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Prevalence and Salience of Problematic Microtransactions in Top-Grossing Mobile and PC Games: A Content Analysis of User Reviews

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ABSTRACT

Microtransactions have become a major monetisation model in digital games, shaping their design, impacting player experience, and raising ethical concerns. Research in this area has chiefly focused on loot boxes. This begs the question whether other microtransactions might actually be more relevant and problematic for players. We therefore conducted a content analysis of negative player reviews (n=801) of top-grossing mobile and desktop games to determine which problematic microtransactions are most prevalent and salient for players. We found that problematic microtransactions with mobile games featuring more frequent and different techniques compared to desktop games. Across both, players minded issues related to fairness, transparency, and degraded user experience, supporting prior theoretical work, and importantly take issue with monetisation-driven design as such. We identify future research needs on why microtransactions in particular spark this critique, and which player communities it may be more or less representative of.

CCS CONCEPTS

• **Human-centered computing** → HCI theory, concepts and models; • **Applied computing** → Computer games.

KEYWORDS

microtransactions, mobile games, dark patterns, player experience, ethics

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1 INTRODUCTION

Contemporary video games are monetised in a variety of ways. These monetisation models include the upfront payment for games

as finished products, as well as so-called 'freemium' games: a business model in which games are designed as a service that are free to play upfront, but which generate revenue through repeated uncapped in-game purchases, often known as *microtransactions*. Examples of these include cosmetic items such as skins for characters, functional items which aid progress in the game, and additional content such as expansion packs and season passes. By one count, microtransactions today generate 40-67 percent of all revenues in mobile games [14], which in turn are reported to now make up more than half of global game revenues and players [32]. Microtransactions are increasingly adopted by console and PC game studios and publishers as well [2]. Their prevalence within the marketplace holds important ramifications for game designers, players, and with them, game HCI researchers.

First, much like technical platforms, monetisation models shape the possibility space for design [11]. Many players and game developers view in-game purchases negatively and complain that designing games for microtransaction-based revenue intrudes on and degrades the player experience [37, 39]. As many digital products move to a freemium online service model, the questions of how monetisation shapes the possibility space of design, and how to design freemium monetisation to not negatively impact user experience, are becoming general concerns for user experience and digital product and service designers.

Secondly, there is vivid debate among game developers, players, and the public about the ethics of microtransactions: several design techniques used to drive monetisation are perceived as unethical "dark patterns" [55] that manipulate, coerce, deceive, exploit, or may even actively harm player wellbeing by inducing excessive spending [12, 28]. This directly connects microtransactions to the broader debate in computing and HCI research about the ethics of computing systems and "dark patterns" or "asshole design" [16] – manipulative or coercive design techniques where "user value is supplanted in favor of shareholder value" [18].

Public, regulatory, and research attention to date have mostly focused on one kind of microtransaction, so-called loot boxes: items in video games that may be bought for real-world money, but which provide players with a randomised reward of uncertain value [59]. This focus has been largely driven by the similarity of loot boxes to gambling services and products, and connected worries that loot boxes might serve as a "gateway" to problem gambling. We already know that loot boxes are highly prevalent across digital games, with 58% of games on the Google Play store and 36% of games on the Steam store containing loot boxes [59]. However, given the presence of many other microtransactions, it remains unclear whether loot boxes are actually the most *prevalent* problematic

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microtransaction in contemporary digital games, let alone the one most *salient* to players – that is, the one players themselves perceive and notice most as problematic – as opposed to something perceived as problematic by academics or external regulatory bodies. Put simply, have we been focusing our attention on the right thing?

To address this question, the present study assessed the prevalence and player-perceived salience of problematic microtransactions across the most popular desktop and mobile games, using negative player reviews ($n=801$) from the 50 highest grossing games on the Google Play store (mobile games) and Steam store (PC games) as a data basis. Our content analysis found stark differences between mobile and PC games: 88% of top-grossing mobile games contained at least one microtransaction which players perceived as problematic, led by game dynamics designed to drive spending and game experiences being degraded without spend. In contrast, only 28% of PC games contained at least one problematic microtransaction, with content locked behind a paywall, dynamics designed to drive spending, and overpricing the most frequent. Unrealistic product presentations (mobile games) and content locked behind a paywall (PC games) were most negatively noticed by players. This sits at odds with the near-exclusive focus of the current debate on loot boxes. We discuss limitations of our study and ramifications for games HCI and wider HCI debates on ethical design.

2 BACKGROUND

2.1 'Problematicness' of microtransactions

As freemium social and mobile games emerged in the late 2000s, they were widely met with scorn and derision from 'traditional' PC and console game developers and players [9]. Part of this heated response has been the critique that games using microtransactions are *intentionally designed* to trigger and sustain player spending – in assumed contrast to pay-upfront console and PC games [37]. Some scholars have pointed out that such critiques are historically blind to the fact that all commercial games are designed with monetisation in mind: so-called AAA console and PC games for instance tend toward sequels with better graphics but little gameplay innovation as these are easier to market and de-risk sales, while arcade games have an intentionally steep difficulty curve to expel players fast from their purchased game session, requiring them to insert more coins [11, 37].¹

The games industry's embrace of microtransactions and broader indirect revenue streams is part and parcel of the wider industry shift toward games as a service [44] and the platformization of cultural production [34]: internet technologies *afforded* the continuous online maintenance and data-driven updating and monetisation of

games, intermediated by increasingly few and concentrated platforms like Steam or the Apple App store. Meanwhile, the technology race and blockbuster marketing logic of pay once upfront AAA games made their production increasingly expensive and risky [33]. Freemium service games monetised by microtransactions and advertising make use of the affordances of internet technologies and platforms and promise to de-risk and increase revenues with predictable continuous player spending over months or years [5, 25]. On the industry side, this has led to a different view of players and play: player activity is value generation for companies [56]. As free-to-play games translate player effort, personal information, and needs into revenue streams, games are being designed to increase time-on-device, player retention, and conversion from free to paid play [49].

