Understanding the dark patterns in push notifications in games and its influence on user behavior

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Abstract:
Deceptive design elements known as dark patterns have infiltrated various digital applications, including games, raising ethical concerns. These deceptive techniques have become widespread within the realm of gaming. Push notifications, which are effective at engaging players, can be used to create a sense of urgency, trigger behavioral reactions, and promote addictive gameplay by employing social pressure. This study aims to investigate the widespread use of dark patterns, with particular focus on push notifications in games. The goal is to investigate how these patterns influence user behavior, decision-making, and emotions across age and gender groups. The study seeks to comprehend the negative methods by which users can be controlled. The methodology involved conducting a survey to gain insights into user behavior regarding game notifications. A total of 156 responses were collected, consisting of 86 male respondents, 67 female respondents, and 3 participants who chose not to disclose their gender. In terms of age groups, 56 respondents fell within the 21-30 year old range, 35 were aged between 18-20, 34 were in the 31-40 age group, 18 were between 41-50, 10 were between 51-60, and 3 were 61 years old or older. Statistical analysis was performed using ANOVA (Analysis of Variance) in R software.
Keywords: Dark patterns, deceptive design pattern, dark patterns in games, push notifications, manipulative dark patterns, user behavior, negative player experience

Introduction:
Dark patterns, which are deceptive design techniques used to manipulate user behavior, have become common in digital applications, including games. Within the gaming realm, push notifications, though often underestimated, are a significant type of dark pattern. These notifications, utilizing sensory cues like sound and touch, interrupt users' activities to deliver messages, making them powerful tools for game developers to engage players and encourage prolonged participation. This research focuses on understanding the impact of push notification dark patterns in games and exploring their influence on user behavior, emotions, and decision-making processes. The study intends to shed light on their ability to negatively manipulate users by delving into how these patterns can shape gameplay experiences. This investigation will provide a deeper understanding of the deceptive tactics used in digital interfaces, particularly in the context of gaming, contributing valuable insights to the broader discourse on user interaction and technology ethics.

Literature review:
The evolution of digital technologies and online services has transformed the way individuals interact with interfaces, raising concerns about ethical design practices. One such concern revolves around the concept of 'dark patterns,' deceptive user interface techniques intentionally crafted to manipulate users into making choices contrary to their best interests. While these methods may be beneficial to the company employing them, they raise serious ethical concerns about user freedom, trust, and informed decision-making. This deliberate deception, intended to influence user behavior, highlights the complex relationship between interface design and human psychology. Dark patterns serve as a tool to illuminate the nuances of interactions between user experience, digital ethics, and corporate motivations in the online realm. The emergence of dark patterns reflects the ongoing struggle between user empowerment and corporate agendas. Dark patterns have infiltrated various digital interfaces. Gamification, the

use of game elements in non-game settings to increase user engagement, has become a popular persuasive tool. Dark patterns are visible in this persuasive technique, showcasing the manipulative tactics used to influence user behavior. Games, as immersive digital experiences, provide an opportunity to learn about dark patterns. These patterns illuminate the interconnections between a game's design and a player's knowledge about games, shaping emerging gameplay experiences. These design strategies, which frequently benefit developers at the expense of the target audience, involve unethical practices such as coercion, deception, and fraud. These unethical design techniques not only result in a negative player experience, but they also reveal the complex relationship between game design and player knowledge. When dark patterns are used in games, players' experiences can extend beyond the game itself, influencing their emotions and behaviors. Similarly, push notifications on mobile phones are both one of the most common and one of the least critically regarded media forms, falling under the umbrella of dark patterns. The term 'notification' refers to an instance or combination of sound, vibration, image, light, touch, or other sensations intended to interrupt what a person is doing in order to convey an external message. While notifications have the potential to be useful, the competitive online realm constantly bombards users with notifications in an attempt to capture their attention. Push notifications can indeed be manipulated to function as a dark pattern in games. Game developers, particularly in mobile gaming, have been observed using push notifications in ways that can be perceived as manipulative and coercive, falling within the realm of dark patterns. Push notifications, when used manipulatively in games, can create a sense of urgency, exploit psychological triggers, and induce social pressure, fostering compulsive and addictive gameplay. Understanding how games influence mood or behavior and how this affects decision-making, could be beneficial. This understanding not only helps gamers choose games wisely but also protects them from games that attempt to manipulate them in unfavorable ways.

