

AKADÉMIAI KIADÓ

Watch and yearn? Effects of watching gambling livestreams on cravings

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ABSTRACT

Background: Gambling content on streaming platforms has gained popularity. Given their intense, cue-laden nature, watching gambling streams may trigger cravings among viewers. At the same time, people who gamble may be motivated to watch gambling streams in an attempt to regulate their cravings. **Methods:** We tested these ideas across two preregistered online studies, recruiting i) people who gamble to compare a subgroup of gambling stream viewers with non-viewers (Study 1; $n_{\text{viewers}} = 221$, $n_{\text{non-viewers}} = 642$), and ii) a group of gambling stream viewers (Study 2; $n_{\text{viewers}} = 271$). **Results:** Gambling stream viewers were younger, tended to identify as men, and displayed higher levels of problem gambling and gambling cravings compared to non-viewers. Problem gambling severity was correlated positively with both the motivation to use gambling streams to regulate cravings and with cravings elicited by watching gambling streams. **Discussion:** Our findings indicate that while viewers with higher levels of problem gambling may use gambling streams to regulate their cravings, doing so might evoke cravings.

KEYWORDS

gambling streams, craving, streaming, Twitch, gambling, problem gambling

The proliferation of digital streaming platforms has made watching gameplay a highly accessible form of entertainment. On platforms such as Twitch, which was originally dominated by video game streams, gambling has emerged as one of the most-watched categories, surpassing even highly popular video games (Gwilliam, 2022). Although Twitch has implemented policy curbs on gambling broadcasts, they remain ubiquitous (Gibbs, 2022), and newer streaming platforms such as Kick have successfully attracted a gambling audience by eschewing such restrictions (Taylor-Hill, 2023). Regardless of platform, it is clear that people are drawn to watching gambling. The emergence of gambling streams has fueled controversy on the risks and harms that come with spectatorship. Thus far, much of the debate has focused on the possible risks of exposing young people to gambling content below the legal age for gambling (Koncz, Demetrovics, Griffiths, & Király, 2023). However, gambling streams also attract adult viewers who may already gamble. In the present research, we focus on the potential risks associated with watching gambling streams among people who may already gamble.

On streaming platforms, streamers broadcast their engagement in an activity to an audience (Johnson, 2024). In contrast to traditional forms of media, streams are highly interactive, including elements from social networking sites. Viewers can follow their favorite streamers and use the chat function to communicate with other viewers and with the streamer. These social elements play an important role in motivating people to watch streams

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(Diwanji et al., 2020; Hilvert-Bruce, Neill, Sjöblom, & Hamari, 2018; Hu, Zhang, & Wang, 2017; Kowert & Daniel, 2021; Nah, 2022; Sjoblom et al., 2017), which, in part, explains the growing popularity of streams, expanding from broadcasts of video gaming to a plethora of other content such as gambling.

Streamers try to make their streams as entertaining as possible to grow their audience (Woodcock & Johnson, 2019). In particular, gambling streams contain various events that make for an exciting viewing experience. Streamers broadcast themselves engaging in intense forms of gambling, such as placing high-stake bets, receiving jackpot wins, and suffering heavy losses. By analyzing 21 prerecorded gambling streams on YouTube, Hoebanx and French (2023) identified that a prominent feature of gambling streams (e.g., emphasized in titles and thumbnails) is the highlighting of jackpots. Still, watching gambling streams is distinct from gambling. Despite its highly stimulating nature and the fact that viewers can support streamers through paid subscriptions and donations, gambling streams are free to watch and viewers do not benefit financially even if the streamers win.

Nonetheless, gambling streams contain numerous cues due to their dynamic and multisensory nature (Yalachkov, Kaiser, & Naumer, 2012). According to behavioral theories, gambling-related stimuli elicit cravings through their repeated pairing with the act of gambling, forming Pavlovian associations and conditioned responses. Cravings play an important role in theoretical accounts of the maintenance of addiction. Among people who gamble, cravings are associated with higher levels of problem gambling (Mallorquí-Bagué, Mestre-Bach, & Testa, 2023; Young & Wohl, 2009). Brief exposure to gambling-related cues, such as pictures or short video clips, can elicit self-reported cravings among people with problem gambling (Limbrick-Oldfield et al., 2017; Wulfert, Maxson, & Jordin, 2009). Similarly, in other domains, people with internet gaming disorder report stronger video game cravings after watching footage of their favorite video game compared to a non-favorite game (Ha, Park, Park, Im, & Kim, 2021). These findings suggest that watching gambling streams may elicit gambling cravings, especially for people with higher levels of problem gambling.

At the same time, people may be motivated to watch gambling streams in an attempt to regulate their gambling craving. Qualitative reports show that viewers may watch other people eat tasty foods to satisfy their own food cravings (Anjani, Mok, Tang, Oehlberg, & Goh, 2020; Choe, 2019). Such motivation has also been shown for social casino games which are simulated gambling games that do not involve monetary wagers or prizes (Hollingshead, Kim, Wohl, & Derevensky, 2016, 2020). Among people with problem gambling, the motivation to use social casino games to reduce cravings was correlated with a reduction in reported gambling activity over 6 months (Hollingshead et al., 2016, 2020). We wonder if

watching gambling streams may produce vicarious habituation (i.e. repeated exposure reduces a learned response). People tend to eat less food after watching other people eat the same food (Li & Lee, 2023) and are less motivated to complete a laboratory task after watching another person complete the same task (McCulloch, Fitzsimons, Chua, & Albarracín, 2011). Another possibility is that watching gambling streams may discourage gambling because viewers may observe the negative consequences of gambling; By this account, seeing a streamer experience heavy gambling losses might thwart desires to gamble.

