Winning isn't everything: The impact of optimally challenging Smartphone games on flow, game preference and individuals gaming to escape aversive bored states

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Pre-print version : July 16th, 2021. This article has been peer-reviewed and published.

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Abstract

Recently there has been concern surrounding the relation between flow and the development of problematic gaming among players who game to escape noxious mood states. There is a scarcity of research examining how this relation might extend to smartphone games. Here we assessed whether gaming to escape is characterized by heightened boredom proneness and depressive symptomology in everyday life in addition to negative consequences related to smartphone gaming. We also assessed whether escape players preferentially experience flow, positive affect and effectively less boredom than non-escape players. We also measured whether escape players had enhanced arousal and urge during actual gameplay. To compare the in-game experiences between escape and non-escape players, we characterized gaming to escape as the upper tercile of all escape scores in our sample ($n = 20$), and non-escape players as the lower tercile of escape scores ($n = 20$). As expected we showed that gaming to escape was associated with boredom proneness in everyday life, which was in itself correlated with depressive symptomology. During gameplay, those who game to escape boredom demonstrated heightened flow and positive affect compared to non-escape players. State boredom scores however were comparable between the two groups. Importantly, those who game to escape demonstrated greater arousal and urge-to-play following gameplay than non-escape players – but only for optimally challenging games. Findings converge to suggest that bored escape players may seek flow and its consequent positive affect for relief from states of hypo-arousal and monotony through optimally challenging games.

Winning isn't everything: The impact of optimally challenging Smartphone games on flow, game preference and individuals gaming to escape aversive bored states

Mobile gaming continues to be the most lucrative subset of gaming in the global games market, garnering \$77.2 billion in revenue in 2020 (constituting 48% of the total games market revenue; Wijman, 2020). Despite its lucrativeness, there is a dearth of research examining how smartphone games might impact the general well-being of players. Most research focuses on general smartphone use rather than their use for gaming specifically. The little evidence available in the domain of smartphone use in general suggests that smartphone gaming may carry the potential for negative consequences in a subset of players in a way that parallels other types of gaming (Wang, 2019; Jeong, 2016; Samaha & Hawi, 2016; Gradisar, King & Short, 2017; Turel, Romanshkin, & Morrison, 2016; Turel, Serenko & Bontis, 2011). What has yet to be considered is whether the pronounced differences in the utility of typical smartphone games might uniquely impact players.

Unlike videogames that are played from a desktop computer or console, smartphone games are a more accessible and immediate form of gaming – they can be played anytime and anywhere. Such accessibility may be problematic for some players, especially if they use these games to cope with negative thoughts and feelings. Indeed, gaming to ‘escape’ noxious mood states (such as depression and anxiety) has been associated with the development of problematic technology use in general (Lin, Chiang, & Jiang, 2015; Liang & Leung, 2018; Kuss et al., 2012; Hagström & Kaldo, 2014; Kardefelt-Winther, 2014). What is less understood is whether smartphone games may also be used as a form of escape.

One commonly cited reason for playing smartphone games is to “pass the time” (Lukoff, Yu, Kientz, & Hiniker, 2018). Consider a bus ride that is part of our daily commute. People may

occasionally resort to smartphone games to alleviate boredom in such situations (Leung, 2020; Wolniewicz, Rozgonjuk, & Elhai, 2020). This type of occasional gaming is generally considered benign. However, some may find they become bored in many different contexts (termed trait boredom proneness; Farmer & Sunberg, 1986). As previously observed for general smartphone use, these boredom-prone individuals may be more vulnerable to experiencing negative consequences related to frequent smartphone gaming (Wolniewicz, Rozgonjuk, & Elhai, 2020).

At its core, boredom is an aversive state that can be triggered in situations perceived to be meaningless, monotonous, or overly difficult (Burn, 2017; Chin et al., 2016). Boredom-prone individuals experience boredom not only more frequently than others, but also may experience its accompanying negative affect more strongly. Boredom proneness is typically characterized by difficulty in engaging with the environment, and problems with sustaining attention (e.g., being prone to distraction) due to a perceived lack of environmental stimulation (Mercer-lynn, Bar, & Eastwood, 2014). The negative affect linked to boredom can range from frustration in the moment, to more chronic forms of negative affect such as depression (Chin et al., 2016). Like depression, boredom proneness is also characterized by ruminative thoughts – however, these ruminations tend to relate to the need for something to do (Danckert, 2019; Elhai, Vasquez, Lustgarten, Levine, & Hall, 2018). Thus, smartphone games may provide these boredom-prone players with an easy and immediate route to sustainable, effortless attention and engagement that they otherwise lack. Importantly, if players frequently resort to smartphone gaming to stave-off boredom, problems related to gameplay may surface (Chou & Ting, 2003; Roberts, Yaya, & Manolis, 2014).

