Fast Play, Fast Profit: Unveiling the Prevalence of Aggressive Ad Behaviors in Mini-Game

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Abstract

In recent years, mini-games, that can be played without downloading, have become an important part of the gaming market. In mini-game ecosystem, they often rely on advertisements as the primary revenue source. However, some miscreants abuse this incentive mechanism by displaying annoying, biased, and even discriminatory advertisements to users. Despite the growing importance of mini-games, little is known about the scope and nature of aggressive advertising in this ecosystem. In this paper, we conduct the first study on aggressive advertising in mini-games. By analyzing policies across nine major platforms and measuring on real-world mini-games, we reveal the prevalence of aggressive ad behaviors in mini-games. These findings highlight significant gaps in platform governance and raise urgent concerns about user experience, platform credibility, and ecosystem health.

CCS Concepts

• **Security and privacy** → **Software and application security**;
• **General and reference** → *Measurement*.

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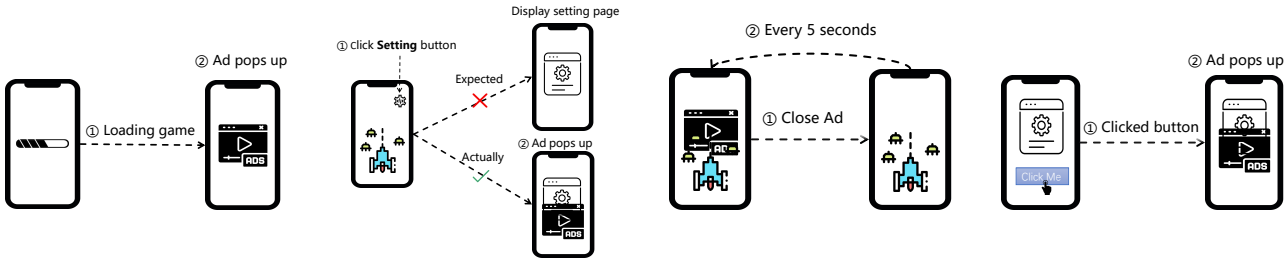
1 Introduction

Games have become a significant component of modern entertainment. In 2025, the global number of gamers reached 2.7 billion [12]. Mini-games, as a form of game that does not require downloading and installation, and can be played immediately by clicking on links or within the application, are rapidly rising and being welcomed by a large number of users. Many platforms, such as WeChat[15], Facebook[6], and QuickGame[11], support mini-game as a core tool for user retention due to its ease of use and shareability [8].

Unlike native games, which typically charge for installation and/or in-game purchasing, most mini-games generate income primarily through advertisements. Although game platforms have guidelines for integrating ads, for instance, Facebook specifies that "ads must not be implemented in a way that surprises users or interrupts the natural flow of the app" [10], some mini-game developers still try to embed massive, or even aggressive, advertisements in pursuit of profit. Figure 1 shows four popular scenarios of aggressive ad behaviors summarized from official regulations of mini-game platforms [1, 2, 5, 9, 10, 14, 16–18]. Aggressive ad behaviors (*e.g.*, clickbait, unstoppable pop-ups) significantly harm user experience,



(a) Interrupting Pop-ups (b) Hijacking Pop-ups (c) Unstoppable Pop-ups (d) Clickbait

Figure 1: Examples of Four Popular Aggressive Ad behaviors

increasing the need for mini-game markets and auditing departments to regulate mini-game advertisements.

This paper first investigates the advertising regulations imposed by various mini-game platforms. We surveyed the top 15 popular mini-app marketplaces [21] (9 of which support mini-games), collected their advertising policies, and identified 8 categories of aggressive ad behaviors with 16 specific forms. Then we applied an automated detection method based on static control flow analysis to test mini-games published on four main mini-game platforms, *i.e.* WeChat, Facebook, Quickgame, VK.

Our findings reveal the presence of aggressive advertising behaviors in the current mini-game ecosystem, which poses serious risks to user experience. This not only underscores the severity of the problem in current practice, but also highlights the lack of effective oversight in rapidly evolving app environments. To mitigate these risks and promote a healthier ecosystem, we call for stronger enforcement from mini-game platforms as well as broader collaboration between researchers, developers, and regulators.

2 Background

2.1 Advertisement Integration in Mini-game

In-game advertising is a key monetization strategy for mini-game developers. Typically, developers register a payment account in the mini-game platform, generate ad IDs for various formats, and integrate ad objects at chosen points in the game, retaining broad control over when and how ads are triggered based on gameplay events.

The monetization is usually based on Cost-Per-Click (CPC) or Cost-Per-Mile (CPM) models. Since CPC requires user interaction and CPM only requires display, some developers are incentivized to increase the frequency and intrusiveness of ads, which can result in aggressive ad behaviors.