To date, limited work has examined gambling streams. In a survey of gambling-like activities in a nationally-representative sample in the United Kingdom ($n = 1,081$), 4% of participants reported watching gambling streams in the past year, and this was associated with problem gambling severity (Zendle, 2020). Other work has highlighted gambling-like mechanics used in the chat on Twitch (e.g., raffles that do not involve monetary wagers or prizes; Abarbanel & Johnson, 2020). This mechanic is available across both gambling and non-gambling streams and speaks to engagement features on livestreaming platforms more broadly rather than the effects of exposure to gambling streams. Lastly, Hoebanx and French (2023) qualitatively examined themes of prerecorded gambling streams on YouTube, showing the intense and stimulating nature of these streams, but the psychological correlates of these elements are unknown.

The present study is among the first to focus on the psychological effects of watching gambling streams, so we began by recruiting a large sample of people who gamble to establish group-level characteristics between gambling stream viewers and non-viewers. We predicted that gambling stream viewers will score higher on problem gambling severity, as well as two psychological correlates of problem gambling, gambling cravings and boredom proneness, than non-viewers (https://aspredicted.org/XKD_VY3). We included boredom proneness because it is a risk factor for problem gambling (e.g., Mercer & Eastwood, 2010) and is related to engagement in livestreams (Zhang & Li, 2022). It has been conceptualized as an aspect of impulsivity and novelty-seeking, which are central to wider accounts of problem gambling (Blaszczynski & Nower, 2002). In Study 2, we recruited a more selective sample of gambling stream viewers to examine whether problem gambling severity is related to cravings elicited by watching gambling streams (i.e., evoked craving) and the motivation to use gambling streams to regulate their cravings (i.e., regulation motives). Viewers with higher levels of problem gambling are highly sensitive to gambling cues. Given that gambling streams contain rich cues (and thus likely evokes cravings), we suspected that cue reactivity from watching gambling streams would outweigh motivations to use them to regulate cravings, and thus in Study 2 we predicted that problem gambling severity would be more strongly correlated with



evoked craving than regulation motives (https://aspredicted.org/PV8_C7G).¹ Lastly, we explored whether cravings from watching gambling streams could be associated with affective responses to particular gambling stream events, such as high-stake bets, jackpot wins, and heavy losses. We have made our data, materials, and code publicly available: https://osf.io/gkt34/?view_only=09b572e99f424f46a561b7b1014f4e53.

STUDY 1

METHODS

Participants

Participants were recruited from the United States, United Kingdom, Ireland, Australia, Canada, and New Zealand using the online recruitment platform Prolific Academic. Participants first completed a prescreen that assessed their eligibility to participate in our study. Those that met the criteria (gambled at least once within the past three months), were invited to the main survey. Of the 2,000 respondents to the prescreen, 1,387 reported gambling within the past three months and were invited to the main survey.

As preregistered, in the main study we aimed to have a final sample of 800 people who gamble, comprising 300 gambling stream viewers and 500 non-viewers, informed by a pilot study. This would allow us to detect a minimal effect size of $d = 0.24$ at 90% power and an alpha level of 0.05 (Faul, Erdfelder, Lang, & Buchner, 2007) for mean differences in problem gambling, craving, and boredom proneness scores between viewers and non-viewers. We oversampled, anticipating some data loss from cleaning, recruiting 1,000 participants for our main survey (https://aspredicted.org/XKD_VY3). Following our preregistration, we excluded participants who failed at least one of two attention checks ($n = 11$), completed the survey in under 4.8 min ($n = 17$), or reported that they had not gambled in the past three months ($n = 13$, i.e., inconsistent with their prescreen response on the eligibility item). Our final sample consisted of 965 participants. Participants demographics are shown on Table 1.

¹We also preregistered this hypothesis in Study 1 (see https://aspredicted.org/XKD_VY3). However, after collecting the data, we found low reliability for a regulation motive item that was reverse-coded. It was negatively correlated with the other regulation item ($\rho = -0.39$), so it was not sensible to average the scores. Since we only had two items, the removal of this item influenced the pattern of results. This item was fixed in Study 2. The preregistered results are reported in our Online Supplemental (see Table S1). In Study 1, we additionally preregistered testing correlations between these measures and problem gambling severity, boredom proneness, and general gambling cravings, as well as whether these correlations hold among men and women. Given the low reliability of our regulation item in Study 1, we report these in our Online Supplemental instead (see Table S2).

Measures

Gambling stream viewership. Participants reported how frequently they watched gambling on streaming platforms within the past year. Responses were made on a scale consisting of 0 (*I have never done this*), 1 (*Not at all in the past 12 month, but I have done this before then*), 2 (*Less than 10 times in total*), 3 (*Once a month*), 4 (*2–3 times a month*), 5 (*Once a week*), 6 (*2–3 times a week*), and 7 (*4 or more times a week*). Following our preregistered plan, participants who reported having watched gambling streams within the past year (i.e., scores of 2–7) were classified as gambling stream viewers, and participants who reported having never watched gambling streams were classified as non-viewers (scores of 0). A further 102 (11%) participants reported having watched gambling streams before but not within the past year, and those subjects were excluded from the group-level comparisons (as per our preregistration).²

Problem gambling severity. To measure problem gambling severity, we used the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001). It consists of 9 items on a scale ranging from 0 (*Never*) to 3 (*Almost Always*). Example items included “Have you bet more than you could really afford to lose?”, “Have you borrowed money or sold anything to gamble?”, and “Has your gambling caused you any health problems, including stress and anxiety?” Scores were summed. Scores could range from 0 to 27. Higher scores corresponded to higher problem gambling. Reliability was good (Cronbach’s alpha = 0.90; Taber, 2018).

Gambling cravings. Gambling cravings were assessed using the gambling urge scale (Raylu & Oei, 2004), which consists of 6 items ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Example items include “All I want to do now is to gamble”, “It would be difficult to turn down a gamble right now”. Scores were averaged. Scores could range from 1 to 7. Higher scores corresponded to stronger gambling cravings. Reliability was good (Cronbach’s alpha = 0.95; Taber, 2018).

