Lifting the Lid on Loot-Boxes

Chance-Based Purchases in Video Games and the Convergence of Gaming and Gambling

James Close & Joanne Lloyd

UNIVERSITY OF PLYMOUTH

UNIVERSITY OF WOLVERHAMPTON

GambleAware

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Dr James Close
Senior Research Fellow. Faculty of Health, University of Plymouth
james.close@plymouth.ac.uk

Dr Joanne Lloyd
Senior Lecturer in Psychology. Faculty of Education Health & Wellbeing, University of Wolverhampton
Joanne.Lloyd@wlv.ac.uk

Executive Summary

1. Introduction & Background

Loot boxes are purchasable video game content with randomised rewards. Due to structural and psychological similarities with gambling, they have come under increasing media, academic and legal scrutiny. The UK government is currently reviewing evidence on loot boxes, which will be considered in the forthcoming review of the Gambling Act 2005.

In January 2020, we were commissioned by GambleAware to conduct a package of research into loot boxes. This interdisciplinary collaboration between the University of Wolverhampton and the University of Plymouth draws from our backgrounds in gambling, gaming, psychology and healthcare. It aims to inform future UK policy on loot boxes with a robust, evidence-based approach.

The goals of our project are to investigate the psychological profiles of young people and adults who buy loot boxes, studying their purchasing motivations, and any links with potential harms. These could include unsustainable spending, lower wellbeing, problem gambling and problem video gaming.

The first section of this document, *Introduction and background*, presents a primer on loot boxes, revealing how they evolved from Asian 'free to play' games, before diversifying into every available genre, including many big-budget 'AAA' titles. This is followed by subsequent sections (summarised below) that present our emerging findings, contextualised within the current evidence around loot boxes, before concluding with implications for future policy.

Key Questions

- What evidence is there for links between loot boxes and problem gaming or gambling?
- What are the player motivations for loot box purchasing?
- Does loot-box purchasing lead to harm, financial or otherwise?
- Are any groups, such as young people or children, particularly at risk?
- If so, what can be done about it?

2. Loot boxes, Problem Gambling and Problem Video Gaming

One of the most influential academic publications on loot boxes was a 2018 survey of gamers by the UK researchers David Zendle and Paul Cairns[1]. This identified an association between loot box purchasing and problem gambling scores, as measured by the Problem Gambling Severity Index (PGSI). Similar surveys soon followed, prompting us to carry out a systematic review establishing their robustness, reproducibility and effect sizes. Our review demonstrates that relationships between loot box engagement and problem gambling have been robustly verified in around a dozen studies. These draw from various nationalities and cohorts, and now include pre-registered and nationally representative samples.

The effect sizes are 'moderate' – a magnitude which bears statistical and practical relevance: they are stronger than or comparable with well-established associations between problem gambling and other co-morbidities, such as depression, alcohol and drug dependencies. Similar relationships have been established with problem video gaming.

3. Motivations for purchase

Relationships between loot box engagement and problematic gambling are now well demonstrated, but they tell us nothing about the underlying motivations for purchase in the first place. At the moment, there has been almost no academic literature published about the motivations for loot box purchasing. This contrasts with gambling research, where we know gambling is driven by a multitude of overlapping motivations.

Without similar information about loot boxes, it is difficult to understand the mechanisms via which any harms might manifest. We therefore conducted a series of in-depth interviews with a diverse sample of regular loot box purchasers from across the UK.

This revealed that motivations for loot box purchasing are embedded within a network of personal, social and gameplay factors, and often overlap with motivations for purchasing other, non-randomised in-game content (although there is typically more excitement associated with winning an item within a loot box than with buying it from the in-game store).

Such motivations include both social interactions (such as gaining status and approval, or as part of a group experience) and game-related motivations (such as improving performance, aesthetics or gameplay experience).

Participants also purchased loot boxes because of a 'fear of missing out' either socially (e.g. on shared experiences around 'unboxing'), financially (on promotions) or acquisitively (on items that are only available for a limited time). Within the cyberpsychological literature, 'fear of missing out' (abbreviated to FoMO), typically refers specifically to anxiety about missing out on social (or social media) interactions whilst offline. Here, we define loot box-related 'fear of missing out' as the range of things our participants worried about missing if they did not engage with loot boxes.

Furthermore, players are often nudged towards purchasing via a number of well-known psychological techniques, such as endowment effects (by giving away 'free' loot boxes, but then charging for opening), price anchoring, special limited-time offers or items, and obfuscation of costs (i.e. via in-game currencies). Developers have openly discussed such approaches, where loot boxes (with their gambling-like structure) are just one architectural choice from a psychological playbook of monetisation strategies.

Our observations also highlight that the concept of 'value' extends beyond the legal 'money's worth' definition. Instead, prized items in loot boxes can hold significant social or psychological capital. Nonetheless, many gamers do ascribe discrete financial values to loot box contents – based on purchase or resale price – suggesting that many loot boxes meet existing criteria for gambling regulation.

4. Problematic play? Loot boxes, financial harm and psychological harm

To investigate notions of financial harm, we conducted a secondary analysis of six open access datasets of loot box surveys, aggregating the freely available data[2]. The combined dataset comprised of 7,767 loot box purchasers, and our analysis established that a disproportionate amount of revenue is derived from high-level spenders. For example, around 5% of loot box purchasers in our dataset (those spending more than around £70 / $100 per month, or local equivalent) generate around half of industry revenue from loot boxes. Moreover, almost one third of these top 5% of spenders fall into the 'problem gambler' category.

Conversely, there is no evidence that higher loot box spend is correlated with higher earnings. Our research therefore demonstrates that games developers, unwittingly or not, appear to be generating outsized loot box profits from at-risk individuals (these are likely to include both people with gambling problems or problematic patterns of video gaming) – but not from wealthy gamers.

At present, there is a paucity of evidence investigating links between loot box engagement and wellbeing or psychological distress. Any preliminary evidence has been cautiously interpreted, with mixed results. However, harms associated with loot boxes (either financial or psychological) are liable to have a disproportionate effect on specific cohorts of gamers. We present data from our own brief screen of around 14,000 UK gamers, which confirms that loot box engagement is linked with a number of demographic factors including male sex, younger age, and lower educational attainment.

5. Loot box defences, industry self-regulation and previous policy responses

We note that a chorus of voices are calling for the UK to legislate loot boxes as gambling, including academic researchers[3,4], the Department for Digital, Culture, Media and Sport (DCMS)[5], the House of Lords Gambling Committee[6], a number of influential charities[7,8], and over 40,000 signatories of a recent petition to the government[9]. There have been a number of responses to these growing calls for policy action.

First, there have been a series of arguments rallied in defence of loot boxes as an unproblematic, non-gambling activity. For example, loot boxes have been compared with earlier, unfounded video game-related moral panics, such as links between video gaming and violence. However, these earlier controversies were based on questionable, unrepeated evidence – which contrasts markedly with the loot box evidence. Loot boxes have also been defended as 'surprise mechanics' – no different, for example, to a Kinder Egg. Such arguments, however, do not tally with well-established associations between loot boxes and problematic gambling behaviour.

Second, there have been some recent attempts at industry self-regulation. However, 'odds disclosures' of loot boxes have sometimes been presented in a confusing and incomplete manner[10], and these attempts at corporate transparency remain opaque. Similarly, game labelling for loot boxes currently

fall short of age restrictions, despite being regularly called for[3,7,11,12]. Nonetheless, age restrictions are, in any case, ignored by the majority of parents and children[13,14].

Third, there has been policy action on loot boxes from a number of jurisdictions, including China, Belgium and the Netherlands. However, these initial attempts to legislate loot boxes have suffered from a series of shortcomings, including industry manoeuvring (i.e. to sidestep legislation) and inconsistent policy (i.e. they only mitigate risks associated with certain classes of loot boxes, such as those with explicit 'cash out' features).

6. Conclusions and recommendations

Any legislation regulating loot boxes will require careful consideration. Drawing from experiences in other jurisdictions, we present a series of recommendations for future policy. Prospective policy should include provisions for *clear definitions* of loot boxes, *game labelling* and *age ratings, full disclosure of odds* presented in an *easy-to-understand* way, *spending limits* and prices in *real currency*, and finally, *obligations of gatekeepers* (i.e. developers, distributors, content providers) for the *trade they enable and profit from*.

Finally, we conclude with a stark warning: in the rapidly evolving world of video gaming, legislation against loot boxes is liable to be quickly rendered anachronistic. Longer-term mitigation of risk – from the potential dangers of a broad range of psychological nudges, potentially liable to cause unsustainable levels of spending in vulnerable individuals – will require increased provision for consumer protection, child-focused data protection policies, more research, and educational packages that mitigate against these dangers and harms.

Contents

1. Introduction & Background

Loot boxes are often compared to baseball cards, trading card games or Kinder Eggs. This is a reasonable analogy, since loot boxes trace their roots to the Japanese '*gachapon*' – popular toy vending machines, named from the onomatopoeic '*gacha*' sound of the hand-cranking, followed by the reward-dropping '*pon*,' as the random, capsule-encased toy plops down into the collection tray. This 'payment for a random reward' idea was first imported into video games back in 2004, appearing in the Japanese version of *MapleStory*.

These digital '*gacha*' quickly spread into many Southeast Asian video game titles. In a region dogged by heavy counterfeiting, these new types of payment enabled developers to give their titles away for free, yet still accrue significant revenue[15]. The 'freemium' model of monetisation was born. It was not long before Western developers took note. By the late 2000s, free-to-play (f2p) social games were being added to sites like MySpace and Facebook[15], where gamers could purchase 'mystery boxes' in games like *Farmville*, along with other non-randomised add-ons such as cows, sheep and corn. The business model enabled Zynga, the developer of *Farmville*, to accrue billions in revenue[16].

With the smartphone and tablet market revolutionising computing, these free-to-play games soon started hitting the expanding mobile market – and began revolutionising the way games were monetised. Loot boxes were quickly retrofitted into many big-name 'AAA' titles, such as the 'player packs' of EA's *FIFA* (in 2009) or the crates in the cartoonish first-person shooter *Team Fortress 2* in 2010. Within *Team Fortress 2*, these crates were given away for 'free' – but they could only be opened with a purchasable 'key.'

Just like the earlier Asian titles, this 'crate and key' mechanic allowed Valve, the developer of *Team Fortress 2*, to release the game for free, leveraging network effects and rapidly swelling their active player base. *Team Fortress 2* was a huge success. Games such as *The Lord of the Rings Online* (in 2011) and *Counter Strike: Global Offensive* (in 2013) soon followed, offering loot boxes alongside other, non-random transactions.

The Biggest Metagame in Town

These days, big-budget games have moved to a 'service' business model, with developers accruing ongoing revenue via ongoing 'season pass' subscriptions or extra, downloadable digital content[17]. With gamers now accessing games though a variety of channels – desktops, laptops, consoles, tablets, smartphones[18–20] – these innovations have enabled the game industry to become bigger than film and music combined[21].

> **"Games are really becoming services, where the launch of the game is just the beginning of monetization, and the big money is having a large community, a large user base, that keeps playing year after year after year."**
> – Lewis Ward, gaming analyst[15].

Within this evolving gaming ecosystem, loot boxes are just one possible monetisation option in what the developers call 'the metagame.' The metagame envelops the main game within a series of menu screens, replete with options, customisations and game-related stats, enabling the player – depending

on the game – to level-up characters; upgrade weapons; modify vehicles. Here, loot boxes sit in the 'item shop' alongside other types of game-related purchases, and they can be found in just about every genre of game, aimed at just about all types of people – shooters, role-plays, card games, action games.

Loot boxes can come in various (virtual) shapes and sizes (see Figure 1), and have evolved to become increasingly sophisticated[17], for instance, they often incorporate exciting and drawn-out animations when revealing their contents, building a sense of anticipation (see Figure 2). They might be called crates, chests, packs, cases, bundles or cartons[22–25]. In some games, they might not be constrained to the item shop, but are instead discovered in the virtual environment. Often, a game will offer loot boxes for free, encouraging later real-money purchases. They can provide items that improve in-game performance – so called 'pay2win' features, like a weapons upgrade or a faster, stronger character. Alternatively, the upgrade might be purely cosmetic – only changing the appearance of characters or weapons.

These transactions are not always 'micro,' either. In Overwatch, bundles of up to 50 loot boxes can be purchased for £34.99. In FIFA, the most expensive 'player packs' can cost more than £15 each. For this reason, we avoid using the term 'microtransaction.' It is often a misnomer.

Figure 1. *Various features of loot boxes.*

Due to the dizzying array of possible loot box configurations, many people disagree on what, exactly, constitutes a loot box. Our definition of loot boxes is therefore:

<div align="center">

Any game-related purchase with a chance-based outcome

</div>

Our definition does not preclude loot boxes that might also be given away as free offers, or earned through gameplay – where, oftentimes, these 'free' loot boxes are designed to encourage future purchase. Whilst our definition might seem simple, it does carry some nuanced implications. Since January 2019, for example, Epic Games' *Fortnite* has allowed players to view the contents of their piñata-style 'loot boxes' prior to purchase. Under our definition, these transactions are no longer actual loot boxes. The contents are known, not random.

