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Free-To-Play? An Examination of Intrinsic Motivation and Gaming Behaviors in U.S. Female Mobile Gamers

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Abstract

The prevalence of U.S. female gamers has skyrocketed in recent years, largely due to the popularity of mobile games; however, this population is underrepresented in academic research. The present study aimed to close this gap in the literature by focusing on the motivations and behaviors of adult female mobile gamers in the U.S. It also aimed to capture changes in gaming motivation and behavior resulting from the onset of the COVID-19 pandemic. An online sample of 354 American women 18 to 77 years of age (M = 36.79, SD = 12.38) were surveyed about their motivations for mobile gaming, their mobile game preferences, how much they typically play overall (frequency) and the duration of a typical gaming session. Results of hierarchical regression analyses showed that alleviation of boredom and enjoyment were significantly related to gaming frequency. Autonomy, relatedness and enjoyment were significantly related to gaming duration. Of the women who reported pandemic-related changes in their gaming behavior, 86.6% reported an increase in mobile gaming. Additionally, women who reported pandemic related changes in gaming behavior rated alleviation of boredom and stress significantly higher than those who reported no change. Implications and future directions for research are discussed.

Keywords: mobile gaming, female gamers, self-determination theory, boredom, stress, intrinsic motivation, COVID-19

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Currently, 46% of the total U.S. gaming population is female (Entertainment Software Association [ESA], 2019). Although the prevalence of female gamers (e.g., console, computer, online, and mobile) has grown consistently over the past two decades, there is a relative dearth of research on this population compared with commonly recognized (e.g., young, male) groups of gamers (Lopez-Fernandez, Williams, Griffiths, et al., 2019). This is especially remarkable in light of recent findings that adult women represent a substantially greater proportion of the U.S. gaming population than boys and adolescent males combined (ESA, 2017; 2018).

One important reason for the increase in American female gamers is the burgeoning popularity of mobile games. In 2020, mobile games are projected to outpace computer and console games in both engagement and revenue (Wijman, 2020). Mobile games have several features that distinguish them from console and PC games and provide a unique gaming experience. Aside from their portability and ease of use in a variety of contexts, mobile games typically require a low barrier to entry in terms of skill and cost (i.e., "Free-to-play"), are easy to learn, and require minimal time commitment, unlike console and computer games that often involve the investment of many hours of gameplay at a time (Omori & Felinto, 2012). The appeal of these features of mobile gaming among American women is evident: 77% of female gamers age 18-34, 78% of female gamers age 35-54, and 63% of female gamers age 55-65 most often play games on their smartphones (ESA, 2020) and a substantially larger proportion of women play mobile games (63%) than men (37%; Mediakix, 2018). Compared to these more intensive game formats, the flexibility that mobile gaming allows is more conducive to the

lifestyles of American women, who have less free time which is available in smaller chunks (Winn & Heeter, 2009).

Because mobile gaming is a relatively new technology, there has been an increase in academic interest in mobile game-focused research. While there has been a recent increase in mobile gaming specific studies in Western Europe (Cutting et al., 2019, de Kervenoael et al., 2016; Engl & Nacke, 2013; Merikivi et al., 2016; Molinillo et al., 2018; Pappas et al., 2019), East Asia (Chan, 2008; Chen et al., 2017; Jin et al., 2015; C.S. Kim et al., 2010, Liu & Li, 2011; Okazaki et al., 2008), the Middle East (Almuhanna et al., 2019), and Australia (McCauley et al., 2017; McCauley et al., 2018; Phillips et al., 2007), academic interest in the U.S. remains relatively low.

One possible reason for lack of academic mobile gaming research in the U.S. is that the majority of interest seems to come from market research and game development firms. Unfortunately, much of the existing information on the U.S. population's mobile gaming behavior, like most video game player data, is sequestered from public and academic scrutiny by a proprietary barrier upheld by market research firms and game development companies (Williams et al., 2008). The financial motives and lack of transparency regarding methodology of these industry reports makes it impossible to assess whether their findings are reliable and valid, thus highlighting the need for rigorous academic study of this population.

Why Do People Play Mobile Games?

Enjoyment

It is intuitive to say that people play mobile games because they are fun. Indeed, enjoyment derived from hedonism (i.e., enjoyment for its own sake) strongly drives continued intention to play mobile games (Merikivi et al., 2017). This conceptualization of enjoyment as an

intrinsic motivation to play games is well supported in the literature, but beyond the hedonic pleasure that gaming provides, enjoyment may also be defined as the fulfillment of certain fundamental human needs (Tamborini et al., 2010).

Self-Determination Theory

Self-determination theory (SDT; Ryan & Deci, 2000) is a theory of human motivation which posits that people possess an innate propensity to behave in ways that satisfy certain fundamental needs: the need to feel that they can overcome challenges and affect their environment (competence), the need to feel as if they possess the freedom to make choices (autonomy), and the need to feel connected to others (relatedness). The satisfaction of these needs is contingent upon the perception that the activity being undertaken is inherently valuable, pleasurable, or interesting and that the individual's participation is the result of an internal (i.e., intrinsic) locus of control rather than external influences (Ryan & Deci, 2000). This internalized sense of agency, or perception that one's actions are self-determined, intrinsically drives each and every person to engage in certain activities. If these needs are met, the result is an enhanced sense of well-being and continued motivation and engagement. If these needs are not met, the result is a decreased sense of well-being and intrinsic motivation and further engagement wanes (Ryan & Deci, 2000).

Self-determination theory has been successfully applied in examining intrinsic motivation in a variety of contexts, and lends itself well to the study of gaming motivation in relation to the satisfaction of these three needs. Video game play provides continuous and immediate feedback in response to the player's actions of navigating and overcoming in-game challenges. By increasing the difficulty of the game proportionally to the player's increasing skill, progression within the game enables players to experience a sense of enhanced competence. The dynamic

balance between game difficulty and player skill prevents players from attaining excessively high levels of competence and thus becoming bored, or excessively low levels of competence resulting in frustration (Przybylski et al., 2010). Indeed, "video games are enjoyed the most when the level and speed of the game match players' respective optimal mental and motor capacity" (Lucas & Sherry, 2004, p. 508). Video games also afford the player varying degrees of choice regarding which in-game tasks and goals to take on (Ryan et al., 2006). The degrees of flexibility and diversity of these in-game choices may proportionally enhance the player's sense of autonomy, as the availability of these choices empowers the player to dictate their individual gaming experience. The mobile game format is exceptionally suited to satisfy the need for autonomy. In addition to the choices that one makes about what to do within the game, the ubiquity of smartphones, limited time commitment, and low barrier to entry for gameplay also enhances a sense of autonomy about when one chooses to play (McCauley et al., 2018).

Virtually all multiplayer video games are inherently social, but the rich and immersive environments in many games, as well as thoughtful storyline and character development can enhance a sense of relatedness even in single-player games. Since the advent of the internet, the potential for relatedness has exploded. Massively multiplayer online games (MMOs) enable very large numbers of players (i.e., hundreds or thousands) to interact in virtual environments, often via the use of an avatar (Ryan et al. 2006). The introduction of social-networking sites (SNS; e.g., Facebook) enabled social digital gaming experiences to move out of spaces associated with "hardcore" gamers and greatly expands the audience for digital gaming. SNS games are typically casual in nature (e.g., Candy Crush, Farmville, etc.) and utilize existing social networks of friends (Almuhanna et al., 2019). This access was further extended with the introduction of

mobile social games, which coincided with dissemination of internet enabled mobile devices (Wei & Lu, 2014).

