



Investigating Players' Perceptions of Deceptive Design Practices within a 3D Gameplay Context

JOHN KING, University of Central Lancashire, United Kingdom

DAN FITTON, University of Central Lancashire, United Kingdom

BRENDAN CASSIDY, University of Central Lancashire, United Kingdom

Deceptive design practices have been identified and studied in games but, to date, there have been no substantial explorations of deceptive design practices within 3D environments typically found in PC games. These offer a new set of affordances for interacting with the player, and game developers may be able to utilize these in order to shape gameplay experiences. The goal of this work was to explore users' perceptions of deceptive design present in a popular free-to-play 3D game. A survey was carried out with 259 adult respondents identifying and explaining instances of deceptive design within video clips of gameplay from a popular Roblox game. Thematic analysis of the responses revealed six new categories of deceptive design pattern within a 3D gameplay context: *Predatory Monetization*, *Default to Purchase*, *UI Misdirection*, *Emotional Interpersonal Persuasion*, *Physical Placement*, and *Narrative Obligation*. Through our work we hope to highlight the use of deceptive design both within current 3D games and future 3D gaming environments. This work is particularly important as 3D and VR gaming grow in popularity alongside game publishers increasingly moving towards "freemium" monetization models for income.

CCS Concepts: • **Human-centered computing** → **User interface design**; • **Applied computing** → **Computer games**.

Additional Key Words and Phrases: free-to-play, freemium, monetization, 3D games, games, deceptive design patterns

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1 INTRODUCTION

In December 2022 Epic Games agreed to refund a record-breaking \$245 million to customers after the US Federal Trade Commission (FTC) ruled that the company had employed "myriad design tricks" in the popular game Fortnite [25]. This case highlighted not only the substantial amounts of money generated by this practice but also the growing prevalence of deceptive design in 3D games. The FTC's ruling identified the design tricks as "dark patterns"; however, the current paper follows ACM guidelines [1] and uses the terminology *deceptive patterns*. These are a type of design pattern (a re-usable solution to a problem) focused on "purposeful deception and manipulation" of users [8]. Common examples include the "roach motel" (an interface that makes it easy to purchase a subscription but difficult to cancel) and "preselection" (using a default selection to influence choice). Deceptive patterns have long been associated with ecommerce [49], social

Authors' addresses: John King, JKing11@uclan.ac.uk, University of Central Lancashire, Preston, United Kingdom; Dan Fitton, DBFitton@uclan.ac.uk, University of Central Lancashire, Preston, United Kingdom; Brendan Cassidy, BCassidy1@uclan.ac.uk, University of Central Lancashire, Preston, United Kingdom.



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networking [50], privacy consent mechanisms [33], and with mobile & social media games [23]. In addition to deceptive patterns, published research has highlighted other manipulative techniques for generating revenue in video games: *loot boxes* (purchasable packs of random in-game items) [66], *grind* (repetitive gameplay to earn in-game rewards) [45, 63], and use of *multiple currencies* (in-game currency that obscures the real cost of items) [45, 57]. These techniques are described as *predatory monetization* [42].

Deceptive design is an umbrella term for design involving deceptive patterns or predatory monetization. This field is increasingly subject to regulation: the UK's Age-Appropriate Design Code (which applies to websites, online games, and gaming services) states that “nudge techniques should not be used to encourage children to provide unnecessary personal data, weaken or turn off their privacy settings” [36]. A similar act introduced by the State of California in the US requires that businesses shall not use deceptive patterns “to lead or encourage” children beyond reasonable actions affecting privacy, health or well-being [60]. However, despite attempts at regulation, deceptive design strategies are still “not adequately covered by existing law” [57].

Freemium games are a particular concern: the term describes games that are free-to-play but generate revenue from in-game purchases or from showing advertisements. These games frequently include deceptive design, with many developers accused of “misleading, aggressive” [57] and “unfair or exploitative” [41] practices. Historically, the main market for freemium games has been mobile devices (phones and tablets) [23] in the form of lightweight, short-play games using 2D or 2.5D. However, in recent years, there has been a significant rise in the number of freemium games set in 3D environments, which introduces potential for new deceptive design practices taking advantage of the affordances offered by 3D, especially when experienced within Virtual Reality (VR) gameplay. To date, studies of game monetization have focused predominantly on freemium mobile games or on problem gambling linked to loot boxes on PC or console; there is a gap in knowledge relating to deceptive design in 3D, and this study aims to contribute to this area.

Within this paper we sought to gain insights into players' perception of deceptive design in 3D games, through the following research questions:

- (1) To what extent can players detect deceptive design elements in 3D games?
- (2) How do players perceive the role of deceptive design elements in the monetization process?

A survey was created in which volunteer participants were asked to view short video clips taken from a popular 3D game. These participants were given a plain-English definition of deceptive design and were asked to subjectively identify whether they thought each clip contained deceptive design, giving a reason for their answer. 259 complete responses were analyzed, identifying 26 elements of deceptive design which were grouped into 6 core themes. Three of these themes reflected existing categories of deceptive pattern or predatory monetization found in literature; however, the remaining three themes comprised many elements that did not fall within existing taxonomies — including several elements that were particular to, or enhanced by, the 3D nature of the environment.

Importantly, these elements have been identified within a prominent commercial game. There is potential for them to be found in other 3D games and in other 3D contexts, such as the 3D worlds within VR gameplay. VR games have historically been monetized through up-front payment, but the success of portable, relatively low-cost systems like the Meta Quest is likely to promote a growing market for freemium VR games, further expanding the potential for 3D-specific deceptive design.

The main contribution of this paper is six new categories of deceptive design pattern within a 3D gameplay context classed as problematic by a sample of active game players. The secondary contribution is a set of implications for understanding and studying deceptive design patterns

within a 3D gameplay that highlight areas for future work. These contributions are relevant to the gaming community, to HCI researchers, to game developers, and to legislators.

2 BACKGROUND

2.1 Deceptive Patterns

Deceptive patterns, also known as “dark patterns”, originated through Harry Brignull’s description of manipulative design elements found in ecommerce websites [7]. There is disagreement over a precise definition for the term, but core factors are an action on the part of the designer to mislead or deceive [29, 49] and an end goal that is not in the user’s best interest [7, 29, 65]. Lewis [45] describes the latter in more detail, stating that motivational deceptive patterns violate the user’s best interest “by encouraging them to give up or jeopardize some resource to an extent that they were not expecting (time, money, social capital).” Brignull classified deceptive patterns by reference to practical examples; these were reorganized and expanded by Gray et al. [29] into a taxonomy with five major categories. Later studies used this classification system to analyze deceptive patterns, including Mathur et al. [49], which cross-referenced deceptive patterns with the cognitive biases they exploit.

Prior to Gray et al.’s ecommerce-based taxonomy, Zagal et al. [65] created a classification system for deceptive patterns in games that had an overlapping – but divergent – set of categories. The Zagal et al. taxonomy has been cited in over 100 other papers and forms the basis of the *darkpattern.games* website [54], which contains a crowd-sourced corpus of deceptive pattern examples found in approximately 20,000 mobile games. The Zagal et al. taxonomy has been criticized: Deterding et al. [16] found the classification subjective, reflecting historic PC & console game players’ bias against the different form & aesthetic exhibited by freemium casual & social network games.