Within these broad shifts in industry practice, the financing of games via microtransactions has arguably made the impact of revenue-generation on gameplay design more directly apparent to players; and has sparked an active and ongoing ethical debate over what forms of monetisation are acceptable or problematic [19–21, 26, 31].

One particular focal point of this conversation has been loot boxes. Loot boxes can be defined as 'items in video games that may be bought for real-world money, but which provide players with a randomized reward of uncertain value' [59]. They are seen as a major form of the 'gamblification of games' [5] and have been repeatedly linked to problem gambling [12, 57, 58], to the extent that they have drawn the regulatory attention of several governments, including Belgium, China, and the United Kingdom. Loot boxes and similar formations like daily fantasy sports challenge our cultural and regulatory distinctions between inconsequential, skill-based games and luck-based gambling with monetary consequences [11, 48, 49].

Research has also considered microtransactions more broadly, seeking to delineate what may be defined as ethically problematic, illegal, or potentially harmful to players. In terms of ethicality, researchers especially in game studies have brought a range of ethical frameworks to bear on game monetisation, including Kantian deontology [31], consequentialism [21], virtue ethics [20], and objectivist ethics [19]. While each ethical framework highlights different issue sets and frames them differently, common problems raised are deception/lack of transparency about costs and rewards, impairing player self-determination through coercive or even addicting design techniques, and negative impacts on player wellbeing.

Together with questions of legality, such potential player harm has dominated the debate in gambling studies. Beyond the above-mentioned empirical work on links between loot boxes and problem gambling, King and Delfabbro [27] for instance discuss the wider idea of 'predatory' monetisation, labelling it as 'purchasing systems which disguise or withhold the long-term cost of the activity until players are already financially and psychologically committed.' As such, they frame problematic microtransactions through the lens of psychological entrapment, with players likely to engage in further spending on the game due to high prior spend. King et al. [28] examined patents for potential design strategies that might be characterised as unfair or exploitative, drawing on principles of consumer protection law. A similar taxonomisation has been carried out by Windleharth & Lee [51] of 65 mobile games, who, by

¹So-called indie or independent games can be seen as a partial cultural counter-movement of game makers and audiences valuing culturally, aesthetically, and financially independent games that put the authentic expression of *auteur* creators first [23]. However, as multiple critics have pointed out, even the indie aesthetic is co-constituted, afforded, and constrained by particular technological-economic platforms and financing, business, and monetisation models: platforms like Kickstarter, Steam, or Xbox Live Arcade made direct-to-consumer marketing, sales, and distribution possible for small studios. Indie games embrace crowdfunding or single pay upfront monetisation models in deliberate distinction to AAA and (hyper)casual games; and they require and are enabled by highly precarious and often self-exploitative labour [24, 43, 49]. Some indie developers highlight microtransactions as counteracting their ethical values, opting for alternative monetisation methods because of this: for example, Metronomik refuses to implement loot boxes despite potential commercial loss [52].

playing their sample identified methods which companies use to drive engagement. More specifically, certain mechanics have been addressed in more depth with the aim of understanding their potential for damage: for example, pay-to-win, which refers to being able to pay to gain an advantage towards proceeding in the game [30], and battle passes [22, 38].

In summary, research on the ‘problematicness’ of microtransactions to date chiefly consists of (a) researchers’ own conceptual analyses using ethical and legal frameworks and (b) empirical inquiries into potential player harm. Player perceptions of problematicness by and large do not figure in the current discourse. This stands in contrast to the broader dark pattern debate in HCI, which explicitly brings in user perspectives [16, 17]. To our knowledge, there are only two exceptions: Nielsen read qualitative data of player focus groups and interviews through the lens of Sayer’s moral economy [35] to find that players chiefly perceive microtransactions as potentially undermining a desired meritocratic moral economy in games, where in-game victories and unlocked items display superior skill, not deeper wallets. Additionally, Petrovskaya and Zendle [39] have conducted a thematic analysis of a large-scale survey asking players to report microtransaction techniques they found unfair, misleading, or aggressive, creating a taxonomy of 35 ‘predatory’ techniques.

While philosophical, legal, and empirical public health analyses can inform our evaluation of microtransactions, we think it is essential to include such player perspectives – both on normative discourse-ethical and democratic grounds that the people affected by an issue should have a say in it; and epistemically in that people’s direct lived experience may surface very different issues than armchair analysis. While prior work [35, 39] has established *what* microtransactions player consider problematic, it does not speak to *how salient* these different types are: which matter more in their everyday gameplay experience?

2.2 Prevalence of microtransactions

Such player-perceived negative salience is one important consideration for what problematic microtransactions should ‘matter’ to researchers, designers, and regulators. A second one is their *prevalence*: how frequent are they in the marketplace? Particularly in gambling research, such prevalence studies have been acknowledged as a necessary foundation of effective regulation (e.g. [50]).

However, the literature to date has again focused on the prevalence of loot boxes. Thus, Zendle et al. [59] assessed the prevalence of loot boxes across the highest grossing mobile and desktop games, with the rationale that many of these games are available to children. They showed that 58% of games on the Google Play store and 36% of games on the Steam store contained loot boxes; 93% of loot box-containing games on the Play store were available to children. Similarly, Xiao et al. [53] studied the prevalence of loot boxes across the 100 highest grossing games available on the Apple Store in the People’s Republic of China, and found loot boxes in 91 of them. In Australia, Rockloff et al. [42] found that 62% of the 82 ‘best-selling’ video games they studied included loot boxes. In contrast, we are not aware of any studies to date assessing the prevalence of other problematic microtransactions across games.