Self-determination theory has been widely used as the theoretical basis for investigating gaming motivation and outcomes. Ryan et al. (2006) developed The Player Experience of Needs Satisfaction (PENS) scale in order to measure the satisfaction of these needs in relation to specific video game play experiences. The first three studies examined the influence of in-game competence and in-game autonomy on game enjoyment and preference for future play in university students. Participants in the first study (N = 89; 74.2% female) played one console video game (Mario 64) in a lab setting, which established that the relationship between these variables held up in the context of a single game. The second study (N = 50; 72.0% female) extended this finding by examining whether the relationship between these motivations and outcomes would be consistent across different games from the same type, comparing two games which were at opposite ends of the popularity rankings for a specific genre. The third study (N = 58; 79.3% female) examined the relationship between these variables across four different genres of video games. Findings were consistent across these three studies and showed that both in-game competence and in-game autonomy significantly and positively predicted game enjoyment and preference for future play. The fourth study was an online survey of MMO gamers (N = 730; 7.0% female). Participants were asked to reflect on their gaming experience with regard to the variables previously mentioned as well as the need for relatedness and hours of play. Competence, autonomy, and relatedness all significantly predicted enjoyment and preference for future play. Additionally, competence and relatedness were significantly and positively associated with hours of gameplay per week. Taken together, these results provide strong evidence that satisfying the needs of competence, autonomy and relatedness facilitate game

enjoyment and motivation to play in the future. The findings also provide support for SDT as an appropriate theoretical framework for examining gaming motivations. In addition, the PENS was found to be superior in its ability to predict game enjoyment, weekly hours of play, and game-related player well-being when compared to other conceptualizations and measures of gaming motivation (Przybylski et al., 2010). Later research adapted this scale to evaluate more general video gaming experiences (Johnson et al., 2016; H. Kim et al. 2018) and mobile gaming-specific experiences (McCauley et al., 2017; McCauley et al., 2018). For example, H. Kim et al. (2018) found that competence, autonomy and relatedness was associated with enjoyment in a group of South Korean online gamers ranging from 10 to 40+ years of age. Johnson et al. (2016) examined motivations for video-game play in a sample of 573 gamers who ranged from 13-54 years of age (18% female) and found that time spent playing was significantly associated with stronger experiences of competence, autonomy and relatedness. This study also reported some mobile gaming-specific findings, analyzing the relationship between time spent playing and gaming platform types (e.g., mobile vs. non-portable). They found that platform type was not a significant predictor of time spent playing, but they advised that these results should be interpreted with caution, as the data collected only pertained to people's favorite game, rather than their general gaming behavior.

McCauley et al. (2017) were the first researchers to examine SDT motivations exclusively in the context of mobile gaming. The authors sought to examine when, why, and how much people play mobile games. They surveyed an international sample of 293 mobile gamers (18-25 years of age; 53.6% female), about the mobile game they played most frequently, collecting data on gaming motivations, frequency of use and outcomes such as enjoyment and positive word of mouth. Results showed that satisfaction of the needs for competence, autonomy,

and relatedness positively affected mobile gaming enjoyment and communication of the virtues of mobile games to others.

Alleviation of Boredom and Stress

In addition to enjoyment, competence, autonomy, and relatedness, alleviation of boredom and stress are widely cited as primary motivations for playing video games. These constructs have been widely used in research on motivation and media use and evolved over time to accommodate emerging technologies. In a study on motivation and internet use, Korgaonkar & Wollin (1999) defined "social escapism motivation" as internet usage for relaxation and relief from daily boredom and stress. Building on this construct, Ko (2000) identified social escapism and an additional dimension of "pass time" as motivations for internet use. With regards to video game play, Sherry et al. (2006) proposed that alleviation of boredom and stress fall under a single construct of diversion: "Video games are frequently used to avoid stress or responsibilities. Respondents reported playing video games to fill time, relax, escape from stress, or because there is nothing else to do" (p. 217). In a sample of 550 American university students ranging in age from 18 to 23 years of age (M = 19.68 years of age; 58% female), diversion was found to be the strongest predictor of time spent playing video games. After the internet gave rise to MMOs, Yee (2006) proposed the concept of escapism as "using the online environment to avoid thinking about real life problems" and found it to be one of the main motivations of video game play. Due to the recent ubiquity of mobile devices, mobile games provide an easily accessible and enjoyable way to pass time (Engl & Nacke, 2013). In a study on mobile gaming behavior in Chinese university students (N = 267; Liu & Li, 2011) alleviation of boredom strongly predicted enjoyment, positive attitudes about mobile gaming, and future intention to play mobile games. A study examining the relationship between psychological factors and

mobile gaming addiction to the mobile game, Candy Crush, found that feelings of boredom strongly predicted longer daily mobile game play (Chen & Leung, 2016). McCauley et al. (2017) examined the potential impact of escapism on enjoyment and frequency of mobile gaming. Results showed that escapism had a significant positive effect on frequency of use. McCauley et al. (2018) also identified mobile escapism as a distinct motivational construct from those encompassed by SDT and proposed that it may provide stress relief from daily life.

Indeed, Reinecke (2009a) similarly proposed that the benefits of computer and video game play in alleviating stress may go beyond the mere avoidance of stress that previous conceptions of escapism had proposed and may actually facilitate the recovery process. Because video games are engaging and interactive, these games consume a person's attention, which allows them to divert attention away from and put psychological distance between themselves and the source of stress (i.e., negative cognition & ruminations). Reinecke also proposed that, despite the physiological arousal that videogame play can induce, playing video games can also result in a paradoxical relaxation effect similar to physical exercise, an effect, which Reinecke argues, is due to the distraction from stress that psychological detachment related to game play can facilitate. These two concepts (psychological detachment and relaxation) coupled with mastery and control, which overlap conceptually with SDT's competence and autonomy, can facilitate the replenishment of physical and psychological resources. Findings from a survey of 1614 German video and computer gamers who ranged in age from 12 to 56 years of age (M = 22.8 years of age; 3.7% female) support Reinecke's claims, demonstrating that computer game play can facilitate key elements in the recovery process.

Furthermore, in a study examining computer gaming during work (Reinecke, 2009b), participants who reported higher levels of work-fatigue also reported a stronger experience of

recovery from that stress through gaming and tended to play games at work more frequently. Findings from this study also highlight the role of gaming in alleviation of stress as a way to buffer a lack of social support. Participants who reported low social support in the workplace played computer games more frequently compared to those with high social support. Altogether, these findings suggest that the escapism related to gaming may have potential utility as a positive coping practice in non-leisure settings. The low time commitment required for mobile games may be especially suited for this purpose, as free time in work or other non-leisure environments is typically limited.

Female Gamers in the Literature

Gender Differences in Play Time

One of the main gender differences reported in the literature on digital gaming is the amount of time spent playing. Lucas and Sherry (2004) examined sex differences in video game play in a sample consisting of 544 American university students ranging in age from 18 to 24 (*M* = 19.71 years of age; 57.5% female). Findings showed that 88.3% of male participants reported playing video games at least once a week, compared to only 54.6% of female participants. Additionally, male participants reported playing over twice as many hours per week (*M* = 11.00) compared to females (*M* = 4.25). Similarly, Johnson et al. (2016) found that men reported playing their favorite video game for more hours per week (*M* = 8.92) compared to women (*M* = 7.77). These findings suggest that women would be less likely to play video games than men and that if they did play, they would play for less time.

Winn & Heeter (2009) proposed that differences in game play time was largely due to gender differences in available leisure and free time. A sample of American university students (*N* = 276) ranging in age from 18 to 24 years of age (M = 20.4 years of age; 69% female) were

surveyed on how much free time they had, how much time they spent on leisure and non-leisure activities, and how often and for how long they typically played video games. On average, female participants reported playing video games significantly less (*M* = 1 hour per week) than male participants (*M* = 5.3 hours per week). A stark difference in the duration of a typical gaming session was also found: 78.2% of females reported that they typically played games for half an hour at most, compared to 23.6% of males. However, females also reported having smaller available chunks of free time (*M* = 1 hour, 21 minutes) on fewer days per week (*M* = 3.3) compared to males (*M* = 1 hour, 21 minutes; M = 4.8 days per week). Taken together, these findings make a compelling argument for gender differences in video game play being characterized by time availability. These findings also have important implications for the types of games that women prefer to play. Winn & Heeter note that, given the most frequently reported gaming session duration among women was 30 minutes at most, casual games are likely the only type that can reasonably be played. Notably, the study did not include mobile games as a potential gaming platform, possibly because of the nascent nature of smartphones and mobile gaming at that time.

