The prevalence of loot boxes in mobile and desktop games

Abstract

Background and aims

Loot boxes are items in video games that may be bought for real-world money but provide randomised rewards. Formal similarities between loot boxes and gambling have led to concerns that they may provide a 'gateway' to gambling amongst children. However, the availability of loot boxes is unclear. This study aimed to determine what proportion of top-grossing games contained loot boxes, and how many of those games were available to children.

Method

We undertook a systematic review of both the top mobile games on the Google Play and iPhone stores, and the top desktop games on the Steam store.

Results

We found that 58% of the top games on the Google Play store contained loot boxes; 59% of the top iPhone games contained loot boxes; and 36% of the top games on the Steam store contained loot boxes. Worryingly, many loot boxes were in games that are available to children. 93% of the Android games that featured loot boxes and 94% of the iPhone games that featured loot boxes were deemed suitable for children aged 12+. Age ratings were more conservative for desktop games: Only 38% of desktop games that featured loot boxes were available to children aged 12+.

Conclusions

Loot boxes appear prevalent in games that are deemed suitable for children, especially on mobile platforms. We suggest that ratings boards like PEGI and the ESRB consider adding 'loot box' content descriptors to games that feature this mechanism.

Introduction

What are loot boxes?

Loot boxes are items in video games that may be bought for real-world money, but which provide players with a randomised reward of uncertain value. When paying their money, players have no way of knowing exactly what they will receive in return for their investment.

Loot boxes and gambling

Both when opening a loot box and when using a slot machine, individuals risk money on the chance outcome of an uncertain future event. This similarity has led to concerns over links between loot boxes and gambling-related harm.

In (1), researchers found that the more money gamers spent on loot boxes, the more severe their problem gambling was. This link between problem gambling and loot box spending appears robust and has been replicated numerous times (2–6).

The availability of loot boxes

As Blaszczynzki and Nower note, the "starting block"(7) of problem gambling is the availability of gambling activities. Indeed, empirical findings have repeatedly shown that increased access to gambling is linked to increases in the prevalence of problem gambling (8–10).

Related concerns may be proposed when it comes to the availability of loot boxes. In (11), Drummond and Sauer propose that some loot boxes can be considered "psychologically akin" to

gambling. Engagement with these loot boxes may therefore form a gateway to the development of problem gambling amongst gamers.

The impact of potential relationships between problem gambling and loot box spending are heavily dependent on how prevalent loot boxes are. If few games contain loot boxes, then the potential for harm present in them may be limited; if many do, the potential for harm may be more serious.

However, surprisingly, the academic literature contains very little information about the prevalence of loot boxes. A report by the UK Gambling Commission has estimated that 31% of UK adolescents aged 11-16 have opened a loot box (12); apart from this, there is no other publicly available data which can inform researchers either directly or indirectly about the prevalence of loot boxes.

Loot boxes and children

It is especially important to understand the prevalence of loot boxes in games that are made available to children. Most countries have laws that prohibit children from gambling. However, there are currently no restrictions on which games may contain loot boxes.

Rating systems like the Pan European Game Information system (PEGI) are intended to set advisory age ratings for games, and thereby prevent children being exposed to inappropriate content like sex and violence. However, there is no inclusion of loot boxes under such systems(13).

It is therefore plausible that many games that are deemed suitable for children contain loot boxes. If this is the case, it may be cause for concern: Exposure to gambling in early childhood has been shown to predict problem gambling in later life (14,15).

The prevalence of 'cash out' loot boxes

In some (though not all) games, loot box contents carry real-world value. In these games, players can 'cash out' their winnings by selling their items to other players via digital marketplaces. Whilst common items may only resale for a few cents (16), rare loot box items can sell for hundreds of dollars (17).

Some loot box contents may be sold via officially-sanctioned marketplaces such as the *Steam* marketplace. However, other games have no official market to cash out in. Players of these games may sell loot box contents via unlicensed third party websites(18).

In the Netherlands, loot boxes that allow players to cash out their winnings, whether sanctioned by developers or not, have been deemed so similar to gambling that they have been regulated as an illegal form of gambling(19).

Method

Design

A list was made of the top 100 highest-grossing Android games in the UK Google Play store, and the 100 highest-grossing iPhone games on the Apple App store.

Steam does not provide estimates of number of installs for games in the Steam store, nor does it provide any detail of what its best-selling games are. Therefore, a list of the 50 most popular games on Steam was obtained from the aggregator *SteamSpy*, which attempts to approximate the popularity of Steam games.

