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# Gaming for Post-Work Recovery: The Role of Immersion

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## ABSTRACT

Playing digital games can be an effective means of recovering from daily work strain. However, limited research has examined which player experiences contribute to this process, limiting the ability of players to select games and play them in a manner which helps them recover effectively. Hence, this paper reports a mixed-methods survey study investigating how a recent post-work recovery episode was impacted by immersion: a player experience which has been implicated in theoretical accounts relating games and recovery. We found that particular dimensions of immersion, such as cognitive involvement, support specific post-work recovery needs. Moreover, participants report not only experiencing benefits in a passive manner, but actively optimising their levels of immersion to achieve recovery. This study extends previous research by improving our understanding of how digital games support post-work recovery and by demonstrating that immersion is key in determining the restorative potential of digital games.

## CCS CONCEPTS

• **Human-centered computing**; • **Human computer interaction (HCI)**; • **Empirical studies in HCI**;

## KEYWORDS

Immersion, Player Experience, Digital Games, Restorative Play, Post-Work Recovery

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## 1 INTRODUCTION

HCI researchers are increasingly interested in investigating ways in which digital games can be used to improve wellbeing. For example, existing research has demonstrated that games can support emotion regulation [55], coping with difficult life events [26] and the satisfaction of basic psychological needs [71–73]. Recently, researchers have begun to examine the restorative potential of digital games. This refers to the capacity of games to replenish internal resources that have been depleted by an earlier negative event. For example,

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digital games can restore players' sense of competence and autonomy when these basic psychological needs have previously been depleted [69, 70].

A specific context in which restorative play has been investigated is post-work recovery: the process of recuperating from a day at work by returning a person's level of strain to its pre-work levels [59, 61, 83]. Understanding how recovery occurs is a topic of vital importance given the serious long-term health impacts of work-related strain [57]. One way in which some people choose to recover from work-related strain is by playing digital games [41, 55] and this can be an effective strategy [15, 16, 42, 45, 81]. It has been speculated that this effectiveness owes to the capacity of games to engage and absorb players [41]; in other words, their ability to elicit the player experience of immersion [10, 19]. However, this assumption is yet to be empirically tested directly. Filling this gap will allow gamers who play for recovery [40, 41] to better understand which player experiences they should be attempting to curate during their post-work recovery episodes and make informed decisions regarding their choice of game and gameplay style accordingly.

In order to investigate the research question, we conducted a mixed-methods survey study in which participants reflected on their player experiences during a recent post-work play episode. We found that participants adopted deliberate strategies in order to experience an optimal level of immersion for their post-work recovery needs, a process that we term *immersion optimisation*. Various dimensions of immersion were optimised to facilitate specific aspects of recovery. For example, experiencing cognitive involvement allowed participants to mentally detach from their working day, whilst experiencing challenge led to a sense of post-work mastery.

This study offers several key contributions to the HCI literature. Firstly, our findings provide evidence that the extent to which digital games elicit immersion is a key determinant of post-work recovery, offering empirical support for the mechanisms outlined in theoretical accounts within this area of study [41]. Secondly, we extend prior research which has examined the restorative potential of other player experiences under laboratory conditions by demonstrating this phenomenon within the real-world context of post-work recovery. Thirdly, our findings demonstrate that players are not simply passive bystanders to the processes by which immersion influences post-work recovery. Instead, we find that players employ immersion optimisation to actively curate a restorative player experience. Finally, this study demonstrates ways in which immersion might be a useful tool when gaming for self-care purposes [14, 75], offering a counterpoint to arguments that immersive experiences might harm mental wellbeing by encouraging problematic usage [56].

## 2 RELATED WORK

### 2.1 Restorative Play

The notion of restorative play refers to instances where digital games are used to restore wellbeing after an earlier, negative experience [70]. Several studies have demonstrated the existence of this phenomenon, focusing particularly on the importance of player experience (PX): the individual and personal experiences of players during and immediately after playing a game [78]. For instance, Tyack and colleagues have explored the restorative effect of having one's basic psychological needs, such as competence and autonomy, satisfied while gaming. In one of their studies [70], participants completed a task that either satisfied or frustrated their sense of competence, following which they played a digital game selected on the basis that it would increase feelings of competence. They found that those in the competence-frustrating, but not competence-satisfying, condition experienced improved post-play vitality and negative affect relative to their pre-play levels. Similar findings were obtained in a second study [69], with in-game autonomy satisfaction associated with greater vitality and intrinsic motivation in individuals who had experienced an autonomy-frustrating event. Another study [76], examined how the player experience of spatial presence, the sensation of being located in the game environment, influenced the restoration of mood. It was found that, following a stress induction task, experiencing greater spatial presence during a gaming episode was associated with greater enjoyment of the game which, in turn, predicted increased mood repair.

