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FULL-LENGTH REPORT

Bidirectional relationships between desire thinking and gambling disorder tendency: Insights from a longitudinal study of Esports gamblers

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ABSTRACT

Background and aims: With the popularization of electronic sports (esports), an emerging type of gambling activity, esports betting, has risen. Esports gamblers are vulnerable to Gambling Disorder (GD), but we lack knowledge about their cognitive predictors of GD. Desire thinking about gambling (DTG) is found as a risk factor for GD in general gamblers, but little is known about its role in esports gamblers and its bidirectional relationship with GD. This study aimed to examine the differences in DTG between esports gamblers and their non-esports counterparts, as well as the bidirectionality between DTG and GD among gamblers. *Methods:* We conducted a two-wave, longitudinal online study with a 6-month interval. Data from 1,063 lifetime gamblers (50.0% female, M_{age} = 29.11 years, SD = 7.78), of whom 50.5% were esports gamblers, was collected. At follow-up, 582 of the participants completed the same survey. *Results:* Esports gamblers reported higher levels of DTG and GD at both time points. The bidirectionality between DTG and GD was noted. Sub-group analysis identified a more prominent prediction of imaginal prefiguration on GD among esports gamblers. *Discussion and conclusions:* Our findings suggest a higher risk of GD among esports gamblers, with DTG forming a reciprocal loop with such risk. Findings highlight the adverse impact of imaginal prefiguration on GD, especially in esports gamblers. Based on these findings, regulators should consider being more vigilant in the early screening of GD in esports gamblers. Appropriate preventative strategies (e.g., promoting responsible gambling) and psychological interventions (e.g., Metacognitive Therapy) may help reduce gambling-related harms among esports gamblers.

KEYWORDS

desire thinking, electronic sport, esports gambling, longitudinal, cross-lagged panel model, addictive behavior, gambling, internet, internet use, behavioral addiction

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INTRODUCTION

Electronic video gaming is not only a popular recreational activity but has also become a form of competitive sport, known as electronic sport (i.e., esport) (Kim, Nauright, &

Suveatwatanakul, 2020; Hamari & Sjöblom, 2017). The increasing popularization of esports has brought a large-scale market for the gambling industry, and an emerging type of gambling activity, esports betting, has increased. Esports betting involves taking wagers on the outcomes of esports events using cash or virtual items (e.g., skins and virtual currency) (Mangat et al., 2024). Estimates are that the revenue of the global esports betting market will be around 2.8 billion USD in 2025 with an annual growth rate of 5.47% (Statista Market Insights, 2025). Given the anonymity, easy accessibility, and high diversity of games (Lelonek-Kuleta & Bartczuk, 2021), esports betting is widespread across age groups (Czakó et al., 2023; Mangat et al., 2024). Based on the data from the UK Gambling Commission, around 8.5% of adults have bet on esports (Gambling Commission, 2017). Notably, prior studies suggest that esports betting is related not only to higher involvement in gambling activities but also higher levels of problem gambling and associated harms (Gainsbury, Abarbanel, & Blaszczynski, 2017; Greer, Rockloff, Russell, & Lole, 2021). Though extant evidence has indicated the extensive and rapidly growing audience of esports betting, as well as its notable link to gambling-related problems, little is known about modifiable psychological features of esports gamblers, which may hinder the regulation and prevention of potential harms (e.g., gambling-related problems) of esports industry development.