2.3 The present study

To summarise, while problematic microtransactions have become a centre point of debates on the ethics of game design and game monetisation, research has been narrowly focused on loot boxes and researcher-driven conceptual analyses and effect studies thereof. We don’t know how prevalent different problematic microtransactions are (besides loot boxes), nor how salient these are to players themselves. In response, we decided to conduct the present study, addressing the following two research questions:

- (1) *What is the prevalence of problematic microtransactions across the highest-grossing mobile and desktop games?*
- (2) *Which problematic microtransactions are most negatively salient to players?*

3 METHOD

To answer these questions, we conducted a directed content analysis of negative player reviews of the 50 top-grossing mobile and desktop games, using the existing taxonomy of player-perceived problematic microtransactions Petrovskaya and Zendle [39] derived bottom-up from player responses. Thus, when we here speak of ‘problematic microtransactions’ or ‘problematic monetisation techniques’, we mean techniques that were identified by players in this study as unfair, misleading, or aggressive.² We chose to analyse mobile and desktop games separately as prior work on loot boxes showed stark differences between the two [59]. We opted for negative player reviews as these offer economic access to large amounts of ecologically valid data and embody a player-centric perspective: it registers problematic microtransactions when players themselves register them as negative. Finally, using existing reviews avoids potential demand effects, as they may occur when directly eliciting responses as part of a study. All study materials, including our code book, full sample, and code used for scraping are available at <https://osf.io/z7gqe/>.

3.1 Data collection and pre-processing

Our sampling strategy of games followed the precedent of Zendle and colleagues [59]: for mobile games, we sampled the top 50 highest grossing games on the Google Play store, according to the store’s own charts at the time of data extraction (18.02.2021). We chose this sample as the Google Play store serves the largest global install base (73% of all smart phones in 2021 [10], and is the biggest mobile app store worldwide by number of apps available and installed [10]). We focused on the 50 highest grossing games as they are likely to account for a serious percentage of player spending: while we do not have a specific estimate for the top 50 games, by some estimates, the top 30 games accounted for 30% of all user spending on the Google Play store and Apple App Store [6], and the top 100 games accounted for 64% of all spend on both app stores [7]. For desktop games, we used Steam’s self-reported top sellers of 2020 as measured by gross revenue, and again selected the top 50 games [46]. We chose Steam as it is currently the largest online store for PC games by total and active player base and play time [54]. We focused on the top 50 highest-grossing games to have a comparable sample for mobile and PC games and again, since user

²The original paper equates the terms ‘microtransaction’ and ‘monetisation technique’. As such, we do the same in the current work.

spend on Steam is distributed highly unevenly and top-heavy, with more than half of all spend going to the top 100 (or top 0.5%) of all games available on Steam [47].

Written player reviews were scraped from the product page for each game on the Steam and Google Play store respectively. For Steam, the scraping criteria were that reviews were classed as 'Negative' (the only two options are 'Positive' and 'Negative'). For the Play Store, the classification system is 1-5 stars; we scraped the 1 star reviews. For each game, the last 50 reviews were collected. This generated an initial total of 5,000 negative reviews.

The data was cleaned prior to beginning analysis by manually removing any negative reviews which were unrelated to monetisation. This included removing reviews which did not directly mention real money, as well as ambiguous reviews, for example, those mentioning 'coins', as it is unclear without context whether in-game currency can be obtained only through purchase or also for free, through play. Based on our personal moral and ethical principles, we also removed any reviews which were discriminatory (for example, sexist or racist). Finally, any reviews not written in English were also removed, as we did not have the capacity to analyse these in our team. After cleaning had been completed, 801 reviews remained: 692 of mobile games and 141 of Steam games.

3.2 Ethical considerations

Ethical approval was obtained for this research by the University of York Physical Sciences Ethics Committee, case number Petrovskaya20210208. Even though we used review data, which was publicly available, we were concerned that individuals could be identified from their reviews, given the presence of monikers and chosen images. We handled this issue by completely removing any identifiable information as soon as the data had been collected. As mentioned above, we also looked to our personal morals and values as researchers in the data collection and analysis process to understand which data we might not be comfortable with analysing. On this basis, we removed any reviews which were offensive to certain demographics purely because they belonged to said demographics - we do not condone discrimination of any sort.

3.3 Data analysis

Data was analysed using quantitative content analysis following Krippendorff [29], which took part in several stages. Individual reviews served as our smallest unit of analysis. For coding, we used the taxonomy of player-perceived problematic microtransaction techniques developed by Petrovskaya and Zendle [39]. We coded the whole data set of 801 reviews for each technique, where each review could include and therefore be coded as several techniques at once.

3.3.1 Coding scheme. The taxonomy of Petrovskaya and Zendle [39] consists of 35 categories across the following eight domains:

- **Game dynamics designed to drive spending**, in which players referred to feeling that aspects of a game had been designed especially to encourage spending, rather than primarily for the game experience (e.g. pay or grind).
- **Monetisation of basic quality of life**, in which players discussed aspects of games which were central to what they imagined their experience of playing a game to be, but which

they could not access without a transaction (e.g. core parts of game content locked behind paywalls).