### 2.2 Post-Work Recovery

One example of a real-world context in which restoration takes place is in response to work-related strain. As a working day poses significant physical and psychological demands, a post-work recovery process is required in which depleted resources are restored [59, 61, 83]. In the absence of a successful recovery, strain levels remain elevated the next working day. Over a longer time period, this lack of recovery can have a cumulative effect, leading to chronic issues with mental [3] and physical health [1]. The extent to which recovery takes place is determined by the activities that are undertaken during non-work hours. These activities might be resource-promoting in nature (e.g., resting) or resource-depleting (e.g., household chores) [43]. However, it is not activities *per se* that determine whether resources are promoted or depleted [60, 61, 63, 64]. Instead, the restorative potential of an activity is dictated by its underlying psychological experiences, which are termed recovery experiences [61].

Sonntag and colleagues [61] have suggested that there are four types of recovery experience, which are drawn from two major theories of recovery. The first of these theories is the Effort-Recovery Model [35], which suggests that working days lead to load reactions, such as fatigue, which are reversed when an individual is no longer exposed to work demands. In line with this theory, the recovery experiences of *psychological detachment* and *relaxation* have been proposed. The former refers to an individual's ability to mentally disengage from the demands of work, whilst the latter refers to a state of low activation and positive affect that occurs as load reactions recede [62]. The second theory which recovery theorists have drawn from is the Conservation of Resources Theory

[24, 25], which postulates that individuals are motivated to obtain, retain and protect their external and internal resources. This theory motivates two further recovery experiences: *mastery* and *control*. Mastery refers to opportunities for challenge and learning that are not related to work and provide feelings of accomplishment. Control refers to an individual's ability to choose between one or more potential actions and confers a sense of self-efficacy and competence. Together, these four recovery experiences (*psychological detachment*, *relaxation*, *mastery* and *control*) dictate recovery outcomes, which reflect an individual's psychological and physiological state following a post-work activity [63, 64]. Here, successful recovery episodes should result in improvements in psychological and physiological functioning, such as reductions in perceived stress, negative affect and fatigue [62].

### 2.3 Gaming for Recovery

It has been argued that digital games are uniquely suited to promote the four recovery experiences [41]. Firstly, because digital games pose cognitive demands on their players they should reduce their capacity for work-related thoughts, allowing for *psychological detachment* [41]. Secondly, games are frequently ascribed a relaxing effect by their players [21, 58, 82] and can bring about the positive affect that is characteristic of *relaxation* [33, 48, 51]. Thirdly, some games require players to develop their skills such that they can beat in-game challenges, offering a foundation for *mastery* experiences [41, 46]. Finally, players can have an active influence on the game environment, which is believed to elicit a sense of *control* [41].

There are also several lines of research evidencing that playing digital games is beneficial for post-work recovery. For example, the frequency with which individuals play digital games is predictive of their recovery experiences [15, 42]. Furthermore, experimental data demonstrates that digital games can be more effective in eliciting recovery experiences than other activities [16, 45, 81]. There is also evidence, albeit not specific to a work context, that digital games can impact recovery outcomes. Specifically, digital games have been found to restore positive affect after watching a sad movie clip [48] or completing tasks designed to induce stress or boredom [5, 6, 53]. Taken together, these findings indicate that digital games can be an effective means of promoting post-work recovery.

However, the mechanisms by which digital games impact recovery are yet to be fully elucidated. Existing studies of restorative play outside of a post-work recovery context [69, 70, 76] indicate that player experiences might be important in translating a gaming session into a successful recovery episode. Indeed, it has been suggested that it is games' capacity to elicit experiences such as engagement and challenge that make them an ideal recovery activity [41]. Notably, these player experiences are related to the concept of immersion: the sense of engagement and involvement experienced whilst playing a digital game [19]. Though various definitions of immersion exist (see [37, 79]), in this paper we use the conceptualisation offered by Cairns and colleagues [10, 19, 27], which has been shown to capture gradations in this player experience across a range of contexts e.g., [11, 13, 39, 68]. Here, immersion is considered a multifaceted player experience, consisting of five inter-related components: *cognitive involvement* (the effortful direction of attention towards the game), *emotional involvement* (affective reactions

to the game, including tension and suspense), *real world dissociation* (the sensation of mental transportation to the game world, accompanied by losing awareness of both one's surroundings and the passage of time), *challenge* (the perceived difficulty of the game) and *control* (the perception that the game controls have become "invisible" as a consequence of their ease of use) [27]. It should be noted that the immersion subcomponent of *control* is distinct from the recovery experience of the same name. Whereas the former is specific to gaming and relates to the ease of using the controls, the latter refers to a sense of autonomy during activities conducted during non-work hours.

