The Relationship between Problem Gambling, Spending on Loot Boxes, and Loot Box Opening Videos

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Abstract

Loot boxes are in-game purchases in video games where the content is unknown before opening and is randomised. The content can have high or low rarity and can provide advantages in-game, encouraging ongoing purchasing behaviours through increased desirability of content. Loot boxes within video games operate on Variable-Ratio reinforcement similar to legally defined gambling and are argued to meet the criteria for gambling. Evidence shows a positive association between problem gambling symptomology and spending on loot boxes. However, there may be other factors in the relationship, one of these being loot box opening videos (e.g., on YouTube or Twitch). To date, one study has investigated the possibility that loot box opening videos are associated with loot box spending, which has suggested that this relationship between watching loot box opening videos and loot box spending exists; therefore, it is important to explore the association between problem gambling, loot box spending, and loot box opening videos, and also establish the problem gambling and loot box spending relationship in a New Zealand sample. We recruited a cross-sectional New Zealand sample (*n* = 313), and *a convenience sample* (*n* = 118) and conducted a survey investigating the relationship between loot box spending, problem gambling symptomology, and frequency and time spent watching loot box opening videos. The results from the two samples were mixed. There were few significant effects in *the convenience sample*; however, limitations (such as extremely low loot box spending) in *the convenience sample* suggest the findings from the cross-sectional New Zealand sample may be more valid. The results from the cross-sectional New Zealand sample revealed that higher problem gambling symptomology correlated significantly with higher loot box spending. Regression analyses showed that the interaction between problem gambling symptomology and time spent watching loot box opening videos

explained a significant amount of variance in loot box spending, while the interaction between problem gambling symptomology and frequency of watching loot box opening videos did not. Results replicated previous research suggesting that people with higher problem gambling symptomology are spending more money on loot boxes. The results also suggest that the amount of time spent, not the frequency of, watching loot box opening videos in combination with problem gambling symptomology is associated with higher loot box spending. Further research is required to attempt to replicate the findings.

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Preface

We contracted Qualtrics to obtain a representative sample for this study, unfortunately this was not delivered. This is a failure on the part of the data collection company. We have therefore tried to be appropriately cautious as to not interpret the findings as though they are derived from a representative sample. This has not impacted on our ability to make observations about the relationships between psychological constructs.

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NZ - New Zealand

US - United States

UK - United Kingdom

PGSI - Problem Gambling Severity Index

Introduction

As the video game industry grows fast it brings the potential for both positive and negative impacts. In New Zealand (NZ) society, video games are widely played with 67% of New Zealanders playing video games, 98% of homes with children having computer games, and New Zealanders playing video games for an average of 85 minutes daily (Brand, Todhunter, & Jervis, 2017). The industry generates substantial revenue, with $424 million worth of video game sales in NZ in 2016 (Brand et al., 2017). Worldwide, sales and engagement show similarities with the NZ market. In the United States (US), 65% of American adults play video games, 75% of households have at least one gamer, and 21% of gamers are aged under 18 (Entertainment Software Association, 2019). In the US in 2018, video game sales reached $43.4 billion (Entertainment Software Association, 2019). In Australia, video game sales totalled $4.03 billion in 2018, an increase from $2.04 billion in 2013 (Brand, Jervis, Huggins, & Wilson, 2019). Global video games sales reached over $100 billion (Juniper Research, 2018). Video game engagement is also comparable with NZ and US; two out of three Australians play video games, 91% of homes own a video game device, 22% of video gamers are aged under 18, and Australians play video games for an average of 81 minutes per day (Brand et al., 2019). It is clear that video games are involved in millions of lives and generate significant revenue. This study investigated a relatively new way that video games can be monetised and its relationship to problem gambling symptoms – that is, loot boxes.

Figure 1. Examples of unopened loot boxes (left pane; Carpenter, 2017) and opened loot boxes (right pane; Tassi, 2017a) from multiplayer first-person shooter game Overwatch.

Loot boxes are in-game purchases where the content is unknown before opening and is based on chance. They have differing visual presentation and functioning. Figure 1 illustrates a common design of a loot box. Loot boxes operate by gamers paying money directly to open a crate or card pack, or in some cases players will be given a loot box and then will need to buy a key to open the box. Inside the box is a random reward that could have high or low rarity. As some items are rarer than others, people tend to desire these more, which encourages ongoing participation in loot box spending as the chance of receiving the item could be low (King & Delfabbro, 2018). Other potential rewards that loot boxes provide for gamers, thereby attracting gamers to spend money on them, include better weapons, armour, and players or characters. Some items give players a greater chance of winning, which enables them to gain an advantage and remain competitive in future games (Drummond & Sauer, 2018). A crucial feature across all loot boxes is that the player does not know the content of the loot box before opening. The controversy from loot boxes arises from similarities to real-life gambling as they are argued to have gambling-like mechanisms.

Gambling and Loot Boxes.

To establish the relationship between loot boxes and gambling it is important to first define the key criteria and features that differentiate gambling from general risk-taking behaviour, and how loot boxes relate to these criteria. Griffiths (1995) states it is difficult to determine when an activity involves risk-taking, skill, and chance, three of the core definitional components for something to be considered legally gambling. Instead it is more efficient to identify commonalities that distinguishes gambling behaviour from other risky behaviour. Griffiths (1995) details five core criteria for gambling that are more specific than many legal definitions:

1) the exchange of money or goods;
2) "winners gain at the sole expense of losers" (p. 2);
3) the exchange is determined by a future event where the outcome is unknown prior;
4) the outcome, at least partially, is determined by chance;
5) by not participating in the activity losses can be avoided.

Another important key feature to identify is how gambling activities function. A common mechanism underlying almost all forms of gambling is that it occurs on the Variable-Ratio reinforcement schedule of operant conditioning. For example, a slot machine may, on average, pay out every X times a user gambles on it. Crucially, the exact timing of the reward is randomised, so the actual amount of button presses required for the reward varies (Ferster & Skinner, 1957; Rachlin, 1990). This is an important contributor to compulsive behaviour; the responder has the chance of winning on the very next attempt due to the random ratio that is applied to the

event. Variable-Ratio schedules of reinforcement contribute to people acquiring behaviours quickly, which become repetitive and persistent in hope to receive the desired reward (Ferster & Skinner, 1957; Rachlin, 1990). This reinforcement schedule creates very persistent behaviours; of all known operant conditioning schedules, extinction is most difficult for Variable-Ratio reinforcement. That is, behaviour reinforced on a Variable-Ratio schedule is very resistant to elimination (Hearst, 1961), and contributes to addictive behaviour observed in gambling (Knapp, 1997). The criteria and underlying mechanisms of gambling have been an important part of the argument for researchers in establishing the link between gambling and loot boxes.

Drummond and Sauer (2018) used the five core criteria of gambling outlined by Griffiths (1995) to illustrate the similarities between gambling and loot boxes. Examining 22 video games containing loot boxes released in 2016-2017, Drummond and Sauer (2018) showed that 10 of the video games met the criteria defined by Griffiths (1995). To meet the criteria the loot box had to be purchasable using real-world money, the loot box was received following payment, the contents of the loot box were determined randomly, losses could be avoided by not purchasing a loot box, and winners gain at the expense of losers by receiving a competitive advantage in the game from the loot box content. The psychological similarities between loot boxes and gambling arises from the fact that loot boxes function on a Variable-Ratio reinforcement, similar to real-life gambling. Loot boxes contain highly desirable (visually appealing items or items which provide competitive advantage) or rare items that a player will receive after X amount of loot box purchases. The reward is also randomised so the player will have to make an undetermined amount of loot box purchases in order to receive the desired reward. Considering the similarities between loot boxes and

real-life gambling, there is concern from researchers, policy makers, and general public (Drummond & Sauer, 2018; McCaffrey, 2019; Zendle & Cairns, 2019) about the effect of loot boxes.

These "structural and psychological similarities with gambling" (Drummond & Sauer, 2018, p. 532) appear to be recognised by some regulatory bodies. In 2018, the Netherlands and Belgium determined that loot boxes contravene gambling laws and ordered their removal from video games (Chalk, 2018; Gerken, 2018). The US have introduced legislation in 2019 to regulate games with loot boxes (Romm & Timberg, 2019). Further, the United Kingdom (UK) House of Commons Digital, Culture, Media and Sport Committee released the Immersive and Addictive Technologies report (House of Commons Digital Culture Media and Sports Committee, 2019). This recommended that loot boxes based on chance should not be allowed in games played by children unless evidence demonstrates that exposing children to the gambling-like mechanisms of loot boxes produces no harm. The report also recommends that PEGI, the European video game rating system, implements the Gambling classification on games that include loot boxes. The document additionally states that the UK government should next "specify that loot boxes are a game of chance" (House of Commons Digital Culture Media and Sports Committee, 2019, p. 62).

This response has not been shared by all authorities. NZ's Gambling Compliance Office has stated that loot boxes do not meet the legal definition of gambling as gamers are not seeking financial return by purchasing them, "gamers do not purchase loot boxes seeking to win money or something that can be converted into money" (Cross, 2017). Using this argument, NZ stated loot boxes cannot be regulated under the Gambling Act 2003 (Cross, 2017). Similarly, French gambling bodies declared that loot boxes cannot legally be considered as a form of gambling based on the argument that there is no real-world

financial return (Postrado, 2018). An Australian Senate report did not make a declaration about the status of loot boxes, but recommended a review of loot boxes in video games pertaining to regulatory gaps, classification, consumer protection frameworks, and consistency with international counterparts (Reilly, 2018).

The argument that there is no financial loss from purchasing a loot box and the received virtual items are not considered valuable, appears to be an important point of contention in legally defining loot boxes as gambling. With the consideration of a sixth criteria of gambling - cashing out winnings - Drummond and Sauer (2018) contest this argument put forward by gambling regulators. Gamers can, in some cases, trade their virtual items, received through loot boxes, for real-world cash. This is not available in all video games though; of the 10 that met the five core criteria for gambling, five had the capability for players to cash out winnings. Four were via websites independent of the game and the fifth was through a marketplace run by the company which distributed the game. This demonstrates another similarity between loot boxes and real-world gambling and challenges the arguments from regulatory bodies that loot boxes do not constitute a form of bona fide gambling.

This similarity between loot boxes and traditional forms of gambling has serious implications. Drummond and Sauer (2018) state that the legal gambling age is at least 18 years and over for most countries. In their analysis, Drummond and Sauer (2018) showed that of the 10 games that met Griffiths' criteria for gambling, six were classified as appropriate for 13 years old and younger, which presents legal and ethical concerns. Numerous authors have called for regulation (Brooks & Clark, 2019; Drummond & Sauer, 2018; King & Delfabbro, 2018; Zendle & Cairns, 2019). Zendle and Cairns (2019) state that the similarities between loot boxes and gambling (e.g., placing a bet on a roulette wheel and

buying a loot box both present the possibility of losing real-world money for a chance at a high value reward), introduce a risk that spending on loot boxes contributes to the development of problem gambling behaviours. Similarly, the availability of loot boxes to young children and teenagers may create a "ripe breeding ground" (Drummond & Sauer, 2018, p. 532) for problematic gambling; exposure to gambling activities and behaviour in childhood is associated with problem gambling later in life (Johansson, Grant, Kim, Odlaug, & Götestam, 2009). Such a relationship is very concerning considering the aforementioned problem gambling consequences and the UK Gambling Commission (2018) estimating 31% of people aged 11-16 have opened a loot box.

Problem Gambling and Loot Box Spending

To establish evidence of a relationship between loot boxes and gambling, authors have utilised the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001) and loot box spending. The PGSI is a standardised measure of behaviour related to problem gambling. Nine items assess how often on a scale of "1 (Never), 2 (Sometimes), 3 (Most of the time), and 4 (Always)", an individual participates in behaviours related to gambling. This enables categorisation of gambling symptomology into four groups based on increasing severity: Non-problem, low-risk, moderate-risk, and problem gambling. Zendle and Cairns (2018) conducted a survey on an international sample of 7422 gamers aged 18 and over measuring loot box spending and problem gambling severity, as measured by the PGSI. Zendle and Cairns (2018) demonstrated a significant difference in loot box spending between PGSI categories. This illustrated that an increase in severity of gambling classification (i.e., non-gambler, low-risk gambler, moderate-risk gambler, problem gambler) corresponded to an increase in loot box spending per month. An important difference the

authors showed was that the strength of this relationship was not present in non-loot box in-game spending, that is, purchasing non-randomised rewards (e.g., new levels). A relationship did exist, but was much weaker than between problem gambling severity and loot box spending. This provided an important distinction between gambling and non-gambling-like mechanisms, and their relationship with problem gambling severity. Zendle and Cairns (2018) also noted that the effect size of the relationship between problem gambling and loot box spending was stronger than the relationship between some risk factors and problem gambling, for example, depression (Feigelman, Kleinman, Lesieur, Millman, & Lesser, 1995), and major drug problems (Welte, Wieczorek, Barnes, & Tidwell, 2006).

