The Prevalence and Co-occurrences of Dark Patterns in Popular Mobile Free-to-Play Games

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EXTENDED ABSTRACT

Dark Patterns (DPs), or "deceptive design patterns," refer to "practices that materially distort or impair, either on purpose or in effect, the ability (of users) to make autonomous and informed choices or decisions (Regulation (EU) 2022/2065 2022)." In the context of video games, Zagal et al. (2013, 7) define them as "patterns used intentionally by a game creator to cause negative experiences for players which are against their best interests and likely to happen without their consent." DPs have attracted growing attention from scholars, policymakers, and the public due to their widespread presence and often ambiguous nature, which complicates regulatory efforts and limits user awareness (King et al. 2023; Aagaard et al. 2022; Bongard-Blanchy et al. 2021).

Existing research on dark patterns in video games primarily relies on players' self-reports (e.g., Hadan et al. 2024; Veiga et al. 2025), whose reliability is often questioned (Di Geronimo et al. 2020). Most studies focused on the mere prevalence of DP across games, overlooking its frequency within games and interactions in "combos". In practice, a game feature typically comprises several co-functioning DPs, and their interplay precisely complicates the persuasive impact on users (Gray et al., 2025; Zhang et al., 2025). While DP research in other fields has begun to explore their intersectionality through content analysis (e.g., Kelly and Rubin 2024; Kocyigit

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et al. 2024), similar approaches remain underdeveloped in (mobile) gaming. Existing endeavors either focus on taxonomy building with limited samples (e.g., Zhang et al. 2025) or rely on users' self-reports with questionable rigor (e.g., Niknejad et al. 2024; Gupta et al. 2025; Veiga et al. 2025). Thus, a more rigorous and representative mapping of DP prevalence in mobile games, alongside a systematic analysis of their design-level interactions, is needed to support future empirical and regulatory work. We present our Research Questions (RQ):

RQ1: How prevalent and frequent are (different types of) dark patterns in mobile free-to-play games?

RQ2: How do dark patterns in mobile free-to-play games co-occur in design?

METHOD

This study conducted a content analysis of the top 50 mobile Free-to-play (F2P) games on Google Play's Top Grossing chart in the US as of 16 June 2025. The game list is archived on the OSF repository: https://osf.io/a5394. The first author played and recorded each game for approximately 1 hour (*M* = 1:03:07, *SD* = 0.002) to simulate 'light play', where the player has made meaningful progress but not yet exhausted the gameplay (Aarseth 2003). The second author coded the recordings in NVivo 15 based on the ADD (App Dark Design) framework by Fitton and Read (2019). Due to methodological restraints, we excluded several DPs (e.g., Persuasive Design and Developmentally Insensitive) that emphasize the conceptual value of certain designs' exacerbated effect on susceptible groups (Nyström and Stibe 2020; Fitton and Read 2019). While significant, these types do not point to distinct design features and are difficult to operationalize without experience sampling (Gutiérrez-Manjón et al. 2026). The used codebook is presented in Table 1.

Category	Types/Codes	Reference
Temporal	Grinding	Zagal et al. (2013); Bojin (2008)
	Play by Appointment/Wait to Play	Zagal et al. (2013)
	Interstitial Non-app Content	Fitton and Read (2019)
Monetary	Pay for Permanent Enhancements	Fitton and Read (2019)
	Pay for Expendable Updates	Fitton and Read (2019)
	Pay to Skip/Progress	Zagal et al. (2013)
	Pay to Win	Zagal et al. (2013)
	Subscriptions	Fitton and Read (2019)
	Intermediate Currencies	Fitton and Read (2019)

Social	Impersonation/Friend Spam/Personification	Zagal et al. (2013), with modifications
	Prompts to Share/Review	Meyer et al. (2019)
	Social Pyramid Schemes	Zagal et al. (2013)
Disguised Ads	Advergames	An et al. (2014)
	Characters Placement	Meyer et al. (2019)
Sneaky Ads	Difficult/Deceptive to Dismiss	Fitton and Read (2019)
	Camouflaged Game Items	Meyer et al. (2019)
	Notification-based Ads	He et al. (2018)
Inappropriate	Unsuitable Adverts	Fitton and Read (2019)
	Encouraging Anti-Social Behavior	Fitton and Read (2019)
	Psychological Manipulation ● Endowed Value; ● FoMO; ● Collection Completion; ● Emotional Manipulation; ● Excessive Feedback; ● Variable Rewards; ● False Urgency/Scarcity; and ● Anchoring Tricks	Fitton and Read (2019)

Table 1: The used codebook in the study.