The following four variables were then measured for each of these games: (1) The **presence/absence of loot boxes,** (2) whether **loot boxes could be cashed out for real-world money,** (3) **the number of overall installs** that a game had**,** and (4) the **age rating** for that game

These variables were measured as follows:

Presence/absence of loot boxes, and **whether loot boxes could be cashed out** were measured by having a researcher investigate each game in each list.

Games were coded as containing loot boxes if they had in-game items or rewards that (a) could be bought for real world money and (b) had randomised contents of varying value.

Mobile games were coded as 'cash out' if secondary websites could be found offering to buy or sell items from loot boxes. Both coders used the Google search engine to investigate the presence of this feature. Due to the diversity of games under examination, no specific script was given to the coders when looking for the presence of 'cash out'. Example searches included "(buy | sell | trade) [name of in-game currency/item] [name of game]".Steam games were coded as 'cash out' if loot box contents could be sold to other players on the Steam store. 'Social casino' games, in which developers virtually recreate games traditionally found in casinos, were coded as not containing loot boxes. 76 of the 100 iPhone games also featured on Android. Coding from their Android counterparts was transferred over.

When possible, the presence of loot boxes was ascertained by watching videos of gamers playing, and buying, these items. When these videos were not available, or were not clear, the game itself was installed and played until it became apparent whether loot boxes were present. Due to the complexity and diversity of loot boxes, no specific definition of 'value' was given to either coder. After the fact, one coder reported looking for differing levels of item rarity; the other simply looked to see if randomisation was occurring, and assumed that its presence implied different levels of value.

Following this, a formal reliability analysis was conducted for each dataset.

There was near-perfect agreement (92%; Cohen's Kappa = 0.84) between coders regarding the presence of loot boxes in Android games, substantial agreement regarding the presence of loot boxes in iPhone games (90%; Cohen's Kappa = 0.80), and near-perfect agreement regarding the presence of loot boxes in Steam games (94%; Cohen's Kappa = 0.86).

A third researcher checked the coding and determined that the 8 points of disagreement regarding Android games consisted of 8 false negatives. The 10 points of disagreement regarding iPhone games consisted of 1 false positive in which a coder identified *Fortnite* as containing loot boxes, and 9 false negatives. The 3 points of disagreement regarding Steam games consisted of 3 false negatives. The final coding was adjusted in each case to reflect this.

Cohen's Kappa could not be calculated for the degree of agreement between raters when it came to the presence of cash out on mobile platforms. Whilst there was substantial agreement between coders across both platforms (94% agreement for Android games, 95% for iPhone games), no single case existed in which both coders found that the contents of any game's loot boxes could be cashed out. There was moderate agreement between coders when it came to the ability to cash out loot boxes on desktop games (88%, Cohen's Kappa = 0.55). Due to the lack of reliability regarding cash out, no further analysis of this feature is presented here.

The number of overall installs was calculated for games in the Google Play store from the estimated number of installs provided by Google for each game. In each case, Google provided a lower bound estimate of the number of installs (e.g. '10,000,000+ installs'). The aggregator *SteamSpy* provided an approximation of the number of owners of desktop games. No estimate was available for iPhone games.

The age rating was obtained directly from each game's description on either the Steam store, Apple App store, or the Google Play store. Steam games and Google Play games are typically associated with a PEGI age rating; Apple provides its own rating system for iPhone games. Only 5 games across both Android and lacked an age rating. All 5 were on Steam.

Results

Overall, 58 out of 100 top-grossing Android games contained loot boxes (58%). 59 of the 100 top-grossing iPhone games contained loot boxes (59%). When aggregated across mobile platforms, there were 124 unique mobile games. Of these, 70 (56%) contained loot boxes. 18 out of 50 top desktop games contained loot boxes (36%).

The age-ratings of Android and Desktop games featuring loot boxes are represented below as Table 1 as cumulative counts and frequencies, as are the cumulative number of downloads of games that feature loot boxes.