In a replication study with 1172 US based gamers, Zendle and Cairns (2019) again investigated the relationship between loot box spending and problem gambling severity. They found that those with higher PGSI scores spent more on loot boxes compared to those who scored lower on the PGSI. This research also addressed a limitation highlighted by Zendle and Cairns (2018) in their first survey. In Zendle and Cairns (2018), the participants were aware that the survey was related to loot boxes and gambling. Zendle and Cairns (2019) removed from the sample any participants that appeared aware of the aims. With an important limitation accounted for, this provided more robust evidence demonstrating the relationship between problem gambling severity and loot box spending. Unlike Zendle and Cairns (2018), when problem gambling was collapsed into discrete groups this did not show a significant difference between non-gamblers, low-risk gamblers, moderate-risk gamblers and problem gamblers. This supports an idea that treating problem gambling on a continuum, as opposed to collapsing gambling symptomology into discrete groups, may be more appropriate in this research setting (Orford, Wardle, Griffiths, Sproston, & Erens,

2010). Zendle and Cairns (2019) suggest their results could be due to sample size, or small and statistically insignificant demographic and behavioural differences between low-risk and moderate-risk categories. For example, Currie, Hodgins, and Casey (2013) showed these two groups engage in similar amount of gambling types and at a similar frequency. Additionally, low-risk and moderate-risk gamblers did not show any significant differences in stress, wellbeing, or mental health problems (Currie et al., 2013). Zendle and Cairns (2019) also recognise the correlational nature of the research; it is unclear whether problem gambling results in loot box spending, loot box spending causes problem gambling, or the relationship is bi-directional. Zendle and Cairns (2018; 2019) and Drummond, Sauer, and Hall (2019) point out that any scenario is concerning, as it implies disproportionate spending by a high-risk group.

Griffiths (1995) states that although national surveys, for example, on the British population (Cornish, 1978), indicate that there are more 'gamblers' than 'non-gamblers', a majority of this population are "normal or social gamblers" (p. 2) that on occasion gamble on activities like the lottery. This appears to apply in NZ with over half of adults gambling on at least one activity in the past 12 months (Rossen, 2015). It is therefore important to distinguish problem gambling from 'normal' gambling. The Gambling Act 2003 defines a problem gambler as "a person whose gambling causes harm or may cause harm" (p. 27). The PGSI also provides a useful measure to help define this (Ferris & Wynne, 2001), as it produces a measure of problem gambling severity and enables the categorisation from non-problem to problem gambling.

Problem gambling is a very serious issue with many significant consequences for problem gamblers, their work life, their family, and society. In NZ, 22% of people report being affected by gambling, either through their own gambling or someone else's

(Thimasarn-Anwar, Squire, Trowland, & Martin, 2017). Negative effects for the individual may include financial distress and potential secondary effects such as the need to access money through loans, and potentially even criminal acts (Ladouceur, Boisvert, Pépin, Loranger, & Sylvain, 1994). Problem gamblers can also face significant physical and mental health issues, with research demonstrating links between problem gambling and depression (Feigelman et al., 1995), and major drug problems (Welte et al., 2006). In NZ, problem gambling is associated with higher rates of alcohol dependence and drug use, and problem gamblers are more likely to be diagnosed with a depressive disorder, bipolar disorder, or an anxiety disorder (Rossen, 2015). These physical and mental health problems can also manifest in the family members of problem gamblers; substance abuse, depression, and suicide are common in their children (Lorenz & Shuttlesworth, 1983; Lorenz & Yaffee, 1988). The effects on family can also include gamblers being violent towards their spouse and children, neglect of children, and breakdown of relationships with their spouse and children (Lorenz & Shuttlesworth, 1983; Lorenz & Yaffee, 1988). The impact on broader society includes the cost of crime perpetrated by problem gamblers attempting to obtain money for gambling activities or pay off gambling debts, for example, fraud, theft, and embezzlement (Blaszczynski & McConaghy, 1994). Further social costs involve the treatment of problem gambling and secondary health issues such as drug abuse (Abbott, 2017). These costs can be borne by society through taxes in countries that have national health insurance, such as NZ and Australia (Collins & Lapsley, 2003). In NZ, individuals categorised as a problem gambler on the PGSI were associated with greater use of health services such as general practitioners, psychologists, social workers, and counsellors (Rossen, 2015).

Research is establishing that problem gamblers are spending more on loot boxes than non-gamblers. Supplementing the concern raised about the effect on younger

populations, Zendle, Meyer, and Over (2019) showed that the more adolescents spend on loot boxes, the greater their problem gambling severity and this association was more than double the strength of that demonstrated in Zendle and Cairns (2018, 2019). Furthermore, compared to adolescent non-problem gamblers, adolescent problem gamblers spent five times as much on loot boxes. Zendle et al. (2019) concluded that video game companies are risking exposing adolescents to gambling mechanisms and associated consequences when making loot boxes available to them. The authors comment that loot boxes could be causing problem gambling, problem gamblers are being exploited through loot boxes, or the relationship is bi-directional. Zendle et al. (2019) and Drummond et al. (2019) reiterate concerns that any of these relationships have the potential for significant harm

Zendle and Cairns (2019) comment that many of the factors producing loot box spending remain unknown. One potential factor is gamers watching loot box opening videos on websites such as YouTube and Twitch. There is limited data on the relationship between watching loot box opening videos and loot box spending. As these avenues of media content are becoming increasingly popular (Bailey, 2017), an important question is whether increased exposure to loot box openings through online videos increases the likelihood of people opening more loot boxes.

The findings (Zendle & Cairns, 2018, 2019; Zendle et al., 2019) increasingly highlight that people susceptible to gambling problems are spending more money on loot boxes than those without such problems. In a NZ sample this is yet to be established. Developing a NZ sample is important considering the bicultural society that exists in the country. NZ has, although not exclusively, a more collectivist culture than some western societies (Podsiadlowski & Fox, 2011), consequently assumptions cannot be made about similarities between countries in engagement with activities despite commonalities. In the context of

this study important differences between countries could exist in how they engage with video games and gambling, owing to cultural diversity. Differences between cultures can have important implications in the development and implementation of policies pertaining to popular activities like video gaming and gambling (Burstein, 1991). Recognising and establishing cultural differences is therefore vital in addressing affected groups and avoiding unjustly impacting certain groups.

In the relationship between loot boxes and gambling, a representative sample of a population has not been obtained, which would increase the robustness of the generalisability. Establishing a representative sample would minimise over-representation and under-representation of groups and help avoid bias in analyses and interpretation (Heckman, 1979). For example, a large number of gamers view loot boxes negatively (Brooks & Clark, 2019) and their frustrations with their implementation could contribute to motivation for responding on a survey exploring loot boxes. A non-representative sample biased towards groups with disdain towards loot boxes who spend very little money on loot boxes may show a weaker relationship between loot box spending and problem gambling. Minimising this possibility will assist researchers, policy makers and the general public to identify groups most at risk of overspending on loot boxes and implement appropriate responses.

This study aimed to explore the relationship between loot box spending, problem gambling symptoms and the frequency of watching loot box opening videos in a representative NZ sample. To foreshadow the results, unfortunately we were unsuccessful in obtaining a representative sample, though our data remain a valuable examination of the relationship in a larger cross-section of NZ participants. Irrespective of whether loot box spending is causing problem gambling symptoms, problem gambling symptoms are causing

increased loot box spending, or both, the relationship is concerning as it implies, at a minimum, that an at-risk population is spending a disproportionate amount on a gambling-like mechanism. Moreover, little is known about the multitude of factors that contribute to the relationship. Another aim of this study, therefore, is to determine whether watching loot box opening videos is associated with an increase in loot box spending, and if such an increase meaningfully combines with problem gambling symptomology to produce a larger effect than either factor on their own. This effect being present would add further concern to the already alarming evidence about the gambling-like nature of loot boxes.

Loot Box Opening Videos

Although the consumer response to loot boxes has been negative, some gamers have recognised and utilised the attractiveness as a source of entertainment. McCaffrey (2019) states that a "cottage industry" (p. 485) has developed where gamers have taken advantage of the event-like nature of loot box where images, sounds, and other engaging elements increase the excitement involved in opening one. It has been commonplace for players to record or livestream themselves playing video games and make this available on video sharing sites such as YouTube, and video game streaming sites like Twitch for viewers' entertainment (Bailey, 2017). An example of a loot box opening video from YouTube is shown in Figure 2. These avenues of media consumption are popular: In NZ, 25% of gamers have watched a live stream of gameplay on Twitch, and 50% have watched gameplay videos on YouTube (Brand et al., 2017). To add to their quantity of content, the 'content creators' upload videos or livestream themselves opening loot boxes. Bailey (2017) states that a culture has emerged where thousands of people watch streamers open loot boxes and react to the contents. These videos, often accompanied by exciting titles and thumbnails, can get

hundreds of thousands, and sometimes millions of views (TheseKnivesOnly, 2018; W2S, 2019). Brand et al. (2017) do not state if the statistics on watching videos on YouTube or Twitch included loot boxes or micro-transactions. Daily active users of Twitch spend an average of 95 minutes on the website per day, 55% of users are aged between 18 and 49, and half of the viewers spend 20 or more hours on Twitch per week (mediakix, 2019). Statistics from YouTube suggest a similar popularity of viewing gaming-related YouTube videos. Just under half (48%) of YouTube gamers state they spend more time watching gaming videos than actually playing games (Petrov & Gross, 2017). Motivations for watching these videos are presently largely unknown, and it is unclear the extent to which they include loot box openings.

Figure 2. An example of a common design of a YouTube loot box opening video from Overwatch.

Though official statistics on YouTube and Twitch do not include loot box opening videos, viewership count on these YouTube videos can, as previously noted, reach hundreds of thousands to millions, which highlights their popularity. Some game companies have

incentivised and encouraged players to watch loot box opening videos in-game. At release, *Call of Duty WWII* had a mission that required the player to watch other players open three loot boxes (Yin-Poole, 2017). Furthermore, game companies appear to be attempting to increase the number of loot box opening videos by offering improved odds for loot boxes opened live by Twitch and YouTube streamers (Viana, 2019). These sorts of actions may contribute to players purchasing loot boxes through observational learning and availability heuristic mechanisms. This idea will be visited in the following section. Considering this engagement, and the relationship between loot boxes and problem gambling that is being established, an important relationship worth exploring is a potential association between problem gambling, loot box spending, and how much and how often an individual watches loot box opening videos.

The issue of whether watching loot box opening videos is a risk factor for problematic spending on loot boxes is largely unexplored. One recent paper has demonstrated a weak but potentially important relationship between loot box spending and watching pre-recorded and live streams of loot box opening videos in a UK sample (Zendle, 2019) This relationship has not yet been replicated, and has also not been explored in NZ. It is also unclear the extent to which problem gambling symptoms might moderate the relationship between loot box opening videos and loot box spending. A conceptual model of this moderation is shown in Figure 3. Nonetheless these early results trend towards suggesting a relationship between loot box spending, watching loot box opening videos, and problem gambling exists. One reason such a relationship exists may be due to social learning and cognitive processes being engaged following loot box videos being viewed.

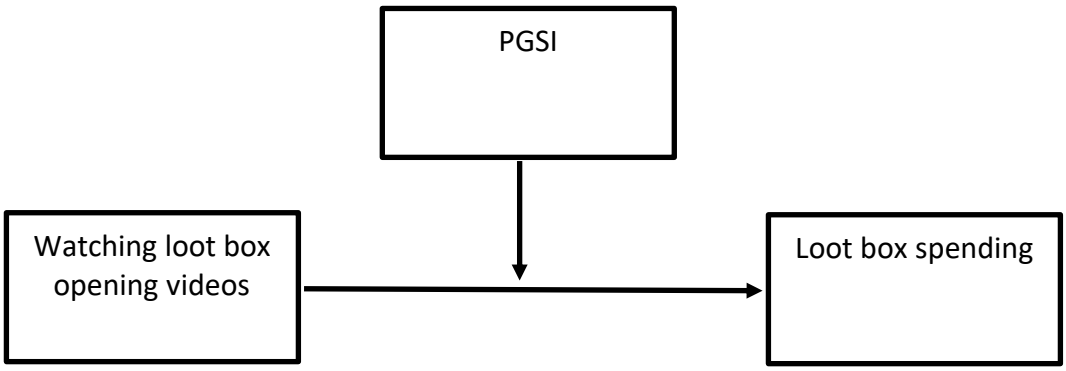

Figure 3. Conceptual model of the moderating effect of PGSI on the relationship between watching loot box opening videos and loot box spending.

Social Cognitive Theory

Social Cognitive Theory posits that behaviour is caused by a reciprocal triad of personal (cognition), environmental, and behavioural influences (Bandura, 2001). Under Social Cognitive Theory, individuals acquire behaviours through their own actions and by observing others' actions and the outcomes of these behaviours. Social Cognitive Theory emphasises human capabilities in understanding human behaviour: Symbolising, self-regulatory, self-reflective, and vicarious capability. Through symbolising, people convert information from what they observe in the environment and from their own experiences into cognitive models. These models are then used to develop solutions to problems, assess future outcomes, and select appropriate actions and behaviours. The symbolising capability underpins the other human capabilities.