Within a gaming context, Di Geronimo et al. [17] investigated user perception of deceptive patterns in 3 mobile apps and 2 mobile games (Tag with Ryan and Roblox), using Gray et al.’s taxonomy but found that “certain adaptations were necessary” where instances in the mobile games were not explicitly included in the taxonomy. By contrast, Fitton and Read’s *Framework to Support Critical Consideration of Dark Design Aspects in Free-to-Play Apps* [24] focused on the Zagal et al. taxonomy in preference to the ecommerce-based taxonomy, noting that “The work by Zagal et al. is not mentioned in [the more recent] Gray et al.” Karlsen [40] also used the Zagal et al. taxonomy to look at deceptive patterns in Clicker Heroes, FarmVille2, and “World of Warcraft: Legion”, finding that these games relied extensively on a grinding-and-reward system and the “play by appointment” pattern. With reference to Deterding’s comment above, it is evident that the majority of the games used in these studies are mobile or web-based games with 2D interfaces.

To date, the majority of academic papers on deceptive patterns focus on examples from ecommerce or social media, with only limited investigation of deceptive patterns in video games; where games have been included in studies, the examples are primarily those with 2D interfaces. The role of loot boxes in 3D games is well-researched [13, 66]; however, there is a clear gap in study of general deceptive design in games with 3D environments, primarily found on PC & console platforms.

2.2 Game Monetization and the Rise of “Freemium”

Video game business models have changed significantly in the last 30 years. Originally, publisher income for PC and console games came from up-front purchases through retail sales [63]. However, as users moved online, digital distribution began to supplant this, and alternative revenue models appeared: publishers found they could generate more regular revenue by selling additional

downloadable content (DLC) or by following a subscription model (most commonly for massively multiplayer games) [23]. Free-to-play games started to appear, earning income through in-game third-party advertising which took the form of banners (appearing at the edges of the display screen) or interstitial videos between game levels [34].

The rise of mobile gaming (and web-based social network games) corresponded with a shift toward microtransaction payments, permitting more frequent, smaller payments. This gave rise to the *freemium* model, where games are offered free-to-play, but revenue is generated by sale of additional in-game features or advantages [57]. This has since become one of the major pillars of game monetization: in a 2020 survey of 4,000 developers worldwide, 43% said they were using the freemium model [12]. It has also proved to be highly lucrative: Candy Crush Saga earned \$1.19 billion in 2020 [14], despite its developer’s claim that 70% of players completing the game “have never made a currency payment” [59]. The freemium model opens up the possibility of deliberate design choices in order to maximize revenue; developers typically explore player behavior in detail and then correspondingly optimize gameplay to encourage repeated or continuous spending from those who choose to spend in-game [43]. Numerous studies have described the motivations driving user engagement with in-game purchasing [3, 32, 38, 39] and designers can potentially exploit these motivations to increase game profits. The industry uses a variety of key performance indicators to measure success, including metrics such as DAU/MAU (daily/monthly active users), ARPU/ARPPU (average revenue per user, or per paying user), Retention Rate (how many customers return after their first visit), and LTV (lifetime value, based on estimated duration of interest in the game) [23]. In addition, those players who have excessively high spending are identified as “whales”, and their in-game behavior can be of interest because they may represent a disproportionately large proportion of overall game revenue [58]. Many freemium game publishers monitor metrics continuously and use A/B testing to test the effect of minor changes to game elements, retaining those that maximize revenue [23]. The use of data in this way allows companies to take a more strategic and long-term approach to customer purchasing behavior.

The term *predatory monetization* describes “purchasing systems that disguise or withhold the long-term cost of the activity until players are already financially and psychologically committed” [42]. One of the most prominent examples of this is the *loot box*: a reward system where players purchase a package containing a random selection of virtual items. (The “gacha mechanic”, named after Japanese Gashapon toy vending machines, offers a system similar to loot boxes; hence, the terms “loot box” and “gacha” are often used interchangeably.) By varying the probability of items appearing, the designer may encourage players to spend repeatedly in order to gain desired items. As a result, loot boxes have been linked with problem gambling [66] and have been subject to numerous academic studies. Petrovskaya and Zendle [57] identify further cost issues including locking parts of the game behind a paywall, diminishing functionality (without additional purchases), *grinding*, and – most commonly – the use of *multiple currencies* to disguise the real-money price of items. Within their broader description of *problematic monetization*, Petrovskaya and Zendle also include deceptive user interface (UI) patterns that are designed to manipulate users into transactions that they did not intend.

2.3 Deceptive Design Opportunities in a 3D Environment

3D games that reflect conventions of the “real” world and use human-like player avatars provide opportunities for deceptive design. Greenberg et al. [30] described examples of deceptive patterns in proxemic interactions, illustrating ways that a “knowledge of proxemics may (and likely will) be easily exploited to the detriment of the user.” The term “proxemics” was coined by Edward Hall, who emphasized the idea that the proximity between an individual and other people affects that individual’s behavior and relationship with those people; Hall described differences between

intimate, personal, social, and public space [31]. In particular, Hall defined intimate & personal space as a region where individuals exhibit heightened attention. This presents opportunities for deceptive design in a 3D environment: the use of physical position to encourage (or discourage) user interaction, and an increased influence through interpersonal persuasion.

One of Greenberg's patterns, the "milk factor" [30], was based on the way that supermarkets may place frequently purchased items in a distant position to force shoppers to walk through more aisles, increasing the likelihood of seeing promoted items and making impulse purchases. Similar patterns are employed by retail stores to encourage a desired behavior from shoppers, including store route layout (forced-path, grid, and free-form) [19] and transition zones [62]. This has the potential to be mirrored in 3D game environments at social & public space scales, using distance and barriers to encourage desired interactions with specific game objects. A retail adage states: "eye-level is buy level"; the positioning of objects on shelves has a significant impact on sales figures. This stems from the Eastman Kodak "standard rule", which identified a preferred viewing angle from horizontal to 15 degrees below [18]. This has the potential to be mirrored in first-person 3D games at a personal space scale, placing desired interactions within eye-level (and less-desired interactions outside a comfortable viewing angle).

First-person and third-person 3D viewpoints offer a greater level of spatial immersion than those found in 2D or isometric games. As noted by Hall, interpersonal interactions within intimate or personal space fall within a "limit of domination" [31]. In a 3D game, a character may increase the intensity of dialogue by looking the player in-the-eye during a conversation; within VR, this effect would be compounded due to a greater emotional engagement [21]. Designers have agency to carefully craft the actions of Non-Playing Characters (NPCs), utilizing the persuasive and compliance-gaining methods traditionally associated with confidence tricksters or cybersecurity social engineering, creating a form of manipulative interaction pattern.

Miller et al. [51] outlined a set of strategies for gaining compliance in an interpersonal situation, including:

- Liking – getting the target in a "good frame of mind" before a request.
- Self-Feeling – infer the target will feel better for compliance (or worse for non-compliance).
- Altercasting – infer that a "good" person would comply (or "bad" would not). Altercasting can be made more successful by closer proximity (to the persuader), having multiple persuaders, emphasizing emotional aspects, inferring common goals, and by narrowing the range of options [64].
- Altruism – "do this for me."

Cialdini [11] proposed 6 tendencies displayed by people, particularly when they are cognitively overloaded. These are often cited as a basis for social engineering in cybersecurity [44, 52].

- Reciprocation – social obligation to repay gifts and favors in kind.
- Consistency – people feel the need to keep commitments or promises.
- Social validation – desire to keep in line with what others are doing
- Liking – compliance with requests from likeable individuals (see Miller et al., above).
- Authority – compliance with figures of authority.
- Scarcity – more likely to comply if there is time pressure or a fear-of-missing-out (FOMO).