Boredom proneness. Participants completed the Boredom Proneness Scale (Struk, Carriere, Cheyne, & Danckert, 2017), which consists of 8 items ranging from 1 (*Strongly Disagree*) to 7 (*Strongly Agree*). Example items include “I find it hard to entertain myself”, “It takes more stimulation to get me going than most people”. Scores were averaged. Scores could range from 1 to 7. Higher scores corresponded to higher propensity to feel bored. Reliability was good (Cronbach’s alpha = 0.91; Taber, 2018).

²We conducted a secondary analysis comparing PGSI, cravings, and boredom proneness scores between viewers, non-viewers, and this subset of previous viewers (not within the past year). Generally, previous viewers scored between viewers and non-viewers. Results are reported in our Online Supplemental.



Table 1. Demographics of participants in Studies 1 and 2

	Study 1		Study 2
	Viewers <i>n</i> (%) or <i>M</i> (<i>SD</i>)	Non-Viewers <i>n</i> (%) or <i>M</i> (<i>SD</i>)	Viewers <i>n</i> (%) or <i>M</i> (<i>SD</i>)
Gender			
Man	100 (45.2%)	190 (29.6%)	214 (79.0%)
Woman	119 (53.8%)	447 (69.6%)	54 (21.0%)
Non-binary	2 (1.0%)	5 (0.8%)	3 (0.0%)
Age	36.8 (12.5)	42.1 (11.0)	36.0 (11.4)
Marital Status			
Divorced or separated	10 (4.5%)	49 (7.6%)	20 (7.4%)
Married or domestic	126 (57%)	396 (61.7%)	115 (42.4%)
Single, never married	85 (38.5%)	197 (30.7%)	136 (50.2%)
Education			
High school or below	29 (13.1%)	102 (15.9%)	39 (14.4%)
Some college	76 (34.4%)	162 (25.2%)	75 (27.7%)
Bachelor's	86 (38.9%)	264 (41.1%)	117 (43.2%)
Above Bachelor's	30 (13.6%)	114 (17.8%)	40 (14.8%)
Income (USD)	53,914.0 (37859.8)	52,492.2 (34664.9)	51,254.6 (29035.3)
Employment			
Employed full-time	145 (65.6%)	320 (49.9%)	172 (63.5%)
Employed part-time	28 (12.6%)	131 (20.4%)	19 (7.0%)
Self-employed	25 (11.3%)	127 (19.8%)	29 (10.7%)
Not working	19 (8.6%)	52 (8.1%)	51 (18.8%)

Note. Study 2 did not select participants based on gambling status, but most participants (92%) reported gambling in the past 3 months. Income (USD) refers to household income in the previous year.

Statistical analyses

To test the differences in problem gambling, gambling cravings, and boredom proneness between gambling stream viewers and non-viewers, we conducted our preregistered paired *t*-tests (https://aspredicted.org/XKD_VY3). We also ran a number of exploratory analyses. We tested demographic differences using chi-squared tests on categorical variables, and *t*-tests on continuous variables. In the survey, participants reported their age and income in categorical brackets (e.g., “25–29 years old”), but for the group tests and logistic regression, we recoded them as continuous using their midpoints (e.g., 27). To test which variables were most strongly associated with being a gambling stream viewer compared to non-viewer, we conducted a logistic regression model predicting viewership status from the above variables. Analyses were conducted in R Studio. The base R package “stats” was used for *t*-tests, chi-square tests, and regression models, the package “effectsize” was used to calculate effect sizes for the *t*-tests and chi-square tests (Ben-Shachar, Lüdtke, & Makowski, 2020), and the package cocor was used to compare correlation coefficients (Diedenhofen & Musch, 2015).

Ethics

The study was approved by The University of British Columbia's Behavioural Ethics Review Board. Participants were reimbursed £0.14 for completing a pre-screen survey and £1.20 for completing the main survey. Data was collected in June 2022. Participants provided informed consent at the beginning of the study, and they received a debriefing form including problem gambling resources at the end of the study.

RESULTS

Descriptive statistics

Among 965 people who regularly gamble, 221 (23%) reported watching gambling streams within the past year and 642 (66%) reported never having watched gambling streams. Among gambling stream viewers, 74% reported gambling with real money before watching gambling streams online. Among non-viewers, 78.5% reported watching other content online (i.e., streams unrelated to gambling and unrelated to online television), indicating that most participants consumed some form of streaming media. Figure 1 shows density plots of PGSI, gambling cravings, and boredom proneness.

Differences between gambling stream viewers and non-viewers

Supporting our preregistered hypotheses (https://aspredicted.org/XKD_VY3), gambling stream viewers reported higher PGSI scores, stronger gambling craving, and higher boredom proneness, compared to non-viewers. Regarding the demographic variables, chi-square tests showed that gambling stream viewership differed between gender, age, employment status, and marital status but not income or education. Specifically, gambling stream viewers were younger than non-viewers; On inspection of the standardized residuals for the categorical outcomes, gambling stream viewership was overrepresented among people who identified as men, in full-time employment, and single. Results are shown on Table 2.



