

Video game loot boxes are linked to problem gambling: Results of a
large-scale survey

David Zendle^{1*}, Paul Cairns²

¹ Department of Computer Science, York St. John University, York, North Yorkshire, UK

² Department of Computer Science, University of York, York, North Yorkshire, UK

*Corresponding author

Email:

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14 Abstract

15 Loot boxes are items in video games that can be paid for with real-world money and contain
16 randomised contents. In recent years, loot boxes have become increasingly common. There is
17 concern in the research community that similarities between loot boxes and gambling may lead to
18 increases in problem gambling amongst gamers. A large-scale survey of gamers ($n=7,422$) found
19 evidence for a link ($\eta^2 = 0.069$) between the amount that gamers spent on loot boxes and the
20 severity of their problem gambling. There were strong differences in the amount spent by problem
21 gamblers and non-problem gamblers ($\eta^2 = 0.377$). This link was stronger than a link between
22 problem gambling and buying other in-game items with real-world money ($\eta^2 = 0.010$), suggesting
23 that the gambling-like features of loot boxes are specifically responsible for the observed
24 relationship between problem gambling and spending on loot boxes. It is unclear from this study
25 whether buying loot boxes acts as a gateway to problem gambling, or whether spending large
26 amounts of money on loot boxes appeals more to problem gamblers. However, in either case these
27 results suggest that there is good reason to regulate loot boxes in games.

28 Introduction

29 Loot boxes are virtual items in video games that contain randomised contents but can be paid for
30 with real-world money. They are available for players to buy in popular games like *Overwatch* (40
31 million players (1)), *Rocket League* (40 million players (2)), and *Counter-Strike: Global Offensive*
32 (Over 25 million players (3)). It is estimated that the total amount of revenue generated by loot
33 boxes this year will be approximately \$30 billion (4).

34 The widespread availability of loot boxes in modern video games has led to questions over whether
35 they should be regulated as a form of gambling. As noted in (5), many of the characteristics of loot
36 boxes are commonly associated with gambling. Both when gambling and when buying loot boxes,

individuals stake money on the outcome of a future event, whose result is determined at least partially by chance in the hopes of receiving a valuable reward.

Various regulatory organisations have therefore had to recently decide whether they consider loot boxes to legally constitute a form of gambling. This has resulted in a broad spread of decisions.

Earlier this year the Belgium Gambling Commission ruled that some loot boxes were in violation of national gambling legislation, and ordered that they be removed from video games in Belgium (6).

Contrastingly, France's online gambling authority ARJEL have ruled that all loot boxes do not legally constitute a form of gambling as there is no financial value to items that can be won in loot boxes (7). Controversy over the legal status of loot boxes seems set to continue for the foreseeable future, with bills proposed in recent months in both Washington and Hawaii to regulate games that contain loot boxes (8) (9).

Connected to legal arguments about the status of loot boxes are questions about the effects of loot boxes on gamers. More specifically, there is concern in the academic community that similarities between loot boxes and gambling may lead to problem gambling amongst gamers. Problem gambling can be defined as a pattern of gambling activity which is so extreme that it causes an individual to have problems in their personal, family, and vocational life (10). These issues range from domestic abuse (11) and intimate partner violence (12) to involvement in illegal activities (13), increased medical costs (14), and suicidality (15). Problem gambling is typically described as being both excessive and involuntary.

Problem gambling is thought to often be caused by individuals being conditioned by the arousing features of gambling to the point that their need for the excitement of gambling becomes harmful both to themselves and to others (16). There is reason to believe that such conditioning may occur because of loot box use. In (17), Drummond and Sauer analysed 22 games which featured loot boxes in order to determine if these games had characteristics of gambling that are necessary for such conditioning, and could therefore form a gateway for gamers to become problem gamblers. Their

analysis concluded that “in the way they encourage and sustain user engagement, loot-box systems share important structural and psychological similarities with gambling”. They recommended regulation of loot boxes in games, lest they create a “ripe breeding ground” for problem gambling amongst gamers.

Conversely, it may be the case that similarities between loot boxes and gambling are the root of a different relationship between problem gambling and loot box use. As noted above, problem gambling is characterised by an excessive and harmful involvement with gambling activities. There are key similarities between loot boxes and gambling. These similarities may cause individuals who are already problem gamblers to spend large amounts of money on buying loot boxes in games, just as they would spend large amounts of money on other forms of gambling. If loot boxes are attractive to those with problem gambling behaviours, they pose a serious moral question for the games companies who profit from them.