In contrast, some games not normally considered to have loot boxes are encapsulated by our definition. For example, in Niantic's *Pokémon Go*, extra 'incubators' can be purchased to accelerate the hatching of 'eggs,' which increases the chance of hatching a desirable character**. Magazines such as *Eurogamer*[26] and *Forbes*[27] have argued that *Pokémon Go* incubators are indeed a disguised form of loot box, enabling developers to sidestep any regulations in a game widely played by children.

Figure 2. *The magical 'reveal' of a card pack and its collectible contents. Blizzard's Hearthstone. © Blizzard.*

** Technically, the 'eggs and incubator' model of Pokémon Go is a time-delayed 'crate and key' loot box. Their similarity to traditional loot boxes is further obscured by the fact that a base number of incubators (the 'keys') are provided for free – but, in fact, these are comparable to introductory/free loot boxes, often aimed at encouraging future purchase.

The loot box backlash

The history of loot boxes can be followed in a simple line graph. In Figure 3, we can see the surge in loot boxes around the years 2012-2015[19]. By the middle of the decade, EA was reporting that around a third of their digital sales revenue – approximately £470 million – was derived from their loot box style FIFA Ultimate Team packs[28]. By the end of the decade, the UK loot box market alone was estimated to be worth £700 million[7,29]. By 2023, the global loot box market is predicted to rise to around £36 billion ($50 billion)[29].
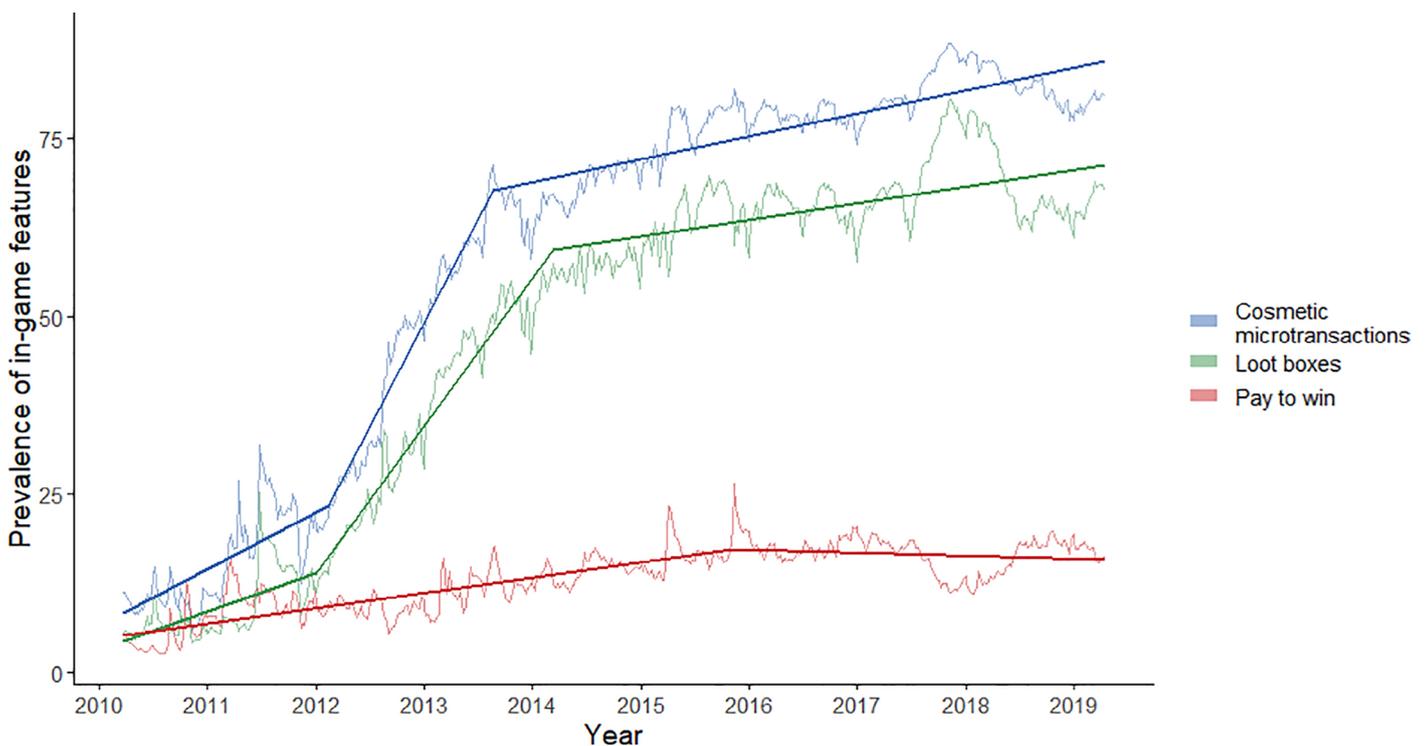
Figure 3. *The rise of loot boxes around 2012-2015 – but still in an upward trend. Graph shows the percentage of games played with various monetisation features, where cosmetic microtransactions = blue; loot boxes = green; pay to win = red. Data is from desktop games available on the content provider, Steam, between 2010-2019. The blue and red lines refer to all types of transactions, not just loot boxes – and establish that cosmetic transactions dwarf 'pay to win' features. For original, See Zendle, 2020, The Changing Face of Desktop Video Game Monetisation[19].*

When looking at Figure 3, the upward trajectory of loot boxes (in green) undergoes a distinct downward blip around the end of 2017, falling from being present in 75% of games on Steam to 60% of games in a matter of months. At the time there were several forces starting to work against loot boxes, but this downtrend coincides almost precisely with the bungled release of *Star Wars Battlefront II*.

The 'pay to win' loot box system in EA's eagerly-awaited game was immediately derided by the gaming community. To compete, players were forced into either spending large sums of money or, alternatively, spending days of 'grinding' (performing repetitive tasks for gameplay advantage or loot) to earn boxes for free. For many gamers, the main gripe was that these loot boxes gave unfair advantages to big spenders, and the high profile controversy – EA's infamously woolly defence on Reddit earned an entry in *The Guinness Book of World Records* as the 'most hated' post on the internet ever[30] – intensified the spotlight on loot boxes.

This is a turning point in the history of the loot box. EA's stock fell 8% in the aftermath[31], and developers of other games – such as *Middle-earth: Shadow of War* – also started stripping loot boxes and pay to win features from their games[32]. But the backlash against loot boxes did not just influence the fortunes of games developers – the controversy drew in academics, lawyers and politicians. There were other controversies, too, that started to work against loot boxes.

Skins in the game

The *Battlefront II* fiasco exposed the widespread unpopularity of loot boxes – but there were also a series of more notorious scandals, which often encircled the game *Counter-Strike: Global Offensive (CS:GO)*. Following the success of 'crate and key' loot boxes in *Team Fortress 2 (TF2)*, Valve introduced random drops of weapons 'crates' into *CS:GO* in 2013. The items inside, however, remain unknown – and the crates can only be unlocked with a key purchased from the item shop. Once opened, the armaments inside do not offer any gameplay advantage, but are instead known as 'skins': purely cosmetic finishes to the standard roster of weaponry.

The game developer Valve promoted *CS:GO* as a centrepiece for the burgeoning eSports movement, which was transitioning into a professional sport, replete with tournaments in large, spectator filled arenas, often with substantial money prizes at stake[33]. Fairly quickly, the rarer, more attractive skins became integrated into the culture of the game: desirable skins came to be referred to as 'legendary', synonymous with the kudos of talented, experienced players. Many players started trading skins (often obtained in loot boxes) for large sums of money, sometimes thousands of dollars[34]. Conversely, the 'consumer grade' (i.e. default) skins were derided as the mark of a 'noob' (new player). These routinely trade for less than nominal value – i.e. far less than the cost of unboxing.

This 'skin trading' also happened in games like FIFA – with valuable players being traded for cash in illicit secondary markets – but with games like *TF2* and *CS:GO*, the virtual economy was facilitated by the launch of Valve's Steam Community Market. This marketplace fluidly integrated trade into *Steam*, the world's largest PC game distribution platform[35]. The marketplace allows players to seamlessly trade digital assets for funds in their *Steam* wallet, with Valve collecting a 15% fee from each transaction.

There are, however, limits to this trade. With the lack of direct cash-out features, the Steam Community Market stops short of allowing players to explicitly 'cash out' any proceeds from loot box transactions. All funds remain within the *Steam* account, only available for buying new games or new upgrades. In this way, the developer Valve avoids transgressing many legal thresholds for gambling, which classically depend on 'money's worth' definitions of wins.
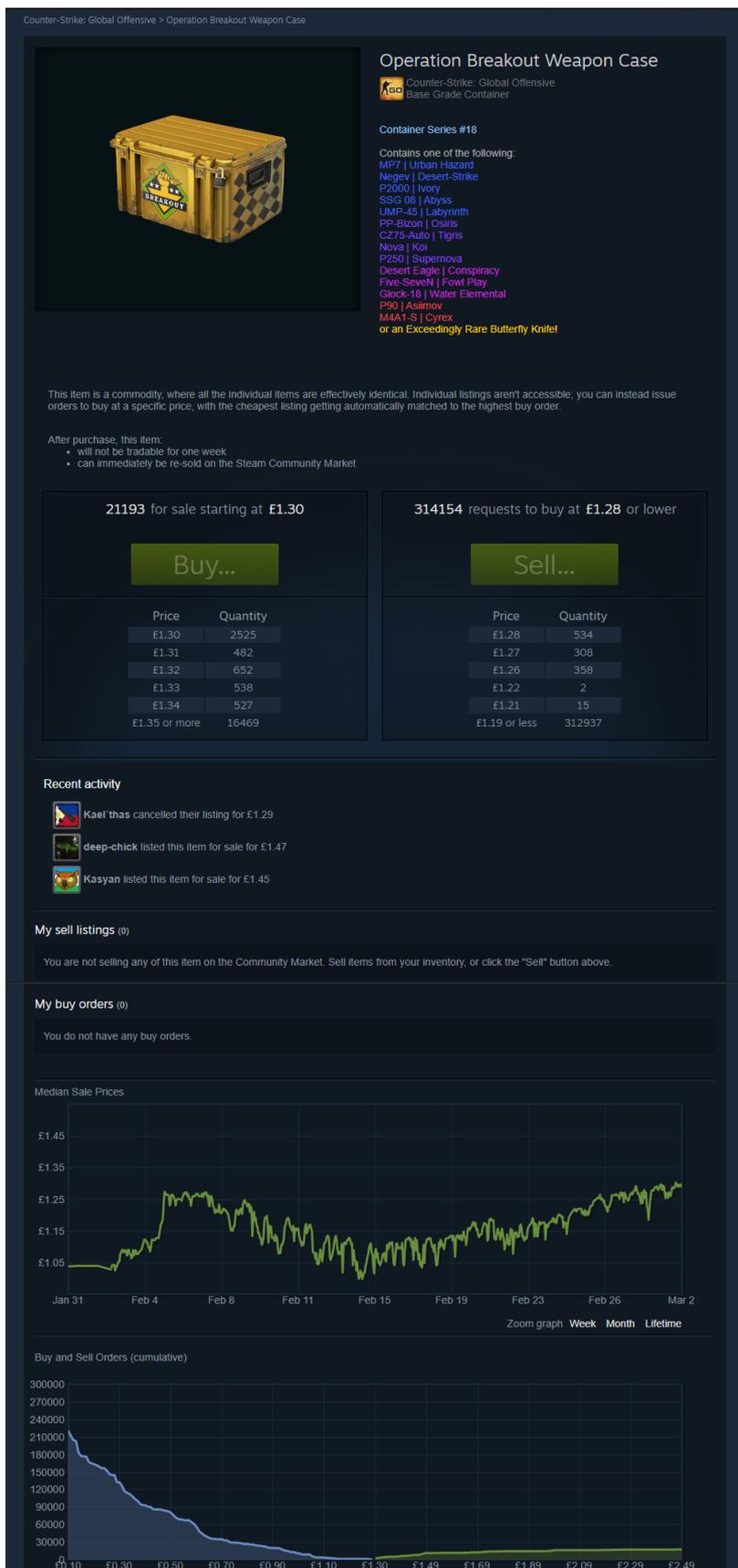
Figure 4. *Example of a loot box trade item on the Steam Community Market, along with associated buy/sell order, time series chart and order history. The billion-dollar marketplace has many parallels with a global financial market but with none of the regulatory oversight. ©Valve Corporation.*

The Steam Community Market, however, is not the only way to shift digital goods. The existence of Steam's Application Programming Interface (API), also developed by Valve, enables third-party websites to facilitate black-market trade between Steam and payment services such as PayPal. Other websites allow Steam funds to be exchanged for cryptocurrencies such as Bitcoin or the specialised SkinCoin[36].