- **Pay to win**, transactions the outcome of which give players an advantage towards being successful in the game, often at the expense of other players (e.g. advantage over other players).
- **Predatory advertising**, advertising or product descriptions which present incorrect, incomplete, or skewed pictures of what the product entails. Sometimes the way in which this advertising is presented is also seen as problematic (e.g. unrealistic presentation of product).
- **Product not meeting expectations**, covering the sale of products which do not serve their purpose in the way the player expects before engaging with a transaction (e.g. sale of useless products or duplicates).
- **In-game currency**, virtual currency which can only be used within the context of the game world and has no value outside of it (e.g. fixed purchase rates are unfair).
- **General presence of microtransactions**, being the perception of some players that additional transactions in games with upfront payments are predatory, as are their implementations (e.g. overpricing).
- **Other**, categories which did not naturally cluster into another domain (e.g. limited time offers).

3.3.2 Coding process. Coding was conducted manually using a spreadsheet: each review was entered as a line in the spreadsheet, and marked with a number which corresponded to a category in the codebook. We derived an initial code book, including definitions of each category, from the above taxonomy, which was then used for the analysis. Two coders were involved in the analysis.

As part of coder training, both coders initially coded a subset 100 reviews from across all 100 games. We calculated Krippendorff's alpha to establish inter-rater reliability, as it is able to handle coding units of analysis (review) with several values [4]. After the initial round of coding, Krippendorff's alpha was 0.36, significantly below Krippendorff's suggestion of values of > 0.8 for confidence in the coding process.

We then systematically reviewed disagreements between the two coders, explaining terms to one of the coders who was less familiar with the subject matter, and changing the code book as follows:

- We added two codes: '**game is broken**', defined as 'the game itself stops working in a way which means the player loses their money', and '**stealing money**', defined as 'money being taken from the player without their consent, refunds are refused in situations where a product is not as expected, or anything else which might be labelled as a 'scam''. These codes were added as they were frequently being referenced by players in our sample and yet had not been adequately captured by our coding scheme; we felt they had to be incorporated into the current analysis for us to have a valid understanding of the data.
- Within the 'pay to win' domain we merged the '**pay to play competitively**' and '**boosts**' codes, as we found players mostly referred to pay to win mechanics in one specific contexts and the distinction was unnecessary in this sample.

The merged code was named ‘**game experience better if paying.**’

- We split the code ‘**game builds dependency on transactions**’ in the ‘game dynamics designed to drive spending domain’ into two codes: ‘**game dynamics designed to drive spending**’ and ‘**escalating payments**’, as there appeared to be a distinction being made by players clearly, whereupon ‘game dynamics designed to drive spending’ was referenced more broadly as an overall perception of the game, and ‘escalating payments’ as references to increasing payments.
- Building on the above, we renamed the domain ‘game dynamics designed to drive spending’ into ‘intentional design to drive spending’, to avoid confusion between higher-level domains and lower level codes.
- We renamed the code ‘**game unplayable without spending**’ in the ‘monetisation of basic quality of life’ domain into ‘game realistically unplayable without spending’ for clarification.
- We removed the code ‘**core aspects of game monetised**’ from the ‘monetisation of basic quality of life’ domain, as there was confusion over what ‘core’ referred to.

Thus, our final categorisation scheme was as laid out in Figure 1. The initial and final codebook, including definitions for each code/category, are available at <https://osf.io/z7gqe/>.³

A second subset coding round of 60 reviews, coded by both of the coders, yielded a satisfactory Krippendorff’s alpha of 0.81. We resolved any remaining disagreements through discussion. One coder - the first author of this paper - then coded the rest of the data (the remaining 641 reviews) using the final coding scheme, and completed the further discussed analyses.

3.3.3 Prevalence analysis. Once all reviews were coded for microtransaction techniques, we could establish which games included which techniques. To maximise validity, we only counted a game as featuring a particular technique if at least two negative reviews mentioned it: we saw this as operationalising a form of intersubjectivity analogous to using multiple coders in content analysis. For example, if only one review mentioned that a game included a ‘pay or grind’ mechanic, the game would not be counted as being pay or grind. We categorised games as mobile or desktop based on whether we accessed them on the Google Play store (mobile) or Steam store (desktop), and categorised games by genre based on the descriptions of games on the store pages. We then calculated the prevalence of a technique based on the number of games within a platform or genre counted as containing this technique. E.g. a prevalence of 7 for a microtransaction technique means that 7 games featured at least two negative reviews each mentioning that technique. For easy access, find a database of all games with technique, developer and genre information for each game at <https://osf.io/z7gqe/>.

3.3.4 Salience analysis. To operationalise the salience of different techniques – how noticeable they were to players – we calculated the relative share of negative reviews per technique. Firstly, for each

technique within each game, we counted the number of reviews which mentioned this technique. Then, for each technique within each game, we calculated which proportion of *all* the negative reviews of that game that technique accounted for. For example, if the game *Lord’s Mobile* contained ‘unrealistic presentation of product’, which had been mentioned in 6 reviews, and the total number of negative reviews for the game was 50, then the relative share of ‘unrealistic presentation of product’ *for this game* would be $6/50 = 0.12$. We then summed the shares for each technique across all games and divided by the total number of games in which the technique appeared. So to continue with the above example: ‘unrealistic presentation of product’ appeared across 21 games in total, with a sum of relative shares of 3.88. This left us with a value of $3.88/21$ or 0.18. This was done for each technique, and will be referred to as the *salience value* of a monetisation technique in this paper henceforth, as it delineates the extent to which a technique was discussed by the players within our sample in a negative fashion.