Prior studies have suggested that cognitive factors (e.g., attentional inhibition and cognitive distortion, etc.) play a crucial role in the development of gambling disorder (GD) (Ioannidis, Hook, Wickham, Grant, & Chamberlain, 2019; Jacobsen, Knudsen, Krogh, Pallesen, & Molde, 2007), which is a persistent and maladaptive gambling pattern with severe consequences (e.g., financial problems, poor job/academic performance, interpersonal conflicts, etc.) (APA, 2013). Considering the previous evidence about the significant associations between esports betting and gambling-related problems (e.g., higher problem gambling severity; Greer et al., 2021; Gainsbury et al., 2017; Greer, Hing, Rockloff, Browne, & King, 2023), esports gamblers may suffer a higher risk of GD compared to general gamblers. Existing literature on esports gambling has focused on identifying their demographic and motivational characteristics and found that esports gamblers are more likely to be young males, from non-white ethnic backgrounds, betting for financial gain and excitement (Greer et al., 2023; Mangat et al., 2024). However, there is limited knowledge of modifiable, cognitive characteristics of esports gamblers as well as how this relates to their risk for GD.

One of the key features of GD is preoccupation with gambling (e.g., thinking about past gambling experiences and planning the next venture; APA, 2013), which is a typical manifestation of desire thinking (Spada, Caselli, Nikčević, & Wells, 2015). Indeed, desire thinking is defined as voluntary and conscious cognitive process oriented to images, information, and memories about addictive targets (e.g., drinking and gambling) (Caselli & Spada, 2010), and thus presumed to lead to the escalation and persistence of craving for the corresponding addictive behavior under the framework of the Elaborated Intrusion Theory of desire and Metacognitive Model of Addictive Behaviors (Caselli & Spada, 2015; Kavanagh, May, & Andrade, 2009). Desire thinking is considered to have two domains: (i) verbal perseveration (i.e., prolonged self-talk about the worthwhile reason for engaging in target activities); and (ii) imaginal prefiguration (i.e., allocation of attentional resources to target-related information as well as multi-sensory elaboration through anticipatory positive imagery or memories related to the target) (Caselli & Spada, 2011). A meta-analysis has shown that both domains of desire thinking are consistent and problematic features across substance and behavioral addictions (Mansueto et al., 2019). Indeed, desire thinking for gambling (DTG), indicated by gambling-specific verbal perseveration and imaginal prefiguration (Fernie et al., 2014), appears to be a promising cognitive feature for distinguishing gamblers with and without GD (Chen, Spada, Ling, Tong, & Wu, 2024), whereas its role in esports gamblers remains unknown. This study aims to address a knowledge gap by testing the following two hypotheses that 1) esports gamblers will report a higher level of DTG than their counterparts (Hypothesis 1 [H1]); 2) DTG will predict higher GD tendency among both general gamblers and esports gamblers (Hypothesis 2 [H2]).

In addition to the risk-enhancing effect of desire thinking on addictive behaviors, the cross-sectional findings of its positive association with higher severity of alcohol and nicotine addiction (e.g., Caselli, Ferla, Mezzaluna, Rovetto, & Spada, 2012; Caselli, Nikcevic, Fiore, Mezzaluna, & Spada, 2012) can also be explained if addiction severity worsens one's desire thinking. Indeed, both the Interaction of Person-Affect-Cognition-Execution (I-PACE) model (Brandtner, Antons, Cornil, & Brand, 2021) and the metacognitive model of addictive behaviors (Spada et al., 2015) posit a feedback loop from individuals' addictive behavior to their (meta)cognitive processes. Through their recurrent engagement in an addictive behavior, individuals not only suffer from worsening executive function and self-control but also develop an inflexible and maladaptive cognitive pattern regarding that addictive behavior, including more attentional bias toward addictive behaviors as well as a higher level of desire thinking (Brandtner et al., 2021; Spada et al., 2015). The impaired executive functions are expected to modulate the contents of working memory to the imagination and elaboration of thoughts related to desired activities, while addiction-oriented attentional bias shifts attentional resources toward desired activities (Brandtner et al., 2021). Thus, those individuals (e.g., gamblers in our case) would allocate more and more cognitive resources to attend, appraise, and respond to the internal/external stimuli related to their desired addictive behavior. Consistent with the theorized feedback loop, previous longitudinal studies have shown the adverse impact of individuals' addictive behaviors (i.e., Internet use) on their cognitive processes, including gaming metacognitions (Zhou, Hui, Wang, & Wu, 2025) and executive function (Song, 2022). However, the bidirectional link between desire thinking and GD has yet to be examined, as only cross-sectional studies have been

