens (1994), describing the intrinsic and recursive relations and information flow between object-level and meta-level and their contribution to problematic gaming and gambling symptoms. This sequence triggers the onset and then maintenance of symptoms. Five recursive interactions are displayed: R1: Metacognitive biases can bias sensory experiences, which can bias metacognitive processes. R2: Metacognitive beliefs about gaming-related information

can steer attention towards gaming and reinforce the metacognitive beliefs about gaming. R3: Metacognitive beliefs about gaming can tint gaming memories, and those memories can reinforce the metacognitive beliefs about gaming. R4: Metacognitive beliefs can create metacognitive biases and vice versa. R5: Metacognitive beliefs about gaming/gambling can affect general self-beliefs such as self-esteem. These general self-beliefs, in turn, can trigger certain metacognitive beliefs about gaming and gambling (“I feel better if I game”), which can influence lower processing levels

Gaming Disorder is associated with deficits in cognitive metacognition and understanding the nuances of this relationship is crucial for shaping effective interventions.

A necessary direction for future studies would be combining local (task-specific) and clinical metacognitive measures and assessing how they evolve over time. As stated before, there is much research showing a positive effect of metacognitive treatment on symptom severity, dysfunctional attitudes, metacognitions, rumination, worry and global social functioning in a variety of disorders, including Gaming Disorder [6, 21, 22]. However, clinical studies that test changes in cognitive metacognitive abilities are scant. One recent study found that metacognitive biases in anxious depression responded to treatment; when symptoms improved, so did confidence in their performance [12]. There is also increasing interest in understanding how cognitive metacognitive training impacts cognitive metacognition, higher-order beliefs [62], and well-being [16]. Empirical studies have suggested that cognitive metacognitive training may improve metacognition in people without psychiatric disorders [15], but whether this kind of cognitive training truly improves cognitive metacognition [63], including in clinical samples, and positively affects higher self-concepts requires further examination [12, 16].

A way forward – incorporating the Two Metacognitive Research Fields

We present a new cognitive model for Game and Gambling Disorder, that combines the existing cognitive metacognitive models with the clinical and cognitive models by Wells and Matthews [4] and Nelson and Narens [2], (Fig. 2). To help provide a way forward to incorporate the two important fields and enable testing of the mechanisms of clinical metacognitive interventions. Moreover, it postulates testable hypotheses on how intervention should be shaped to improve treatment outcomes or develop effective prevention against Gaming Disorders. The general premise of this new model is that the activation of metacognitive beliefs about gaming/gambling behaviour by triggers in a vulnerable individual is both the initial and penultimate process in addictive behaviour. Activating specific metacognitive beliefs triggers biased cognitive processes, including cognitive metacognitive processes, that can further affect attention and memory for sensory experiences. As a result, incoming experiences are filtered in light of the metacognitive beliefs held by the individual. If the affected individual experiences game/gambling cues, this can reinforce the metacognitive beliefs about that behaviour, further strengthening the individual's metacognitive beliefs about their behaviour. Whether these various recursive relationships exist between different levels of processing and how intrinsic relations interact to

establish the onset and maintenance of symptoms needs to be established by future research. One way forward would be to combine the strengths of randomized controlled trials and experience sampling methodology during Metacognitive Therapy, for example, in a micro-trial approach [64, 65], to identify the complex relationship between metacognitive abilities and beliefs.

Conclusion

This narrative overview, including a new cognitive model explaining Game and Gambling Disorder, presents an overview of these two metacognitive research fields. It bridges gaps in our comprehension of metacognition in general and hopes to contribute to strengthening metacognitive research into behavioural addictions to create (and understand the mechanisms of) effective therapeutic interventions.

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Data Availability No datasets were generated or analysed during the current study.

Declarations

Competing Interests The authors declare no competing interests.

Conflict of interest None to report.

Human and Animal Rights and Informed Consent No animal or human subjects by the authors were used in this study.

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