4 RESULTS

4.1 RQ1: What is the prevalence of problematic microtransactions in top-grossing mobile and desktop games?

Of the 50 top-grossing mobile and 50 top-grossing desktop games in our sample, 44 mobile games (88% of our mobile sample) and 14 desktop games (28% of the desktop sample) contained at least one problematic microtransaction. The average number of techniques per game was 2 for desktop games and 3 for mobile games.

4.1.1 Mobile games. The most prevalent problematic technique across mobile games was ‘game dynamics designed to drive spending’ with 26 occurrences (52% of the total sample of 50), defined as ‘general discussion of how the game feels like it has been made to manipulate players into spending, as opposed to a genuinely good product for the user.’ The next most prevalent was ‘unrealistic presentation of product’ (21 occurrences, 42%), defined as ‘the product is presented as being better or more attractive than it actually is, for example, through explicit deceit, misinformation about the product, or tactical highlighting of certain features’, followed by ‘game experience better if paying’ (20 occurrences, 40%): ‘payment makes progress through the game quicker, easier, and more pleasant - paying customers have a better experience playing the game. Players will have a worse experience without spending money and feel driven into purchases’. They are closely followed by ‘game realistically unplayable without spending’, defined as ‘although payment is not officially required to progress through the game, it is realistically impossible to play without spending’ (16 occurrences, 32%). Three of these techniques are characterised by their focus on altering the game experience for revenue generation. Full frequencies of the microtransactions are outlined in Table 1.

Across the 44 mobile games with at least one problematic technique, we found the following genres in descending order of number of games: strategy ($n=13$), puzzle (11), role-playing (6), casino (4), sports (2), simulator (2), and other (6). Of those, the genre with the highest prevalence of problematic techniques was casino games, at

³Readers may point out that several of these categories seem to have overlapping or similar definitions. For example, ‘escalating payments’ might be said to incorporate ‘pay or grind’. While that may be true, we note that these categories were developed bottom up from player perceptions and emerged as distinct *gestalts* in how players view and conceive microtransactions.

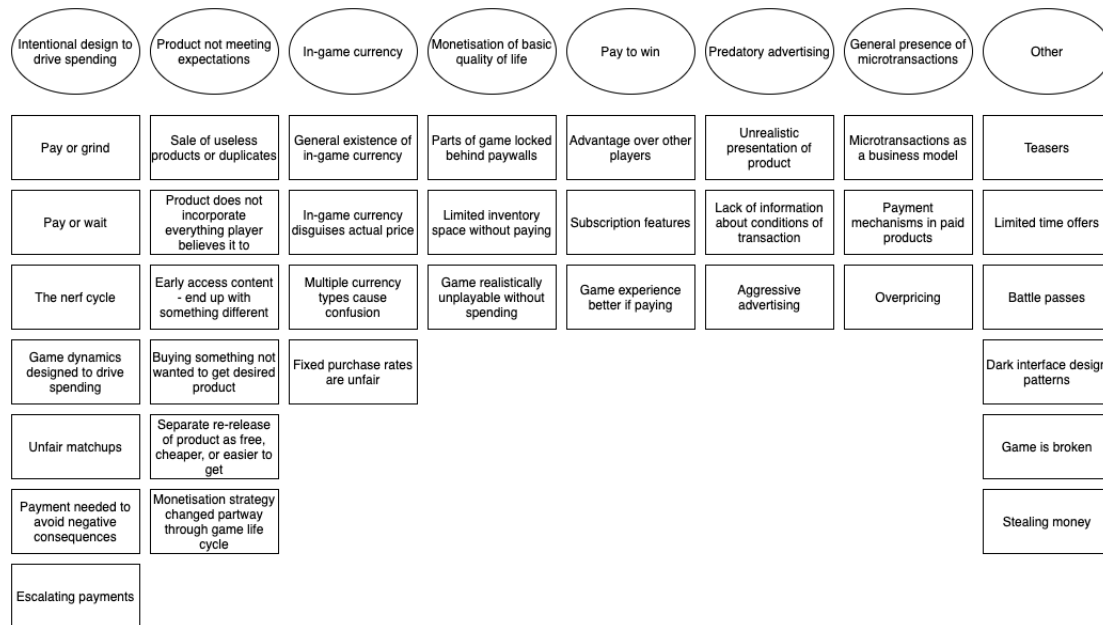


Figure 1: Final categorisation scheme of monetisation techniques used for coding.

Table 1: Problematic microtransactions across 50 top-grossing mobile games.

Technique	Frequency of occurrence	% of games featuring technique
Game dynamics designed to drive spending	26	52%
Unrealistic presentation of product	21	42%
Game experience better if paying	20	40%
Game realistically unplayable without spending	16	32%
Overpricing	10	20%
Game is broken	8	16%
Pay or grind	6	12%
Stealing money	6	12%
Escalating payments	5	10%
Aggressive advertising	4	8%
Desired product not received	3	6%
Pay or wait	2	4%
Unfair matchups	2	4%
Monetisation strategy changed partway through game lifecycle	2	4%
Limited inventory space without paying	1	2%
Advantage over other players	1	2%

an average of 5.25 different techniques per game, followed by role-playing games, at 4.5 techniques per game, and simulation games, also at 4.5 techniques per game. The full breakdown of counts by genre is available in Table 2 ('other' is not included as it covers a range of genres).

The mobile game with the highest number of problematic monetisation tactics was *Marvel Strike Force* by Scopely, with 9 techniques: 'game dynamics designed to drive spending', 'overpricing', 'game realistically unplayable without spending', 'game experience better if spending', 'pay or grind', 'unfair matchups', 'desired product not received', 'unrealistic presentation of product', and 'game is broken'.