Some third-party websites, however, began pushing even further over legal and ethical boundaries: allowing contents of the 'Steam Wallet' to be used as collateral in illegal 'skin gambling'. This enabled skins to be wagered on the outcome of eSports or other games of chance. The gambling is entirely unregulated, often involving children[37,38]. Given the opaque nature of these black-market transactions, the extent of skin gambling is difficult to estimate. The sums, however, are not insubstantial: around £1.6 billion ($2.3 billion) of skins were thought to have been wagered in 2015[39], accelerating to £3.6 billion ($5 billion) the following year[38].

> **"[Valve have] created and is profiting from an online gambling ecosystem that, because it is illegal and unregulated, harms consumers, many of whom are teenagers. Parents don't know this is going on and can't talk to their kids about it because the gambling chips are called 'Skins' and it seems like just another in-game purchase."** – Jasper Ward, Legal Attorney[40].

This increase in skin gambling, however, was slowed by a spate of scandals. Some of these involved famous eGamers or YouTube influencers, who were discovered to hold undisclosed connections with the black-market operators. There were sometimes allegations of match rigging, too[41]. For example, legal action was taken against skin-gambling websites such as CSGO Lotto[42] and the UK-based FutGalaxy.com[43]. There were litigations against Steam themselves[44–46]. There was also increasing pressure on Valve/Steam from various gambling commissions and authorities, including both the Washington State and UK Gambling Commissions[47–50].

Valve vowed to crack down on skin gambling[51], reiterating their lack of any business connection with third-party websites that contravene their policies. They issued a number of cease and desist letters – but many of these sites, including CSGOLounge; implicated in eSports rigging[52] – have continued with unfettered operations[38].

The phenomenon of skin gambling stretches loot boxes into new legal territory, now transgressing several legal boundaries. Such activities, clearly, cannot be ignored. But skin gambling is a relatively niche activity, and is not representative of the majority of loot box purchasing. Instead, it is linked with a specific sub-culture of gaming.

Given the distinct legal and cultural status of skin betting, this document (and our research more generally) errs more towards a broader perspective of loot boxes. Our main goal, instead, is to understand more general and pressing questions, which apply to all the different sorts of loot boxes, and those who buy them. In particular how to: summarise the extant evidence for links between loot boxes and problem gambling and gaming; present our own insights into players' motivations for purchasing loot boxes; consider whether chance-based game-related purchases can be linked with financial, or other harms; and discuss whether particular groups (such as young people and children) may be at particular risk – and if so, what can be done about it.

2. Loot boxes: problem gambling, problem gaming?

Slot machine mechanics

Loot boxes, as noted in the previous section, were introduced into Western gaming during the early 2010s. But it was not until later in the decade – when controversies such as skin betting started gathering momentum – that the academic community started taking much note. Some influential, peer-reviewed scientific papers were soon published.

A publication authored by Drummond and Sauer established that many loot boxes are structurally akin to gambling, sharing many psychological and legal criteria with traditional gambling games[53]. A survey on loot boxes from Zendle and Cairns also established an association between loot box purchasing and problem gambling behaviour. It was these similarities with gambling that started to attract the interest of legislators and politicians across the Western world[**]. The wider media also started to ask the same question[15,54,55]: are loot boxes gambling?

It is a reasonable and important question. After all, the *gachapon* roots of loot boxes have much in common with the crank-and-pull of early slot machines. As loot boxes have evolved, they have often diversified to mimic the cards, dice and spinning wheels of casino games. And importantly, purchasable loot boxes require the staking of something of value on an uncertain outcome, a defining characteristic of gambling.

Given these similarities, a growing body of academic work on loot boxes has explored links with traditional gambling – but before reviewing this literature in the next section, it is first worth understanding some of the psychological underpinnings for these similarities. This is defined by one overarching concept: variable ratio reinforcement (VRR) schedules.

The psychology of VRR schedules dates back to the 1950s, when the behavioural psychologist B. F. Skinner was running a series of psychological experiments on animals. Running short of feed for the vast number of rats and pigeons he was housing, Skinner was forced to ration his supplies. Having already trained his animals to perform actions (such as pressing a button) to receive a reward (i.e. food), Skinner took the opportunity to experiment with providing a reward *only some of the time*.

He experimented with various regimens – rewards at set intervals and certain times, utterly randomised. What Skinner discovered was that behaviours were more strongly learned and repeated when the rewards were random. In other words, there is something inherently enticing about rewards that are unpredictable, operating on a *variable reinforcement ratio*.

** We will deal more comprehensively with legal issues in the final chapter.

A vast body of literature has since confirmed Skinner's original revelation: when various rewards – such as food or psychoactive drugs – are randomised[56–61], animals are more compelled to keep repeating the behaviour that provides a *chance* of reward, such as pressing a button or pulling a lever.

Similar behaviours can be observed with human subjects. With gambling games, there is increasing evidence that it is not simply the allure of winning money that makes gambling so compulsive, but the deployment of intermittent rewards[62] – tantalizing the player with a potential win at any time, yet never quite knowing when it will happen.

Psychologists in various domains have established that these variable schedules result in higher engagement with, and spending on, gambling[53,63,64]. For many decades, these effects have been knowingly exploited by the slot machine industry[62,65]. But over more recent years, it has been the turn of the video game industry.

Within the video game industry, these sorts of random rewards have historically been exploited for benign, entertainment purposes, such as in-game rewards like coins or extra lives appearing in a pseudo-random way. This has been going on since the days of *Space Invaders* and *Pac-Man*[66].

> **"The player is basically working for reward by making a series of responses, but the rewards are delivered unpredictably."** – Dr Luke Clark, Director of Center for Gambling Research at the University of British Columbia[67].

Modern video games amplify these effects by having many overlapping VRR schedules. A player might be trying to progress the main game, whilst simultaneously juggling the variable rewards of the metagame: accruing in game currency, 'levelling up' players, and obtaining rare items. One variable reward leads to the next, and there is a constant trickle of overlapping reinforcement.

This is not necessarily an unhealthy or harmful undertaking. There is nothing inherently 'bad' or 'dangerous' about reward pathways, nor even about variable ratios of reinforcement. Along with playing games, they form an integral part of natural learning behaviours – such as teachers sporadically rewarding students with 'merit' awards to motivate them.

The introduction of loot boxes, however, brings a twist. Where VRR schedules were originally used for entertainment purposes, they are now often integrated for profit motives. Crucially, they involve the staking of something of value (money) on the uncertain outcome, and this is where the distinction with traditional gambling has become blurred. Senior executives, industry psychologists, games developers and journalists have openly acknowledged the exploitation of 'slot machine' mechanics for monetisation purposes[67–71]. Some interfaces are aesthetically modelled on slot machines or roulette wheels[67].

> **"We [build anticipation] in a lot of ways — animations, camera work, spinning plates, and sounds. We even build a little anticipation with the glow that emits from a loot box's cracks before you open it.... Seeing purple or gold you start to think about what specific legendary or epic you've unlocked."** – Game designer of the Overwatch loot box[72].

Just like the evolution of slot machines over the last century[62], loot boxes have also been crafted through years of trial and error, resulting in sophisticated optimisations for user engagement. With a heritage and structural similarities to traditional gambling, it is perhaps unsurprising that academics would start investigating links with gambling harms.

Loot boxes and problem gambling

The first academic survey of loot box purchasers was conducted late in 2017 – around the same time as the release of *Star Wars Battlefront II*, with its aforementioned loot box-related fiasco. In a publication[1] that has since become influential on loot box literature, Zendle and Cairns reported a moderately sized association between loot box purchasing behaviour and problematic gambling scores. This was measured by the frequently used Problem Gambling Severity Index (PGSI).

There have since been a number of further studies exploring links between loot boxes and problem gambling. To consolidate this knowledge and research, we conducted a systematic review of all the available evidence (for detailed methods, see[73] and appendix). This established that such associations between loot boxes and gambling harms have now been replicated across various cohorts, nationalities and age groups, including convenience online cohorts[74,75]; North American adults and Canadian students[63]; adolescents aged 16-18[3]; a nationally representative sample of around 1,100 Danish adolescents[75]; and a nationally representative sample of around 1,100 UK adults[76].

The associations between loot boxes and gambling harms remain significant after controlling for age and gender[75,77]. They are therefore not simply explained by confounding factors such as demographics. These studies have been conducted with improving designs, including open-science, pre-registered studies, and nationally representative cohorts (see Table 1 for a summary). Their results cannot tell us whether loot boxes cause problem gambling or whether the *causes* of problem gambling increased purchasing of loot boxes, but they do suggest that the two behaviours are indeed psychologically akin. This helps inform debates around potential harms, who might be at risk, and how these risks might be mitigated.

These findings also enabled us to understand the scale and scope of loot box purchasing. The results reflect how integrated loot boxes have become in modern games. They are unavoidable for many gamers. One survey established that more than half of video game players have purchased loot boxes[63]. Another survey cited 78%[1].

Many consumers of loot boxes are children. In the UK, 93% of children regularly play games[8], with estimates that some 25-40% of these have made a loot box purchase[7,78]. In the rapidly changing gaming ecosystem, the numbers are in constant flux – but whatever the exact frequencies, research has demonstrated that loot boxes are now widely available to the majority of gamers, whatever their age, game or platform.

Table 1 shows that for surveys investigating relationships between loot box engagement and problem gambling, 12 out of 13 publications have established unambiguous positive correlations: the higher the level of involvement in loot boxes, the higher the score on a measure of problem gambling symptomatology.

Furthermore, we have also performed a secondary analysis[2] of six of these datasets. Where authors have made their data freely available, we have combined the data into one single analysis. The combined dataset, comprising 7,771 loot box purchasers, establishes a significant correlation between loot box expenditure and problem gambling scores. This correlation has a moderate effect size ($r=0.26$ $p<0.0001$) – a size that bears statistical and practical significance[1]. The relationship is similar or stronger than those between problem gambling and well-established co-morbidities, including depression, drug use, and current alcohol dependence[1,79]. In other words, this is not an inconsequential association – something notable is going on here.

Table 1. Surveys investigating relationships between loot box purchasing, gambling and gaming

Publication details			Statistical		Cohort			Open Data
Author and year	Ref	Design	LB/ PG	LB/ PVG	Country	n	Cohort	
Zendle & Cairns (2018)	1	C-S	🟩		International	7,422	Online forums; 18+	Y
Macey & Hamari (2019)	20	C-S	🟩		International	582	Online forums	N
Zendle & Cairns (2019)	74	C-S	🟩		USA	1,172	AMT; 18+	Y
Zendle & al. (2019)	3	C-S	🟩		International	1,155	Online forums; 16-18	Y
Zendle (2019)	84	L	🟩		?	112	AMT; 18+	Y
Zendle & al. (2020)	81	C-S	🟩		?	1,200	AMT; 18+	Y
Kristiansen & Severin (2020)	75	C-S	🟩		Denmark	1,137	Adolescents, 12-16, rep.	N
Zendle (2019)	76	C-S	🟩		UK	1,081	UK adults; rep.	Y
Li & al. (2019)	64	C-S	🟩	🟩	?	618	Online forums/ students	N
Brooks & Clark (2019)	63	C-S	Mixed	🟩	1: N America	144	AMT	N
				🟩	2: Canada	113	Students	
Drummond & al. (2020)	77	C-S	🟩	🟩	NZ, Aus, USA	1,049	Rep.	Y
Von Meduna & al. (2019)	165	C-S	🟩	Mixed	Germany	1,508	Pay to win players; rep.	N
King et al. (2020)	121	C-S		🟥	International	428	Online forums	N

In the column 'design,' 'C-S = cross-sectional; L = longitudinal. The column 'LB/PG' is the results of associations between loot box purchasing and problem gambling; column 'LB/PVG' provides results between loot box purchasing and problem video gaming. Statistically significant associations are shown in green, negative results (i.e. no significant link) in red, mixed results in yellow. In the column 'Cohort,' AMT = Amazon Mechanical Turk; rep. = representative. The final column shows those datasets used below for our secondary analysis (see below and section 4).

In addition to this aggregate evidence, specific findings in these papers add further support to the notion that loot box purchasing and gambling are related behaviours. We have identified a number of key supporting observations that underpin this notion, summarised in the box below:

Five further notions supporting loot box purchasing's relation to gambling

1. Loot box purchasing is predicted by gambling-related cognitions, such as 'illusions of control', where players believe they can influence the outcomes of random events[80]. Such cognitions have been found to play a role in the development of gambling disorder[63].

2. Associations with problem gambling are weakest with 'free' (i.e. giveaway) loot boxes[1,75]. This supports the notion that actually staking money on an uncertain outcome is fundamental to relationships between loot boxes and gambling.

3. The strength of association does not vary much across different 'types' of paid-for loot boxes, such as those using in-game currencies versus real currency, or those with 'cosmetic' versus 'pay to win' content[1,74,75]. Nonetheless, in one study, the association was stronger when loot boxes revealed near misses[81] – an effect also observed in traditional gambling games[82]. This result has been corroborated in a rare experimental study on loot boxes[83].