2.2 Advertisement Regulations

To clarify the policy boundaries of in-game advertising, we systematically surveyed the top 15 popular mini-app marketplaces [21], 9 of which support mini-game. We collected their advertising policies specific to mini-game, or to mini-apps in general, when no dedicated rules were provided [1, 2, 5, 9, 10, 14, 16–18].

We filtered the policy documents using the keyword "ad", retained those specifying developer obligations or advertising restrictions, and clustered them by user-facing consequences into 8 categories of aggressive ad behaviors, with 16 concrete forms (see Table 1). The annotation was independently conducted by two authors.

Among them, WeChat and QuickGame impose the strictest constraints—likely due to their larger user and mini-game bases and more mature penalty systems. Notably, WeChat employs a graded enforcement mechanism, issuing penalties ranging from warnings and account suspension to termination and revenue deductions[19]. However, the VK [18] only prohibits three forms of aggressive ad behavior, i.e., In-game ads during gameplay, frequent pop-ups in the short intervals, and fake impressions or clicks. As for the aggressive ad behavior views, most mini-game platform prohibits at least one forms of interrupting pop-ups, including Wechat, Facebook, TikTok and etc.

3 Aggressive Ad Behaviors in Real-world

To understand the prevalence of aggressive ad behaviors in the real-world mini-game ecosystem, we conduct a large-scale measurement study. We focus on four major mini-game platforms: WeChat, Facebook, Quickgame, and VK, as they host the largest mini-game ecosystems with each exceeding 100 million monthly active users (MAU) [3, 7, 13, 20]. Using the open-source tool *minicrawler* [22], we crawled 9,475 mini-games from the *Game* category of the official mini-game markets of these platforms. Due to the significant overhead introduced by variations in file structures across different game engines, we limit our analysis to games developed with Cocos, the most widely used engine in the mini-game ecosystem [4]. Among the games we collected, we identified 2,125 Cocos-based mini-games, including 1,593 from WeChat, 312 from Facebook, 171 from Quickgame, and 49 from VK.

We implement a static analysis framework that performs context-sensitive control flow analysis and applies rule-based matching to detect aggressive ad behaviors.

For example, a Hijacking pop-ups case is that an ad unexpectedly appears prior to the intended functionality of a button, thereby hijacking the user's interactions. Figure 1-b presents an example that the event's callback function of a "Setting" button is the trigger of ad pop-ups. Whenever a player interacts with this button for purposes such as adjusting the volume level or navigating to the main menu, an advertisement will unexpectedly pop up.

Table 1: Prohibition of Aggressive Ad Behaviors in Mini-game platform policies. ✗ indicates prohibiting such behavior.

Aggressive Ad Behavior		Mini-game Platform								
Category	**Description of Forms**									
Interrupting Pop-ups	1. In-game ads during gameplay		✗	✗	✗			✗	✗	✗
	2. Ads masking functional buttons	✗	✗	✗		✗	✗	✗	✗	✗
Hijacking Pop-ups	1. Hijacking functional buttons			✗						
	2. Hijacking unexpected clickable areas			✗					✗	
Unstoppable Pop-ups	1. Frequent pop-ups in short intervals		✗		✗	✗		✗	✗	
	2. Auto pop-ups after close			✗						
Clickbait	1. Misleading text/image to lure clicks	✗		✗		✗	✗		✗	
	2. Habitual misleading triggers	✗						✗	✗	
	3. Unclear reward ads	✗		✗						
	4. Modified ad component style	✗					✗			
Ad overloading	1. Multiple ads on one screen	✗	✗	✗		✗		✗	✗	
	2. Ads stacking	✗	✗							
Unskippable Pop-ups	1. Ads required to proceed the game	✗		✗				✗	✗	
	2. No close or delayed close button			✗			✗	✗	✗	
Conditional Evasion	1. Conditioned trigger to bypass review	✗		✗						
Ad fraud	1. Fake impressions or clicks	✗		✗	✗		✗	✗		

Platforms: WeChat Mini Game, Facebook Instant Game, QuickGame, VK Mini Game, Baidu Mini Game, Alipay Mini Game, TikTok Instant Game, UC Browser Game.

4 Conclusion

In this paper, we present the first systematic study on aggressive ad behaviors in mini-games. Through policy analysis and large-scale static analysis-based measurement, we reveal the presence of aggressive ads in the wild and highlight gaps in platform governance. Our findings suggest that unchecked propagation of such behaviors poses serious risks to user experience, platform credibility, and developer trust. We call for stronger regulation, greater transparency in review processes, and collaborative efforts to foster a healthier and more sustainable ecosystem.

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