Thirty-three developers accounted for the 44 mobile games with at least one problematic technique. Of those, seven had produced more than one game: Playrix features with three, Playtika with three, and Scopely, Zynga, Long Tech, Lilith Games, and Century Games all with two games. Of these seven, Scopely had the largest number of problematic techniques per game, with an average of 6.5, followed by Playtika with an average of 4.33. The full breakdown of games and developers is available in supplementary materials located at <https://tinyurl.com/prevalence-salience>.

Table 2: Problematic microtransactions in mobile game genres.

Genre	Number of games with at least one technique	Average techniques per game
Casino	4	5.25
Role-playing	6	4.5
Simulation	2	4.5
Strategy	13	2.69
Puzzle	11	2
Sports	2	1.5
Other	6	-

4.1.2 Desktop games. Not only were there far fewer desktop games with problematic monetisation techniques, but desktop games also featured different problematic techniques. The most prevalent technique across our sample was ‘core parts of game locked behind paywall (DLCs)’, with seven occurrences (14% of the 50 games), defined as ‘parts of the game which players feel should be integral to the game experience are inaccessible without spending’. This was closely followed by ‘game dynamics designed to drive spending’ (five occurrences, 10%). See Table 3 for all prevalence data.

Genres proved more difficult to characterise across desktop games, as most games spanned several genres. For example, *Mount & Blade 2: Bannerlord* describes itself as a ‘strategy action role-playing’ game. Thus, we did not analyse monetisation techniques according to desktop game genre. Across the 14 games with at least one problematic technique, Paradox accounted for three games and Bethesda for two, with an average of 2 and 2.5 problematic techniques per game respectively. The Steam game with the highest number of monetisation techniques was *War Thunder* by Gaijin Entertainment, with four techniques: ‘pay or grind’, ‘game experience better if paying’, ‘advantage over other players’, and ‘game dynamics designed to drive spending’.

4.2 RQ2: Which microtransactions are most negatively salient to players?

Having evaluated which microtransactions were the most prevalent, we then wanted to consider an estimate of the extent as to which the presence of such microtransactions across games was likely to impact the player experience.

4.2.1 Mobile games. While there are some links between the most prevalent and most salient monetisation techniques across mobile games, they are not fully parallel. The most prevalent technique (appearing in 26 games), ‘game dynamics designed to drive spending’, was not the most salient, with a salience value of only 0.09. The by far most salient technique was ‘unrealistic presentation of product’ (‘the product is presented as being better or more attractive than it actually is, for example, through explicit deceit, misinformation about the product, or tactical highlighting of certain features’), with a value of 0.18, which also ranked second in terms of prevalence (21 games). It is followed, however, by ‘pay or wait’, which appears only in two games and yet has a salience value of 0.12.

The full breakdown of salience scores of the microtransactions is presented in Table 4.

4.2.2 Desktop games. The microtransaction most prominent in the sample of desktop games was ‘core parts of games locked behind paywall (DLC)’ (parts of the game which players feel should be integral to the game experience are inaccessible without spending), with a salience value of 0.12 across 7 games. This was followed by ‘game is broken’ (the game itself stops working in a way which means the player loses their money), with a value of 0.09 from 2 games, and ‘game experience better if paying’, also at 0.09 across 3 games. Unlike in the case of mobile games, in desktop games the most prevalent technique is also the most salient to players.

The full breakdown is available in Table 5.

5 DISCUSSION

We assessed the prevalence and salience of problematic microtransactions across the 50 top-grossing desktop and mobile games. We found stark differences between the two platforms: in our sample, 88% of mobile games featured at least one problematic technique, and each game contained three different techniques on average, compared to 28% of desktop games with at least one technique and an average two techniques per desktop game. Mobile casino games were special outliers with an average 5.25 techniques per game. This matches public perception [37] and prior empirical work [59], which suggest that problematic microtransactions are far more prevalent in mobile than desktop games. Thus, while our data supports that microtransactions are on the rise in desktop games [2], as of to date, differences remain. Future longitudinal studies would be useful to see whether and how fast desktop games are ‘catching up’ in the adoption of microtransactions.

The mobile/desktop divide also holds for the kinds of problematic monetisation techniques: in mobile games, the most prevalent (and fifth-most salient) technique was ‘game dynamics designed to drive spending’, occurring in 52% of the sample, followed by ‘unrealistic presentation of product’ as the most salient and second-most prevalent (42%). On desktop, ‘core parts of games locked behind paywall’ was the most salient and most prevalent technique, occurring in 14% of the sample, followed by ‘game dynamics designed to drive spending’ as the second-most prevalent (10%), and ‘overpricing’, which, while third-most prevalent (8%), was one of the least salient. One way of interpreting this is that on mobile games, the freemium model and thus pressure to monetise through microtransactions dominates, which players perceive as intruding on their play experience. On desktop games, players still in the main pay up front and then take issue with not receiving the ‘whole’ game for their first up-front purchase; ‘holding back’ content as

Table 3: Problematic microtransactions across 50 top-grossing desktop games.

