

Carleton University

# **Dark Patterns in Mobile Games:**

## **An Exploratory Study**

Pallavi Sodhi

HCIN 5100: Fundamentals of HCI Design and Evaluation

Dr. Elizabeth Stobert

December 15, 2022

# **Theoretical background**

## **Dark Patterns**

An often discussed topic under the field of persuasive technology is the issue of dark design patterns. First coined in 2010 by UX designer Harry Brignull, dark patterns are deceptive user interactions designed to exploit human psychology which leads users into making choices they otherwise might not make. These dark design patterns are utilized in a number of cases on online platforms to trick or manipulate users, according to Brignull's website [darkpatterns.org](http://darkpatterns.org) [1]].

## **Dark Patterns in Mobile Games**

In mobile gaming, "dark patterns" refer to design strategies employed in games that are meant to trick players into taking actions they might not have otherwise opted for [2]. These strategies can be used in a variety of ways, such as time-based pressure tactics, "pay-to-win" mechanics, and other psychological manipulation approaches. The website, [darkpatterns.games](http://darkpatterns.games) is devoted to helping players find which games do or do not use dark patterns [2]. The site groups dark patterns in four categories: Temporal Dark Patterns, Monetary Dark Patterns, Social Dark Patterns, and Psychological Dark Patterns.

**Temporal Dark Patterns:** These Temporal Dark Patterns are used to entice you to play the game for longer than you otherwise would have [2]. The game creator profits at your expense if this time is used to watch more advertising or buy more in-app stuff.

**Monetary Dark Patterns:** With the introduction of downloadable content (DLC) and microtransactions (in-app payments), game developers use a variety of strategies to persuade players to spend more money on games than they otherwise would [2].

**Social Dark Patterns:** There are various techniques that game designers can employ to take advantage of our social ties and get us to play a game for purposes beyond pure enjoyment [2].

**Psychological Dark Patterns:** Games can entice you to keep playing long after they stop being enjoyable by employing a variety of psychological techniques [2].

## **Research Purpose**

This exploratory study investigates the degree to which users recognize the presence of persuasive elements and how users perceive these elements in mobile games. Specifically, it aims to answer two questions:

- 1) Are users typically aware of and able to recognize dark patterns in mobile games while playing?
- 2) How do dark patterns in mobile games impact users' emotions and behaviors?

## **Application**

### **Methodology**

This study was conducted in a lab setting, where participants were recruited using the convenience sampling method. Hence, all participants in this study were part of the HCIN 5100 Fall 2022 course at Carleton University. After signing the consent form, the participants were first asked to fill a questionnaire on Qualtrics that collected information on their demographics, playing habits, as well as their self-reported level of awareness of persuasive strategies employed in mobile games ([https://carletonu.az1.qualtrics.com/jfe/form/SV\\_0IYS4D6vwL34LQQ](https://carletonu.az1.qualtrics.com/jfe/form/SV_0IYS4D6vwL34LQQ)). Following that, using the within-subjects design method, the participants played three different mobile games that were assigned one of the three conditions - Aggressive Dark Patterns, Mild Dark Patterns, and No Dark Patterns. After playing every game for 5 minutes, they were prompted to go back to Qualtrics to do a survey that collected both quantitative and qualitative data about their enjoyment of each game, the persuasive elements they recognized, and what they thought of these persuasive elements. It is important to note that the participants didn't play all three games at once before completing the survey; instead, they played one game before completing the survey for that particular game, then moved on to another game before completing the survey for that one, and so on. This was done to ensure that the participants did not forget or mix up the games when sharing their thoughts in the survey. The enjoyability was measured through making participants' rate the games out of 5 stars, as well as completing the In-game Game Experience Questionnaire [3]. Meanwhile, the data about how participants' recognize and perceive persuasive elements was mainly collected through asking open-ended questions.

While the questions regarding the persuasive elements were asked in order to answer the two main research questions of this study, the participants' enjoyability of the mobile game was measured to determine whether enjoyment could act as a confounding variable in this study. Specifically, the enjoyability was evaluated to determine whether the participants paid more or less attention to persuasive features in mobile games depending on if they enjoyed playing the game or not.

## **Mobile Game Selection**

In order to understand how users perceive dark patterns in mobile games with various levels of dark patterns in them, three games with three conditions had to be selected - a game with a lot of dark patterns (Aggressive Dark Patterns), a game with a moderate amount of dark patterns (Mild Dark Patterns), and a game with no dark patterns (No Dark Patterns).