However, criticism of loot boxes has been roundly rebuffed by representatives of the games industry, with the ESRB recently claiming that there was insufficient evidence to state that loot boxes had negative consequences for gamers. They instead declared that “we do not consider loot boxes to be gambling for various reasons ... loot boxes are more comparable to baseball cards, where there is an element of surprise and you always get something.” (18).

The position that there is currently no strong evidence of a link between loot box use and problem gambling is tenable. Loot boxes, whilst extremely widespread, are a relatively recent phenomenon. Consequently, no study has yet investigated the links between their use and problem gambling. Such work is urgently needed. In a recent editorial to *Addiction* (19), King and Delfabbro called on the community to immediately begin work that investigates whether there are any links between loot box use and gaming-related harm. These concerns about the effects of loot boxes on gamers are echoed by policymakers, with the Australian Senate recently authorising a committee enquiry into the extent to which loot boxes may be harmful to their players (20).

The research that is presented below addresses this lack of research and provides evidence that is of direct relevance to ratings boards and gambling regulators. We surveyed a large international sample of gamers (n = 7,422) and measured both how much these individuals spent on loot boxes, and the severity of their problem gambling. By doing so we established both the existence, the size, and the importance of links between purchasing loot boxes and problem gambling.

Method

Design

We conducted an online survey with a self-selected sample of gamers aged 18 or older. Participants were recruited via reddit, a popular online bulletin board. The recruitment message stated that we were interested in understanding links between loot boxes and gambling, and that gamers could take part regardless of whether they had previously purchased loot boxes. Participants were not remunerated for their participation. A total of 29 links to the survey were placed on a variety of gaming-related special interest pages (or 'subreddits') on this site. Demographic details about participants were collected, as were quantitative measures of **problem gambling**, **loot box spending**, and **other microtransaction spending**.

Problem gambling was measured using the Problem Gambling Severity Index (PGSI) (21). This nine-item instrument contains a series of questions about how frequently individuals have engaged in a variety of gambling-related behaviours in the past 12 months (e.g. 'Have you needed to gamble with larger amounts of money to get the same feeling of excitement?', 'Have you borrowed money or sold anything to get money to gamble?').

Individuals must indicate how frequently they engage in these activities on a four-point scale ranging from 'Never' to 'Almost Always'. These responses are each scored from 0 – 3, with their sum forming a total score ranging from 0 to 27. The severity of participants' problem gambling is then classified on the basis of these scores, using the revised scoring system presented in (22): Individuals who

score 0 are classified as ‘non problem gamblers’; those who score 1-4 are classified as ‘low-risk gamblers’; those who score 5-7 are classified as ‘moderate-risk gamblers’; and those who score 8+ are classified as ‘problem gamblers’.

Loot box spend was measured using a series of two questions. Participants were first asked whether they had ever bought a loot box in a video game (Yes/No). If they indicated that they had bought a loot box, they were asked “Approximately how much money in US dollars would you say that you spend on loot boxes each month?”. This question had 13 possible responses: (1) Less than \$1; (2) \$1-\$5; (3) \$5-\$10; (4) \$10-\$15; (5) \$15-\$20; (6) \$20-\$30; (7) \$30-\$40; (8); \$40-\$50; (9) \$50-\$75; (10) \$75-\$100; (11) \$100-\$200; (12) \$200-\$300; (13) Greater than \$300. For the purposes of analysis, those who indicated in the first question that they had never bought a loot box in a game were coded as (0).

Other in-game microtransaction spend was measured to check whether any observed relationship between **loot box spend** and **problem gambling** was due to the specific features of loot boxes, and not due to individuals who were problem gamblers spending more money in general.