Central to Social Cognitive Theory is the idea that many human behaviours can be attained through observational learning, which can be quicker than direct experience. This vicarious learning can take place in one's direct environment; however, symbolic modelling through the mass media also provides a significant amount of information about behaviour, social values and morals, and thinking. Observational learning is influenced by attentional,

retention, production, and motivational processes. Attentional processes select what modelled events are observed through factors such as their perceived value, salience, and attractiveness. Once an observed event is selected for attention, retention processes encode and store the observations for later recall and reconstruction. Subsequently, production processes result in the individual replicating the retained behaviour. Motivational processes influence whether an observed behaviour will be reproduced. If a behaviour is observed to be followed by positive or desirable consequences it is more likely to be reproduced, and it is less likely to be performed if followed by negative or undesirable effects. The modelling processes enable people to learn what behaviours to reproduce, and those actions they should inhibit. Observing the actions of others can also act as a prompt for performing an already acquired behaviour that has not had sufficient motivation to be performed.

Thus, from the theoretical framework of Social Cognitive Theory, watching loot box opening videos may produce learning. Loot box opening videos are often edited to show and emphasise desirable content being won. As noted, companies have attempted to increase the odds of winning in live-streamed loot box openings (Viana, 2019). In the retention process of observational learning if loot box opening videos are viewed which predominantly feature wins, this might increase the chance that individuals retain instances of winning from loot box openings. This could result in an availability heuristic (Tversky & Kahneman, 1973) where people later are more easily able to recall examples of winning and overestimate the likelihood of it occurring for themselves. This may lead them to overestimate the positive consequences thereby increasing motivational processes to engage in the activity leading to an increase in the production of loot box purchasing behaviours.

Attentional processes could also influence motivation and subsequent production of loot box purchasing behaviours. When someone creates a pre-recorded video or live stream of themselves opening a loot box it is often paired with an exciting title and thumbnail. Receiving valuable content can evoke a positive emotional response from the creator, which is modelled to the viewer. The loot box opening itself can be a salient event for the viewer due to attractive sounds and images. The contents received from a loot box could also display positive consequences for the observer; items that provide advantages in-game or change the look of characters may provide a source of attraction. Through appearance, associated emotions, and in-game effects, a social model can illustrate short-term positive consequences of opening loot boxes to the observer. There are also potential long-term positives where loot box content provides in-game advantages that helps the player extend these benefits over a longer period of time. Negative consequences could include not instantly receiving the desired content and spending more money than is within someone's needs and going into debt. The latter point is often not shown or is not the focal point. These observational processes present a balance between positive and negative consequences of loot boxes with the scales - for some - tipped towards these in-game micro-transactions being viewed favourably. What could result is the motivational processes become influenced by these positive expectations and increase the likelihood of loot box spending behaviour being produced. While Social Cognitive Theory emphasises a person's capacity for self-regulation in situations that can negatively affect them, it can falter when learning occurs vicariously, not directly.

Social models presented through loot box opening videos could also factor significantly into an individual's self-reflection and subsequent behaviour reproduction. Social Cognitive Theory states vicarious learning can be more efficient than direct learning,

therefore, people can also check the accuracy of their thoughts and behaviours more swiftly and with less effort through observing others and the effects of their actions, especially when these actions are biased towards success. This could be prevalent when loot box opening videos are focused on wins, edited to overstate the odds of success or show disproportionate wins due to odds manipulation (Viana, 2019). Direct experiential learning may also be less accessible for the individual due to concerns about spending money on loot boxes, and could utilise loot box opening videos as an avenue to experience loot box opening videos, or as a way to verify if the action of spending money on loot boxes will have positive consequences. As noted, using media versions of social reality can produce misconceptions, upon which a person may act. An individual's belief could be that loot boxes do not give out the rewards they desire or have experienced such an outcome. Alternatively, they may not have any existing thoughts or behaviours involving loot boxes. A video which features small or large quantities of loot boxes being opened and shows valuable content being received could create the expectation of a positive outcome from opening loot boxes, thus could adjust or influence the thoughts and subsequent behaviours of the observer.

The potential of such an effect existing introduces further concern. Vulnerable populations, those who show higher problem gambling severity for example, could be particularly affected by watching loot box opening videos, where this may influence the likelihood of them spending increased amounts of money on loot boxes. Considering the young demographic of gamers, the relationship between loot box spending and problem gambling, and the significant negative consequences associated with problem gambling, increased exposure to gambling-like mechanisms through loot box opening videos is concerning if this behaviour is being learned through Social Cognitive Theory mechanisms.

This study aimed to recruit a representative NZ sample showing the relationship between loot box spending and problem gambling severity. Additionally, this study explored the relationship between problem gambling, loot box spending, and watching loot box opening videos. Based upon the literature, we predicted the following.

1. There will be a significant positive correlation between number of problem gambling symptoms on the PGSI and the amount of money (in $NZD) participants report spending on opening loot boxes in the past month.
2. Participants classified as higher risk gamblers by the PGSI will report spending significantly more real-world money ($NZD) on loot boxes in the past month than participants who are classified as lower risk by the PGSI. Non-problem gamblers will spend less than low risk gamblers, who'll spend less than moderate risk gamblers, who'll spend less than problem gamblers.
3. There will be a significant positive correlation between how often participants report watching loot box opening videos in the past month and the amount of money (in $NZD) they report spending on opening loot boxes in the past month.
4. There will be a significant positive correlation between how much time participants report spending watching loot box opening videos in the past month and the amount of money (in $NZD) they spend on opening loot boxes in the past month.
5. Problem gambling symptomology will moderate the relationship between watching loot box opening videos and the amount of money (in $NZD) participants spend on opening loot boxes. Specifically, for moderate risk and problem gamblers as classified by the PGSI, it is predicted that the relationship between watching loot box videos in the past month and real-world money spent on loot boxes in the past

month will be stronger than for participants classified as low-risk or non-problem gamblers by the PGSI.

6. Gambling disorder symptomology will moderate the relationship between how often participants watch loot box opening videos and loot box spending such that participants who have higher problem gambling symptomology (PGSI scores) and higher reported instances of watching loot box opening videos will spend significantly more than participants without high scores on both of these measures.
7. Gambling disorder symptomology will moderate the relationship between time spent watching loot box opening videos and loot box spending such that participants who have higher problem gambling symptomology (PGSI scores) and higher reported time spent watching loot box opening videos will spend significantly more than participants without high scores on both of these measures.
8. Additionally, there will be no significant relationship between problem gambling symptomology and other forms of in-game spending (i.e., downloadable content, and in-game items which are not randomised).

Method

This research was approved by the Massey University Human Ethics Committee: Human Ethics Southern B Committee: SOB-19-11.

Participants

Two samples were collected for the present study. Sample one, hereafter referred to as *the Qualtrics sample*, was collected via Qualtrics' survey targeting tool (see procedures section below for more information). Four hundred and seventy-nine responses were collected in total from a cross-sectional NZ sample. One hundred and sixty-six participants' responses were excluded from analyses. These exclusions are detailed further below. Unfortunately, although we contracted Qualtrics for a representative sample the data were not representative. For instance, the data overrepresented females (63.3%). From the remaining 313 participants, 198 participants were female, 110 were male, one participant selected non-binary as their gender, and one participant indicated they would prefer not to disclose their gender. The mean age of participants was 39.41 years (*SD* = 17.41, Range 16-86). Sixteen participants did not provide a response to the age question. Forty-six participants (14.7%) had a weekly income of less than $350. Eighty-one participants (26.0%) had a weekly income of $351-$700. One hundred and seventeen participants (37.5%) had a weekly income of $701-$1650. Forty-nine participants (15.7%) had a weekly income of $1651-$3500. Nineteen participants (6.1%) had a weekly income of greater than $3500. One participant did not provide a response about their weekly income.

For sample two, hereafter referred to as *the convenience sample,* 258 responses were collected in total. One hundred and forty responses were excluded. These exclusions are detailed further below. Unfortunately, prior to our data collection beginning, the

/r/gaming reddit forum had a change in their forum moderation rules. Previously, this subreddit was a valuable source for survey data collection, however the new rules disallowed the posting of surveys, which resulted in our sample being substantially smaller than the 1000 target we had pre-registered. From the remaining 118 responses, 47 participants were female and 69 participants were male. Two participants did not provide a response to the gender question. The mean age of participants was 28.51 years (*SD* = 8.85, Range 17-59). Thirteen participants did not provide a response to the age question. Nineteen participants (17)% had a weekly income of less than $350. Nineteen participants (17%) had a weekly income of $351-$700. Thirty-seven participants (33%) had a weekly income of $701-$1650. Thirty-one participants (27.7%) had a weekly income of $1651-$3500. Six participants (5.1%) had a weekly income of greater than $3500. Six participants did not provide a response about their weekly income.

We pre-registered that we would analyse the sample separately based on the sampling procedure we employed. *The Qualtrics sample*, although not representative, gave us a wide cross-sectional sample (e.g., of gamers and age). *The convenience sample* was recruited through forums related to gaming and through the University, so was more likely to have low diversity in demographic characteristics. As a result we did not combine the two samples for analyses.

Pre-registration

The hypotheses, analyses, stopping rules, and exclusions were pre-registered with AsPredicted. The link to this can be found at https://aspredicted.org/blind.php?x=nv3id6.

Design

We conducted two surveys. One was a cross-sectional sample of NZ participants. We intended this to be stratified by age and income, however due to unforeseen circumstances with the company contracted to undertake this data collection, the sample was unfortunately not representative of the NZ population. The second sample was a self-selected sample from NZ advertised online and by posters on Massey University Campus. The recruitment message for the self-selected sample did not mention loot boxes, but stated we were interested in technology use and gambling. The recruitment message is included in Appendix A.

Materials and Measures

Demographic details about participants were collected, along with quantitative measures of problem gambling, loot box spending, time spent watching loot box opening videos, and video game, downloadable content, and other microtransaction spending. A full copy of the questionnaire can be found in Appendix B

Problem gambling was measured using the PGSI (Ferris & Wynne, 2001). The PGSI has high internal reliability, α = 0.90 (Orford et al., 2010), α = 0.855 (Holtgraves, 2009), and good criterion-related validity as it correlates at 0.83 with both the DSM-IV and the South Oaks Gambling Screen (Ferris & Wynne, 2001). This is a self-assessment tool containing nine questions that asks how often the individual has engaged in behaviour related to problem gambling in the past 12 months. One example is “Has gambling caused you any health problems, including stress or anxiety?”. The respondent answers the questions on a four-point scale: 0 (Never), 1 (Sometimes), 2 (Most of the time), 3 (Almost always). The scores

over the 9 questions are totalled to give a PGSI score from 0-27, where a higher total score indicates a higher risk of problem gambling behaviour. Participants were then divided into four groups: Non-problem gamblers (score of 0), low-risk gamblers (score of 1-2), moderate-risk gamblers (score of 3-7), or problem gamblers (score of 8+). Cronbach's alpha for this study showed high internal reliability, $\alpha = 0.913$. A full scale is in Appendix C.

Loot box spending was measured by first asking participants if they had paid for loot boxes during the past month. If they answered yes, they were then asked how much they had spent in NZ dollars on loot boxes in the past month. If participants had not spent any money they were asked to input zero. To disguise the hypotheses of the survey, questions relating to other video game spending were also included: How much money participants spent purchasing video games in the past month, how much money participants spent purchasing downloadable content in the past month (e.g., new levels), and how much money was spent on other in-game purchases that were not randomised loot boxes. Participants indicated in NZ dollars how much they had spent on these items in the past month. If participants had not spent any money they were asked to input zero. Participants were also asked how often they had used a computer tablet and mobile phone in the past month.

Frequency of watching loot box videos and time spent watching loot box opening videos was measured by first asking participants if they have watched a loot box opening video in the past month on video streaming sites such as YouTube and Twitch. If the participant answered yes to this, the questionnaire then asked how often they have watched someone open loot boxes in the past month. This question had six possible answers: 1 (Once); 2 (Several times); 3 (Once a week); 4 (Almost every day); 5 (Every day); 6 (More than once a day) to ascertain the *frequency of watching loot box opening videos*. We

also asked participants approximately how long they had spent watching someone open loot boxes in the past month. This response was provided in hours and minutes, which we then totalled into minutes, giving a measure of *time spent watching loot box opening videos*.

Procedure

The Qualtrics sample was collected via Qualtrics' survey targeting tool and were reimbursed through Qualtrics. Qualtrics invited participants to participate in the survey through their professional mailing lists provided they were NZ citizens. Participants were directed to a link which contained the survey. Participants were screened during the survey to ensure we captured those who regularly played video games: "In the past month, how often have you played a video game (this includes games on a smart phone or computer tablet)?".

The convenience sample was available to the general public and was collected via postings on the following subreddits from the forum website Reddit: /r/newzealand, /r/palmy, /r/palmerstonnorth, /r/auckland, /r/dunedin, /r/wellington, /r/kiwitech, and /r/aotearoa. Poster advertisements were displayed throughout the university, and online class announcements were also made. The survey was available on Qualtrics from 29th July to September 20th 2019, corresponding with the pre-registered stopping rule. Participants in *the convenience sample* were not compensated for their time.

Exclusions

We pre-registered the following exclusion rules. We had three questions checking that participants were paying attention and were responding seriously to questions; "I once owned a three-headed dog.", "What is 2+2?", and "Please respond 3 to this question.". As

outliers can have a serious effect on analyses, in line with Tabachnick, Fidell, and Ullman (2007) we also excluded participants' data if they had spent > 3.29 Standard Deviations from the mean on loot boxes, if they had total minutes watched loot box opening videos > 3.29 Standard Deviations from the mean, and if they watched loot box opening videos at a frequency > 3.29 Standard Deviations from the mean. If a participant provided a non-serious answer, for example they answered their gender as a meme (e.g., apache attack helicopter), to the gender question they were excluded. We also checked the country participants live in and if their country was not NZ then the survey ended and their data was excluded.