These strategies and tendencies could be employed by designers within NPC interactions in 3D environments to increase the likelihood of players complying with requests or suggestions. (As noted in section 3.1, instances of both interpersonal persuasion and physical positioning were found in the Roblox game "Adopt Me!").

3 METHODS

To answer the research questions a mixed-methods approach was taken, combining different aspects from prior studies that have explored user perception of deceptive patterns. This took the form of a survey in which participants were shown examples from 3D games and asked to identify whether each contained deceptive design (based on a simple definition), why they thought this, and what they believed the designer's intent to be. Answers were subjected to inductive thematic analysis.

3.1 Survey Design

The survey follows a format established by Di Geronimo et al. [17] for exploring deceptive patterns in mobile applications, which used short video clips to present the patterns to participants. Candidate games were selected from a list of popular freemium 3D games. This began by obtaining a market report ranking the Monthly Average Users (MAU) of PC games [53], which was filtered to remove non-freemium entries. The remaining titles fell predominantly into two genres: *shooting games* – First Person Shooter (FPS) or Battle Royale – and *role-playing games* – solo (RPG) or multi-player online (MMORPG). The most popular game of each respective genre was selected as a candidate for further investigation: “Fortnite: Battle Royale” and Roblox “Adopt Me!” The primary investigator followed a systematic process to identify monetization events and potential points of interest relating to interpersonal interaction or physical positioning. For each candidate game, the process comprised three stages: a two-hour free-play of the game; 30 minutes spent viewing third-party gameplay videos (working sequentially through YouTube's top-ranked results); and examination of a variety of player-authored materials [10, 15, 37, 54, 55] yielded through search engine results for the game title accompanied by keywords associated with monetization or deceptive design.

The majority of Fortnite's monetization events take place in the lobby (2D storefront) between game rounds. The only monetization events found within Fortnite's 3D gameplay were in-game purchases of “exotic weapons” from an NPC; however, these were proximity-based, and NPC dialogue appeared irrelevant to the purchase activity. By contrast, “Adopt Me!” contained frequent monetization events taking place within the 3D world. Potential points of interest included player interactions with NPCs: the game contains more than 50 NPCs [2], of which nine engage the player through dialogue containing direct references to a purchasable item. Another potential point of interest was a vehicle showroom containing items of descending price, arranged at increasing distances from the entrance. Due to its richer set of points of interest, “Adopt Me!” was selected as the source for video clips.

A further systematic selection process was carried out to select suitable video clips. For each of the nine NPCs with purchase-related dialogue, a tally was recorded indicating the number of matches with Miller's strategies. The NPCs were ranked accordingly: NPCs with the highest number of matches were classed as examples of strong interpersonal interaction. Likewise, those with median and lowest number of matches were classed, respectively, as examples of medium and weak interpersonal interaction. Finally, the vehicle showroom was selected as an example of physical positioning.

For each of the choices, example gameplay showing the relevant interaction was recorded using screen capture software, and edited to a length of approximately one minute:

- *Clip A*, demonstrating strong interpersonal persuasion. This shows interaction with “Doug” (Figure 1), an NPC with comical half-man/half-dog appearance who talks in the third person. Doug states that he will be “sad [and ...] upset if you don't buy an egg.” The clip reflects Miller et al.'s compliance-gaining strategies of “self-feeling” (inference that the target will feel worse for non-compliance) and “liking” (getting the target in a good frame of mind before the request) [51].



Fig. 1. Doug.



Fig. 2. Justin.



Fig. 3. Vehicle Dealership.



Fig. 4. Sir Woofington.

- *Clip B*, acting as an experimental control, shows “Justin” (Figure 2): a plain-looking NPC. This is the weakest-ranked NPC, edited to ensure that the character delivers factual information only, with a neutral facial expression. Justin makes no attempt at compliance-gaining.
- *Clip C*, demonstrating physical positioning. This shows the Vehicle Dealership (Figure 3): a shop with expensive items placed close to the entrance and cheaper items further away. The clip also contains an introduction from “Rich”, a well-dressed salesperson who states: “You probably can’t afford anything in here.”
- *Clip D*, demonstrating a medium level of interpersonal persuasion, shows interaction with “Sir Woofington” (Figure 4), a talking dog NPC with a monocle and top hat. The clip reflects Miller’s “liking” strategy (as per clip A).

Following an introduction and informed consent stage, the first survey section contained questions gathering background data on gaming experience: participant’s age (selecting from 10-year ranges); genre or types of games regularly played, and any specific titles played in the last month; regularity of play; whether they have interacted with game monetization and, if so, how regularly, and how much spent in the last month. This was followed by a brief primer introducing the context of the clips and describing the in-game currency system. The remaining sections in the survey presented video clips A, B, C, & D, ordered using a Latin square. Each section began with a statement, “The following video clip may (or may not) include an example of ‘Dark Design’,” followed by a set definition of the term. The term “Dark Design” was chosen because the authors felt it would be most easily understood by participants (compared with differing interpretations of “deceptive design”) and reflected historical terminology in the practitioner community. A comparison of existing definitions by Brignull [6, 7], Gray et al. [29], and Zagal et al. [65] had identified two key components: intentional manipulation of the player, and an outcome beneficial to the game publisher. These were combined into a working definition used in the study:

Dark Design is where the creators of the game are trying to influence what the player does, to try to make money from the player through their action.

After watching each clip, participants were asked questions in the structure established by Di Geronimo et al. [17]: could they spot any “malicious design” in the video and, if the answer was “yes”, the participant was asked to explain their reasoning. For this survey, the first question was phrased, “Do you think there was ‘Dark Design’ in that clip?” and the second question as, “Why do you think the clip contains ‘Dark Design’?” The anonymous survey was delivered through Qualtrics and concluded with a debrief, reminding participants that they may withdraw consent at any point within a defined period by use of a supplied link. A full copy of the survey used, including all questions, is available at: <https://jking11.github.io/deceptive-design-3d-survey.pdf>

3.2 Survey Distribution

The target group for the survey was adults aged 18+, preferably with experience of PC games with 3D environments. Participants were recruited through the Reddit social media platform. Reddit's categorized structure and large user base made it ideal for reaching the target group. Initially, 12 different *subreddit* communities devoted to gaming were identified as suitable; however, a number of these had very strict rules and would not allow posting of academic surveys. After identifying eligible subreddits from this group, recruitment advertisements were posted on *r/truegaming*, *r/AskGames*, and *r/SampleSize*, (in compliance with the respective community survey solicitation rules), linking directly to the survey. Statistical data indicated that nearly half of all Reddit users are based in the US, so survey posts were timed to match peak activity periods for a US audience. Responses were gathered over a 4-week period.

3.3 Summary of Survey Responses

In total there were 506 responses to the survey, including 259 respondents who completed the survey fully (a 51.2% complete response rate) – responses containing answers in all five sections were deemed to be valid. Those with no completed answers ($n=93$) or any section omitted ($n=151$) were removed from the dataset, as were the handful of respondents ($n=3$) who completed the survey but withdrew consent within the defined period. Out of 259 valid responses, the age distribution was as follows: 18-24 ($n=72$), 25-34 ($n=135$), 35-44 ($n=41$), 45-54 ($n=9$), 55-64 ($n=2$), and none aged 65 or over. The proportion of participants aged 25-34 is far greater than anticipated (in comparison with UKIE [61] and ESA [20] demographic data); however, this is likely a result of using Reddit as a crowdsourcing platform: a recent study of *r/SampleSize* [47] indicated that 91% of that subreddit's users were aged 18-34 years old. Therefore, the study's results must be considered in the context of the sample group and may not be generalizable to a wider population. 95.8% of respondents indicated that they play games "most days" ($n=207$) or "a few times per week" ($n=41$); this is a little higher than suggested by comparable ESA demographic data, which states that between 71-84% of gamers play 3+ hours per week. Most indicated that they played multiplayer games with (or against) friends ($n=234$).