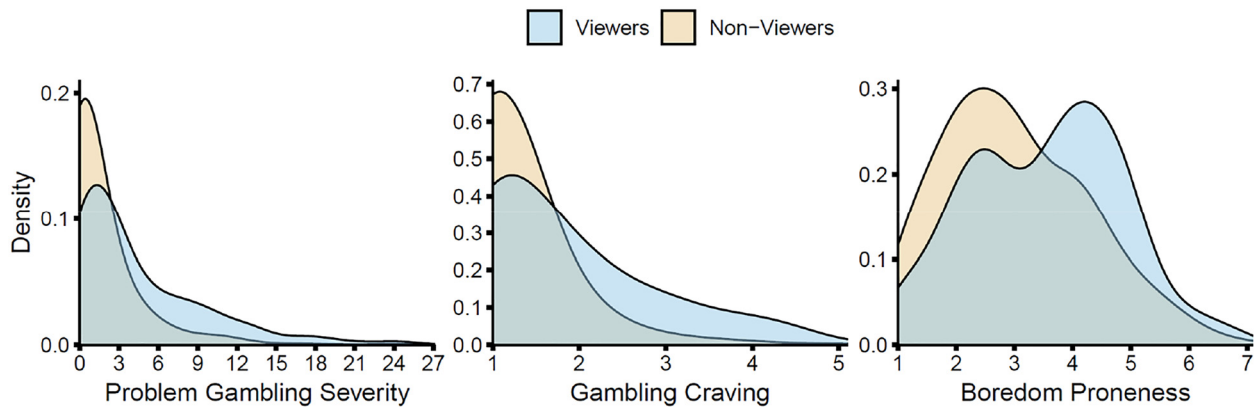


Fig. 1. Density plots of problem gambling severity, gambling cravings, and boredom proneness between gambling stream viewers and non-viewers
 Note. Density plots of PGSI (viewers $M = 4.45$, $SD = 5.02$; non-viewers $M = 1.64$, $SD = 3.00$), gambling cravings (viewers $M = 1.85$, $SD = 0.99$; non-viewers $M = 1.25$, $SD = 0.54$), and boredom proneness (viewers $M = 3.54$, $SD = 1.31$; non-viewers, $M = 3.01$, $SD = 1.26$).

Table 2. Group differences between gambling stream viewers and non-viewers

Variables	Logistic regression model			Bivariate tests		
	OR	95% CI	<i>p</i>	Effect size	95% CI	<i>p</i>
Problem Gambling	1.07	1.00, 1.14	0.026	0.78	0.58, 0.97	<0.001
Gambling Craving	2.12	1.47, 2.92	<0.001	0.87	0.69, 1.07	<0.001
Boredom Proneness	0.98	0.84, 1.17	0.895	0.42	0.26, 0.58	<0.001
Gender	2.76	1.81, 3.99	<0.001	0.22	0.15, 0.29	<0.001
Age	0.96	0.94, 0.98	<0.001	−0.44	−0.28, −0.59	<0.001
Income	1.00	1.00, 1.00	0.897	−0.04	−0.19, 0.11	0.623
Employ: Full	1.40	0.77, 2.53	0.245	0.15	0.08, 0.21	<0.001
Employ: Part time	0.89	0.41, 1.87	0.741			
Employ: Self	1.34	0.58, 2.91	0.445			
Marital: Married	1.07	0.34, 2.64	0.750	0.08	0.02, 0.14	0.049
Marital: Divorced	1.05	0.70, 1.65	0.903			
Edu: Some college	1.34	0.70, 2.71	0.328	0.10	0.03, 0.15	0.050
Edu: Bachelor's	0.97	0.52, 2.00	0.933			
Edu: Above	0.89	0.39, 1.71	0.457			

Note. Results from logistic regression model and bivariate tests comparing viewers and non-viewers. Effect Size for PGSI, gambling craving, and boredom proneness represent Cohen's *d*. The reference group was men for gender, single for marital status, high school for education, and unemployed for employment status; Their Effect Size represents Cramer's *V*. Effect Size for age and income represent Cohen's *d*.

We conducted a logistic regression with these variables predicting gambling stream viewership.³ The reference group was men for gender, single for marital status, high school for education, and unemployed for employment

status. The odds of being a gambling stream viewer compared to non-viewer was 7% greater for each additional point on the PGSI, 112% greater for every additional score on the gambling craving scale, 176% greater for men, and 4% less for every 5-year increase in age. Boredom proneness, marital status, employment statuses, and income were not significantly associated with gambling stream viewership in this model. Results are shown on Table 2.

BRIEF DISCUSSION

In Study 1, we examined characteristics that differentiate people who gamble and watch gambling streams from people who gamble and do not watch gambling streams. Gambling stream viewers tended to be younger, identify as men, and reported higher problem gambling severity and stronger gambling cravings compared to non-viewers. Some

³We preregistered that we would test group differences in two additional ways (https://aspredicted.org/XKD_VY3). First, we initially reported that we would run separate multiple regressions with viewership predicting problem gambling, boredom proneness, and gambling cravings while controlling for demographic variables. However, this would not allow us to control for all the psychological variables and all the demographic variables simultaneously, so instead we conducted a logistic regression with all the variables predicting viewership. Second, we preregistered that we would look to identify a third group who watched non-gambling streams. Supporting our predictions, the third group who watched non-gambling streams scored lower on problem gambling, boredom proneness, and gambling cravings compared to the group who watched gambling streams. They did not differ from the group who did not watch any streaming content. We report this in our Online Supplemental (Table S3).



other variables, including boredom proneness as a pre-registered variable, did not differ significantly in viewers in the logistic regression model. These findings indicate that among people who gamble, gambling stream viewers tend to have increased levels of gambling problems as well as other risk factors associated with emerging gambling-like activities (Closer et al., 2022; Macey, Abarbanel, & Hamari, 2021).

STUDY 2

In Study 2, we recruited a sample of gambling stream viewers to examine a potentially paradoxical scenario: Viewers may be motivated to watch gambling streams to regulate their gambling cravings; Yet, watching gambling streams may also elicit cravings to gamble via cue reactivity. We examined these variables as a function of PGSI and tested whether cravings from watching gambling could be attributed to particular gambling stream events, such as watching jackpot wins or heavy losses.

METHODS

Participants

Participants were recruited from the United States, United Kingdom, Ireland, Australia, Canada, and New Zealand using the online recruitment platform Prolific Academic. We first used a prescreen to identify participants who watched gambling streams at least once within the past year. Those that met this criterion were invited to the main survey. Of 3,000 prescreen respondents, 888 reported watching gambling streams within the past year and were invited to complete the main survey.