conducted to test the link between desire thinking and behavioral addictions, including GD (Chen et al., 2024; Fernie et al., 2014) and problematic Internet use (Allen, Kannis-Dymand, & Katsikitis, 2017; Spada, Caselli, Slaifer, Nikčević, & Sassaroli, 2014). This study, therefore, aims to examine the bidirectionality between DTG and GD tendency using a two-wave longitudinal survey in adult gamblers. In addition to H2, we further hypothesized that a higher GD tendency would predict increased DTG (Hypothesis 3 [H3]). The invariance of the links, if any, by esports betting experience will also be explored.

METHODS

Participants and procedures

The present study is a two-wave longitudinal study, using a convenience sampling method via the professional online survey platform, Credamo (https://www.credamo.com), which has over 3 million pooling participants and has been demonstrated to provide valid data (Wang, Nelson, Gao, Jung, & Hung, 2022). In the current study, two anonymous online surveys were conducted in China, in December 2023 (i.e., baseline/Wave 1 [W1] survey) and June 2024 (i.e., follow-up/Wave 2 [W2] survey).

A total of 1,100 Chinese adults responded to the survey at W1, of whom 1,063 (50.0% female, age 18 to 66, M_{age} = 29.11 years, SD = 7.78) were considered as eligible respondents by meeting the two inclusion criteria (i.e., lifetime gambling experience and a valid answer (i.e., yes or no) to the item "Have you ever bet on any esports events with cash and/or virtual items like skins?"). Among these eligible participants, 537 (50.5%) of them were esports gamblers (i.e., have betted on esports events). After 6 months, 582 of the participants (47.4% female) completed the follow-up survey. All the eligible participants passed two attention checks (e.g., "Please select disagree for this item") at both waves.

The attrition analysis showed, between participants who retained at W2 (54.8%) and those who dropped out, no significant differences in gender ($\chi^2_{(1)}$ = 2.641, p = 0.205), GD tendency ($t_{(1061)}$ = 1.019, p = 0.308), and two domains of DTG (IP: $t_{(1061)}$ = 1.762, p = 0.078; VP: $t_{(1061)}$ = 0.925, p = 0.355). However, a significant difference was observed in age ($t_{(1061)}$ = 4.582, p < 0.001), with those who dropped out (Mean$_{age}$ = 27.92 years) being significantly younger than those followed up (Mean$_{age}$ = 30.10 years).

Measures

Esport betting experience. One item (i.e., "*Have you ever bet on any esports events?*") was used to discern whether participants are esports gamblers.

Gambling disorder tendency (GD tendency). The present study employed the diagnostic criteria for GD in DSM-5 (APA, 2013), which has been adopted in Chinese people in previous studies (e.g., Chen, Tong, Wu, Lau, & Zhang, 2018), to measure participants' GD tendency. Participants used a dichotomous response scale to answer whether they had experienced each of the nine GD symptoms (e.g., "*Do you need to gamble with increasing amounts of money in order to achieve the desired excitement?*") in the past year. A higher total score indicated a higher GD tendency. The internal consistency was confirmed using Kuder-Richardson Formula 20 (*KR-20* = 0.811 for W1; *KR-20* = 0.793 for W2). Moreover, the measurement invariance of this assessment tool (as a one-factor model) was found, in this study, not only between groups of esports gamblers and their counterparts (Supplementary Table 1a) but also across waves (Supplementary Table 1b) from the configural to the scalar levels (Chen, 2007; Cheung & Rensvold, 2002), using WLSRV estimation (Millsap & Yun-Tein, 2004) conducted in the *lavaan* package (Rossel, 2012) in R.