4. Unregulated websites that allow players to cash out loot box winnings increase associations with problem gambling[81]. Also, players who are more engaged with loot boxes (i.e. buying and selling them) have significantly higher proportions of at-risk and problem gambling behaviour[75,81,83]. This suggests that loot box purchasing has a closer link with gambling when the contents hold real monetary (i.e. resale) value.

5. In a naturalistic follow-up study, the removal of loot boxes (in the game *Heroes of the Storm*) resulted in people who met criteria for problem gambling spending significantly less money. However, this was a small study, and the results were not significant with all statistical methods used[84].

Loot boxes and problem video gaming

As we learnt in the previous section, there is a psychological overlap between reward processing in gambling and video gaming. Some studies have also investigated relationships between loot box engagement and problem video gaming. Drawing from a more limited number of surveys (see Table 1), the results are more mixed. Nonetheless, these correlations tend to be even larger than the links with problem gambling[85].

The notion of 'problem video gaming,' has been a controversial notion[86–88]. In 2013, the American Psychiatric Association (APA) stated there was insufficient evidence for the inclusion of internet gaming disorder in the *Diagnostic and Statistical Manual of Mental Disorders*[87], but by 2019, the World Health Organization included 'gaming disorder' in the 11th revision of the International Classification of Diseases (ICD-11)[89].

For most people – even those who play extensively – video games do not appear to be associated with worse mental health[90]. However, correlations between loot boxes and problem video gaming highlight that loot boxes could present a burden on other at-risk populations, beyond those with problematic gambling.

It is important to note that there is one shortcoming in all these surveys. They are cross-sectional, meaning the data is all collected at a single time point and the results are therefore purely correlational. '*Correlation does not imply causation*,' goes the adage. There is no way to distinguish between the various alternatives: problem gambling might lead to increased loot box purchasing. Alternatively, loot box purchasing – via 'gateway effects' – might lead to problem gambling.

To make things even more complicated, the direction of effect might not even be the same for everyone. Similar to the relationships between gambling and other risky behaviours[91,92], there are likely to be complex, bidirectional links between all these related behaviours, working alongside a whole host of other personal and social factors. The results of these surveys suggest high loot box engagement, problem gaming and problem gambling are related behaviours, possibly driven by shared cognitive biases or distortion[93–95].

A second shortcoming of these studies is the limited scope of the survey evidence. Whilst they suggest that relationships are complex and multidirectional, the bare correlations are abstract numbers. They say nothing about the nuances, the rich cultural context of gaming. And without understanding this, it is difficult to understand the mechanisms through which any harms might manifest. In the following section – drawing from our in-depth interviews with gamers – we investigate how motivations for loot box purchasing are embedded within a network of personal, social and gameplay factors. Then, in section 4, we explore how some of these motivations for loot box purchasing might become 'problematic', leading to financial or psychological harm.

3. Motivations for purchase

So far, the majority of loot box research has focused on exploring links with problematic gaming and gambling. A crucial part of the puzzle, however, is understanding why people buy loot boxes in the first place. What attracts them to it? What do they get out of it? Why do some people do it over and over, whilst others can take it or leave it?

At present, there has been almost no academic literature published on such questions. This contrasts with gambling research, where we know gambling is driven by a multitude of overlapping factors – and where problematic gambling is often linked with things like impulsive traits and escape motivations[96]. With regard to loot boxes, only a single publication has broached the subject[97].

As part of a wider online survey of adolescents' loot box engagement, this work included an open-text question about reasons for buying, identifying that there are at least eight different motivations[97]. These involve factors such as gameplay advantages, cosmetic reasons and the 'thrill' or excitement. Whilst this single question does capture data from a large sample (441 gamers in this case), such an approach only captures a sentence or two from each person. It therefore provides little information about the full spectrum of personal motivations (most gamers only listed a single motivation), and how these motivations might interact within the nexus of gameplay, personal and social factors.

As is the case with gambling research, a deeper understanding is necessary to allow us to understand which motivations might be linked with 'harm,' enabling strategies such as risk-assessment and targeted interventions. For these reasons**, we conducted a series of 28 in-depth interviews with a diverse sample of regular loot box purchaser from across the UK, spending upwards of an hour with each person, learning as much as we could about their motivations for buying loot boxes.

Beyond seeking to understand classic 'motivations' in the way psychological science defines them – factors like 'mastery' and 'affiliation' – our work also encompassed external, loot box specific factors such as promotions, advertisements, or in-game mechanics. Strictly speaking, within the psychological literature, these might be more accurately termed 'facilitators', which act to amplify pre-existing motivations, but when we asked people 'why' they bought loot boxes, they spoke often of these factors, and we had no reason to restrict our interest to primary motivations. Indeed, these facilitators cannot and should not be ignored: if they do drive excessive or harmful purchasing in vulnerable groups, then they might be the focus of specific interventions.

We collected a rich body of data in our interviews, and after transcribing them, we used a robust, well-established approach (reflexive thematic analysis[98]) to pull out and describe the important, recurring themes that were discussed by respondents (for details, see[99].)

The overall structure of these themes is summarised in Figure 5, with more details – including illustrative quotes for each – provided in Table 2.

** Another outcome of this work was development of a comprehensive, validated set of questions (or 'scale') to measure reasons for loot box engagement. Such scales are invaluable in reliably quantifying motivations within large-scale, survey-type studies, and we will be deploying it in our future studies.

Many of these themes are fairly close analogues of motivations seen in gambling. For example, the excitement of opening (enhanced by colours, sounds and animations); the thrill of 'near misses' (narrowly missing out on a high-value item); benign and toxic social factors (from shared social activity to unrequited peer pressure); the feeling of being motivated by 'temptation' or 'compulsion'; and the influence of external factors like promotions and advertisements.

> **"Just like a rush of, like, I don't know, like, excitement, a rush of excitement, or, like, just pleasure, really, it was like a hit, do you know what I mean?"**
> – Male gamer, aged 20-30 (all anonymous quotes are taken from our qualitative interviews).

Fear of missing out was another common theme with some overlap with gambling motives. This loot box-related fear of missing out (distinct from the 'FoMO' commonly-referenced in relation to social-media engagement) encompassed a sense of urgency to take advantage of time-limited offers/events, and a fear of being left out of social events centred around loot box openings or their contents.

Motivation

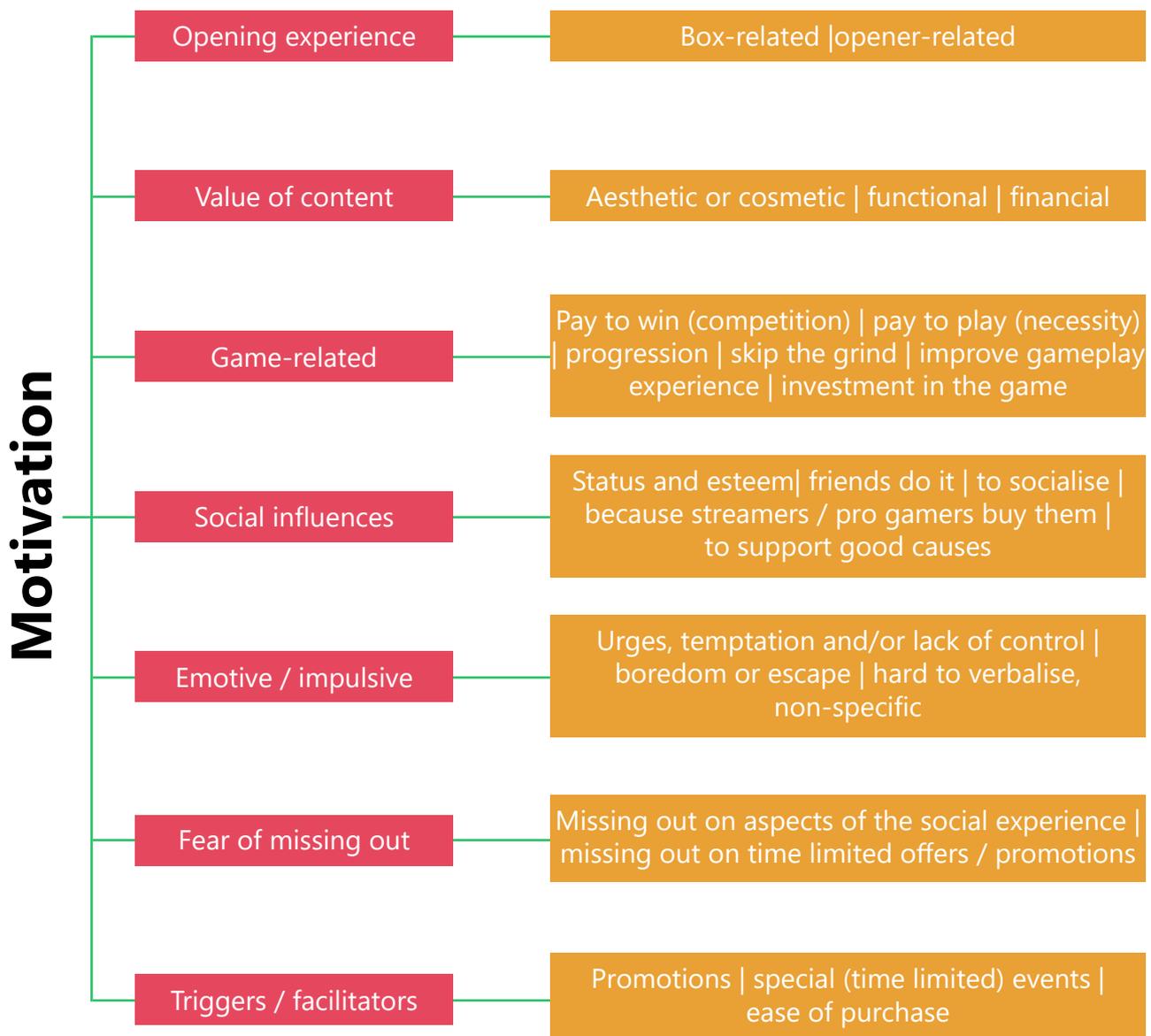|	
Opening experience	Box-related |opener-related
Value of content	Aesthetic or cosmetic | functional | financial
Game-related	Pay to win (competition) | pay to play (necessity) | progression | skip the grind | improve gameplay experience | investment in the game
Social influences	Status and esteem| friends do it | to socialise | because streamers / pro gamers buy them | to support good causes
Emotive / impulsive	Urges, temptation and/or lack of control | boredom or escape | hard to verbalise, non-specific
Fear of missing out	Missing out on aspects of the social experience | missing out on time limited offers / promotions
Triggers / facilitators	Promotions | special (time limited) events | ease of purchase

Figure 5. *A conceptual framework of motivations for purchasing loot boxes.*

Table 2: Summary of loot box motivations with illustrative quotations

Theme 1: Opening experience	
Box-related factors	**Opener-related factors**
"It's not just you click a button and then there you go you've got it – there's a lot of, like, animation that comes with it and that's quite, like, exciting and thrilling for me."	"Just like a rush of, like, I don't know, like, excitement, a rush of excitement, or, like, just pleasure, really, it was like a hit, do you know what I mean?"

Theme 2: Value of box contents		
Financial	**Aesthetic/cosmetic**	**Functional**
"If you got a good player, like, a rare player, it was just, like, it was, like, ultimately winning virtual currency, because you could sell that player for virtual currency, so that's what it was all about."	"It's just an opportunity for you to buy the skin and buy something that you think looks good." "You want to compete with the other players, not just in-game, but with your skin."	"Obviously if you've got a more powerful character [from a loot box] you've got a higher chance of winning."

Theme 3: Game-related elements		
Progression	**Skip the grind**	**Pay to win**
"The game offers so much fun… if only you could get over this little speed bump [through box contents] … where the game is really, really hard and there's things you want to do and… progress onto."	"You can either spend a lot of time grinding it for free or you can, like, cheat. Well, not cheat, but shortcut your way in by just spending money [on a loot box] and just getting the content as well."	"… just wanting to be able to do better, so, in the games where it gives you items, and, so, you get that special item that will help you out or… beat that last boss, or help beat more people online."
Pay to play	**Enhanced game experience**	**Investing in games**
"If you don't buy packs or you don't grind the game for hours and hours and hours it's just not possible to be competitive."	"These load outs from the loot box were affecting the gameplay, giving me new weapons, making my characters more stronger, and that made it a lot more fun."	"Most of these games that offer them are free to play, so others… some people justify the purchase, saying, like, this game gives me entertainment, so I'm going to pay for it."

Theme 4: Social influences		
Status and esteem	**Influence of friends/others**	**Influence of streamers and/or pro gamers**
"You could brag to the lads at work, like: 'I just packed so and so in a pack last night'." "… it was kinda like a status thing, I guess… if you could display these skins… There's that power that comes behind with it.'	"I'm then comparing myself to him, because he's got it and I don't, so I want to get something… like that sort of jealously, almost." "… to get some more respect in the game you do have to have, like, skins and stuff."	"The reactions on YouTube… it's like, if you pull a good player, people go absolutely crazy… because you pulled that amazing item… if there wasn't influence, I don't think there would be more sales of loot boxes…"

Socialising	To support good causes
"I'd be out with my friends, a few of us would all normally play FIFA and we'd be like, 'Oh, actually shall we all just throw like a tenner on some packs?'." "If I'm opening a loot box and there's other people that I'm chatting to and they're opening loot boxes, and you can, it's a shared experience."	"They do charity events once a year, or a couple of times a year, where it says like 'spend £10 and you will get this rideable mount' and you just move around on it, you fly around on it, and it looks special, and all the money will go to charity."