We aimed to have a final sample of 240 participants, which would allow us to detect a small effect size of at least $r = 0.21$ at 90% power and at an alpha level of 0.05 (Faul et al., 2007), which is considered clinically meaningful (Ferguson, 2016), for the correlation between i) PGSI and evoked craving and ii) PGSI and regulation motives. Anticipating some exclusions from cleaning, we oversampled and recruited 300 participants for the main survey (https://aspredicted.org/PV8_C7G). As preregistered, we excluded participants who failed one of two attention check ($n = 2$), completed the survey in under 6.2 min ($n = 9$), or reported in the main survey that they have not watched gambling streams within the past year ($n = 21$, i.e., inconsistent with their prescreen response). Our final sample consisted of 271 participants (see Table 1).

Measures

Evoked craving and regulation motive. Evoked craving (i.e., experiencing an increase in cravings from watching gambling streams) and regulation motive (i.e., the motivation to watch gambling streams as self-regulation to reduce cravings) were measured using four items that were adapted

from a similar scale designed for social casino games (Hollingshead et al., 2016, 2020). Regulation motive was assessed using two items: “I purposely watch gambling online to reduce my desire to gamble” and “I intentionally watch gambling streams to help myself cope with my cravings to gamble.” Responses were made on a scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). These two items were strongly correlated, $\rho = 0.73$, $p < 0.001$. Evoked craving was assessed using two items: “When I watch gambling streams it seems to increase my urge to gamble for real money” and “Watching gambling online seems to trigger my desire to gamble.” These items were strongly correlated, $\rho = 0.81$, $p < 0.001$. The two items for each measure were averaged. Higher scores corresponded to stronger regulation motive and evoked craving.

Other measures. Problem gambling severity was assessed using the PGSI (Ferris & Wynne, 2001). Reliability was good (Cronbach’s alpha = 0.91; Taber, 2018). Participants also reported how they felt when watching different gambling stream events, using an affect grid (Russel et al., 1989). They were asked, “Please use the cursor to select how watching [Gambling Stream Event] makes you feel.” The seven events were “high-stake bets,” “low-stake bets,” “jackpot wins,” “heavy losses,” “interactions in the chat,” “interactions with the streamer,” and “chat raffles/bets.” The 500×500 affect grid consisted of a horizontal valence axis labelled from unpleasant to pleasant, and a vertical arousal axis labelled from sleepy to high arousal. Participants reported their affect rating by using their cursor to click on the grid, thus capturing valence and arousal ratings simultaneously. Before these ratings, participants were asked to indicate a neutral rating (i.e., the center of the grid). Participants who failed to report their neutral rating within the 50×50 border from the center were excluded from analyses of the gambling stream events for careless responding ($n = 10$).

Statistical analyses

To test the relationships between problem gambling, evoked craving, and regulation motives, we first examined their bivariate correlations using Spearman’s rank coefficients, as preregistered (https://aspredicted.org/PV8_C7G). To test if the strength of the correlation for problem gambling was larger for evoked craving than regulation motives, we compared the z-transformed correlation coefficients (Diedenhofen & Musch, 2015). As exploratory analyses, we examined if the relationship between problem gambling and evoked craving was moderated by regulation motives using a linear regression model with PGSI, regulation motive, and their interaction term predicting evoked craving. These variables were standardized. We additionally ran two models to examine the effect of PGSI on evoked craving at low (-1 SD) and high ($+1$ SD) levels of regulation motive. Most participants in Study 1 reported that they gambled before watching gambling streams (74%), so we tested PGSI as the predictor, rather than the outcome variable, though this was somewhat arbitrary



given our cross-sectional design. Lastly, we explored the correlations between these variables and the affect ratings associated with the different gambling stream events, adjusting for multiple comparisons using False Discovery Rate corrections (Benjamini & Hochberg, 1995; Colquhoun, 2014).

Ethics

The study was approved by The University of British Columbia's Behavioural Research Ethics Board. Participants were reimbursed £0.15 for completing the prescreen and £2.25 for the main study. Data was collected in December 2022. Participants gave their informed consent at the beginning of the study and received a debriefing form with problem gambling resources at the end.

RESULTS

Descriptive statistics

Among gambling stream viewers, most reported gambling within the past three months (92%). The average PGSI was 4.63 ($SD = 5.15$), indicating that our sample of viewers had moderate levels of problem gambling on average. Similar to Study 1, most participants (75%) reported gambling with real money before watching gambling streams. On average, participants reported watching gambling streams 3.20 ($SD = 3.69$) hours per week and watched 3.62 ($SD = 2.87$) different streamers per week. They reported following 3.66 ($SD = 6.08$) and subscribing to 2.43 ($SD = 4.79$) gambling streamers on average. On average, participants reported low levels of endorsement (i.e., disagreement, on average) of using gambling streams to regulate their gambling cravings ($M = 2.31$, $SD = 1.12$). On average, they were approximately neutral to gambling streams evoking cravings ($M = 2.98$, $SD = 1.27$).

Relationships between evoked craving, regulation motives, and problem gambling

We found that PGSI was significantly correlated with evoked craving, $\rho = 0.42$, $p < 0.001$ and regulation motives, $\rho = 0.40$, $p < 0.001$. In contrast to our prediction (https://aspredicted.org/PV8_C7G), these two correlation coefficients were not significantly different from each other, $z = 0.45$, $p = 0.650$. Next, we examined the correlation between regulation motive and evoked craving. If people use gambling streams to successfully thwart their gambling craving, regulation motives should be negatively correlated with evoked cravings. However, regulation motive was positively, albeit modestly, correlated with evoked craving, $\rho = 0.18$, $p = 0.003$, suggesting that some viewers who attempt to use gambling streams as a form of self-regulation may actually experience more craving as a result of watching the streams.