Gender Differences in Gaming Motivation

While time restrictions may provide a practical explanation for gender differences in gameplay, other, more complex motivational factors may play a significant role. In addition to examining gender play time, Lucas and Sherry (2004) examined gaming motivations in relation to several uses and gratifications of video game play (challenge, arousal, diversion, fantasy, and competition). Women and men similarly rated video game challenge as the most gratifying out of all the constructs presented, but showed a large disparity with regard to gratification of game play from social interaction. In addition to rating the gratification of social interaction in video

game play significantly lower than men, women rated social interaction as the least gratifying out of all of the constructs presented. Additionally, women were significantly less motivated by competition in video games compared to men, which may be related to the problematic social dynamics that competition can facilitate. Lucas and Sherry proposed that these dynamics may occur due to the gender stereotypes which frame video game play as a masculine activity and due to the social stigma surrounding female gamers.

Reinecke et al. (2007) echo Lucas and Sherry's (2004) findings on women's gaming motivations, further highlighting the complexity surrounding social motivation to play. In a qualitative study that examined adult (19-37 years of age) female video/computer gamers' attitudes on gaming motivation, gratification, feelings of representation in games, and perceived social support of their gaming interests, participants reported game challenge, escapism (e.g., distraction from stress), and social interaction as important motives for gaming. However, women reported receiving less social support of their hobby from their female peers in particular, while men have no trouble finding same-sex peers that share their gaming interests. Reinecke et al. also note that women reported that winning the game and/or beating opponents was less important than mastering the game's challenges and working effectively as a team (for multiplayer games) while previous studies show men having a greater interest in competitive games than women (e.g., Hartmann & Klimmt, 2006). While the extant literature described above laid the groundwork for examining gender differences in video game motivation and play behavior, the rate at which video gaming and, more specifically, mobile gaming technology, has progressed and is currently accelerating has caused the number of female gamers to grow exponentially. This paradigm shift is undoubtedly reshaping attitudes about who can game and when, where, and how games can be played. Consequently, rapidly evolving attitudes and social

norms surrounding female gamers may potentially render many of these findings obsolete, highlighting the need for ongoing study of female gamers who play mobile games.

Mobile Gaming in the Literature

A Brief History of Mobile Gaming

Mobile games are broadly defined as, "A video game played on mobile devices, including mobile phones, smart phones, PDAs, or handheld computers" (Liang & Yeh, 2011). Although people commonly associate mobile games with internet-enabled smartphones and tablets, games on mobile phones date back to the mid-1990s. Tetris was the first mobile game to be released on a mobile phone in 1994 (Wang, n.d.). This era saw the introduction of second generation (2G) mobile phones, which were considerably more technologically advanced and included more features (e.g., text messaging) than the first generation (1G) "brick" phones of the 1980s. The rollout of third generation (3G) mobile phones, however, increased the number and quality of mobile games dramatically (H.M. Kim, 2013). The advancement of mobile gaming technology reached another milestone in 2007 with the advent of the iPhone and the launch of the App Store shortly after. Faster processing speeds, wireless internet access, high definition graphics, and larger screens enabled game developers to produce an unprecedented variety of high-quality games across many genres. The introduction of fourth generation (4G) mobile technology in 2009 and Apple's release of the first iPad in 2010 only served to accelerate mobile technology's (and gaming's) ubiquity. Since that time, the variety and complexity of the mobile game market has exploded. Evolving from simple, arcade style games to more immersive and elaborate games (e.g., The Sims Mobile, Animal Crossing: Pocket Camp, and Pokémon Go, among others). In 2020, global revenue generated from mobile games will exceed $77 billion,

accounting for 48% of the total digital gaming market, and shows no signs of slowing down (Wijman, 2020).

Unique Features of Mobile Gaming

One of the primary features that distinguishes mobile gaming from other gaming platforms is its portability. Freedom from the spatial constraints of larger platforms enables people to game with greater time flexibility in a variety of contexts (e.g., Wei & Lu, 2014) and is arguably one of this platform's strongest assets (H.M. Kim, 2013). Findings from a study on mobile gaming contexts demonstrate how the portability of this gaming format enables it to permeate every facet of daily life, citing scenarios that range from the office, to public transit, to the bathroom (Engl & Nacke, 2013).

Closing the Gaps in the Literature on Women and Mobile Gaming

Despite the surge in popularity of gaming among women, relatively little research has focused on gender in the area of mobile gaming. The vast majority of research on gaming, and specifically gaming addiction, is focused on male gamers (Lopez-Fernandez, Williams, Griffiths et al. 2019). A recent meta-analysis on gaming motivation (Hamari & Keronen, 2017) illustrates this point well. Of the 48 studies included in their analyses, only three examined gender as a predictor of gaming motivation and the results showed that gender was the only non-significant predictor of intention to play. This underrepresentation of gender in the studies included for review may be due to the fact that only quantitative studies were included. The majority of studies that focus on female gamers are qualitative (Lopez-Fernandez, Williams, Griffiths et al., 2019). Williams et al. (2008) is another example of how underrepresentation can impede the progress of research, even when making strides in other areas. In a sample of 7,000 online gamers who play the MMO, EverQuest 2 (Williams et al., 2008), analyses revealed that women

played slightly but significantly more than men, and that average number of hours played per week increased steadily with age. Findings from this study are particularly compelling, as they relied on unobtrusively collected (i.e., through the app itself) behavioral data as well as self-report. However, authors reported that men outnumbered women four to one in their sample and proposed exploration of this gender disparity as direction for future research. Additionally, Johnson et al. (2016) noted in their study on gaming motivations, gamer characteristics and video gaming behavior that both women (17.0%) and mobile gamers (5.3%) were underrepresented in their sample and recommended that future studies investigate these populations further. Even when gender is the focus in video game research, mobile gaming is often not included, likely because it is still a relatively emergent technology. For example, in a recent study on general gaming, Lopez-Fernandez, Williams, and Kuss (2019) surveyed an international sample of female gamers ($N = 625$; $M = 26.87$ years of age) about their game play patterns and preferences, gaming motivations, and symptomatology of Internet Gaming Disorder (IGD) and other psychological disorders. While findings from this study offer some valuable insights into the adult female gamer profile, their findings on mobile game play were surprising. In terms of game-play patterns, mobile gaming only accounted for 6.9% ($SD = 14.27$) of time spent playing video games overall. Given the stark contrast of these findings to video game industry reports (e.g., ESA, 2017, 2018, 2019, among others) and a limited number of academic studies that women are playing more video games and more specifically, mobile games than ever before, and the increasing popularity of mobile gaming among women, it is clear that additional research focusing on mobile gaming behavior in this population is needed, if a complete picture of women's mobile gaming behavior is to be achieved.

Current Study

In light of the review above, little is known about the motivations and mobile gaming behaviors of adult female mobile gamers in the U.S. The present study has three aims. The first aim is to add to the relatively scant body of academic literature on female gamers by focusing on a surprisingly underrepresented population in terms of age group (adults), geography (U.S. residents) and preferred gaming platform (mobile). By collecting demographic information from a relatively large sample of a population that has primarily been examined in small focus groups or in proprietary market research contexts, the hope is to create a profile of American, adult, female mobile gamers that is academically rigorous, methodologically transparent, and publicly available.

In addition to creating this demographic profile, the present study aims to examine intrinsic motivations (competence, autonomy, and relatedness) and enjoyment of mobile gaming based on the theoretical framework of SDT. This extends the research of Johnson et al. (2016) by examining the role of these motivations in how much time is spent playing, as well as the work of McCauley et al. (2018) by exclusively focusing on these variables in a mobile gaming context. (H_{1a}) It is expected that mobile gaming frequency and duration will be positively associated with perceptions of competence, autonomy, relatedness, and enjoyment.

In addition to examining the relationship between SDT motivations (competence, autonomy, and relatedness) and enjoyment, the present study expands mobile gaming motivations outside of this framework by including alleviation of boredom and alleviation of stress (psychological detachment and relaxation) in its examination of the relationship between mobile gaming motivations and how much time is spent playing. (H_{1b}) it is predicted that mobile gaming frequency and duration will be positively related to alleviation of boredom and stress.

(H_{1c}) it is predicted that these motivations will retain their significance after controlling for demographic variables. The final aim of this study is to examine the role of alleviation of boredom and stress in the context of altered patterns of mobile gaming behavior due to the current Coronavirus Disease 2019 (COVID-19) pandemic. The extraordinary stress brought on by the existential threat of a global pandemic coupled with the severe and sustained disruptions to daily life (e.g., community lockdowns, remote education, loss of employment, etc.) likely affects the role of mobile gaming as a coping mechanism as well as a leisure activity. Therefore, (H_2) it is predicted that women who report a change in mobile gaming behavior since the arrival of COVID-19 in the U.S. will report greater alleviation of boredom and stress as a motivation for mobile gaming compared to women who report no change.

