Do People Use Games to Compensate for Psychological Needs During Crises? A Mixed-Methods Study of Gaming During COVID-19 Lockdowns

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ABSTRACT

Do people use games to cope with adverse life events and crises? Research informed by self-determination theory proposes that people might compensate for thwarted basic psychological needs in daily life by seeking out games that satisfy those lacking needs. To test this, we conducted a preregistered mixed-method survey study (n = 285) on people's gaming behaviours and need states during early stages of the COVID-19 pandemic (May 2020). We found qualitative evidence that gaming was an often actively sought out and successful means of replenishing particular needs, but one that could 'backfire' for some through an appraisal process discounting gaming as 'unreal'. Meanwhile, contrary to our predictions, the quantitative data showed a "rich get richer, poor get poorer" pattern: need satisfaction in daily life positively correlated with need satisfaction in games. We derive methodological considerations and propose three potential explanations for this contradictory data pattern to pursue in future research.

CCS CONCEPTS

• **Human-centered computing → HCI theory, concepts and models**.

KEYWORDS

coping, video games, basic needs, compensation, mixed methods, Covid-19

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1 INTRODUCTION

Crises and disasters can severely impact people's well-being, leading them to engage in coping activities [62]. In the case of the ongoing COVID-19 pandemic, frequently mentioned possible negative mental health effects include increased anxiety, stress, depression, and loneliness due to uncertainty, loss, increased caring responsibilities, economic hardship, and social isolation [19]. This has prompted calls among the HCI community to explore how interactive technologies can be used to mitigate adverse mental health impacts and other issues of the COVID-19 pandemic [11].

People already use gaming as a coping and recovery mechanism in everyday life, be it to recover from stress, lift their mood, replenish thwarted psychological needs, temporarily escape from distressing situations, or build social support [20, 31, 51, 54]. One of the most frequently used psychological theories to explain the coping potential of gaming has been self-determination theory (SDT) [31]. A general theory of human motivation and well-being, SDT posits that human well-being depends on the satisfaction of basic psychological needs for autonomy (experiencing that you endorse and 'own' your actions), competence (feeling effective in your activities and interactions), and relatedness (feeling connected and involved with others and having a sense of belonging), which can occur in daily life as much as 'in-game' [57].

At the start of the pandemic, a wide range of opinion pieces, editorials, and anecdotal news stories thus speculated that games helped people cope with the pandemic. Specifically, games like *Animal Crossing: New Horizons* [43] might let players socialise with virtual and real others in-game, provide an open world to explore and achievable tasks to master, thereby replenishing basic needs that were frustrated by social isolation measures in real life [14, 33]. The gaming industry latched onto this and similar ideas with the social media campaign #playaparttogether, which presented online gameplay as a way to promote WHO health advice and foster social connections during COVID-19 [64]. However, such claims were based on little rigorous evidence as to whether gaming was actually actively sought out by people to cope with the stresses of COVID-19 and replenish needs possibly thwarted by the pandemic.

We therefore wanted to explore whether people's psychological state during crises leads to changes in what games they play and how—that is, whether people selectively exposed themselves to gaming to cope with crises, and if so, how. We conducted a

preregistered, mixed-method survey study (n = 285) using the first population-wide social isolation measures introduced during the COVID-19 pandemic in the Spring of 2020 as a backdrop against which to assess (a) whether their psychological need satisfaction/frustration levels in everyday life correlates with selecting games that provide particular kinds of need satisfaction, and (b) what game features and gaming practices are associated with particular kinds of need satisfaction. Qualitative data supported that people actively used gaming to replenish basic needs, while quantitative data showed a positive feedback loop or 'Matthew effect' [39]: for each need, higher need satisfaction in daily life correlated with experiencing greater satisfaction of that need in gaming. We discuss possible explanations for this data pattern and identify need-satisfying mechanisms in gameplay.

2 BACKGROUND

2.1 Gaming, well-being, and self-determination theory

As noted, a rich and growing body of literature supports that digital entertainment media use can both directly support well-being [23, 31, 65, 66] and help users actively cope with and recover from adverse life events [9, 20, 50, 51, 53, 54].

When it comes to conceptualising psycho-social well-being and its antecedents, self-determination theory (SDT) counts among the presently most influential and well-supported general psychological theories [56, 57]. Importantly, life experiences can both satisfy or frustrate a need, that is, actively add to, or detract from, our present state of need satiation. While early SDT research focused solely on need satisfaction, recent lines of work support that need satisfaction and need frustration are distinct experiences: an actively autonomy-frustrating experience is 'more' and different than the mere absence of autonomy-satisfying experiences [73].

In HCI research, SDT has similarly become one the most frequently used and well-validated theories employed both for explaining the potential positive impacts of interactive system use and design on well-being [a.k.a. "positive computing" 6], and for explaining the motivational pull and well-being impacts of digital games [48, 67]. However, as pointed out in a recent review [67], uses of SDT remain often superficial and opportunistic, leaving important questions unanswered. We look to address two such broader questions in the current work.

The first concerns gaming as a compensatory behavior. SDT researchers variously predict that if people experience need frustration in their everyday life, they actively seek out compensatory activities that promise to replenish the frustrated need [71, 73]. Evidence suggests that this does occur, at least in some contexts; Sheldon and Gunz [60], for example, found that low need satisfaction was associated with greater motivation to acquire those missing experiences.

Unlike 'purely' intrinsically motivated behaviour, such compensatory behaviour is seen to be less flexible and apt, and can therefore lead to negative effects [73]. Under the header "need density hypothesis" [55], several researchers have posited that well-designed video games deliver need satisfaction with a higher density and reliability than everyday life, inviting their compensatory use in need-thwarting life situations. There is some evidence that games can replenish thwarted needs after a short play session [70]. Other studies suggest however that compensatory gaming can have adverse effects like obsessive use [1]. Recent work is exploring potential moderators (like stress, social vs. solitary play styles, or harmonious vs. obsessive engagement) to explain when and why compensatory gaming may have positive or negative effects [30], but is in early stages.

In short, there is evidence that gaming can compensate for thwarted needs, with possible positive and negative follow-on effects. However, a crucial untested aspect of compensatory gaming is whether people indeed actively choose games and gaming styles to compensate for thwarted needs. Past research has looked into effects of gameplay on need satisfaction, not of need states on media selection. Related work on such "selective exposure" has mainly focused on *mood* management not *need* management [35]. The recent Recovery and Resilience in Entertaining Media Use (R^2EM) model [54] proposes that people with depleted needs may actively choose media that provide recovery experiences of mastery, a claim in line with the SDT need density hypothesis on competence. A study of general entertainment media use supports this link, finding that higher stress correlated with less "eudaimonic" (roughly, need-satisfying) media use, and higher anxiety with more eudaimonic media use [13]. In the current study, we seek to extend this proposed link in the context of games.

A second unanswered question in present games HCI research concerns the mechanisms of need satisfaction in games. The vast majority of SDT research on games has been quantitative and theory-testing [67]. Thus, we have extensive evidence that games, and certain game features, can satisfy one or more basic needs, but only limited insight into the mechanisms via which this occurs.

2.2 COVID-19, well-being, and gaming

Early into the COVID-19 pandemic, public health officials, researchers, and the media voiced concern about a possible mental health epidemic following in the footsteps of the pandemic due to stress and isolation [17, 49]. The evidence since has been more nuanced: While some systematic reviews have found evidence for reduced mental health [19], especially for healthcare professionals, the possibly most comprehensive and up-to-date meta-analysis of the "Living Systematic Review of Mental Health in COVID-19" (https://www.depressd.ca/covid-19-mental-health) finds no evidence for a population-wide negative effect of COVID-19 on mental health [63].

Be that as it may, the rapidly growing literature on gaming during COVID-19 can be largely split into two groups: one concerned with potential negative mental health effects, the other with positive ones. This mirrors the structure of the public and scientific debate on technology and media use [13, 47, 61].