Technique	Frequency of occurrence	% of games featuring technique
Core parts of game locked behind paywall (DLCs)	7	14%
Game dynamics designed to drive spending	5	10%
Overpricing	4	8%
Game experience better if paying	3	6%
Game is broken	2	4%
Subscription features	2	2%
Season pass	1	2%
Pay or grind	1	2%
Advantage over other players	1	2%
Early access content	1	2%

Table 4: Salience of problematic microtransactions across mobile games

Technique	Salience value
Unrealistic presentation of product	0.18
Pay or wait	0.12
Game experience better if paying	0.11
Aggressive advertising	0.10
Game dynamics designed to drive spending	0.09
Overpricing	0.07
Game realistically unplayable without spending	0.06
Pay or grind	0.06
Escalating payments	0.05
Desired product not received	0.05
Monetisation strategy changed partway through game lifecycle	0.05
Unfair matchups	0.05
Game is broken	0.04
Limited inventory space without paying	0.04
Stealing money	0.04
Advantage over other players	0.04

Table 5: Salience of problematic microtransactions across desktop games

Technique	Salience value
Core parts of game locked behind paywall (DLCs)	0.12
Game is broken	0.09
Game experience better if paying	0.09
Game dynamics designed to drive spending	0.08
Overpricing	0.07
Subscription features	0.04

e.g. for-purchase downloadable content is seen as designed to drive spend and overpricing. More generally, this would suggest that the general monetisation model (pay upfront versus freemium) sets up a context in which different microtransactions are differently likely to occur – and potentially, differently irk players.

This brings us to the difference we found between *prevalent* and *salient* problematic monetisation techniques; in mobile games more so than in desktop games, what is salient is not necessarily what is prevalent. Relatedly, while we found a wide range of problematic

microtransactions, the negative reviews only surfaced 21 of the 35 types identified by Petrovskaya and Zendle [39]. Even among these, a few stood out with markedly higher prevalence and salience: unrealistic product presentations, pay or wait, and game experiences that are better if one pays. We take all this as indications that not all monetisation techniques are seen as equally problematic by players, which provides useful pointers for designers what techniques in particular to steer clear of. More generally, as freemium monetisation is becoming more popular across digital products, designers

and product managers could consider analysing negative salience or sentiment as one input into what kinds of microtransactions to implement. (One alternative explanation for the observed difference between prevalence and salience is that some techniques are simply more apparent than others and were therefore noticed more frequently. For instance, unrealistic product presentations are likely easy to spot and could therefore be the most salient in mobile games. This invites future work using alternative operationalisations of salience.)

Contextualising our findings in the wider literature, the first thing to note is that alongside the attention loot boxes have received, we found plenty *other* frequent and salient problematic ways of designing in-game purchases from a player perspective. While loot boxes can be categorised as ‘game dynamics designed to drive spending’, this latter category entails both more diverse and more general concerns, and is far from the only one.

Furthermore, many of the issues player reviews surfaced have nothing to do with gamblification, addiction, manipulation, entrapment, or even deception – the main ethical and player well-being concerns raised in the context of loot boxes (e.g. [31, 58]). Overpricing, core parts of the game locked behind paywall, subscription features, unfair matchups, advantage over other players for those who pay, a game experience that is better for paying players, pay or wait: these read alternatively as an ‘unfair’ deal or ‘unfair’ difference between paying and non-paying players, or instances where the user experience is degraded for the non-paying. Fairness and degraded user experience have been variously raised in conceptual ethical analyses (e.g. [20]), but mostly absent in the regulatory and ethical debate on loot boxes. Another such value set previously only theorized that we found expressed in player reviews is honesty and transparency: ‘unrealistic product presentation’ featured as a highly prevalent and salient issue for players. Thus our findings provide empirical support that fairness, degraded user experience, and honesty and transparency matter to players as well.

Another fact worth noting is that ‘game dynamics designed to drive spending’ is the most prevalent problematic monetisation technique across both platforms by far, appearing in 31 of the total 100 mobile and desktop games. In other words, players take issue with the ‘mere’ fact that a game is *noticeably* designed with monetisation in mind. This connects to recent findings by Gray and colleagues on user perceptions of dark patterns across digital products [16]. They observed that users perceived freemium products *as such* to be manipulative (or likely to be). Similarly, users who perceived themselves to be manipulated by a product also tended to perceive its designers to value them more ‘as customers’ than ‘as persons’ [16]. Taken together, this points to an underlying normative expectation by users and players that the relation between them and developers and designers should not be governed (at least primarily) by economic concerns, but others, like interpersonal regard or a good user/player experience. As we noted at the beginning, taking offence over microtransactions because they manifest a commercial imperative is somewhat historically blind, as *all* commercial games are and have been designed with monetisation in mind. This raises an important question for future research: namely whether some of the microtransactions found in freemium games indeed break this norm (of not putting commercial concerns first), and if so, how; whether they simply make the

ever-present commercial concerns *apparent* to players, by moving payment into the ‘magic circle’ of play [11, 48]; or a mixture of the two.

Maybe the greatest puzzle presented by our data is that our sampled games are highly commercially successful *and yet* contain many microtransactions that players find problematic: why do players stick with spending money on something they disapprove of? One possible explanation is entrapment or manipulation: players are manipulated into continuing to play and spend more than they would choose under conditions of no manipulation [27]. Another is that spend comes from a group of players that is content to play and pay for microtransactions and therefore doesn’t show in our negative reviews, e.g. a small number of high spenders who has the means and therefore is happy to spend [37].

5.1 Limitations and qualifications

This leads us to a general important qualification of our approach: by taking as problematic what players writing negative reviews on the Google Play and Steam stores position as problematic, we give voice to *particular* player groups that are likely to share particular backgrounds, shaping particular norms and views about ‘good’ games and ‘good’ forms of monetisation [37]. There is good evidence that ‘casual’ mobile games, which are in the main freemium, reach broader demographics than ‘hardcore’ desktop games [41], but also that ‘casual’ mobile gamers are coded in gaming discourse and industry *as* female and middle-aged, despite more careful analyses complicating this construction [8, 13, 40]. A prime example of this is the microtransaction-monetised game *Kim Kardashian: Hollywood*. The game was heavily criticised by game reviewers, but still highly successful. As journalist Leigh Alexander noted, this is likely due to a discrepancy between those who are in a position to write about the game and those who play it [1]. The discrepancy in problematic microtransactions between mobile and desktop games could perhaps also be explained in a similar vein: the same demographics, engaging with both mobile and desktop games, may have less criticisms of the monetisation of what they perceive to be ‘traditional games’.