### 3 RESEARCH QUESTIONS & HYPOTHESES

Though it has been argued that immersion, and its subcomponents, might be important when gaming for recovery [41], there is a lack of empirical work investigating this directly. The research described in this paper employs a mixed-methods approach to address this gap in the literature. For the qualitative component of the study, we adopted an exploratory lens, asking participants to provide open-ended reflections on their player experiences during a recent post-work play episode and outline how these experiences impacted their recovery. A thematic analysis of these responses was conducted in order to answer the following research question:

**RQ1.** How does the player experience of immersion shape the post-work recovery potential of digital games?

For the quantitative component of the study, we sought to examine statistical relationships between immersion and post-work recovery. Specifically, we examined the ability of each immersion dimension (cognitive involvement, emotional involvement, real-world dissociation, challenge and control) to predict the four recovery experiences (psychological detachment, relaxation, mastery and control). Unique relationships are predicted for each recovery experience, hypotheses for which can be found below. Each of these four hypotheses will contribute towards answering the following overarching research question:

**RQ2.** Which components of immersion when gaming after work are predictive of the four recovery experiences?

In terms of psychological detachment, it is thought that the experience of real-world dissociation, cognitive involvement and emotional involvement pose significant demands on players, leaving minimal capacity for thoughts not related to the game [41]. As such, work-related ruminations should be reduced when involvement and real-world dissociation are high. Though it might be supposed that experiencing the challenge component of immersion would also increase demands on players and promote psychological detachment, evidence suggests that this is not the case. This is demonstrated by Wulf and colleagues' study [81], in which they found that games with greater subjective task demands (a related concept to the experience of challenge) were no better at eliciting psychological detachment than versions with lower subjective demands. Finally, the control facet of immersion does not factor into any theoretical accounts of gaming for post-work recovery nor is there any empirical evidence suggesting that it plays a role. Hence,

no relationship is predicted with psychological detachment. The first hypothesis is therefore:

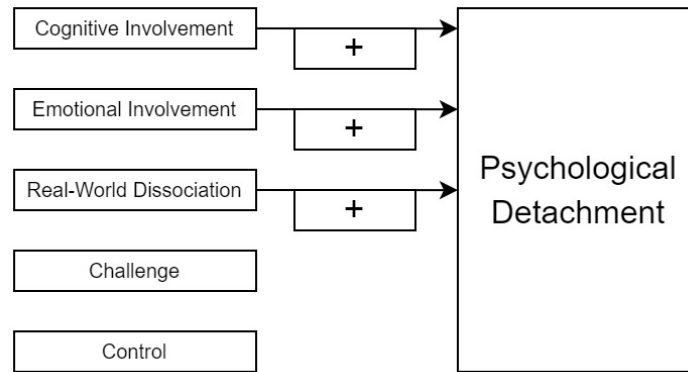
**RQ2-H1 (1).** Psychological detachment will be positively predicted by (a) cognitive involvement, (b) emotional involvement and (c) real-world dissociation, but not (d) challenge or (e) control.

With respect to relaxation, as playing games is frequently reported as being a relaxing activity [33, 48, 51], this would suggest that directing more attention (i.e., cognitive involvement) towards a game should increase this recovery experience. Furthermore, there is also evidence to suggest that gamers ascribe a relaxing effect to the immersive facets of control (with intuitive controls described as eliciting a "zen-like" experience by players [19]) and real-world dissociation (specifically, losing awareness of the passage of time was found by [80] to be relaxing for participants). Hence, there is reason to suppose that these two facets of immersion will positively predict relaxation. By contrast, emotional involvement involves affective experiences, such as tension and suspense, that are at odds with the reduced activation that characterises relaxation. Furthermore, games which are perceived as more demanding have been found to be less relaxing to play than those that are perceived as simpler to play [81]. As such, it is predicted that emotional involvement and challenge will be negatively associated with relaxation. Taken together, these arguments lead to the second hypothesis:

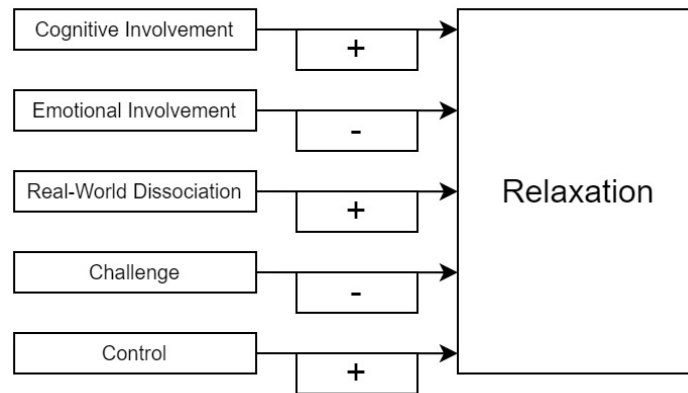
**RQ2-H2 (2).** Relaxation will be positively predicted by (a) cognitive involvement, (b) real-world dissociation (c) and control, and negatively predicted by (d) emotional involvement and (e) challenge.