On the one side, researchers speculated early into the pandemic that problematic game use may rise during the pandemic, due to fewer available activities and higher stress during lockdown [5, 27, 29]. Some emerging evidence supports these concerns. Gaming does appear to have increased during the pandemic, with one study finding an increase of approximately 20% in daily peak players on Steam games from April–May 2020 compared to 2019, but also that the increase receded to 5–10% by June and remained roughly

stable for the remainder of the year [75]. This increased quantity of gaming may indeed have had negative effects for some: initial findings suggest small-to-moderate increases in dysregulated and excessive gaming [44, 77].

Other researchers emphasized potential positive impacts of games on well-being during the pandemic, explaining increased playtime as healthy coping. Marston and Kowert [38] advocated for gaming during COVID-19 to support social connection and psychological healing, particularly for older adults and first responders who may be dealing with post-traumatic stress. An analysis of Twitter posts and subsequent survey found that players used digital games to recreate social events not possible to hold out-of-game due to the pandemic, cope with being alone, and connect with distant friends and family [28]. Similarly, Yuan and colleagues [78] found that players used remote tabletop gaming during COVID-19 to create shared spaces, shared understanding, and shared time. In a survey study by Barr and Copeland-Stewart [3], the majority of players reported increased game use and positive mental health impacts like cognitive stimulation and opportunities to socialise, connecting their findings to potential SDT explanations. A recent interview study among Danish teenagers paints a similar picture [4]. A German survey found a negative correlation between particularly social gaming and perceived loneliness during lockdown [42]. In contrast, an Italian survey found that increased play of *Animal Crossing: New Horizons* was associated with higher anxiety and loneliness [34], which the authors connected to possible negative pathways of compensatory behaviour.

In summary, there has been much speculation and mixed evidence about positive and negative well-being effects of gaming under adverse circumstances and the COVID-19 pandemic in particular. Data supports that gaming use has increased during lockdown, mitigating loneliness and social disconnection. Grounded in SDT, more general research proposes that such compensatory gaming (like other compensatory behaviours) can replenish needs (and thus, improve well-being), but also lead to obsessive engagement. One recent qualitative study of gaming during the COVID-19 pandemic [3] explicitly proposed SDT as a possible explanatory framework for some of the positive well-being effects it observed. However, we do not know (a) whether people during crises actually actively select different kinds of games and gaming forms to compensate for frustrated psychological needs, and (b) what the potential mechanisms and features of gaming are by which it may compensate for thwarted needs during adverse life circumstances.

2.3 Present Study

The present paper reports a part of a larger mixed-method survey study on the relation of gaming and mental health during the COVID-19 pandemic (see https://osf.io/vp7ye). Due to the size and richness of the underlying study, we here focus on results specifically speaking to the SDT-related concerns outlined above. Concretely, we focus on two research questions.

RQ1 asks: Do people actively select games and gameplay behaviours that compensate for thwarted needs in daily life during isolation periods, as predicted by SDT? This question speaks to the aforementioned lack of knowledge about compensatory game selection. If people actively choose gaming to compensate for thwarted needs, one would expect that the less satisfied (or more frustrated) a given need is in their daily life, the more they should select games that satisfy this given need. We expressly distinguished need satisfaction and need frustration as the literature suggested that these are distinct, rather than two ends of a spectrum. We preregistered this need compensation hypothesis as follows. We note that the hypotheses have been slightly reworded from the preregistration (changing "importance placed on satisfying/frustrating that need in gaming" to "satisfaction/frustration of that need in gaming"); this change was made to better align the hypotheses' wording with the phrasing of our measure, which assesses the *experience* of need satisfaction in games and is unchanged from the preregistration.

- **H1a–c**: Satisfaction of autonomy (H1a), competence (H1b), and relatedness (H1c) in daily life will be negatively related to satisfaction of that need in gaming.
- **H2a–c**: Frustration of autonomy (H2a), competence (H2b), and relatedness (H2c) in daily life will be positively related to satisfaction of that need in gaming.

RQ2 asks: How do people use and adapt gaming to manage their need satisfaction? This speaks to our lack of knowledge about the mechanisms and features of gaming that support a compensatory function.

3 METHOD

To address our questions, we adopted a mixed-method approach, testing the hypotheses of RQ1 quantitatively and identifying features and mechanisms supporting compensation (RQ2) qualitatively. We recruited participants to fill out an online survey including both quantitative measures and open-ended questions about their daily life and gaming during the previous week. The time frame of one week appeared long enough to capture differential choices in gaming and be robust to fluctuations in affect and events, and short and recent enough to be remembered with some accuracy. In a given day, participants may just not have had time to play and be strongly affected by events of that day, while a month-long frame was more likely to produce generalised narratives.

Our study received ethical approval from Queen Mary University of London (QMERC2020/26) and was preregistered on OSF.io. The preregistration and study materials (including power analysis, questionnaire, anonymised survey responses, quantitative analysis script and qualitative coding tree and coding project file) can be found at https://osf.io/vp7ye.

3.1 Recruitment and Sample

We recruited participants via social network platforms Facebook, Twitter, and Reddit to complete an online survey in Qualtrics, specifying in the advertisement that players should play one or more hours of digital/non-digital games during an average week. The survey consisted of 55 Likert scale questions and 9 open response questions, and had a median completion time of 17 minutes. Data collection began on May 4, 2020 and was scheduled to conclude either after two weeks or upon reaching our minimum adjusted sample size, whichever came later. As we achieved a sufficiently large sample within the 2-week period, data collection ended on May 18, 2020.

At the end of the survey, participants were presented with the option to leave their email address in order to either enter a raffle for one of three £20 Amazon gift cards, or opt-in to an optional second wave of the same survey in order to examine within-person effects, or both. Data from wave 2 of the study have not been collected as of the time of writing.

A total of 437 people clicked the link to begin the survey. Of these, 292 completed the entire survey; the majority of the remainder did not proceed past the consent form. Of the 293 eligible participants completing the survey, 285 correctly answered our careless response check and were therefore included in the final sample. This sample included participants from 37 unique countries, with the majority coming from the UK (58%) and the US (16%). Of the 285 included participants, 125 identified as female, 130 as male, and 29 identified as non-binary or preferred to specify another gender. The mean age was 31.6 years (SD = 11.6). Participants reported playing a mean of 14.2 hours of games per week (min: 1, max: 26+).

3.2 Quantitative Method

3.2.1 Sample Size Calculation. We identified a minimum unadjusted sample size of 215 by conducting a simulation study using Spearman's ρ correlation analyses with a smallest effect size of interest of $\rho = .2$ (see preregistration for further details), which yielded an observed power of .81. We incorporated a safety margin of 20% for participants who responded incorrectly to the careless response check or were otherwise ineligible, resulting in a final required sample of 269, which our final valid sample of 285 exceeded.

3.2.2 Measures. Need satisfaction in daily life: Participants completed the Basic Psychological Need Satisfaction and Frustration Scale [BPNSFS; 7], which contains distinct subscales for need satisfaction and frustration, and has been extensively validated across cultures [7]. The BPNSFS contains a total of 24 items, with 4-item subscales for satisfaction and frustration of each basic need (autonomy, competence and relatedness, thus 6 subscales in total), with each item rated from 1 (not at all true) to 5 (completely true). People were prompted to rate "the kind of experiences you've had in your daily life in the last week" using these scale items. Reliability was good-to-excellent for all subscales, with most participants reporting generally high need satisfaction and low need frustration.

