THE JOURNAL OF CONCURRENT DISORDERS

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Testing the gateway hypothesis between online gambling and gaming disorder through network analysis: A preliminary study

Laura Maldonado-Murciano, Ph.D.[1,4*], Georgina Guilera, Ph.D.[2,5], Halley M. Pontes, Ph.D.[3,6]

Citation: Maldonado-Murciano, L., Guilera, G., Pontes, H.M. (2025). Testing the gateway hypothesis between online gambling and gaming disorder through network analysis: A preliminary study. Journal of Concurrent Disorders.

Editor:
Fayez Mahamid, Ph.D.

Received: 02/25/2025
Accepted: 09/21/2025
Published: 10/22/2025

[1]Universitat Internacional de Catalunya, Spain
[2]Institute of Neurosciences Barcelona, Spain
[3]Birkbeck, University of London, U.K.
[4]**ORCiD:** 0000-0001-5427-729X
[5]**ORCiD:** 0000-0002-4941-2511
[6]**ORCiD:** 0000-0001-8020-7623
*Corresponding author: Laura Maldonado-Murciano, lmaldonado@uic.es

Abstract. Researchers have argued in favour of potential convergence between gambling and gaming since the early 90s, giving rise to the so-called '*gateway hypothesis*'. Despite several theoretical works supporting such hypothesis, particularly through in-game microtransactions as seen in contemporary video games, little empirical investigation has been carried out to date testing the '*gateway hypothesis*' between online gambling and disordered gaming. To achieve this goal, a sub-sample of gamblers and gamers (n = 553) from a larger online survey study has been examined. Participants filled out the Gaming Disorder Test (GDT) assessing disordered gaming and the four items of the online gambling factor from the specific internet-based problematic behaviours (s-IAT) assessing online disordered gambling. A network analysis approach has been adopted to estimate the degree of empirical convergence between these two disorders. Overall, the results obtained indicated that '*preoccupation*' in online gambling disorder and '*loss of control*' in disordered gaming appear to be associated (r = .09). However, this association was not robust enough to fully corroborate the '*gateway hypothesis*' between these two disorders. Further studies are needed to examine whether the '*gateway hypothesis*' may be specific to online or offline gambling and gaming activities in the context of disordered usage.

Keywords: Online Gambling, Gaming Disorder, Behavioural Addiction, Network Analysis.

Introduction

Gambling and gaming are frequently reported in the literature as two intersecting activities due to their shared commonalities (Derevensky & Griffiths, 2019). They became recognised as having similar features at the structural and aesthetic levels, especially with the advent of online gambling and gaming (Derevensky & Griffiths, 2019). In recent years, the phenomenon of gamblification, defined as the 'presence of gambling (or gambling-related content) in non-gambling contexts in order to realise desired outcomes' (Macey & Hamari, 2022) has had a significant impact on video games with the appearance of new features. Free-to-play games which lead players to engage in microtransactions to continue to play, or to purchase loot boxes, an in-game reward system that can be bought with real money in order to obtain a random selection of virtual items (Delfabbro & King, 2020), are examples of the so-called gamblification and the increasing relation between gambling and gaming (Derevensky & Griffiths, 2019; Zendle & Bowden-Jones, 2019).

The phenomenon of gamblification has significantly impacted the gaming industry, influencing aspects such as game design, monetisation strategies, player engagement, and ethical considerations (Macey & Hamari, 2022). According to Karlsen (2022), based on insights from three small-scale Norwegian game companies, the drive to monetise games steams from three primary factors: (1) *economic incentives* and profit-seeking motives, (2) *artistic values* such as production quality or more flow and player retention, and (3) *ethical considerations*, which can hinder implementation when certain in-game components are deemed abusive or unethical. Johnson and Brock (2020) echoed this idea, highlighting that in larger companies, the push for monetisation often prioritises profit over game quality. This shift towards gamblification in video games has implications, influencing player experiences, shaping monetisation strategies, raising regulatory and ethical considerations, impacting public perception, and influencing game design decisions (Johnson & Brock, 2020; Karlsen, 2022; Macey & Hamari, 2022).

Both the World Health Organisation (WHO) and the American Psychiatric Association (APA) have recognised Gambling Disorder (APA, 2013; WHO, 2019). Following extensive debate, the APA also tentatively recognised Internet Gaming Disorder in the fifth version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; APA, 2013) and, after considerable debate, the WHO has officially included Gaming Disorder in the 11th version of the International Classification of Diseases (WHO, 2019). The latter continues to be contentious, with ongoing debates focused on whether it represents a distinct disorder or is a manifestation of other conditions, such as anxiety or depression (see Ma, 2023). These two disorders appear to share some commonalities and discrepancies at the diagnostic level. For example, in a cross-sectional study, Sanders and Williams (Sanders & Williams, 2019) reported that gamers and gamblers shared similar demographic features, mental health problems, and high impulsivity compared to non-disordered individuals. These findings have also been reported within the Italian population by Marinaci and colleagues (2021). Furthermore, gamers tend to be younger and more likely to exhibit depression than gamblers, who are more impulsive and experience substance use disorder (Sanders & Williams, 2019). Drummond et al. (2020) reported an association between impulsivity in gamblers and increased in-game spending through loot boxes, resembling spending patterns observed in other gambling activities items (Raneri et al., 2022). Notably, loot boxes pose the most significant risk for Gambling Disorder among gamers, over and above other types of microtransactions, underscoring another example of shared commonalities between these activities. However, loot boxes are not the sole point of overlap between gambling and gaming risks. Relatedly, Richard and King (2023) highlighted that in-game spending activities such as skin wagering, in-game expenses, and loot boxes, become more prevalent from childhood through to emerging adulthood. These activities have been linked with heightened tendencies for risk-taking and increased sensitivity to rewards. It is worth noting that microtransactions are predominantly found in a limited number of games, rather than the majority of them.