Desire thinking about gambling (DTG). DTG was measured using the Chinese version (Chen et al., 2024) of the Desire Thinking Questionnaire (Caselli & Spada, 2011). This scale consists of 10 items measuring two domains of desire thinking: imaginal prefiguration (DTG-IP; e.g., "*I imagine myself gambling.*") and verbal preservation (DTG-VP; e.g., "*I repeat mentally to myself that I need to gamble.*"). Items are scored on a 4-point Likert scale ranging from 1 (*almost never*) to 4 (*almost always*), with higher scores indicating higher levels of DTG. In the current study, the *Cronbach's α* were 0.867 [W1] and 0.861 [W2] for DTG-IP and 0.911 [W1] and 0.897 [W2] for DTG-VP. Furthermore, the measurement invariance of this assessment tool (as a two-factor model) was shown, not only between groups of esports gamblers and their counterparts (Supplementary Table 2a) but also across waves (Supplementary Table 2b) from the configural to the scalar levels (Chen, 2007; Cheung & Rensvold, 2002), using the ML estimation (Cheung & Rensvold, 2002) conducted in the *lavaan* package (Rossel, 2012) in this study.

Demographics. All participants were asked to report their age (*year*) and gender (1 = *male*, 2 = *female*).

Data analysis

Descriptive analyses, reliability tests, attrition analyses, and correlation analyses were conducted via SPSS 29.0. In addition, *t*-tests and chi-square tests were used to examine the differences between esports gamblers and non-esports gamblers with SPSS 29.0. Results of the Little's MCAR (missing complete at random) test (Little, 1988) for all variables indicated the pattern of missing data to be MCAR (χ^2 = 7.268, p = 0.064). Thus, missing data were handled using full information maximum likelihood (FIML) (Enders & Bandalos, 2001). Before To examine the bidirectional relationships between GD tendency and DTG, the cross-lagged panel analysis was conducted using the *lavaan* package (Rosseel, 2012) in R (Version 4.3.2). In this model, all the variables at W1 are allowed to correlate and all the residual covariances between variables at W2 were allowed. The model fit was evaluated using the following indices: χ^2 test

($p > 0.05$), *CFI* > 0.95, *TLI* > 0.95, *RMSEA* < 0.08, and *SRMR* < 0.08 (Schreiber, Nora, Stage, Barlow, & King, 2006; Wheaton, 1987).

Ethics

This study conforms to the principles of the Declaration of Helsinki. The corresponding and first authors obtained ethics approval (Reference Number: DPSY/2022-22R1) from the Department of Psychology of the institute they are affiliated. All the participants provided their consent for participation before they started the survey and would receive a monetary reward of 18–28 CNY (around 2 – 4 USD) for completing the survey.

RESULTS

Descriptive statistics, comparison, and correlations

As shown in Table 1, esports gamblers reported higher levels of both DTG-IP and DTG-VP as well as GD tendency than non-esports gamblers at both time points, which supported H1. Males were more likely to participate in esports betting than females, while no age difference was found between these two groups.

The bivariate correlations between variables in the total sample are shown in Table 2. At each time point, GD tendency was positively correlated with both DTG-IP and DTG-VP. GD tendency and two domains of DTG at W1 showed positive correlations with their corresponding values in W2.

Cross-lagged panel model

We tested a cross-lagged panel model using path analysis to test the bidirectional relationships between DTG and GD tendency among gamblers. Age and gender were considered as covariates in this model. The model fit is good: $\chi^2_{(6)} = 29.717$, $p < 0.001$, $CFI = 0.995$, $TLI = 0.977$, $RMSEA = 0.061$, 90% CI [0.040, 0.084], $SRMR = 0.044$.

As illustrated in Fig. 1, GD tendency and both domains of DTG at W1 positively predicted their corresponding values at W2. In line with our H2, DTG-IP [W1] but not DTG-VP [W1] showed significantly positive prediction on GD tendency [W2] (IP: $\beta = 0.128$, $p < 0.05$; VP: $\beta = 0.110$, $p = 0.063$). H3 was supported, as both domains of DTG [W2] were positively predicted by GD tendency [W1] (IP: $\beta = 0.111$, $p < 0.01$; VP: $\beta = 0.151$, $p < 0.01$). Besides, DTG-IP [W1] positively predicted DTG-VP [W2] ($\beta = 0.212$, $p < 0.001$).