The three mobile games used during the study were selected from the website [darkpatterns.games](https://darkpatterns.games) where real players rate mobile games based on the dark patterns they have seen in those games. On the website, there are 8 games rated below -4 and are in the 'Toxic' category, 77 games rated below -3 and above -4 and categorized as 'Bad', and 75 games rated fully 5 in the 'Healthy' category. The three games that the participants' played in this study were randomly chosen from this website through using a random number generator:

- The 'Toxic' game selected was named My Cafe and was assigned the 'Aggressive Dark Patterns' condition.
- The 'Bad' game selected was Best Fiends, and was assigned the 'Mild Dark Patterns' condition.
- The 'Healthy' game selected was called Duet and was assigned the 'No Dark Patterns' condition.

One significant point to note here is that since the participants were only going to be given 5 minutes to play each game, it was essential that the games chosen were easy to learn so that the participants could see the core mechanics and get an idea for what the game was about. Hence, in the case of picking the game for the Mild Dark Pattern condition, the random number generator was done twice because the first game it picked had a extremely long tutorial.

## **Participants**

The participants in this study were 9 people from the HCIN 5100 Fall 2022 class (4 women, 3 men, 1 non-binary/third gender, and 1 preferred not to say), with 55% of them between the ages of 25-34, 22% between the ages of 18-24, 11% between the ages of 35-44, and one person preferred not to say. Informed consent was obtained from all participants prior to starting the study. Most participants had some degree of familiarity with mobile games and had played casual mobile games before. Additionally, all participants answered that they had some degree of awareness about persuasive techniques employed in mobile games. Their answers ranged from Slightly Aware to Extremely Aware.

## Results and Discussion

### Recognition

#### *Best Fiends*

7 out of the 9 total participants noticed instances of persuasive elements in Best Fiends while 2 people answered that they did not notice anything in the survey. When asked to identify which persuasive elements they noticed, all the answers were related to dark patterns - persuasive elements that were there to trick or manipulate them.

The website [darkpatterns.games](https://darkpatterns.games) displays a number of dark patterns that this game has, however since the participants were only allowed to play the game for 5 minutes, the only dark patterns that could be observed in the game were 3 of the Temporal Dark Patterns, and 2 of the Psychological Dark Patterns. Specifically, the Temporal Dark Patterns were Advertisements, Rewards, and Can't pause or save, while the Psychological Dark Patterns were Complete the Collection, and Aesthetic Manipulations. For further information on the definition of these patterns, please refer to the [darkpatterns.games](https://darkpatterns.games) site for Best Fiends [4].

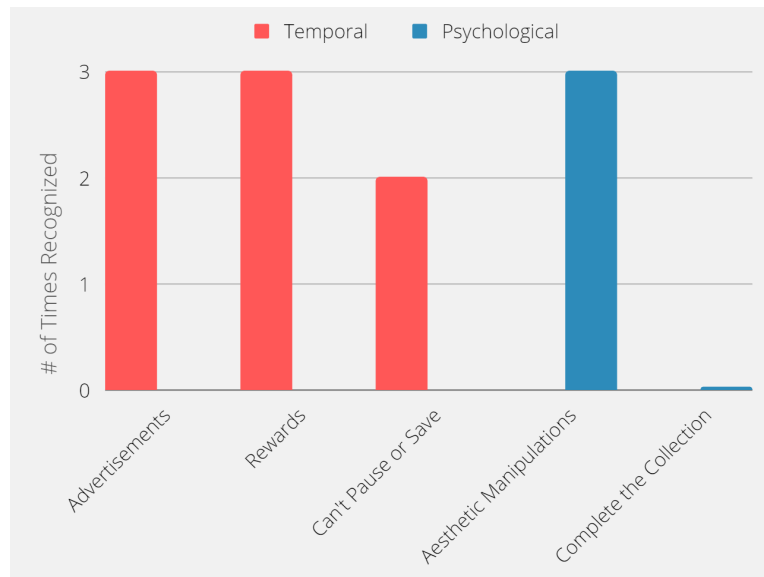
To analyze the participants' recognition of dark patterns (which ones they identified and which ones they missed), their answers to the question, "Please identify the persuasive elements you noticed while playing Best Fiends", were categorized under one of the five dark patterns mentioned previously to quantify the data in following table [Table 1]. To keep the confidentiality of the participants, they'll be referred to as [P1], [P2], [P3], and so on.