In a similar vein, Griffiths (1991) conducted a comparative theoretical analysis, reporting many shared characteristics between gaming and gambling (including the addictive potential and features of the players), hypothesising that they may converge. As previously argued, these two activities may be connected at different levels (e.g., problematic behaviours, used devices).

Taking this premise into account and following the syndrome model of addiction (Shaffer et al., 2004), gambling and gaming disorders may also be further related at the symptom level. Previously, Delfabbro and King (2020) suggested the '*gateway hypothesis*' noting the possibility for individuals to switch from one addiction to the other due to some of their commonly shared structural characteristics. However, there is insufficient evidence supporting a direct relationship between these two disorders, with Kim and King (2020) suggesting that further research is necessary to understand this issue.

Based on the aforementioned rationale, it can be hypothesised that gambling and gaming disorders may also converge at the symptom level, further supporting the proposed '*gateway hypothesis*'. This hypothesis can be elucidated through network analysis (Epskamp et al., 2018) as it assumes that symptoms of different conditions interact with one another within a network whereby symptoms are interpreted by *nodes* and interactions between those are the *connection between nodes*, following the conceptualisation known as the *network approach to psychopathology* (Borsboom, 2017). Such approach has the central tenet that mental disorders arise from the interactions between symptoms in a network but are agnostic concerning how these relations are instantiated (Borsboom, 2017).

Objective

The main objective of this study is to investigate the '*gateway hypothesis*' between disordered online gambling and disordered gaming behaviours within a network analysis framework to ascertain the most central symptoms across both disorders and their potential interactions, together with a group comparison between online gamblers and non-gamblers regarding disordered gaming. In other words, this study seeks to examine if there are any direct connections between the symptoms related to disordered gaming and gambling that can help clinicians to better understand the shared features of the two disorders and better target treatment efforts.

Materials and methods

Participants and procedures

A total of 192,260 participants were recruited via the Corporate Social Responsibility campaign promoted by ESL (Electronic Sports League), a global campaign developed to promote responsible and healthy gaming behaviours within diverse gaming communities. The sole role of ESL was to disseminate the online survey among their global esports community which was achieved by promoting the project's website on ESL's page and via the media. Participants visiting the survey platform (www.do-i-play-too-much.com) disseminated by ESL opted to partake in the study if they wished to do so. The study received ethical approval from the research team's University Ethics Committee (College Research Ethics Committee of the Nottingham Trent University [2018/95]).

Data was collected using an online survey that was heavily promoted online and offline through several sources, including university press releases, specialised gaming forums and websites, online magazines, international news platforms, and radio interviews. Participants did not receive any monetary reward for completing the survey. However, they were provided with detailed anonymised feedback containing graphical and text-based data-driven insights into their gaming behaviours compared to those who had completed the survey then.

Participants were provided with feedback via a unique link, which could be revisited later when more data were collected. This allowed them to compare their personalised feedback against a broader set of data from a larger participant pool at a later time. This approach facilitated higher levels of participant engagement with the online survey. Both the platform and survey were displayed to participants in the English language. The data can be made available to interested readers upon reasonable requests that must be addressed to the last author of this study (HMP).

All participants in this study identified as gamers, with varying degrees of self-reported engagement, spanning both professional and non-professional statuses. However, investigating this distinction was not a goal of this study. The data cleaning process initially excluded participants that: i) did not provide parental consent (n = 12,246, 6.37%); ii) were under 12 years of age (*n* = 27,456, 14.28%); iii) reported being older than 80 years of age (*n* = 196, < 10%); iv) did not play video games in the last 12 months from the date of taking the survey (*n* = 715, .37%); v) endorsed a sham item (*n* = 4,974, 2.59%); vi) provided unreasonable amounts of time spent gaming (> 119 hours per week) (*n* = 434, .23%); vii) reported playing more than 48 hours on the weekends (*n* = 918, .48%); and viii) reported not being fluent in English language (*n* = 16,314, 8.49%). Of note, ix) participants who completed the survey in 2019 (*n* = 123,570, 95.79%) and x) who did not answer the entire survey (*n* = 4,904, 2.55%) were also excluded. We opted to exclude participants from 2019 as their data was published in a recent study (see Rozgonjuk et al., 2021) and to study the phenomena after the influence of the COVID-19 pandemic in these behaviours. The effective sample comprised 533 participants (*n* = 65, 12.2% female, M_{age} = 21.56 years, *SD* = 7.15 years), which is appropriate in size to estimate the network (Epskamp et al., 2018). All data cleaning procedures and analyses were conducted using the statistical package for R *dplyr* (Wickham et al., 2018).