Table 1. Descriptive and comparative analysis of variables

	Mean ± SD/N (%)			
	Non-esports Gamblers ($N_{[W1]} = 526$, $N_{[W2]} = 283$)	Esports Gamblers ($N_{[W1]} = 537$, $N_{[W2]} = 299$)	t/χ^2	p
Age (year) [W1]	29.36 ± 8.40	28.87 ± 7.14	1.028	0.304
Gender [W1]			34.326	<0.001
Male	215 (40.9%)	316 (58.8%)		
Female	311 (59.1%)	221 (41.2%)		
GD tendency [W1]	1.74 ± 1.97	3.27 ± 2.51	11.104	<0.001
DTG-IP [W1]	1.82 ± 0.57	2.27 ± 0.68	11.752	<0.001
DTG-VP [W1]	1.36 ± 0.50	1.79 ± 0.75	11.211	<0.001
GD tendency [W2]	1.91 ± 2.20	2.98 ± 2.33	5.665	<0.001
DTG-IP [W2]	1.92 ± 0.62	2.26 ± 0.65	6.476	<0.001
DTG-VP [W2]	1.43 ± 0.57	1.73 ± 0.70	5.853	<0.001

Note: GD: Gambling Disorder, DTG-IP: Desire Thinking about Gambling – Imaginal Prefiguration, DTG-VP: Desire Thinking about Gambling – Verbal Perseveration, W1: assessed at baseline, W2: assessed at follow-up.

Table 2. Correlations between variables in the total sample

	1	2	3	4	5	6	7
1. GD tendency [W1]	1						
2. DTG-IP [W1]	0.666***	1					
3. DTG-VP [W1]	0.719***	0.775***	1				
4. GD tendency [W2]	0.609***	0.509***	0.536***	1			
5. DTG-IP [W2]	0.505***	0.634***	0.552***	0.704***	1		
6. DTG-VP [W2]	0.509***	0.539***	0.569***	0.754***	0.788***	1	
7. Age	0.068*	0.071*	0.114***	0.078	0.063	0.080	1
8. Gender	−0.084**	−0.125***	−0.117***	−0.084*	−0.014	−0.070	−0.144***

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, GD: Gambling Disorder, DTG-IP: Desire Thinking about Gambling – Imaginal Prefiguration, DTG-VP: Desire Thinking about Gambling – Verbal Perseveration, W1: assessed at baseline, W2: assessed at follow-up.

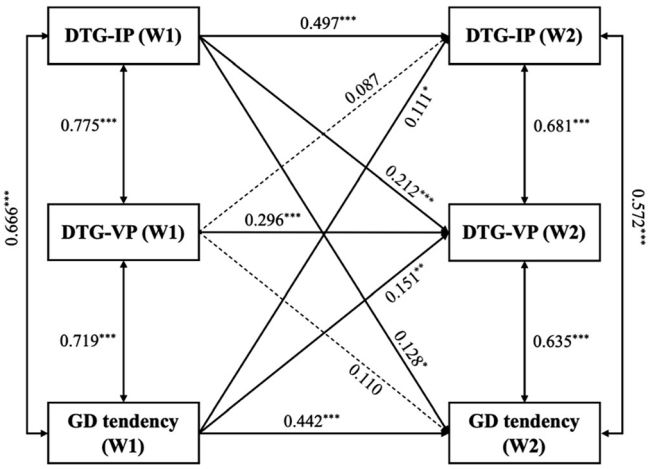

Fig. 1. The cross-lagged panel model with standardized estimations in the total sample (N = 1,063)

Note: Gender and age were controlled for dependent variables as covariances in this model, which are not shown. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, GD: Gambling Disorder, DTG-IP: Desire Thinking about Gambling – Imaginal Prefiguration, DTG-VP: Desire Thinking about Gambling – Verbal Perseveration, W1: assessed at baseline, W2: assessed at follow-up.