Temporal Dark Patterns	Advertisements	"Watch free ads for reward" [P1] "There were ads that would give me energy to allow me to play more" [P5] "Advertisement revenues" [P7]
	Rewards	"Watch free ads for reward" [P1] "1. The rewards" [P4] "Free rewards, in the beginning, to reel in" [P6]
	Can't Pause or Save	"Automatically going to the next level" [P2] "Play restrictions" [P7]
	Complete the Collection	
		"Maybe when 'you entered next level' one that encouraged me to play again because it showed that I'm good enough" [P3]

Psychological Dark Patterns	Aesthetic Manipulations	<p>“2. The emotional storyline” [P4]</p> <p>“The encouraging wordings that keep the players proceeding and keep playing” [P6]</p>
-----------------------------	-------------------------	---

*Table 1: Participants’ answers for persuasive elements in Best Fiends categorized*

Following displays the graphical representation of the data.



### *My Cafe*

Similarly to the previous game, 7 out of the 9 total participants noticed instances of persuasive elements in My Cafe while 2 people answered that they did not notice anything in the survey. When asked to identify which persuasive elements they noticed, all the answers were related to dark patterns - persuasive elements that were there to trick or manipulate them.

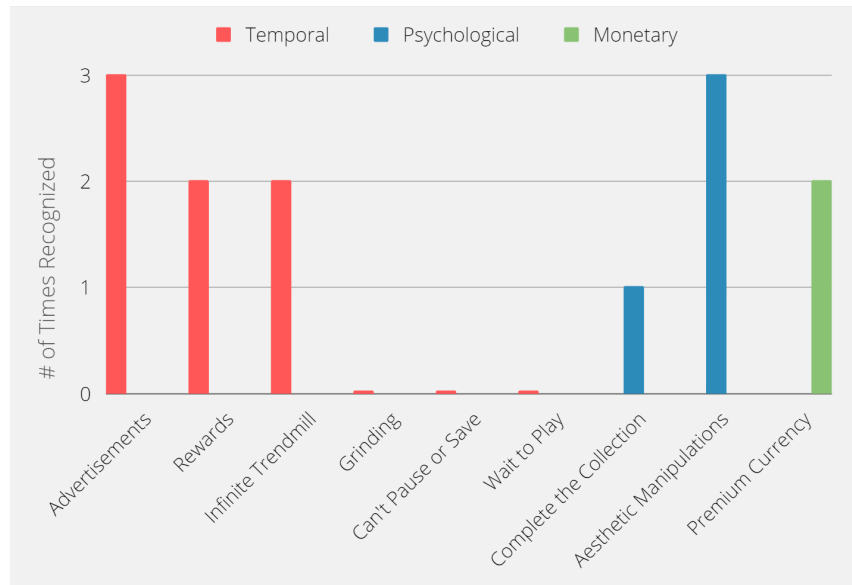
The dark patterns that could be observed in the game in a 5 minute playthrough were 6 Temporal Dark Patterns, 2 Psychological Dark Patterns, and 1 Monetary Dark Pattern. Specifically, the Temporal Dark Patterns were Advertisements, Rewards, Can't pause or save, Infinite treadmill, Grinding, and Wait to play, while the Psychological Dark Patterns were Complete the Collection, and Aesthetic Manipulations. The one Monetary Dark Pattern that could be observed was Premium Currency. For further information on the definition of these patterns, please refer to the [darkpatterns.games](https://darkpatterns.games) site for My Cafe [5].

The analysis of the participants' recognition of dark patterns for this game was done the same way as the previous game [Table 2].

<b>Temporal Dark Patterns</b>	<b>Advertisements</b>	<p>“When I bought the TV in the game, I knew that at some point I had to watch ads to continue.” [P1]</p> <p>“There were pop up ads” [P5]</p> <p>“Advertisement” [P7]</p>
	<b>Rewards</b>	<p>“Reward system, making you go to manu” [P2]</p> <p>“1. Rewarding coins” [P4]</p>
	<b>Can't Pause or Save</b>	
	<b>Infinite Treadmill</b>	<p>“2. Additional machines every time a new level was unlocked” [P4]</p> <p>“The constant addition of the new features and menu encourage players to keep going” [P6]</p>
	<b>Grinding</b>	
	<b>Wait to Play</b>	
<b>Psychological Dark Patterns</b>	<b>Complete the Collection</b>	<p>“The blank space of the cafe makes you feel like you want to fill it up as you play along” [P6]</p>
	<b>Aesthetic Manipulations</b>	<p>“Flashing arrows” [P3]</p> <p>“3. Conversations with the customers” [P4]</p> <p>“The sound effects when you tap money make it feel addictive to interact with.” [P6]</p>
<b>Monetary Dark Pattern</b>	<b>Premium Currency</b>	<p>“Gems to buy new items” [P5]</p> <p>“Buyable currency” [P7]</p>

*Table 2: Participants' answers for persuasive elements in My Cafe categorized*

Following displays the graphical representation of the data.