Measures

Sociodemographic and gaming behaviours data: gender, age, and time spent gaming on weekdays and weekends.

The Gaming Disorder Test (GDT) (Pontes et al., 2021): is a four-item Likert scale assessing disordered gaming under the 11th version of the International Classification of Diseases (WHO, 2019) (see Table 1). The scale answers range from 1 (*never*) to 5 (*very often*). In the present study, the scale presented a Cronbach's alpha of .80 and a McDonald's omega of .84, suggesting high internal consistency.

The online gambling factor of the specific internet-based problematic behaviours questionnaire (s-IAT) (Müller et al., 2017): the s-IAT is a 20-item Likert scale which assesses five specific problematic internet use behaviours based on Young's Internet Addiction Scale and its briefer version (Young, 1998). The s-IAT consists of five factors related to five types of problematic internet uses with four items rated on a five-point Likert scale ranging from 1 (*never*) to 5 (*very often*) for each problematic usage. In the present study, only the items assessing online gambling disorder were used (see Table 1) with Cronbach's alpha of .81 and a McDonald's omega of .86).

Table 1. Sociodemographic data and items of the GDT and the online gambling factor of the s-IAT, their respective label used for the Network Estimation and their associated symptom

Sociodemographic features		**Values**
Age (years) (mean, *SD*)		21.56 (7.15)
Gender (female) (*n*, %)		65 (12.2%)
Time spent gaming (hours/week) (mean, *SD*)		28.29 (19.93)
Gaming Disorder Test (mean, *SD*)		
GDT1: *I have had difficulties controlling my gaming activity*	Loss of control	2.67 (1.22)
GDT2: *I have given increasing priority to gaming over other life interests and daily activities*	Increased priority	3.11(1.15)
GDT3: *I have continued gaming despite the occurrence of negative consequences*	Continuation	2.78 (1.31)
GDT4: *I have experienced significant problems in life (e.g., personal, family, social, education, occupational) due to the severity of my gaming behavior*	Problems in life	2.15 (1.15)
Short Version of Internet Addiction Test – Online Gambling Factor (mean, SD)		
Gamb1: *How often do you find that you spend more time gambling online than you intended?*	Loss of control	2.66 (1.34)
Gamb2: *How often do you neglect household chores to spend more time gambling online?*	Neglect	2.34 (1.33)
Gamb3: *How often do you feel preoccupied with online gambling when offline, or fantasise about gambling online?*	Preoccupation	1.91 (1.20)
Gamb4: *How often do you choose to spend more time gambling online over going out with others?*	Increased priority	2.42 (1.38)

Data analysis

Network estimation

The Gaussian Graphical Model (GGM) (Lauritzen, 1996) was adopted to estimate the network using the s-IAT and GDT items. The GGM is part of the pairwise Markov random field (PMRF) (Lauritzen, 1996). Within this family of networks, the nodes, representing items related to symptoms, can be interpreted in terms of their interconnections, which indicate that the nodes are somehow related. However, it does not provide clarity on whether a direct causal relationship exists between them. For instance, while '*loss of control*' and '*preoccupation*' might be connected, it remains unclear which may be the cause of the other (Epskamp et al., 2018). This can be shown via the edges within the network. In the GGM, the edges can be directly interpreted as partial correlation coefficients between two variables after conditioning all other variables in the network (Epskamp et al., 2018), with a minimum weight of.05. In order to apply this model, a polychoric correlation matrix was estimated since the s-IAT and the GDT items are ordinal (Epskamp, 2016).

This correlation matrix and all the models were estimated using the EBICglasso function, available in the R package *qgraph* (Epskamp et al., 2012), as this function is based on the graphical version of the Least

Absolute Shrinkage and Selection Operator (LASSO) (Tibshirani, 1996), which limits spurious edges in combination with the minimisation of the Extended Bayesian Information Criterion (EBIC) (Chen & Chen, 2008), helping reduce Type I error in the network (Epskamp & Fried, 2016).

Network structure and centrality

In order to assess the accuracy of the network as in previous research (Hirota et al., 2020), the following indicators were adopted to estimate the importance of each item in the network (McNally, 2016; Opsahl et al., 2010): *strength,* defined as the sum of the weights of the paths connected to one node, with high values indicating the core nodes of the network; *expected influence,* the absolute value of the sum of the weights; *closeness*, the inverse of the total length of the paths from a node to another node, with higher values indicating a more direct relationship between the other nodes; and *betweenness*, the number of the shortest paths which pass through a node, indicating how many times a node is a pathway between other two. These indicators were assessed with the respective centrality coefficients: node strength coefficient (SC), expected influence coefficient (EIC), closeness coefficient (CC), and betweenness coefficient (BC).