Methods

Participants

Volunteers who are female, age 18+, English speaking, reside in the U.S. and play mobile games (at least once in the past month) were recruited via posts on several mobile gaming websites, subreddits, and Facebook groups and pages that are frequented by mobile gaming fans. Across these platforms, 399 people accessed the survey link. Of these respondents, 19 did not meet the eligibility criteria during the screening process (two for not agreeing to informed consent, five for not currently residing in the U.S., one for not meeting the minimum age requirement to participate, five for reporting that they do not play mobile games, and six for not meeting the gender requirement to participate) and were exited from the survey. Additionally, of the respondents who answered the gender question in the demographics section of the survey, rather than in the screener section, 10 participants were excluded from analyses for not meeting the gender requirement. Sixteen participants entered the survey but dropped out before

completing screening, so their data was also excluded. The exclusion of these respondents resulted in a total of 354 participants for the final analyses.

Participants' ages ranged from 18 to 77 years (M = 36.79, SD = 12.38). The majority were white, suburban, educated, employed full- or part-time, and married or in a relationship. Just under half (48.2%) reported having children. The detailed breakdown of participant demographic characteristics appears in Table 1.

Procedure

All data was collected online via Qualtrics survey software. Participants who met the selection criteria were directed to a webpage where informed consent was obtained via checkbox. Respondents who did not meet selection criteria were redirected to a webpage where they were informed that they did not meet the selection criteria, and thanked for their time. The survey took approximately 18 minutes to complete (Mdn = 17.98). In exchange for completing the survey, participants had the opportunity to enter a raffle to win one of ten $25 gift cards to either Amazon.com or the app store of their choice (Google, Android, Apple, etc.). To ensure confidentiality, participants entering the raffle were directed to a new webpage where they provided their email address and gift card choice. This allowed survey responses and email addresses to remain separated. Raffle winners were randomly selected and notified via email. Gift cards were sent electronically.

Measures

Mobile Gaming Behavior

Information collected on mobile gaming behavior patterns included questions on typical gaming behaviors such as gaming frequency (e.g., "In a typical week, about how many days do you spend at least 30 minutes playing mobile games?" and "In a typical day, what is the total

amount of time that you spend playing mobile games?") and duration (e.g., "How long is an average mobile gaming session for you?"). Both frequency and duration were captured as a combination of hours and minutes. Other items included lifetime duration (e.g., "How long have you been playing mobile games?"), preferred mobile game genres (e.g., favorite and most frequently played) and devices used to play (e.g., smartphone, tablet).

COVID-19. In anticipation of typical gaming behaviors being disrupted due to the coronavirus pandemic, three items regarding these changes were included. The first item assessed whether participants had experienced a change in their gaming behavior since the arrival of COVID-19 in the U.S. using a yes/no format. The second and third items were qualitative, open-ended questions asking about the nature of the change in gaming behavior (e.g., more, less, etc.), and why they thought the change had occurred.

Motivations for Mobile Gaming

Motivational variables of mobile gaming included competence, autonomy, relatedness, alleviation of boredom and stress, and enjoyment.

Competence, Autonomy, and Relatedness. Subscales from the Player's Experience of Needs Satisfaction (PENS; Ryan et al., 2006) scale were used to assess the main elements of SDT. The wording of items was adapted, similarly to McCauley et al. (2018), in order to measure general gaming experience rather than post-gameplay experiences which was the PENS' original intended use. Sample items included, "I feel competent at mobile gaming" (competence), "Mobile gaming provides me with interesting options and choices" (autonomy), and "I find the relationships I form in mobile games fulfilling" (relatedness). Each subscale contained three items which were answered using a 7-point Likert Scale (1 = do not agree to 7 = strongly agree). Previous studies using these subscales (Ryan et al., 2006; Johnson et al., 2016;

McCauley et al., 2018) reported acceptable to high reliability (α = .68 – .90). In the present study, these subscales demonstrated similar levels of reliability (α = .76 – .85).

Enjoyment. In line with previous research, enjoyment/entertainment was measured by three items adapted from the Intrinsic Motivation Inventory (IMI; McCauley et al., 2017; Ryan et al., 1983). Each item (e.g., "I enjoy playing mobile games"; "Playing mobile games is fun to do"; and "I think playing mobile games is a boring activity") was rated on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree). Previous studies show good to excellent reliability, with alphas ranging from α = .86 – .96 (McCauley et al., 2017; Ryan et al., 2006). In the present study, this scale demonstrated acceptable reliability (α = .75).

Alleviation of Boredom. To measure alleviation of boredom (e.g., "for me, playing mobile games is a good way to kill time"), a three-item subscale taken from a study on the impact of the context of use on mobile gaming (Liu & Li, 2011) was used. Each question is rated on a 7-point Likert scale (1 = strongly disagree to 7 = strongly agree). These items previously demonstrated good internal consistency (α = .89; Liu & Li, 2011). In the present study, this scale demonstrated good reliability (α = .90).

Alleviation of Stress. Alleviation of stress was measured using adapted versions of the psychological detachment (α = .78 – .85) and relaxation (α = .70 – .85) subscales of the Recovery Experience Questionnaire (REQ; Reinecke, 2009a, 2009b; Sonnentag & Fritz, 2007). The wording of the scale was modified to be mobile gaming specific (e.g., "When I play mobile games…"). Each subscale consisted of four items pertaining to recovery experiences (e.g., "I distance myself from my stress" and "I use the time to relax"). Responses were measured on a 5-point Likert scale (1 = does not apply at all to 5 = applies fully) In the present study, both the

psychological detachment (α = .85) and relaxation (α = .88) subscales demonstrated good reliability.

Demographic Characteristics of Mobile Gamers

Demographic information that was collected included age, highest level of education completed, total annual household income, current employment status, occupation, community type (e.g., urban, suburban or rural), relationship status (e.g., in a relationship or not in a relationship), and child status (has children/childless).

Data Analytic Strategy

Likert scales were used to measure all motivation variables in the hypotheses. Therefore, the data was treated as ordinal and non-parametric statistical tests were used for the majority of the analyses (Carifio & Perla, 2007). The rationale for using non-parametric statistics was further justified as the majority of these variables were non-normally distributed (see Table 3 for a detailed description of skewness and kurtosis). Although gaming frequency was captured in terms of weekly gameplay of more than 30 minutes per day and total time spent playing in a typical day, for the primary analyses, gaming frequency was operationalized as the latter. Gaming frequency and duration were found to be positively skewed and were therefore log transformed (Tabachnick & Fidell, 2007). Due to the fact that the data is non-parametric, medians and ranges were reported in addition to means and standard deviations in Table 3. For multi-response questions (i.e., “mark all that apply”) each answer choice was exported from Qualtrics as a separate variable and binary-coded (e.g., 0= not selected, 1=selected). Therefore, response sets of all answer choices for each multi-response question were created and frequency analyses were run.

A priori power analyses were conducted using G*Power to determine adequate sample sizes for the study hypotheses. The review of the literature suggested estimating medium effect sizes for these analyses. Spearman rank correlations ($H_{1a,b}$) were run to determine the strength and direction of the relationships between gaming motivations and gaming frequency and duration. An a priori power analysis for a two-tailed bivariate correlation indicated that a minimum sample size of 84 participants would be needed to reliably detect a medium effect size ($r = 0.30$) at $p = 0.05$ with statistical power of at least 0.80.

Additionally, two multiple hierarchical regressions were run to estimate the relative importance of various individual gaming motivations as well as their combined contribution on game frequency and duration after controlling for demographic variables (H_{1c}). Results of an a priori power analysis using 15 predictor variables (eight potential control variables and seven motivational variables) indicated that in order to reliably detect a medium effect size ($f^2 = 0.15$) at $p = 0.05$ with statistical power of at least 0.80, the minimum sample size should be 199 participants. In order to test whether assumptions for multiple regression were met, both models were checked for nonlinearity, homogeneity of variance, normality of residuals, and multicollinearity. Both models met these assumptions for multiple regression. In order to identify potentially influential multivariate outliers, Mahalanobis distances were calculated for both analyses and compared to chi-squares with the corresponding degrees of freedom in order to calculate the *p*-value of the right-tail of the chi-square distribution. It is recommended that any outliers with a value less than .001 is a multivariate outlier and should be removed prior to running inferential analyses (Statistics Solutions, n.d.). Seven multivariate outliers were identified in the calculation for gaming frequency and gaming duration. These seven cases were removed from further analyses.