Need satisfaction in video games: Video game need satisfaction was measured using the Ubisoft Perceived Experience Questionnaire [UPEQ; 2], which contains 21 items measuring satisfaction (but not frustration) of autonomy (6 items), competence (6 items), and relatedness (9 items). We chose UPEQ instead of the alternative Player Experience of Need Satisfaction scale [58] because of known psychometric flaws of PENS that UPEQ avoids [22] and since UPEQ notably contains three items in the relatedness subscale that refer to connections with non-player characters: thus, again unlike PENS, it allows for capturing forms of relatedness satisfaction occurring in non-multiplayer contexts [69]. To maintain consistency with the BPNSFS, items were adapted to use the same 5-pt Likert scale ranging from "not at all true" to "completely true". People responded to the prompt "During the last week, I played games in which ...", followed by each scale item (e.g. "I was free to decide how I wanted to play"). Reliability was high for all three subscales. Descriptive statistics for both UPEQ and the BPNSFS can be found in Table 1.

3.2.3 Analysis. To account for the ordinal nature of our measures, all hypothesized relationships were tested using Spearman's ρ correlation tests. Exploratory analyses show that results of Spearman's ρ tests do not meaningfully differ from Pearson's r, and thus the values can be interpreted similarly. Further sensitivity checks find that results and interpretations are largely similar if using linear regression models with needs in daily life as predictors and needs in games as outcomes, controlling for age and gender (see supplementary materials). For simplicity, we therefore report only Spearman's ρ in line with our preregistration.

For interpreting results, we specified a smallest effect size of interest of $\rho = .2$, a value that has previously been proposed as an anchor for minimally important differences in media effects research [15]. In this study, we used this effect size as an estimate of the smallest relationship that would be considered 'minimally important' by players.

We generated 95% confidence intervals using 5000 bias-corrected and accelerated bootstrap samples, and based our preregistered inference strategy on upper (UB) and lower (LB) bounds of these confidence intervals. This process acts as a simplified and slightly more conservative variation of a two one-sided test (TOST) equivalence test [32]. The inference anchors were as follows:

- If LB > .2, we will interpret the result as evidence of a practically significant effect
- If LB > 0 and UB > 0.2, evidence of an effect that may be practically significant
- If LB > 0 and UB < 0.2, we will interpret the result as evidence that there is an effect, but that it is not practically significant
- If LB > −0.2 and UB < 0.2, we will interpret the result as evidence that there is no practically significant effect
- If LB < −0.2 and UB > 0.2, we will interpret the result as inconclusive

3.3 Qualitative Method

3.3.1 Sample. Data for the qualitative analysis consisted of the answers to the nine open response questions (see supplementary materials on the OSF for exact item wording). These asked participants to list up to three games they had been playing recently, and describe what made each of those games appealing. Participants were then asked (1) how (if at all) their gaming activities had changed since the introduction of social isolation measures, (2) how (if at all) gaming had affected their mood, and (3) how (if at all) their attitude toward gaming has changed. These items were designed to generate rich data on the wider set of research questions of the overall study; pilot data confirmed that they prompted useful responses for all questions, including our present questions on need satisfaction.

The 285 participant responses totalled 67,000 words. Qualitative analysis proceeded until 90% saturation was reached on RQ1 (i.e., for every 10 coded segments, no more than 1 would be a new code). We reached saturation and stopped further analysis at 155 participant responses (38,000 words). The subsample for analysis was generated by randomly selecting participants scoring low (≥ 1 SD below mean), medium (within 1 SD of mean), and high (≥ 1 SD above mean) on the measures in the study, in waves of 45 participants at a time (see preregistration for further details).

Table 1: Descriptive statistics

	Mean	SD	Scale Reliability (ω_h [95% CI])
Demographics			
Age	31.6	11.6	N/A
Daily life			
Autonomy satisfaction	3.14	.90	.82 [.78, .85]
Autonomy frustration	2.85	.95	.78 [.74, .82]
Competence satisfaction	3.33	.96	.90 [.88, .92]
Competence frustration	2.82	1.11	.82 [.78, .86]
Relatedness satisfaction	3.91	.89	.86 [.83, .90]
Relatedness frustration	1.97	.92	.87 [.84, .89]
Games			
Autonomy satisfaction	4.21	.60	.78 [.73, .83]
Competence satisfaction	3.87	.75	.85 [.81, .89]
Relatedness satisfaction	3.61	.93	.82 [.78, .86]

Reliability is reported as McDonald's hierarchical ω_h with 1000 bootstrap samples. This value can be interpreted similarly to Cronbach's α.

3.3.2 Analysis. We used qualitative content analysis combining a deductive first cycle of coding with an inductive second cycle [40, p. 81]. In the first cycle, we were interested in identifying segments reporting on instances of need satisfaction and frustration—both in-game and in daily life. To this end, we developed a set of theory-derived protocol codes [59, p. 174–177] with clear descriptors for each basic psychological need and instances of satisfaction and frustration of each need, drawn from the most recent and comprehensive SDT handbook [57] (see Supplementary Materials). Specifically, these protocol codes were satisfaction and frustration of each of autonomy, competence, and relatedness. For clarity, we deviated slightly from the preregistration and created separate versions of these codes for satisfaction/frustration in daily life and in games, resulting in 12 codes total (e.g., *autonomy satisfaction in games*, defined as "experiences in games where you act with willingness, congruence and in control of yourself"). The rationale behind this was that references to need frustration in daily life were closely related to compensatory gaming—we did not prompt participants to discuss need frustration generally, and therefore people tended only to do so when this was relevant to their gaming.

In the second, inductive coding cycle, we then openly coded for *how* gameplay satisfied or frustrated needs—these were therefore emergent, inductively developed subcodes for each high-level protocol code (e.g., *shared stimulation*, an emergent subcode describing participants who played games as a means of providing a shared focus and joint attention with others). Emergent subcodes were not limited to solely instances of compensation, but rather any time participants discussed the satisfaction or frustration of autonomy, competence, and relatedness in connection with gaming.

In a third coding cycle, we organized the emergent subcodes into broader mid-level themes for more succinct reporting here. Mid-level themes thus integrate the emergent subcodes to describe more general patterns of need-satisfying or -frustrating play (e.g., *social lubricant*, a mid-level theme of relatedness-satisfying gaming experiences which describes "playing games to improve the quality of interactions with others", encapsulating 7 emergent subcodes). The full coding tree with protocol codes, emergent subcodes, and mid-level themes is available in the supplementary materials.

As set out in our preregistration, two researchers (the first and second authors) coded an initial subset of participant entries in parallel and then compared codes and discussed disagreements to arrive at a shared understanding of the deductive coding scheme. Both coders have substantial expertise in self-determination theory both in games and other contexts; the second author has extensive expertise in qualitative methods and supervised the coding process. For logistical reasons, we then deviated from our preregistration as follows: the subsequent coding of all entries was conducted by a single coder and regularly counter-read by the other coder, resolving disagreements through discussion. Resulting emergent subcodes and mid-level themes were iteratively developed and presented to the whole study team for discussion.

4 RESULTS

The following sections report the results for each basic need in turn, leading with the quantitative findings. For reasons of parsimony, we report our qualitative findings in a more narrative format corresponding to our research questions, with reference to mid-level themes. Readers interested in the specific emergent subcodes are directed to the full coding tree in our supplementary materials on the OSF (https://osf.io/vp7ye).