Epskamp et al. (2018) indicated that a network needs to be stable. The authors defined stability as the order of the centrality indices after estimating the network with fewer cases (single observation) or nodes that remain the same. For this purpose, the *bootstrapping difference tests* were used to assess if centrality indices differed significantly from one another, as measured by correlation stability coefficients (CS-coefficients) for strength, edges, and expected influence.

Bridge centrality

The primary aim of this study was to examine the potential association between disordered gaming and gambling behaviours. To this end, bridge centrality analysis was conducted. This analytical approach, using bridge centrality statistics, offers a quantitative measure to pinpoint symptoms that may promote diagnostic comorbidity (Jones et al., 2021). It serves as an extension of the centrality indices, specifically targeting bridges between symptoms. The bridge centrality indices adopted here were the Bridge Strength Centrality (BSC), to indicate a node's total connectivity with another scale, and the Bridge Expected Influence (BEI), which highlights the node's sum with another scale (Jones et al., 2021). Furthermore, the bootstrapping difference test between bridges to assess the stability of the network was also reported.

To conduct the aforementioned analyses, the R packages *networktools* (Payton, 2020), *qgraph* (Epskamp et al., 2012), and *bootnet* (Epskamp et al., 2018) were used to estimate the networks and assess their stability. Note that the number of random permutations for this study was set to 1,000, similarly to previous studies (Hirota et al., 2020).

Results

Descriptive analysis

In terms of gaming behaviours, the sample reported spending an average of 28.29 hours/week (*SD* = 19.93 hours) playing video games, and regarding the game devices participants used to play, most of them used a desktop computer (223, 41.84%) and consoles such as the Play Station or Xbox (184, 34.52%), 78 participants reported using laptops (14.64%), and 48 reported using small portable devices such as Nintendo DS, mobile phone or tablets (9.01%). Furthermore, the mean score of each item across both scales is shown in Table 1.

Network structure, centrality indices, and stability

After inspecting the data and identifying sample skewness, the nonparanormal transformation was employed via the *huge* package (Haoming Jiang et al., 2021) to conduct the analysis. As shown in Figure 1, the network contained eight nodes (one for each item) and 28 edges, where 23 are non-zero (82.14%). Furthermore, Figure 2 shows the centrality indices for the items measuring the two constructs. As seen in Figure 2, the item with the highest strength centrality was '*Gamb1*' ('*loss of control*' in gambling; SC = 1.56) which was also the one with the highest expected influence coefficient since the network does not have any negative correlation between the nodes. These findings indicate that the core item in the network is 'Gamb1'. Moreover, the 'GDT1' item ('*loss of control*' in gaming) had the highest closeness coefficient (CC = 1.33), while both the 'GDT1' and 'Gamb2' ('*loss of control*' in gaming and '*Neglect*' in gambling) items had the highest betweenness (BC = 1.45).

Figure 1

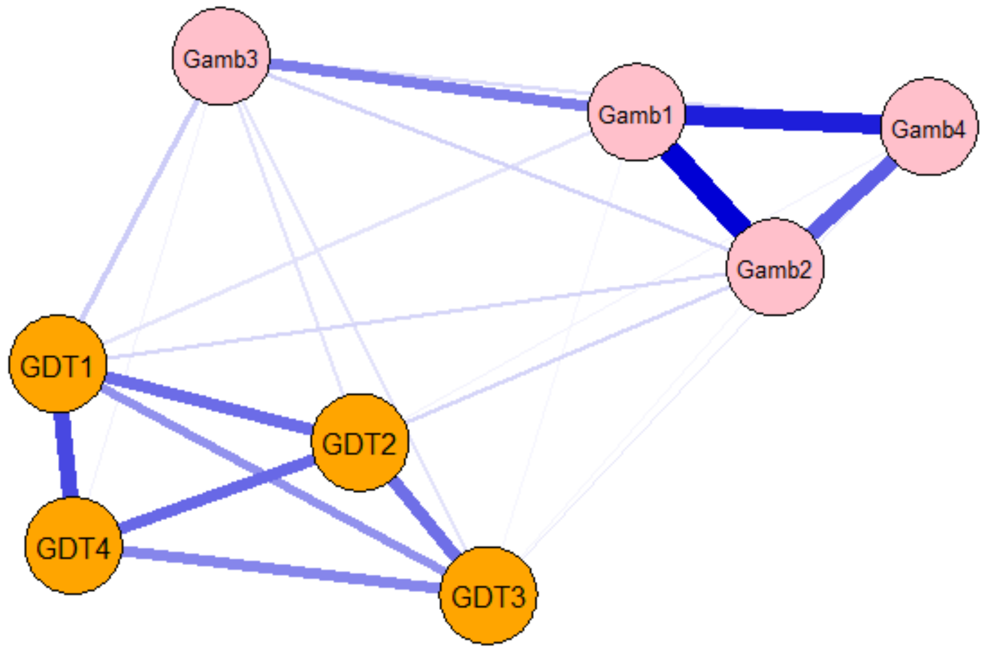

Figure 1. Network structure depicting the relationship between gambling and gaming disorder symptoms. Blue lines represent positive relations, while red lines represent negative relations. The thickness of the lines represents the strength of the connection between the nodes (circles). The description of each node is reported in Table 1.