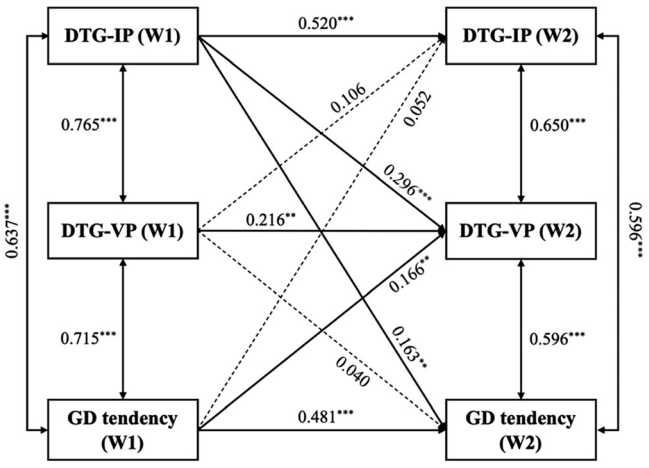

Fig. 2. The cross-lagged model with standardized estimations in the sub-group of esport gamblers

Note: Gender and age were controlled for dependent variables as covariances in this model, which are not shown in the figures. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, GD: Gambling Disorder, DTG-IP: Desire Thinking about Gambling – Imaginal Prefiguration, DTG-VP: Desire Thinking about Gambling – Verbal Perseveration, W1: assessed at baseline, W2: assessed at follow-up.

Subgroup analysis on Esports gamblers

As shown in Table 3, we tested the correlations between variables in the sub-group of esports gamblers, and the results were found to be overall consistent with that in the total sample.

After controlling age and gender for DVs (i.e., GD tendency [W2], DTG-VP [W2], DTG-IP [W2]), the cross-lagged models in the sub-sample with esports gambling experience showed satisfactory model fit ($\chi^2_{(6)} = 20.495$, $p < 0.01$, $CFI = 0.994$, $TLI = 0.972$, $RMSEA = 0.067$, 90% CI [0.037, 0.100], $SRMR = 0.049$). The models with regression coefficients are shown in Fig. 2.

Overall, the results in esports gamblers were highly similar to those in the total sample. GD tendency, DTG-IP, and DTG-VP at W1 positively predicted their corresponding values at W2. Only DTG-IP [W1] positively predicted GD tendency [W2] ($\beta = 0.163$, $p < 0.01$), while in turn, GD tendency [W1] positively predicted DTG-VP [W2] ($\beta = 0.166$, $p < 0.01$), supporting H2 and H3. Moreover, the positive prediction from DTG-IP [W1] to DTG-VP [W2] ($\beta = 0.296$, $p < 0.001$) was also found.

DISCUSSION

This study is the first to examine not only whether esports gamblers report higher DTG than non-esports gamblers but also the bidirectional relationship between desire thinking and GD tendency. Our results indicated that esports gamblers reported higher levels of DTG as well as GD tendency than their non-esports counterparts, and that these differences were stable over time. In addition, a bidirectional relationship between DTG and GD tendency among gamblers was observed. Specifically, only DTG-IP predicted a higher level of GD tendency, while, in turn, GD was linked to an increase in both domains of DTG. Further subgroup analysis also supported the prominent prospective effects of DTG-IP on GD tendency in esports gamblers. These

Table 3. Correlation between variables in the sub-group of esport gamblers

	1	2	3	4	5	6	7
1. GD tendency [W1]	1						
2. DTG-IP [W1]	0.637***	1					
3. DTG-VP [W1]	0.715***	0.765***	1				
4. GD tendency [W2]	0.606***	0.505***	0.521***	1			
5. DTG-IP [W2]	0.472***	0.637***	0.549***	0.705***	1		
6. DTG-VP [W2]	0.512***	0.567***	0.563***	0.728***	0.776***	1	
7. Age	0.130**	0.140**	0.174***	0.115*	0.162**	0.122*	1
8. Gender	0.004	−0.064	−0.052	−0.064	−0.003	−0.045	−0.089*