4.1 Autonomy

We hypothesised that autonomy satisfaction in gaming is negatively related to autonomy satisfaction (H1a) and positively related to autonomy frustration in daily life (H2a). Contrary to these hypotheses, we found a significant positive relationship between autonomy

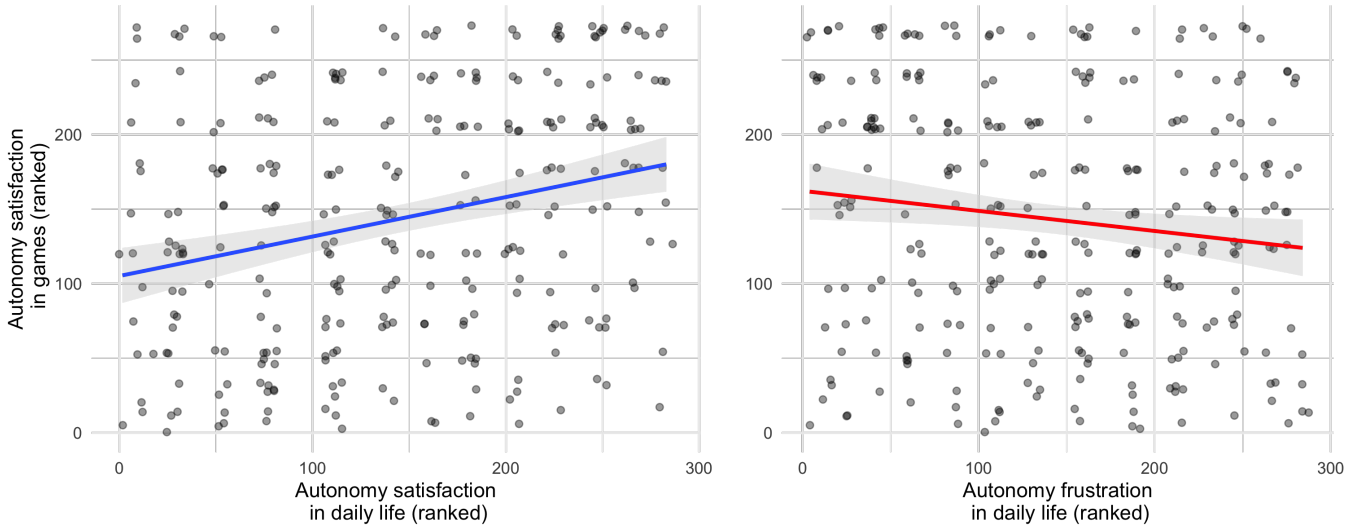

Figure 1: Autonomy satisfaction in games correlates positively with autonomy satisfaction in daily life (left) and negatively with autonomy frustration in daily life (right). Horizontal and vertical jitter are added for visibility.

satisfaction in daily life and games (ρ = 0.26, 95% CI [0.15, 0.37], $p < .001$) (Figure 1, left). Because the point estimate, but not the full confidence interval, exceeds our smallest effect size of interest, we consider this effect to be of potentially practically significant magnitude [32]. Similarly contrary to our hypotheses, we found a weak negative correlation between autonomy frustration in daily life and autonomy satisfaction in games (ρ = −0.13, 95% CI [−0.26, −0.02], p = .023) (Figure 1, right).

This quantitative finding on its own opens several possible interpretations of whether compensatory gaming occurred or not (see Discussion). Our qualitative data indicated that some players sought autonomy satisfaction in games as a compensatory strategy. We identified three themes describing types of autonomy-frustrating experiences in daily life that people compensated for with games: *restricted movement* (3 instances), *fragmented time/space* (3 instances), and *limited activities* (7 instances).

In the case of *restricted movement*, players described how lockdown policies imposed on their ability to go places, and talked about how games offered an outlet for them to travel:

> "You can explore the islands and go wherever you want. It's quite liberating when we are stuck inside." (P12955, male, 26)

For others, lockdown led to participants having *limited activities*, or a lack of control or inability to do desired pursuits. The following participant explicitly discusses how having a large degree of control over in-game characters in a game helped to balance out the lack of self-direction afforded to them out-of-game:

> "The chance to control the lives and fates of sims made up for a current lack of control of my own situation (stuck with social distancing and home office while living alone) [...] Before social isolation I would maybe play 10 hours a week at most, this time has now doubled. This change was motivated by an increased amount of time on my hands, but the effects of playing the sims (control vs. lack of control) have certainly played a part as well." (P14741, female, 26)

Another variation of autonomy compensation is referred to as *fragmented time/space*, which describes people describing a sense of having limited opportunities to get away or find personal space:

> "My routine after isolation measures has actually become more chaotic and unpredictable. While I do get more time for myself overall, it's in these chunks of uncertain length that can be broken up at any moment by calls relating to family or work, a myriad of other issues, and ultimately my own inability to focus. I would have liked to dedicate more consecutive time to games that demand consistent focus and explore the ones that I consider to be interesting experiences. Unfortunately, I ended up having to settle for mainly one game that requires little attention (Epic Seven)."

Paradoxically, reflecting on and framing gaming as the only activity remaining available could foreground the lack of willingness, volition, and control in gaming, thereby thwarting autonomy. Such experiences are examples of autonomy frustration in games, for which we had four mid-level themes: *guilt/shame about time spent* (14 instances), *no perceived alternatives* (3 instances), and *cannot engage in desired way* (2 instances).

Several participants described a lack of volition or whole-hearted endorsement of their gaming, leading to feelings of *guilt/shame about time spent* when it conflicted with other social norms and demands:

> "I've played more games because I've been asked to play more often by friends (since they're all free to play now). When a friend asks, I find it impossible to refuse when I'm hoping to work. As such I usually

> end up momentarily enjoying my games, but fall into a pit of guilt and self-flagellation afterwards." (P42517, male, 26)

Paradoxically, reflecting on and framing gaming as the only activity remaining available, as was the case for participants reporting that they had *no perceived alternatives* to gaming, could foreground the lack of willingness, volition, and control in gaming, thereby thwarting autonomy:

> "Playing on my own has been frustrating and lonely. ... I'm not choosing to be alone. It's not recreation time for me. I'm playing because I can't do anything else. And that makes my mood worse." (P59433, non-binary, 31)

For the cases where gaming was successful in satisfying autonomy, it did so in two broad ways: *through one's in-game actions* (25 instances), and through the *act of playing* itself (8 instances). With regard to *in-game actions*, players discussed valuing being able to play at one's own pace, or undertake self-directed exploration. Often, this was associated with games that had few goals and no time limit, as in the following instance:

> "I am also finding the type of games I'm focusing on is slightly different: I'm enjoying open-world games (Skyrim and Deadfire) where I'm not on a set linear narrative, but have the freedom to just roam around the digital landscape and accomplish tasks at my own pace." (P14316, female, 26)

For others, choosing to engage with a game, or the *act of playing*, was autonomy-satisfying in itself. This was especially salient with games that allowed them to freely (dis)engage by being playable anywhere (mobile games or portable board games) or any time, thanks to their short session length:

> "[Epic Seven is] a mobile game that can be played anywhere with an internet connection - I could play it away from home, during breaks … [it] requires less focused attention than most games, can be interrupted at any time without penalty." (P77309, male, 32)

Taken together, our qualitative data suggests that gaming can compensate for lacking daily-life autonomy by providing players both with an in-game 'space of their own' that affords high control and self-paced exploration with little pressure, and an in-life alternative course of action that fits many situations and demands little commitment. This would manifest if participants perceived their daily life sphere as unduly restricted and controlled, and if gaming did not also elicit controlling, introjected emotions like shame or guilt, nor was discounted as 'not a real choice'.

4.2 Competence

Again contrary to our hypothesis H1b, we found a significant positive relationship between competence satisfaction in daily life and games: $\rho = 0.27$, 95% CI [0.15, 0.38], $p < .001$, with a potentially practically significant magnitude (Figure 2, left). The relationship between competence frustration in daily life and competence satisfaction in games was negative but non-significant ($\rho = -0.07$, 95% CI [−0.19, 0.05], $p = .220$; Figure 2, left). The confidence interval suggests no practically significant relation, similarly contradicting our hypothesis H2b.

Yet as with autonomy, the qualitative data showed incidents of participants selecting gameplay to compensate for lacking or frustrated competence experiences in daily life. Participants reported on two broad types of competence frustration in daily life: *feeling stagnant* (6 instances) and *feeling powerless* (7 instances).