### *Duet*

8 out of the 9 total participants noticed instances of persuasive elements in Duet while 1 person answered that they did not notice anything in the survey. When asked to identify which persuasive elements they noticed, all the answers were related to dark patterns - persuasive elements that were there to trick or manipulate them. This was surprising as the [darkpatterns.games](https://darkpatterns.games) site displays no dark patterns in this game [6].

The analysis of the participants' recognition of dark patterns for this game, participants' answers were categorized under the gaming dark patterns that fit the most [Table 3].

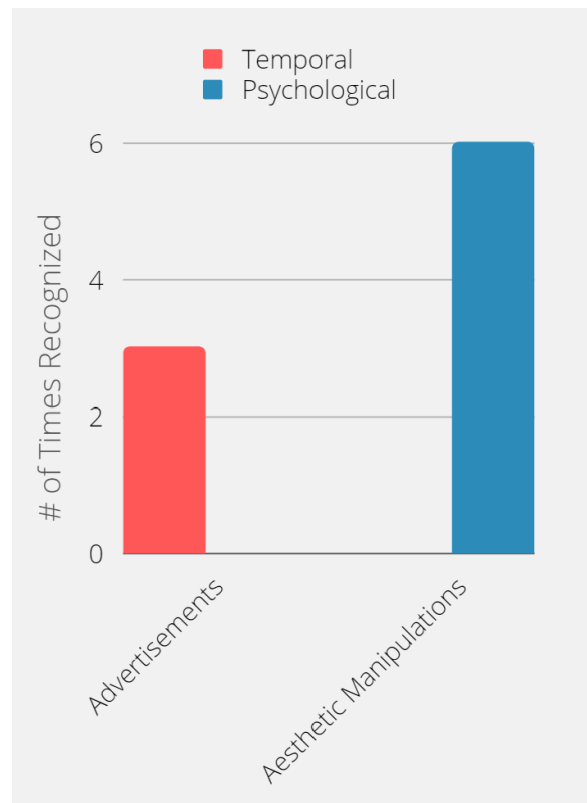
<b>Temporal Dark Patterns</b>	<b>Advertisements</b>	<p>"The advertisement that popped up in the middle of the game" [P1]</p> <p>"There were ads at the end of a level" [P5]</p> <p>"Advertisements, unskippable ads" [P8]</p>
<b>Psychological Dark Patterns</b>	<b>Aesthetic Manipulations</b>	<p>"The woman's voice" [P1]</p> <p>"The emotion names for the labels?" [P2]</p> <p>"The girl was ordering me in the beginning of the game" [P3]</p> <p>"The paints on the falling bars I guess" [P4]</p>



		<p>“The positive message like you can do it or keep going is there to encourage player to keep going. The design of the game also allows player to continue immediately once they failed also contribute as the encouraging message to keep player going without any interruptions” [P6]</p> <p>“The music and urge to win” [P7]</p>
--	--	--

*Table 3: Participants’ answers for persuasive elements in Duet categorized*

Following displays the graphical representation of the data.



## Perception

To analyze how most participants’ perceived the dark patterns used in the games both emotionally and behaviorally, their answers to the questions, “How did you feel about encountering these persuasive elements while playing \_\_\_?”, as well as “How do you think these

persuasive elements influenced your behavior while playing \_\_\_\_?” were categorized as either Negatively Affected, Positively Affected, or Neutral [Table 4] [Table 5].

*How did you feel about encountering these persuasive elements while playing \_\_\_\_?*