To better understand these relationships, we examined whether the relationship between PGSI and evoked craving

(i.e., cue reactivity) was moderated by regulation motives (Fig. 2). In this model, PGSI was significantly associated with evoked craving, $\beta = 0.43$, 95% CI [0.26, 0.57], $p < 0.001$, as expected. However, regulation motives was no longer significantly associated with craving, $\beta = 0.03$, 95% CI [-0.11, 0.17], $p = 0.617$. We found a significant interaction between PGSI and regulation motives in predicting evoked craving, $\beta = -0.24$, 95% CI [-0.37, -0.08], $p < 0.001$. The relationship between PGSI and evoked craving was stronger at low levels, $\beta = 0.67$, 95% CI [0.36, 0.91], $p < 0.001$, than high levels of regulation motives, $\beta = 0.19$, 95% CI [0.06, 0.32], $p = 0.005$. Among people with high problem gambling severity, the predicted mean of evoked craving was 3.91 for those with low regulation motive and 3.38 for those with high regulation motive, which corresponds to $d = 0.46$, indicating a medium effect size.

Craving and affect from gambling stream events

We examined whether evoked craving from gambling streams could be linked to specific gambling stream events. Table 3 shows the bivariate correlations between the valence (pleasantness) and arousal (stimulation) ratings of the seven gambling stream events, with evoked craving, regulation motive, and PGSI. After correcting for multiple comparisons, evoked craving was correlated with affect ratings from three gambling stream events: Stimulation from watching high-stake bets, $\rho = 0.22$, $p < 0.001$; stimulation from watching jackpot wins, $\rho = 0.27$, $p < 0.001$; and lower pleasantness from watching heavy losses, $\rho = -0.19$, $p = 0.002$. PGSI was correlated with stimulation from watching jackpot wins, $\rho = 0.23$, $p < 0.001$, and lower pleasantness from watching heavy losses, $\rho = -0.17$, $p = 0.026$. Lastly, regulation motives were correlated with stimulation, $\rho = 0.21$, $p = 0.006$, and pleasantness, $\rho = 0.16$, $p = 0.010$, from jackpot wins, as well as stimulation, $\rho = 0.24$, $p < 0.001$, and pleasantness, $\rho = 0.18$, $p = 0.004$, from chat raffles.

BRIEF DISCUSSION

In Study 2, we examined the relationship between problem gambling severity, evoked craving, and regulation motives. Problem gambling severity was positively correlated with evoked craving, in line with cue reactivity to gambling streams among people with more severe gambling problems (Limbrick-Oldfield et al., 2017). At the same time, problem gambling severity was correlated with regulation motives, adding to evidence that people who gamble use related activities to control their cravings (e.g., Hollingshead et al., 2020). In some respects, it is ironic that people with higher levels of problem gambling try to use streams to regulate cravings but also experience more cravings from watching streams. However, the relationship between problem gambling and evoked craving was negatively moderated by regulation motives, indicating that although people with



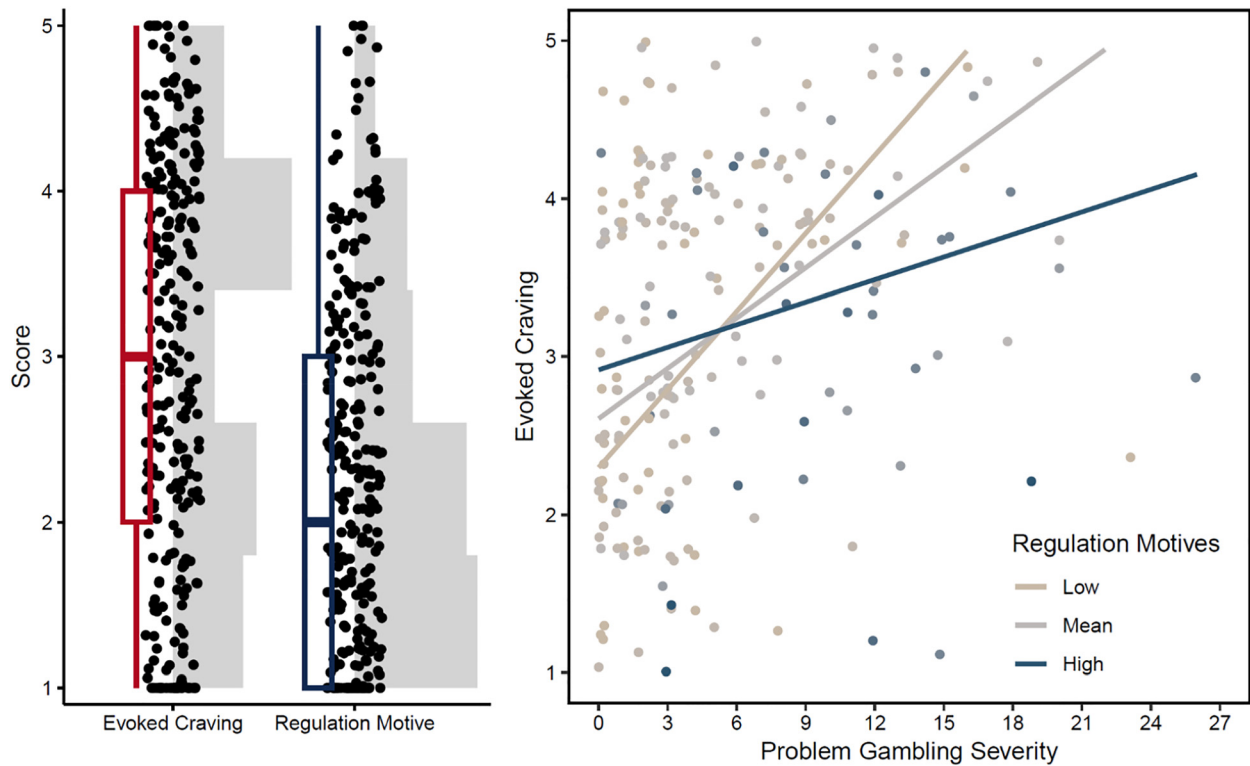


Fig. 2. Relationship between problem gambling and cravings as a function of regulation motive
Note. Left: Scores for evoked craving and regulation motive with box plots and histograms. Right: Relationship between PGSI and evoked craving at low (−1 SD), mean, and high (+1 SD) levels of regulation motive.