Many participants stated that games gave them a or accomplishment that they were not getting (sufficiently) elsewhere, leaving them *feeling stagnant*:

> "Especially when work can at times feel[s] like I've not really achieved anything, the thrill of knowing that I've accomplished something each session is a huge drive." (P14316, female, 24)

For some, this compensatory effect even built momentum for then seeking competence in other areas of life again, in a positive feedback loop:

> "It has been effective in making me feel like I've achieved something and so I can go back to my work and try to mirror my achievement there as well." (P73118, male, 25)

This positive feedback loop notably did not manifest for all players reporting competence-compensating play. As the following statement illustrates, players could frame and discount in-game competence experiences as virtual and fleeting post-game, which would block a possible transfer. For this player, games were unsuccessful at compensating for *feeling powerless*:

> "[In a game] I can escape into another world where I have the power to solve the problems there, where I can be/look/act like who I want to be but am not able to in life. Artificial feelings of achievement, collecting those cheevos as some kind of almost tangible proof of having done something lasting. its all transient and in substantial but it lets you forget about the real life issues you have no power to solve, while in game you are succesful" (P14198, non-binary, 34)

We found two high-level aspects of how games satisfy competence needs, namely by offering a *source of challenge and achievement* (12 instances), a *sense of progress/momentum* (19 instances). By being a source of challenge and achievement, games provide a opportunity to test physical and/or cognitive skills:

> "The specific DLC I was playing, Hamlet, is essentially rebalancing the game to be more difficult, shifting it from a survival game about thriving to a survival game where there really is a genuine struggle to survive at all times. (that's the appeal to me.) I picked it up because, in quarantine, I figured I finally had enough free time to make a successful run of that game, unlike during my previous attempts." (P36744, male, 18)

The presence of challenge on its own would not afford competence, however. If and when players *overcame* these challenges, then this would create a sense of achievement and pride:

> "The battle aspect makes the game challenging, so it provides both an escape from the real world and a

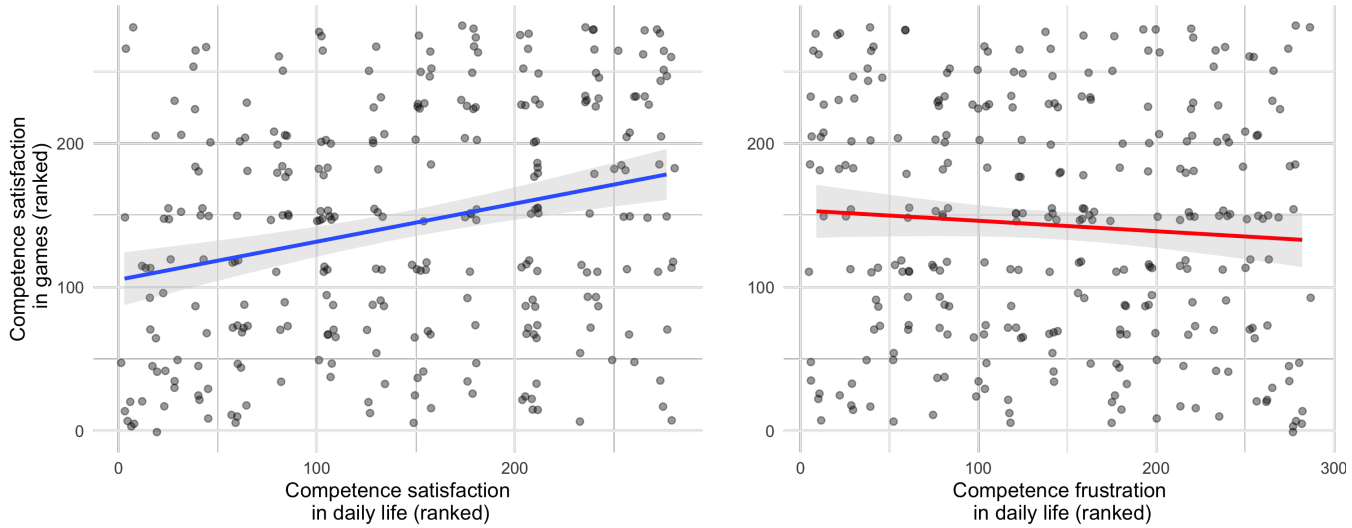

Figure 2: Competence satisfaction in games correlates positively with competence satisfaction in daily life (left) and negatively but non-significantly with competence frustration in daily life (right). Horizontal and vertical jitter are added for visibility.

> sense of accomplishment when successfully defeating enemies (the game is difficult for my skill level)." (P14741, female, 26)

Overcoming difficult challenges in games often requires prolonged effort to improve. As participants observed, one reason they were willing and able to tackle and overcome challenges was that they could (during lockdown) invest time and energy into the game such that they could improve and notice improvements in their ability:

> "Being allowed to take my time with the game means I also have the mental space to delve into the rules and synergies in a new way, and so I make better decisions. At the moment I am, frankly, steamrolling it and thinking about upping the difficulty. In other words, I'm getting GOOD at this game. It's thrilling, and I am going to miss this feeling if I ever end up back in a place where I can't be motivated to play. I'll try not to go there because I'm starting to feel like I'm on some great gaming-play-medicine." (P74444, female, 33)

However, competence did not necessarily need to be related to challenge. For some, casual games similarly afforded a *sense of progress or momentum*, helping to provide structure and forward momentum in their day:

> "[Kittens Game is] an idle game so i decided to start playing it with the idea that it could help motivate me to do other things by forming the idea i was making progress in the game whilst going about errands. I also was drawn to it for the sense of progression." (P65511, female, 25)

In summary, gaming can compensate for lacking or frustrated daily-life competence during lockdowns by providing players with increasing non-trivial challenges that they are nevertheless able to overcome, if players have opportunities in their daily life to invest prolonged time and effort into the game, and if they did not discount the value of in-game accomplishments.

4.3 Relatedness

Again, in contrast with our hypotheses (H1c and H2c), we found a significant positive relationship between relationship satisfaction in daily life and games (ρ = 0.27, 95% CI [0.16, 0.37], $p < .001$; Figure 3, left). The confidence interval bounds indicate that this effect may be practically significant in size. Relatedness frustration in daily life was not significantly related to relatedness satisfaction in games in our sample, but we narrowly cannot conclude that there is no practically significant relationship (ρ = −0.08, 95% CI [−0.20, 0.04], p = .168; Figure 3, right).

The qualitative data meanwhile surfaced clear evidence that people chose games to compensate for lacking or frustrated relatedness experiences in their daily life. We identified two mid-level themes of the kinds of relatedness-thwarting experiences people used games to help alleviate, namely *lacking opportunities to connect* (20 instances) and *connecting in unsatisfying ways* (8 instances). In the former, numerous participants echoed the usefulness of gaming to connect with others when other means of doing so were unavailable to them:

> "I didn't previously play co-op games. I'm missing human contact at the moment, so playing with friends is the closest I can get. it also gives us something to do instead of talking awkwardly about how we haven't done anything." (P59433, non-binary, 31)

Other participants reported *connecting in unsatisfying ways*—despite having opportunities to connect with others, these were found to be stilted or incomplete in some way that gaming could help alleviate, as this participant illustrates:

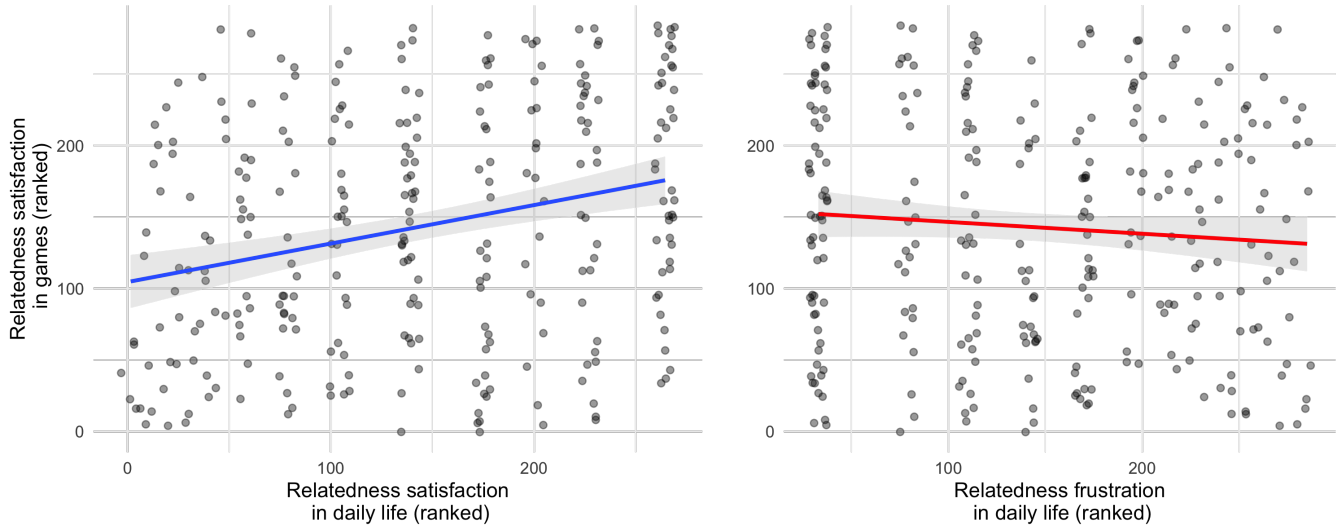

Figure 3: Relatedness satisfaction in games correlates positively with relatedness satisfaction in daily life (left) and negatively with relatedness frustration in daily life (right). Horizontal and vertical jitter are added for visibility.

> "I'm not a great conversationalist at the best of times and I don't have anything to talk about at the moment as I'm not doing anything. I like playing games with my housemates or with friends over houseparty as it takes pressure off to constantly be thinking of things to talk about and lets me enjoy their company in person and over video." (P42020, female, 23)

For most, this compensatory selection seemed to be successful. Participants reported that gaming stabilised their relatedness satisfaction in a life situation that otherwise could have created feelings of disconnection:

> "[Gaming] definitely helped. [...] it soothed the feeling of isolation, especially playing ESO [Elder Scrolls Online] and coming in contact with other players, although it was only online." (P16863, female, 42)

However, for others, gaming was not successful in addressing relatedness deficits. As with competence, some participants perceived or framed the social connection and relatedness experienced in-game as less 'real' or 'deep', as in the following case:

> "[Gaming has] allowed me to keep in contact with friends more often, but I wonder if the connections and conversations I have with them are shallower. We don't seem to talk about how we're doing or how life's going, just about the game. Maybe that could be [because] very little is happening in our lives. I feel like I haven't really connected to anyone in a long time…" (P42517, male, 26)

Relatedness was by some margin the need most often explicitly targeted for satisfaction through gameplay. The data indicated three broad ways in which gaming was used to satisfy relatedness needs: as an *excuse for interaction* (93 instances), as a *social lubricant* (43 instances), and as a *source of connection* itself (20 instances).

The first is gaming as an *excuse for interaction*. By "excuse", we mean that games would serve as a technological mediating environment for people to interact with each other; but more importantly, also as a socially accepted occasion to socialise. In other words, gaming became a means to the end of interacting with others, with players not necessarily invested in the game itself (or in winning it).

> "[During lockdown] I use games a lot more as a tool to socialise, rather than just to unwind or kill small amounts of time." (P14454, male, 21)

> "The game is mainly an excuse to talk on voice chat with friends. Choice of game was fairly random, we picked it up by coincidence." (P67726, male, 32)

As part of this theme, participants reported playing games to spend time with current friends and family, reestablish relationships with older friends and family, spend quality time with a partner, or meet new people. Synchronous multiplayer games tended to be associated with gaming as an excuse for interaction.

Another way that games supported relatedness satisfaction was as a *social lubricant*: people chose gaming because it improved the quality of interactions with others, and thus, the relatedness satisfaction that it would bring. For some, games served as a source of shared stimulation and structure, something that participants felt was missing in their lockdown life, making conversations without gaming as a lubricant harder:

> "Video calls to catch up with friends are all good and well but as we have little to report back on in our increasingly small lives, it can be more rewarding to actively participate in something together, and I find games are a nice way to do that - gives some structure to the virtual interaction time." (P82408, female, 34)

Finally, gaming could be selected as a direct *source of connection*. In these instances, participants aimed for and derived relatedness

satisfaction from gaming interactions and practices, rather than the game establishing and smoothing non-game interactions. Participants described feeling relatedness as a member of a group or community of players with a shared interest, be it by virtue of playing a game they knew or saw others play, or by participating in online discourse about the game:

> "[The Wretched] also encourages players to record audio/video journals during gameplay which I've been sharing with other players on Twitter, and it's helped me feel part of a community when I can't otherwise see my friends." (P68390, non-binary, 33)

This sense of connection through the appreciation of others' work that might resonate extended beyond other player creations (like custom maps in Minecraft or music in Second Life) to include felt connection to the world created by game developers.

> "[I] really enjoy the atmosphere of the game and its obvious the world is made with care and I love walking around in the game and seeing the incredible thought and effort gone into creating the world" (P33122, male, 29)

Nor was this sense of connection limited to other human beings; some participants reported parasocial relationships, where they felt connected to the virtual, non-player characters of the game that they were playing:

> "It's doing wonders to my mental health, just having that relaxing space and nowhere else to be. I end up reading most of the lore and dialogue this way, and really lose myself in the game world, as cheesy and that sounds. I'm starting to really care about these characters and I laugh audibly at their shenanigans. It feels good and - I think - physically mitigates some of the stress I felt early on during lock-down." (P74444, female, 33)

Summarising, people actively chose games to compensate for thwarted relatedness satisfaction that offered an excuse and lubricant for non-game interactions, provided a sense of community belonging, and/or supported parasocial interactions with non-player characters. This could backfire if and when participants perceived gaming-based relatedness satisfaction as unreal and/or foregrounding their lack of relatedness satisfaction in everyday life.

5 DISCUSSION

5.1 Compensatory gaming selection

Overall, our results paint a mixed picture on compensatory gaming selection (RQ1). Our qualitative data contains clear incidents of people intentionally choosing gaming, particular games, and particular styles of gaming to compensate for lacking or unpleasant experiences in their day-to-day life. These lacking experiences match basic needs as framed in SDT, such as a perceived lack of control, freedom, and 'personal space', or a sense of being stuck (autonomy); a lack of achievement or accomplishment (competence); and a felt lack of human contact or sense of isolation (relatedness). Many participants who report such compensatory gaming also report it to be a valued and successful strategy to replenish their needs and support their well-being during the COVID-19 pandemic. This aligns with previous work on positive psychological effects of gaming during the pandemic [3, 28], and prior research relating to stress and difficult life circumstances [20, 54]. In particular, our results support the existence of diverse pathways through which games can support social connection beyond simply the act of playing together. Some of these overlap with previous work; for example, Trepte et al. [66] found a positive relationship between in-game social capital and offline social support in competitive video game players, while Colder Carras et al. [8] showed that veterans used video games as an opportunity to discuss meaningful and personal topics.

However, our quantitative data showed a pattern that we did not predict for compensatory gaming. We expected a negative correlation between need satisfaction in daily life and need satisfaction in games people chose to play, based on previous literature that suggested that deprived needs should lead to behavioral changes that may replenish those needs [60, 71, 73]. Instead, we found a positive correlation for all three needs, and the effect size estimates indicate that this relationship might be practically significant in magnitude (i.e., important to players). Similarly, counter to our expectation, we found negative correlations between need frustration in everyday life and need satisfaction in chosen games, though not practically significant for two out of three needs (relatedness, competence).