With regard to monetization, 88.8% ($n=230$) stated that they had purchased in-game items. These respondents were asked further questions about their in-game spending within the preceding month: 47.5% ($n=123$) had not made a purchase; 40.5% had purchased either "once" ($n=59$) or "a few times" ($n=46$); and 0.8% on a weekly ($n=1$) or daily ($n=1$) basis. A breakdown of spending estimates revealed that those who spent more regularly tended to spend more in total per month.

3.4 Data Analysis

Of the 259 respondents, 93% ($n=242$) felt that clip A (stronger interpersonal persuasion) contained deceptive design. Results for clips C (physical positioning) and D (weaker interpersonal persuasion) were also high, with 86% ($n=223$) and 83% ($n=214$) respectively. Clip B (control) scored lowest, with 26% ($n=66$) finding deceptive design. Of those, 22 stated that presence of multiple currencies was their reason for this; a further six indicated that in-game item purchases were too easy to make (despite the clip showing only a very minimal transaction for food, easily earned with a single in-game task). There was no otherwise clear pattern here, suggesting a possible confirmation bias from knowing that one-or-more clips would contain deceptive design. Across non-control clips (A, C, & D), an average 7.5% ($n=17$, $n=18$, $n=17$) commented that the bulk-buy currency packs presented in the in-game currency storefront were arranged in increments that forced players to buy more currency than actually needed. For the same clips, 5% ($n=6$, $n=12$, $n=14$) noted that the discount available for larger purchases of the currency packs would also encourage players to spend more

than they may have initially intended. A very small proportion ($n=2$) mentioned both observations for the same clip.

Whenever a participant identified a video clip as containing deceptive design they were prompted to explain (in their own words) why they made this decision. Replies were collected and analyzed following the phased method outlined by Braun and Clarke [5]: familiarization with data; documentation of patterns to produce initial codes; combination of codes into overarching themes; review of themes; defining and naming themes. This approach has been used in prior investigations of end-user perception of deceptive patterns [28, 48].

The research team began by familiarizing themselves with the data and looked for patterns with reference to the research questions. Participants' responses ranged from a few words to multiple sentences, with an average length of 93 characters. In cases where participants gave multiple reasons for their decision, these answers would be assigned more than one code. Next, patterns were identified in the data such as certain phrases and words appearing repeatedly ("real money", "emotional manipulation", "prove [the NPC] wrong", "guilt", "currencies", "random", "premium", and "rare"). One member of the team carried out a first pass to generate a list of labels, which were optimized into initial codes, and a second pass to process and document the response data, tallying instances of these codes using a spreadsheet. The research team then met to check through each code in turn, examining a sample of the data in each to verify the accuracy of the coding. In the next phase, members of the research team used card-sorting to combine codes into thematic groups using printed cards (one for each code). This was an iterative process which developed as the codes were discussed in relation to the research questions. The themes identified were now reviewed by the team and arranged as a codebook (see Table 1). During this process, it was noted that the code "Item price shown only after NPC interaction" had resulted from a small number of participants ($n=6$) stating that the item price had been withheld prior to purchase. However, upon review, this impression is purely a result of the way the clip was recorded: in free gameplay the player may view the price at any time, but in clips B–D this did not occur until after the NPC interaction. Therefore, this code was rejected and removed from the codebook. The next phase, naming and definition of themes, is provided in the following section. Each of the themes describes a new category of deceptive design in the context of 3D gameplay.

4 RESULTS

The following section presents the six new categories of deceptive design in the context of 3D gameplay identified through thematic analysis of survey responses.

Predatory Monetization. This theme describes aspects that fall within the definition outlined in section 2.2 (disguising or withholding the long-term cost of an activity [42]), and contains three main code clusters: loot boxes, multiple currencies, and bulk purchase mechanisms. The in-game "egg" items are a kind of loot box, and their presence in clip A was noted by 17% ($n=40$), and clip D by 27% ($n=57$). The higher figure for clip D may reflect the fact that the list of odds (for gaining higher-value items) in that clip was displayed directly beside the egg, but further away in clip A. Use of multiple currencies (real money and in-game currency) was identified as a concern by an average 13% ($n=15$, $n=22$, $n=33$, $n=25$) across clips A–D. As noted in section 3.4, the player may only purchase in-game currency in set pack sizes, with a bulk-buy discount to encourage larger purchases. In addition, the pricing of items is not aligned to the pack sizes, meaning that players must often purchase more currency than required.

Default To Purchase. This theme addresses instances where the player was directed to purchase in-game items or in-game currency as a default action; if they do not wish to purchase, they must opt-out. This covers two distinct aspects. Firstly, there are instances where the NPC prompts the

Table 1. Codebook, including themes from analysis of responses across all four video clips

Theme	Code name	<i>n</i>	Description
Predatory Monetization	Gacha / loot box / random	70	Transaction has a randomized element.
	“Gambling”	35	Refers directly to gambling. ^a
	Use of multiple currencies	95	Robux or bucks are linked to real money.
	Purchasing is too easy (low barrier)	16	Refers to the ease of a spending action.
	Bulk-buy discount on Robux	32	Reduction if purchasing large quantity of Robux.
	Must buy more Robux than needed	52	Mismatch of item costs and Robux pack prices.
Default To Purchase	Prompted to buy Robux (storefront)	76	Redirection to the “Buy Robux” storefront when the player has insufficient funds.
	Purchase prompt is immediate	40	The “Buy Robux” storefront appears quickly. ^b
	NPC asks or suggests a purchase	50	The NPC requests that the player buy an item.
	Instructed / told to do	18	The NPC insists that the player buy an item.
UI Misdirection	Exciting sound effect	16	Use of sound effects to draw attention to an item, or to imply positive characteristics.
	UI colours / animation	29	Direct attention with colour or animation.
Emotional Interpersonal Persuasion	NPC is cute or very likeable	29	The NPC is amiable or has prominent characteristics that are endearing.
	Player feels good for helping NPC	3	Feel a positive emotion for carrying out the action.
	Sympathy / pity for NPC	10	Feel sympathetic toward the NPC.
	Player feels ashamed / guilty	44	Feel a negative emotion if action is not carried out.
	General emotional manipulation	116	Non-specific descriptions of emotional manipulation of the player.
	Want to prove NPC wrong	72	Feel motivated to counter an NPC’s taunt.
	Fear Of Missing Out (FOMO)	7	Player is motivated by an anxiety that they might fail to experience key aspects of the game.
Narrative Obligation	Real money spend expected	112	Implicit assumption that the player should spend real-world money.
	Purchase feels part of narrative	15	Spending is intrinsic to the game’s storyline.
	“Premium value” or “rare” items	82	Virtual items are specifically labelled as having high value or importance.
Physical Placement	Cheap item placed next to [expensive] item	12	Uses arrangement or ordering of items as a way to influence player decisions.
	Physical placement of item	17	Refers to the relative distance or visibility of items from the player’s viewpoint.
	Uses images associated with wealth	9	Items presented in a context that implies high value or importance.