The Skill-Challenge Balance and Flow in Facilitating Escape from Boredom

Indeed, there are several aspects of gameplay that may contribute to why players choose to keep playing any game (King et al., 2010; Griffiths & Nuyens, 2017). One integral aspect of gaming that might appeal to the idle minds of boredom-prone individuals in particular is the experience of flow. Flow is defined as a deep and effortless state of concentration in an activity, and has been shown to be an affectively positive, rewarding and motivating state that is tied to a loss of awareness of time and space in those who experience it (Csíkszentmihályi, 1990; Wood, Griffiths & Parke, 2007). Due to its rewarding properties, flow has been implicated in the emergence of problematic play among those who frequently or predominantly play to escape chronic, noxious mood states (e.g., depression). Indeed, the motive of playing to escape has been consistently linked to the onset of gaming-related problems (Wan & Chiou, 2006; Hellstrom et al., 2012; Kuss et al., 2012; Loton et al., 2016; Blasi et al., 2019; Moudiab et al., 2019;), with other recent work suggesting that escape players may be particularly compelled by the positive affect that accompanies flow during gameplay. In both the gaming and gambling literature, it has been shown that depressed players who game to escape preferentially experience more flow and positive affect during gameplay compared to those who do not game to escape (Dixon, et al., 2017; Dixon, Guitterez et al., 2019b; Larche, Tran, Kruger, Dhaliwal & Dixon, 2021). The heightened positive affect tied to the experience of flow during gameplay may provide the relief from negative thoughts and feelings that depressed players experience in their daily lives (Wan & Chiou, 2006; Yee, 2006; Schuler, 2012; Hull et al., 2013; Dixon, Stange et. al, 2017; Bowditch et al., 2018; Dixon, Guitterez et al., 2019a, 2019b; Sanjamsai & Phukao, 2019; Hu et al., 2019; Larche et al., 2021). This profound state of flow in escape players may presumably lead to excessive play attributable to distortions in the passage of time that accompanies this state and hence a greater report of negative consequences tied to play for this reason (Wood, Griffiths

& Parke, 2007; Hull et al., 2013). Thus, here we propose that boredom prone individuals may also report gaming to escape as a way to cope with their aversive thoughts and feelings they experience during their frequent episodes of boredom.

As mentioned, for boredom-prone individuals, the aversive thoughts and feelings appear to trigger the need to act. Certain actions may be preferred above others. If bored individuals suffer from insufficient stimulation during their everyday tasks, they may seek actions that increase arousal (Struk, 2019; Mercer-lynn, Bar, & Eastwood, 2014; Burn, 2017). Since flow states are associated with elevated arousal (Peifer et al., 2014; Drachen et al., 2010) and smartphone games can induce flow, boredom prone people may be particularly drawn to such games.

To sustain optimal flow and arousal, game designers go to great lengths to maintain a balance of skill and challenge. The skill-challenge balance is classically defined as the extent to which players feel the challenges of a given game align closely with their skills (not too easy or too hard). Several studies have found that players typically report low flow and low arousal for games that are too easy. By contrast both flow and arousal increase when they feel that the game challenges slightly exceed or are equal to their skill (Baumann et al., 2016; Engeser & Reinberg, 2008; Keller & Bless, 2008; Keller, Ringelhan, & Blomann, 2011; Keller, Bless, Blomann & Kleinböhl, 2011; Kennedy et al. 2014; Tozman et al., 2017; Laffan et al., 2016). This relation between the skill-challenge balance, arousal and flow has been shown in the exceedingly popular smartphone game Candy Crush (Larche & Dixon, 2020). When playing Candy-Crush games that were too easy players reported: a lack of skill-challenge balance, low flow, low arousal and high boredom. For games that were more challenging, they reported: greater flow, more arousal and

less boredom (Larche & Dixon 2020). Importantly, the more challenging games were also shown to trigger stronger urge to continue gameplay (Larche & Dixon, 2020).

As mentioned, a key component in gaming to escape involves the positive affect experienced while gaming. In the Larche & Dixon study, the degree of positive affect experienced by players during gameplay was not reported. However, given the strong positive correlation between flow and positive affect during gambling and gaming scenarios (e.g., Dixon, Gutierrez et al., 2019b; Sweetser et al., 2005; Baumann et al., 2016) one might expect that those seeking relief from boredom may also experience more pronounced positive affect during optimally challenging, flow inducing games. Taken together, if playing games induces flow, arousal and positive affect this may provide a triad of experiences that bored individuals might use to quell their boredom. If so then we might expect greater flow, arousal, positive affect, and urge-to-play among this group.

Through their experimental design, the Larche and Dixon study showed that more balanced games led to not only increases in arousal and flow but also in urge to keep playing. In this study they also showed that the more deeply players experienced flow the greater their urge-to-play ratings. They also showed using hierarchical regression that flow accounted for unique urge variance over and above arousal. Yet, this study does not tell us how players may behaviourally act on their urge. As a next step the current study sought to provide converging evidence for the motivational affects of flow by having players actively choose which games they wish to re-engage in. This approach was used in a study by Keller, Ringlehan & Blomann (2011) examining the relation between flow, enjoyment and motivation. It featured a 5-minute free-choice period following a trivia game task where participants had the option to engage in the same game, read a magazine, or doing nothing at all. Participants were randomly assigned to one

of three potential difficulty levels – either a level that was too easy, too hard, or a level where the challenges adequately match their skill level. More players opted to re-engage in the trivia game when difficulty of the game matched their skills (hence producing higher flow) compared to players who were assigned to play a version of the same trivia game that was too easy or too hard. Accordingly, we predicted that players would choose to continue playing a game in which there was a balance of challenge and skill (conducive to flow) over an easy game that should trigger less flow.

Overview of the Present Study

Research Question #1: Can we replicate and extend results from Larche & Dixon (2020)?