How do we explain this prima facie contradiction of qualitative and quantitative results? Though our cross-sectional data cannot establish a causal direction, we see three possible explanations worth exploring in future work. The first and perhaps most parsimonious explanation is that compensatory gaming is successful: People who experienced more need satisfaction overall in a week did so *because* they played more need-satisfying games that week. Our predicted pattern (low life need satisfaction → high in-game need satisfaction) fits our qualitative data and is occluded in the quantitative data by people reporting on their resultant need states of a given week (e.g., average, peak, or end state), not the need state at the time they were making game choices. To test this explanation, one would require study designs that capture current need states and expected in-game need satisfaction at the time of game selection, such as experience sampling or ecological momentary assessment.

A second possible explanation is that compensatory gaming is successful (as before), but in a differentiated 'rich get richer, poor get poorer' Matthew effect [39] pattern: people relatively high in need satisfaction in life benefit further from in-game need satisfaction, while people relatively low in need satisfaction in life are left even more thwarted in their needs by gameplay. This explanation directly fits the pattern of our quantitative data. Our qualitative data also entailed some matching instances of these positive and negative feedback loops. Across all three needs, we found reports where people discounted the value of game-generated need satisfaction, perceiving it as insubstantial. This discounting itself may have negated or reversed the need satisfaction consequences of these events (see our discussion on qualitative results below); or reflecting on one's compensatory use of gaming could foreground and thereby exacerbate the lack of other, 'real' need satisfaction opportunities. Alternatively, people who believe that gameplay is a 'waste of time' may have experienced guilt and a lower-self image when thinking about the fact that they played more video games. There is some evidence that this mechanism can reduce, negate,

or even reverse the overall well-being benefits of entertainment media use for recovery, moderated by self-regulation resources [52]. For competence (but not autonomy or relatedness), we also found instances of a positive feedback loop, where in-game need satisfaction would replenish a person's psychological resources and motivation to seek out similar need satisfaction out-of-game.

This 'rich get richer, poor get poorer' pattern would fit an emerging overall picture in the literature that compensatory media use can 'work' or 'backfire' for well-being, depending on situational and especially personal moderators [30, 73]. First, there is emerging evidence that higher state stress leads to more and more avoidant, escapist, procrastinating kinds of media use that do not contribute to wellbeing (which would include need satisfaction) [1, 13, 30]. This could be due to stress impeding self-regulation [52]: people are momentarily less capable of exerting cognitive effort to direct their media use toward beneficial forms. Similarly, people high in resilience could bounce back from stress faster and therefore more easily regulate their media use in beneficial forms [13].

A further matching picture comes from SDT research building on Vallerand's dualistic model of passion [72]. Following this model, an intensely pursued activity or passion can be harmonious if it is overall fuelled by self-determined and integrated motives, or obsessive if it is fuelled by controlled and introjected motives. Harmonious passions are experienced as autonomous and need-satisfying, supporting wellbeing, while in obsessive passions, the person feels controlled by the activity, and persisting in it impedes wellbeing. Obsessive passions have been found to arise as initially compensatory strategies in life circumstances where people's needs are thwarted [72]; in the absence of other coping strategies, people stick to the obsessive activity habitually and rigidly even where it harms wellbeing. A rapidly growing body of literature finds that harmonious and obsessive passion are distinct patterns in gaming experience associated with distinct more adaptive (harmonious) or maladaptive (obsessive) gaming motives, and that obsessive passion shows a negative feedback loop: low need satisfaction and need frustration in everyday life predict obsessive passion, which in turn predicts need frustration in everyday life [21, 30, 41, 46]. One study found loneliness positively correlated with obsessive passion and negatively correlated with harmonious passion toward gaming [36] (though [30] found loneliness not to moderate between forms of passion and adverse wellbeing outcomes in gaming).

In short, our data pattern would fit an emerging picture that factors like stress or obsessive versus harmonious passion moderate the wellbeing effects of compensatory gaming, where people with overall high momentary wellbeing who relate to games as a positive source of need satisfaction easily regulate their gaming use to receive such satisfaction, whereas people with poor momentary wellbeing engaging obsessively with games are less likely to positively regulate their gaming, and thus more likely to not receive great need satisfaction from their gaming. To test this properly, longitudinal study designs would be in order, including some theory-derived or mixed-method parcelling out of possible moderators. One possible, unexplored part of this overall dynamic is whether people discount or devalue gaming – see the next section.

Third and finally, the pattern in the quantitative data could be explained by people's current experience of 'global' need satisfaction at the time of reporting overshadowing remembered need satisfaction during gaming in the past week. That is, the reported positive correlation occurs because people on reporting cannot and did not differentiate experienced or remembered overall daily life need satisfaction from in-game need satisfaction. This would be consistent with both compensatory gaming actually existing (which would fit the qualitative data) and not existing; in the latter case, the compensatory gameplay we found in our qualitative data would be spurious in some way. For instance, it could result from impression management as a form of demand characteristics [45]: participants may have chosen to selectively report compensatory gaming instances which paint gaming in a positive light and thereby legitimise their increased gaming during lockdown to themselves and us. Relatedly, compensatory gaming might be an extra-ordinary player experience [68], which would be therefore easier to recall and thus, over-reported in the qualitative data relative to ordinary gaming experiences with no compensatory function. We believe this latter explanation is less likely given other evidence on compensatory media use and effects, but it remains a possibility. In either case, testing this explanation would again need methods like experience sampling that can capture need states and expected need satisfaction at the time of game selection.

5.2 Features and mechanisms of need-compensating gaming

Moving on to need-compensating gaming mechanisms and features (RQ2), our qualitative results suggest moderators for whether people succeed in compensatory need satisfaction from games which are to our knowledge not accounted for in current research. As noted above, we found instances where participants' reflection on gaming as the only available option for need satisfaction and/or as less 'real' would result in an overall worse mood and perceived lower state of need satisfaction. In SDT, the basic idea that an internal appraisal process determines whether an external event is perceived to be need-satisfying or -thwarting is well-established as "functional significance" [57, p. 130]. But this appraisal process is commonly only used to explain the motivational consequences of especially negative performance feedback: e.g., people can perceive the same negative feedback as controlling (this tells me what to do), which thwarts autonomy; or as informational (this helps me improve), which supports competence; or as amotivating (this tells me the task is irrelevant or futile), which leads to amotivation: the lack of motivation. The instances we found could be read as participants reframing the functional significance of gameplay from autonomy- or competence-supporting to autonomy- and competence-thwarting or amotivating by discounting or devaluing them as unreal and therefore, futile or socially inappropriate. This would suggest that people's cultural beliefs and attitudes towards gaming might moderate the impacts of compensatory gaming: If people endorse gaming as a positive and 'real', worthwhile activity, guilt, poor self-image, introjected ego and social approval motives, and discounting of experienced need satisfaction are less likely to arise. Vice versa, if they believe gaming to be an 'unreal', worthless pursuit, these negative processes are more likely to occur. Unfortunately, our qualitative data was not rich enough to establish this possible mechanism as a richly saturated theme. This is an interesting area for future research.

In terms of what gaming features and practices replenish needs, and how they do so, our findings mostly align with existing literatures – noting that our findings vary in their saturation: autonomy satisfaction was afforded by games offering an in-game 'space of one's own' with high player control, self-paced exploration, and low perceived pressure, while not eliciting controlling, introjected emotions like shame or guilt. This matches prior work on in-game and contextual autonomy support [12]. One novel observation was that games afforded contextual autonomy support when they were perceived as broadening the spectrum of available courses of action in a situation, thanks to easily 'fitting in' and demanding little commitment, as with casual mobile games that are easy to start and stop playing anywhere. This is a known appreciated quality of casual games [24] that may be understood through the lens of autonomy support.