This variable was measured in a similar way to **loot box spend**. Participants were first asked “Have you ever bought any other item or product in a game using real-world money? (Excluding loot boxes)” (Yes/No). If they indicated that they had bought an item which was not a loot box, they were then asked “Approximately how much money in US dollars would you say that you spend on these items per month? (Excluding loot boxes)”. This question had the same 13 possible responses as the measure of loot box use: (1) Less than \$1; (2) \$1-\$5; (3) \$5-\$10; (4) \$10-\$15; (5) \$15-\$20; (6) \$20-\$30; (7) \$30-\$40; (8); \$40-\$50; (9) \$50-\$75; (10) \$75-\$100; (11) \$100-\$200; (12) \$200-\$300; (13) Greater than \$300. For the purposes of analysis, as with **loot box spend**, those who indicated that they had never engaged in in-game microtransactions were coded as (0).

Participants

14,182 responses were collected in total from gamers. 3173 participants did not give details of their ages and were removed from the study prior to analysis for ethical reasons. 872 participants listed their ages as numbers less than 18, and were removed from the study prior to analysis for ethical reasons. Two participants listed their ages as numbers greater than 120, were deemed non-serious and were removed from analysis. Two participants listed their monthly spend on gambling as greater than \$1,000,000, and 9 participants listed their monthly spend on gambling as a negative number. They were deemed non-serious and removed from analysis. 2,702 incomplete responses were removed from the study and not analysed. This left a total of 7,422 responses.

Most participants had engaged in both purchasing loot boxes and buying other in-game items with real-world money. 5793 (78%) of the participants had bought a loot box in a video game, whilst 1629 had not. 6441 (87%) participants had bought an item other than a loot box in a video game using a microtransaction, whilst 981 participants had not.

Most participants, 6,612 (89%), described themselves as male and 694 (9%) as female. Nearly half of the participants (3,589, 48%) were 18-24. 2,066 (27.8%) were aged 25-29; 1,061 (14.3%) were aged 30-34; 444 (6.0%) were aged 35-39; only 262 (3.5%) were in the age groups above 45.

There was no dominant group in terms of annual household income. Incomes ranged from less than \$10,000 pa to above \$100,000 pa. Most participants were from the US (3290, 44%), UK (572, 8%) and Canada (525, 7%). 382 participants (5%) did not state their nationality. Additionally, there were respondents from 92 other countries.

Data Availability

The data that support the findings of this study are available as supporting information with this manuscript

Results

A box plot showing the relationship between loot box spend and problem gambling is presented below as Figure 1. A box plot showing the relationship between other microtransaction spend and problem gambling is presented below as Figure 2. Means and standard deviations for each variable are presented below as Table 1.