To summarize, the first aim of the current study was to replicate the findings of Larche & Dixon (2020) concerning flow, arousal, state boredom and urge in too easy versus more balanced games. We also sought to extend these findings by showing that balanced games resulted in not only in less boredom, and greater flow and arousal, but also more positive affect than games that were too easy. This is of crucial importance since if we can show that flow inducing games increase positive affect, it sets up the possibility that such games may be particularly alluring to those who seek to escape the negative affect associated with state boredom. Finally we further sought to extend the findings of Larche & Dixon by showing that not only do balanced games trigger greater urge-to-play compared to easy games, but that players would actively choose to play these optimally challenging games more so than the too-easy games.

Research Question #2: Is the motive of gaming to escape related to boredom proneness, depression and more problems related to smartphone gaming?

We sought to replicate the robust relation between boredom proneness and depression. In terms of our predictions for boredom-prone players and playing to escape, we expected that those with elevated trait boredom proneness would more strongly endorse gaming to escape as a motivation for their gameplay. We also expect to replicate previous findings showing that gaming to escape is associated with more problems related to smartphone gaming.

Research Question #3: Do those who preferentially report gaming to escape experience higher flow, arousal, positive affect, less boredom and a stronger urge to continue gameplay?

Next we sought to show that players who preferentially reported gaming to escape would experience more flow, arousal, positive affect, and subsequently *less* state boredom during gameplay than those who more weakly endorsed gaming to escape. To assess this hypothesis, we compared those in the upper tercile of escape scores to those in the lower tercile. Finally, motivated by the relation between escape gaming and problem gaming we then sought to show that players who strongly endorse gaming to escape would also experience a greater urge to continue playing than those their low-escape gaming counterparts.

Methods

Participants

A total of 60 participants (53 female, 7 male) consisting of psychology undergraduate students aged 17-46 were recruited and included in our final analysis. Participant level standings ranged from 77-3307.

To be eligible for participation, potential participants must: 1) Have played up to at least level 70 in the Candy Crush Saga, and (2) have played Candy Crush Saga within the last 12

months. Assigning a cut off level of 70 in the Candy Crush Saga ensure that researchers could create an easy game condition as per Larche & Dixon (2020).

The current study's protocol was reviewed and approved by the University of Waterloo Research Ethics Committee. All participants were provided sufficient information about the study prior to participating, and were advised that they could withdraw at any point in the study without penalty.

Apparatus

Lenovo Tablets. Two Lenovo Tab 10" tablet devices were used: one for gameplay, the other for participants to respond to survey questions.

Candy Crush Saga Game. Participants played a real version of the Candy Crush Saga. The tablet was mounted onto an inclined platform, along with a logitech camera (1080 HDMI) positioned to record the game. Games were recorded in order to track in-game events during gameplay, particularly game outcomes (e.g., winning, losing).

Materials

Demographics. Demographic information (e.g., age, gender, average Candy Crush playing frequency within a week, and average smartphone gaming frequency outside of Candy Crush) was measured at the beginning of the session.

Subjective Arousal. Subjective arousal was measured after each game using the arousal subscale of the Self-Assessment Manikins scale (SAM; Lang 1985) –five manikins depicting increasing levels of arousal as pictured in Figure 1 (lowest levels of arousal falling on the leftmost side of the scale, with the highest levels on the rightmost side of the scale). Participants selected the manikins that best matched their arousal level during gameplay.

Figure 1: Self-assessment manikins (SAMs) indexing subjective arousal from low arousal on the left, to high arousal on the right.

Game Experience Questionnaire. The in-game module of the Game Experience Questionnaire (GEQ; IJsselstein, De Kort, & Poels, K., 2013) was used to assess flow, perceived skill, perceived challenge and, positive affect. Cronbach's alpha values corresponding to all 8 individual administrations of this measure over the course of the study ranged from $\alpha = 0.69$ to $\alpha = 0.803$, indexing good to very good internal consistency.

For flow, participants responded to the statements "I forgot everything around me" and "I felt completely absorbed". For skill, participants responded to the two items "I felt skilful" and "I felt successful". For challenge, participants responded to the two items "I felt challenged" and "I had put a lot of effort into it". All items on the GEQ were answered on a 5-point Likert scale, with 0 indicating '*not at all*' and 4 indicating '*extremely*'. Items for each construct (flow, challenge, and skill) were summed and averaged across for easy, regular and hard games respectively.

Positive affect was assessed through player responses to the statements "I felt content" and "I felt good" were on a 5-point Likert scale, with 0 indicating '*not at all*' and 4 indicating

'extremely'. For state boredom, participants responded to “I felt bored”, rated their response on a 5-point Likert scale, with 0 indicating *'not at all'* and 4 indicating *'extremely'*.

Skill-Challenge Balance. The skill challenge balance was determined by taking the absolute difference between perceived challenge ratings and perceived skill ratings respectively for each game (e.g., Skill-Challenge Balance = $|\text{Challenge} - \text{Skill}|$). Lower scores on this measure are indicative of being closer to balance.