Games afforded competence satisfaction with increasing non-trivial challenges that players are nevertheless able to overcome, which again matches the literature [55]. Interestingly, our data contained fewer instances of participants reporting that they gravitated toward 'easy wins'. This somewhat contradicts recent work on media use for recovery which suggests that people with depleted psychological resources might gravitate to less challenging media because they do not have the energy to engage them or want to avoid the risk of being depleted even further [54]. This might be explained by our sample on the whole reporting mild or even no psychological depletion during the early stages of the pandemic (the mean competence frustration was 2.82 on a 5-point scale, comparable to other non-pandemic samples [7]). Another interesting and novel observation was a contextual competence support: to derive competence satisfaction from challenging games, players need opportunities in their daily life to invest prolonged time and effort into the game. This offers an intriguing sociological explanation for demographic differential preferences for different kinds of games (e.g. "hardcore" versus "casual").

As for relatedness support, we found games could offer (1) an excuse and lubricant for non-game interactions, (2) a sense of community belonging through sheer play and participation in meta-communication and sharing about play, and (3) parasocial interactions with non-player characters. The latter two mechanisms have been observed or speculated on in prior work [25, 55, 69]. Gaming as an (1) excuse and lubricant for non-game interactions has been incidentally observed before [25] and recently in the context of COVID-19 [3]; our findings overlap with certain aspects of Kleinman et al.'s *using games to connect with others* theme of gaming during the pandemic [28]. This may represent a shift in focus, as earlier work in this area often focused on offline social links and social capital afforded by online gaming communities like MMORPG guilds [3]. The use of gaming to structure and afford non-game interactions with non-gamer friends and family may be a previously less noted phenomenon, or actually emerged as a novel strategy during social isolation.

5.3 Practical Implications

Our results suggest that campaigns to promote gaming as a safe and adaptive hobby during the pandemic such as #playaparttogether [64] aligned with many players' personal perceptions of gaming as a valuable coping mechanism during the pandemic. While our sample consists of relatively engaged players who are likely to have played games regardless, promoting gaming to a wider audience may have led to psychological benefits for many people. As discussed, however, potential benefits were not universal, and our results may help inform why players may be suffering negative wellbeing consequences in relation to their gaming.

In terms of deliberately choosing or designing games for coping benefits, our findings broadly align with prior findings on what kinds of games and game design features support the satisfaction of psychological needs. Counter to common devaluations of casual games as somehow less 'real' or legitimate [10], we found that their interruptibility and short required play span could actually make them more potentially beneficial for people who would not be able to fit non-casual games into their lives.

One interesting potential practical implication of our findings is the role of people's attitudes and beliefs regarding the worth, legitimacy, or 'realness' [10] of gaming itself. People who devalue and discount gaming may experience guilt, poorer self-image, conflicted and introjected motives ("I like this but I shouldn't, that's bad") over gaming, and this in itself may partially moderate whether people benefit from gaming. If this were true, current media and public health messaging around gaming as worthless or addicting would help undermine the potential psychological benefits of gaming and feed obsessive relations with gaming by reinforcing people's conflicted, non-integrated relation to gaming, in a form of self-fulfilling prophecy. Media and public health could in turn support any potential mental health benefits of gaming by endorsing and communicating them, thereby reducing devaluing attitudes and beliefs towards gaming. For designers, this would mean that the legitimising framing messaging around a game ('this is good for you') would be an important part of the overall design. We emphasize that this is a potential mechanism that requires more research before jumping to any implementation.

5.4 Limitations

As with anything relating to the ongoing COVID-19 pandemic, our findings may be biased by history effects: We collected data during May 2020, early into the first lockdown measures for many countries across the globe [16]. People may have experienced need satisfaction or frustration to different degrees at this stage than during later phases of the pandemic. Participants will also have experienced different kinds of social isolation measures, furlough schemes, and health challenges based on their location. The main potential history effect we can imagine is that over time, need thwarting may become more acute and the compensatory power of gaming may 'wear thin'. This could be probed with follow-on or longitudinal studies.

Another obvious limitation is our cross-sectional study design, which cannot speak to causality—it may be that need satisfaction in games leads to need satisfaction in daily life, the inverse, or some other pattern. Notably, our participants were prompted to reflect about the previous week, and therefore described "summary" experiences rather than individual compensatorily-motivated sessions. Further work is needed on how gaming decisions are made on shorter timescales, for example using ecological momentary

assessment to disentangle compensatory seeking and successful compensation (i.e., compensatory experience). Such work might also explore whether some sub-populations are more likely to experience positive or negative effects by others, different for example by age, gender, or degree of involvement in gaming.

Quantitative results for relatedness should be interpreted cautiously, as a confirmatory factor analysis of the UPEQ relatedness subscale indicated that the items addressing connection with in-game characters may load onto a separate factor than items referring to other players. Future work is necessary to understand the role of parasocial interaction in relatedness satisfaction, and how to measure this appropriately.

Finally, in terms of our qualitative results, we hasten to add that the themes we report have highly varying degrees of saturation: due to our one-shot survey design, we could not engage in iterative rounds of data collection, coding, and interpretation to thoroughly pursue and saturate the themes we found. As we flag in our results and discussion throughout, many of the themes we found invite multiple alternative interpretations and explanations that we could not resolve in any direction; put differently, while we did achieve code saturation, we cannot speak to the degree of meaning saturation we achieved [18]. Future qualitative work is needed here to firm up our findings–especially on how people's beliefs and attitudes toward gaming differentially shape the wellbeing impact of compensatory gaming.

5.5 Conclusion

We found qualitative evidence that during the COVID-19 pandemic, people actively sought out gaming to compensate for thwarted needs in daily life. This is in line with prior evidence that gameplay can replenish thwarted needs, and empirically supports prior untested predictions in SDT research about compensatory gaming selection. Games afforded need satisfaction through an in-game 'space of one's own' with high player agency, self-paced exploration, low pressure, and no triggers for controlling emotions, which fitted into people's lives (autonomy); provided non-trivial challenges to overcome with sufficient time to invest into getting better (competence); and supported parasocial interactions, belonging to a play community, and an excuse and structure for non-game social interaction (relatedness).

Our quantitative results complicated this picture; counter to our predictions, they showed a robust positive correlation between need satisfaction in daily life and in games played, and no strong relations between need frustration in daily life and need satisfaction in chosen games. We offer three possible explanations for this data pattern: (1) compensation succeeded, as people who played more need-satisfying games report higher need satisfaction in their daily life generally; (2) there is a Matthew effect, where participants with high need satisfaction in daily life are more likely to to experience need satisfaction in gaming, and people with low need satisfaction in daily life experience low need satisfaction in gaming as well; or (3) global daily-life need satisfaction overshadowed remembered need satisfaction during reporting—qualitative instances of compensatory gaming may be insignificant or extraordinary gaming experiences that get over-reported, or impression management by the participants. Our qualitative data offers some support for the Matthew effect explanation, which also matches broader theory and evidence about differentiated positive and negative outcomes of compensatory gaming. One possible moderator worthy of future work is people's beliefs and attitudes toward gaming potentially undermining experienced in-game need satisfaction and inducing negative social motives and emotions like guilt or a lower self-image.

Together, our mixed-methods results show that gaming is a common and valued strategy for compensating for basic psychological needs, but that it is not universally successful, and that cross-sectional and summative quantitative assessments of compensatory gaming are limited in their ability to detect this process: summative measurements over longer timescales may be unable to detect minor, ongoing behavioral adjustments intended to balance out depleted needs. Future work would benefit from longitudinal designs with access to momentary need states and decisions, such as experience sampling or ecological momentary assessment.

DATA/CODE AVAILABILITY

The preregistration, qualitative data, quantitative data, and analysis files in this study are available on the Open Science Framework (https://osf.io/vp7ye).

SOFTWARE USED

All statistical analyses were conducted in R version 4.0.3, using the packages *tidyverse* [76], *MBESS* [26], and *rcompanion* [37]. Qualitative analyses used MAXQDA version 12 [74].

CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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