Finally, a two-tailed Mann-Whitney U test was run to examine the difference in alleviation of boredom, psychological detachment, and relaxation between those who reported a change in mobile gaming behavior since the arrival of COVID-19 in the U.S. and those who did not (H_2). An a priori power analysis indicated that a minimum sample size of 134 participants would be needed to reliably detect a medium effect size ($d = 0.50$) at $p = 0.05$ with statistical power of 0.80. The final sample size for this study ($N = 354$) exceeds the minimum sample size required for sufficient power across all analyses. All primary analyses were conducted in SPSS Statistics (Version 27) predictive analytics software. Pairwise deletions were used for all analyses.

Results

Descriptive Analyses

Due to the fact that Likert data is non-parametric, medians and ranges were reported in addition to means and standard deviations where appropriate. With the exception of alleviation of stress (psychological detachment and relaxation), which was measured on a 5-pt Likert scale, all measures of motivation were rated on 7-pt Likert scales. In terms of gaming motivations, alleviation of boredom (*Mdn* = 6.34) was rated highest overall, followed by enjoyment (Mdn = 6.07). Out of the three STD motivations, competence was rated the highest (*Mdn* = 6.00) followed by autonomy (*M* = 5.46) and then relatedness (*Mdn* = 3.33). Psychological detachment (Mdn = 3.50) and relaxation (*Mdn* = 3.75) were also highly rated.

The majority of participants (59.4%) reported playing mobile games for at least the past five years and (74.7%) reported playing a mobile game for at least 30 minutes a day, seven days a week. On average, participants played mobile games for roughly two and half hours a day (*M* = 141.76 minutes, *Mdn* =120.00 minutes, *SD* = 124.28) and typical gaming sessions were just over

half an hour long (M = 34.10 minutes, Mdn = 20.00 minutes, SD = 36.15 minutes). Puzzle games were the most popular genre of mobile game (69.7%) followed by casual (39.1%), strategy (36.0%), and word (34.4%) games. The vast majority of participants played mobile games on a smartphone (93.4%), while substantially fewer (37.6%) reported using a tablet to play. These results along with detailed information on demographics and gaming behavior can be found in Table 2.

Categorical demographic variables were also assessed in order to see if there were significant differences in gaming frequency and duration between variable levels. Race was a multi-response question and therefore answers were recoded to account for Latinx/Hispanic origin and multiracial participants. Participants who checked Latinx/Hispanic and no other race were combined with those who checked Latinx/Hispanic and one other race. Participants who checked more than one race or Latinx/Hispanic and two or more other races were recoded as multiracial. Kruskal-Wallis tests were run to see if there were significant differences in categorical variables with three or more categories. Results showed no significant differences in race for gaming frequency $H(4) = 6.39$, $p = .172$, or duration, $H(4) = 6.66$, $p = .155$. Similarly, insignificant results were found for annual income, $H(9) = 14.77$, $p = .097$; $H(9) = 11.17$, $p = .265$, and community type, $H(3) = .81$, $p = .848$; $H(3) = 4.85$, $p = .183$, for gaming frequency and duration, respectively. Mann Whitney tests were run to see if there were significant differences in categorical variables that had two categories. Results for education (below Bachelor's vs. Bachelor's and above), showed no significant difference between categories in terms of gaming frequency, $U = 5755.50$, $p = 0.088$ but did differ significantly for gaming duration, $U = 5428.00$, $p = 0.018$ and was therefore included as a control variable in the gaming duration regression analysis. Results for Mann Whitney analyses showed no significant differences for relationship

status (e.g., in a relationship/not in a relationship), $U = 6365.00$, $p = 0.951$; $U = 6419.50$, $p = 0.963$, employment status (e.g., employed/unemployed), $U = 6486.00$, $p = 0.920$; $U = 6362.50$, $p = 0.886$, and child status (e.g., have children/have no children), $U = 6544.50$, $p = 0.155$; $U = 6528.50$, $p = 0.144$ as a function of gaming frequency and duration, respectively.

Correlational Analyses

It was predicted that mobile gaming frequency and duration would be associated with perceptions of competence, autonomy, relatedness, enjoyment, alleviation of boredom, psychological detachment, and relaxation. Spearman's correlations were run to test this hypothesis. As seen in Table 4, significant positive correlations were found between gaming frequency and competence, autonomy, enjoyment, alleviation of boredom, psychological detachment, and relaxation, but the correlation for relatedness was not significant. Significant correlations were also found between gaming duration and autonomy, relatedness, enjoyment, alleviation of boredom, and relaxation. In addition to evaluating Spearman's correlations between motivational variables and gaming frequency and duration, a Spearman's correlation was run to test the relationship between age (which was also continuous) and gaming frequency and duration. The relationship between age and gaming frequency ($\rho = .06$, $p = 0.387$) and gaming duration ($\rho = -.09$, $p = 0.166$) were not significant.

Regression Analyses

While bivariate correlations reveal the zero-order relationships between how much one plays mobile games and their motivations, these factors do not necessarily operate independently of one other. Additionally, demographic variables may dynamically affect gaming motivations and how much one plays. In order to further examine the role of motivations while controlling for associated demographics in gaming frequency and duration, a multiple regression analysis

was conducted using two hierarchical ordinary least squares (OLS) multiple regression analyses. A three-step hierarchical regression was conducted with gaming frequency as the dependent variable (see Table 5). SDT motivations (competence, autonomy, and relatedness) were entered on step 1, alleviation of boredom and stress (psychological detachment, and relaxation) were entered on step 2, and enjoyment was entered on step 3 as predictor variables. SDT motivations contributed significantly to the regression model, $F(3, 261) = 5.50$, $p = .001$ and accounted for 5.9% of the variance in gaming frequency. The introduction of alleviation of boredom and stress explained an additional 7.7% of the variance, and this change in R^2 was significant, $F(3, 258) = 7.68$, $p < .001$. Finally, the addition of enjoyment explained an additional 3.3% of the variance and this change in R^2 was also significant, $F(1, 257) = 10.35$, $p = .001$. The model containing all seven predictor variables was statistically significant, $F(7, 257) = 7.52$, $p < .001$ and accounted for 17.0% of the variance in gaming frequency. In the model with all variables added, alleviation of boredom ($\beta = .18$, $p = .009$) and enjoyment ($\beta = .25$, $p = .001$) were the only two motivations significantly related to gaming frequency, such that the more alleviation of boredom and enjoyment, the more frequently mobile games were played. Alleviation of boredom accounted for a unique 2.5% of the variance associated with frequency, and enjoyment accounted for 3.8%.

A four-step hierarchical regression was conducted with gaming duration as the dependent variable. Education was entered on step 1, SDT motivations were entered on step 2, alleviation of boredom and stress (psychological detachment and relaxation) were entered on step 3, and enjoyment was entered on step 4. Education contributed significantly to the regression model, $F(1, 232) = 6.14$, $p = .014$ and accounted for 2.6% of the variance in gaming duration. The introduction of SDT motivations explained an additional 4.9% of the variance, and this change in

R^2 was significant, $F(3, 229) = 4.04$, $p = .008$. Adding alleviation of boredom and stress explained an additional 4.3% in variance and this change in R^2 was also significant, $F(3, 226) = 3.71$, $p = .012$. Finally, the addition of enjoyment explained an additional 1.9% of the variance and this change in R^2 was also significant, $F(1, 225) = 4.85$, $p = .029$. The model containing all eight predictor variables was statistically significant, $F(8, 225) = 4.46$, $p < .001$ and accounted for 13.7% of the variance in gaming duration. Autonomy ($\beta = -.19$, $p = .032$) was significantly negatively related to gaming duration, and accounted for 2.0% of the variance. Relatedness ($\beta = .20$, $p = .002$), and enjoyment ($\beta = .19$, $p = .029$) were significantly positively related to gaming duration, with each contributing 4.0%, and 2.1%, respectively (see table Y).