Urge-to-Play. Two items “All I want to do is keep playing” and “I want to play so badly that I can almost feel it” were used to measure players’ urge to continue game play following each game. For each statement participants were asked to rate their desire to continue playing using a 7-point Likert scale, with 1 indicating *'Strongly Disagree'* and 7 indicating *'Strongly Agree'*. Both items of urge were summed (see Larche, Musielak & Dixon, 2017). For multiple games of the same difficulty level (e.g., four easy games) these summed scores were averaged for each game condition. Cronbach’s alpha values corresponding to all 8 individual administrations of this measure over the course of the study ranged from $\alpha=0.80$ to $\alpha = 0.87$, indexing very good internal consistency.

Preference. Following the end of all game play the researcher presented the participant with two levels on which to continue gameplay: one easy level, and one “balanced” level. The researcher recorded the participant’s selection as “easy” or “balanced” in the online survey.

Reasons for Gaming Scale. The reasons for Gaming Scale (RFGS; Larche et al., 2020) was used to assess player motives for gameplay. The scale features an escape motivation and excitement motivation subscale, comprising of 6 items total. For the purpose of the current study only the three items corresponded to the escape subscale was used. The escape subscale features

statement items such as “I like playing casual/smartphone games mostly because they take my mind off of daily worries”, where participants would indicate the extent they endorse the statement on a 7-point Likert scale where *1 = completely disagree*, and *7 = completely agree*. Items were summed for each participant to create an escape motivation score. This scale yielded very good internal consistency in the current study, $\alpha = 0.89$.

Trait Boredom Proneness. The 9-item short-form Boredom Proneness Scale (BPS-SF; Struk et al., 2017) was administered to assess trait levels of boredom susceptibility outside the context of the gameplay. The scale features items such as “Unless I am doing something exciting, even dangerous, I feel half-dead and dull”, and were scored on a 7-point Likert scale with 1 indicating ‘*Strongly Disagree*’, and 7 indicating ‘*Strongly Agree*’. Items were summed to produce a single boredom proneness score. This scale yielded very good internal consistency in the current study, $\alpha = 0.89$.

Depressive symptomology Outside the Gaming Context. The 21-item Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovibond, 1995) is a self-report instrument designed to measure the three related negative emotional states of depression, anxiety and tension/stress. For the current study only the Depression subscale was administered. Examples of the seven items of this subscale included “I felt that I had nothing to look forward to”, “I found it hard to wind down”, and “I experienced trembling (e.g. in the hands)”. Responses were scored on a 4-point Likert scale where 0 = *Did not apply to me at all* and 3 = *Applied to me very much or most of the time*. Scores were summed for each participant and multiplied by 2 as recommended by the official DASS scoring standards – with higher scores indicating more depressive symptomology. This scale yielded excellent internal consistency in the current study, $\alpha = 0.92$.

Problem-Videogame Playing Questionnaire. The Problem Video Game Playing Questionnaire (PVPQ) is a nine-item measure that assesses problem video gaming status or video game addiction (Tejeiro-Salguero & Bersabé-Moran, 2002). We adapted this questionnaire to include language reflecting smartphone gaming as opposed to video-gaming for the present study. An example item includes ‘I spend an increasing amount of time playing smartphone games’ for which participants respond ‘yes’ or ‘no’ to each item. Items are summed (‘yes’ is scored as 1 and ‘no’ is scored as 0) to create a total PVPQ score. Higher overall PVPQ scores are indicative of more video game related problems. This scale yielded acceptable internal consistency in the current study, $\alpha = 0.67$.

Design and Skill-Challenge Balance Manipulation

The present study followed a within-subjects design, where all participants played a series of eight games: four balanced games and four “too easy” games interspersed over the playing period. Balanced games consisted of games that were near their current level standing (within a ten-level interval above or below the participant’s current level standing). The “too easy” games were selected from levels (1-10) at the very beginning of the game, which contain goals that can easily be reached for players that met our level-70 entrance criterion. To facilitate counterbalancing of the order of easy and balanced games, games were separated into two blocks of four games. Each block consisted of two balanced and two easy games. To measure player preference, after playing the eighth game participants were given the choice to continue playing an easy game or a balanced game. To ensure that players choices were not enticed by the chance to improve their current level standing, for the balanced game, they were offered the chance to play only games 1-10 levels below their current level standing. Thus, they could play either very

easy games, or games near their current level, but with no chance of them obtaining a “personal best”.

Procedure

Participants first completed a consent form and verified their current level standing in the game which determined the levels participants would play for the balanced games (current level + or – 10 levels). Easy games were from levels 1 to 10.

Participants played two practice games to familiarize themselves with the procedure and the post-game surveys administered at the end of each game (e.g., including questions of skill, challenge, flow, arousal, positive affect boredom, and urge-to-play). Participants then played the first block, followed by a second block of games, totalling approximately 45 minutes of gameplay.

Following the eight games, the researcher would present the participant with two possible levels in which to continue gameplay. Participants were instructed that they could stop playing at any time once they selected their level.

Results

Perceived Challenge, Skill, Skill-Challenge Balance, Flow and Arousal

Table 1 displays the means and standard deviations for perceived challenge, skill, skill-challenge balance, flow and arousal for easy and balanced games.

Firstly, we performed a manipulation check by assessing players perceived challenge, skill and skill-challenge balance to ensure that our easy and balanced games did indeed differ in terms of the skill-challenge balance. In line with past findings, players felt less challenged by the easy games compared to the balanced games, $t(59) = -11.76$, $p < .001$, $d = 1.71$ (Panel A of

Figure 2). Additionally, players felt more skillful when playing the easy games compared to playing the balanced games in Candy Crush, $t(59) = 7.81, p < .001, d = 1.09$ (Panel B of Figure 2). When comparing the absolute value of challenge minus skill ratings (see Larche & Dixon, 2020) players felt significantly less balanced during the easy games than the balanced playing games, $t(59) = 2.37, p = .021, d = .445$. (Panel C of Figure 2).

