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Loot boxes are more prevalent in United Kingdom video games than previously considered: updating Zendle *et al.* (2020)

Paid 'loot boxes' are products in computer games that consumers can purchase to obtain randomised rewards [1]. Loot boxes are structurally similar to gambling [2, 3], and loot box expenditure is correlated with problem gambling severity [4, 5]. Zendle *et al.* [6] influentially reported that loot boxes are prevalently implemented in United Kingdom (UK) games in February 2019: specifically, *inter alia*, that 59.0% of the 100 highest-grossing iPhone games contained loot boxes. Xiao *et al.* [7] conducted a replication and found that 77.0% of a comparable sample contained loot boxes in June 2021. Overall, 76.9% of the 52 games only appearing in Xiao contained loot boxes, whereas 63.5% did in Zendle. This suggests that games with loot boxes became more popular over the intervening time period. However, there were 11 disagreements (22.9%) among the 48 overlapping titles, each of which involved only Xiao identifying loot boxes, whereas Zendle did not. Table 1 summarises each disagreement, and timestamped screenshots of loot boxes uniquely identified by Xiao are available at: <https://doi.org/10.17605/OSF.IO/CX5RV>.

Game 1 disclosed starting to sell loot boxes between the two studies [8]. Xiao also discovered relatively obscure loot boxes in four games that Zendle did not: games 2 and 3 were known to implement loot boxes during Zendle's data collection period [9, 10]; game 4 likely also did as revealed by contemporaneous evidence [11]; and game 5 potentially contains loot boxes implemented by third-parties through user-generated content. A methodological difference may have allowed for more accurate identification by Xiao: Zendle reviewed online videos recorded by other players and, if unable to decide, then through personal gameplay, whereas Xiao determined through gameplay and, if unable to decide, then through online resources. Studying video games through personal gameplay, whenever possible, is likely preferable.

Further, recovering older versions of the software to verify is now likely impossible, which is why future research studying video games should account for their easily changeable nature by following open science principles [12] (e.g. through providing screenshots).

Additionally, five games were simulated casino games [13], and a sixth game allowed players to virtually operate physical claw machines (which are an older quasi-gambling product available to children) [14]. These games bore near identical names alluding to gambling at both data collection points, so their primary content likely did not change. Zendle did not recognise certain simulated casino games in which players can spend real-world money to buy more stakes to continue participating in simulated gambling as loot

boxes, although such randomised mechanics requiring payment to engage do fall within the definition of 'loot boxes' from a ludology perspective [15], as they similarly use gambling-like mechanisms, and are, therefore, relevant to policymaking concerned with addressing potential harms [16].

Paid loot boxes are now more commonly implemented in the highest-grossing UK iPhone games (which are reflective of other Western markets) than reported by Zendle. This is because of multiple reasons: games with loot boxes becoming more popular; some popular games subsequently introducing loot boxes; methodological factors around loot box identification; and semantic ambiguities around what constitutes a 'loot box.' Policymakers [17–19] and researchers should proceed on that updated basis.

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DECLARATIONS OF INTEREST

L.Y.X. was employed by LiveMe, a subsidiary of Cheetah Mobile (NYSE:CMCM) as an in-house counsel intern from July to August 2019 in Beijing, People's Republic of China. L.Y.X. was not involved with the monetisation of video games by Cheetah Mobile or its subsidiaries. P.W.S.N. is a member of the Advisory Board for Safer Gambling—an advisory group of the Gambling Commission in Great Britain, and was a special advisor to the House of Lords Select Committee Enquiry on the Social and Economic Impact of the Gambling Industry. In the last 3 years, P.W.S.N. has received research funding from Clean Up Gambling and has contributed to research projects funded by GambleAware, Gambling Research Australia, NSW Responsible Gambling Fund and the Victorian Responsible Gambling Foundation. P.W.S.N. has received travel and accommodation funding from the Spanish Federation of Rehabilitated Gamblers and received open access fee grant income from Gambling Research Exchange Ontario.

TABLE 1 Potential reasons why Zendle and Xiao disagreed as to whether 11 games contained loot boxes (of an overlapping sample of 48 games)

Potential reason for disagreement	Game name		Presence of loot boxes		
	Game no.	Zendle	Xiao	Zendle	Xiao
Self-disclosed starting to implement loot boxes after Zendle's data collection [8]	1	Game of Thrones: Conquest	Game of Thrones: Conquest	No	Yes
Known to have implemented loot boxes prior to Zendle's data collection through the egg incubator system, as documented by changes to the game's Fandom Wiki page dated 2016 [9] (The loot box identified by Xiao was relatively unique and similar to the implementation in Counter-Strike: Global Offensive (CS:GO) and may have been missed by Zendle: players were able to pay real-world money for incubators to act as 'keys' to unlock Pokémon eggs, which contained randomised content and were the 'loot boxes'; the eggs themselves were not directly purchasable and were obtained through gameplay. However, there is an upper limit as to how many eggs a player is allowed to have simultaneously: without purchasing incubators using real-world money, the player will quickly reach that limit and lose the opportunity to obtain more eggs and, by implication, more randomised content.)	2	Pokémon GO	Pokémon GO	No	Yes
Seemingly implemented randomised mechanics through the Materials Chest system prior to Zendle's data collection, as documented by YouTube videos dated, e.g. 2017 (timestamps: 0:56 and 1:05 show that Materials Chests contain randomised content and 17:02 shows that they can be purchased with real-world money) [10] (The loot box identified by Xiao could only be purchased as part of a bigger bundle of many products and therefore was relatively hidden and may have been missed by Zendle.)	3	War and Order	War and Order	No	Yes
Seemingly implemented randomised mechanics through the mystery boxes and keys system prior to Zendle's data collection, as documented by YouTube videos dated, e.g. 2017 [11]	4	The Sims FreePlay	The Sims FreePlay	No	Yes
Sandbox game allowing for user-generated loot boxes on private servers not recognised by Zendle as containing loot boxes	5	Minecraft	Minecraft	No	Yes, because of third-party implemented loot boxes
Simulated casino game not recognised as containing loot boxes by Zendle	6	Bingo Blitz Free Bingo	Bingo Blitz-BINGO games	No	Yes
	7	Cash Frenzy-Slots Casino	Cash Frenzy-Slots Casino	No	Yes
	8	Lotsa Slots: CasiNoSLOTS	Lotsa Slots-Vegas Casino	No	Yes
	9	Slotomania Slots-777 Free CasiNoFruit Machines	Slotomania Vegas Casino Slots	No	Yes
	10	Zynga Poker-Texas Holdem	Zynga Poker-Texas Holdem	No	Yes
Claw machine game not recognised as containing loot boxes by Zendle	11	Clawee	Clawee	No	Yes

AUTHOR CONTRIBUTIONS

Leon Y. Xiao: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; resources; software; visualization. **Laura Henderson:** Investigation; validation. **Philip Newall:** Conceptualization; methodology; project administration; supervision.

KEYWORDS

Consumer protection, gambling, game analysis, loot boxes, UK, video gaming

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