Theme 5: Emotive/impulsive motivations		
Urges, temptation and/or lack of control	**Boredom or escapism**	**Hard to verbalise, non-specific motivations**
"I was more focused on buying the loot boxes in school. I wasn't concentrating a lot and that affected my mental ability… and I was very disrespectful. It was always very difficult to resist the temptation."	"Sometimes you sit there, and you think, 'well, hold on, I'm a little bit bored, I don't really want to watch TV, I know, I'll open some FIFA packs'."	"I don't know, really – it's a bit embarrassing in a group of 20-year-olds… sitting there putting hundreds of pounds into what is a football game on Xbox."

Theme 6: Fear of missing out
"Fear of missing out, that's what people are most vulnerable to… they think, 'oh wow, I want to really get into this and do well in this game', then they put a time limited event on and you think, 'hang on a minute, I haven't really gathered enough resources to do this event, maybe I need to buy something'." "They all ran, as a joke, there was these bright pink guns… and I remember I didn't have this skin and you had to [have it to join in]."

Theme 7: Triggers/facilitators		
Promotions	**Special (time-limited) events**	**Ease of purchase**
"… they would give you, like, 20% extra free if you spent £80 straight up, as opposed to just £20, or they give you, like, a better pack with more chance of getting a good player if you spent more money on the game, so more money on the pack."	"… they would have this time-limited event going on, which brought the rate up and a lot of people… would end up resorting to buying, like, additional tickets to try and, like, roll for the unit they want."	"It doesn't feel like you're spending money 'cause you're just buying packs 'cause your card's stored in there… It's just so easy… It's so, so quick, like, it's – I can spend £80, £80, I could spend £500 in five seconds."

In contrast, other themes – such as the value of box contents and the game-related elements – are more novel and specific to loot boxes. Some of these are related to game mechanics, such as game 'pinch-points' (almost impossible to overcome without purchase), games that require loot boxes to remain competitive, and 'free' loot boxes, which frequently work as a 'teaser' to encourage future purchases.

Regarding box contents, notions of 'value' are more nuanced and subjective than traditional gambling games, with their simple cash rewards. With the 'prized' loot box assets, some people coveted aesthetic appeal and others sought functional items with competitive advantage. But this was not just related to the sort of games people were playing. Instead, it also related to the 'psychological

needs' their gaming fulfilled, linking with their game-related motives: those seeking social approval, for example, might value the 'kudos' skins that attract attention and give them 'bragging rights'. In contrast, those seeking competency might value 'pay to win' contents, such as high-grade weapons or stronger characters.

> **"You could brag to the lads at work, like: 'I just packed so and so [i.e. opened a player pack, and a desirable player was revealed] in a pack last night'."**
> – Male gamer, aged 30-40.

As we expected, our findings highlight that there is *no single dominating motivation*. There are personal differences: an array of multiple, personal, overlapping factors that contribute to loot box engagement. Motivations often interact in a complex relationship with game design, which deploys a sophisticated choice architecture. Players become psychologically invested in social or competitive gameplay factors before a range of incentives and nudges push players toward purchase. This sometimes includes traditional gambling-like strategies such as revealing 'near-misses'.

Despite personal difference and nuances, there was one perception that unified all our participants: notions of value. This was consistently linked with item rarity. The rarer the haul, the higher the value. This might even have direct financial implications as some participants were hoping to get lucky, and unbox items that were available to buy outright in the item shop, but were normally too expensive. In some cases, this is the only way they might be able to afford the item. In other cases, they were hoping to later trade any lucky wins for an overall profit. These sorts of observations suggest that many loot boxes meet existing criteria for gambling regulation[100].

> **"If you got a good player, like, a rare player, it was just, like, it was, like, ultimately winning virtual currency, because you could sell that player for virtual currency."**
> – Male gamer, aged 20-30.

This concept of 'value', however, extends beyond the classic legal 'money's worth' definition. Items won through loot boxes can hold considerable social or psychological capital. As one respondent says, 'this is something that you've purchased, this is something that no one else has, this is something really, really cool that, like, people would want'.

This is, for most, more important in driving purchase than the potential for monetary reward: in both our sample and Zendle's[97] survey-based study of motivations, financial profit was a very infrequent influence.

Concluding with a real world analogy, it could be argued that the 'prized' contents of loot boxes are equivalent to the latest pair of trainers, or a high-spec bike – but for many young people, these digital assets are now more relevant than those traditional 'real world' status symbols. They often hold a more sophisticated allure than a simple cash prize. And just because the winner decides to keep the prize, rather than sell onwards, that does not render the prize as having no 'money's worth.'

4. Problematic play? Loot boxes, financial harm and psychological harm

Financial harm

Headlines stating: 'One teenager spent nearly £3,000 on his addiction[101]' and 'I blew my parents' savings on Fifa'[102], are inconsistent with a review of the academic evidence. Here, the sums of money tend to be rather modest: from all the survey evidence presented in the last section, the average monthly spend on loot boxes is typically less than £20[1,3,74,84]. Why the discrepancy?

The key point is that the distribution of spend is highly *skewed*. Whilst most loot box purchasers spend modest amounts, there is a small number of high-level spenders, sometimes referred to as *whales*[103]. Here, there are industry insinuations that these big spenders are simply high-earning individuals, those who can afford the recreational outgoings[68]. However, others have argued that this group of players may instead be over-represented by people with gambling problems[3].

To investigate this issue, we conducted a secondary analysis of six open access datasets of loot box surveys, aggregating data where authors made their data freely available[2]. The combined dataset comprised of 7,771 loot box purchasers, and our analysis confirms that a disproportionate amount of revenue is derived from high-level spenders (see Figure 6). For example, around 5% of loot box purchasers in our dataset (those spending more than around £70 ($100) per month, or local equivalent) generate around half of industry revenue from loot boxes. Similarly, around a third of revenue is derived from the top 2% of purchasers**.

Moreover, these players have considerably higher scores of problem gambling symptoms (see Figure 6). For example, with the 5% of gamers spending over £70 / $100 per month, almost one third fall into the 'problem gambler' category. Conversely, there is no evidence in our dataset that higher loot box spend is correlated with higher personal earnings. Others have reported similar results, estimating that almost half the top 5% of loot box spenders are people who gamble problematically[104].

** Our pre-screen survey with 13,000 UK gamers, in section 'Who is at risk?' confirmed a similar relationship.
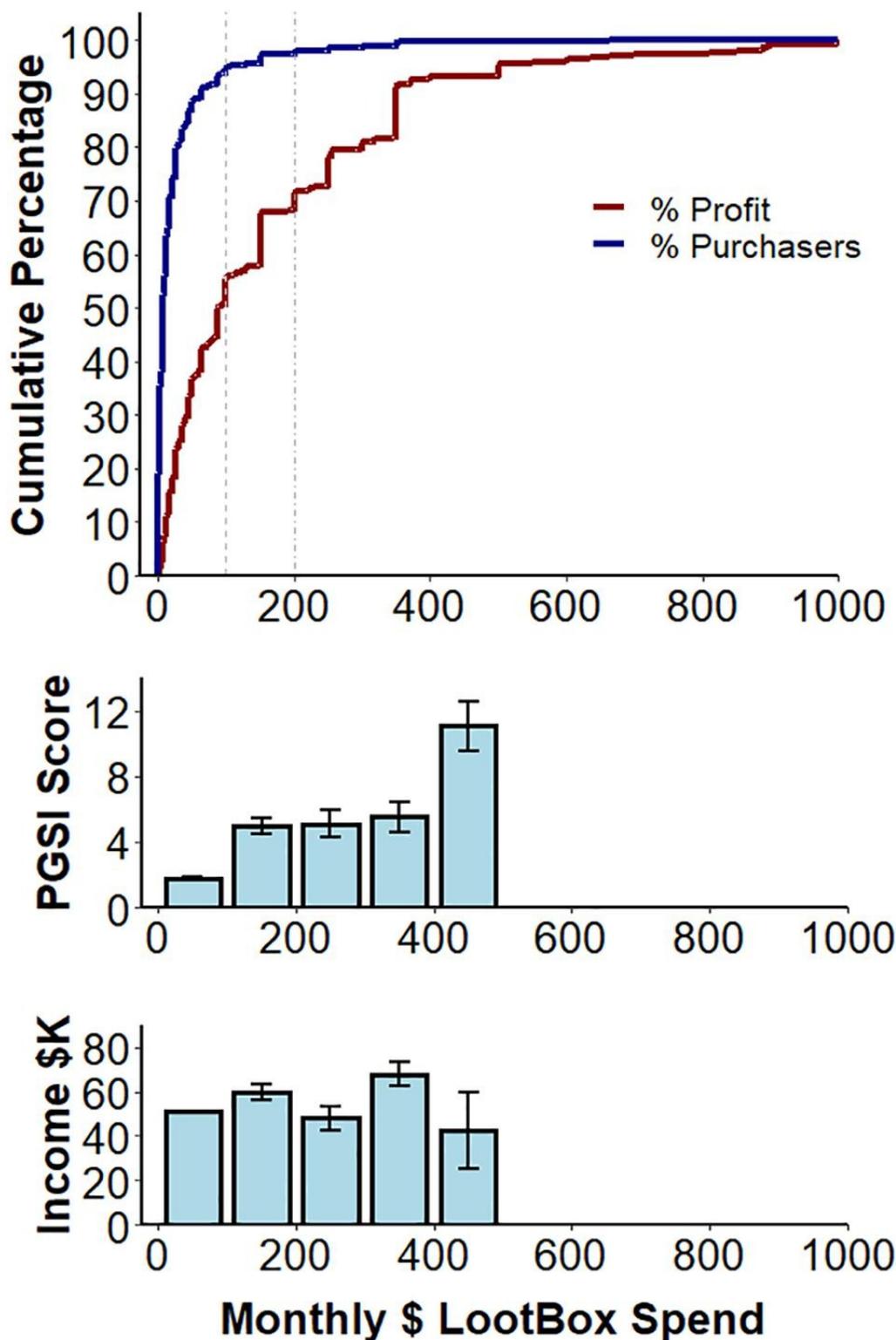
Figure 6. *Secondary analysis from six open-access survey datasets, comprising of 7,771 loot box purchasers. Graph plotted in USD due to this being the predominant currency in our dataset.*
TOP: Cumulative % of company revenue derived from self-report loot box spenders (red line) coming from those players spending up to this dollar amount (blue line). This illustrates that a small proportion of players make up a disproportionate amount of loot box revenue. X-axis represents dollar monthly loot box spend. Y-axis is the cumulative percent of company revenue (red line) derived from players spending up to this dollar amount (blue line). For example, the first grey vertical dashed line (plotted at $100) reveals that around half of revenue in this dataset (intercept with red line) is derived from approximately the top 5% spenders (i.e. those spending more than $100 per month).
MIDDLE: Mean PGSI score for these same loot box purchasers, grouped into the $100 monthly spend intervals of the top panel.
BOTTOM: Mean self-report earnings for loot box purchasers, binned into $100 monthly spend intervals.

Overall, the results establish that whilst most individuals spend modest sums on loot boxes, there are a minority of high-spending individuals (i.e. hundreds of pounds per month). Such patterns of spending mirror those observed with gambling revenues[105]. These people, our analysis reveals, are much more likely to be experiencing problematic gambling.

Whilst our analysis did not investigate problem video gaming, it has been established that associations between loot box purchasing and problem video gaming are, on aggregate, larger than associations with problem gambling[85]. It is therefore possible that a similar proportion of high spenders might also be classified as people who have problems with their video gaming.

Games developers, unwittingly or not, appear to be generating outsized loot box profits from at-risk individuals, likely to include both those with disordered gambling and disordered gaming – but not from wealthy gamers, as they claim.

What our aggregated data analysis cannot reveal, however, is the degree to which such spending translates into downstream harm, such as distress or poorer psychological wellbeing.

Psychological harm

The history of video gaming research is dogged by controversies around issues of 'psychological harm.' There is a large body of research built up over decades, for example, investigating whether violent video games increased aggressive behaviour. But as scientists implemented more robust approaches, it has turned out that any associations were of negligible magnitude. Eventually, the American Psychological Association summarised there was 'scant evidence'[106].

Given this history, any links between loot boxes and wellbeing or psychological distress should be interpreted cautiously. After all, something like wellbeing is influenced by a myriad of personal, social, and lifestyle factors, and any effect of loot boxes will be difficult to disentangle from other aspects of gaming behaviour, swamped by other influences.