Figure 2

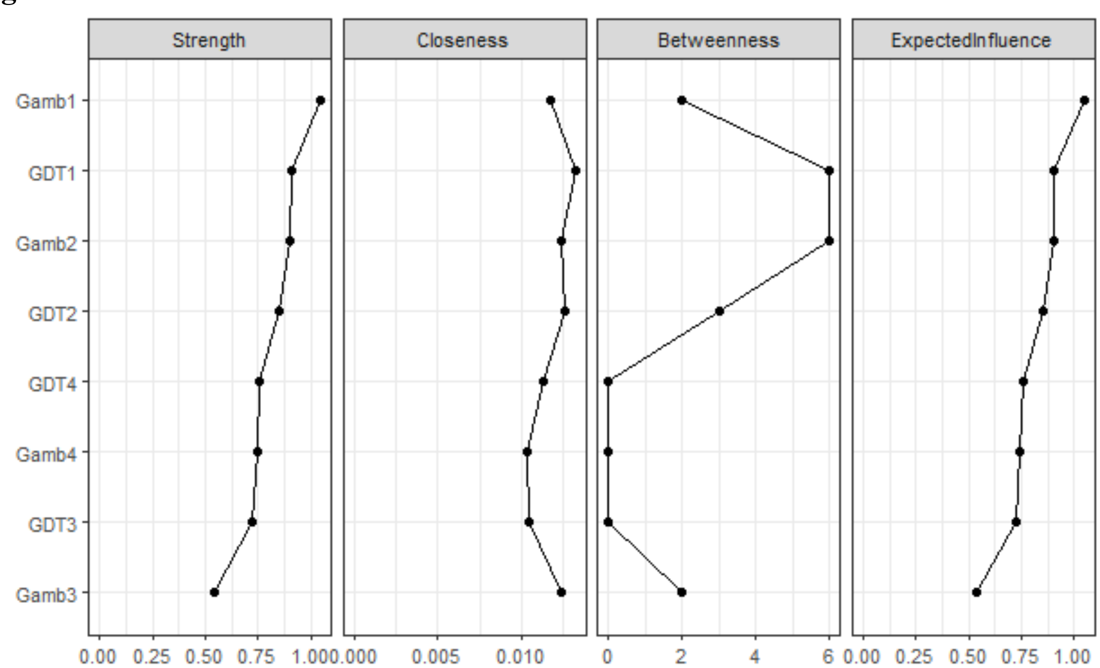

Figure 2. Network centrality of s-IAT online gambling items and GDT gaming items. The graphics are ordered by the strength of the nodes.

Based on the findings obtained, the network was deemed mostly stable since the CS-coefficients extracted after the bootstrapping were all above 0.50: strength = 0.60, edges = 0.75, and expected influence = 0.60. The exception to this was betweenness and closeness that dropped below 0.50 but were still above the acceptable threshold of 0.25 (Epskamp et al., 2018). Figure 3 shows the confidence interval and the correlation with the original samples in the different dropping of the sample cases.