PRELIMINARY RESULTS

Four DP types—Psychological Manipulation, Intermediate Currencies, Pay for Expendable Updates, and Play by Appointment—are the most prevalent, with over 80% of games containing all of them. Notably, on average, each game includes over 6 distinct instances of psychological manipulation. The prevalence and frequency of each DP are exhibited in Figure 1 and Figure 2, respectively.

With Spearman correlation, we examined the co-occurrences. Psychological Manipulation shows strong correlations with all 6 Monetary DPs and Play by Appointment. Moreover, DPs within the Monetary category also exhibit high intercorrelations. Table 2 shows extracted correlations with $r > 0.4$ (Sig. < 0.05).

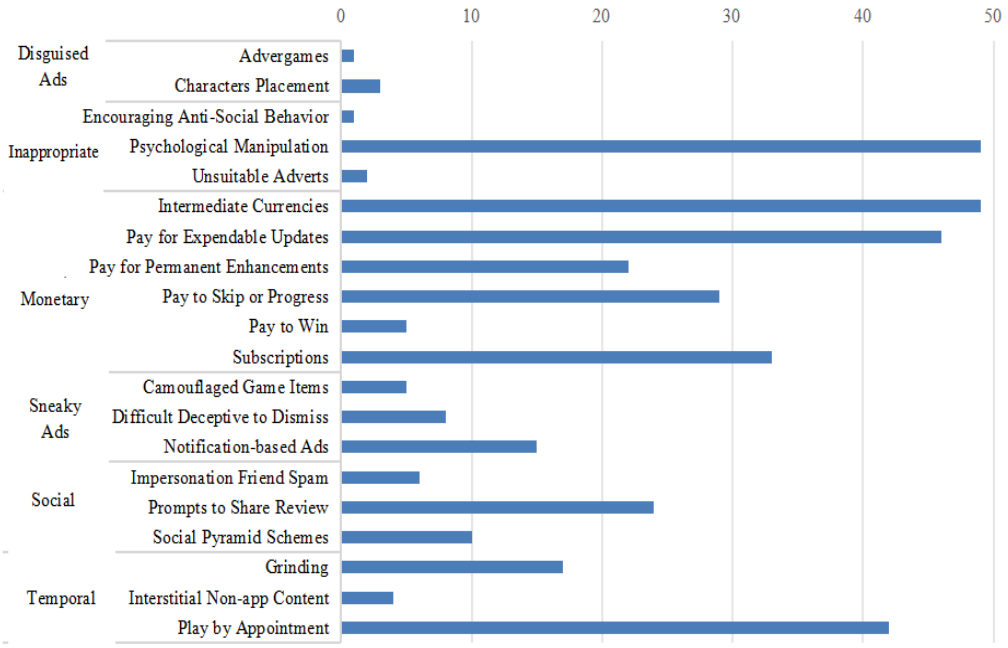

Figure 1: The prevalence of each Dark Pattern in the sampled 50 games.