Nonetheless, numerous academic commentators have stressed the potential negative impacts of loot boxes on player mental health and wellbeing[64,107,108]. Preliminary evidence has linked loot box engagement with higher levels of psychological distress, albeit a finding that is indirect[64] or of a small magnitude[77], and cautiously interpreted by the authors[77]. In fact, in one of these studies, loot box spending seemed to be correlated with both negative and positive moods[77].

Such findings indicate that relationships with mental wellbeing are likely to be complex. Gambling research has shown that 'psychiatric disorders can represent both as a precursor and as a consequence of problem gambling'[109]. It is therefore plausible that loot box purchasing could be both a *cause* and a *consequence* of mental distress. Furthermore, additional comorbid conditions – just like gambling – could further contribute to both heavy loot box engagement and psychological distress[109].

It remains to be established whether relationships between loot box purchasing and problem gambling translate into psychological harm, and more research is required to further unpack complex relationships between gaming, gambling, spending behaviour and financial/psychological wellbeing. The next stages of our own research, currently being conducted, aim to use novel survey approaches to investigate these questions more fully.

Who is at risk?

There has been much commentary around the potential dangers of loot boxes for young people[53]. Adolescents are some of the most avid consumers of video games[110], and loot boxes are widely available[53,104] and frequently purchased by young people[7,78,111]. Moreover, young people have a higher vulnerability[93,112] and prevalence of problem gambling[92,113,114]. This suggests that the gambling-like harms of loot boxes might be amplified with greater proximity *and* greater risk.

Such fears appear warranted. Two academic surveys of adolescent loot box behaviour have been undertaken, both of which established stronger links with problem gambling[3,75]. In one survey, the link was more than twice as strong as with adults[3].

There are likely to be several underlying reasons. First, neurodevelopmental immaturity is thought to be linked to reduced impulse control in adolescents[115,116]. Second, this cohort may lack effective coping strategies for the challenges of adolescence[117], leading to greater urges for 'escape' – a known risk factor for problem gambling[118]. Third, adolescents are more susceptible to influences of peer pressure, where social networks can serve to normalise behaviour such as high-risk gambling[119,120].

> **"If somebody had a sleepover, the first thing that would be asked is, like, 'are you going to get some FIFA points for us to watch you open some packs?' That was pretty much a necessity for every sleepover, party, anything like that."**
> – Male gamer, aged 20-30.

All these risks are liable to transfer across to loot boxes, potentially culminating in enhanced dangers and risks around loot boxes for young people – especially males[23,75,107], who have greater impulsivity[3,121] and problem gambling behaviours[122–124]. Furthermore, developers have alluded to the fact that loot boxes are more readily accepted by younger audiences, who have grown up with different consumer habits to older gamers[125].

> **"Everybody else was doing it [buying loot boxes], like, 'ah, yeah you haven't got it!' and yeah, I'd like to say no, but I'd probably give in to peer pressure."**
> – Male gamer, aged 20-30.

We have recently conducted a brief screen of UK gamers on the survey recruitment platform Prolific Academic, seeking to identify people who purchase loot boxes (see[126] and appendix). This screen, involving around 13,000 UK gamers, reveals that loot box purchasers are indeed skewed towards younger players – especially younger men (see Figure 7).
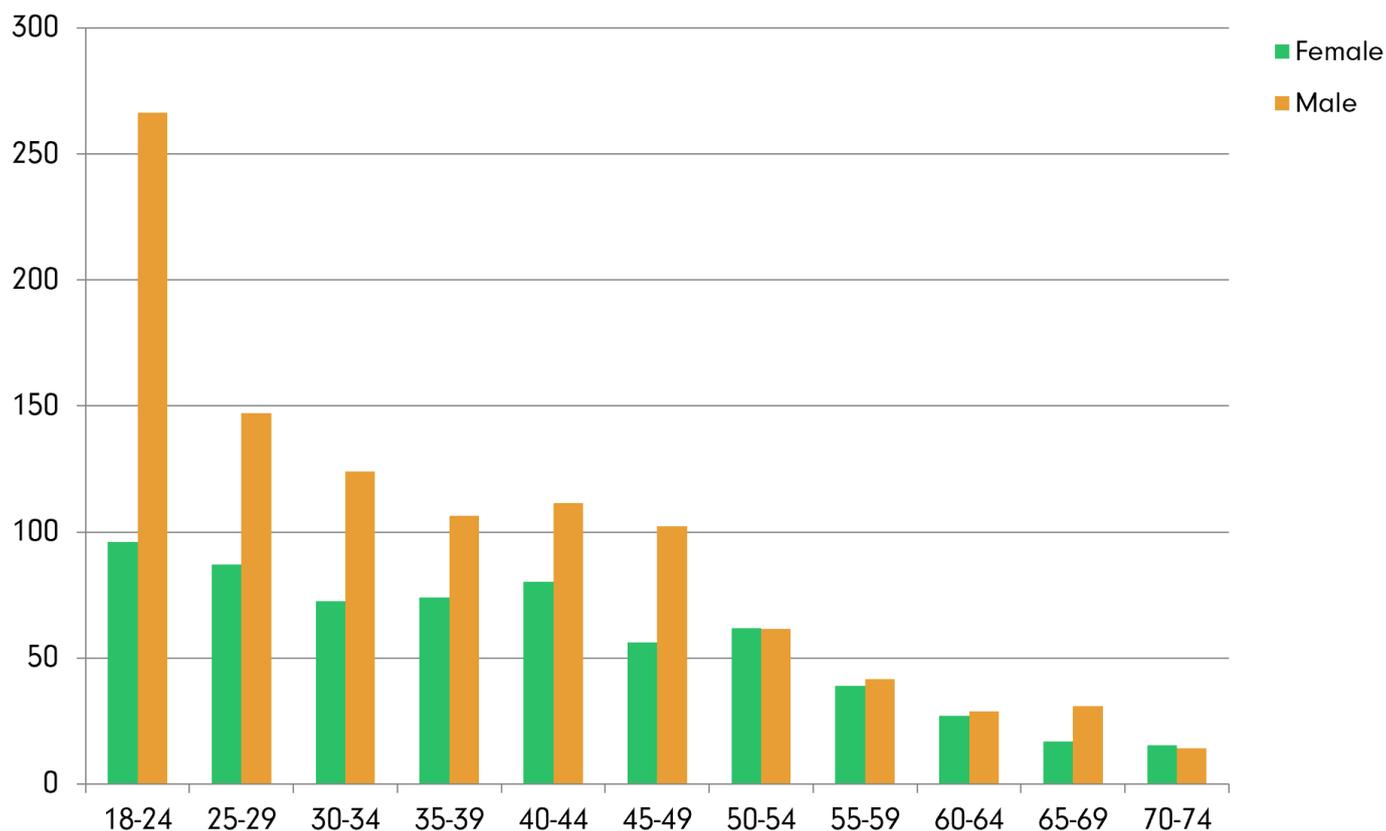
Figure 7: *Numbers of loot box purchasers, by age and sex, from 13,000 UK gamers on Prolific Academic. Due to skews in the underlying sample from Prolific Academic, age and sex bands have been normalised, so as to represent a UK representative sample (for methods, see appendix and[126]).*

Whilst our data does not extend to children, we know that many consumers of loot boxes are children, with studies estimating that around 25-50% of children and adolescents have opened a loot box[7,8,75,78]. If harms are associated with loot boxes, these harms are liable to disproportionately affect children, adolescents and young people – possibly compounding other related problems, such as problem gambling or problem video gaming. Our qualitative work, presented in section 3, also suggested that there may be a window of particular risk in late adolescence/early adulthood. At this stage in their lives, many young people are gaining their first taste of independent income (which they might not be used to managing), yet still have strong personal and social investment in gaming, so can end up spending unsustainable amounts of money on loot boxes.

> **"I got my first job when I was doing my A-Levels at sixth form... That was my first real experience of getting, like, some actual money, and literally, I could say easily half of it went on FIFA... about £700 a month, so, you know, easily a grand went on FIFA, easily, from that."** – Male gamer, aged 20-30.

Finally, in addition to younger gamers, any risks associated with loot boxes may disproportionately affect other cohorts. Our preliminary survey data suggests that other demographic variables might also be associated with increased loot box engagement – including lower educational attainment, ethnic minority status and unemployment (see Table 3).

The skew in loot box purchasers – particularly towards those who are younger and male – is particularly concerning when framed alongside the discovery that high spending loot box 'whales' tend to be problem gamers, rather than wealthy individuals. These demographic trends are likely

to overlap with psychological drivers, such as impulsivity and gambling-related cognitions. This relationship could result in disproportionate risks for specific groups and cohorts of gamers – suggesting that legislations or controls on loot boxes may have utility for harm minimisation.

Table 3. Percentage of active loot box purchasers from 13,000 UK gamers, according to demographic profile	
	Percent LB buyers
Total from 13k gamers	16.6%
Gender: Males purchase more LBs	
Female	13.7%
Male	20.8%
Age: Younger purchase more LBs	
18-25	18.9%
25-30	18.0%
30-35	15.8%
35-40	16.1%
40-45	16.6%
45-50	13.5%
50-55	12.2%
55-60	9.8%
60-65	9.4%
Ethnicity: Minorities purchase more LBs	
Ethnic Minority	18.4%
White	16.4%
Education: Inverse relationship with attainment	
Secondary education (e.g. GED/GCSE)	15.7%
High school diploma/A-levels	16.7%
Technical/community college	18.9%
Undergraduate degree (BA/BSc/other)	12.9%
Graduate degree (MA/MSc/MPhil/other)	12.8%
Doctorate degree (PhD/other)	10.9%
Employment: Unemployed purchase more LBs	
Full-Time	17.6%
Part-Time	15.2%
Due to start a new job within the next month	19.3%
Unemployed (and job seeking)	18.4%
Not in paid work (e.g. homemaker, retired, disabled)	13.2%
Other	15.0%

These risks, however, may not be limited to loot boxes. Our qualitative work with gamers has highlighted how players are often nudged towards purchasing via a number of well-known psychological techniques, such as endowment effects (i.e. giving players 'free' loot boxes, which can only be unlocked with a paid-for key), price anchoring, 'fear of missing out' (on special, limited-time offers or items) and obfuscation of costs (i.e. via in-game currencies.)

Developers have openly discussed such approaches, where loot boxes (with their gambling-like structure) are just one architectural choice from a psychological playbook of monetisation strategies. Furthermore, analysis of patents[127] has revealed that some game designers are engaging in practices that specifically target psychological tendencies with so-called 'dark-nudges'[68–71], where players can be manipulated in ways that would be considered illegal in the context of traditional gambling.

Tactics include deploying reward schedules that are not determined by chance[107,127], but instead use informational asymmetries about players, such as spending habits, funds available, or game-related preferences. For such reasons, some researchers have suggested using the umbrella term '*predatory monetisation*', rather than focusing specifically on loot boxes[107].

Having discussed the harms that may be associated with loot box purchases, in the next section we shall discuss the various responses to these putative harms. These have included defences of loot boxes, attempts at self-regulation, and policy actions.

5. Loot box defences, industry self-regulation and previous policy responses

Loot boxes have many contrasts to the earlier video-game moral panics. Unlike those earlier backlashes – such as touted links between gaming and violence – the outrage, this time, has largely been driven by the gamers themselves[9,30,46]. Unlike those earlier controversies, the evidence appears to be stacking up against loot boxes. Many questions remain, but associations between loot boxes and problem gambling have been robustly verified across a variety of cohorts and nationalities. Loot box fears, it turns out, cannot be easily dismissed. Beyond such comparisons with earlier video game controversies, there are a series of other arguments rolled out in defence of loot boxes.

Some senior gaming executives, for example, have defended loot boxes as 'surprise mechanics,' arguing they have been around 'for years, whether it's Kinder Eggs, or Hatchimals, or L.O.L. Surprise!'[5]. Here, it is worth remembering that developers themselves have openly acknowledged the gambling design behind loot boxes[67–71]. Furthermore, traditional 'surprise mechanics' aimed at children have not, themselves, avoided similar controversies[128].

Back in the 20th century, *The Wall Street Journal* ran a feature-length article entitled '*Sports Trading Cards: Wholesome Fun or Gambling?*'[129]. Both baseball cards and the Pokémon Trading Card Game have been the subject of law suits[16]. Nonetheless, academic evidence has established that 'surprise mechanics' behave differently in video games versus traditional contexts.

Firstly, a study investigating players of collectible card games – a physical analogue of loot boxes – could not repeat the associations with problem gambling[130]. Secondly, the scale, scope, availability and technological sophistication of loot boxes is substantially greater than traditional 'surprise' toys[130] – leading to a 'continuous play' effect that is not seen with traditional items. It is akin to the difference between the 'always on' nature of slot machines versus the discontinuous nature of national lotteries.

There is a further insinuation of this 'surprise mechanics' defence of loot boxes: the idea that everyone is a winner. The evidence, however, suggests otherwise. When marketplace features allow, contents of most loot boxes are traded for less than the cost of unboxing[131] – i.e. monetary losses occur, and consumers do not always 'win something.' Even when there are no mechanisms for cash out, our qualitative work confirmed that most gamers perceive loot box contents as generally representing 'a loss'. Sometimes, the sought-after, 'winning' items were so rare that almost every purchase was a disappointment, often spurring another purchase.