For *the Qualtrics sample,* 107 participants were excluded for incorrectly answering at least one attention check. Sixteen participants were excluded for providing a score > 3.29 Standard Deviations from the mean on loot box spending in the past month (> $94.27), minutes spent watching loot box opening videos (> 2,436.44 minutes), or how often someone watched loot box opening videos (> 5.82). The responses were removed from the analyses. In line with pre-registration, their responses have been included in a separate reported analyses for completeness. One participant responded "not sure" so they were categorised as not having purchased a loot box in the past month. Two participants typed in random letters for loot box spend, therefore were deemed as non-serious and thus their responses were removed from the analyses. Two participants were excluded after indicating 'other' for their country. Twenty-seven participants were excluded for failing to respond to at least 75% of the PGSI questions. This left a total of 313 responses for analysis.

For *the convenience sample,* one participant was excluded for providing a non-serious response to the gender question. Thirty-two participants were excluded for incorrectly answering at least one attention check. Sixteen participants were excluded for providing a score > 3.29 Standard Deviations from the mean on loot box spending in the

past month (> $112.65), total minutes watching loot box opening videos (> 115.66 minutes), or how often they watched loot box opening videos (> 4.45). Six participants were excluded after indicating 'other' for their country. Eighty-five participants were excluded for failing to respond to at least 75% of the PGSI questions. This left a total of 118 responses for analysis.

We had pre-registered that we would implement a pairwise exclusion procedure for participants who answered less than 75% of the PGSI questions. However, no participant who answered less than 75% of the PGSI questions also answered both the loot box opening video questions and the loot box spending question. Due to this, these participants would not have been included in any analysis pre-registered in the present study, and thus we decided to employ a list-wise deletion procedure on their data. This allowed us to be more accurate in the reporting of the number of participants who were included in the final dataset who had provided data which was usable in our analyses.

Results

Descriptive Statistics

For *the Qualtrics sample* the mean PGSI score was 2.52 (*SD* = 4.04, Range 0-19). 166 participants were categorised as non-problem gamblers, 52 were categorised as low-risk gamblers, 56 were categorised as moderate-risk gamblers, and 39 were categorised as problem gamblers. Three hundred and thirteen participants reported they had played a video game in the past month. Ninety participants reported they had watched a loot box opening video in the past month. Thirty-four participants reported they had spent real-world money to purchase loot boxes in the past month. For *the convenience sample* the mean PGSI score was 0.72 (*SD* = 1.80, Range 0-12). 88 participants were categorised as non-problem gamblers, 19 were categorised as low-risk gamblers, nine were categorised as moderate-risk gamblers, and two were categorised as problem gamblers. One hundred and eighteen participants reported they had played a video game within the past month. Twenty-two participants reported they had watched a loot box opening video in the past month. Thirteen participants reported they had spent real-world money to purchase loot boxes in the past month.

Across both samples there was low spending on loot boxes, particularly in *the convenience sample*. For *the convenience sample*, after exclusions, the number of participants in each group was too low to run reliable group testing, and the mean spend in the problem gambling group (and therefore associated Standard Error) was $0. Therefore *t*-tests comparing problem gambling groups for this sample were not employed. This was in line with recommendations of a minimum of 25 participants (Simmons, Nelson, & Simonsohn, 2011), and more recently 50 participants per cell for reliable statistical difference testing (Simmons, Nelson, & Simonsohn, 2018). *The Qualtrics sample* contained

participant numbers which were more aligned with minimum recommendation numbers to justify reliable group testing (Simmons et al., 2011, 2018). For *the Qualtrics sample*, after the exclusion of outliers, the mean spend on loot boxes in the past month was $2.34 (*SD* = $7.97, Range $0-$50). For *the convenience sample*, after the exclusion of outliers, the mean spend on loot boxes in the past month was $2.39 (*SD* = $10.54, Range $0-100). For *the convenience sample* we did not test for differences in group means due to the low sample number, and the mean spend in the problem gambling group in *the convenience sample* being zero. The mean and standard deviation of loot box spending categorised by PGSI group for *the Qualtrics sample* are presented in Table 1.

Table 1

Mean and standard deviation for loot box spending in the Qualtrics sample categorised by PGSI group

PGSI Group	*Loot box spend*	*SD*	*n*
Non-problem gamblers	$0.59	$3.71	165
Low-risk gamblers	$3.44	$10.03	52
Moderate-risk gamblers	$4.35	$9.72	54
Problem gamblers	$5.91	$13.11	34
Totals	$2.34	$7.97	305

Confirmatory Analyses

All confidence intervals for these and all subsequent inferential analyses were bootstrapped with 1000 bootstraps. Pearson's correlation between PGSI Total and loot box spending was conducted for both samples. Correlation coefficients and confidence intervals for *the Qualtrics sample* and *the convenience sample* are shown in Table 2. Conforming to the prediction that there will be a significant positive correlation between problem

gambling symptomology and loot box spending, *the Qualtrics sample* showed a significant small positive correlation between PGSI total and loot box spend[1]. Contrary to the same prediction, *the convenience sample* showed a non-significant small negative correlation between PGSI total and loot box spend[2].

Non-Loot Box Purchases

For *the Qualtrics sample* the mean spend on in-game purchases that were non-randomised in-game purchases was $7.97 (*SD* = $42.35, Range $0-$477). For *the convenience sample* the mean spend on in-game purchases that were non-randomised in-game purchases was $2.99 (*SD* = $9.19, Range $0-$50). We used Pearson's correlation to test the prediction that there was no significant relationship between problem gambling symptomology and in-game purchases that were not randomised loot boxes. Contrary to our prediction, for *the Qualtrics sample* there was a small positive correlation between non-randomised in-game purchases and PGSI total $r(298) = 0.126$, $p < 0.01$, [0.038, 0.305][1]. For *the convenience sample* there was a non-significant negative correlation between non-randomised in-game purchases and PGSI total $r(15) = -0.149$, $p = 0.568$, [-0.364, 0.256][3].

[1] In *the Qualtrics sample* when data points that met the criteria for exclusion were included in the analyses the same association was found for this correlation.
[2] In *the convenience sample* when data points that met the criteria for exclusion were included in the analyses it showed a significant positive moderate assocation for this correlation $r(143) = 0.380$, $p < 0.001$, [0.012, 0.697].
[3] In *the convenience sample* when data points that met the criteria for exclusion were included in the analyses it showed a significant positive small assocation for this correlation $r(143) = 0.238$, $p < 0.004$, [-0.085, 0.588].

Table 2

Problem gambling, loot box spending, loot box opening videos: Correlations, confidence intervals, p values

	PGSI Total	Loot box video watch time	Loot box video watch frequency
Loot box spend (*Qualtrics sample*)	0.269** [0.096, 0.425]	0.326** [0.143, 0.510]	0.294* [0.056, 0.506]
Loot box spend (*convenience sample*)	-0.188 [-0.352, 0. 098]	0.108 [-0.207, 0.680]	-0.266 [-0.501, -0.152]

**Indicates p < 0.01 (2-tailed)
* Indicates p < 0.05 (2-tailed)

Loot Box Spending and Watching Loot Box Opening Videos

For *the Qualtrics sample* the mean time spent watching loot box opening videos in the past month was 134.5 minutes (*SD* = 388.1, Range 0-2093). The mean frequency for watching loot box opening videos was 2.21 (*SD* = 1.01, Range 0-5), which approximately equates to several times in the past month. For *the convenience sample* the mean time spent watching loot box opening videos in the past month was 6.14 minutes (*SD* = 18.57, Range 0-90). The mean frequency for watching loot box opening videos was 1.77 (*SD* = 0.81, Range 1-4), which approximately equates to between once and several times in the past month.

Correlation coefficients and confidence intervals for *the Qualtrics sample* and *the convenience sample* are shown in Table 2. We used Pearson's correlation to test the prediction there would be a significant positive correlation between total time spent watching loot box opening videos and loot box spending for both samples. *The Qualtrics sample* showed a significant moderate positive correlation between time spent watching

loot box opening videos and loot box spending[4]. *The convenience sample* showed a non-significant trivial positive correlation between time spent watching loot box opening videos and loot box spend[5]. For the prediction that there would be a significant positive correlation between how often participants watched loot box opening videos and loot box spending, Pearson's correlation revealed a significant small positive correlation in *the Qualtrics sample*[6]. *The convenience sample* showed a non-significant small negative correlation between how often people watched loot box opening videos and loot box spending[7].

Loot Box Spending and Problem Gambling

We undertook an Analysis of Variance (ANOVA) using PGSI group and the amount of money spent by participants on loot boxes in the past month to determine whether the gambling classification indicated by the PGSI was associated with higher spending behaviour. If there was a significant difference between groups we used *t*-tests to compare a) non-gamblers to low-risk gamblers, moderate-risk gamblers and problem gamblers, b) low-risk gamblers to moderate-risk gambler and problem gamblers, and c) moderate-risk gamblers to problem gamblers to determine which groups have different spending patterns. This was only carried out for *the Qualtrics sample* due to low PGSI group numbers in *the convenience sample,* and no spending in the problem gambling group after exclusions, hence there was no variance and we could not make comparisons. As pre-registered there

[4] In *the Qualtrics sample* when data points that met the criteria for exclusion were included in the analyses it showed a significant positive small assocation for this correlation $r(437) = 0.222$, $p < 0.001$, [0.166, 0.409].
[5] In *the convenience sample* when data points that met the criteria for exclusion were included in the analyses it showed a non-significant positive small assocation for this correlation $r(143) = 0.124$, $p = 0.137$, [-0.033, 0.582].
[6] In *the Qualtrics sample* when data points that met the criteria for exclusion were included in the analyses it showed the same association was found for this correlation.
[7] In *the convenience sample* when data points that met the criteria for exclusion were included in the analyses it showed a non-significant positive small assocation for this correlation $r(143) = 0.108$, $p = 0.197$, [-0.057, 0.464].

was no correction for familywise type 1 error rates for hypotheses that were theoretically driven**.**

ANOVA revealed there were significant differences between PGSI group mean in *the Qualtrics sample* $F(3,298) = 12.05$, $p < 0.001$) for loot box spending. We then undertook *t*-tests to examine differences between each PGSI group for *the Qualtrics sample* to determine if there were significant differences in loot box spending. Zero spending in the problem gambling group for *the convenience sample* did not allow *t-tests* to compare PGSI groups, therefore ANOVA was not carried out. There was only one significant difference in spending between PGSI groups[8]. Specifically, moderate-risk gamblers (M = $4.35, *SD* = $9.72) spent significantly more than non-problem gamblers (M = $0.59, *SD* = $3.71), $t(217) = -4.14$, $p = 0.01$, d = 0.511, 95% CI [0.193, 0.897]. Figure 4 shows loot box spending categorised by PGSI group.

[8] In *the Qualtrics sample* when data points that met the criteria for exclusion were included in the analyses there were no significant differences between PGSI groups in loot box spending.

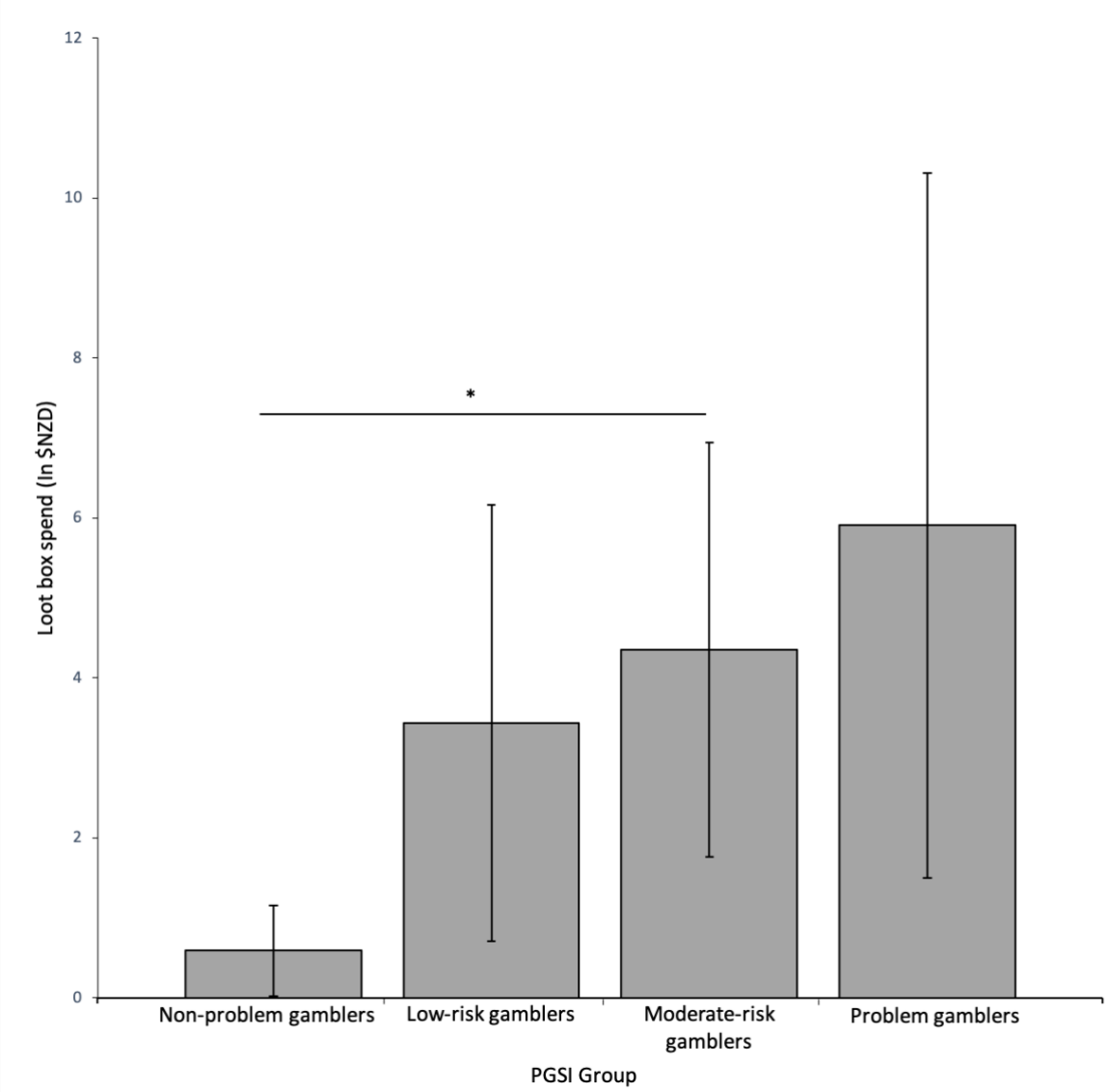

Figure 4. Loot box spending categorised by PGSI group. Error bars represent lower and upper 95% confidence intervals. * indicates statistical significance. All other comparisons were non-significant.