Table 3. Correlations between affect ratings, regulation motive, evoked craving, and PGSI

Stream event	Evoked craving			Regulation motives			PGSI		
	ρ	p	Cor p	ρ	p	Cor p	ρ	p	Cor p
Valence									
High-Stake Bets	0.08	0.198	0.309	0.12	0.048	0.136	0.10	0.102	0.200
Low-Stake Bets	−0.04	0.556	0.707	−0.06	0.370	0.520	0.01	858	0.925
Jackpot Wins	0.15	0.019	0.081	0.16	0.010	0.048	0.13	0.038	0.122
Heavy Losses	−0.19	0.002	0.017	−0.02	0.722	0.843	−0.17	0.005	0.026
Viewer Chat	−0.03	0.574	0.709	0.08	0.178	0.286	−0.10	0.107	0.200
Streamer Chat	−0.01	0.973	0.973	0.11	0.090	0.200	−0.06	0.372	0.520
Raffle Chat	0.14	0.022	0.084	0.24	<0.001	0.001	0.14	0.029	0.102
Arousal	ρ	p	Cor p	ρ	p	Cor p	ρ	p	Cor p
High-Stake Bets	0.22	<0.001	0.003	0.10	0.093	0.200	0.09	0.130	0.219
Low-Stake Bets	−0.03	0.666	0.799	0.00	0.954	0.973	−0.04	0.538	0.706
Jackpot Wins	0.27	<0.001	<0.001	0.21	<0.001	0.006	0.23	<0.001	0.002
Heavy Losses	0.10	0.110	0.200	−0.01	0.855	0.925	−0.11	0.058	0.153
Viewer Chat	−0.01	0.900	0.945	0.07	0.288	0.432	−0.12	0.049	0.136
Streamer Chat	0.04	0.485	0.657	0.10	0.100	0.200	−0.01	0.833	0.925
Raffle Chat	0.09	0.128	0.219	0.18	0.004	0.026	0.11	0.087	0.200

Note. Bivariate correlations between affect ratings and evoked craving, regulation motive, and PGSI. Cor p represents the p -value after applying false discovery rate corrections. Bolded effects are statistically significant (alpha = 0.05) after adjusting for fales discovery rates.

gambling problems experience cravings from watching, this effect is attenuated by regulation motives.

GENERAL DISCUSSION

The goal of the present research was two-fold. First, we set out to establish the basic characteristics of people who

gamble and watch gambling streams, finding that gambling stream viewers tended to be younger, tended to identify as men, and had higher levels of problem gambling and gambling cravings, compared non-viewers. Second, we investigated whether problem gambling was associated with cravings to gamble elicited by watching gambling streams or motivations to watch gambling streams as a form of self-regulation. Recognizing the antagonism between these



effects, we predicted a stronger relationship between problem gambling severity and evoked cravings than regulation motives. We found that problem gambling severity was interestingly associated with both stronger evoked cravings *and* regulation motives, of similar strengths. To make sense of this, in a moderation analysis, we found that the relationship between PGSI and evoked cravings was actually attenuated by higher levels of regulation motives.

Participants with higher problem gambling severity scores reported stronger cravings from watching gambling streams. Shi, Renwick, Turner, and Kirsh (2019) proposed that various forms of social media, such as online forums, team-chat applications, and video streaming websites, can either “push” or “pull” people from the content they are engaging with. For watching video game streams, these media consistently act as a pull mechanism, making viewers want to play video games for longer (Cabeza-Ramírez, Sánchez-Cañizares, Fuentes-García, & Santos-Roldán, 2022; Macey & Hamari, 2018). Our findings suggest that this may be, in part, due to cravings evoked from watching the streams. Our findings are in line with behavioral theories that suggest gambling-related stimuli may elicit cravings via Pavlovian conditioning and conditioned responses. Elaborated Intrusion Theory further proposes that learned associations (which include classical conditioning of cues but also intrusive thoughts) can lead to the construction of mental imagery which have strong affective associations central to the development of cravings (Kavanagh, Andrade, & May, 2005). Given that gambling streams contain rich, multisensory cues that are more salient than traditional, simpler stimuli (Yalachkov et al., 2012), it is no surprise they may trigger cravings, akin to gambling-related images and other addiction-related stimuli in many laboratory studies (Limbrick-Oldfield et al., 2017; Tiffany & Wray, 2012).

Viewers reported watching gambling streams in an attempt to *reduce* their cravings to gamble. This highlights two competing possibilities – “the good and the bad” – as previously described for social casino games as another free-to-play, gambling-like format (Hollingshead et al., 2016, 2020; Wohl, Salmon, Hollingshead, & Kim, 2017). Watching gambling streams does not directly incur or exacerbate financial losses which is a key vector to harm in problem gambling (Langham, Thorne, & Rockloff, 2016). This may create a perception among people who gamble that gambling streams could be strategically and adaptively used as an alternative to real-money gambling. But if watching gambling streams also *evokes* cravings, this creates a delicate balancing act in which regulation motives may backfire, driving an ‘ironic’ desire to gamble. This may ultimately increase the subsequent likelihood of real-money gambling, especially among those with existing gambling problems, and future studies could test this possibility by tracking behavioural patterns between gambling stream viewing and subsequent gambling (e.g. through online applications). Our observation that the link between problem gambling severity and evoked craving was buffered by regulation motive indicates that the triggering effects of gambling streams

may be malleable and could be targeted by psychological interventions (Mena-Moreno et al., 2021).