PEGI Rating	Number of games that feature loot boxes (Cumulative)		Number of installs / owners of games that feature loot boxes, in millions (Cumulative)		
	Android	Desktop	Android	Desktop	Total
3+	15/37 (40%, CI: 0.26 – 0.56)	2/4 (50%, CI: 0.15 – 0.85)	545	5.2	550.2
7+	33/58 (56%, CI: 0.44 – 0.68)	3/7 (42%, CI: 0.16 – 0.75)	961.5	15.2	976.7
12+	54/93 (58%, CI: 0.47 – 0.67)	7/16 (43%, CI: 0.23 – 0.66)	1383	60.2	1443.2
16+	58/100 (58%, CI: 0.48 – 0.67)	9/24 (38%, CI: 0.21 – 0.57)	1553	130.2	1683.2
18+	58/100 (58%, CI: 0.48 – 0.67)	18/44 (41%, CI: 0.27 – 0.55)	1553	299.7	1852.7
Unrated	58/100 (58%, CI: 0.48 – 0.67)	18/50 (36%, CI: 0.24 – 0.49)	1553	299,7	1852.7

The age-ratings of iPhone games featuring loot boxes are represented below as Table 2 as cumulative counts and frequencies.

Apple Store Age Rating	Number of games that feature loot boxes (Cumulative)
4+	14/33 (42%, CI: 0.27 – 0.59)

9+	33/55 (60%, CI: 0.46 – 0.71)
12+	56/95 (58%, CI: 0.48 – 0.68)
17+	59/100 (59%, CI: 0.49 – 0.68)

Discussion

The availability of loot boxes

Overall, the majority of top-grossing mobile games on both Android (58%) and iPhones (59%) featured loot boxes, as did 36% of desktop games. This high level of availability is mirrored by the large number of players that may be exposed to loot boxes: In total, we found more than 1.8 billion installs of games that contain this gambling-like feature. Almost a billion of these were of games that were deemed suitable for children aged 7+.

Loot boxes and children

The prevalence of loot boxes in games that are available to children are a cause for potential concern. 93% of the Android games that featured loot boxes (54/58) were deemed suitable for children aged 12+, as were 94% of the iPhone games that featured loot boxes (56/59). Many of these games were deemed suitable for those aged 7+.

Mobile devices are thought to be the "preferred media choice"(20) amongst young children. Furthermore, many parents are thought to approve video game spending agreements with their children (21). It therefore seems likely that large numbers of children have had the opportunity to buy loot boxes.

Desktop games revealed lower, but still substantial, levels of prevalence. They also showed higher age-ratings for games with loot boxes: 18 of the 50 most-played Steam games contain loot boxes (approximately 299 million installations). Of these, only a small proportion are PEGI rated as suitable for those aged 7+; however, several are still classified as suitable for those 12+.

Limitations

Whilst a rigorous method was followed when coding games as containing loot boxes, it is possible that some games present loot boxes later in the game than others, leading to 'false negatives'. This is reflected in a small number of disagreements between coders. The true prevalence of loot boxes in these games may therefore be higher than estimated.

Similarly, the number of installs of games is necessarily an imperfect approximation of the number of active players that a game has. As a result, future research may wish to consider active player data, although it must be noted that data of this nature can be difficult for researchers to acquire without cooperation from game developers.

It is not clear why the coding of 'cash out' proved unreliable. Video game publishers rigorously police secondary markets. It seems possible that a lack of agreement may have occurred because secondary marketplaces are frequently erased, and therefore their presence is inherently unreliable. However, the ability to 'cash out' loot box contents has not been seen to strongly influence links between loot box spending and problem gambling(4). These results therefore bear real-world meaning despite the absence of an analysis of 'cash out'.

Finally, it should be noted that the current research considered a subset of the most popular games available on mobile and desktop devices. This sample can depict the exceptionally broad reach of loot boxes among video game players but may not be representative of all games.

Conclusions

Given the prevalence of loot boxes in both desktop and mobile games, and the age ratings associated with most of these titles, it seems likely that large numbers of children have the opportunity to buy loot boxes. If loot box mechanics really are "psychologically akin to gambling", as suggested in (11), then they may well be opening the door to the development of problem gambling amongst these young gamers.

In Europe, many video games must come with PEGI (Pan European Game Information) age labels, and must also have clearly visible descriptors showing whether the game contains theoretically sensitive features like the depiction of sex or violence(22). Similarly, in the USA and Canada, "virtually all video games"(23) come with age ratings and content descriptors from the ESRB (Entertainment Software Rating Board).

Video game companies are currently not required to disclose to their customers that any game contains loot boxes prior to purchase. In the absence of suitable content descriptors, it seems difficult for parents and guardians to make an informed decision about the exposure of their children to this potential risk factor for problem gambling. We therefore argue that regulators and ratings boards like PEGI and the ESRB urgently consider adding content descriptors for loot boxes to games.

References

1. Zendle D, Cairns P. Video game loot boxes are linked to problem gambling: Results of a large-scale survey. PLoS One. 2018;13(11):e0206767.