For flow we found that the easy games were less inducing of flow than the balanced games, $t(59) = 2.96, p = .004, d = .218$ (Panel D of Figure 2). Players also experienced more arousal for the balanced games compared to the easy games, $t(59) = 5.81, p < .001, d = .621$ (Panel E of Figure 2). Overall, our findings suggest that when playing around their level standing players feel adequately challenged relative to their skillset, and in turn experienced greater flow and arousal for these games compared to playing games that were too easy.

Table 1. Means and Standard Deviations of dependent measures across easy and balanced games

	Easy <i>M (SD)</i>	Balanced <i>M (SD)</i>
Challenge	.71 (.78)	2.35 (.94)
Skill	2.18 (1.00)	1.23 (.75)
Balance = Challenge – Skill	1.47 (.82)	1.21 (.85)
Flow	2.58 (1.11)	2.83 (1.09)
Arousal	2.31 (1.00)	2.92 (.88)

Figure 2. Average ratings for A) Challenge, B) Skill, C) Skill-Challenge balance (calculated as the absolute difference between skill and challenge scores, respectively), D) Flow, and E) Arousal across levels of game difficulty. ** $p < .01$, * $p < .05$.

Positive Affect and State Boredom During Gameplay

Table 2 displays the means and standard deviations for positive affect and boredom scores for easy and balanced games.

Average scores for positive affect and state boredom are depicted in Figure 3. Surprisingly, positive affect following the *easy* games was greater compared to the balanced games despite $t(59) = 2.72, p = .008, d = .341$ (Panel A of Figure 3). We reasoned that this pattern might be attributable to the positive affect associated with winning outcomes. For the easy games all participants won each of the games. For balanced games some players ($n=16$) never experienced a win, only losses. Most players ($n= 44$) experienced at least one win, but losses were still more frequent - a situation that might have lowered positive affect. We therefore took the 44 players who had at least one balanced win, and compared their positive affect for easy wins, versus the balanced win (or wins if there was more than one). As shown in Panel B of Figure 3, in line with our original hypotheses, positive affect following balanced wins was markedly higher than positive affect following the easy wins, $t(43) = 4.38, p < .001, d = .519$. Indeed, although winning in Candy Crush is generally a pleasurable experience, the heightened positive affect for balanced wins illustrates the important role of feeling adequately challenged, and flow in maximizing positive affect following a rewarding outcome. Finally, boredom aligned with our predicted patterns; easy games were found to be more boring to play compared to the balanced games, $t(59) = -3.63, p = .001, d = .387$ (Panel C of Figure 3).

Table 2. Means and Standard Deviations of affect dependent measures across easy and balanced games

	Easy	Balanced
Positive Affect for all Games	1.91 (.77)	1.55 (.71)
Positive Affect for balanced wins	-	2.42 (.92)
State Boredom	.94 (.94)	.69 (.86)

Figure 3. Average subjective of A) Positive Affect for all games in easy and balanced levels, B) Positive affect for easy and balanced condition wins, C) State boredom for easy and balanced levels. ** $p < .01$, * $p < .05$.

Arousal, Urge and Preference

In addition to players experiencing more flow and arousal for the balanced games, players also expressed more urge following balanced games ($M = 6.68$; $SD = 2.71$) compared to easy games ($M = 5.96$; $SD = 5.53$), $t(59) = -3.76$, $p < .001$, $d = .268$ (Panel A of Figure 4). Hence, playing around one's level standing was not only flow and arousal inducing, but also urge

inducing. Following Larche and Dixon (2020) we conducted a hierarchical multiple regression with arousal entered at Step 1 and flow entered at Step 2 of the model. At step 1, arousal accounted for 35.4% of total urge variance, $F(1,58) = 31.82, p < .001$. At step 2, flow accounted for an additional 6.8% of unique urge variance over and above arousal, $F\text{-change}(1, 57) = 6.65, p = .013$.

Next we assessed whether one's level of urge impacts their game preference in continuing gameplay. When prompted to select a game to continue their gameplay, a majority of players selected to continue playing the balanced games over the easy games. As shown in Panel B of Figure 4, 53 (88.3%) participants selected to continue playing the balanced games, while only 7 participants selected to continue playing the easy games (11.7%), $\chi^2 = 35.26, p < .001$.

Figure 4. Average subjective ratings for easy and balanced games for A) Urge. B) Proportion of participants selecting to play balanced and easy games at preference point. $**p < .01$, $*p < .05$.

Escape, Boredom and problematic smartphone gaming

In this study we replicated the robust relation between boredom proneness and symptoms of depression, $r(58) = .577, p < .001$. Surprisingly the correlation between depression and scores

on our measure of escape gaming motivations was not significant, $r(58) = .183, p = .162$. Similarly the escape gaming was positively correlated with boredom proneness in everyday life, however this relation fell short of significance. The more symptoms of boredom proneness experienced in everyday life however, the more players endorsed gaming to escape, $r(58) = .254, p = .050$. This relation should be considered with caution given the correlation met but did not exceed our alpha criterion. As predicted, and similar to other domains of video-gaming, the more a player endorsed smartphone gaming to escape, the more problems related to smartphone gaming they reported, $r(58) = .435, p = .001$. Thus, gaming to escape aversive feelings tied to boredom proneness specifically was related problematic smartphone gameplay.