The direction of the relationship between autonomy and gaming duration changed from positive to negative after enjoyment was entered on the last block. Multicollinearity was not indicated based on the tolerance or VIF values of the regression coefficients. However, given that autonomy and enjoyment were both significantly correlated with each other and also with gaming duration (see Table 6), the change in direction and the increase in strength of the predictor variable with the weaker coefficient after the stronger predictor variable (enjoyment) was added is indicative of net or cross-over suppression (Watson et al., 2013), although this finding may be spurious as the B coefficient is very small.

Mann-Whitney *U*

It was predicted that women who reported a change in mobile gaming activity since the arrival of COVID-19 in the U.S. would have higher reported alleviation of stress and boredom compared to people who did not. Of the participants who answered this survey item ($n = 331$), 52.8% ($n = 187$) indicated that their typical mobile gaming patterns had changed since the arrival of COVID-19 in the U.S. Of those who reported a change, 86.6% ($n = 161$) reported that they

were playing mobile games more. Seventeen participants reported playing less, however, four of these respondents reported that their decrease in mobile gaming was due to an increase in gaming on other platforms (e.g., console). The remaining nine respondents gave answers that could not be coded in terms of time spent playing (e.g., "Trying new games," "More inclined to spend money in game," failing to answer the qualitative item, etc.) and were excluded from subsequent analyses.

The Mann-Whitney *U* test showed that there was a significant difference in alleviation of boredom, $U = 5441.50$, $p = 0.005$ between those who reported a change ($Mdn = 6.67$) and those who reported no change ($Mdn = 6.00$). Psychological detachment followed a similar pattern of results, $U = 5728.50$, $p = 0.036$ with those who reported a change scoring significantly higher ($Mdn = 3.75$) than those who reported no change ($Mdn = 3.25$). There was no significant difference in relaxation, $U = 6388.00$, $p = 0.408$ between those who reported a change ($Mdn = 3.75$) and those who did not ($Mdn = 3.75$).

Discussion

The present study aimed to explore the motivations and mobile gaming behaviors of adult female mobile gamers in the U.S during the COVID-19 pandemic. Using the theoretical framework of self-determination theory, the need satisfactions of competence, autonomy, and relatedness were operationalized as intrinsic motivations for mobile game play. Enjoyment was also conceptualized within this framework as an integral element of the intrinsic motivation process (McCauley et al., 2018). Additional constructs of alleviation of boredom and stress (psychological detachment and relaxation) were examined as gaming motivations as they are widely supported in the general videogame literature and are particularly relevant in the context of the unique features of the gaming experience that mobile devices offer. These motivation

variables were examined in relation to total time spent mobile gaming in a typical day, as well as the average duration of play in a typical mobile gaming session. Additionally, alleviation of boredom and stress were identified as mobile gaming motivations that could be especially pertinent to how much one plays mobile games in situations of amplified boredom and stress, such as the current pandemic. The strengths of these motivations were compared between those who reported pandemic-related changes in their mobile gaming behavior and those who did not.

It was predicted that mobile gaming frequency would be positively associated with perceptions of competence, autonomy, relatedness, alleviation of boredom and stress (psychological detachment and relaxation) and enjoyment. All motivations were positively and significantly correlated with gaming frequency with the exception of relatedness. At first glance, these results align well with the findings of prior studies that use the SDT framework to examine mobile gaming motivation (McCauley et al., 2018) as well as studies focused on female gaming behavior (Lucas & Sherry, 2004; Reinecke et al., 2007) that demonstrate support for similar gaming motivations (e.g., challenge, control, enjoyment, diversion, escapism). However, results from the multiple regression reveal that only alleviation of boredom and enjoyment retained their significance, with enjoyment contributing 3.8% of the unique variance over and above the other predictors. This pattern of results is consistent with previous studies in which mobile game use was similarly operationalized (Chen & Leung, 2016) and supports the claim that alleviation of boredom can be a strong motivator for playing mobile games. Additionally, these results extend the findings of several studies that showed enjoyment to be an important predictor of future intention to play mobile games (C.S. Kim et al., 2010) by measuring reports of actual game play that has occurred, rather than hypothetical future play.

As predicted, autonomy, relatedness, enjoyment, alleviation of boredom, and stress (psychological detachment and relaxation) were significantly and positively correlated with gaming duration. However, when all variables were entered in the regression model, only relatedness and enjoyment retained their positive direction and significance and together explained 6.1% of the unique variation in gaming duration. As cited several times in the review of the extant video gaming literature, longer play sessions are historically associated with more intensive game types such as MMOs, which facilitate a variety of social relationships. Despite the complex attitudes that many female gamers have about the social aspect of gaming which may affect how much they play mobile games overall (frequency), for those who are motivated by the social aspect of gaming, it makes sense that social motivation would be significantly related to longer play duration in a single session. Although autonomy also maintained its significance in the final model of the regression for gaming duration, its sign changed direction, typically indicative of a potential suppression effect. However, this may be a spurious finding and thus uninterpretable (Ludlow et al., 2014).

Overall, the models for both gaming frequency and gaming duration were significant, yet they only explained 17.0% and 13.7% of the variance, respectively. While small, this finding is not without precedent. Findings from Johnson et al. (2016) on the relationship between SDT motivations demographic characteristics and game preference type yielded similar results, with their overall model accounting for 12.6% of the variance in hours of play. The results from the regression reveal that the variation in how much one plays overall and in how long one plays in a typical session is likely explained by additional factors.

Given that the study commenced during the pandemic, it was predicted that women who report a change in mobile gaming activity since the arrival of COVID-19 in the U.S. will have

higher reported alleviation of boredom and alleviation of stress in the form of psychological detachment and relaxation compared to people who did not. This hypothesis was partially supported. Alleviation of boredom and psychological detachment were significantly stronger motivations for mobile gaming for women who reported a change in gaming behavior compared to those who did not. For alleviation of stress due to relaxation, there was no significant difference between groups. Conceptually, this makes sense, as the construct of psychological detachment (i.e., "zoning out") as a consequence of mobile gaming may serve a greater need in those going through crisis than would general relaxation, which may appeal to everyone.

Indeed, motivations for playing mobile games can be dependent on contexts that evoke negative feelings of boredom and stress, which people are intrinsically motivated to alleviate. The pandemic has given rise to many situations that would be likely to increase boredom and stress (quarantine, lockdowns, becoming unemployed, etc.). Therefore, it is unsurprising that for those who reported a change in mobile gaming behavior (the vast majority of whom reported an increase in mobile gaming) since the arrival of COVID-19 in the U.S., the utility of mobile gaming as a means to alleviate boredom and stress, particularly through psychological detachment, would be highly rated. The ubiquity of mobile devices highlights the accessibility and utility of mobile gaming as a potentially positive coping practice (e.g., de Kervenoael et al., 2016) that is more relevant than ever. In sum, these results extend the findings on alleviation of boredom and stress as motivations for game play by demonstrating that, in times of extraordinary stress and boredom, for those who find that playing mobile games is effective at alleviating their boredom and stress, their motivation to play and subsequent perception of play time may be amplified.

Strengths, Limitations and Future Research

This study fills a gap in the academic literature by focusing on a population at the intersection of four underrepresented areas in gamer research: U.S. residents, adults, females, and mobile games. Findings from this study improve understanding about motivations for mobile gaming in this population as well as their mobile gaming behavior. This study also contributes to the literature by examining gaming motivations using the SDT framework in a mobile gaming context, which has only recently been explored (McCauley et al, 2018). Finally, this is the first research to examine the impact of COVID-19 on U.S. women's mobile gaming behavior to date.

A major strength of this study was its sample size and recruitment methodology. Although the sampling method was not randomized, recruiting from mobile gaming focused social media groups and websites rather than the university student subject pool made it possible to have a more representative distribution of demographic characteristics than a convenience sample of undergraduate students would have provided. Additionally, recruiting from mobile gaming focused channels increased the likelihood that participants would be genuine fans of mobile gaming, as they were independently motivated to participate in those groups. This affords a degree of authentic enthusiasm for mobile gaming that might not be achieved on a research panel website such as Amazon Turk, where panelists are extrinsically motivated by financial incentives to participate in surveys on a broad range of topics. While this study did have entry into a prize draw as a form of incentive, it is possible to infer from this study's findings that these participants are intrinsically motivated to play mobile games and to share their play experiences.