Moderation Analyses

To test the moderating effect of problem gambler status on the relationship between watching loot box videos and the amount of money spent on purchasing loot boxes, we undertook a linear regression including the amount of time participants spent watching loot box opening videos in the past month, the number of gambling symptoms on the PGSI and the interaction between these two variables as independent variables, and the

amount of money participants spent on loot boxes in the past month as the outcome variable. We also undertook a linear regression including the amount of time participants spent watching loot box opening videos in the past month, and PGSI category where non-problem and low-risk gambling were coded as one variable and moderate-risk and problem gambling were coded together as another separate variable, and the interaction between these two variables as independent variables. The amount of money spent on loot boxes in the past month was the outcome variable. This additional analysis was conducted to investigate whether risk category rather than symptomology on a continuum moderated the relationship between watching loot box opening and amount spent on loot boxes.

We firstly tested the moderating effect of problem gambling severity on the relationship between watching loot box opening videos and money spent on loot boxes. For *the Qualtrics sample* the regression model was a significant predictor of loot box spend in the past month $F(3,297) = 18.63$, $p < .001$, $r^2 = 0.150$. The interaction between PGSI total score and total minutes of loot box opening videos watched ($B = 0.001$, 95% CI [-0.001, 0.002], $p = 0.002$) contributed significantly to the model, therefore supporting the prediction that problem gambling symptomology would moderate the relationship between total minutes spent watching loot box opening videos and loot box spending. PGSI total score ($B = 0.213$, 95% CI [0.026, 0.505], $p = 0.079$) and total minutes spent watching loot box opening videos ($B = 0.001$, 95% CI [-0.008, 0.009], $p = 0.941$) did not significantly contribute to the model on their own when the interaction term was included in the regression[9].

[9] In *the Qualtrics sample* when data points that met the criteria for exclusion were included in the analyses the interaction between PGSI total score and total minutes of loot box opening videos watched did not contribute significantly to the model ($B = 0.001$, 95% CI [-0.001, 0.002], $p = 0.057$). PGSI total score did contribute significantly to the model on its own when the interaction term was included in the regression ($B = 1.460$, 95% CI [0.316, 2.603], $p = 0.012$). Time spent watching loot box opening videos did not contribute significantly to the model on its own when the interaction term was included in the regression.

For *the convenience sample* results the regression model was not a significant predictor of loot box spend in the past month $F(3,108) = 0.040$, $p = 0.989$, $r^2 = 0.001$. The interaction between PGSI total score and total minutes of loot box opening videos watched ($B = -0.011$, 95% CI [-0.073, 0.020], $p = 0.758$) did not contribute significantly to the model. This did not support the prediction that problem gambling symptomology would moderate the relationship between total minutes spent watching loot box opening videos and loot box spending. PGSI total score ($B = -0.050$ 95% CI [-0.539, 3.139], $p = 0.951$) and total minutes spent watching loot box opening videos ($B = 0.011$ 95% CI [-0.060, 0.130], $p = 0.864$) also did not contribute significantly to the model on their own when the interaction term was included in the regression[10].

We then tested whether being dichotomously categorised in a high-risk (moderate-risk, problem gambler) gambling group (cf. lower-risk groups) moderated the relationship between total minutes spent watching loot box opening videos and loot box spending. For *the Qualtrics sample* the regression model was a significant predictor of loot box spend in the past month $F(3,297) = 15.09$, $p < 0.001$, $r^2 = 0.132$. The interaction between the lower-risk vs. higher-risk comparison variable and total minutes spent watching loot box opening videos ($B = 0.006$, 95% CI [-0.005, 0.014], $p = 0.051$) did not contribute significantly to the model, though did approach significance[11]. This did not support the hypothesis that problem gambling symptomology, when dichotomously categorised in higher-risk and

[10] In *the convenience sample* when data points that met the criteria for exclusion were included in the analyses the interaction between PGSI total and time spent watching loot box opening videos watched contributed significantly to the model ($B = 0.041$, 95% CI [-0.056, 0.078], $p = 0.010$). PGSI total score ($B = 3.280$, 95% CI [-0.615, 26.038], $p = 0.046$) contributed significantly to the model on its own when the interaction term was included in the regression. Total minutes spent watching loot box opening videos did not.

[11] In *the Qualtrics sample* when data points that met the criteria for exclusion were included in the analyses the interaction between the lower-risk vs. higher-risk comparison variable and time spent watching loot box opening videos contributed significantly to the model ($B = 0.021$, 95% CI [0.004, 0.082], $p < 0.001$). The lower-risk vs. higher-risk comparison variable and time spent watching loot box opening videos did not contribute significantly to the model on their own when the interaction term was included in the regression.

lower-risk gambling groups would moderate the relationship between total minutes spent watching loot box opening videos and loot box spending. The lower-risk vs. higher-risk comparison variable (B = 1.849, 95% CI [0.265, 4.220], p = 0.068) did not contribute significantly to the model, nor did total minutes spent watching loot box opening videos (B = 0.001, 95% CI [-0.001, 0.014, p = 0.675) when the interaction term was included in the regression.

Lastly, we tested the moderating effect of problem gambling severity on the relationship between how often participants watched loot box opening videos and money spent on loot boxes. For *the Qualtrics sample* the regression model was a significant predictor of loot box spend in the past month $F(3,75) = 4.95$, $p = 0.003$, $r^2 = 0.165$. The interaction between PGSI total score and how often participants watched loot box opening videos (B = 0.336, 95% CI [-0.607,0.929], p = 0.214) did not significantly contribute to the model. This did not support the hypothesis that problem gambling symptomology would moderate the relationship between how often participants watched loot box opening videos and loot box spend. Neither PGSI total score (B = -0.080, 95% CI [-1.569, 0.1.410], p = 0.915) nor how often participants watched loot box opening videos (B = 0.336, 95% CI [-0.607, 0.929], p = 0.432) contributed significantly to the model when the effects of the interaction were taken into account[12].

For *the convenience sample* the regression model was not a significant predictor of loot box spend in the past month $F(3,17) = 1.071$, $p = 0.388$, $r^2 = 0.159$. The interaction between PGSI total score and how often participants watched loot box opening videos (B =

[12] In *the Qualtrics sample* when data points that met the criteria for exclusion were included in the analyses the interaction between PGSI total and frequency of watching loot box opening videos contributed significantly to the model (B = 0.743, 95% CI [0.045, 2.164], p = 0.031). PGSI total and frequency of watching loot box opening videos did not contribute significantly to the model on their own when the interaction term was included in the regression.

2.060, 95% CI [-1.588, 7.759], p = 0.341) did not contribute significantly to the model. This did not support the hypothesis that problem gambling symptomology would moderate the relationship between how often participants watched loot box opening videos and loot box spending. How often participants watched loot box opening videos (B = -1.970, 95% CI [-9.580, 0.037], p = 0.303) and PGSI total score (B = 2.870, 95% CI [-12.870, 6.381], p = 0.488) did not contribute significantly to the model on their own when the interaction term was included in the regression[13].

[13] In *the convenience sample* when data points that met the criteria for exclusion were included in the analyses the interaction between PGSI total and frequency of watching loot box opening videos contributed significantly to the model (B = 2.509, 95% CI [-3.171, 4.688], p = 0.011). PGSI total contributed significantly to the model on its own when the interaction term was included in the regression (B = 3.357, 95% CI [-0.866, 22.344], p = 0.044. Frequency of watching loot box opening videos did not.

Discussion

This study investigated the relationship between loot box spending, problem gambling symptoms and watching loot box opening videos using two cross-sectional samples*: a Qualtrics sample* and *a convenience sample*. We found mixed evidence in the two samples. We observed a positive correlation between problem gambling symptomology and loot box spending in *the Qualtrics sample*, which supports our hypothesis, but not in *the convenience sample*. Contrary to our prediction regarding PGSI group differences in loot box spending, we found that only the non-problem and moderate-risk gambler group comparison showed significant differences in loot box spending in *the Qualtrics sample*. All other subgroup comparisons did not show differences in spending. Zero spending and low sample size in the problem gambling group in *the convenience sample* did not allow for PGSI group comparisons.

Although the evidence from this study appears mixed, we had a low sample size and very low spending figures in *the convenience sample*, therefore we interpreted the evidence as generally favouring the hypothesis that problem gambling symptoms are linked to loot box purchasing, especially in the light of the multitude of studies demonstrating this effect (Zendle & Cairns, 2018, 2019; Zendle, Cairns, Barnett, & McCall, 2020; Zendle et al., 2019). How frequently people and the minutes watched loot box opening videos positively correlated with loot box spending in *the Qualtrics sample*, but not in *the convenience sample*. Additionally, we found the association between time spent watching loot box opening videos and loot box spending was stronger for participants with higher problem gambling symptomology (cf. lower problem gambling symptomology). Again, this finding was present in *the Qualtrics sample* but not *the convenience sample*, offering mixed evidence. The association between frequency of watching loot box opening videos and loot

box spending was not stronger for participants with higher problem gambling symptomology (cf. lower problem gambling symptomology). This was observed in both samples. In testing the hypothesis that problem gambling symptomology moderates the relationship between watching loot box opening videos and loot box spending, a larger sample size, more spending and wider demographic characteristics in *the Qualtrics sample*, compared to *the convenience sample*, suggests the evidence from this population may have greater validity. This was the first study to test this relationship, therefore appropriate caution must be applied when interpreting the results. Further future research will be required to replicate these effects to establish their veracity. Contrary to our prediction, we found a positive correlation between non-randomised in-game spending and problem gambling symptomology in *the Qualtrics sample*; however, this was weaker compared to the relationship between problem gambling symptomology and loot box spending. The correlation between non-randomised in-game spending and problem gambling symptomology was not observed in *the convenience sample*. The above results will be discussed in further detail below.

Loot Box Spending is Linked to Problem Gambling

The results of this study provide further evidence of the relationship between loot box spending and problem gambling (Zendle & Cairns, 2018, 2019; Zendle et al., 2020; Zendle et al., 2019). There was a significant small positive correlation between loot box spending in the past month and symptomology on the PGSI in *the Qualtrics sample*. Consistent with our prediction and previous research, as the severity of problem gambling symptomology increased, so too did the average monthly spending on loot boxes. However, analyses revealed for *the Qualtrics sample* that the only significant group difference in

average monthly spending on loot boxes was between non-problem gamblers and moderate-risk gamblers, with the other groups showing no significant differences. This may be due to having relatively small sample sizes in the PGSI subgroups which resulted in low power. Alternatively, grouping gambling symptomology according to the PGSI may not be appropriate. Orford et al. (2010) suggest that thinking is shifting towards viewing problem gambling as a disorder with severity occurring on a continuum, as opposed to a discrete categorisation approach that sees problem gambling as a disorder where the criteria is either met or not met. The view of continuity may be a more appropriate way to handle data in a population survey (Orford et al., 2010). Additionally, collapsing a continuous variable into discrete categories can reduce the power to detect relationships between that variable and other variables (Cohen, 1983). In this study, collapsing problem gambling symptomology into PGSI groups may have reduced statistical power, therefore overshadowing group differences in loot box spending. In *the convenience sample* low PGSI group numbers and the problem gambling group having zero spending on loot boxes did not allow for reliable *t-tests* to be conducted. As such, comparisons about significance in group differences could not be made. *The convenience sample* also did not show any significant correlations, not even the typical relationship between problem gambling symptomology and loot box spending. This is most likely due to a low sample size and low loot box spending in the *convenience sample*. Therefore, although it appears our studies yielded mixed results, we must be cautious when making statements based on *the convenience sample*. With this in mind, we suggest that taken together, the evidence favours the interpretation that loot box spending is linked to problem gambling symptomology.