> **"I could have been buying loot boxes until the end of time and not necessarily have got the thing that I was looking for."** – Male gamer, aged 40-50.

There is a final tranche of defences, which cite free-market capitalism, consumer choice, and the unintended consequences of unnecessary regulation, especially around reduced developer income. The game *Fortnite*, however, remains the world's most profitable game, even after removing loot boxes[132]. Furthermore, our preliminary survey of around 13,000 gamers suggests that loot boxes are

engaged with at a lower frequency than other types of monetisation strategies (only 16% of gamers purchase loot boxes, versus 40% of gamers purchasing add-ons and downloadable content, for example). Such statistics suggest that disbenefits of regulation will be mitigated by the availability of other approaches to monetisation.

Far more pertinent than such defences, however, is the issue of harm. Associations of loot boxes with problem gambling and problem video gaming have been robustly repeated. The relationship is stronger than those between problem gambling and well-established co-morbidities, such as depression and drug use[1,79]. Furthermore, our data indicates that high spenders on loot boxes are not simply high-earning 'whales' – but are over-represented by people with gambling problems[2]. And the evidence also suggests that specific groups might be especially vulnerable to such harms, especially young men. This tallies with media reports which frequently publicise cases of unsustainable spending.

The research does not yet tell us much about how this spending might translate into psychological distress. Nonetheless, with the stakes so high – children and young people are particularly exposed to loot boxes – cautionary principles should apply, as others have argued[5]. And over the last decade, a number of legal jurisdictions have already reached similar conclusions – but these early attempts at legislation have often struggled with the dynamic and unique challenges posed by loot boxes.

Early loot box regulation: prescient or premature?

Policy action on loot boxes has often followed a similar geographical trajectory as the boxes themselves. In Japan, consumer legislation was levied as far back as 2012 against 'complete gacha' games, often involving the near-impossible task of completing specific item sets. Some developers attempted to evade the rules[133] – a theme echoed as legislation has spread into other jurisdictions. Nonetheless, most developers acceded, forming a self-regulating industry group to avoid further legislation. A broad spectrum of self-regulatory measures were implemented, including payment caps for young players, provisions against real money trading, warnings, probability disclosures and limits on item rarity[134].

Other Southeast Asian nations soon followed. Singapore's parliament passed broadly worded legislation in 2014[135], and in 2017, China passed laws enforcing mandatory odds disclosures. But once again, some companies side-stepped legislation[133]. Blizzard China, for example, removed 'standard' loot boxes from *Overwatch*, but replaced them with loot box 'gifts,' available with every purchase of in-game currency[136]. Furthermore, the underlying odds for loot boxes have sometimes been presented in an obfuscated, confusing manner[10].

Legislative attempts spread to Western economies along with the *Star Wars Battlefront II* controversy in 2017. Around that time, the Belgian Gaming Commission investigated *Overwatch, Star Wars Battlefront II* and *FIFA Ultimate Team* – ruling that these loot boxes constituted unlicensed gambling. This decision was aided by Belgium's relatively strict gambling laws, which has rather broadly interpreted notions of 'value' (i.e. 'money's worth'). This case-by-case approach, however, has resulted in inconsistencies, where Valve's other crate-filled games – such as *Team Fortress 2* and *Dota 2* – remained unaffected, presumably because they did not attract similar levels of controversy[137].

Around the same time as Belgium, the Netherlands gave similar rulings, covering a slightly broader (but still limited) roster of games. It took the maximum fine of €10m for EA to capitulate, and finally remove purchasable player packs from FIFA[138].

Following their ruling, the Netherlands solicited the European Union to harmonise approaches to loot boxes across member states. The problem for the EU, however, is that the gambling laws themselves have not yet been harmonised, and loot boxes are not, in any case, a perfect fit for gambling legislation. This often leads to problems of a square peg, round hole scenario. We shall elaborate on these problems shortly. It is worth noting that it was partly due to such issues that a July 2020 EU report reframed loot boxes as a consumer protection issue[139].

Recently, however, both the UK's Department for Digital, Culture, Media and Sport and the House of Lords Gambling Industry Committee[5,6] have stated that video game loot boxes should be classified as 'games of chance', and regulated under the Gambling Act 2005 to protect young people from 'gambling and gambling-like products'. Such a move, however, would involve a series of complex and nuanced ramifications, more fully explored later in this section.

> **"If a product looks like gambling and feels like gambling, it should be regulated as gambling…. The government must act immediately to bring loot boxes within the remit of gambling legislation and regulation."**
> – House of Lords Gambling Industry Committee.

A chorus of other voices are also calling for action, including academic researchers[3,4], the Royal Society for Public Health[7], the Office of the Children's Commissioner[12], charities such as Parent Zone[8], a petition to the government[9], and even stakeholders like Tim Sweeney, the CEO of *Epic Games* and developer of *Fortnite*[140].

Industry self-regulation: too little, too late?

In attempts to avoid or forestall legislation, the gaming industry has made moves towards responsible and transparent corporate practice.

Since 2017, the Apple Store[141,142] has required that games should disclose 'odds' of obtaining items from loot boxes, the Google Play Store instated similar rules in 2019[143], and last year, a consortium of games distributors (including Sony, Microsoft and Nintendo) made similar pledges. There are, however, limitations to such approaches. As observed in China, odds are often obfuscated and incomplete, not easily comprehensible by adults nor children[10].

Furthermore, within some games, ostensibly 'similar' items are not fungible assets. Instead, they are variable. For example, within the game *Counter-Strike: Global Offensive*, weapons come with a 'wear rating,' varying on 100-point scale from 'factory new' through to 'battle scarred.' Therefore, a much-prized loot box item, might, in fact, turn out to be damaged goods, with a reduced re-sale market value.

Similar principles apply in other games and formats, where 'drop rates' are often disclosed only for item types, such as 'legendary' items in games such as *Overwatch* or '84+ rated players' in games such as *FIFA Ultimate Team*. This obfuscates the fact that the most heavily desired items – Cristiano Ronaldo or Lionel Messi, for instance – are vanishingly rare, costing small fortunes (or incredible luck) to obtain[144]. According to Electronic Arts themselves, 'probabilities are for example only and may not be the same as in the final product'[145]. The exact odds of a particular item or player, therefore, remain unknown. Such corporate practices are not transparent. They are opaque.

> **"We were struck by how difficult it was to get full and clear answers... We felt that some representatives demonstrated a lack of honesty and transparency... It is unacceptable that companies with millions of users, many of them children, should be so ill-equipped to discuss the potential impacts of their products."** – DCMS report on Immersive and Addictive Technologies, in reference to gaming and social media companies.

A second approach to industry self-regulation has been the use of game labelling. In April 2020, the Entertainment Software Rating Board (ESRB) and Pan European Game Information board (PEGI) added 'random items' labels to game certification. However, the labels from the ESRB and PEGI are criticised as being vague, and falling short of recommended age restrictions[146]. Many loot box games are still deemed suitable for children and teenagers[18]. Furthermore, imposing PEGI/ESRB age restrictions on loot boxes will likely be an ineffective strategy. They are ignored by the majority of parents and children alike[13,14].

These approaches are unlikely to mitigate risks posed by loot boxes. They are either ineffective or poorly implemented. Not surprising, then, that such efforts have also failed to stymie increasingly vociferous calls for policy action[14].

The conundrum of 'money's worth'

Policy action on loot boxes, therefore, can take several guises. The most commonly-touted route is existing gambling regulations. 'Regulate loot boxes as gambling,' scream the headlines. This is easier said than done.

Legal definitions of gambling rest on three components: (1) consideration (i.e. the wager), (2) chance and (3) the prize. It is the final component – the prize – where loot boxes confound. For some jurisdictions – such as Belgium – strongly worded policy has enabled swift action. For others – such as Poland – a clear mandate for monetary wins also makes things simple, albeit in the opposite direction[147]. But for many national gambling regulators, life is not so easy. Policy wording tends to fall between extremes, leaving regulators baffling over decades-old, ambiguously-worded legislation.

In the UK, the Gambling Act (2005) has not generally been considered applicable to many loot boxes (due to lack of 'money's worth' winnings). However, on this point, the ability to 'monetise' loot box contents – either via third-party websites or game-related marketplaces such as Steam – has profound implications.

On the largest PC game-distribution platform, Steam (a service of Valve corporation), it is easy for players to trade game-related items (including loot boxes and their contents). Recently, Drummond, Sauer and colleagues established, via Steam marketplace data, that loot box 'contents' can hold real world value, and could therefore be regulated under existing gambling regulations[131]. Their study established over a billion dollars of trades in real world value. This a sizeable marketplace, operating along analogous principles to a betting or financial market from which Valve takes a commission of 15% from each trade.

> **"Loot boxes could fall within the [current] definition of gambling148... The ability to convert in-game items into cash, or to trade them (for other items of value), means they attain a real world value and become articles of money or money's worth[49]."**
> – UK Gambling Commission.

However, placing such loot boxes (i.e. those that can be monetised) under the auspices of existing gambling regulation could create yet more confusion. At one end of the spectrum, there will be 'cash out' loot boxes, clearly transgressing 'money's worth' principles. At the other end of the spectrum, there will be loot boxes utterly locked into their gaming environments. And then there will be a yawning gap between these two extremes, confounding policymakers and creating liability for abuse by unscrupulous developers. Where are the cut-offs? At what point does a loot box represent 'money's worth'? Do third-party 'cash-out' websites count? What are the developer responsibilities for such third-party marketplaces?

In an attempt to grapple with some of these issues, the Department for Digital, Culture, Media and Sport (DCMS), the UK Gambling Commission, and the Washington State Gambling Commission have all pressured Valve to prevent illegal third-party activities such as cashing out and skin gambling[5,49,149], enabled via the Steam Application Programming Interface (API). Valve have taken measures against a limited number of operators[150], and argue they cannot shut down services without impacting legitimate users[149]. However, with games publishers acting as the 'de-facto central bank' for virtual goods (according to the UK's Gambling Commission) these marketplaces/APIs could be configured for efficient vetting and approved trading**.

> **"... there are large video game companies who are failing to proactively enforce their own platform's terms of use to prevent in-game items being readily exchanged for cash... such companies should have the resource and creative talent to develop solutions and we consider they have a responsibility given these problems have arisen from the platform and eco-system for games that they have created in pursuit of commercial objectives."**
> – UK Gambling Commission[152].

An obvious policy response is to regulate all loot boxes that are easily monetised as gambling. Such an approach, however, runs the risk of creating conflicted policy. Some loot boxes will be legislated against, others not: a situation already observed in the Belgium and the Netherlands. Existing research, however, tells us that any dangers associated with loot boxes are largely robust to these various configurations[1,74,75]. If harm minimisation is the legislative goal, then it needs to be wary of ignoring specific types of loot boxes.

There is an obvious solution to this problem: broaden the definition of 'money's worth.' Here, our qualitative work has highlighted that digital assets hold significant psychological value, even in lieu of cash-out features. This is utterly logical. After all, if someone is willing to stake money for something, then the desired prize (for them at least) must hold 'money's worth.' Furthermore, that 'winnings' from

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** From a policy perspective, it is also worth noting that the Steam Community Market has, allegedly, been utilised for extensive fraud and money laundering[151], although the size and scale is entirely unknown. It is completely unknown to what extent the measures implemented by Valve to counteract laundering (removing 'keys' from the marketplace, for example, but not other items) would curtail such activities.

a loot box are often items for sale in the in-item shop further demonstrates their monetary value.

At first glance, such observations suggest that regulating *all loot boxes as gambling* might be a viable solution to avoid the problem of conflicted policy. It would bring all loot boxes under the umbrella of existing gambling regulation – and it is the strategy favoured by many, including over 40,000 signatories of a recent UK petition[9]. Such an approach, however, would be a radical overhaul of gambling law – but once again, life is not so easy when it comes to legislative fine-print.

Gambling regulation was not conceived for loot boxes, and it is here that we get into the thorny 'square peg, round hole' problems. For example, it is unclear how developers should deal with aspects such as 'return to player' – a legal obligation for gambling games. Similarly, there will need to be provisions for issues like rule-bending, where (for example) developers might provide 'gift boxes' with every real-money purchase. Changes to gambling laws will also have unexpected ramifications. It will require, for example, clarifications of whether other types of items, such as trading card games, will now be subject to gambling controls.

Any legislation will require careful consideration. Next, in the concluding section, we present a series of recommendations for future policy.

6. Conclusions and recommendations

> **"If government does move to tackle loot boxes, it needs to ensure the legislation is airtight or developers will work around it."**
> – Vic Hood, Eurogamer magazine[133].

Any legislative framework for loot boxes will depend on the jurisdictive context. It might involve new loot box regulation, re-framing existing gambling laws, utilising consumer protection powers, or even a simple, outright ban – all of which are currently being considered, for example, by Spain[153]. A future framework could even include a role for industry self-regulation – but given a rather questionable track record, any corporate measures would need to be decisive, comprehensive and transparent**.