<b>My Cafe</b>	<b>Negatively Affected</b>	<p>“It’s annoying AF” [P1]</p> <p>“Annoyed” [P2]</p> <p>“Negative: everything about the game seemed designed to reduce my agency in playing it” [P3]</p> <p>“They increased my levels of cortisol making me an angry user” [P5]</p> <p>“Again, due to my bias and experience I feel that this is nothing new and boring to me. Also the tutorial takes too long with hand holding mechanics, I barely felt like I “played” the game at all.” [P6]</p> <p>“Killed my enthusiasm, Boring” [P7]</p>
	<b>Neutral</b>	
	<b>Positively Affected</b>	<p>“The coins were fun because I could buy new things and increase the number of customers” [P4]</p>
<b>Best Fiends</b>	<b>Negatively Affected</b>	<p>“Annoyed” [P1]</p> <p>“Unimpressed” [P2]</p> <p>“Frustrated” [P5]</p> <p>“Because I have seen it a lot of times in the past, I feel like they are artificial and intrusive to the game” [P6]</p>
	<b>Neutral</b>	<p>“I did not feel anything in particular” [P4]</p> <p>“It doesn’t bother me” [P7]</p>
	<b>Positively Affected</b>	<p>“I felt good, it showed me that I’m kinda skilled” [P3]</p>
<b>Duet</b>	<b>Negatively Affected</b>	<p>“It felt overwhelming at times. I felt like I was forced into watching advertisements if I wanted to continue playing. I also felt like the women’s erotic voice was used to create interest which was awkward” [P1]</p> <p>“Frustrating, makes me not want to play it” [P8]</p>
	<b>Neutral</b>	<p>“It was a shame to find ads for other games as a persuasive element since the Duet itself is entertaining and it divides my attention to something else” [P5]</p>
	<b>Positively Affected</b>	<p>“positive - they seemed to encourage me” [P2]</p> <p>“I mean i couldn't say no to that voice lol” [P3]</p>

		<p>“I wanted to perform better” [P4]</p> <p>“Not feeling intrusive and actually quite well implemented, maybe because it's there to really keep the gameplay fun and engaging without interfering too much with the addictive core gameplay” [P6]</p> <p>“To play more” [P7]</p>
--	--	--

*Table 4: Participants' answers for how they felt categorized*

In terms of emotions, from [Table 4] it is evident that most participants' were negatively affected when playing Best Fiends and My Cafe. Participants' were especially annoyed and angered when playing My Cafe which was the Aggressive Dark Patterns condition. Through observing the participants, while the dark patterns Advertisements and Infinite Treadmill were a big part of why the participants' felt that way, it seemed to be mainly due to dark patterns that most people did not notice - Grinding and Wait to Play. Grinding is when the game requires the player to perform repetitive and tedious tasks to advance, whereas Wait to Play is when in-game timers make the players arbitrarily wait for something.

These results are similar to the results of another study that measured the influence of dark patterns [7]. This study found that the use of dark patterns in user interfaces increased the likelihood of players feeling annoyed or frustrated. This can lead to players becoming disengaged with the game, and can ultimately decrease their overall enjoyment of the game.

On the other hand, although participants noticed that there were a few dark patterns (encouraging women's voices, paint on bars, etc.) in the game, most of them were still positively affected when playing the game. Many participants said that they actually liked the woman's encouraging voice and wanted to play more.

*How do you think these persuasive elements influenced your behavior while playing \_\_\_\_?*

<b>My Cafe</b>	<b>Negatively Affected</b>	<p>“It made me feel awkward and less interested.” [P1]</p> <p>“I guess I kept playing it because there wasn't a natural stopping place” [P3]</p> <p>“Made me not pursue the success in the game but against the game” [P5]</p> <p>“Yes it surely kept my attention throughout and took advantage of my passiveness while playing” [P6]</p> <p>“Made me want to stop playing, Too distracting” [P7]</p>
	<b>Neutral</b>	<p>“Not much” [P2]</p>

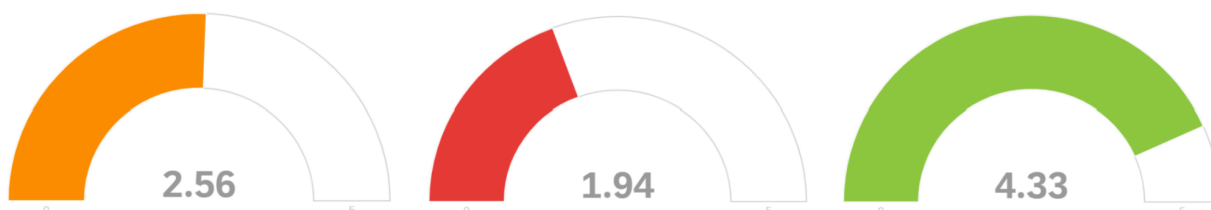
	<b>Positively Affected</b>	“Made me wanna get more coins!” [P4]
<b>Best Fiends</b>	<b>Negatively Affected</b>	<p>“It made me want to stop playing” [P1]</p> <p>“I think I kept playing longer than I would have if given more of an out” [P2]</p> <p>“Negatively influenced by the intrusive ads. :c” [P5]</p> <p>“Wanted to quit playing because they are not so subtle in how they do it” [P6]</p> <p>“Negatively affected my enthusiasm” [P7]</p>
	<b>Neutral</b>	“They did not influence my behavior, I just felt like I was passing my time lol” [P4]
	<b>Positively Affected</b>	“it encouraged me playing more till certain point” [P3]
<b>Duet</b>	<b>Negatively Affected</b>	<p>“It made me feel uncomfortable sometimes. The advertisements really annoyed me.” [P1]</p> <p>“kept me playing longer, but also exhausted me” [P2]</p> <p>“It would probably make me not like the game in the long term” [P5]</p> <p>“Increased my frustration at the game” [P8]</p>
	<b>Neutral</b>	“Yes” [P7]
	<b>Positively Affected</b>	<p>“The girl's voice was hot :))” [P3]</p> <p>“Made me wanna perform better and keep my bars clean, also wanted to get better in the game” [P4]</p> <p>“The voice kept me going and trying without feeling discouraged” [P6]</p>