Note: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, GD: Gambling Disorder, DTG-IP: Desire Thinking about Gambling – Imaginal Prefiguration, DTG-VP: Desire Thinking about Gambling – Verbal Perseveration, W1: assessed at baseline, W2: assessed at follow-up.

findings showcase the higher risk of GD among esports gamblers, which could guide appropriate regulatory action to promote responsible gambling among esports gamblers as well as the development of educational programs to help reduce gambling-related harm.

As we hypothesis, the current findings identified the higher level of DTG as a significant correlate of esports betting. Compared to non-esports gamblers, esports gamblers are more inclined to consciously and voluntarily prefigure images, memories, and information about gambling, which helps explain why they are more likely to engage in gambling with higher frequencies in more types of games (Gainsbury et al., 2017) and to suffer higher levels of problem gambling as well as gambling-related harms (Greer et al., 2021). In addition, the present study also provided the first piece of longitudinal evidence that DTG is a significant risk factor in GD tendency in gamblers, regardless of their esports gambling experience, which is consistent with previous longitudinal studies on alcohol use (Martino et al., 2017, 2019). These findings suggest that targeting desire thinking in both prevention and intervention programs for GD would be a valuable supplementary option (Caselli & Spada, 2016). For example, public campaigns may be conducted to improve gamblers' awareness that frequently recurring imaginal prefiguration and verbal perseveration are precursors and consequences of GD, and hence good indicators of their risk of GD, and encouraging them to seek professional help in a timely manner when these forewarnings occur.

Regarding the longitudinal relationship between DTG and GD tendency, previous studies have documented the predictive effect of DTG on GD, and the current results noted that GD tendency could also predict DTG. The bidirectional relationship between DTG and GD tendency was also supported by the existing evidence from cross-sectional studies, which reported that desire thinking tends to increase along the continuum of addictive behaviors (Caselli et al., 2012a, 2012b). According to both the Elaborated Intrusion Theory of Desire (Kavanagh et al., 2009) and the Metacognitive Model of Addictive Behaviors (Spada et al., 2015), desire thinking aggravates individuals' addictive behaviors by increasing their craving toward targeted behaviors (Caselli & Spada, 2015). In turn, individuals' escalating addictive behaviors may, through the experience of gratification and compensation (Brandtner et al., 2021), alter their cognitive processes, such as desire thinking, as well as more distal cognitive ones, which would exacerbate their desire thinking (e.g., metacognition) (Spada et al., 2015; Zhou et al., 2025). These findings provide empirical evidence for the integration of desire thinking into the I-PACE model (Brandtner et al., 2021) and highlight the significance of desire thinking in the development and maintenance of GD. Meanwhile, our findings also suggest that techniques or principles to interrupt the vicious loop between DTG and GD, such as Metacognitive Therapy (Wells, 2011), may be helpful in the treatment of GD. Mental health workers may consider holding workshops and developing websites centred on self-learning skills in order to enhance gamblers' accessibility to helpful skills (e.g., attention training techniques and situational attentional refocusing; Wells, 2011), especially for at-risk gamblers.