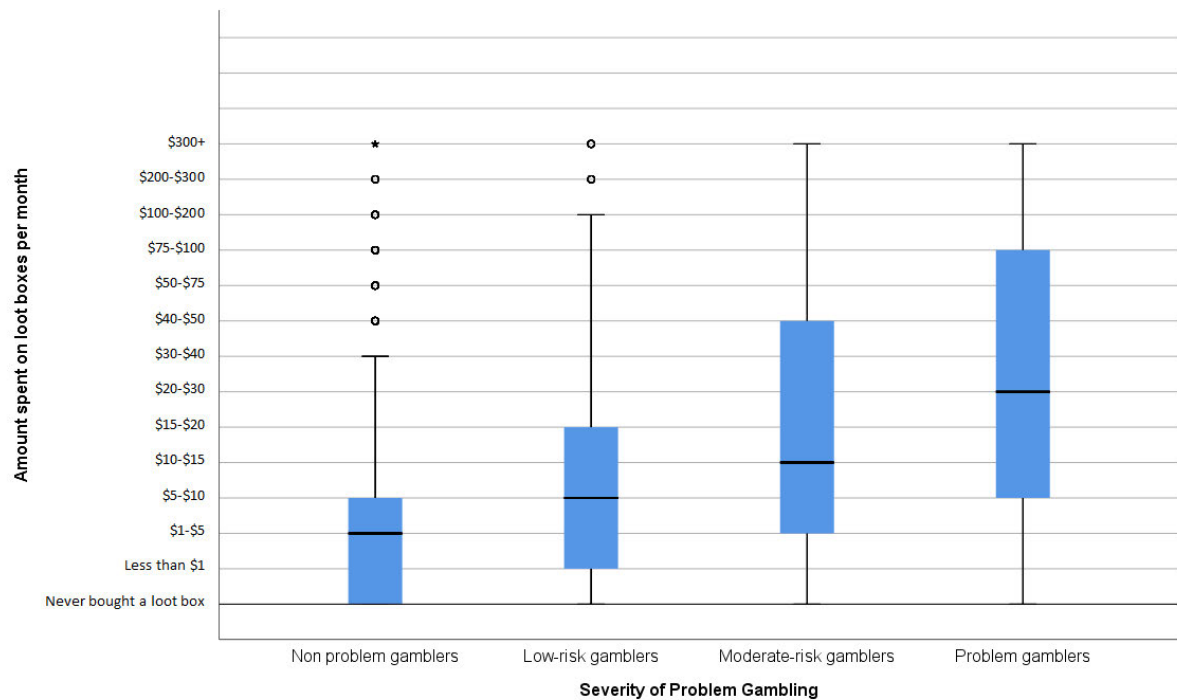


Figure 1: Box-plot of spend on loot boxes, split by severity of problem gambling

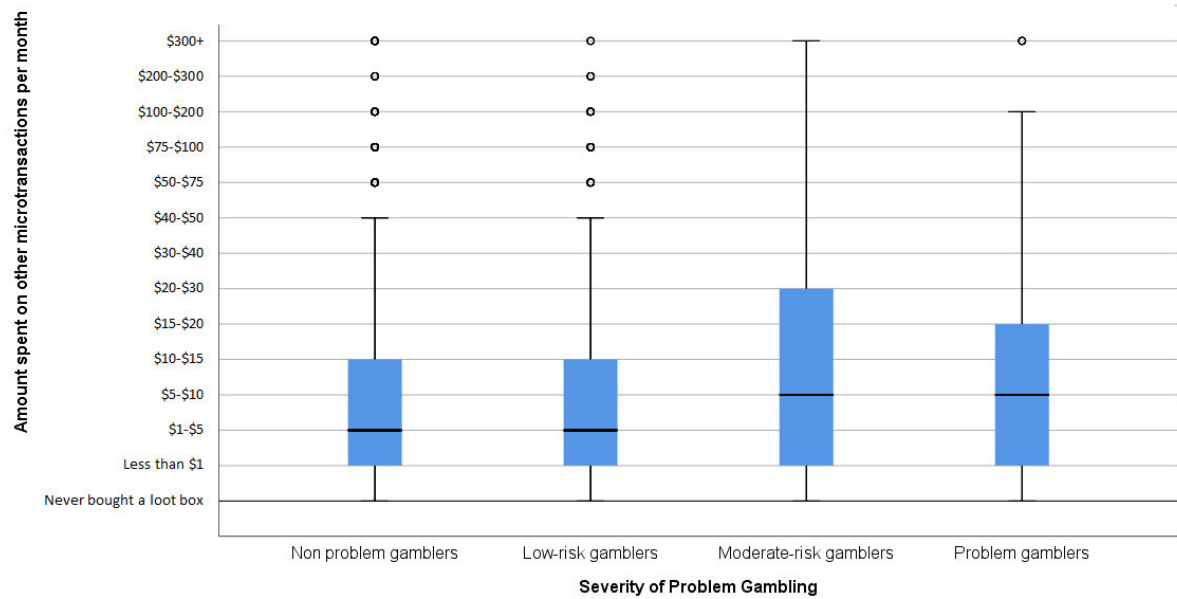


Figure 2: Box-plot of spend on other micro-transactions in games, split by severity of problem gambling

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	Loot box spend	Other microtransaction spend	N
Non problem gamblers	2.41 (2.57)	2.69 (2.36)	5726
Low-risk gamblers	3.67 (3.12)	3.04 (2.61)	1422
Moderate-risk gamblers	4.96 (3.77)	4.03 (3.38)	170
Problem gamblers	6.47 (4.01)	3.57 (3.54)	104
Total	2.77 (2.84)	2.80 (2.47)	7422

169 *Table 1: Means and standard deviation of both loot box spending and other microtransaction spending, split by problem*
170 *gambling severity. Standard deviations in brackets.*

171 The effects of problem gambling (non problem gamblers, low-risk gamblers, moderate-risk gamblers,
172 problem gamblers) on loot box spend were tested via a one-way ANOVA. Results indicated that
173 there was a statistically significant effect of problem gambling on loot box spending, $F(3,7418) =$
174 183.12 , $p < 0.00001$, $\eta^2 = 0.069$.