^a Small overlap (n=5) where responses included both “gacha/loot box/random” and “gambling.”^b Small overlap (n=7) where responses included both “storefront” and “purchase prompt is immediate.”

player to make a purchase, either as a request or as an instruction. For clip D, 3% (n=9) noted the NPC “instructing the player” or “literally told the player to spend money.” Secondly, if the player attempts to buy an item with insufficient credit, the user interface displays a prompt for the user to purchase additional in-game currency with real money; an average of 6% (n=15, n=12, n=14) cited the fact that this prompt “appeared instantly”, “immediately” or “suddenly” in clips A, C, & D (without further player interaction).

UI Misdirection. This theme relates to examples where the user interface (i.e., not the NPC) contains elements designed to purposefully focus attention on specific options, or away from opportunities to opt-out. A small number – an average of 4% (n=3, n=5, n=13, n=8) across the range of clips – noted the use of colors and animation to direct the player’s attention to selected UI elements (such as the “buy in-game currency” button). Comments included “even on the transaction screen, the buy button is highlighted and animated”, “[the buy button] was attracting more attention than the rest of the screen.” In clip C, 4% (n=8) commented on the use of a pleasing sound effect – described as “an angelic choir” and “a heavenly sound” – to accompany the appearance of the in-game currency storefront.

Emotional Interpersonal Persuasion. This theme reflects use of the NPC to solicit an emotional reaction from the player to support engagement in monetization. 38% (n=93) classified clip A as generally emotionally manipulative, using phrases such as “emotionally compels the player” and “appealing emotionally to the player.” Further comments were more specific. For clip A, in which the NPC character would “feel sad” if the player refused to buy an egg, 13% (n=32) considered this to be particularly manipulative. Responses used phrases like “it’s making the player feel bad”, “tried to guilt-trip the player”, “shaming the player into buying Robux [currency].” The player will also feel more disposed to help a “cute” NPC – 5% (n=13) mentioned this for clip A, and 5% (n=11) for clip D. Comments included, “It uses something that many people find friendly like a dog”, “vulnerable, child-like”, “Western populations tend to like dogs.” In clip C, the dealership salesman states: “You probably can’t afford anything here.” Significantly, 32% (n=72) interpreted this as a challenge to the player, and noted that the player would feel a strong desire to prove the salesman wrong: “player is negged by the NPC”, “classic reverse psychology sales trick of trying to get the customer to prove [themselves]”, “taunting the player.” Other comments such as “the player feels good for helping the NPC”, “sympathy/pity for the NPC” were coded but represented only a small proportion (n=8).

Physical Placement. This theme describes instances where in-game elements are arranged in physical positions that encourage the player to engage in monetization. This includes 3D physical positioning (as outlined in section 2.3): for clip C’s vehicle dealership, 6% (n=14) noticed that the most expensive items were closest to the entrance (with cheaper items further away). Comments include “items less likely to require a microtransaction are hidden at the back of the room” and “having the seemingly best car right by the entrance.” For clip D one participant commented “More expensive options have detailed pictures.” Another noted in clip C that “[the] NPC is named Rich and presented as living successfully due to their wealth”; however, this particular comment has been ignored because such styling is a common practice in real-world dealerships, so this effect appears to be an indirect consequence of the setting. Within the vehicle dealership, 4% (n=8) also mentioned that placing expensive items next to cheaper ones would make the cheaper one more attractive.

Narrative Obligation. This theme identifies where the game’s narrative structure makes the purchase of in-game items a regular or repetitive part of gameplay. Although in-game currency may be earned, this is generally at a slow rate, so players may be forced to spend to keep the game flowing. For clips A, C, & D, a consistent 15-16% (n=38, n=33, n=33) described an expectation that

players would need to spend real money (to purchase additional in-game currency) in order to obtain many of the in-game items. In these clips – particularly clip D – certain items are described by NPCs as having “premium value” or rarity to make them more attractive to players. Comments here included “he asked you to buy an egg as part of the funny story”, “made purchasing the item seem like a required part of the quest”.

5 DISCUSSION

Within the *Predatory Monetization* theme, results included player concerns about the use of multiple currencies (also known as intermediate currency). This finding corroborates existing studies that have labelled this pattern as problematic [29, 57], including a European Commission report that explains: “the consumer lost awareness of the real value of the content being purchased and may have been induced into spending more unconsciously” [22]. One paper also draws connections between multiple currencies and the mismatched currency exchange [57], as noted in results. The *Default To Purchase* theme reflects the Preselection pattern identified by Gray et al. [29]. This includes instances where the player was directly instructed to make a purchase by an NPC, and relates to Cialdini’s observation that individuals have a tendency to obey authority [11]. Indeed, this effect might potentially be enhanced by the designer, using visual elements to portray the NPC more clearly as a figure of authority. The fact that relatively few participants identified this instruction as deceptive design is interesting, given its prominence and regularity within the gameplay, and it is something that is worthy of future investigation. Visual misdirection is a common form of deceptive pattern, first identified by Brignull and Darlington [9]. Gray et al. [29] include this within a broader category titled Aesthetic Manipulation, which covers both visual misdirection and the use of UI elements to evoke emotional reaction (such as the pleasing sound effect associated with the appearance of the storefront). The current study’s theme of *UI Manipulation* confirms that users view these as a form of deceptive design.

Participants responded particularly strongly to the “sad” dog and “negging” salesman clips. Although it could be argued that these examples of emotional manipulation fall within the scope of Grey et al.’s Aesthetic Manipulation, the language of responses in both cases indicated that the participants saw each of these instances as an anthropomorphic interaction, rather than as an interaction with a software. For this reason, the theme of *Interpersonal Emotional Persuasion* aligns with published psychology literature on persuasion and compliance-gaining. In clip A, the dialogue in the interaction corresponds with Miller’s “self-feeling” compliance-gaining strategy, where the manipulator deliberately infers that an individual will feel worse for failure to carry out the action [51]. Similarly, the player will feel more disposed to help a “cute” NPC – an observation that aligns with Miller’s “liking” strategy [51]. In clip C, the salesman states, “You probably can’t afford anything here”, which one third of comments interpreted as a challenge or taunt to the player, noting that the player would feel a strong desire to prove the salesman wrong – a behaviour known as “reactance” [11]. This theme represents a new category of deceptive design which may be particularly effective in 3D environments.

The *Physical Placement* theme represents an escalation of Grey et al.’s False Hierarchy, where an option is given visual precedence over others. Grey et al. describe this as convincing the user “to make a selection that they feel is either the only option, or the best option”; however, in participant responses coded Physical Placement Of Item, the choice is driven by an unwillingness to travel further in 3D space, giving the designer agency to take advantage of player laziness. For clip C, participants noted that placing expensive items next to cheaper ones would make the cheaper item more attractive. This cognitive bias is known as “framing”, which may be classified as a deceptive pattern in itself [45, 46]. A few comments noted the images of increasing wealth and happiness

on more expensive currency packs — a persuasion technique well-established in advertising and marketing [26].

The theme of *Narrative Obligation* does align closely with Grey et al.'s category of Nagging [29] but may be considered a form of Pay To Skip, as outlined in Zagal et al. [65]. This relies on engagement with monetization to keep the gameplay experience aligned to the game's narrative structure, and provides the designer with greater agency in 3D games, due to the immersive nature of interaction with NPCs. Petrovskaya et al. [56] raise significant concerns over the use of game dynamics to drive spending.