Regarding mastery, gamers typically experience a sense of accomplishment when they attribute their in-game success to their own efforts, as opposed to uncontrollable factors such as aptitude [2]. This is suggestive of an association between mastery, an experience which can evoke a feeling of accomplishment, and cognitive involvement, which reflects the degree of effortful attention dedicated to a game. It is also believed that a sense of challenge is required for mastery to occur [41] and research which has examined the related psychological need of competence supports this assertion [31, 36]. However, [81] found that a game with greater perceived demand did not increase mastery, suggesting that perceived challenge might not in fact increase mastery experiences. Crucially, the authors noted that this surprising finding may have owed to the lack of feedback available to their participants. As a result, they likely could not engage in any meaningful comparison with other participants, leaving them unsure as to whether a sense of mastery was justifiable based on their performance. Due to this mitigating factor, it is expected that challenge will predict mastery. There is also evidence to suggest that the immersion dimension of control will predict mastery, as competence is facilitated by easily understood controls [54]. Finally, there are no theoretical mechanisms nor supporting research to suggest that emotional involvement and real-world dissociation should demonstrate an association with mastery. Therefore, the third hypothesis is:

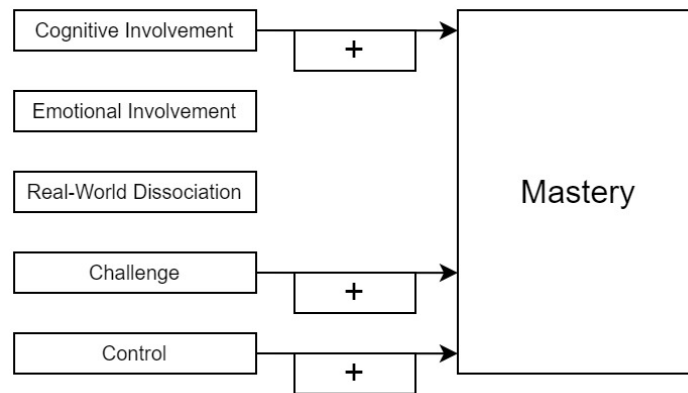
**RQ2-H3 (3).** Mastery will be positively predicted by (a) cognitive involvement, (b) challenge and (c) control, but not (d) emotional involvement or (e) real-world dissociation.



**Figure 1: Predicted relationships between immersion subcomponents and psychological detachment. “+”denotes a positive predicted relationship.**



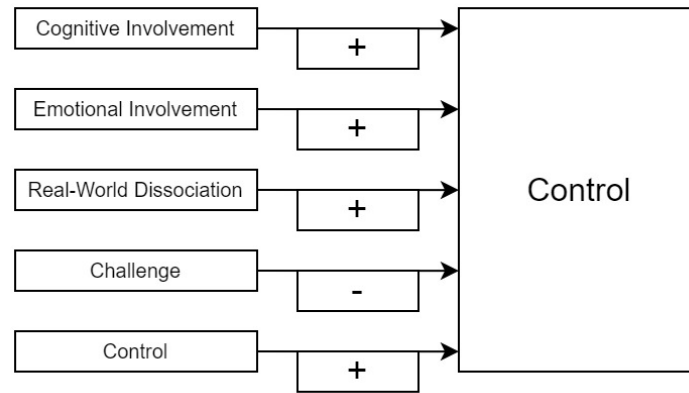
**Figure 2: Predicted relationships between immersion subcomponents and relaxation. “+” and “-“ denote positive and negative predicted relationships respectively.**



**Figure 3: Predicted relationships between immersion subcomponents and mastery. “+”denotes a positive predicted relationship.**

With respect to the recovery experience of control, it is thought that a greater sense of agency is felt over in-game actions when

experiencing deeper levels of cognitive and emotional involvement and mental transportation to the game world [12]. As control is



**Figure 4: Predicted relationships between immersion subcomponents and control. “+” and “-” denote positive and negative predicted relationships respectively.**

thought to arise with the perception that players are having an effect in the game environment [41] it follows that this recovery experience should increase with greater involvement and real-world dissociation. Furthermore, research into gaming and basic psychological needs indicates that autonomy, which can be considered broadly analogous to the recovery experience of control, is increased when game controls are well understood [54]. Thus, it is hypothesised that the control facet of immersion will predict the recovery experience of control. Finally, challenge is expected to negatively predict the experience of control, based on the finding that games which are high in perceived cognitive demand led to reduced feelings of control [81]. The authors of this paper suggest that this finding arises because players feel that they are unable to successfully complete challenges which reduces their sense of control over the game environment. Hence, we make the following predictions for the fourth hypothesis:

**RQ2-H4 (4).** Control will be positively predicted by (a) cognitive involvement, (b) emotional involvement (c) real-world dissociation and (d) control, and negatively predicted by (e) challenge.