Methodology:

Survey

A survey was carried out in order to gain an understanding of user behavior in relation to push notifications in games. It is also to determine whether there is a significant difference in age and gender in relation to game notifications, as well as whether game notifications play a role in an individual's daily activities. A set of variables were constructed for this survey.

Variables:

1. Age: 18-20, 21-30, 31-40, 41-50, 51-60, 61 and above
2. Gender: Male, Female, Prefer not to say, Other
3. Have you ever played mobile games?: Yes, No
4. From the following options, select the games that you've played (multiple choices): Hayday, Candy Crush Saga, Wordscapes, Township, Farmville, Clash of Clans, Homescapes, Other
5. Do you keep your notifications turned on for these games?: Yes, Depends on the game, No option to turn it off, No
6. Do you think that the game notifications are useful?: Yes, Maybe, No
7. Why do you think that the notification is useful? (multiple choices): A reminder to play the game, To receive game alerts, To check for game events, To check for game updates or rewards, To check for invitations or requests from friends, Other

8. Do you wait for game notifications?: Yes, Sometimes, Rarely, No
9. How long does it take for you to open the game notifications? (Multiple choices): Immediately, Whenever I get free time, When I'm bored, Sometimes I tend to forget, Other
10. How do you know if you have received a notification? (Multiple choices): The sound of game notification is different, My phone screen lights up, I keep checking for the notification, Other
11. Do you have a particular time to play the games?: Yes, I play the game whenever I receive a notification, I play the game whenever I am bored, No, Other
12. Select all options you feel when you receive/read a game notification. (multiple choices): Happy, Disappointed, Excitement, Fear of missing out, Anticipation, Urgency to play the game/finish the tasks, Competitiveness, Need to socialize, Annoyed, Other

A total of 156 survey responses were collected, of which 56 participants were between 21-30 years old (35.9%), 35 between 18-20 (22.4%), 34 between 31-40 (21.8%), 18 between 41-50 (11.5%), 10 between 51-60 (6.4%), and 3 were 61 years old or older (1.9%). Also, in the data collected, 86 were male (55.1%), 67 were female (42.9%), and 3 respondents chose not to disclose their gender (1.9%).

In the process of analyzing the data, ANOVA (analysis of variance) was employed. ANOVA serves as a statistical tool designed to assess the overall variability present in a dataset. Its primary goal is to determine if the independent variable (IV) has a significant impact on the dependent variable (DV).

In this data, the independent variables were: age groups and gender. The dependent variables were: playing mobile games, turning on game notifications, waiting for game notifications, and game notifications being useful.

In ANOVA, there are two hypotheses: the null hypothesis, indicating no significant difference between variables, and the alternative hypothesis, suggesting a significant difference. The F-statistic in ANOVA represents the ratio of error mean square to model mean square, and the associated P-value indicates probability. ANOVA employs the F-test, where if the F-test's p-value is ≥ 0.05, the null hypothesis is accepted, denoting no significant difference. If the p-value is < 0.05, the alternative hypothesis is accepted, signifying significance. ANOVA analysis was performed using R software, renowned for its ability to handle diverse data types and widely utilized in data science, academic research, and statistics tasks due to its versatility and efficiency.

Findings:

From the ANOVA results,

Null Hypothesis: There is no significant difference across age groups in terms of playing mobile games.

```
> fit<-aov(playinggames~Age,data= mydata1)
> summary(fit)
             Df Sum Sq Mean Sq F value   Pr(>F)
Age           1  2.318   2.318   22.51 4.73e-06 ***
Residuals   154 15.855   0.103
---
```

Result: The P value is less than 0.05, which means the null hypothesis is rejected and the alternate hypothesis is accepted, which is that there is a significant difference across age groups in terms of playing mobile games.