A meta-analysis of nine studies estimated that verbal perseveration is more related to substance (e.g., alcohol use) than non-substance addiction (e.g., Internet use), while the association strength between imaginal prefiguration and addictive behaviors is similar across different addictive behaviors, including alcohol use, nicotine use, gambling, and Internet use (Mansueto et al., 2019). The current study identified the imaginal prefiguration of gambling, compared to verbal perseveration about gambling, as a more salient DTG predictor of GD for esports gamblers. One plausible explanation is that esports betting typically occurs alongside watching video games (Abarbanel, Macey, Hamari, & Melton, 2020), which provides richer and more vibrant visual and auditory stimuli than other types of gambling activities (Donohue, Woldorff, & Mitroff, 2010). Thus, the multi-sensory elaboration, especially the related imagination, may contribute to increases in craving for gambling rather than verbal perseveration. These findings offer practical implications for tailoring intervention or prevention programs for GD. Specifically, strategies for discontinuing imaginal prefiguration about gambling may be helpful to enable at-risk gamblers to take proactive steps in preventing GD before it takes hold, particularly for those with experience with esports betting. For instance, the detached mindfulness strategies from Metacognitive Therapy (Wells, 2011), which emphasize observing internal experiences (e.g., thoughts, feelings, and sensations) rather than engaging, reacting, or controlling them, could help individuals improve their cognitive flexibility, and thus reduce desire thinking (Caselli & Spada, 2015).

This study also has some limitations. First, the convenience sample of only adult gamblers from an online crowdsourcing platform in China limits the generalizability of our findings. Considering the worldwide popularization of esports spectatorship and esports betting among young people (Mangat et al., 2024; Wardle, Petrovskaya, & Zendle, 2020), future studies should involve gamblers in younger age groups (e.g., emerging adults and adolescents; Czakó et al., in press) and other regions. Meanwhile, further studies could use other GD symptom measures such as the South Oaks Gambling Scale and Problem Gambling Severity Index, which has been validated in different age and cultural groups (e.g., Lopez-Gonzalez, Estévez, & Griffiths, 2018; Zhou et al., 2022), to evaluate the replicability of the findings. Besides, stratified or cluster sampling (e.g., via household surveys) in each region is recommended for a more representative sample that engages in online/offline gambling. Second, we only measured GD tendency among esports gamblers. Previous studies have noted that esports gamblers are also at a high risk of problematic video gaming (Zendle, 2020). Future studies could further examine other addictive behaviors of esports gamblers and related psychological factors to facilitate a more comprehensive understanding of esports gamblers. Moreover, the cross-lagged panel model with two-wave data in our study cannot distinguish between between-person and within-person effects or understand the potential links between GD

symptoms and desire thinking. Future research could utilize more sophisticated statistical approaches, such as the random-intercept cross-lagged panel model with multiple-wave design (Mulder et al., 2020) and cross-lagged network analysis (Borsboom & Cramer, 2013), to enhance the precision of the DTG-GD link estimate. In addition, the binary screening item of esports betting experience cannot reflect participants' extent of esports betting involvement. Future studies should incorporate more nuanced measures (e.g., esport betting frequency and types of esports betting) to enrich information regarding the relationship between desire thinking and GD in esport gamblers. Lastly, we did not test any mediators or moderators in the current study. Thus, our results cannot shed light on further mechanisms underlying the relationship between DTG and GD. Hence, further research is needed to address this limitation.

CONCLUSION

This study provides the first piece of empirical evidence for the role of desire thinking in GD tendency among esports gamblers as well as the bidirectional relationship between desire thinking and GD tendency, regardless of esports experience. Given the elevated risk of GD among esports gamblers, governments and related institutions should consider being more vigilant in regulating esports betting and pay more attention to the early screening and prevention of GD in esports gamblers, such as promoting responsible gambling among them. Besides, our findings of the significant predictive role of DTG-IP on GD tendency among esports gamblers suggests that there is an important role for the prevention and treatment for GD. Moreover, our longitudinal evidence for the bidirectionality between desire thinking and GD tendency supports the integration of desire thinking with the I-PACE model (Brandtner et al., 2021), highlighting a potential feedback loop between individuals' addictive behavior and cognitive processes (e.g., desire thinking). From the therapeutic view, breaking this vicious cycle between DTG and GD can be a focus in future interventions for GD.

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SUPPLEMENTARY MATERIAL

Supplementary data to this article can be found online at https://doi.org/10.1556/2006.2025.00084.

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