The current study also seeks to understand the relationship between immersion and overall recovery experience (i.e., the sum of the individual recovery experiences). Given the various directions in which each facet of immersion is hypothesised to be related to the four recovery experiences, it is difficult to make specific hypotheses regarding these relationships. Due to this uncertainty, no predictions are made with respect to the relationship between the immersion components and overall recovery experience. Instead, the analyses pertaining to this relationship will remain exploratory and the following research question is posed:

**RQ3:** Which components of immersion are predictive of overall post-work recovery experience?

As previously discussed, models of post-work recovery highlight how recovery experiences (the psychological experiences underlying a recovery activity) translate into recovery outcomes (an individual’s psychological and physiological state following a recovery activity). Thus, to fully understand the impact of immersion

when gaming for recovery, it is important to examine both recovery experiences and outcomes. To this end, we examined the recovery experience of energetic arousal, which refers to the one’s subjective sense of energy and vigour [66] and is commonly assessed in post-work recovery research [15, 47, 49]. As working is thought to deplete one’s energy levels, experiencing greater energetic arousal following a recovery activity suggests that a restorative process has taken place and is indicative of a successful recovery episode [77]. As with overall recovery experience, it is difficult to generate a specific hypothesis regarding the association between immersion and energetic arousal. Again, this is because of the various directions of the relationships predicted between the dimensions of immersion and the four recovery experiences (which should underlie recovery outcomes). Hence, these analyses are also exploratory, with the following research question proposed:

**RQ4:** Which components of immersion are predictive of post-work energetic arousal?

## 4 METHOD

### 4.1 Participants

Participants were recruited for the study using Reddit (including subreddits for survey-sharing, e.g., r/SampleSize, and related to digital games, e.g., r/Steam), via social media and through word of mouth. The eligibility criteria for the study were that participants were in employment (full-time or part-time) and had played a digital game after work within the last week. All participants were offered the chance to enter a prize draw to win one of eight £25 Amazon vouchers.

In total, 194 participants clicked the survey link of which 75 successfully completed the survey. Of the participants, 55 were male, 16 were female and 4 were non-binary. Their average age was 30.09 years ( $SD = 8.94$ ,  $Range = 18-58$ ). On average participants estimated that they worked 35.30 hours per week ( $SD = 11.64$ ,  $Range = 5-60$  hours). Participants’ occupational fields can be found in Table 1.

**Table 1: Occupational fields of participants.**

Field	Number of Participants
Administration	2
Business Management	7
Education	7
Engineering	5
Finance	2
Human Resources	2
Law	2
Law Enforcement & Security	2
Leisure & Tourism	7
Logistics	3
Marketing & Sales	7
Media	4
Medical	1
Property	1
Retail	5
Technology	13

Note: 5 responses were unable to be placed into an occupational category and were left unclassified.

## 4.2 Procedure

Upon clicking on the study link, participants were given an overview of the concept of post-work recovery. Specifically, they were told that people engage in activities after work that can either help or hinder them in unwinding from their day and that they would be reflecting on their use of digital games for this purpose. They were also informed that throughout the study, all questions should be answered based on their most recent post-work gameplay episode. Following this, they provided informed consent and basic demographic information. Then, they were instructed to name the digital game they had most recently played after work and to report how many days ago this gameplay episode occurred. After this, they were asked to describe as much as they remembered about what happened while they were playing this game. This served as a guided recall process, priming participants to answer the subsequent questions which asked them to reflect upon their most recent post-work gaming episode. As with other studies that have examined gaming experiences [17, 29, 30], guided recall was included to reduce the possibility of participants' recall being biased. This was particularly important given that the episode in question could have occurred up to 7 days prior.

Participants then answered a series of open-ended questions centred on this gaming episode, with this forming the qualitative component of the study. Given the exploratory nature of the study, these questions did not refer to immersion in order to avoid priming participants to include this player experience in their responses. In the first question, they were asked why they had chosen that particular game to help them unwind from work. Then they were instructed to describe any thoughts, feelings and experiences they had in response to playing the game. Finally, they were asked to reflect upon these thoughts, feelings and experiences to explain how the game helped or hindered them in unwinding from work. In this last question, participants were asked about both the costs and benefits of the gaming episode in order allow for the exploration of any

unexpected negative impacts of their player experiences. Following this, participants completed a series of questionnaire measures (detailed below), which constituted the quantitative component of the study.

## 4.3 Materials

Immersion during the post-work gameplay episode was measured using the Immersive Experience Questionnaire (IEQ; Cronbach's  $\alpha = .89$ ) [27], a 31-item measure which consists of five subscales: Cognitive Involvement (IEQ-CI), Emotional Involvement (IEQ-EI), Real-World Dissociation (IEQ-RWD), Challenge (IEQ-Ch) and Control (IEQ-Con). As per [4], two items which referred to "winning" the game were removed. This decision was taken on the basis of our pilot study, as participants reported that they had difficulty answering these questions if they had played a game without a defined victory state. Example items from this measure include: "To what extent did the game hold your attention?" (Cognitive Involvement), "To what extent did you feel emotionally attached to the game?" (Emotional Involvement), "To what extent did you feel as though you were separated from your real-world environment?" (Real-World Dissociation), "To what extent did you find the game challenging?" (Challenge) and "At any point did you find yourself become so involved that you were unaware you were even using controls?" (Control).