Our results from *the Qualtrics sample* are consistent with Zendle and Cairns (2019), who found a small-moderate positive relationship between problem gambling and loot box

spending, but found no differences between non-gambler, low-risk, moderate-risk and problem gamblers in loot box spending. Both studies appear inconsistent with the results of Zendle and Cairns (2018) who found significant differences between the PGSI groups in loot box spending. An important limitation in the research by Zendle and Cairns (2018) was that the participants were potentially aware of the aims of the study. This implies that the findings from Zendle and Cairns (2019) may be more robust, and, importantly, show similarities with the results of this study. This suggests a more accurate reflection of the relationship between problem gambling and loot box spending. A potentially important relationship does seem to exist, but caution must be applied when suggesting those who are categorised in higher problem gambling risk groups by the PGSI (e.g., moderate or problem gamblers), are more at risk; loot box spending did increase with gambling symptomology, but reliable differences in loot box spending did not emerge when participants were classified into risk groups as per the PGSI. Considering this, the results of this study nevertheless tend to suggest that loot box spending increases with an increase in problem gambling severity.

Although the general lack of group differences in *the Qualtrics sample* was contrary to our hypothesis, this result may be due to the categorisation of problem gambling symptomology. Despite the correlations from this study suggesting that as symptomology increases so too does spending on loot boxes, when this symptomology was split into groups it did not show significant differences in spending. As already discussed, Orford et al. (2010) suggest that the development of the PGSI indicates a shift towards thinking of problem gambling on a continuum; however, the PGSI still categorises people into discrete groups, that is as 'meeting' the criteria for non-problem, low-risk, moderate-risk, or problem gambler groups. A better way to view problem gambling may be on a continuum, similar to

what we have produced with the correlations which show higher spending with higher problem gambling symptomology. Moreover, this study utilised the original coding scheme for the PGSI (Ferris & Wynne, 2001) and not the revised one (Currie et al., 2013). The revised coding scheme slightly modifies the cut-offs for the low- and moderate-risk gamblers so that the spending of these groups on traditional gambling acitivies is more closely tied to their gambling classificiation (Currie et al., 2013). As the revised coding scheme does not alter classification of non-problem and problems gamblers it is unlikely to have made a large difference to our PGSI group comparison results on loot box spending, especially given the high variability in spending in the problem gambling group.

Caution must also be applied in assuming the consistency of the 'general' PGSI score to the specific activity of loot box purchasing. Similar to our findings, Monson, Kairouz, Perks, and Arsenault (2019) examined the consistency of moderate-risk and problem gamblers PGSI scores in 'general' and activity-specific gambling (i.e., within specific types of gambling such as lotteries or poker machines). Monson et al. (2019) demonstrate that participants who are classified as problem gamblers 'generally' may not show a similar level of problem gambling behaviour in low-risk gambling behaviours (e.g., lotteries), compared to high-risk gambling activities (e.g., video lottery terminals/poker machines). This implies that, in particular gambling settings, moderate or problem gamblers may not exhibit, or may display more of every problematic gambling behaviour. Monson et al. (2019) suggest that 'general' PGSI scores showing low consistency across all types of gambling could be due to some gambling activities being high-risk (e.g., slot machines) and others being low-risk (e.g., lottery). The authors conclude that researchers collecting population surveys should be cautious about attributing 'general' PGSI scores to specific gambling activities, as it might

lead to the underestimating of those activities and their relationship with problem gambling symptomology.

In our study, the findings from Monson et al. (2019) may be relevant. Firstly, loot boxes (if classified as a gambling activity) may not be as high-risk as some other forms of gambling (e.g., slot machines), but may be higher-risk than other gambling activities (e.g., lotteries). Monson et al. (2019) observed fewer problem gamblers in those who engaged with lottery gambling, which the authors deemed as a lower-risk gambling activity. Finding significant differences between non-problem and moderate-risk gamblers, but not between non-problem and problem gamblers could be a reflection of this. The engagement and thus spending on loot boxes may be clustered towards more moderate-risk gamblers as it could be a 'medium-risk' gambling activity. If loot box purchasing is a 'medium-risk' gambling activity then it may be less preferred for high-risk gamblers, and this could reduce the mean spending among the problem gambling group due to them migrating to higher-risk gambling activities, overshadowing any potential group differences.

Observing non-significant differences between groups may also be due to sample size – there were 52 low-risk, 56 moderate-risk, and 39 problem gamblers in *the Qualtrics sample*. While the sample size was sufficient to undertake group comparisons (Simmons et al., 2011, 2018), consistent with Zendle and Cairns' (2019) explanation, a difference in the real world may be present, however, the sample size was not big enough to demonstrate significant differences. As discussed, the statistical power of sample may be further reduced when problem gambling symptomology is collapsed into categories (Cohen, 1983). Less statistical power from a small sample size and collapsing PGSI scores into categories may therefore account for finding non-significant PGSI group differences in loot box spending.

One important point is that the direction of causality remains unclear. Structural similarities between loot boxes and gambling may open the doorway to problem gambling, the attractiveness of loot boxes may entice problem gamblers into another gambling-like activity, or the relationship is bi-directional. In any scenario the excessive spending has potential for harm (Zendle et al., 2020). This is a longer term question that will have important implications. Evidence suggests that the relationship between gambling and loot boxes is complex and may be affected by a multitude of factors. This study suggests that one such factor is exposure to loot box opening videos.

Watching Loot Box Opening Videos is Linked to Loot Box Spending

One major contribution of the present research is that our correlation results showed that, for *the Qualtrics sample,* the more minutes participants spent watching loot box opening videos, the more money they also spent on loot boxes. Similarly, the more frequently participants watched loot box opening videos corresponded with an increase in the amount of money they spent purchasing loot boxes. This is in line with our predictions that those who more frequently watch and spend more minutes watching loot boxes would spend more money on purchasing loot boxes. *The Qualtrics sample* showed a significant small positive correlation between time spent watching loot box opening videos and loot box spending. However, *the convenience sample* showed a non-significant small positive correlation for the same relationship. Additionally, *the Qualtrics sample* showed a significant small positive correlation between how often participants watched loot box opening videos and loot box spending. *The convenience sample* showed a non-significant negative correlation for the same relationship. As previously discussed*, the convenience sample* had a low sample size and low loot box spending, which may explain the difference in the

correlations between the two samples. *The Qualtrics sample* corresponds with Zendle (2019) in showing a potentially important relationship between loot box spending and watching pre-recorded and live streams of loot box opening videos. Zendle (2019) only looked at how often people watched these videos, not how long they had spent watching them. Therefore, to our knowledge, this research is the first to look at the relationship between loot box spending and the time spent watching loot box opening videos. This shows that it is not just how often people are watching the loot box opening videos that is associated with loot box spending; how long people watch loot box opening videos is also associated with how much money they spend purchasing loot boxes. This suggests that increased exposure time to loot box opening videos may be an important antecedent to loot box spending. As previously noted, the correlational nature of research requires additional experimentation and/or longitudinal research to establish causality in these relationships.

These results appear to support the theory that people are adopting loot box spending behaviours through Social Cognitive Theory mechanisms upon watching loot box opening videos. As with the other relationships, due to the correlational nature of the research, the direction of causality is not clear; it may be that people are being influenced by these videos to purchase loot boxes, or it may be that those who already buy loot boxes actively seek out loot box opening videos due to their interest in the mechanism. The relationship may also be bi-directional or driven by an unmeasured third variable. One crucial factor to consider in this relationship is whether problem gambling symptomology moderates this relationship, as it may indicate who, in particular, is most at risk of loot box overspending.

Problem Gambling and Watching Loot Box Opening Videos is Linked to Loot Box Spending

The results of the moderation analysis for *the Qualtrics sample* suggest that the interaction between problem gambling symptomology and watching loot box opening videos is an important factor in the relationship between loot box spending and watching loot box opening videos. When the interaction between problem gambling symptomology and time spent watching loot box opening videos was included in regression analyses it explained a significant amount of the variance in loot box spending. The interaction suggests that problem gambling symptoms alone are not associated with spending, but that having both problem gambling symptoms and being involved in loot box culture such as watching loot box opening videos combine to be a meaningful risk factor for increased spending on loot boxes. This should not be taken to mean that problem gambling symptoms are not influencing loot box spending, but rather implies that those problem gamblers who are watching more loot box opening videos are also spending more on loot boxes. Moreover, loot box opening videos in the absence of problem gambling symptoms were not associated with loot box spend when the interaction term is accounted for, suggesting that loot box opening videos by themselves are not associated with increased spending. This may indicate that watching these videos appears to have a minimal impact on people without gambling symptoms. Importantly, the interaction term between the combination of problem gambling symptoms and time spent watching loot box opening videos suggests that the relationship between time spent watching loot box opening videos and loot box spending is stronger for those with higher problem gambling symptomology (cf. lower problem gambling symptomology). This identifies a potentially important combination of risk factors for people to spend more money on loot boxes – individuals with problem gambling symptomology who also watch loot box opening videos. *The convenience sample* did not

show this same relationship; the interaction between problem gambling symptomology and time spent watching loot box opening videos did not explain a significant amount of the variance in loot box spending. The different results observed in *the Qualtrics sample* and *the convenience sample* underscores the importance of analysing the relationship again in future research, bearing in mind the aforementioned concerns with quality of the data in *the convenience sample*.

We also undertook a regression analysis that investigated whether problem gambling risk category rather than problem gambling symptomology on a continuum moderate the relationship between time spent watching loot box opening videos and loot box spending. Non-problem and low-problem gamblers were coded as one variable and moderate-risk and problem gamblers were coded together as another separate variable. For *the Qualtrics sample* and *the convenience* sample, the interaction between problem gambling risk category and time spent watching loot box opening videos did not explain a significant amount of variance in loot box spending. This suggests that the relationship between watching loot box opening videos and loot box spending was not stronger for participants categorised in a higher-risk gambling group (cf. lower-risk gambling group). This provides further support for the idea that viewing problem gambling on a continuum rather than in discrete categories may be more appropriate when conducting population surveys (Orford et al., 2010). While both samples showed this result and there is consistency, caution must be applied in saying *the convenience sample* replicated the findings of *the Qualtrics sample*; there was a low sample size, and low diversity in demographic characteristics in *the convenience sample* compared to *the Qualtrics sample.* This highlights the necessity for the relationships to be replicated in order to establish the veracity of the relationship.

In addition to collecting how long participants watched loot box opening videos we also collected how frequently participants watched loot box opening videos (e.g., once a week, several times a week). The regression analyses for *the Qualtrics sample* and *the convenience sample* revealed that the interaction term of problem gambling symptomology and how often participants watched loot box opening videos did not explain a significant amount of variance in loot box spending. Finding no effect in the interaction suggests that the association between how often someone watches loot box opening videos and loot box spending is not stronger for those with higher problem gambling symptomology (cf. lower problem gambling symptomology). This provides an important distinction from the interaction between problem gambling symptomology and minutes spent watching loot box opening videos. How frequently someone watches loot box opening videos appears to have a minimal impact on loot box spending behaviours, and rather the dose, or how long people watch the videos for, seems to be associated with increased spending when in combination with problem gambling symptomology. This explanation appears to have a high degree of face validity, because watching loot box opening videos several times a week but for only 30 seconds or a minute, for example, may not plausibly expose watchers to enough of the activity to significantly impact loot box purchasing behaviour. Where the association appears to be present is for people who are watching loot box opening videos for longer periods of time. Longer exposure to loot box opening videos may increase the potential for Social Cognitive Theory learning opportunities and availability heuristics to be invoked, potentially leading to an overrepresentation of the positive outcomes of opening loot boxes. This could culminate in sufficient inducement to spend money on loot boxes if the person is also exhibiting problem gambling symptomology. This is further supported by the finding that how often participants watched loot box opening videos was not associated with loot

box spending in the absence of problem gambling symptomology. While the results of the regression analysis were contrary to our prediction, it suggests that total time spent, not frequency of, watching loot box opening videos could be an important antecedent to loot box spending, when in combination with problem gambling symptomology. However, the fact that one interaction term (i.e., problem gambling symptomology and time spent watching loot box opening videos) was statistically significant, and the other interaction term (i.e., problem gambling symptomology and how frequently participants watched loot box opening videos) was not statistically significant does not necessarily imply they are significantly different from one another, so the results should be treated with appropriate caution (Gelman & Stern, 2006). Again, while both samples demonstrated the same result for this regression analysis, the limitations in *the convenience sample* accentuates the need for replication.

In identifying groups that are most at risk of excessive spending on loot boxes it is important to discuss the outliers in the data. For loot box spending, in *the Qualtrics sample,* there were ten data points excluded from the sample due to them being more than 3.29 Standard Deviations from the mean. The majority of these outliers were also classified as problem gamblers according to the PGSI. When these higher spending values were included in the analysis, the correlation between loot box spending and problem gambling symptomology was stronger, and problem gambling symptomology became significantly related to loot box spending in the regression analyses. This suggests that perhaps the relationship between problem gambling symptomology and loot box spending is at least partially due to a small number of problem gamblers disproportionately spending on loot boxes; however, even when relatively conservative outlier exclusions were applied the significant positive correlation between problem gambling symptomology and loot box

spending was still present, albeit slightly weaker. Furthermore, problem gambling symptomology and total time spent watching loot box opening videos still interacted to produce stronger associations between time spent watching loot box opening videos and loot box spending for those with higher problem gambling symptomology (cf. lower problem gambling symptomology) to highlight a risk factor for excessive loot box spending. This suggests that while these higher spenders appear to have an influence in the relationship, it is not entirely driven by this small number of people.