*Table 5: Participants' answers for how their behavior was influenced categorized*

In terms of behavior, [Table 5] shows that participants' behavior was negatively affected by the dark patterns in Best Fiends and My Cafe. For both of these games, many participants said that they wanted to quit playing. Meanwhile for Duet, the results were mixed. Some participants' said that the “voice kept [them] going and trying without feeling discouraged” and wanted to keep playing to “perform better”, while others said that the game exhausted them and that they would “not like the game in the long term.”

## Enjoyability Survey

When participants were asked to rate the games out of 5 stars, My Cafe was rated as the worst, followed by Best Fiends, and then Duet. On average, Best Fiends was rated as 2.56, My Cafe was rated as 1.94, and Duet was rated as 4.33 by the participants [Image 1].



*Image 1: Image displaying mean rating of Best Fiends as 2.56, My Cafe as 1.94, and Duet as 4.33*

Participants also did a concise version of Game Experience Questionnaire (GEQ) where they assessed their experience of the game on seven components: Immersion, Flow, Competence, Positive, and Negative Affect [3].

Please indicate how you felt while playing the game for each of the items,  
on the following scale:

not at all	slightly	moderately	fairly	extremely
0	1	2	3	4
< >	< >	< >	< >	< >

- |   |               |
|---|---------------|
| 1 I was interested in the game's story  | GEQ Core – 3  |
| 2 I felt successful                     | GEQ Core – 17 |
| 3 I felt bored                          | GEQ Core – 16 |
| 4 I found it impressive                 | GEQ Core – 27 |
| 5 I forgot everything around me         | GEQ Core – 13 |
| 6 I felt frustrated                     | GEQ Core – 29 |
| 7 I found it tiresome                   | GEQ Core – 9  |
| 8 I felt irritable                      | GEQ Core – 24 |
| 9 I felt skilful                        | GEQ Core – 2  |
| 10 I felt completely absorbed           | GEQ Core – 5  |
| 11 I felt content                       | GEQ Core – 1  |
| 12 I felt challenged                    | GEQ Core – 26 |
| 13 I had to put a lot of effort into it | GEQ Core – 33 |
| 14 I felt good                          | GEQ Core – 14 |

*Image 2: Concise version of GEQ*

Each two items in this questionnaire measures a different component. For instance, items 6 and 8 measure how much Tension the participant felt when playing the game. This questionnaire was done in order to get a more in-depth view of participants' experiences with the game. To analyze, first the mean scores of all items were taken. Then, these items were grouped under one of the

seven components according to the scoring guidelines listed in the GEQ paper [3]. Finally, the average score of each two items under each component was calculated [Table 6].

	MY CAFE	BEST FIENDS	DUET
<b>Competence</b>	1.50	3.11	3.67
<b>Sensory and Imaginative Immersion</b>	1.50	2.00	3.72
<b>Flow</b>	1.61	1.94	3.55
<b>Tension</b>	3.39	1.78	2.28
<b>Challenge</b>	1.61	1.50	4.33
<b>Negative Affect</b>	3.83	2.27	2.22
<b>Positive Affect</b>	1.78	2.78	4.16

*Table 6: GEQ mean scores for each component*

Based on the table above, it is easy to see that these results correlate with the average star ratings that participants gave to each game. Best Fiends was moderately easy to play and gave a low amount of tension, but participants did not find it interesting, immersive, or challenging. My Cafe was also easy to play, but not interesting, immersive, or challenging. Moreover, it gave participants a considerable amount of tension and had the highest Negative Affect out of all games. Duet on the other hand, was easy to play, immersive, interesting, challenging, and gave a slight amount of tension. This game also had the highest ‘Positive Affect’ compared to all the other games.