These findings reinforce a need for further exploration of deceptive patterns in 3D gameplay. As noted earlier (in section 2.1), academic study of deceptive patterns has focused mainly on web, social media or mobile apps to date. A systematic review of deceptive pattern scholarship identified that only 7 of 79 papers focused on games [27]. It may be inferred from Zagal et al.'s taxonomy [65] (see section 2.1), and from broader evaluations of predatory monetization [42, 57], that games exhibit a number of distinct interaction characteristics and cannot simply be grouped with other digital media. Furthermore, an in-depth analysis of microtransactions by Petrovskaya et al. [56] highlighted differences in both form and salience between platforms (i.e., mobile and desktop) and game genres. The current study expands this discourse by identifying concerns particular to games with 3D environments.

5.1 Implications

Concerns within the gaming community about developers' use of devious tactics to drive in-game spending were evident in survey responses and even comments on Reddit posts that were used to advertise the survey. These comments included: "Thank you for doing research in this field. As a long-time gamer, it's been really disheartening to see how overtly manipulative game monetization has gotten," and, "I really hate this trend of blatantly predatory monetization, especially in games aimed at children." This latter point reflects the need to pay special attention to the effect of these tactics on vulnerable groups [22, 63]. Through this paper we hope to provide reassurance to the gaming community that these concerns are being identified and investigated, along with being brought to the attention of academics, game developers and legislators.

The identification of new categories of deceptive design in the context of 3D gameplay has immediate implications for game developers. These categories are not theoretical: examples have been found in a commercially available game with a huge user base, and other developers may seek to emulate this successful model. Developers need to be aware of the salient effect that these strategies have on player experience, to ensure that they do not upset or infuriate players [56]. As noted by van Rooij et al. [63], there are a number of potential changes to game industry internal practices that can address this.

The results of this study provide evidence that may be helpful to regulators and legislators who are seeking to restrict deceptive and manipulative practices in video gaming. There are concerns that regulation has so far been inadequate in this area: in a 2021 speech to the Federal Trade Commission, Harry Brignull noted: "I was quite naive. I thought that [deceptive patterns] could be eradicated by shaming the companies that used them, and by encouraging designers to use a code of ethics. The fact that we're here today means that approach didn't work" [8]. Similarly, a European Commission report concluded that "transparency-based remedies are ineffective" for countering deceptive patterns; "the remedies that have more potential for reducing consumer detriment include the prohibition of the most harmful practices" [22]. This is particularly the case for vulnerable groups: van Rooij et al. [63] reiterates the need for "hard legal measures", citing articles from the UN Convention on the Rights of the Child (CRC). Pre-emptive considerations are also needed: a survey of IT professionals indicated high levels of concern about the new regulatory

challenges presented by VR and Metaverse technologies [4], and the findings within this paper are directly relevant to this context.

The themes identified in this study highlight future areas for exploration for HCI researchers through the greater agency for designers enabled by 3D in terms of physical placement of objects within the 3D space and emotional impact of interactions with in-game characters. Enhanced in-game emotional interpersonal persuasion may have potential in the realm of positive behavioral design [63].

6 LIMITATIONS

The use of videos within the survey has inherent limitations; as noted by Di Geronimo et al. [17], watching a video and actively playing a game are two different experiences. There are advantages and disadvantages: participants may find it harder to spot deceptive design while engaged in the flow of gameplay; however, time-related patterns (such as “grinding”) may not be fully evident within a brief clip. In addition, it is questionable whether a method developed for mobile apps can fully represent interactions in a 3D game; however, there is precedent here: ratings bodies such as the ESRB use gameplay videos to assess game content, rather than actually playing the game [35]. For this study the use of video clips was necessary due to the online nature of the survey, and to ensure consistency of participant experience. The study has looked at user perceptions within just one game, but there are undoubtedly others that may reveal further 3D deceptive design elements and new techniques may be developed by game creators in the future. This work only focused on the Reddit community for recruitment of participants and in future work should focus on a broader range of demographics.

7 CONCLUSION

This paper sought to explore the use of deceptive design for monetization within popular “freemium” 3D games, which is currently an underexplored research area. An online survey was conducted to answer research questions of “How do players notice deceptive design elements in 3D games?” and “How do players perceive the role of deceptive design elements in the monetization process?” The survey involved participants watching clips of 3D gameplay and identifying deceptive design; the survey received 259 responses. Results showed that the method was effective in enabling participants to identify and explain deceptive design practices in the video clips with specific reference to monetization. The main contribution of this paper is six new categories of deceptive design in the context of 3D gameplay successfully identified and classed as potentially problematic by participants in our work. This shows that our survey method was effective and that deceptive design elements are being used in a variety of ways to encourage players to engage in monetization. This is particularly concerning as the game from which the video clips were taken (the “Adopt Me!” Roblox game) is targeted-at and primarily used by children and younger players, who may be more susceptible to deceptive design than adult players. Thematic analysis of the results was used to identify 26 unique codes relating to deceptive design identified and explained by participants. These were then grouped into six core themes which formed new categories of deceptive design: **Predatory Monetization**, **Default to Purchase**, **UI Misdirection**, **Emotional Interpersonal Persuasion**, **Physical Placement**, and **Narrative Obligation**. While all of these themes provide new insights gained from our specific investigation of 3D games, the first three themes have some alignment with existing deceptive patterns identified primarily within ecommerce web sites, while the latter three themes appear unique to 3D gaming environments. The new categories of deceptive design provide the first classification of deceptive design elements specifically for 3D games, which we hope will be valuable to the gaming community, to HCI researchers, to game developers, and to legislators.