Figure 3

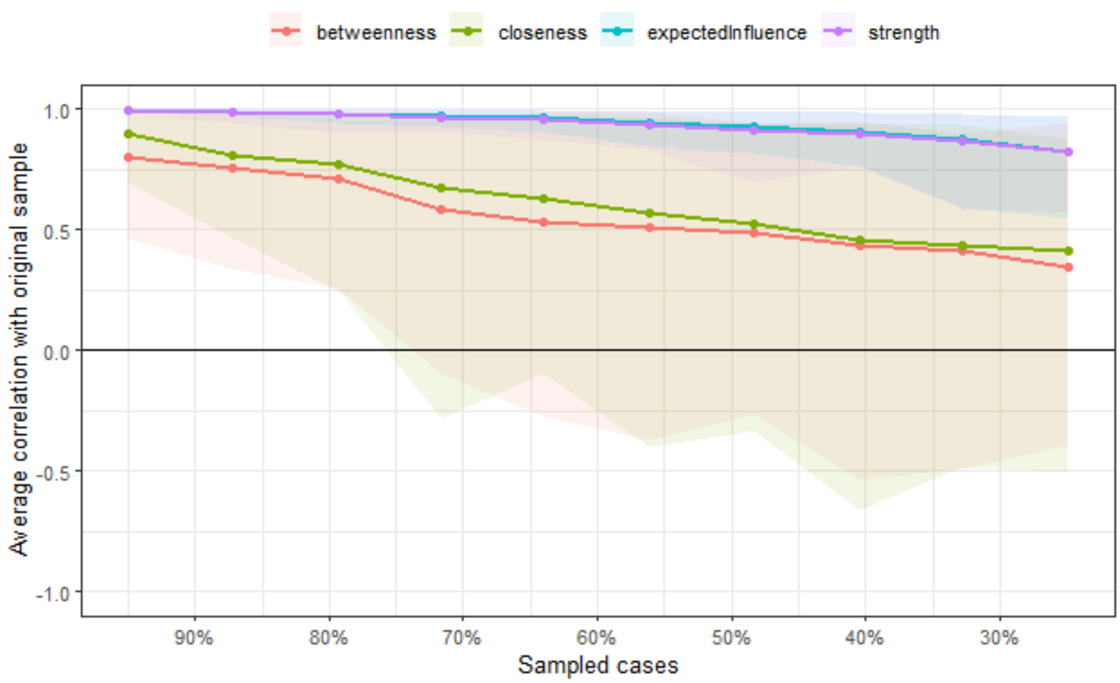

Figure 3. Average correlations between the centrality indices of the network with persons dropped and the original sample obtained through bootstrapping. Lines indicate the means and areas indicate the range from the 2.5th quantile to the 97.5th quantile.

Bridge centrality

The network showed acceptable bridge strength centrality (0.21) and bridge expected influence (0.36). Moreover, the bootstrapping difference test indicated mostly non-significant differences across the network (Figure 4). As shown in Figure 5, the items with the highest bridge strength centrality were 'Gamb3' ('*preoccupation*' in gambling, BSC = 0.20) and 'GDT1' ('*loss of control*' in gaming, BSC = 0.20), suggesting that these two items presented with the highest connectivity among all items between the two disorders.

Figure 4

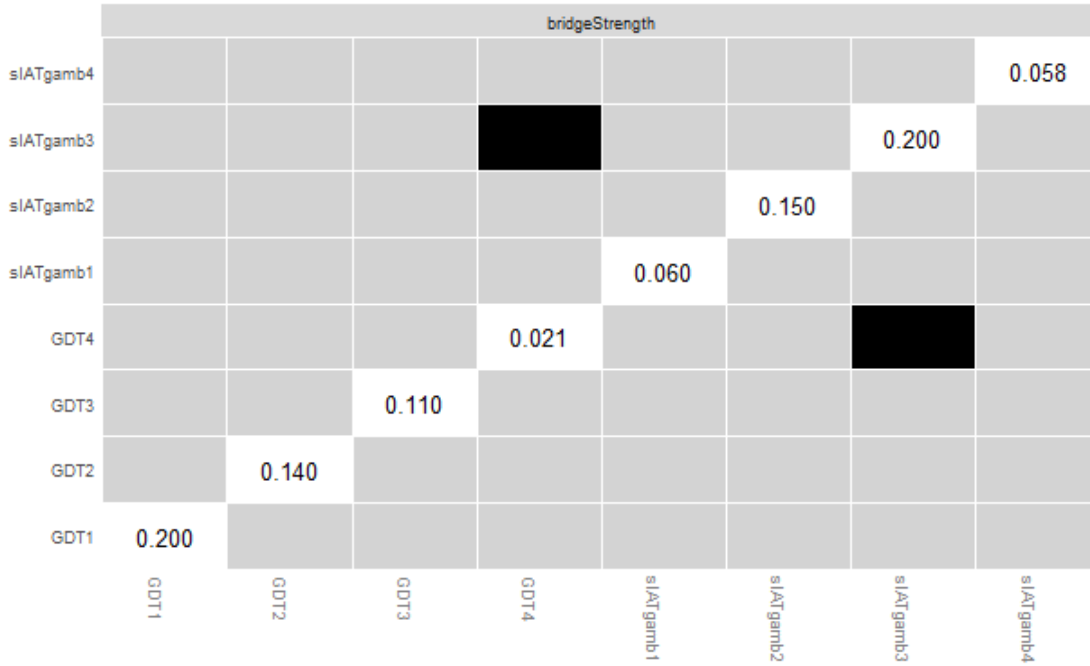

Figure 4. Bridge strength centrality bootstrapping difference test. The black squares indicate significant differences across the bootstrapping and grey ones indicate non-significant differences.