175 Pairwise comparisons were then conducted to measure the effects of problem gambling on loot box
176 spending between all groups of problem gamblers via a series of 6 t-tests. Bonferroni corrections
177 were applied to the results of these tests, raising the alpha level of the tests to $0.05/6$, or 0.008 . The
178 results of all t-tests were significant at the 0.008 level and are reported below as Table 2.

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Pairwise comparison groups	df	t-value	p-value	η^2
Non problem gamblers vs. low-risk gamblers	7146	-15.979	<0.00001*	0.051
Non problem gamblers vs. moderate-risk gamblers	5894	-8.776	<0.00001*	0.192
Non problem gamblers vs. problem gamblers	5828	-15.741	<0.00001*	0.377
Low-risk gamblers vs. moderate-risk gamblers	1590	-4.989	<0.00001*	0.039
Low-risk gamblers vs. problem gamblers	1524	-8.640	<0.00001*	0.161
Moderate-risk gamblers vs. problem gamblers	272	-3.130	0.002*	0.036

181 Table 2: Pairwise comparisons of the effects of problem gambling on loot box spending. Effects that are significant at the
 182 $p < 0.008$ level are marked with a *.

183 The effects of problem gambling (non problem gamblers, low-risk gamblers, moderate-risk gamblers,
 184 problem gamblers) on other microtransaction spend in games were then tested via a one-way
 185 ANOVA. Results indicated that there was a statistically significant effect of problem gambling on
 186 other microtransaction spending, $F(3,7418) = 25.953$, $p < 0.00001$, $\eta^2 = 0.010$.

187 Pairwise comparisons were then conducted to measure the effects of problem gambling on other
 188 microtransaction spending between all groups of problem gamblers via a series of 6 t-tests.

189 Bonferroni corrections were applied to the results of these tests, raising the alpha level of the tests

190 to 0.05/6, or 0.008. The results of all t-tests were significant at the 0.008 level and are reported
191 below as Table 3.

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Pairwise comparison groups	df	t-value	p-value	η^2
Non problem gamblers vs. low-risk gamblers	7146	-4.906	<0.00001*	0.005
Non problem gamblers vs. moderate-risk gamblers	5894	-7.188	<0.00001*	0.072
Non problem gamblers vs. problem gamblers	5828	-3.721	0.0002*	0.032
Low-risk gamblers vs. moderate-risk gamblers	1590	-4.509	<0.00001*	0.032
Low-risk gamblers vs. problem gamblers	1524	-1.936	0.0002*	0.009
Moderate-risk gamblers vs. problem gamblers	272	1.077	0.283	0.004

195 Table 3: Pairwise comparisons of the effects of problem gambling on other microtransaction spending. Effects that are
 196 significant at the $p < 0.008$ level are marked with a *.

197 Discussion

198 The results of this study suggest that there is an important relationship between problem gambling
 199 and the use of loot boxes. The more severe that participants' problem gambling was, the more
 200 money they spent on loot boxes. Non problem gamblers spent the least amount of money on loot
 201 boxes (mean = 2.41); low-risk gamblers spent more (mean = 3.67); moderate-risk gamblers spent yet
 202 more (mean = 4.96); and problem gamblers spent the most of all on loot boxes (mean = 6.47).

203 This is not a weak or unimportant relationship. The overall effect of problem gambling on loot box
 204 spending was measured at $\eta^2 = 0.069$, indicating that it is of medium size (23). Effects of this

magnitude commonly bear practical, as well as statistical significance (24). Indeed, the relationship observed here is stronger than relationship between problem gambling and several common risk factors in the gambling literature. For instance, it is stronger than the relationship between problem gambling and depression ($Rho = 0.10$, equivalent $\eta^2 = 0.001$) and major drug problems ($r = 0.12$, equivalent $\eta^2 = 0.014$) (25). It is comparable in strength to the relationship between problem gambling and current alcohol dependence ($r=0.25$, equivalent to $\eta^2 = 0.0625$) (26).

Furthermore, the pairwise comparisons that were conducted to clarify the effects of the initial analysis paint an even starker picture of the relationship between problem gambling and loot box use. They show that every increase in classification of problem gambling severity amongst gamers comes with an associated increase in loot box spending. Most tellingly, the pairwise comparison between individuals who were categorised as non problem gamblers (scoring 0 on a measure of problem gambling severity) and those who were categorised as problem gamblers (scoring 8 or more on the same measure) showed an effect on loot box spending of magnitude $\eta^2 = 0.377$. In other words, 37.7% of the variance in how much individuals from these subgroups spent on loot boxes was able to be explained by their categorisation as either a non problem gambler or a problem gambler.