REFERENCES

- [1] ACM. 2023. *Alternatives for Charged Terminology in the Computing Profession*. Association for Computing Machinery. Retrieved May 3, 2023 from <https://www.acm.org/diversity-inclusion/words-matter>
- [2] Adopt Me! Wiki. 2022. *NPCs*. Fandom wiki hosting service. Retrieved October 14, 2022 from <https://adoptme.fandom.com/wiki/NPCs>
- [3] Janarthanan Balakrishnan and Mark D. Griffiths. 2018. Loyalty towards online games, gaming addiction, and purchase intention towards online mobile in-game features. *Computers in Human Behavior* 87 (Oct 2018), 238–246. <https://doi.org/10.1016/j.chb.2018.06.002>
- [4] BCS. 2023. *Metaverse must solve child safety and regulatory challenges*. British Computer Society. Retrieved May 18, 2023 from <https://www.bcs.org/articles-opinion-and-research/metaverse-must-solve-child-safety-and-regulatory-challenges-if-it-wants-to-go-mainstream-say-it-professionals/>
- [5] Virginia Braun and Victoria Clarke. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology* 3, 2 (2006), 77–101. <https://doi.org/10.1191/1478088706qp063oa>
- [6] Harry Brignull. 2010. *Dark Patterns: dirty tricks designers use to make people do stuff*. Harry Brignull's 90 Percent of Everything blog. <https://90percentofeverything.com/2010/07/08/dark-patterns-dirty-tricks-designers-use-to-make-people-do-stuff/index.html>
- [7] Harry Brignull. 2013. *Dark Patterns: inside the interfaces designed to trick you*. Vox Media, Inc. <https://www.theverge.com/2013/8/29/4640308/dark-patterns-inside-the-interfaces-designed-to-trick-you>
- [8] Harry Brignull. 2022. *Bringing Dark Patterns to Light — Transcript of a speech at the Federal Trade Commission's Dark Patterns workshop*. Medium. <https://harrybr.medium.com/bringing-dark-patterns-to-light-d86f24224ebf>
- [9] Harry Brignull and Alexander Darlington. 2010. *Types of Dark Pattern*. Dark Patterns website. Retrieved April 26, 2020 from <https://www.darkpatterns.org>
- [10] Gökhan Çakar and Christian Harrison. 2022. *All Fortnite game modes, explained*. Retrieved August 14, 2022 from <https://dotesports.com/fortnite/news/all-fortnite-game-modes-explained>
- [11] Robert B. Cialdini. 1984. *Influence: Science and Practice*. Pearson Education, Boston, MA.
- [12] Jessica Clement. 2020. *Most common gaming business models used by game developers worldwide in 2020*. Statista. Retrieved January 27, 2022 from <https://www.statista.com/statistics/1183087/game-developers-business-models/>
- [13] James Close and Joanne Lloyd. 2021. *Lifting the Lid on Loot-Boxes: Chance-Based Purchases in Video Games and the Convergence of Gaming and Gambling*. Technical Report. Gamble Aware, London, UK. https://www.begambleaware.org/sites/default/files/2021-03/Gaming_and_Gambling_Report_Final.pdf
- [14] David Curry. 2022. *Candy Crush Revenue and Usage Statistics*. Soko Media. Retrieved April 13, 2022 from <https://www.businessofapps.com/data/candy-crush-statistics/>
- [15] Matthew Dean. 2017. Monetization. In *Roblox Developers' Conference*. Roblox Corporation, San Mateo, CA, 28 pages. https://blog.roblox.com/wp-content/uploads/2017/08/Monetization_RDCUK2017.pdf
- [16] Christoph Sebastian Deterding, Jaakko Stenros, and Markku Montola. 2020. Against “Dark Game Design Patterns”. In *DiGRA'20 - Abstract Proceedings of the 2020 DiGRA International Conference (DiGRA conference proceedings)*. DiGRA, Tampere, Finland, 3 pages. <http://eprints.whiterose.ac.uk/156460/>
- [17] Linda Di Geronimo, Larissa Braz, Enrico Fregnan, Fabio Palomba, and Alberto Bacchelli. 2020. UI Dark Patterns and Where to Find Them: A Study on Mobile Applications and User Perception. In *Conference on Human Factors in Computing Systems - Proceedings*. Association for Computing Machinery, New York, NY, USA, 1–14. <https://doi.org/10.1145/3313831.3376600>
- [18] Xavier Drèze, Stephen J. Hoch, and Mary E. Purk. 1994. Shelf management and space elasticity. *Journal of Retailing* 70, 4 (Dec 1994), 301–326. [https://doi.org/10.1016/0022-4359\(94\)90002-7](https://doi.org/10.1016/0022-4359(94)90002-7)
- [19] Claus Ebster and Marion Garaus. 2015. *Store Design and Visual Merchandising* (2nd ed.). Business Expert Press.
- [20] ESA. 2022. *Essential Facts About The Video Game Industry 2022*. Entertainment Software Association. <https://www.theesa.com/wp-content/uploads/2022/06/2022-Essential-Facts-About-the-Video-Game-Industry.pdf>
- [21] Sergio Estupiñán, Francisco Rebelo, and Paulo Noriega. 2014. Can Virtual Reality Increase Emotional Responses (Arousal and Valence)? A Pilot Study. *Duxu II* (2014), 541–549. https://doi.org/10.1007/978-3-319-07626-3_51
- [22] Directorate-General for Justice European Commission, Consumers, Francisco Lupiáñez Villanueva, Alba Boluda, Francesco Bogliacino, Giovanni Liva, Lucie Lechardoy, Teresa Rodríguez De Las, and Heras Ballell. 2022. *Behavioural study on unfair commercial practices in the digital environment: dark patterns and manipulative personalisation*. Publications Office of the European Union, Brussels. <https://doi.org/10.2838/859030>
- [23] Tim Fields. 2014. *Mobile & Social Game Design: Monetization Methods and Mechanics* (2nd ed.). CRC Press, Boca Raton, Florida.
- [24] Dan Fitton and Janet C. Read. 2019. Creating a framework to support the critical consideration of dark design aspects in free-to-play apps. In *Proceedings of the 18th ACM International Conference on Interaction Design and Children, IDC 2019 (IDC)*. ACM, 407–418. <https://doi.org/10.1145/3311927.3323136>