Although the purpose for measuring enjoyability was to determine if it could act as a confounding variable in the study, the results from measuring it gave some interesting insights. Turns out that the more dark patterns a game had, the less enjoyable it was to play. As mentioned previously, the game with mild patterns (Best Fiends) had a rating of 2.56 and the game with aggressive dark patterns (My Cafe) had an even lesser rating of 1.94. Only the game with little to no dark patterns (Duet) had a high rating of 4.33. The GEQ scores of the games were also in match with these ratings. There was also no effect of players' enjoyability linked to their recognition of persuasive elements in the game since most participants identified some patterns in all games. It appears that the use of dark patterns in mobile games can have an impact on players' enjoyment of the game.

Some evidence for the above idea was also seen in the results gathered about the participants' perception of dark patterns in each game. In the cases of games with aggressive and mild dark patterns, participants' felt frustrated or annoyed by the game. The more dark patterns the game had, the more negative their perception of it was. This could have detracted from their overall enjoyment of the game.

## **General Implications**

Dark patterns might damage the relationship of trust between gamers and developers. Players may experience a sense of manipulation or exploitation and be less likely to interact with the game as a result [9]. The developers may experience a loss of income as a result, and their reputation may also suffer. The game industry as a whole may also suffer from the adoption of dark patterns. Users may lose faith in other games and creators after encountering these strategies, which could result in a decline in interest in the sector as a whole.

In some circumstances, using dark patterns in mobile games may potentially have legal repercussions [8]. For instance, a game may be liable to fines or other penalties if it is shown to be employing strategies intended to trick or control consumers. Given that certain nations have laws and regulations that restrict the use of these design strategies, the use of dark patterns in games may also have legal and regulatory repercussions. For instance, the General Data Protection Regulation (GDPR) of the European Union contains regulations that forbid the use of "dark patterns" to persuade people to divulge their personal information [10].

Finally, the choice of dark patterns can harm a game's and its developers' reputations [9]. Users may be less likely to promote the game to others if they believe they have been duped or influenced, which could have a detrimental effect on the game's overall success and popularity.

## **Ethical Implications**

The use of dark patterns in mobile games raises a number of ethical concerns. These strategies, which are intended to trick or manipulate users into acting in ways they might not have otherwise, might be viewed as immoral since they manipulate participants and might exploit their inexperience or lack of knowledge.

The possibility for exploiting vulnerable people, such as young children or those with addictive dispositions, is one of the main ethical worries regarding the usage of dark patterns in games [11]. Dark patterns might make it even more difficult for consumers to resist the impulse to play or spend money on in-game items since many games are made to be quite captivating and addictive. This can lead to excessive gaming, financial difficulties, and even mental health issues in some cases.

## **Societal Implications**

Beyond the individual player experience, the use of dark patterns in games can also contribute to a broader societal problem of digital manipulation and disinformation. The potential for manipulation through the use of dark patterns becomes more substantial as more and more of our daily interactions and decision-making take place online.

The usage of dark patterns in games can affect how society views technology and digital media. Players may develop greater skepticism and suspicion of technology and digital media in general as they become more aware of these strategies and the ways in which they can be misused [12]. The development and uptake of new technologies may suffer as a result of the wider cultural trend of skepticism and suspicion toward digital platforms and technologies.

Furthermore, the use of dark patterns in games can also have negative economic consequences. Dark patterns can lead to overspending and financial instability by pressuring players to spend money on in-game goods [11]. Young or vulnerable players who might lack the essential financial knowledge or self-control to make wise financial judgments regarding their spending may find this to be especially problematic.

## **Design Recommendations**

In order to address the above implications, game developers should prioritize designing games in an ethical and transparent manner. This may entail avoiding the use of dark patterns, giving users a clear way to opt out of certain features or services, and refraining from using persuasion tactics or manipulative design cues.

A few design recommendations are:

**Clearly labeling in-game purchases:** In-game purchases should be clearly labeled and transparent so that players are aware of what they are purchasing and can decide wisely how much money to spend. This can assist gamers avoid being perplexed and frustrated and can save them from making decisions they might later come to regret.

**Provide clear opt-out options for features or services:** Giving users a straightforward way to opt out of certain features or services. Players may find it challenging to reject some features or services due to dark patterns. Game creators should offer obvious and simple-to-find opt-out alternatives for any features or services offered in the game in order to avoid this issue. This can help to ensure that players have control over their experience while they are playing and help to prevent them from feeling imprisoned or powerless in the game.