Contrasting escape gamers to non-escape gamers

Table 3 displays the means and standard deviations for flow, arousal, positive affect following wins, boredom and urge across easy and balanced games by escape score tercile.

To test our predictions about whether those who game to escape would experience greater flow, arousal, positive affect, urge and less boredom we compared players falling into the upper tercile of all escape scores ($n = 20; M = 10.05$), to those falling in the lower tercile (presumably non-escape players ($n = 20; M = 19.25$)).

We first examined the level of flow experienced during gameplay for escape and non-escape players playing the easy and balanced games. A mixed-repeated measures ANOVA revealed a significant main effect of difficulty level, $F(1, 38) = 15.59, p < .001, \eta_p^2 = .291$, a main effect of tercile, $F(1, 38) = 11.21, p = .002, \eta_p^2 = .228$, but no tercile by difficulty interaction, $F(1, 38) = .00, p = 1.0, \eta_p^2 = .000$. The main effect of difficulty level was driven by the greater flow during the balanced games compared to the easy games. In accordance with our prediction

the main effect of tercile was driven by the more profound flow experienced for players in the upper tercile of escape scores compared to those in the lower tercile. Surprisingly this effect of escape tercile was similar across the easy and balanced games (see Figure 5, panel A).

For arousal (Figure 5, Panel B), a mixed-repeated measures ANOVA revealed a significant main effect of difficulty, $F(1,38) = 19.54$, $p < .001$, $\eta_p^2 = .340$, no main effect of tercile, $F(1,38) = 3.30$, $p = .077$, $\eta_p^2 = 0.08$, but a tercile by difficulty interaction, $F(1,38) = 5.01$, $p = .031$, $\eta_p^2 = .117$. The main effect of difficulty was driven by the greater arousal experienced in the balanced game condition. Simple effects analyses unpacking the interaction indicated that those in the upper tercile of escape experienced greater arousal than non-escape players, but only in the balanced game condition ($p = .018$), not for the easy game condition ($p = .335$).

Next, we looked at levels of affect experienced during winning gameplay for the upper and lower terciles of escape (Figure 5, Panel C)¹. As expected there was a significant main effect of difficulty level on positive affect ratings, $F(1,38) = 20.58$, $p < .001$, $\eta_p^2 = .407$, a main effect of tercile, $F(1,38) = 1.68$, $p = .046$, $\eta_p^2 = .101$, but no tercile by difficulty interaction, $F(1,38) = 1.68$, $p = .204$, $\eta_p^2 = .053$.

For state boredom (Figure 5, Panel D), a mixed-repeated measures ANOVA revealed a main effect of difficulty level, $F(1,38) = 14.68$, $p < .001$, $\eta_p^2 = .279$, no main effect of tercile, $F(1,38) = .886$, $p = .353$, $\eta_p^2 = .023$, and no tercile by difficulty interaction, $F(1,38) = 1.01$, $p = .320$, $\eta_p^2 = .026$. The main effect of difficulty was driven by the higher boredom overall for the easy games compared to the regular games. Although those in the upper tercile nominally

¹ Here we directly compared easy and balanced winning outcomes only since the previous analysis for all participants revealed that positive affect was dampened by losses.

appeared less bored than those in the lower tercile (especially in the balanced game) the large error bars convey that boredom ratings were highly variable reducing statistical power.

Finally, for urge (Figure 5, Panel E), a mixed-repeated measures ANOVA revealed a significant main effect of difficulty, $F(1,38) = 12.02$, $p = .001$, $\eta_p^2 = .240$, no main effect of tercile, $F(1,38) = 2.95$, $p = .094$, $\eta_p^2 = .072$, but a tercile by difficulty interaction, $F(1,38) = 6.13$, $p = .018$, $\eta_p^2 = .139$. The main effect of game difficulty was driven by the greater urge to continue gameplay in the balanced condition over the easy condition for all players. Simple effects analyses indicated the tercile by difficulty interaction was caused by those in the upper tercile of escape scores experiencing greater urge to play than the lower tercile of escape scores for the balanced games ($p = .028$), but not for the easy game condition ($p = .346$).

Table 3. Means and Standard Deviations for each dependent measure across easy and balanced games by escape score tercile

	Lower Tercile of Escape Scores (n = 20)		Upper Tercile of Escape Scores (n=20)	
	Easy <i>M (SD)</i>	Balanced <i>M (SD)</i>	Easy <i>M (SD)</i>	Balanced <i>M (SD)</i>
Flow	2.17 (1.20)	2.43 (1.07)	3.07 (1.09)	3.56 (.80)
Arousal	2.32 (1.04)	2.70 (.93)	2.49 (.98)	3.38 (.78)
Positive Affect for wins	1.72 (.88)	2.13 (1.01)	2.23 (.76)	2.90 (.72)
Boredom	1.04 (1.11)	.86 (1.20)	.86 (.92)	.40 (.44)
Urge	5.14 (2.60)	5.50 (2.62)	6.00 (2.63)	7.40 (2.82)

Figure 5. Average subjective ratings for upper and lower tercile of escape scores across easy and balanced games for, A) Flow ratings, B) Arousal C) Positive Affect for wins, D) State Boredom, E) Urge. ** $p < .01$, * $p < .05$.