- [25] FTC. 2022. Epic Games: Complaint. https://www.ftc.gov/system/files/ftc_gov/pdf/1923203EpicGamesComplaint.pdf.
- [26] Robert H. Gass and John S. Seiter. 2014. *Persuasion, Social Influence, and Compliance Gaining* (5th ed.). Routledge, New York.
- [27] Colin M Gray, Lorena Sánchez Chamorro, Ike Obi, and Ja-Nae Duane. 2023. Mapping the Landscape of Dark Patterns Scholarship: A Systematic Literature Review. In *Designing Interactive Systems Conference (DIS Companion '23)*. Pittsburgh, PA, USA. <https://doi.org/10.1145/3563703.3596635>
- [28] Colin M. Gray, Jingle Chen, Shruthi Sai Chivukula, and Liyang Qu. 2021. End User Accounts of Dark Patterns as Felt Manipulation. *Proceedings of the ACM on Human-Computer Interaction* 5, CSCW2 (Oct 2021). <https://doi.org/10.1145/3479516>
- [29] Colin M Gray, Yubo Kou, Bryan Battles, Joseph Hoggatt, and Austin L Toombs. 2018. The Dark (Patterns) Side of UX Design. In *Conference on Human Factors in Computing Systems - Proceedings*. 1–14. <https://doi.org/10.1145/3173574.3174108>
- [30] Saul Greenberg, Sebastian Boring, Jo Vermeulen, and Jakub Dostal. 2014. Dark patterns in proxemic interactions: A critical perspective. In *Proceedings of the Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques (DIS)*. ACM, 523–532. <https://doi.org/10.1145/2598510.2598541>
- [31] Edward T. Hall. 1966. *The Hidden Dimension*.
- [32] Juho Hamari, Kati Alha, Simo Järvelä, J. Matias Kivikangas, Jonna Koivisto, and Janne Paavilainen. 2017. Why do players buy in-game content? An empirical study on concrete purchase motivations. *Computers in Human Behavior* 68 (Mar 2017), 538–546. <https://doi.org/10.1016/j.chb.2016.11.045>
- [33] Philip Hausner and Michael Gertz. 2021. Dark Patterns in the Interaction with Cookie Banners.
- [34] Boyuan He, Haitao Xu, Ling Jin, Guanyu Guo, Yan Chen, and Guangyao Weng. 2018. An Investigation into Android In-App Ad Practice: Implications for App Developers. In *INFOCOM 2018 - IEEE Conference on Computer Communications*. 2465–2473. <https://doi.org/10.1109/INFOCOM.2018.8486010>
- [35] Felix Hilgert and Philipp Sümmerrmann. 2016. Youth Protection in Virtual Reality Environments. *Computer Law Review International* 17, 3 (2016), 75–81. <https://doi.org/10.9785/crl-2016-0304>
- [36] Information Commissioner's Office. 2020. Age-Appropriate Design: a code of practice for online services. <https://ico.org.uk/media/for-organisations/guide-to-data-protection/key-data-protection-themes/age-appropriate-design-a-code-of-practice-for-online-services-2-1.pdf>.
- [37] Jailbreak Wiki. 2017. *Safes*. Fandom wiki hosting service. Retrieved July 26, 2021 from <https://jailbreak.fandom.com/wiki/Safes>
- [38] Moonkyoung Jang, Rumi Lee, and Byungjoon Yoo. 2021. Does fun or freebie increase in-app purchase? Analyzing effects of enjoyment and item experience intention to purchase mobile game contents. *Information Systems and e-Business Management* 19 (2021), 439–457. <https://doi.org/10.1007/s10257-019-00420-z>
- [39] Yifan Jiao, Christopher S Tang, and Jingqi Wang. 2021. *An Exploratory Study of Play Duration and In-App Purchase Behavior in Mobile Games*. <https://doi.org/10.2139/ssrn.3871031>
- [40] Faltin Karlsen. 2018. *Exploited or Engaged? Dark Game Design Patterns in Clicker Heroes, FarmVille 2, and World of Warcraft*. 219–233. <https://doi.org/10.7551/mitpress/11550.003.0019>
- [41] Daniel King, Paul Delfabbro, Sally Gainsbury, Michael Dreier, Nancy Greere, and Joël Billieux. 2019. Unfair play? Video games as exploitative monetized services — An examination of game patents from a consumer protection perspective. *Computers in Human Behavior* 101 (Dec 2019), 131–143. <https://doi.org/10.1016/j.chb.2019.07.017>
- [42] Daniel L. King and Paul H. Delfabbro. 2018. Predatory monetization schemes in video games (e.g. ‘loot boxes’) and internet gaming disorder. *Addiction* 113, 11 (2018), 1967–1969. <https://doi.org/10.1111/add.14286>
- [43] Daniel L. King and Paul H. Delfabbro. 2019. Video Game Monetization (e.g., ‘Loot Boxes’): a Blueprint for Practical Social Responsibility Measures. *International Journal of Mental Health and Addiction* 17, 1 (Feb 2019), 166–179. <https://doi.org/10.1007/s11469-018-0009-3>
- [44] Katharina Krombholz, Heidelinde Hobel, Markus Huber, and Edgar Weippl. 2015. Advanced social engineering attacks. *Journal of Information Security and Applications* 22 (2015), 113–122. <https://doi.org/10.1016/j.jisa.2014.09.005>
- [45] Chris Lewis. 2014. *Irresistible Apps Motivational Design Patterns for Apps, Games, and Web-based Communities* (1st ed.). Apress, New York, NY.
- [46] Jamie Luguri and Lior Jacob Strahilevitz. 2021. Shining a light on dark patterns. *Journal of Legal Analysis* 13, 1 (2021), 43–109. <https://doi.org/10.1093/jla/laaa006>
- [47] Raymond Luong and Anna M. Lomanowska. 2022. Evaluating Reddit as a Crowdsourcing Platform for Psychology Research Projects. *Teaching of Psychology* 49, 4 (Oct 2022), 329–337. <https://doi.org/10.1177/00986283211020739>
- [48] Maximilian Maier. 2020. Dark Design Patterns — An End-User Perspective. *Human Technology* 16, 2 (2020), 170–199. <https://doi.org/10.17011/ht/urn.202008245641>
- [49] Arunesh Mathur, Gunes Acar, Michael J. Friedman, Elena Lucherini, Jonathan Mayer, Marshini Chetty, and Arvind Narayanan. 2019. Dark patterns at scale: Findings from a crawl of 11K shopping websites. *Proceedings of the ACM on*

- Human-Computer Interaction* 3, CSCW (11 2019). <https://doi.org/10.1145/3359183>
- [50] Thomas Mildner and Gian-Luca Savino. 2021. Ethical User Interfaces: Exploring the Effects of Dark Patterns on Facebook. In *CHI '21 (CHI)*. ACM. <https://doi.org/10.1145/3411763.3451659>
- [51] Gerald Miller, Frank Boster, Michael Roloff, and David Seibold. 1977. Compliance-gaining message strategies: A typology and some findings concerning effects of situational differences. *Communications Monographs* 44, 1 (1977), 37–51. <https://doi.org/10.1080/03637757709390113>
- [52] Kevin D. Mitnick and William L. Simon. 2001. *The Art of Deception: Controlling the Human Element of Security*. John Wiley & Sons.
- [53] Newzoo. 2022. *Most Popular PC Games - Global*. <https://newzoo.com/insights/rankings/top-20-pc-games>
- [54] Jake Olefsky. 2020. DarkPattern.games: Helping You Find Healthy Mobile Games. Retrieved October 22, 2020 from <https://www.darkpattern.games>
- [55] Dan Olson. 2019. Manufactured Discontent and Fortnite. <https://www.youtube.com/watch?v=dPHPNglhR0&t=728s>. “Folding Ideas” YouTube channel.
- [56] Elena Petrovskaya, Sebastian Deterding, and David I. Zendle. 2022. Prevalence and Salience of Problematic Microtransactions in Top-Grossing Mobile and PC Games: A Content Analysis of User Reviews. In *Conference on Human Factors in Computing Systems – Proceedings*. ACM. <https://doi.org/10.1145/3491102.3502056>
- [57] Elena Petrovskaya and David Zendle. 2021. Predatory Monetisation? A Categorisation of Unfair, Misleading and Aggressive Monetisation Techniques in Digital Games from the Player Perspective. *Journal of Business Ethics* (2021). <https://doi.org/10.1007/s10551-021-04970-6>
- [58] Jesse Schell. 2008. *The Art of Game Design: A book of lenses*.
- [59] Ramin Shokrizade. 2013. *The Top F2P Monetization Tricks*. Retrieved April 5, 2022 from <https://www.gamedeveloper.com/business/the-top-f2p-monetization-tricks>
- [60] State of California. 2022. California Age-Appropriate Design Code Act.
- [61] UKIE. 2021. *Player Diversity & Demographics*. Association for UK Interactive Entertainment. Retrieved August 26, 2022 from https://ukiepedia.ukie.org.uk/index.php/Player_Diversity_%26_Demographics
- [62] Paco Underhill and R. Anderson. 1999. *Why We Buy: The Science of Shopping*.
- [63] Antonius J. van Rooij, Max V. Birk, Simone van der Hof, Sanne Ouburg, and Stijn van Hilten. 2021. *Behavioral design in video games: A roadmap for ethical and responsible games that contribute to long-term consumer health and well-being*. Technical Report. Trimbos institute, Eindhoven University of Technology & Leiden University.
- [64] Eugene A. Weinstein and Paul Deutschberger. 1963. Some Dimensions of Altercasting. *Sociometry* 26, 4 (1963), 454–466. <https://doi.org/10.2307/2786148>
- [65] José Pablo Zagal, Staffan Björk, and Chris Lewis. 2013. Dark patterns in the design of games. In *Proceedings of the 8th International Conference on the Foundations of Digital Games (FDG 2013)*. Society for the Advancement of the Study of Digital Games, Chania, Greece, 39–46. http://www.fdg2013.org/program/papers/paper06_zagal_etal.pdf
- [66] David Zendle, Rachel Meyer, and Nick Ballou. 2020. The changing face of desktop video game monetisation: An exploration of exposure to loot boxes, pay to win, and cosmetic microtransactions in the most-played Steam games of 2010-2019. *PLoS ONE* 15, 5 (2020). <https://doi.org/10.1371/journal.pone.0232780>

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