In order to measure their recovery experience during the post-work gameplay episode, participants completed the Recovery Experience Questionnaire (REQ;  $\alpha = .82$ ) [61]. This is a 16-item questionnaire which consists of four subscales: Psychological Detachment (REQ-Detach), Relaxation (REQ-Relax), Mastery (REQ-Mastery) and Control (REQ-Control). Overall recovery experience (REQ-Overall) was computed by summing the scores from each of these subscales. Example items from this measure include: "When I played the game, I forgot about work." (Psychological Detachment), "Playing the game allowed me to kick back and relax." (Relaxation), "Playing the game

**Table 2: Genres of games chosen by participants for their most recent recovery episode.**

Game Genre	Number of Games
Action role-playing	5
Action-Adventure/platformer	11
Augmented Reality (AR) Game	1
Massively Multiplayer Online Role-Playing Games (MMORPGS)	2
Multiplayer Online Battle Arena (MOBA)	4
Puzzle/simulation/construction	18
Real-time and turn-based strategy	1
Role-playing games (RPG)	4
Shooters (first- and third-person)	16
Sport/racing/fighting	6

Note: 7 responses were unable to be categorised into a game genre and were left unclassified.

meant I could learn new things.” (Mastery) and “Playing the game made me feel like I could decide for myself what to do.” (Control). Note that items were adapted from the original scale to make them applicable to a gaming context (i.e., prefacing each item with “playing the game...”).

The Activation-Deactivation Adjective Checklist (ADACL) [66] was used as a recovery outcome measure. The ADACL consists of a series of 20 adjectives organised into four subscales: Energy (e.g., “lively”), Tiredness (e.g., “sleepy”), Tension (e.g., “jittery”) and Calmness (e.g., “at-rest”). Participants rated the extent to which they felt these adjectives applied to them following their post-work gameplay episode. In line with other studies in the games and recovery literature [16, 43, 50], the Tiredness subscale was reverse scored and summed with the Energy subscale to form a measure of energetic arousal (ADACL-Arousal;  $\alpha = .86$ ). The Tension and Calmness subscales, though completed by the participants, were not subject to analysis, as only energetic arousal is an indicator of recovery [50].

## 5 RESULTS

### 5.1 Overview of Gameplay Episodes

The gameplay episodes reported by participants occurred 1.62 days previously on average ( $SD = 1.71$ ,  $Range = 0-7$  days). Participants played a range of games during the reported recovery episode, including *Elden Ring*, *Pokémon Go*, *GTA V*, *Apex Legends*, *Princess Farmer*, *Skyrim*, *Motorsport Manager* and *Lego Star Wars: The Skywalker Saga*. A full breakdown of the game genres played by participants, adapted from [28], can be found in Table 2.

### 5.2 RQ1: How does the player experience of immersion shape the post-work recovery potential of digital games?

Qualitative data analysis was carried out in NVivo, using a hybrid thematic analysis approach [65]. Here, two phases of data coding took place. In the first phase, the responses were coded inductively, guided by the data rather than any pre-existing theories related to immersion or post-work recovery. For the second phase, the data was coded deductively and with reference to the five subcomponents of immersion from the IEQ [27] and the four recovery

experiences outlined in the REQ [61]. Once the two phases of coding were complete, inductive and deductive codes were merged and theme development took place in line with a traditional thematic analysis [7, 8]. Combining inductive and deductive coding ensured a flexible approach could be taken to the analysis, wherein novel concepts not already covered by existing literature could be explored, whilst also leveraging the explanatory power offered by existing theory and research. The thematic analysis was carried out by the first author, with regular discussions involving the rest of the authors.

The following four themes were generated from the participants’ open-ended survey responses: (1) Optimising Immersion for Recovery, (2) Immersion as a Post-Work Distraction, (3) The Mastery-Relaxation Dichotomy and (4) Prioritising Completionism & Convenience Over Immersion. Each theme is accompanied by illustrative quotes, labelled with the participant code and the game the participant reported playing in their recovery episode. Note that all participants, even those who didn’t successfully complete the survey, were assigned a participant code. As a result, the participant codes exceed the sample size of 75. All quotes have been recorded verbatim, with no editing to correct errors of spelling or grammar. Where immersion subcomponents (cognitive involvement, emotional involvement, real-world dissociation, challenge and control) and recovery experiences (psychological detachment, relaxation, mastery and control) have been identified using deductive coding, they have been italicised for clarity.

**5.2.1 Optimising Immersion for Recovery.** The first theme refers to occasions where participants adopted deliberate strategies in order to curate the optimal level of immersion for their post-work recovery needs. One way in which participants did this was through their choice of game for the recovery episode. For some, this involved tailoring their selection to achieve an immersive experience which addressed the specific recovery needs arising from their workday, as compared to other days when they experienced no work demands. For example, the following participant specifically sought out an experience that was low in *cognitive involvement* in order to maximise their recovery during the week:

*“I am a long time gamer and enjoy multiple types of games. During the weekend I will enjoy a more involved*

*playing experience like a RPG or action game. But after work I need to switch off and I will prefer simple low agency games.” (P137 – Battle Cats).*