Null Hypothesis: There is no significant difference across genders in terms of playing mobile games.

```
> fit<-aov(playinggames~Gender,data= mydata1)
> summary(fit)
             Df Sum Sq Mean Sq F value Pr(>F)
Gender        1  0.597  0.5968   5.229 0.0236 *
Residuals   154 17.576  0.1141
---
```

Result: The P value is less than 0.05, which means the null hypothesis is rejected and the alternate hypothesis is accepted, which is that there is a significant difference across genders in terms of playing mobile games.

This shows that there is a significant difference across age groups and genders in terms of playing mobile games, suggesting that age and gender factors can influence mobile gaming behavior, as different demographics have different perspectives, motivations, and engagement levels.

Null Hypothesis: There is no significant difference across age groups in terms of turning on game notifications.

```
> fit<-aov(notificationson~Age,data= mydata1)
> summary(fit)
             Df Sum Sq Mean Sq F value   Pr(>F)
Age           1  40.11   40.11   23.41 3.15e-06 ***
Residuals   154 263.86    1.71
---
```

Result: The P value is less than 0.05, which means the null hypothesis is rejected and the alternate hypothesis is accepted, which is that there is a significant difference across age groups in terms of turning on game notifications.

Null Hypothesis: There is no significant difference across genders in terms of turning on game notifications.

```
> fit<-aov(notificationson~Gender,data= mydata1)
> summary(fit)
             Df Sum Sq Mean Sq F value Pr(>F)
Gender        1  12.42  12.424   6.562 0.0114 *
Residuals   154 291.55   1.893
---
```

Result: The P value is less than 0.05, which means the null hypothesis is rejected and the alternate hypothesis is accepted, which is that there is a significant difference across genders in terms of turning on game notifications.

This shows that there is a significant difference across age groups and genders in terms of turning on the game notifications, suggesting that there are varying preferences and behaviors in relation to notifications.

Null Hypothesis: There is no significant difference across age groups in terms of waiting for game notifications.

```
> fit<-aov(waiting~Age,data= mydata1)
> summary(fit)
             Df Sum Sq Mean Sq F value    Pr(>F)
Age           1  24.67  24.672   14.15 0.000239 ***
Residuals   154 268.48   1.743
---
```

Result: The P value is less than 0.05, which means the null hypothesis is rejected and the alternate hypothesis is accepted, which is that there is a significant difference across age groups in terms of waiting for game notifications.

Null Hypothesis: There is no significant difference across genders in terms of waiting for game notifications.

```
> fit<-aov(waiting~Gender,data= mydata1)
> summary(fit)
             Df Sum Sq Mean Sq F value  Pr(>F)
Gender        1  14.55  14.553   8.044 0.00518 **
Residuals   154 278.59   1.809
---
```

Result: The P value is less than 0.05, which means the null hypothesis is rejected and the alternate hypothesis is accepted, which is that there is a significant difference across genders in terms of waiting for game notifications.

This shows that there is a significant difference across age groups and genders in terms of waiting for game notifications, suggesting that individuals of different genders and age groups may have distinct preferences, attitudes, or responses when it comes to receiving game notifications.

Null Hypothesis: There is no significant difference across age groups in terms of game notifications being useful.

```
> fit<-aov(Notificationsusefulness~Age,data= mydata1
> summary(fit)
             Df Sum Sq Mean Sq F value   Pr(>F)
Age           1  47.17   47.17   46.12 2.28e-10 ***
Residuals   154 157.51    1.02
---
```

Result: The P value is less than 0.05, which means the null hypothesis is rejected and the alternate hypothesis is accepted, which is that there is a significant difference across age groups in terms of game notifications being useful.

Null Hypothesis: There is no significant difference across genders in terms of game notifications being useful.

```
> fit<-aov(Notificationsusefulness~Gender,data= myda
> summary(fit)
             Df Sum Sq Mean Sq F value  Pr(>F)
Gender        1   9.02   9.018   7.098 0.00854 **
Residuals   154 195.67   1.271
---
```

Result: The P value is less than 0.05, which means the null hypothesis is rejected and the alternate hypothesis is accepted, which is that there is a significant difference across genders in terms of game notifications being useful.