While the large sample size and intrinsic motivation of participants highlighted this study's strengths, the sample noticeably lacked racial/ethnic diversity, with 79.9% of respondents reporting White, Non-Hispanic or Latinx origin. The ability to read and understand English was

also an inclusion criterion. This disparity may reflect recruitment methods, as it is possible that participants who join mobile gaming enthusiast communities on the internet may skew more heavily white, although without being able to access information on the demographic breakdown of these sites, only speculation is possible. Even so, future research would benefit from including non-digital recruitment strategies such as posting flyers and word-of-mouth in order to achieve a more diverse sample. Additionally, if resources allow for it, future questionnaires should be offered in more languages than English, to ensure that non-English speaking U.S. mobile gamers are represented as well. A more diverse sample could potentially increase the generalizability of the findings to adult female U.S. mobile gamers across all races and ethnicities.

In terms of generalizability of findings, this study limited its target population to female gamers and therefore no inferences about gender differences can be made. Although findings on gaming motivations from this study are supported by previous literature that focused on gender-related gaming motivations (e.g., Hartmann & Klimmt, 2006; Lucas & Sherry, 2004; Reinecke et al., 2007), future studies should recruit a gender-inclusive sample to examine whether these gender differences in motivation persist in mobile gaming contexts specifically. Furthermore, gender inclusivity in recruitment would enable researchers to capture gaming motivation across gender identities beyond the binary, thus increasing representation of additional marginalized groups.

Another major limitation to the study however is its cross-sectional nature. A common limitation of cross-sectional studies is their inability to capture causal relationships, and thereby preclude the inference of a causal direction in the relationship between gaming motivations and how much one plays. This limitation has particular implications for enjoyment. Out of all the motivations, only enjoyment retained its significance in both hierarchical regressions and was the

most important predictor of gaming frequency. However, without evidence of a causal relationship, it is impossible to know whether enjoyment, along with the other motivations, is an antecedent to game play, or if it is an outcome of game play or an outcome of other motivations, as previous literature has suggested (e.g., H. Kim et al., 2018; Liu & Li, 2011; McCauley et al., 2018). And indeed, it is most likely the relations are reciprocal over time, which a longitudinal study could examine more fully. Future studies should examine the potential mediating effect of enjoyment on the relationship between other gaming motivations and how much one plays.

The cross-sectional design of this study also presents a limitation to its interpretation of pandemic-related changes in gaming behavior. Its original aim was to capture typical mobile gaming behavior, but due to the arrival of the pandemic in the U.S. shortly before the period when data was collected, many people's typical behavior was dramatically altered. It would have been ideal to conduct a longitudinal study to capture these behavior changes, as longitudinal studies are generally superior to cross sectional studies in examining ongoing behavior. Unfortunately, the average American could not have anticipated the onset and scope of the pandemic. The best option was to add quantitative and qualitative items relying on retrospective self-report to the survey. Analysis of this data yielded interesting results, but without having a baseline of typical gaming behavior from the sample to compare them to, the conclusions that can be drawn are limited.

More generally, self-report data has limitations, as recalling a specific amount of time spent doing any activity on a regular basis will be a rough approximation at best (McCauley et al., 2017; 2018). This is compounded by the knowledge that a strong motivation for mobile gaming is zoning out and killing time (Wei & Lu, 2014), which could potentially distort one's perception of how much time is spent playing. One way to improve the accuracy of the

measurement of gaming behavior is to use smartphone behavior tracking applications. While these applications have their own limitations, it is likely that they will provide more accurate data and serve as a behavioral measure that does not rely on self-report. Where previously, only large game development companies and market research firms had the resources available to monitor game usage, the acceleration of technology has reduced the cost and time associated with developing these applications making them more accessible to academic researchers. Future research should use these tools to gain insight into the potential discrepancy between perceived and actual game play time, and how motivational and contextual variables might influence this relationship.

While the goal of the study was to examine motivation to play mobile games, frequency and duration of play might be affected by other variables. Indeed, the low variance explained across analyses suggests that there are other variables that may help explain the remaining variance in mobile gaming frequency and duration. For example, context of use may be captured in several ways that that may have important implications for frequency and duration of mobile game play. Location (e.g., at home, standing in line, commuting, etc.) and time of day (after school/work, at bedtime, etc.) as well as game mode (e.g., single vs. multiplayer) may paint a more complete picture of what motivates mobile gaming overall as well as how long one plays in a single sitting. Gamer identity (e.g., "Do you identify as a gamer?") may also impact social motivations and time spent playing. While this study collected data on preferred games genres, all-time favorite and current favorite mobile games, as well as current, most frequently played mobile game, these were not included in the regressions. In addition, context of use, time of day for mobile game play, gamer identity, and preferred player mode were not captured. Furthermore, with regards to player mode, it is not necessarily sufficient to infer player mode

from particular mobile games, as many contain capabilities for both modes, and formerly single player games are increasingly adopting mobile social elements. Future research should explicitly capture preferred mode of mobile game play, context of use, and time of day of play in order to examine these factors more in-depth.

Other extrinsic motivations such as in-game rewards for more time spent playing and peer pressure (e.g., gaining rewards for recruiting friends to play) should also be evaluated as possible predictors of mobile gaming frequency and duration. Additionally, the use of an experimental design could help in determining the causal relationship between motivations and time spent playing. In this design, certain game features would be manipulated to alter levels of intrinsic and extrinsic motivations, thus helping to determine the threshold at which games are no longer enjoyable due to intrinsic motivations and result in abandonment of the game. Conversely, this design may also result in continuation of play despite it no longer being enjoyable, which could be a sign of problematic game play. In addition to identifying problematic behavior in players, findings from such studies may also help to identify certain exploitative practices by game developers that result in negative psychological consequences for players and lead to advocacy for game designs that minimize psychological harm and maximize psychological wellbeing.

Conclusion

The aim of this study was to gain insight into the gaming motivations and behaviors of adult, female mobile gamers. It also sought to capture how the onset of the pandemic may have altered this population's mobile gaming behavior in terms of their gaming motivations and how much they play. Results from the study revealed that overall, women are primarily motivated to play by alleviation of boredom and enjoyment, but how long they typically play in one sitting is

motivated by autonomy, relatedness, and enjoyment. The pandemic amplified the motivations of alleviation of boredom and stress as well as increased play for most who reported that their game play was affected.

As the ubiquity of mobile gaming continues to increase along with the prevalence of smartphones and tablets, the positive and negative implications of mobile gaming will become more apparent and far-reaching. Therefore, it is imperative to learn more about the psychological profile of mobile gaming's largest user base and the psychological and health correlates of their mobile gaming activity. With this knowledge, it may be possible to proactively capitalize on mobile gaming's positive consequences and minimize its negative consequences. The hope is that findings from this research will add to the body of knowledge on this population of gamers, and to encourage future research, not only to better understand them as a cohort, but to anticipate the potential impact of gaming on future generations of female mobile gamers as they age into this demographic.

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Tables

Table 1

Participant Demographics: Basic

Variables		*N*	%
Race [a]	White, non-Hispanic	199	79.9
	Asian, non-Hispanic	14	5.6
	Hispanic, Latinx, or Spanish Origin	18	7.2
	Black or African American, non-Hispanic	7	2.8
	Multiracial	9	3.6
	Prefer not to answer	2	1.0
Employment Status [a]	Employed, working 40 or more hours per week	88	35.5
	Employed, working 1-39 hours per week	72	29.0
	Homemaker	32	12.9
	Not employed, not looking for work	31	12.5
	Not employed, looking for work	16	6.5
	Self-employed	16	6.5
	Retired	6	2.4
	Disabled, not able to work	6	2.4
Occupation*[a]	Education, Training, and Library	51	21.2%
	Other (please specify)	38	15.8%

Variables		*N*	%
	Student	32	13.3%
	Business and Financial Operations	28	11.6%
	Office and Administrative Support	27	11.2%
	Management	23	9.5%
	Sales	16	6.6%
	Healthcare Practitioners and Technicians	15	6.2%
	Healthcare Support	15	6.2%
Education*[b]	Bachelor's degree	75	30.5
	Some college	49	19.9
	Master's degree	46	18.7
	High school diploma or equivalent	23	9.3
	Some post undergraduate work	23	9.3

*Only responses that exceed 5% are shown. [a]Percentages of cases. [b]Valid percentages reported for $N = 249$ participants.