Discussion

The present study had two overarching research aims resulting in three research questions. First, we sought to replicate and extend the findings of Larche & Dixon (2020) concerning flow, arousal, state boredom and urge in too easy versus more balanced games. Second, we further examined whether playing to escape was associated with, boredom proneness, depression and problematic gaming. Further appealing to this aim we sought to show that players who preferentially reported gaming to escape would experience more flow, arousal, positive affect, and subsequently less state boredom during gameplay as well as a stronger urge to continue gameplay than those who more weakly endorsed gaming to escape.

Research Question #1: Can we replicate and extend results from Larche & Dixon (2020)?

Overall, our findings aligned with most of our predictions and successfully replicated findings from Larche & Dixon (2020). For all players, playing around their level standing maximized the skill-challenge balance compared to playing easier games and these balanced games produced greater flow and arousal compared to easy games.

Interestingly, our analyses of positive affect scores support the idea that although winning affects positive affect it is not the sole determinant of an enjoyable gameplay experience. When comparing easy games which players consistently won, to a mixture of the odd win amongst frequent losses, we showed that the consistent wins led to more positive affect than the balanced (mostly) losing games. Hence, and perhaps not surprisingly, winning does seem to induce more positive affect than gameplay involving mostly losing outcomes. Yet, when comparing easy wins to balanced wins – the balanced winning games triggered significantly more positive affect. Our positive affect findings extend and refine the relations identified in Laffan et al. (2016), which showed that both reward features (e.g., level progression) and features that make a game more challenging promote flow experience in gameplay. It is the combination of the experience of winning and high flow that maximize positive affect during gameplay. Hence, for players winning an adequately challenging, flow-inducing game in Candy Crush is much more rewarding and enjoyable compared to simply winning a boring, easy game.

The combined findings thus far suggest that not only does the skill-challenge balance foster an enjoyable experience by means of flow and arousal, but since wins were far less frequent than losses in the balanced condition, motivating reinforcement schedules may have affected players experience. That is players mostly lost, but occasionally won playing games near their current level standing – with these wins coming at unpredictable times. We propose

that wins were likely delivered on a variable-ratio (VR) schedule of reward delivery – a reward schedule important for maintaining gaming behaviour in the short-term and long-term (Haw, 2008; Braun & Giroux, 1989; Hopson, 2001; King et al., 2010). A VR schedule with relatively low win frequency is most likely maintained when challenges are slightly above the skill level of a player. Unlike in easy games where skills dramatically exceed the game challenges (guaranteeing a win), in balanced games it is unclear to the player whether they will meet the given challenges and win. In level based games like Candy crush, designers use a ramping structure, where players successes (leveling up) are offset by the game increasing in difficulty. This ramping up of difficulty ensures not only the skill challenge-balance, but wins which will be low in frequency, and unpredictable in terms of when they occur – a recipe for motivating further game play.

Accordingly, we saw how balanced games led to not only more flow, more arousal, more positive affect, but also higher urge to continue playing. Importantly players appeared to act on this urge - 53 out of 60 players chose to continue playing balanced games where they might win, but would most likely lose, rather than the easy game where they were all but assured of winning. Overall, our findings show that more challenging games in mobile games like Candy Crush have marked impacts on flow and arousal, leading to players actively choosing to continue playing games that are conducive to both these motivating experiences.

Escaping Boredom and Implications for Problematic Gaming

Research Question #2: Is the motive of gaming to escape related to boredom proneness, depression and more problems related to smartphone gaming?

Our findings concerning escape and problem smartphone gaming paint a slightly divergent picture from what is typically observed in other modes of videogame play. In line with past findings in the gaming and gambling literature, playing to escape was related to increased negative consequences related to problematic smartphone gaming (Kardefelt-Winther, 2014; Baker et al., 2004). Typically, in other games made for desktop platforms those endorsing playing to escape tend to also report experiencing high levels of depressive symptomology in everyday life (Deleuze et al., 2018; Hagstrom & Kaldo, 2014; Kaczmarek & Drązkowski, 2014; Larche et al., 2021). However, here we did not find a direct association between escape gaming and symptoms of depression. Rather, smartphone players who play to escape primarily endorsed experiencing boredom proneness in everyday life, however we stress that this relation should be replicated given the correlation in the current study met but did not exceed our alpha criterion. In line with past research, boredom proneness in itself was strongly related to greater depressive symptomology. Such findings suggest that those who are susceptible to boredom in everyday life might more frequently engage in smartphone play to escape feelings of monotony or lack of engagement in other aspects of daily life, and any subsequent negative affect stemming from this experience. Hence, escape as it relates to avoidance of frequently occurring aversive moods and mentations tied to boredom increases the likelihood of experiencing negative consequences in the long-term (Kardefelt-Winther, 2014; Bowditch et al., 2018).

Research Question #3: Do those who preferentially report gaming to escape experience higher flow, arousal, positive affect, less boredom and a stronger urge to continue gameplay?