Avoid the use of persuasive language or design elements: Dark patterns may employ persuasive language or visual cues to influence players' decision-making or encourage them to spend money on in-game goods. The use of manipulative language or design features should be avoided by game developers in order to avoid this issue. Instead, they ought to give players unbiased information on in-game purchases and other features and services while preventing them from being persuaded by deceptive language or visual cues.

Overall, game developers can minimize the use of dark patterns in their games by following these recommendations. By designing games in an ethical and transparent manner, creators may give players a more enjoyable and trustworthy experience while also fostering positive relationships between themselves and their audience.

### **Limitations and Future Work**

To begin, the small sample size is one of the main drawbacks of the study that could have affected the precision and interpretation of the results. A small sample size results in a larger amount of variability in results, which weakens the study's external validity. Additionally, the method used to recruit participants was convenient sampling, which is particularly susceptible to sampling bias. Since all the participants' were from the HCIN 5200 design course, participants may have shared certain characteristics or traits. For instance, all the participants' in the study had previously learned about persuasive computing and dark patterns in general which could have led them to be more aware of these patterns in games than the general public. An additional problem with the convenient sampling method is that representativeness of the sample is not guaranteed and there is no way of knowing the true distribution of the population and of the sample. This further undermines the external validity of the study. Repeating this study with a larger number of participants would lead to more reliable results.

Another limitation of the study was that the games chosen for the Aggressive and Mild Dark Patterns conditions were more passive (not much thought required and less challenging), while the game selected for the No Dark Patterns condition was more active (engaging and challenging). This was also evident in the results of the Game Experience Core Questionnaire where items in the Challenging and Immersion section were rated low for the Best fiends and My Cafe game and high for the Duet game. In retrospect, it is highly probable that the results from this study could be only due to this inadequate study design. For future studies, it would be interesting to see if the results change if all the games selected required more active participation like Duet.

Future research in this area should concentrate on conducting more quantitative studies on the presence and effects of dark patterns in mobile games. This research could involve exploring the effects of dark patterns on player behavior, trust, and engagement by gathering and examining

data on the application of these strategies in various games. In order to assist game developers in avoiding the usage of dark patterns in their games, it is also necessary to define best practices and guidelines for ethical game design. These principles might offer helpful suggestions and recommendations for creating games in an ethical and honest way, and game makers might utilize them to raise the reliability and integrity of their creations.

## References

- [1] “Deceptive design - types of deceptive design,” Deceptive Design – formerly darkpatterns.org. [Online]. Available: <https://www.deceptive.design/types>. [Accessed: 12-Dec-2022].
- [2] “DarkPattern.games " Healthy gaming " avoid addictive dark patterns,” DarkPattern.games. [Online]. Available: <https://www.darkpattern.games/>. [Accessed: 12-Dec-2022].
- [3] H. van der Meij, H. Leemkuil, and J.-L. Li, “Game experience questionnaire,” PsycTESTS Dataset, 2013.
- [4] “DarkPattern.games " 'best fiends - puzzle adventure' rating,” DarkPattern.games. [Online]. Available: <https://www.darkpattern.games/game/270/0/best-fiends-puzzle-adventure.html>. [Accessed: 12-Dec-2022].
- [5] “DarkPattern.games " 'My Cafe - Restaurant Game' rating,” DarkPattern.games. [Online]. Available: <https://www.darkpattern.games/game/509/0/my-cafe-restaurant-game.html>. [Accessed: 12-Dec-2022].
- [7] M. Maier and R. Harr, “Dark design patterns: An end-user perspective,” *Human Technology*, vol. 16, no. 2, pp. 170–199, 2020.
- [8] A. Mathur, M. Kshirsagar, and J. Mayer, “What makes a dark pattern... dark?,” *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 2021.
- [9] S. Flankkumäki and E. Söderholm, “How dark patterns affect desirability in Candy Crush Saga,” thesis, 2020.
- [10] G. A. Canada, “The European Union's General Data Protection Regulation,” *GAC*, 01-Apr-2021. [Online]. Available: <https://www.tradecommissioner.gc.ca/guides/gdpr-eu-rgpd.aspx?lang=eng>. [Accessed: 12-Dec-2022].

[11] J. Aagaard, M. E. Knudsen, P. Bækgaard, and K. Doherty, “A game of dark patterns: Designing healthy, highly-engaging mobile games,” CHI Conference on Human Factors in Computing Systems Extended Abstracts, 2022.

[12] D. Caled and M. J. Silva, “Digital Media and misinformation: An outlook on multidisciplinary strategies against manipulation,” *Journal of Computational Social Science*, vol. 5, no. 1, pp. 123–159, 2021.