Similarly, the negative reviews of freemium games and related microtransactions we draw on may manifest particular player communities reproducing their (male, hardcore, desktop/console) norms and identity, while giving no voice to potential other silent player communities who are content to play and pay. Along these lines, some of the critiques of microtransactions Nielsen [35] identifies reflect a particular ‘hardcore git gud’ meritocratic norm that any in-game achievement ought to be ‘well-earned’. It is of course possible that the player reviews we use *at the same time* reproduce the norms and identity of one group *and* in whole or part reflect concerns widely shared across the games’ different player communities.

Determining these and related questions will also require future work eliciting the views of a more diverse and representative sample of players, not just those who chose to speak up negatively. In fact, we consider this an important general caveat for HCI research on design ethics and ‘dark patterns’. Especially where ethical and societal matters are in question, *representativeness* expands from a merely epistemological and methodological question of validity

and reliability to an ethical and political question of legitimacy, with all the issues that constructing ‘micro-publics’ holds [36].

Our reliance on player reviews bring with it another obvious qualification: readers might reasonably argue that games can entail certain microtransactions without players happening to mention them in reviews, and that player perceptions can differ from each other; e.g., different players are likely to bring different personal standards for what they consider ‘overpricing’. This is a valid critique from a realist stance that takes ‘problematic microtransactions’ as objectively existing independent of human meaning-making. In this paper, we are taking a social constructivist stance, empirically reconstructing what players perceive as problematic, operationalising intersubjectivity (not objectivity) as two reviews noticing the same technique. We think this approach is apt, valid, and internally coherent within our stance. We gladly invite future researchers to devise alternative operationalisations and studies grounded in alternative epistemologies.

Moving on to limitations of our game sample, there is some evidence that game revenues and player numbers follow a power law, such that a few top games absorb the lion’s share of each [15]. Sampling the 50 top-grossing games on mobile and desktop platforms should therefore represent a good total share of games spending, but need not be representative of games by published titles, player numbers, or play time. For instance, in one recent analysis, the top 10 mobile games by revenue and by active users share only two titles [3]. This limits the representativeness and generalisability of our sample. Still, since the debate on problematic microtransactions centres on monetary spend, we consider our sample relevant for the topic.

That said, by focusing intentionally on high-grossing, blockbuster games and the platforms which facilitate them, our findings are not representative for the current diversity of modes of game production, especially indie games, given the ethics- and aesthetics-driven monetisation choices of their creators, which intentionally shun freemium models [45], and the potentially differing expectations of their players. We also note that our findings may not generalise to other commercial distribution platforms: for PC/desktop, the Humble Store or GOG arguably publish a different set of games and may attract a different audience with different tastes and values. For mobile games, the Apple App Store is viewed to engage in greater quality control and attract a more well-off demographic than the Google Play Store, and may even attract a different demographic in terms of player personality (e.g. [60]). A connected limit to generalisation of our English-language Steam and Google Play store sample is that we cannot say whether our findings generalise across console games, or across non-English-speaking player populations.

We also limited our sample to the last 50 reviews for each game for practical purposes. Since especially freemium games are continually being developed, this also captures the most recent state of a game. Still, we may have missed player mentions of microtransactions in older reviews.

Finally, we acknowledge that our operationalisation of salience as relative share of negative reviews is one of many possible ones; different methods (like directly asking players to rank or rate techniques by problemativeness) might produce divergent results – we are looking forward to such triangulating future work.

6 CONCLUSIONS

We began our study with the question of whether the near-exclusive focus on loot boxes in public and academic debate was limited or misplaced. Our analysis of negative player reviews found a wide range of problematic microtransactions beyond loot boxes that were prevalent in top-grossing games and negatively salient to players. Put differently: players care about *more and other* issues around microtransactions than loot boxes. Specifically, they care about maintaining a fair playing field between players, the play experience not being degraded by monetisation-driven design, and presenting games and their monetisation transparently and honestly. Earlier conceptual analyses suggested these values, but they haven’t figured strongly in the loot box discourse to date, and there was little evidence whether or that they actually mattered *to players*. Games of course touch many stakeholders beyond players, which may bring different, and even conflicting concerns: We think empirical research giving voice to diverse stakeholder concerns, like the study reported here, provides an essential input for game designers and regulators, last not least on the normative grounds that the people affected by an issue should have a say in it. We also found that mobile and desktop games starkly differ in the prevalence and kind of microtransactions: problematic microtransactions were far more prevalent on mobile than on desktop; they incorporated a more diverse range of problems; and these issues were generally more negatively salient than on desktop. When taken together, these factors suggest that the nature of problematic monetisation on mobile may be both more severe and more complex on mobile than on desktop: the two platforms still differ from each other despite desktop/PC studios and publishers increasingly adopting freemium and service game models. Finally, players across both platforms take issue with the very fact that a game is noticeably designed to drive spending: in other words, the visible encroachment of money into play and blurring of gaming/gambling distinctions not only troubles scholars, regulators, and ‘traditional’ game developers: it also creates player discontent. This raises the wider question for future research why games are commercially successful although players take issue with their monetisation – and whether the players who take issue and problematise certain microtransactions are representative of the full diversity and range of players actually playing and paying.

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