This shows that there is a significant difference across age groups and genders in terms of game notifications being useful, suggesting that individuals of different genders and age groups may have distinct interests, playstyles, and differences in user behaviors.

According to the survey data depicted in Figure 3, a substantial 61.3% of the participants view game notifications useful because they enable them to keep track of in-game events. Furthermore, 59.9% of respondents appreciate notifications for receiving game-related alerts, while 46.7% use them to stay informed about game updates. Additionally, 40.9% find notifications helpful in reminding them to play the game, and 27% use them to monitor invitations or requests. These findings imply that notifications prompting players to engage with the game might contribute to addictive tendencies. This could lead players to develop a compulsion to frequently check for updates or respond to alerts, potentially resulting in excessive gaming habits and adverse consequences for their well-being, including disruptions in sleep patterns and reduced productivity in other areas of their lives.

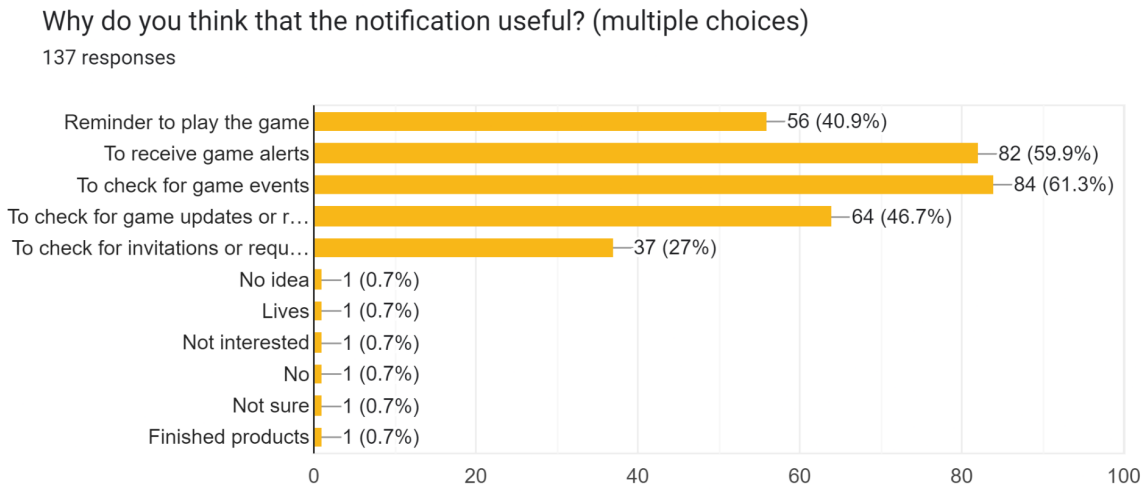
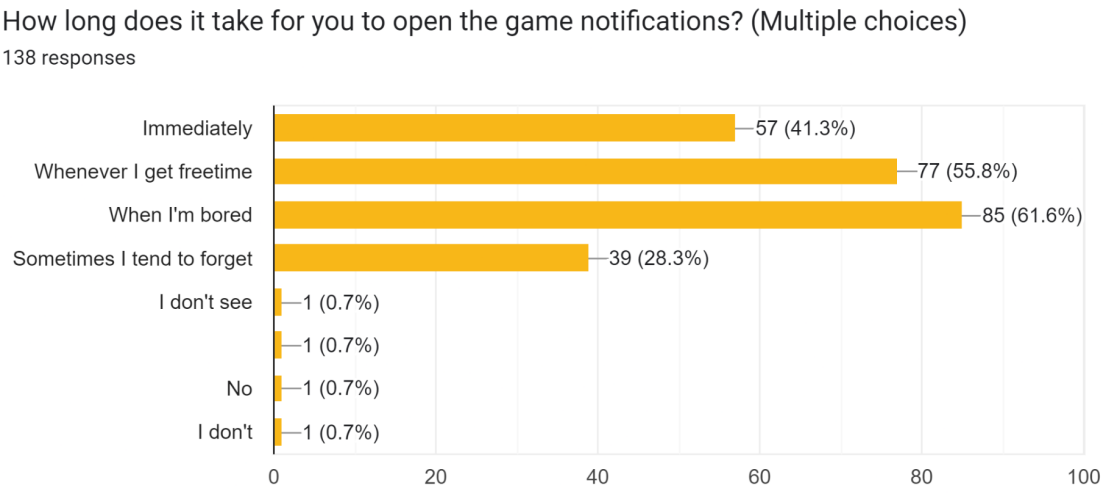