For other players, they stopped playing a game which had previously elicited an immersive experience that hindered their recovery. This learning was used as the basis for the optimisation outlined in their response. Specifically, they sought out an opposing experience in order to improve their post-work recovery. This is exemplified by P4’s description of seeking out a gameplay experience to unwind from work that was less *involved* than a game that they had previously played:

*“I could no longer enjoy any other games that I normally play (eg. Valorant,osu) because I would be too bothered with performance(meaning it actually hindered me from enjoying the game) and I do not have enough time to spend on visual novels. I had to find a game I could enjoy casually.” (P4 – Apex Legends).*

As well as their choice of game, players also optimised their gameplay towards their desired level of immersion. One way of achieving this was by using specific gameplay mechanics such as difficulty settings or game modes. Some participants remarked that their motivation for playing certain games to recover was that they were able to calibrate these mechanics to bring about recovery-promoting immersive experiences. This can be seen by P172 justifying their decision to play Bioshock Infinite for post-work recovery by explaining how its choice of difficulty modes allowed them to reduce challenge and optimise their levels of *emotional involvement*:

*“It’s less ‘stressful’ than playing the main game because there’s no story and no stakes, and no enemies hiding behind corners or ready to attack when you enter an area.” (P172)*

As well as using specific gameplay mechanics to optimise their PX, players also adopted specific styles of play, as can be observed in the below quote from P126’s account of playing Elden Ring. Here, they decided from the outset of the gaming episode to restrict themselves to attempting manageable tasks, calibrating the *challenge* dimension of immersion in a similar fashion to P172. However, in this case it was specifically so that they could experience the sense of *mastery* required for a successful recovery. P126’s description also highlights that immersion is not only optimised towards general recovery needs. Instead, immersion can be tailored to address unique needs arising from the working day preceding a gameplay episode:

*“That game in particular because I know I’ve got stuff to do in it, like I’ve got a mental todo list and I wanted to check a couple bits off. I picked pretty chill tasks to do so I wouldn’t get frustrated so it was mostly nice, still feels like an accomplishment even though I know I’d made it too easy for myself. Sometimes I don’t get everything done in the work day that I want to and that’s frustrating, so getting a quick burst of “I did something!” feeling is good.” (P126)*

**5.2.2 Immersion as a Post-Work Distraction.** The next theme covers instances in which experiencing immersion served as a distraction during post-work recovery. This theme is distinct to *Optimising*

*Immersion for Post-Work Recovery* as participants did not report actively adopting strategies to alter their level of immersion in these examples. However, in principle, immersion’s ability to serve as a distraction could be one mechanism by which a successful optimisation might occur.

One immersion subcomponent which contributed to the ability of immersion to distract was *cognitive involvement*, which resulted in participants’ attention being captured to the extent that they had limited capacity for work-related ruminations: *“I felt I wasn’t thinking about work at all and could forget about the stressful day I’d had. The game completely took my attention, but not in a way that felt stressful or tense.” (P168 – Lego Star Wars: Skywalker Saga).* For some participants, the attention-capturing property of the game that they played translated into relaxation as well as psychological detachment: *“As I am channelling my thoughts into the game it stops me thinking of work and calms my mind.” (P42 – Microsoft Hearts).* However, it should be noted that the ability of the immersion to serve as a distractor was not a necessary condition for participants to experience psychological detachment and relaxation. For example, P28 reported that playing Princess Farmer *“passed the time as I relaxed in bed and got my mind away from life”* despite the fact that they experienced limited *cognitive involvement*: *“had a hard time grasping the vibe the game was going for and didn’t find myself invested in its plot”.*

Players also valued the capacity of games to distract them by mentally transporting them to the game world, frequently citing this as a reason for selecting certain games for post-work recovery: *“Sometimes you just need a place to spend time, and game worlds are virtual and often feel like things you can’t experience in real life.” (P85 – Call of Duty).* Notably, this sense of *real-world dissociation* was connected specifically to the experience of psychological detachment. For example, P119 stated that when playing Mass Effect 3, they *“found myself completely immersed in the game world, which let me shrug off my thoughts about the day’s work for a while.”* Similarly, P82 noted that the playing Kirby and The Forgotten Land *“helped because i felt immersed in the game world and forgot about anything else”.* It is also important to acknowledge that real-world dissociation could co-occur with cognitive involvement during the same recovery episode. This can be seen in P57’s account of playing Total War: Warhammer 3, which incorporates both a sense of *involvement* (finding the battle mechanics highly engaging) and *real-world dissociation* (through being mentally transported to the game’s fantasy setting). This combination appeared to be particularly effective in occupying P57’s mind and distracting them from their work-related concerns.