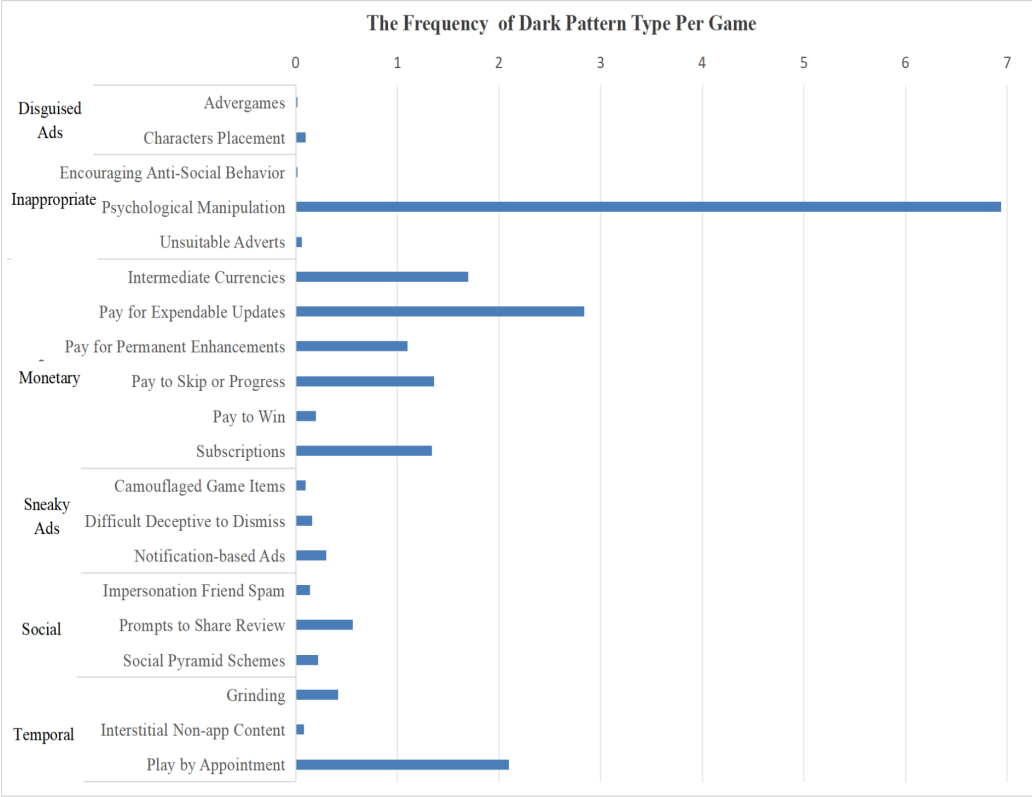

Figure 2: The average number of distinct instances of each Dark Pattern per game.

r	Psychological Manipulation	Intermediate Currencies	Pay for Expendable Updates	Pay for Permanent Enhancements	Pay to Skip/Progress	Pay to Win	Subscriptions	Difficult/ Deceptive to Dismiss	Play by Appointment
Psychological Manipulation	1								
Intermediate Currencies	.876**	1							
Pay for Expendable Updates	.874**	.992**	1						
Pay for Permanent Enhancements	.910**	.937**	.942**	1					
Pay to Skip/Progress	.899**	.945**	.945**	.936**	1				
Pay to Win	.730**	.861**	.876**	.854**	.808**	1			
Subscriptions	.848**	.886**	.878**	.817**	.871**	.615**	1		
Difficult/Deceptive to Dismiss	.629**	.788**	.809**	.761**	.757**	.709**	.675**	1	
Play by Appointment	.848**	.830**	.823**	.796**	.852**	.634**	.850**	.457*	1

Table 2: The extracted co-occurrences of DPs (**: sig. < 0.01; *: sig. < 0.05).

PRELIMINARY DISCUSSION

Psychological Manipulation is the most prevalent dark pattern in our findings, which was also often implemented alongside other categories/types. This is partly due to our definition of Psychological Manipulation being wider and encompassing concepts like FoMO and Waste Aversion, which were categorised in other studies as Social and Monetary patterns instead (e.g., Niknejad et al. 2024; Zhang et al. 2025; Gutiérrez-Manjón et al. 2026). However, we consider our categorization justified as these patterns leverage cognitive mechanisms widely utilized in persuasion practices (Ahuja and Kumar 2022), and grouping them together (rather than under different patterns depending on the context where it is used) better captures the true prevalence of these so-called “borderline cases” (Zagal et al., 2013).

Disagreements as to whether certain patterns should be classified as dark and categorized under Psychological Manipulation re-emphasize the blurred line between manipulation and persuasion. To distinguish manipulation from persuasion, ethical discussions in persuasive technology research have typically focused on factors including intention, method, and especially effect (Berdichevsky and Neuenschwander 1999). However, the interactive nature of video games complicates such deliberation. Various contextual factors, such as the transparency of design, play style, and players’ techno- and ludo-literacy, all mediate the effect of a design

pattern (Zagal et al., 2013). Thus, further study from the player's viewpoint on the mediating effect of these factors would be crucial in future works.

Beyond the challenge of classification, our findings also show that Psychological Manipulation does not operate alone in practice, but frequently co-occurs with Monetary patterns. This co-occurrence points to a deep entanglement between persuasive design and monetization logic, particularly evident in the case of Intermediate Currencies. Previous studies discussed how Intermediate Currencies abstract away real-world cost and reframe in-game spending as an 'optimization' task, creating an illusion of consumer autonomy termed 'financialization' (Nielsen 2025). Our results of the co-occurrences between psychological and monetary patterns suggest the systematic bias underlying such "autonomy," revealing how monetization in mobile F2P games operates through coordinated design rather than isolated features.

PRELIMINARY CONCLUSION

In sum, the prevalence and co-occurrences of dark patterns demonstrated by our findings serve to problematize persuasion practices and their widespread implementations in monetization design. These findings provide an empirical foundation for subsequent regulatory and ethical work on consumer protection in video game monetization, and underscore the need for in-depth inspections from the aspects of ethical design and player experiences.

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