Figure 5

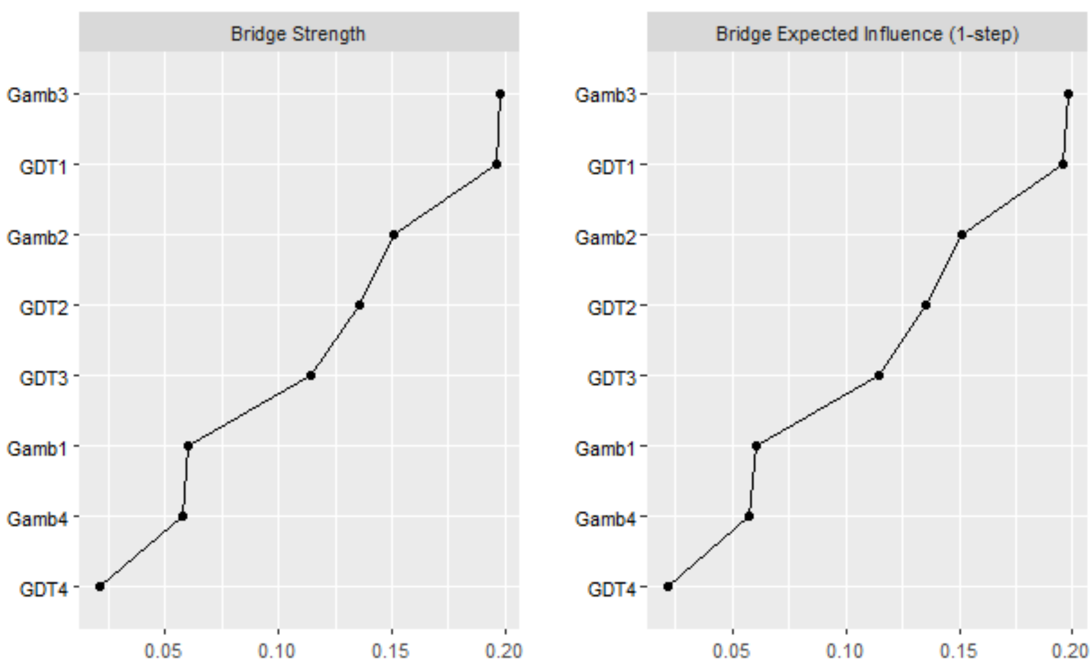

Figure 5. Network bridge centrality of s-IAT online gambling items and GDT gaming items. The graphics are ordered by the bridge strength of the nodes.

In Table 2, 'Gamb3' shows several small partial correlations with the GDT items, while 'GDT1' shows a similar pattern with the gambling items. These multiple weak cross disorder ties add up to higher bridge strength, which explains why both rank highest in Figure 5. Because all edges are positive, bridge expected influence follows the same pattern, and the overall cross disorder connectivity is modest. Taken together, these results provide little support for the *'gateway hypothesis'* at the symptom level.

Table 2. Partial correlation matrix between the items of the two scales

	GDT1	GDT2	GDT3	GDT4	Gamb1	Gamb2	Gamb3	Gamb4
GDT1	-							
GDT2	.24	-						
GDT3	.18	.23	-					
GDT4	.30	.25	.20	-				
Gamb1	.05	0	.01	0	-			
Gamb2	.06	.07	.02	0	.41	-		
Gamb3	.08	.05	.05	.02	.21	.07	-	
Gamb4	0	.02	.04	0	.36	.23	.06	-

Note: GDT1-4 represent the four items of the GDT and the Gamb1-4 represent the four items related to online gambling of the s-IAT.

Discussion

Over three decades ago, Griffiths (1991) observed commonalities between gambling and gaming activities that align with the *'gateway hypothesis'* posited by Delfabbro and King (2020), which became more relevant due to the increasing so-called gamblification of video games (Johnson & Brock, 2020). Nevertheless, this hypothesis has not been systematically tested empirically due to the paucity of research conducted to elucidate the nature of the potential associations between these two disorders.

The gamblification of video games, as discussed by Johnson and Brock (2020), considers gambling-like elements featured within gaming experiences, blurring the boundaries between the two activities and raising concerns about their potential impact on individuals susceptible to gambling disorders. Therefore, the present study applied a network analysis framework to test the potential associations between these two phenomena at the symptom level (to test the so-called '*gateway hypothesis*') using the four items related to gambling disorder in the s-IAT and disordered gaming in the GDT.

As per the results of the network accuracy, item 1 of the s-IAT ('*How often do you find that you spend more time gambling online than you* *intended?'*), referring to the symptom *'loss of control'* emerged as the prominent node of the estimated network. Based on the network theory (Borsboom, 2017), this result suggests that the experience of '*loss of control*' in gambling is a key symptom warranting prioritised intervention during treatment when an individual presents symptoms of both disorders due to its centrality within the network. Consequently, in instances where gambling and gaming-related risk behaviours or disorders are comorbid, addressing '*loss of control*' in gambling could potentially mitigate the severity of the accompanying symptoms.

Furthermore, closeness and betweenness centrality measures rely on finding the shortest paths between nodes and their length in the network (Opsahl et al., 2010). The first item of the GDT ('*I have had difficulties controlling my gaming activity'*) had the highest closeness coefficient, meaning that, in the entire network, this item is the node more directly connected with the rest of the nodes. In other words, it is the node with most connections in terms of quantity. This first item of the GDT, in conjunction with the second item of the s-IAT ('*How often do you neglect household chores to spend more time gambling online*'), showed the highest betweenness coefficient, serving as bridge items linking two distinct items. This finding suggests that 'loss of control' in gaming and 'neglect' in online gambling are crucial symptoms to be addressed in therapeutic interventions, especially when multiple problematic behaviours co-occur, due to their pronounced interconnectedness with other items. Taking this into account, when both disorders co-occur, clinicians may have more success at the clinical level by addressing the '*loss of control*' symptom in gambling. However, if other symptoms are more prevalent than '*loss of control*' in gambling, the focus should shift to the '*loss of control*' in gaming and the experience of *'neglect*' in gambling.