Table 2

Participant Demographics: Gaming Behavior

Survey items	*N*	%	*Mdn* (*Range*)
In a typical week, about how many days do you spend at least 30 minutes playing mobile games?*			
7 days	201	74.7	
6 days	18	6.7	
In a typical day, what is the total time that you spend playing mobile games? (minutes)			20 (1798)
How long is an average mobile gaming session for you? (minutes)			120 (890)
How long have you been playing mobile games?*a			
5+ years	199	59.4	
2 to 3 years	39	11.6	
3 to 4 years	38	11.3	
4 to 5 years	28	8.4	
Which types of mobile games are your favorite?**			
Puzzle	221	69.7	
Casual	124	39.1	
Strategy	114	36.0	
Word	112	35.3	
Simulation	109	34.4	
Adventure	99	31.2	
Card	94	29.7	
Board	72	22.7	

Survey items	*N*	%	*Mdn* (*Range*)
Trivia	71	22.4	
Role playing	71	22.4	
Which types of mobile games do you play most frequently?**			
Puzzle	126	39.9	
Simulation	87	27.5	
Casual	86	27.2	
Which types of devices do you play mobile games on?*			
Smartphone	313	93.4	
Tablet	126	37.6	

*Only responses that exceed 5% are shown. **Only responses that exceed 20% are shown.
[a]Valid percentages reported for $N = 335$ participants.

Table 3

Descriptive Statistics for Variables of Interest

Variable	M	SD	Mdn	IQR	Min	Max	Skew	Kurtosis
Competence	6.04	.88	6.00	1.33	3.00	7.00	-1.01	1.10
Autonomy	5.46	1.09	5.67	1.67	2.00	7.00	-.70	.44
Relatedness	3.30	1.20	3.33	1.33	1.00	6.67	.15	-.050
Enjoyment	6.07	.75	6.00	1.00	2.67	7.00	-.96	1.70
Alleviation of boredom	6.34	.82	6.33	1.00	1.00	7.00	-2.78	13.92
Psychological detachment	3.44	.86	3.50	1.00	1.00	5.00	-.22	-.01
Relaxation	3.76	.79	3.75	1.00	1.25	5.00	-.29	-.01
Gaming Frequency	141.76	124.28	120.00	120.00	10.00	900.00	2.72	10.81
Gaming Duration	34.10	36.15	20.00	15.00	2.00	240.00	3.02	11.25

Note; IQR = inter-quartile range; Min/Max = range of mean scores

Table 4

Spearman's 2-tailed Correlation Matrix for Motivations and Gaming Frequency and Duration

Variable	1	2	3	4	5	6	7	8	9
1. Age	--								
2. Competence	.05	--							
3. Autonomy	.14*	.42**	--						
4. Relatedness	-.06	.11	.31**	--					
5. Enjoyment	.07	.27**	.58**	.16*	--				
6. Alleviation of boredom	.15*	.25**	.32**	.15*	.49**	--			
7. Psychological detachment	.09	.17**	.27**	.15*	.26**	.33**	--		
8. Relaxation	.03	.21**	.37**	.14*	.42**	.37**	.56**	--	
9. Gaming Frequency	.06	.15*	.23**	.09	.39**	.35**	.20**	.25**	--
10. Gaming Duration	-.09	.06	.14*	.16*	.25**	.20**	.11	.21**	.56**

Note: correlations were calculated using pairwise deletions * $p < .05$, ** $p < .0.01$ level (2-tailed). $N = 234$ to 238

Table 5

Summary of Hierarchical Regression Analysis for Variables Predicting Gaming Frequency

Variables						95.0% CI for B				
	B	SE	β	*t*	*p*	LL	UL	sr^2	R^2	ΔR^2
Step 1									.06	.06
Competence	.04	.03	.10	1.56	.120	-.01	.10	.01		
Autonomy	.05	.02	.15	2.20	.029	.01	.10	.02		
Relatedness	.02	.02	.07	1.09	.279	-.02	.06	.004		
Step 2									.14	.08
Competence	.02	.03	.05	.84	.404	-.03	.07	.003		
Autonomy	.02	.02	.06	.88	.382	-.03	.07	.003		
Relatedness	.01	.02	.05	.78	.435	-.02	.05	.002		
Alleviation of boredom	.14	.04	.25	3.90	.000	.07	.21	.06		
Psychological detachment	.02	.03	.06	.83	.407	-.03	.08	.003		
Relaxation	.03	.03	.06	.88	.382	-.04	.09	.003		
Step 3									.17	.03
Competence	.02	.03	.05	.80	.425	-.03	.07	.003		
Autonomy	-.02	.03	-.05	-.64	.524	-.07	.03	.002		
Relatedness	.02	.02	.05	.91	.363	-.02	.05	.033		

Variables						95.0% CI for B				
	B	SE	β	*t*	*p*	LL	UL	sr^2	R^2	ΔR^2
Alleviation of boredom	.10	.04	.18	2.62	.009	.02	.17	.03		
Psychological detachment	.03	.03	.06	.93	.354	-.03	.08	.003		
Relaxation	.01	.03	.03	.40	.687	-.05	.08	.001		
Enjoyment	.13	.04	.25	3.22	.001	.05	.20	.04		

Notes: Step 1 $F(3, 261) = 5.50$, $p = .001$, Step 2 $F(6, 258) = 6.80$, $p < .001$, Step 3 $F(7, 257) = 7.52$, $p < .001$

Table 6

Summary of Hierarchical Regression Analysis for Variables Predicting Gaming Duration

Variables						95.0% CI for B				
	B	SE	β	*t*	*p*	LL	UL	sr^2	R^2	ΔR^2
Step 1									.03	.03
Education	-.11	.05	-.16	-2.48	.014	-.20	-.02	.03		
Step 2									.08	.05
Education	-.09	.04	-.13	-2.09	.038	-.18	-.01	.02		
Competence	.03	.03	.08	1.16	.247	-.02	.08	.01		
Autonomy	.00	.02	-.01	-.18	.858	-.05	.04	.0001		
Relatedness	.06	.02	.21	3.07	.002	.02	.09	.04		
Step 3									.12	.04
Education	-.08	.04	-.12	-1.78	.076	-.17	.01	.01		
Competence	.02	.03	.05	.70	.485	-.03	.07	.002		
Autonomy	-.03	.02	-.10	-1.25	.211	-.07	.02	-.01		
Relatedness	.05	.02	.19	2.93	.004	.02	.09	.04		
Alleviation of boredom	.06	.04	.11	1.55	.123	-.02	.13	.01		
Psychological detachment	.000	.03	.00	.00	.998	-.06	.06	.000		
Relaxation	.07	.03	.17	2.08	.038	.00	.14	.02		

Variables						95.0% CI for B				
	B	SE	β	*t*	*p*	LL	UL	sr^2	R^2	ΔR^2
Step 4									.14	.02
Education	-.07	.04	-.11	-1.65	.101	-.16	.01	.01		
Competence	.02	.03	.05	.68	.498	-.03	.07	.002		
Autonomy	-.06	.03	-.19	-2.16	.032	-.11	.00	.02		
Relatedness	.05	.02	.20	3.06	.002	.02	.09	.04		
Alleviation of boredom	.03	.04	.06	.74	.459	-.05	.10	.002		
Psychological detachment	.00	.03	.01	.13	.898	-.05	.06	.0001		
Relaxation	.06	.04	.14	1.76	.080	-.01	.13	.01		
Enjoyment	.09	.04	.19	2.20	.029	.01	.17	.02		

Notes: Step 1 $F(1, 232) = 6.14$, $p = .014$, Step 2 $F(4, 229) = 4.63$, $p = .001$, Step 3 $F(7, 226) = 4.33$, $p < .001$, Step 4 $F(8, 225) = 4.46$, $p < .001$