Although the cross-sectional nature of the present study makes it difficult to extrapolate the causal direction of these relationships, the data from *the Qualtrics sample* suggests that people exhibiting problem gambling symptomology who are also watching loot box opening videos are spending more money on the gambling-like activity of loot boxes. Loot box opening videos, whether they are streamed live on media platforms or are pre-recorded, are freely and widely available. There are no age restrictions on the videos, there is no cost-barrier to watching the videos (viewers can subscribe to content creator channels for a cost; however, there is no requirement to do so). There are thousands of these videos available which range between minutes and hours in length, and few content warnings about the gambling-like activity are shown (warnings on videos may mention it is for a mature audience due to issues such as offensive language, though often no age checks are employed). Future research should further investigate if age restrictions or regulations for loot box opening videos would be appropriate.

There is well documented concern about the lack of regulation of loot boxes. They are readily accessible to children and adolescents who may be more vulnerable to the development of problem gambling behaviour in the future, potentially owing to factors such as poorer impulse control (Drummond & Sauer, 2018; Zendle et al., 2019). When loot box

opening videos are added into the equation, and considering many young people have easy access to and are watching these videos (House of Commons Digital Culture Media and Sports Committee, 2019; Zendle, 2019), this raises further concern about their potential role in problem gambling behaviour. If people are watching loot box opening videos, which are thought to exhibit gambling-like stimuli, this may create observational learning through Social Cognitive Theory mechanisms, and this may mislead people to over-represent the positive outcomes of loot boxes. For instance, loot box opening videos may create availability heuristics that result in people overestimating the odds of winning and portray positive consequences in engaging with loot boxes, irrespective of whether this is factually correct. In doing so, these videos may encourage vulnerable populations (e.g., problem gamblers, young people) to participate in loot box purchasing. Exposure to gambling at a young age is associated with problem gambling in later life (Johansson et al., 2009). If further research demonstrates that watching loot box opening videos is a causal factor in loot box spending the additive effect of problem gambling symptomology and exposure to loot box opening videos may increase the likelihood that gambling behaviours are learned and reproduced, especially for younger populations. The “ripe breeding ground” (Drummond & Sauer, 2018, p. 532) for problem gambling that includes video gamers, young people, and males, might be even more likely to result in the development of psychological dysfunction and distress when considering the additive risk factors of problem gambling symptomology and loot box opening videos.

Non-Randomised In-Game Purchases and Problem Gambling Symptomology

We found a small significant positive correlation between non-randomised in-game purchases and problem gambling symptomology in *the Qualtrics sample*, and a non-

significant negative correlation in *the convenience sample*. The correlation in *the Qualtrics sample* was weaker than the relationship between problem gambling symptomology and loot box spending. The finding from *the convenience sample* supports our hypothesis that we would find no positive association between non-randomised in-game purchases and problem gambling symptomology. However, as already discussed, low sample size and low spending in *the convenience sample* suggests the relationship observed in *the Qualtrics sample* may provide a more valid indication of the association. This is supported by *the Qualtrics sample* showing consistency with Zendle and Cairns (2018) and Zendle et al. (2019). They showed a significant relationship between other in-game micro-transaction spending and problem gambling symptomology, but this was weaker than the relationship between problem gambling symptomology and loot box spend. Zendle and Cairns (2019) found the relationship between other in-game micro-transactions and problem gambling symptomology was stronger than that documented by Zendle and Cairns (2018), but was still weaker compared to the relationship between loot box spend and problem gambling symptomology. These results suggest that people with symptoms of impulse control disorders (such as gambling disorder) are compulsively engaging in a variety of in-game spending activities, with loot boxes being prominent. The present study showed, in *the Qualtrics sample,* that an increase in problem gambling symptomology corresponded with a stronger positive association with loot box spending behaviour than other in-game purchases. This suggests that in a NZ sample, people exhibiting problem gambling symptomology are not just spending increased amounts of money on any video game purchases, but appear to be especially likely to spend more money purchasing items using mechanisms with specific gambling-like features in-game (i.e., loot boxes).

Limitations

As already mentioned, one limitation of the present study was that there was a small sample size for *the convenience sample* (*n* = 119). One contributing factor was that we could no longer post the survey on the /r/gaming subreddit, which was previously successfully used to recruit samples for this area of research (Zendle & Cairns, 2018). Though we were able to post on some smaller subreddits, such as /r/newzealand and /r/auckland. When it came time to post on /r/gaming their rules had changed and we could no longer post the survey there which limited our ability to obtain a larger sample size. This resulted in us not reaching the preregistered target of 1000 participants for *the convenience sample*. Additionally, after exclusions, the problem gambling group had zero variance in loot box spending. This resulted in the inability to make PGSI subgroup comparisons for *the convenience sample*. Participants in *the convenience sample* being recruited from Reddit could limit our ability to generalise the results to all gamers. Gamers on Reddit may have more awareness of loot box controversies compared to gamers who do not use Reddit, for example, and have greater motivation to participate. Subsequently, caution should be employed in making any statements based on results from *the convenience sample* due to the small sample size and low spending eliminating our ability to make subgroup comparisons.

Due to *the convenience sample* not being reimbursed for their time there is a high probability that these participants self-selected to participate in the study due to their interest in the topic at a higher rate compared to *the Qualtrics sample* who were reimbursed for their time. This could potentially bias results if participants from *the convenience sample* are responding due to having a particular stance regarding loot boxes. We only mentioned the survey involved technology and gambling and made no specific

reference to loot boxes; however, some participants may have had a pre-conceived idea which influenced their participation and responses. To address the limitations in previous research, and in anticipation of limitations that could be present in *the convenience sample* we attempted to recruit a representative sample through Qualtrics. Unfortunately, Qualtrics failed to recruit a truly representative sample. However, the broader distribution of the survey did result in a good cross-section of ages, which implies that while the data were not representative, *the Qualtrics sample* was more diverse in its demographic characteristics compared to *the convenience sample*. Furthermore, this was a correlational study so while potentially important relationships have been shown, there is no ability to make any statements about causality.

There was low spending overall on the variety of in-game purchases, and this may have contributed to observing no differences between PGSI groups on loot box spending. While this could be viewed as a limitation of the study, it may just be reflective of how the NZ population interacts with gaming-related spending. Alternatively, a contributing factor to this may be the methodological design of the study. We asked participants to self-report how much money they had spent on loot boxes in the past month. While this is a relatively recent timeframe, estimates can still be imprecise with self-reporting due to factors such as cognitive dissonance (Kahn, Ratan, & Williams, 2014) and memory (Stone, Bachrach, Jobe, Kurtzman, & Cain, 1999), which may lead to underestimating or overestimating loot box spending. These potential inaccuracies may also exist when participants self-report frequency and length of watching loot box opening videos. For example, a person who engages with loot box opening videos for substantial lengths of time may struggle to recall the hours and minutes they spent watching and provide an inaccurate estimate.

Gender imbalance in sampling has been a point of concern in previous research on loot boxes, for example, Macey and Hamari (2019) and Zendle and Cairns (2018) had only 5.5% and 9% female participants in their samples, respectively. Meanwhile 31% of the sample in Zendle and Cairns (2019) were female. This study contrasted for *the Qualtrics sample* where 63% of participants identified as female. This overrepresentation of women appeared to be due to issues arising from the survey collection procedure. While *the Qualtrics sample* had a better gender balance than the earlier studies, it overrepresented females and presents problems for the representativeness of the sample. While we are able to determine relationships between gambling, gaming, loot boxes, and time spent watching loot box opening videos, because the sample does not appear to be truly representative, there is potential for our estimates to be less precise than would be obtained from a truly representative sample. Future work exploring these relationships using a more representative sample would provide more confidence in the generalisability of our findings.

One issue with the use of PGSI instrument is that the classification of loot boxes as gambling is under contention, so it is not clear as to whether loot box purchasing is considered to be gambling by the person and if they participate in other modes of gambling. For instance, if a person participates in no other gambling activities they will receive a low score on the PGSI even if they participate in gambling-like activities such as the purchasing of loot boxes (Drummond & Sauer, 2018). This may have artificially reduced the relationship between loot box spending and PGSI symptomology. The PGSI categories were developed for 'traditional' gambling, therefore extrapolating this index to a measure whose status as gambling is unclear to participants may not reflect the most accurate relationship to explain the increase in loot box spending. Other explanations have been offered for this

relationship, for example, King and Delfabbro (2018) have explored whether internet gaming disorder symptomology contributes to gambling-like behaviour and harm. Additionally, some items on the PGSI require, by the individual, a recognition of problem gambling on their part. Some populations, women and indigenous people for example (Young & Stevens, 2008), can be reluctant to endorse these questions which may produce an underrepresentation of problem gambling groups (Orford et al., 2010)

Lastly, there was a large number of participants (*n* = 107) in *the Qualtrics sample* who failed at least one attention check in the survey and were subsequently excluded from analyses. The attention checks were: "I once owned a three-headed dog.", "What is 2+2?", and "Please respond 3 to this question." These attentions checks were not particularly onerous, so this is a surprising result. This suggests the sample may have been inattentive as a whole. While the attention checks are designed to minimise the proportion of non-serious participants and their responses, there may be more participants that passed the attention checks and provided data that influenced our outcomes.

Future research

This study has demonstrated potentially important relationships between problem gambling, loot box spending, and loot box opening videos. It will be important to explore if these can be replicated and if they exist for other populations, or if different relationships emerge. Regarding loot box opening videos and the connection to loot box spending, it will be useful to examine motivations behind watching loot box opening videos, emotions and thoughts tied to loot box opening videos, and emotions and thoughts about loot boxes both before and after watching loot box opening videos. Such investigations could help reveal more about where loot box opening videos sit in the problem gambling-loot box

relationship. For example, it might be that loot box opening videos trigger cognitions and emotions similar to those experienced when gambling. The fact that gambling symptomology appears to be consistently linked with higher loot box spending suggests it is likely an important antecedent to loot box spending (Zendle & Cairns, 2018, 2019; Zendle et al., 2019). Future experimental and longitudinal research should attempt to determine whether loot box opening videos have a causal influence, and assist in shedding more light on whether problem gambling symptomology is a causal factor in loot box spending.

Recent behavioural research has shown increased physiological activity, specifically in the form of increased Skin Conductance Response, to receiving a rare item upon opening a loot box (Larche, Chini, Lee, Dixon, & Fernandes, 2019). This suggests that it might be important to investigate the physiological response to watching rare rewards being received on loot box opening videos. For example, a person watching loot box opening videos who produces a similar Skin Conductance Response to a person directly receiving valuable items from loot boxes could provide support for the role that loot box opening videos play in loot box spending. Alternatively, an observable but smaller physiological response (such as Skin Conductance Response) may reflect the observational learning that loot box opening videos may produce. Additionally, to clarify the physiological response to opening loot boxes, measuring response to loot box openings among those with problem gambling symptomology may reveal important information about interactions with loot boxes. Along these lines, Brady and Prentice (2019) found a hyposensitive, compared to baseline, Galvanic Skin Response and Heart Rate to opening a loot box amongst participants with higher amounts of excessive gaming use. Further research would need to explore if this finding is similar amongst people with higher problem gambling symptomology.

Conclusion

This study has provided further support for the relationship between problem gambling and loot box spending, using a large cross-sectional NZ sample. This research has also revealed the relationship between loot box opening videos and loot box spending. Analyses have shown that as problem gambling symptomology increased, so too did loot box spending. Likewise, for participants who watched loot box opening videos for longer, their loot box spend in the past month was higher. This appeared to be particularly true for people with higher problem gambling symptomology. The significant interaction between problem gambling symptomology and total time spent watching loot box opening videos highlighted a potential risk factor for overspending on loot boxes – those who show problem gambling symptomology and watch loot box opening videos. This combination was not present for how often participants watched loot box opening videos and problem gambling symptomology, suggesting that how long people watch loot box opening videos (and not how frequently) is associated with and might be an important determinant in loot box spending. Importantly, for people without problem gambling symptomology there appears to be a minimal relationship between watching loot box opening videos in the relationship with loot box spending. This is useful for identifying those who may be at a higher risk of overspending on loot boxes (i.e., people who watch loot box opening videos and exhibit problem gambling symptomology) and could help inform appropriate responses in addressing excessive spending on the gambling-like mechanism of loot boxes.

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Appendices

Appendix A

Recruitment message on Reddit

Hi r/"…" I am from Massey University in Palmerston North completing a Masters project. I am conducting a survey on the New Zealand population focusing on gambling and video gaming. It would be much appreciated if you could follow the below link and complete the survey. This will take approximately 15 minutes and will remain anonymous and confidential. This survey is for New Zealand participants only, if you are not from New Zealand another related survey will start soon which you will be able to participate in. We appreciate your time and responses.

Appendix B

Survey Questionnaire

VG MURF 2019

Video Games and Cognition
You are being invited to take part in a research study. Before you decide whether or not to take part, it is important for you to understand why the research is being conducted and what it will involve. Please take the time to read the following information carefully and decide if you want to take part in this study.