Fig. 3

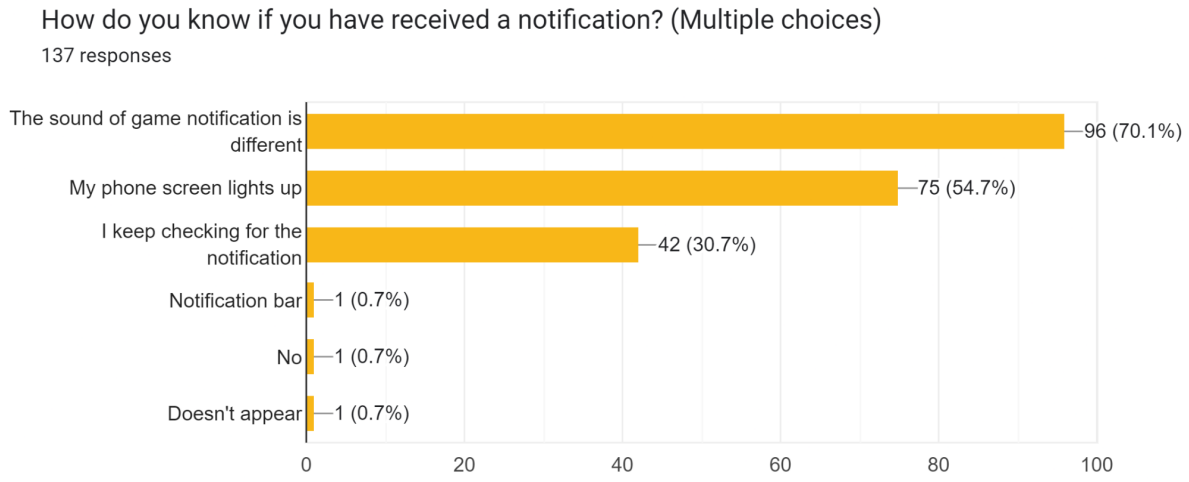
The data presented in Figure 4 indicates that 61.6% of participants tend to open game notifications when they're bored, and 55.8% do so when they have free time. Furthermore, 41.3% open notifications immediately, while 28.3% occasionally forget to do so. These findings suggest potential negative consequences associated with frequent and impulsive interaction with game notifications, impacting productivity, time management, mental well-being, and social interactions. It underscores the importance for individuals to develop healthier notification habits and adopt a more balanced approach to their digital engagement, emphasizing the need for mindful and intentional use of notifications.

Fig. 4



In Figure 5, it is evident that 70.1% of the participants recognize receiving a game notification due to the distinct sound it makes. Similarly, 54.7% notice notifications when their phone screen lights up, and 30.7% actively check for them. These findings imply that notifications have the potential to disrupt individuals, causing interruptions in their tasks or conversations. Persistent monitoring of notifications can heighten stress levels and negatively impact mental health. The combination of unique sounds, screen lighting, and the habit of constantly checking notifications can lead to detrimental outcomes such as disturbance, distraction, obsessive behavior, reduced productivity, and potential harm to mental well-being.