Mirroring previous findings in the gaming and gambling literature, the current study showed that escape smartphone players experienced greater flow, arousal and positive affect during gameplay compared to their non-escape counterparts. Those who game for escape in the

context of smartphone games like Candy Crush became more immersed during gameplay than non-escape players – surprisingly even during easy games. However, only the optimally challenging balanced games were capable of triggering heightened arousal for escape players compared to non-escape players. They also experienced more positive affect than non-escape players – a finding which is important in terms of the rewarding, and motivating properties of games. If escape players find these games more rewarding, they may play longer and more often. Indeed, if these games are capable of alleviating the negative affect associated with boredom, it sets up a circuit of negative reinforcement that may lead to addiction (Griffiths & Nuyens, 2017).

This pattern of results for flow and positive affect specifically resonates with previous roleplaying game (RPG) research (Larche et al., 2021; Yee, 2006). As in the current study, those RPG players who gamed to escape experienced greater flow and positive affect than non-escape players during gameplay. This converging similarity between the two game genres is significant given how different the structural characteristics are between the elaborate avatars, and complex stories of the RPG games and the much simpler smartphone games (Chen, Wigand & Nilan, 1999; Salen, Tekinbaş, & Zimmerman, 2004). Taken together, greater high flow, arousal and positive affect for escape gamers appears to generalize across both game genres.

Contrary to our predictions concerning state boredom, there were no statistical differences between escape and non-escape players in our measures of state boredom during gameplay. Since we tested only those highly familiar with Candy Crush (who had mastered at least 70 levels) our sample may have included only those who find this game inherently appealing - thereby restricting the range of boredom during game play. Future studies might gauge the degree to which gameplay reduces state boredom from a baseline task immediately

before game play to assess whether there is a steeper reduction in boredom for escape players moving from a highly bored state at baseline to an engaged state during gameplay. Nevertheless, although boredom did not differ between groups, we were able to demonstrate that trait boredom proneness in everyday life was correlated with the degree to which players endorsed gaming to escape.

Intriguingly, this rewarding experience of profound flow and arousal among escape players, particularly for the balanced games had a marked impact on their urge to continue playing these games. To our knowledge this is the first empirical study demonstrating that this heightened flow, arousal and positive affect translates to more enhanced motivation to prolong gameplay in those who game to escape boredom. The corroborating patterns between arousal and urge especially among escape players during the most flow-inducing games confirms the motivational force of these games for players who are seeking to alleviate negative affect and the hypo-arousal associated with boredom. This link is especially reinforced by our finding that flow accounted for additional urge variance over and above arousal for all players. Hence, the enhanced arousal and urge among bored escape smartphone game players specifically demonstrates the increased need to seek flow from these optimally challenging games as external sources of stimulation in their habitual play. In doing so, these players may achieve optimal arousal, engaged focus and attention, and ultimately a reduction in feelings of monotony. In turn, this heightened urge-to-play among escape players has implications in the maintenance of problematic smartphone gaming and negative consequences since such heightened flow may lead to excessive time gaming (Hull, Williams & Griffiths, 2013; Wood & Griffiths, 2007; Dong, Wang, Du & Potenza, 2014; Kaczmarek, & Drajkowski, 2014).

The combined findings suggesting that escape players are vulnerable to potentially playing for longer than intended can inform how smartphone game designers can develop and implement safeguards aimed to reduce the emergence of negative consequences for these players. Adding features that increase one's self-awareness that is otherwise lost when locked in a state of flow has been suggested as a promising route to temporarily disrupting flow (Schüler, 2012). Some practical examples from the electronic gambling literature include the addition of voluntary pop-up messaging, such as reminders of approaching time-limits during play, as one way of helping gamblers exit flow to reflect on their behaviour (Delfabbro & King, 2020; Bjørseth et al., 2021). Players of videogames in general have expressed positive attitudes towards the incorporation of similar features in videogames to help reduce negative consequences associated with increased time spent playing (Stevens et al., 2021).

Limitations

This study is not without limitations. We showed that players preferentially opted to play the balanced games more often than the easy games. Yet, due to the relatively low numbers of players choosing the easy games we were not able to show that players choosing the balanced games played longer. Future studies might consider a between-subjects design where equal numbers of players are exposed to easy or balanced games, and after a fixed number of games players would enter a persistence phase in which they could then play for as long as they wished. In a similar vein, future studies aiming to replicate our patterns of results for should opt for larger sample sizes to maximize power, particularly for between group comparisons (given the small to medium effect sizes for the between-subject group comparisons in the present study).

Additionally, one must also exercise caution in generalizing our results to all smartphone game players. Specifically, we only used one particular genre of game which may appeal to a

particular audience (especially female players – a group that was highly represented in our sample; Glance, 2015). It would be interesting for future research investigating the unique subjective experiences of escape players to include other types of smartphone game genres to maximize the generalizability of results observed in the current study.

In summary, our findings provide further insight into how smartphone gaming can be problematic for a subset of players, particularly among those who game to escape the negative mood states and mentations associated with boredom. At the most general level, our findings illustrate the importance of flow and variable ratio rewards in fostering player's positive feelings during game play. We further show that escape players preferentially experienced flow and positive affect during gameplay over those who do not game to escape – complementing findings from other gaming research. Importantly, we were able to show for the first time that such heightened flow and positive affect among bored escape players enhanced their urge to prolong gameplay, which from a harm perspective suggests a heightened potential for the development of gaming problems among these players.

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