You will be asked to complete a brief survey by Qualtrics, which will ask about things like your age, use of technology, including video games and your gambling behaviour. If you are distressed by any of the questions or require any advice about how to manage your gambling behaviour, you can contact the relevant helpline for free in your country. *For New Zealand, contact The Gambling Helpline on 0800 654 655.* The entire questionnaire will last approximately 15 minutes.
Do I have to take part? Participation in this study is completely voluntary, you are under no obligation to take part in this study. The data that you provide will be very useful for our study. You have the right to withdraw from the study at any time (by failing to finish this questionnaire) and without giving a reason. Completion and return of the questionnaire implies consent. You have the right to decline to answer any particular question.
What happens to the information I provide? The information you provide will be confidential. No one apart from the research team (led by the Primary Investigator below) will have access to identifiable information that you provide. Any personally identifiable data will be securely stored for a five-year period after which all personally identifiable information will be destroyed. Once the data is analysed a report of the aggregate findings will be submitted for publication and the de-identified data will be made publicly available for verification by other researchers. It will not be possible to identify any individuals from the public dataset. The results of this study may be used for academic publication and government submissions. If you would like to receive a copy of these results, please provide your e-mail address at the end so we may provide you with a copy of our findings upon conclusion of this study. This e-mail address will be kept for the sole purpose of providing this information to you as requested, will be kept separate from the observations collected during the course of this study and will only be available to the research team.
Who is conducting this research? This study is being conducted by Qualtrics on behalf of researchers in the School of Psychology at Massey University, New Zealand, in collaboration with academic researchers in Australia and The United States of America. The primary

investigator listed below is responsible for overseeing the project. If you have any questions or require any further information, you may contact the primary investigator.
Primary Investigator: **Dr. Aaron Drummond**
E-mail: **a.drummond@massey.ac.nz**
Research Integrity and Ethics Concerns about this project may be raised with the primary investigator Dr. Aaron Drummond by telephone at +64 6 356 9099 (ext. 86238) or email at a.drummond@massey.ac.nz. *This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 19/11. If you have any concerns about the conduct of this research, please contact Dr Rochelle Stewart-Withers, Chair, Massey University Human Ethics Committee: Southern B, telephone 06 356 9099 x 83657, email humanethicsouthb@massey.ac.nz* Thank you for taking the time to read this Participant Information and considering taking part in this study. If you do wish to take part in the study, please click to continue with this questionnaire.

Q1 In which country do you live?

- ○ New Zealand
- ○ Other (please specify) _____

Q2 Indicate the extent you have felt this way over the past week.

	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
Interested	○	○	○	○	○
Distressed	○	○	○	○	○
Excited	○	○	○	○	○
Upset	○	○	○	○	○
Strong	○	○	○	○	○
Guilty	○	○	○	○	○
Scared	○	○	○	○	○
Hostile	○	○	○	○	○
Enthusiastic	○	○	○	○	○
Proud	○	○	○	○	○
Irritable	○	○	○	○	○
Alert	○	○	○	○	○
Ashamed	○	○	○	○	○
Inspired	○	○	○	○	○
Nervous	○	○	○	○	○
Determined	○	○	○	○	○
Attentive	○	○	○	○	○

Jittery	○	○	○	○	○
Active	○	○	○	○	○
Afraid	○	○	○	○	○

Q3
Thinking about the last 12 months, have you bet more than you could really afford to lose?

- ○ Never
- ○ Sometimes
- ○ Most of the time
- ○ Almost always

Q4 Still thinking about the last 12 months, have you needed to gamble with larger amounts of money to get the same feeling of excitement?

- ○ Never
- ○ Sometimes
- ○ Most of the time
- ○ Almost always

Q5 When you gambled, did you go back another day to try to win back the money you lost?

- ○ Never
- ○ Sometimes
- ○ Most of the time
- ○ Almost always

Q6 Have you borrowed money or sold anything to get money to gamble?

- ○ Never
- ○ Sometimes
- ○ Most of the time
- ○ Almost always

Q7 Have you felt that you might have a problem with gambling?

- ○ Never
- ○ Sometimes
- ○ Most of the time
- ○ Almost always

Q8 Has gambling caused you any health problems, including stress or anxiety?

- ○ Never
- ○ Sometimes
- ○ Most of the time
- ○ Almost always

Q9 Have people criticized your betting or told you that you have a gambling problem, regardless of whether or not you thought it was true?

- ○ Never
- ○ Sometimes
- ○ Most of the time
- ○ Almost always

Q10 Has your gambling caused any financial problems for you or your household?

- ○ Never
- ○ Sometimes
- ○ Most of the time
- ○ Almost always

Q11 Have you felt guilty about the way you gamble or what happens when you gamble?

- ○ Never
- ○ Sometimes
- ○ Most of the time
- ○ Almost always

Q12 What is 2 + 2?

- ○ 1
- ○ 2
- ○ 3
- ○ 4

Q13 During the last 30 days, about how often did you feel tired out for no good reason?

- ○ None of the time
- ○ A little of the time
- ○ Some of the time
- ○ Most of the time
- ○ All of the time

Q14 During the last 30 days, about how often did you feel nervous?

- ○ None of the time
- ○ A little of the time
- ○ Some of the time
- ○ Most of the time
- ○ All of the time

Q15 During the last 30 days, about how often did you feel so nervous that nothing could calm you down?

- ○ None of the time
- ○ A little of the time
- ○ Some of the time
- ○ Most of the time
- ○ All of the time

Q16 During the last 30 days, about how often did you feel hopeless?

- ○ None of the time
- ○ A little of the time
- ○ Some of the time
- ○ Most of the time
- ○ All of the time

Q17 During the last 30 days, about how often did you feel restless or fidgety?

- ○ None of the time
- ○ A little of the time
- ○ Some of the time
- ○ Most of the time
- ○ All of the time

Q18 During the last 30 days, about how often did you feel so restless you could not sit still?

- ○ None of the time
- ○ A little of the time
- ○ Some of the time
- ○ Most of the time
- ○ All of the time

Q19 During the last 30 days, about how often did you feel depressed?

- ○ None of the time
- ○ A little of the time
- ○ Some of the time
- ○ Most of the time
- ○ All of the time

Q20 During the last 30 days, about how often did you feel that everything was an effort?

- ○ None of the time
- ○ A little of the time
- ○ Some of the time
- ○ Most of the time
- ○ All of the time

Q21 During the last 30 days, about how often did you feel so sad that nothing could cheer you up?

- ○ None of the time
- ○ A little of the time
- ○ Some of the time
- ○ Most of the time
- ○ All of the time

Q22 During the last 30 days, about how often did you feel worthless?

- ○ None of the time
- ○ A little of the time
- ○ Some of the time
- ○ Most of the time
- ○ All of the time

Q23 In the past month, how often have you used a smart phone or computer tablet?

- ○ Never
- ○ Sometimes
- ○ Most days
- ○ Almost every day

Q24 In the past month, how often have you played a video game (this includes games on a smart phone or computer tablet)?

- ○ Never
- ○ Sometimes
- ○ Most days
- ○ Almost every day

Q25 In the past month, how much did you spend in dollars buying video games? *(If you did not spend any money on this, please enter 0).*

_____

Q26 In the past month, how much did you spend in dollars buying downloadable content for video games (e.g., new levels)? *(If you did not spend any money on this, please enter 0).*

_____

Q27 In the past month, how much money have you spent in dollars on loot boxes (i.e., randomized items including loot boxes, crates, card packs and keys to open these items)? *(This includes paying real world money for an in-game currency that is used to buy loot boxes, or paying real-world money for a key that is used to open loot boxes. If you did not spend any money on this, please enter 0).*

_____

Q28 In the past month, how much did you spend in dollars on other in-game purchases for video games which were *not* randomized loot boxes? *(If you did not spend any money on this, please enter 0).*

_____

Q29 In the past month, have you watched people open loot boxes on video streaming websites (e.g., YouTube, Twitch etc.)?

- ○ No
- ○ Yes

Q30 In the past month, how often have you watched people open loot boxes/card packs on video streaming websites?

- ○ Once
- ○ Several times
- ○ Once a week
- ○ Almost everyday
- ○ Everyday
- ○ More than once a day

Q31 In the past month, approximately how long did you spend watching people open loot boxes/card packs on video streaming websites?

	0 10 20 30 40 50 60 70 80 90 100
Hours ()	
Minutes ()	

Q32 Please indicate how much you agree with each statement below.

	Strongly disagree	Moderately disagree	Mildly disagree	Neither agree or disagree	Mildly agree	Moderately agree	Strongly agree
The thrill of opening loot boxes has encouraged me to buy more.	○	○	○	○	○	○	○
I frequently play games longer than I intended to, so I can earn loot boxes.	○	○	○	○	○	○	○
I have put off other activities, work, or chores to be able to earn or buy more loot boxes.	○	○	○	○	○	○	○
Once I open a loot box, I often feel compelled to open another.	○	○	○	○	○	○	○
I have bought more loot boxes after failing to receive valuable items.	○	○	○	○	○	○	○

Q33 Please respond 3 to this question.

- ○ 0
- ○ 1
- ○ 2
- ○ 3

Q34 I think about previous video gaming or anticipate playing the next video game.

- ○ Not at all true
- ○ More not true than true
- ○ More true than not true
- ○ Very true

Q35 I feel irritable, anxious or sad when I am unable to video game.

- ○ Not at all true
- ○ More not true than true
- ○ More true than not true
- ○ Very true

Q36 Over time I have felt the need to spend more time playing video games.

- ○ Not at all true
- ○ More not true than true
- ○ More true than not true
- ○ Very true

Q37 I have tried to cut down on playing video games but was unable to.

- ○ Not at all true
- ○ More not true than true
- ○ More true than not true
- ○ Very true

Q38 I have lost interest in other hobbies or entertainment in order to play video games.

- ○ Not at all true
- ○ More not true than true
- ○ More true than not true
- ○ Very true

Q39 I have continued playing video games despite they cause me obvious problems.

- ○ Not at all true
- ○ More not true than true
- ○ More true than not true
- ○ Very true

Q40 I have deceived family members, therapists or others about how much time I play video games.

- ○ Not at all true
- ○ More not true than true
- ○ More true than not true
- ○ Very true

Q41 I have played video games to relieve feelings of negative moods (sadness, anxiety, stress, etc.).

- ○ Not at all true
- ○ More not true than true
- ○ More true than not true
- ○ Very true

Q42 My video gaming has jeopardized a relationship, job or educational opportunity.

- ○ Not at all true
- ○ More not true than true
- ○ More true than not true
- ○ Very true

Q43 I once owned a three-headed dog.

- ○ True
- ○ False

Q44 What is your age?
Age

▼ 16 ... 100

Q45 What is your gender?

- ○ Male
- ○ Female
- ○ Non-binary
- ○ Prefer not to say
- ○ Other (please specify) _____

Q46 What is your ethnicity?

_____

Q47 In a typical week, what income range best reflects how much money your household brings in after taxes?

- ○ Less than $350
- ○ Between $351 and $700
- ○ Between $701 and $1,650
- ○ Between $1,651 and $3,500
- ○ Over $3,500

Q48 If you would like to receive the results of this study once it is completed please provide your e-mail address below for us to send you this information?
This e-mail address will be kept confidential and will not be used for any other purpose.

_____

Appendix C

PGSI Scale and Scoring

Problem Gambling Severity Index

This self-assessment is based on the Canadian Pr oblem Gambling Index. It will give you a good idea of whether you need to take corrective action.

Thinking about the last 12 months…

Have you bet more than you could really afford to lose?
0 Never. **1** Sometimes. **2** Most of the time. **3** Almost always.

Still thinking about the last 12 months, have you needed to gamble with larger amounts of money to get the same feeling of excitement ?
0 Never. **1** Sometimes. **2** Most of the time. **3** Almost always.

When you gambled, did you go back another day to try to win back the money you lost?
0 Never. **1** Sometimes. **2** Most of the time. **3** Almost always.

Have you borrowed money or sold anything to get money to gamble?
0 Never. **1** Sometimes. **2** Most of the time. **3** Almost always.

Have you felt that you might have a problem with gambling?
0 Never. **1** Sometimes. **2** Most of the time. **3** Almost always.

Has gambling caused you any health pr oblems, including stress or anxiety?
0 Never. **1** Sometimes. **2** Most of the time. **3** Almost always.

Have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?
0 Never. **1** Sometimes. **2** Most of the time. **3** Almost always.

Has your gambling caused any financial problems for you or your household?
0 Never. **1** Sometimes. **2** Most of the time. **3** Almost always.

Have you felt guilty about the way y ou gamble or what happens when you gamble?
0 Never. **1** Sometimes. **2** Most of the time. **3** Almost always.

TOTAL SCORE

Total your score. The higher your score, the great er the risk that your gambling is a problem.

Score of 0 = Non-problem gambling.

Score of 1 or 2 = Low level of problems with few or no identified negative consequences.

Score of 3 to 7 = Moderate level of problems leading to so me negative consequences.

Score of 8 or more = Problem gamb ling with negative consequences and a possible loss of control.

Ferris, J., & Wynne, H. (2001). The Canadian problem gambling index: Final report. Submitted for the Canadian Centre on Substance Abuse.