When and if policies are ultimately implemented, we recommend that they include provisions for:

Precise definitions. Loot boxes are available in a wide variety of guises and configurations, often complicated by niche implementations such as time delays or crate-and-key mechanisms. This could lead to inconsistently applied legislation. Any policy will need to pay attention to precise decisions, making sure to encompass '*all game related transactions with chance based outcomes*'.

Game labelling and age ratings. There is robust evidence that loot boxes are structurally and psychologically akin to gambling, with associations strongest amongst younger players[97]. New game labels should include clearly worded adult ratings for loot box games, applying across shop-purchased games and digital downloads.

Odds disclosures. The odds of obtaining digital assets in loot boxes should be displayed in an easy interpretable manner, yet also have provisions for *full odds disclosure*. These should include calculations for any modifiers (i.e. that influence item value, such as 'wear ratings') and the ultimate/average cost of obtaining rare items. As an adjunct, regulation will need provisions for time-limited and other special offers, which can create a sense of urgency and further obfuscate underlying costs.

Spending limits and information. Our work has established that high spenders on loot boxes are disproportionately represented by people with gambling problems, rather than wealthy gamers[2]. Default payment limits should be instated to limit gaming profits being derived from at-risk individuals. At more than $50/month (equivalent to around £36/month), the proportions of people with gambling problems rises substantially[4]. Spending limits could thus be applied thereabouts (or at local currency equivalent). Other measures could include 'breaks' on purchasing (i.e. re-inputting username/login),

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**   For an even more comprehensive appraisal of potential corporate measures, see: '*Video Game Monetization (e.g., 'Loot Boxes'): a Blueprint for Practical Social Responsibility Measures*'; King & Delfabbro 2019. However, the willingness of the industry to adopt such measures has been questioned, due to the industry's economic interests[154].

self-limits, regular statements, cool-down 'time-out' periods, and provisions for 'maximum item rarity' (i.e. such that desirable items are not near-impossible to attain.)

Real currency. Loot boxes – and in-game currencies more generally – represent an obfuscation of underlying costs. According to many consumer protection frameworks, they would be unacceptable in most real world environments. Pricing of all game-related items should be clearly displayed in local currencies. Pricing items in 'gold coins' (with confusing and inconsistent exchange rates) is not acceptable practice in 'bricks and mortar' shops, and it shouldn't be allowed in virtual shops, either.

Money's worth definitions. Any 'money's worth' definition of loot boxes needs clarification. At present, developer-run marketplaces are anomalous. Whilst Valve's Steam (for example) may not explicitly allow 'cash out' features, they do enable loot box contents to be sold for money within the Steam wallet. These funds are then available for spending on over 30,000 games or the millions of game-related items available in the marketplace[131]. Such marketplaces would appear to satisfy 'money's worth' definitions for many children and gamers[††]. Any future policy will need to clearly state where the thresholds are for new definitions of 'money's worth.'

Gatekeeper obligations. Complex APIs – often poorly understood by lawyers and regulators – should be configured for efficient vetting and approved trading, rather than enabling anonymous third-party access. Just as we are starting to observe in other domains – for example, social media and news aggregation[155] – gatekeepers should be accountable for the content they manage (and the profit they gain from it).

Provisions for oversight and enforcement. Loot boxes involve new layers of regulatory complexity. Parallels with traditional gambling are often vague and difficult to interpret. Existing gambling bodies are, at present, ill-equipped to deal with such challenges. Any legislation will necessitate increased provisions for monitoring, oversight, and enforcement[‡‡]. Furthermore, given the vast scale of the gaming industry, regulatory bodies would require substantively increased resources to deal with a vastly widened mandate.

Provisions for research and education. Despite some notable recent findings, research into game monetisation remains in its infancy. With an increasing convergence of gambling and gaming[156,157], any future research should be sensitive to ongoing trends in the evolution of the gaming and gambling ecosystems. Furthermore, longer-term mitigation of risk around loot boxes and game-related purchases will require provisions for broader research, consumer protection, development of child-focused data protection (such as the Information Commissioner's Office 'Age Appropriate Design Code' [158]), and finally, educational approaches designed to curb the exploitation of psychological nudges and biases[8,107].

[††] Imagine a game of chance, staked with real money, played by children, but instead of giving cash wins, it gave out 'toy prizes'. These prizes, however, could be readily exchanged for Amazon vouchers. Should such a game avoid gambling laws and regulatory interference?
[‡‡] Here, a 'loot box levy' might sound like a popular option – but it would entail yet another layer of legislative headaches.

Concluding remarks

".. gaming and gambling is increasingly becoming blurred. What may appear benign today can quickly morph into something a lot more sinister tomorrow..."
- Singaporean Minister for Cyber Security, S. Iswaran, 2014[159].

When reviewing the academic evidence, our systematic review has established that engagement with loot boxes has been robustly associated with problem gambling behaviours in around a dozen studies. Loot boxes, however, represent only the most obvious face of an accelerating convergence of gambling and gaming[156,157]. They exist in a complex ecosystem that includes eSports betting, social casinos and skin-betting, where monetisation features also include downloadable content, season passes, events, add-ons and in-game items.

Here, our qualitative work with gamers has highlighted that motivations for loot box purchasing often overlap with motivations for purchasing this other, non-randomised content. Players are often nudged towards purchase via a number of well-known psychological techniques, such as endowment effects, 'fear of missing out' and obfuscation of costs (i.e. via in-game currencies, etc.), where loot boxes are just one aspect of the sophisticated choice architecture deployed for the monetisation of modern video games[67–71].

With loot boxes, emerging evidence suggests that certain categories of people may be at particular risk of any associated harms. Secondary analysis of open-access survey data has established that high spenders on loot boxes are over-represented by those with problem gambling behaviours. Unwittingly or not, developers appear to be profiting from at-risk individuals.

Furthermore, any risks and dangers associated with loot boxes are liable to affect specific demographics. Those particularly affected include males and younger gamers, with our survey screen of over 14k gamers also suggesting that those with lower educational attainment and lower levels of employment may be disproportionately affected. These factors, however, are unlikely to be limited to loot boxes. Those vulnerable to loot box mechanics may also be liable to be disproportionately affected by a suite of the other, alternate monetisation approaches – dangers that might not be so easily identified and defined as the gambling-like mechanics of loot boxes.

Such observations are particularly concerning when contextualised against the history of loot boxes, where there are examples of developers manoeuvring in response to policy action. In the dynamic and rapidly changing world of video games – and with large financial incentives for unscrupulous developers – any action against loot boxes runs the risk of rapidly becoming rendered an anachronism. Monetisation strategies will inevitably evolve in response to any new policy – but any dangers and risks are liable to remain.

When taking this longer-term perspective, the potential short-sightedness of a 'loot box as gambling' regulation is revealed. Such a move wouldn't just create a series of complex new challenges for governments, legislators, lawyers and gambling commissions – but furthermore (as the DCMS have already pointed out), games companies would be unlikely to even bother with the reams of paperwork, operating licences, and subsequent regulations around transparency, duty of care and age restrictions[5]. After all the legislative heavy lifting, loot boxes would soon be consigned to a niche monetisation strategy.

This all begs the question: would an outright 'loot box ban' be simpler for all concerned – developers, gamers, governments, taxpayers alike? This approach would have advantages. It would likely be popular, applauded by many gamers, whose attitudes toward them are predominantly negative[11]. Moreover, such a straightforward move would free up limited government and regulatory resources for more pressing tasks.

Whatever form policy might take, we need to stay mindful that there is now a whole box of psychological tricks available for unscrupulous developers. Longer-term mitigation of risk, as suggested above, will require more research, new education approaches, and updated consumer protection frameworks. Such recommendations, however, do not preclude policy action on loot boxes.

Perhaps, in the long run, the benefits of loot box regulation won't stem from the legislative fine-print. Instead, the gains might be leveraged from a clear message, directed straight at transnational gaming companies that when left with few other options (when an industry does not effectively self-regulate), these types of predatory monetisation strategies are not beyond the reaches of national powers.

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Appendix

Methods for section 2: literature review

We searched the main academic literature databases (PubMed, ScienceDirect, Scopus, Web of Science) for publications related to loot boxes (Search 1), and also for links between problem gambling and problem video gaming (Search 2). See Box 1 for full search terms.

Initial searches were conducted prior to 28 March 2020. However, further/subsequent papers were included via expert knowledge, publication alerts, and a snowballing approach (i.e. via the references of primary articles). Non-English articles were excluded and duplicates were removed. For Search 1, further papers were excluded if they were not relevant to loot boxes, only discussed loot boxes as a peripheral subject, or were publications of a non-empirical nature (e.g. reviews, commentaries and book chapters).

For Search 2, we targeted papers investigating associations between gambling and video gaming. Studies were excluded if they: did not measure both gambling and gaming; were pre-2000 (i.e. generally pre-internet, and often 'coin-op'); were specific to a certain gaming context (i.e. social casinos, which are free-to-play structural homologues of online casinos and known to have high migration rates into online gambling [160,161]); or failed to investigate direct correlations between gaming and gambling. Publication results were deemed positive if they revealed consistent and significant correlations between loot box purchasing (i.e. last or mean monthly spend) and PGSI scores.

Box 1. Terms used for literature searches. Search 1 shows different combinations of searches relating to loot boxes. Search 2 shows searches relating to problem gaming and problem gambling. Whilst the syntax in different databases varies, the logic of searches is consistent with details below.

Search 1: Loot boxes

"loot box" OR "loot boxes"

(microtransactions OR microtransaction) AND "chance based"
AND games AND (video OR computer OR online OR mobile)

gaming AND gambling AND "reward schedule" AND variable
AND online (video OR computer OR mobile)

Search 2: Problem gaming and problem gambling

("problem gambling" OR "gambling addiction") AND
("problem video gaming" OR "problem gaming" OR "gaming addiction")

Methods for section 3: qualitative interviews around motivations for purchase

One-to-one, semi-structured qualitative interviews (duration 35-68 minutes) were conducted remotely (via video or audio call) with 28 gamers aged 16+ (19 males, 9 females, mean age 28.9 years (Range 18-56)). Participants were recruited purposively (for a diverse demographic and geographic range) from England, Scotland, Wales and Northern Ireland. They had to have played one or more video games (on any platform, including mobile) and to have purchased at least one loot box.

After providing informed consent, participants completed a demographic questionnaire (age; gender; ethnicity; marital, occupational, living, and educational status) via Qualtrics survey software. The qualitative interviews utilised a topic guide, which was refined (for content and language) via workshops attended by stakeholders who have personal and/or professional experience of loot box engagement. Interviews covered: introductions and 'warm up' questions; general gaming questions (e.g. 'what kind of gaming do you do?'); and loot box questions (e.g. 'what makes you decide to buy a loot box?'). Participants then completed the Problem Gambling Severity Index (PGSI[162]), and Internet Gaming Disorder Scale (IGD-SF9[89]) evaluations. A £15 shopping voucher was offered to incentivise participation.

Interviews were transcribed verbatim, and analysed within NVivo 12. To support credibility, transferability and dependability, researchers utilised journaling and notation throughout data collection, coding, streamlining, theming and analysis. Reflexive thematic analysis[98] was carried out, following Braun and Clarke's six steps[163], and was wholly inductive, with themes dictated by the data. Ethical approval was granted by Research Ethics Committees at University of Wolverhampton and University of Plymouth. The BPS Code of Ethics and Conduct were followed throughout.

Methods for section 4: survey screen of loot box purchasers

For our demographic data of UK loot box purchasers (chapter 4), we performed a very brief screening survey of self-report UK gamers (18+) on the survey recruitment platform, Prolific Academic[126]. Our very short survey comprised of four to nine items, depending on responses. We first asked participants which of the following activities they regularly do: gambling (any form); gambling online; playing 'social casino' games (i.e. gambling, but not for real money); playing video/computer games (any format, including mobile phones, tablets etc.).

For those players who confirmed they were video game players, we asked a second set of four questions, about their game-related purchasing behaviour. This included whether they had purchased any of the following in the last 12 months: expansion packs, add-ons or other downloadable content; season passes or subscriptions; loot boxes; in-game / in-app purchases which do not have randomised outcomes. For those respondents who had purchased loot boxes, we asked how much they had spent on these purchases in the last month (in GBP).

We received a total of 19,234 complete responses to the survey. After removing participants that failed one of two attention check questions, there were n=13,115 active gamers amongst our respondents. Gaming characteristics, including loot box purchasing, were then compared with demographic characteristics available from Prolific Academic (see Table 3).

To account for skews in the underlying sample from Prolific Academic (e.g. higher proportion of females), we performed post hoc stratification according to the method of Royal, 2019[164]. Note that this post hoc stratification only changes the ns of participants (e.g. in Figure 7), but not the proportions in each category (e.g. Table 3, as these proportions stay the same after normalisation). Data for the Prolific Academic sample characteristics was from all active UK users on 19/11/2020; data for the UK population was taken from the Office for National Statistics, Census data 2010.