The strength of the relationship observed here was specific to loot boxes. It did not apply to other kinds of spending in video games. Whilst a significant relationship was observed between problem gambling and other microtransaction spend in games, it was much weaker ($\eta^2 = 0.010$) than the relationship between problem gambling and loot boxes. In other words, increases in problem gambling corresponded to increases in the amount spent on other microtransactions in games. However, these increases were much smaller than the increases in spending that were associated with loot box use: For example, the difference in spending on microtransactions between non problem gamblers and problem gamblers was of $\eta^2 = 0.0327$ – more than 10 times smaller than the effect of problem gambling on spending on loot boxes between these groups.

230 Conclusions

231 This research provides the first empirical evidence of a relationship between loot box use and
232 problem gambling. The relationship seen here was neither small, nor trivial. It was stronger than
233 previously observed relationships between problem gambling and factors like alcohol abuse, drug
234 use, and depression. Indeed, sub-group analyses revealed that an individual's classification as either
235 a non problem gambler or a problem gambler accounted for 37.7% of the variance in how much they
236 spent on loot boxes.

237 These results may show that, as (17) suggests, there is a causal relationship between buying loot
238 boxes and problem gambling. Due to the formal features that loot boxes share with other forms of
239 gambling, they may well be acting as a 'gateway' to problem gambling amongst gamers. Hence, the
240 more gamers spend on loot boxes, the more severe their problem gambling becomes.

241 However, it is important to note that this is not the only causal relationship which fits the data. It
242 may be the case that individuals who are already problem gamblers instead tend to spend more on
243 loot boxes. There are good reasons why this might be the case. Loot boxes share key similarities with
244 other kinds of gambling. Since problem gambling is characterised by uncontrollable and disordered
245 spending on gambling activities, this lack of control and excess in spending may apply to loot boxes
246 too. Hence, the more severe a gamer's problem gambling, the more they spend on loot boxes. If this
247 is the case, then loot boxes in digital games would be providing less of a 'breeding ground' for
248 problem gambling. They would instead be providing another outlet for individuals who are already
249 problem gamblers to engage in harmful and excessive gambling-related behaviour.

250 Due to the correlational nature of this research, it is impossible to tease apart whether we are seeing
251 a situation in which spending on loot boxes leads to problem gambling, or whether we are seeing a
252 situation in which problem gambling leads to spending on loot boxes. It may, indeed be the case that
253 both directions of causality are true: Problem gamblers spend more on loot boxes, whilst buying loot
254 boxes simultaneously leads to increases in problem gambling amongst gamers.

However, regardless of which of these outcomes is the case, this research bears an important message when it comes to the regulation of loot boxes within the gaming industry. Industry analysts predict that loot boxes will drive a large proportion of the revenue generated in the \$230 billion (27) video game economy by 2022. Gamers are already projected to spend approximately \$30 billion on loot boxes this year alone, with this figure rising to \$50 billion over the next four years (4). It may be the case that this spending is leading to problem gambling. It may be that this level of spending is driven by pre-existing problem gambling amongst gamers. Further experimental and longitudinal work is required to establish the direction of this causal relationship. However, in either case, industry bodies such as the ESRB can no longer claim that there is insufficient evidence of links between problem gambling and loot box use.

Given the relationships observed in this study, we follow (17) in recommending that ratings agencies such as the ESRB and PEGI incorporate additional parental advisories into games that feature loot boxes, and should consider restricting access to games that feature loot boxes to players of legal gambling age. Furthermore, given the severity of the link that was observed here between problem gambling and loot box spending, we strongly recommend that relevant national and federal regulatory authorities restrict access to loot boxes as if they were a form of gambling. Whether loot boxes fulfil the technical requirements to be classified as gambling is a legal matter that will vary from territory to territory and from country to country. However, the evidence presented here clearly shows that there is an important relationship between loot box spending and problem gambling. This relationship remains serious and potentially dangerous regardless of whether loot boxes are technically considered a form of gambling or not.

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