According to the results obtained in the bridge centrality analysis, disordered gambling and gaming behaviours weakly converged at the item level through the association between item 1 of the GDT ('*I have had difficulties controlling my gaming activity*') and item 3 of the s-IAT ('*How often do you feel preoccupied with online gambling when offline, or fantasise about gambling online?'*). These two items allude to '*loss of control*' and '*preoccupation*', two of the diagnostic criteria in both disorders (WHO, 2019).

In clinical practice, bridge symptoms can be hypothesised as symptoms used in diagnostic schemes for multiple disorders (Cramer et al., 2010). Based on the results obtained, it can be hypothesised that '*loss of control'* and '*preoccupation'* can converge at the symptom level between the two disorders. Thus, following the principles of the network approach (Cramer et al., 2010), these two symptoms may explain the potential connection between them since bridge symptoms play a role in maintaining comorbid mental disorders. At the clinical level, this finding may be relevant in two ways: (1) '*loss of control*' and '*preoccupation*' can be regarded as the main symptoms to be treated when individuals present with both disorders and (2) ‘*loss of control*’ and ‘*preoccupation*’ may be essential symptoms in the diagnosis of these two disorders.

Despite this, the overall results suggest that support for the ‘*gateway hypothesis*’ based on the present data is not robust, nor fully supported in this study due to the weak correlation between the related items, which prevents arguing in favour of a robust convergence despite previous claims (Rozgonjuk et al., 2021). A previous study reported that ‘*loss of control*’ appears to be an essential factor to consider in disordered gambling but not in the case of disordered gaming (Luquiens et al., 2021). Based on the results, we found that ‘*loss of control*’ emerged as the central item within the estimated network, underscoring its significance. Additionally, ‘*loss of control*’ in gaming was identified as the linking factor with disordered gambling.

This finding aligns with the results reported by Karlsen (2022), who investigated the perspectives of game designers on monetisation and found that loss of control and preoccupation, features shared by both disorders, were central in driving engagement. This overlap suggests that gamblification elements in gaming, which often capitalise on these aspects, might contribute to the observed weak convergence between the disorders. Marinaci et al. (2021) found that some psychosocial factors are usually related to both types of disorders, using a meta-analysis, corroborating that the two are related in terms of sociodemographic characteristics rather than symptoms (Spicer et al., 2021), suggesting a possible mediation of these factors not taking into account in the estimated network. The results obtained in the present study warrant further investigation in the potential degree of convergence between these two disorders in other settings (e.g., offline disordered gambling) and including sociodemographic factors that could affect the structure of the network.

This study offers interesting insights, not without potential limitations that are worth considering. First, the sample recruited was not a clinical sample, so the reported results need to be replicated within a clinical setting. Second, the sample was not nationally representative and in-depth information on participants’ gambling activity was unavailable. Therefore, the findings are restricted to the characteristics of the participants recruited. Third, all data were collected using a self-reported methodology, which is likely to produce well-known biases. Fourth, information about the engagement in gambling (as frequency and intensity) was missing, and this information could have provided further insights into the *‘gateway hypothesis’*. Fifth, the data utilised in the the present study came from a relatively long survey, which may lead to fatigue in the participants (Choi & Pak, 2005).

Furthermore, the measure adopted to assess online gambling disorder (i.e., gambling factor of the s-IAT) might not be optimally aligned with the core diagnostic criteria for gambling disorder delineated in the DSM-5 (APA, 2013). These discrepancies may underpin the lack of robust convergence between the two disorders, representing a potential limitation in the present study. To this end, it can be argued that the fact that both tools are not assessing the disorders in the same theoretical framework, may have contributed to a possible missing information in the network because of the difference in the definition. Future studies may be conducted to investigate the connection between these two disorders and their clinical interaction in a clinically diagnosed sample. Additionally, replicating this study with the consideration of sociodemographic factors in the network may help identify potentially relevant mediators and determine whether the '*gateway hypothesis*' is more relevant to either online or offline gambling and gaming activities. Another potential future study could include carrying out a longitudinal network analysis to provide a better understanding of the potential causal pathways implicated and further clarify the results of the bridged symptoms analysis.

Conclusion

Although '*preoccupation*' in disordered gambling and '*loss of control*' in disordered gaming appear to be associated, this preliminary association was not robust enough to corroborate the '*gateway hypothesis*' at the symptom-level between these two disorders. Nevertheless, the present study found that '*loss of control'* in gambling was a key symptom of the network estimated and the most important symptom to be treated when designing specific intervention programs for individuals presenting both disorders. Given its potential limitations, the findings presented are mostly exploratory in nature and not causal.

Conflict of Interest

Laura Maldonado-Murciano, Georgina Guilera, and Halley M. Pontes declare that they have no conflict of interest.

Ethics/Informed Consent

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation following the College Research Ethics Committee of the Nottingham Trent University [2018/95], and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all participants included in the study.

Funding Sources

No funding was received for this study.

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