Among people who gamble, we found that viewers tended to be young men, who are likely impressionable (Pitt, Thomas, Bestman, Daube, & Derevensky, 2017). From a social learning perspective, watching gambling streams may increase positive attitudes towards gambling. Future studies could seek to disentangle the factors underlying migration from watching to gambling. Nonetheless, this profile resonates with the risk factors seen for engaging in emerging forms of gambling in other research, including betting on esports (Macey et al., 2021) and purchasing video game loot boxes (Close, Spicer, Nicklin, Lloyd, & Lloyd, 2022). Across Studies 1 and 2, three quarters of participants reported engaging in real-money gambling before they began watching gambling streams, indicating that – conversely – some people appear to migrate from spectating gambling within the context of streaming platforms to real-money gambling. Similar migration effects have been characterized using longitudinal designs in social casino gamers (Gainsbury, Russell, King, Delfabbro, & Hing, 2016), and video gamers with higher levels of engagement with loot boxes (Brooks & Clark, 2023; González-Cabrera et al., 2023). This resonates with concerns surrounding the negative consequences of gambling streams as form of exposure among youth (Koncz et al., 2023).

Our study design did not characterize reactivity to gambling streams *in situ*. The cue-reactivity paradigm presents participants with stimuli depicting learned associations (e.g. images of drug paraphernalia or drug use, e.g., Carter & Tiffany, 1999). This has also been shown in the context of gambling (Limbrick-Oldfield et al., 2017). In our study, we did not directly present stimuli or streams to participants, and participants instead reported their cravings from watching gambling streams based on their memory of these experiences. According to Elaborated Intrusion Theory (Kavanagh et al., 2005), both exposure (e.g., cues) and recall (e.g., intrusive thoughts) can lead to the construction of gambling imagery and the experience of cravings. Nonetheless, exposure, given the saliency, may evoke stronger cravings than recall, and future research is needed to determine the joint role of exposure and recall on cravings and gambling.

Evoked craving from watching gambling streams was correlated with specific events that are widespread in gambling streams. Using an affect grid as a standard procedure in affective science (Russell, Weiss, & Mendelsohn, 1989), we found that participants who reported higher stimulation from watching high-stake bets and jackpot wins reported stronger cravings and higher problem gambling severity. These data forge a link between the intense forms of gambling that are accessed via gambling streams (Hoebanx & French, 2023) and the subjective experience of cravings. This is in line with work finding that high-stake bets and jackpot wins are structural characteristics linked to the high addictive potential of digital slot machine gambling (Edson et al., 2023). An alternative possibility is that the aversive qualities of watching heavy losses (specifically) might



discourage viewers from gambling. If so, stronger negative affective responses to watching heavy losses should weaken cravings, but we did not find evidence for this effect. Unpleasantness from watching heavy losses was correlated with stronger cravings, and regulation motives were not closely correlated with unpleasantness from watching heavy losses. Thus, the satiation of cravings from watching does not seem to be attributable to the unpleasantness evoked from watching negative outcomes.

Our study suffers a number of limitations. First, our samples were crowdsourced from Prolific, so our data should not be treated as representative of population rates (Pickering & Blaszczynski, 2021; c.f. Russell, Browne, Hing, Rockloff, & Newall, 2022). For example, the data from Study 1 may not reflect prevalence of gambling stream viewership among the wider population of people who gamble. We recruited participants based on an eligibility screening in Prolific, and future studies could apply representative sampling (see Zendle, 2020), to establish population-level prevalences and generalizability. Second, our study was cross-sectional, meaning that we could not test the direction of the effects. Future studies using longitudinal designs (e.g., ecological momentary assessment) or experimental manipulations (e.g., exposing participants to gambling streams) could provide more insight into directional relationships and causal effects, as shown for loot boxes (Brooks & Clark, 2023; D'Amico, et al., 2022). Third, we focused on self-reported cravings, which is a widely used and validated measure in addiction science (e.g., Ha et al., 2021; Limbrick-Oldfield et al., 2017), but craving is a complex construct in terms of measurement, its relevance to psychopathology, and its underlying motivational substrates (Sayette et al., 2000). Future studies are required to test the degree to which watching gambling streams impact the various mechanisms that give rise to the phenomenology of cravings. Fourth, not all participants in Study 2 reported gambling within the past 3 months, and we could not distinguish whether PGSI scores of 0 indicated non-problematic gambling or non-gambling (in 8% of the sample). Lastly, our conclusions were drawn from participants who were English-speaking. Future cross-cultural studies are required to determine the degree to which our findings in English-speaking samples generalize to other cultures that use other streaming services.

CONCLUSION

The popularity of gambling streams has grown in recent years, raising concerns on the possible harms of watching gambling. Here, we report two preregistered studies that provide an initial investigation on a) the characteristics of gambling stream viewers, and b) the seemingly contrasting roles of gambling streams in evoking versus regulating cravings. We found that gambling stream viewers have characteristics that may render them more vulnerable to problem gambling. In Study 2, viewers with higher level of problem gambling report stronger cravings from watching

gambling streams, but this relationship was weakened among viewers with stronger regulation motives, which may indicate some malleability in the evoked responses to gambling streams.

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Authors' contribution: RW and LC were involved in the conceptualization and design. RW collected the data and performed the analyses with guidance from LC which were discussed with BA. LC obtained funding. RW wrote the original draft with guidance from LC which was presented to BA for further edits and feedback. All authors approved the final manuscript.

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SUPPLEMENTARY MATERIAL

Data, code, materials, and supplemental materials: <https://osf.io/gkt34/>

Preregistrations: https://aspredicted.org/XKD_VY3; https://aspredicted.org/PV8_C7G.

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