Fig. 5



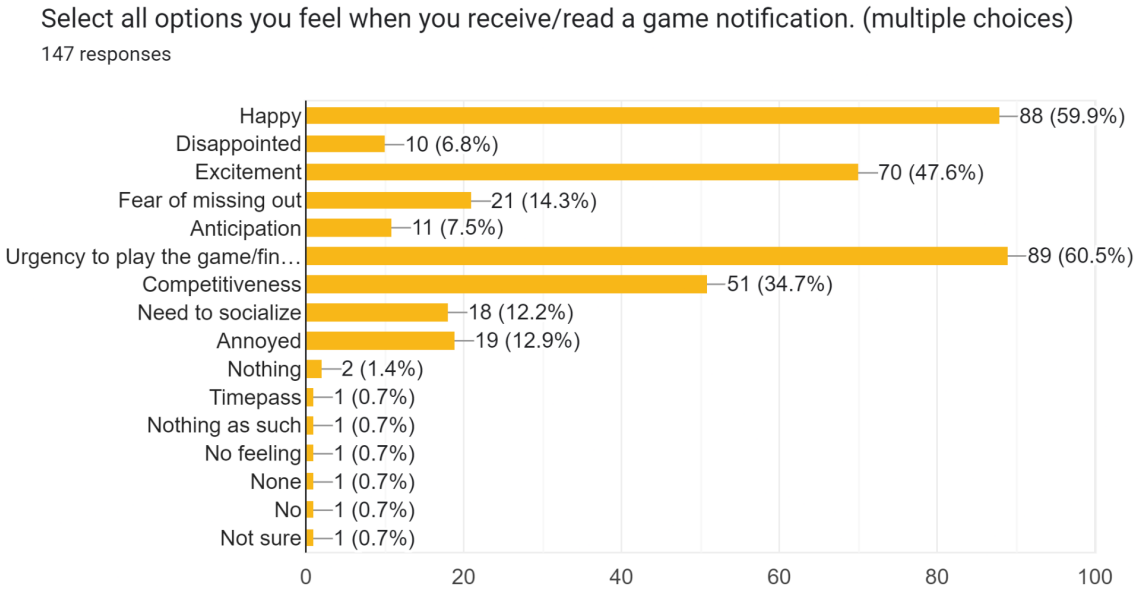


Fig. 6

In Figure 6, it is evident that 60.5% of participants, upon receiving game notifications, feel an immediate urge to play the game or finish the task. Additionally, 59.9% experience joy, 47.6% find excitement, 34.7% feel competitiveness, and 14.3% fear missing out. Annoyance is reported by 12.9% of participants, indicating that these notifications disrupt their experience, causing irritation. Moreover, 12.2% feel the need for social interaction, 7.5% experience anticipation, and 6.8% feel disappointment. These findings underscore the psychological impact of game notifications, particularly in terms of urgency, fear of missing out, annoyance, and disappointment. The data suggests that these notifications play a significant role in shaping users' emotional and psychological responses, providing valuable insights into the user experience with gaming notifications.

Conclusion:

The analysis of game notifications across diverse demographics has illuminated the profound influence of age and gender on user engagement patterns. Variations in mobile game playing habits, notification preferences, and responses reveal distinct preferences and behaviors among different age groups and genders, underscoring the intricate interplay of individual perspectives, motivations, and attitudes within the gaming sphere. However, this study has unearthed concerning patterns in notifications. Specifically, while notifications are designed to enhance user engagement, they might inadvertently fuel addictive behavior. The psychological impact of these notifications manifests as feelings of urgency, fear of missing out, annoyance, and disappointment. The constant pressure to respond to alerts can lead to excessive gaming, disrupted sleep, and diminished productivity in other areas of life. Additionally, notifications disrupt tasks and conversations and contribute to overall stress. Excessive monitoring of notifications can result in distraction, reduced productivity, and negative effects on mental well-being. In light of these findings, it is crucial for individuals to cultivate awareness of the dark patterns embedded in game notifications. Recognizing these manipulative techniques empowers users to make informed decisions about their interactions with digital interfaces. Encouraging healthy notification habits, including setting clear limits and being mindful of engagement, is vital. Moreover, promoting digital literacy can transform technology into an enriching tool, enhancing daily experiences rather than causing disruption and distress.

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