2. Zendle D, Cairns P. Loot boxes are again linked to problem gambling: Results of a replication study. PLoS One. 2019 Mar 7;14(3):e0213194.

3. Zendle D, Meyer R, Over H. Adolescents and loot boxes: links with problem gambling and motivations for purchase. R Soc Open Sci. 2019 Jun 19;6(6):190049.

4. Zendle D, Cairns P, Barnett H, McCall C. Paying for loot boxes is linked to problem gambling, regardless of specific features like cash-out and pay-to-win. Comput Hum Behav [Internet]. 2019 Jul 9 [cited 2019 Jul 24]; Available from: http://www.sciencedirect.com/science/article/pii/S0747563219302468

5. Li W, Mills D, Nower L. The relationship of loot box purchases to problem video gaming and problem gambling. Addict Behav. 2019 Oct 1;97:27–34.

6. Brooks GA, Clark L. Associations between loot box use, problematic gaming and gambling, and gambling-related cognitions. Addict Behav. 2019;

7. Blaszczynski A, Nower L. A pathways model of problem and pathological gambling. Addiction. 2002;97(5):487–499.

8. Welte JW, Barnes GM, Tidwell M-CO, Hoffman JH, Wieczorek WF. The relationship between distance from gambling venues and gambling participation and problem gambling among US adults. J Gambl Stud. 2016;32(4):1055–1063.

9. Storer J, Abbott M, Stubbs J. Access or adaptation? A meta-analysis of surveys of problem gambling prevalence in Australia and New Zealand with respect to concentration of electronic gaming machines. Int Gambl Stud. 2009;9(3):225–244.

10. Adams GR, Sullivan A-M, Horton KD, Menna R, Guilmette AM. A study of differences in Canadian university students' gambling and proximity to a casino. J Gambl Issues. 2007;(19):9–17.

11. Drummond A, Sauer JD. Video game loot boxes are psychologically akin to gambling. Nat Hum Behav. 2018 Jun 18;530–2.

12. UK Gambling Commission. Young People and Gambling: 2018 Report [Internet]. 2018 [cited 2019 Jan 2]. Available from: https://www.gamblingcommission.gov.uk/PDF/survey-data/Young-People-and-Gambling-2018-Report.pdf

13. What do the labels mean? | Pegi Public Site [Internet]. [cited 2019 Aug 15]. Available from: https://pegi.info/what-do-the-labels-mean

14. Jacobs DF. Juvenile gambling in North America: An analysis of long term trends and future prospects. J Gambl Stud. 2000;16(2–3):119–152.

15. Wynne HJ, Smith GJ, Jacobs DF. Adolescent gambling and problem gambling in Alberta. Alberta Alcohol and Drug Abuse Commission (AADAC); 1996.

16. Steam Community Market :: Listings for CZ75-Auto | Twist (Minimal Wear) [Internet]. [cited 2019 Apr 25]. Available from: https://steamcommunity.com/market/listings/730/CZ75-Auto%20%7C%20Twist%20(Minimal%20Wear)

17. Steam Community Market :: Listings for ★ Huntsman Knife [Internet]. [cited 2019 Apr 25]. Available from: https://steamcommunity.com/market/listings/730/%E2%98%85%20Huntsman%20Knife

18. Coutu S. Here's How You Make $12,000 In Profit a Day Selling Virtual Guns [Internet]. Motherboard. 2015 [cited 2018 Oct 10]. Available from: https://motherboard.vice.com/en_us/article/wnj935/heres-how-you-make-12000-in-profit-a-day-selling-virtual-guns

19. Yin-Poole W. The Netherlands declares some loot boxes are gambling [Internet]. Eurogamer. 2018 [cited 2018 Sep 13]. Available from: https://www.eurogamer.net/articles/2018-04-19-the-netherlands-declares-some-loot-boxes-are-gambling

20. Kabali HK, Irigoyen MM, Nunez-Davis R, Budacki JG, Mohanty SH, Leister KP, et al. Exposure and use of mobile media devices by young children. Pediatrics. 2015;136(6):1044–1050.

21. PEGI. PEGI announces new content descriptor: in-game purchases | Pegi Public Site [Internet]. 2018 [cited 2019 Mar 6]. Available from: https://pegi.info/news/new-in-game-purchases-descriptor

22. How we rate games | Pegi Public Site [Internet]. [cited 2019 Mar 5]. Available from: https://pegi.info/how-we-rate-games

23. FAQs about ESRB [Internet]. [cited 2019 Mar 5]. Available from: http://www.esrb.org/ratings/faq.aspx