*“Being able to immerse into a fantasy world and setting is an excellent way to unwind. Watching stories unfold is very rewarding and engaging. The battles are so intense that you don’t have time or space to listen to any nagging or negative thoughts that might be hanging around. The game demands your full focus and attention in these battles and it’s possible to reach a state of “flow”.”*

It is important to acknowledge that being distracted by the immersive properties of a game was not always desirable during recovery episodes. In fact, some participants actively attempted to

avoid *real-world dissociation* and the lost awareness of time that characterises it: “*The game helped me to unwind because it can be played at my own pace. I can play for 10 minutes or 2-hours it doesn’t matter.*” (P48 – *Animal Crossing: New Horizons*). This reticence to engage in mental transportation to the game world sometimes owed to the wider context surrounding players’ game use, such as needing the time to fulfil other responsibilities: “*the nature of the game makes it easy to pick up and play a few rounds, then move on to other things I need to do with my day.*” (P131 – *Rogue Legacy 2*). Thus, being distracted by games after work may sometimes be perceived as inappropriate due to external constraints.

**5.2.3 The Mastery-Relaxation Dichotomy.** The next theme refers to an inherent tension that exists between *mastery* and *relaxation* when gaming for recovery, in terms of the differing levels of the *challenge* component of immersion that these recovery experiences require. Some participants reported that “*mindless*” (P21 – *Deep Rock Galactic*) experiences helped them achieve relaxation. For example, one participant (P82 – *Kirby and The Forgotten Land*) indicated that playing highly challenging games during their recovery time would be a source of stress, rather than relaxation: “*i like to play relaxing or cute games after work, if i played a violent or hard game i would be more stressed rather than relaxed.*” Others elaborated on this idea further, making it clear that they had curated a play experience that was low in challenge so they could relax after working in a stressful environment:

*“It’s a simple game concept which requires very little effort to play. The artwork and character design is goofy and fun. I can easily “switch off” while playing. The goofy aesthetics of the game keep it light. The simple gameplay loops doesn’t require a lot of concentration or involvement. It is a complete 180° from my work. (I work in a high stress performance driven field)”* (P137 – *Battle Cats*)

In contrast, for others, the experience of *challenge* whilst gaming was beneficial for post-work recovery. Or as one participant put it, their post-work gameplay episode provided “*a welcome mental challenge*” (P115 – *Breathedge*). However, it is vital that these experiences were balanced against the player’s skill level, posing a challenge whilst still being achievable: “*The game presented me problems that I could solve with relative ease, as I am very much competent and experienced in it. It felt good to take on challenges in a safe environment.*” (P44 – *Motorsport Manager*). Indeed, the absence of perceived challenge was deemed by some as negative in a post-work recovery context, such as P25, who played *Back 4 Blood* and questioned “*why am I playing this, it’s repetitive and not really ‘challenging’*”.

It appears that high challenge experiences were beneficial for achieving a feeling of mastery. Specifically, taking on and beating challenges set by the game offered participants the sense of accomplishment that characterises this recovery experience: “*Hunting secrets made me feel stupid then smart once I figured them out.*” (P136 – *Ion Fury*). However, this means that a tension exists between different recovery experiences during post-work play. Where a player has a high-challenge experience and achieves mastery, this might be at the cost of a less challenging experience that facilitates relaxation (and vice versa). Again, the influence of challenge on mastery

and relaxation represents a potential route by which immersion optimisation for post-work recovery could take place. However, this theme is still distinct to *Optimising Immersion for Post-Work Recovery* as, in the examples provided, participants did not necessarily actively adopt strategies to manipulate their sense of challenge.

**5.2.4 Prioritising Completionism & Convenience Over Immersion.** The final theme relates to instances where completionism and convenience, rather than the experience of immersion, were prioritised by participants during the recovery episode in question. For example, completionist post-work gaming was demonstrated with instances where participants played the same game each day following work until they had finished it: “*I normally only play one game at a time, and that is the game I had most recently chosen. I like to finish games unless I really don’t like them.*” (P117 – *Lego Star Wars: The Skywalker Saga*). Others maintained a list of games they wanted to play and were habitually working their way through it: “*I’ve been getting into retro FPS/boomer shooters and Ion Fury was on the list.*” (P136).

Another subset of players made their post-work game selections based on convenience rather than a desire to experience immersion. Specifically, some stated that their motivation for playing a game was that it utilised their preferred device, such as P32 who decided to play *Mobile Legends* to recover “*because it is on my phone*”. Other players offered further elaboration on this idea, making it clear that they had chosen a game which allowed them to use the input device that best fitted the desired context for their recovery play episode: “*I wanted to play a game from bed on my laptop rather than one that demanded me use a mouse. The relatively slow pace and simple controls of No Man’s Sky made that viable.*” (P138).

Of course, this is not to say that these participants did not experience immersion during their post-work play episode. Instead, they simply did not make reference to immersion when explaining the motivation for their game selection. However, it was striking that those whose responses fitted into this theme often reported fairly neutral player experiences. For example, P69 chose to play *Pokémon Go* because they “*wanted to keep up my daily streak*”, rather than for any reasons related to immersion. When asked to report their experiences during the play episode, P69 mentioned “*nothing in particular*”. This suggests that completionist- or convenience-based game selection might evoke a more limited post-work player experience, or at least experiences that are less likely to be recalled at a later date.

### 5.3 RQ2: How is the experience of immersion whilst gaming related to each of the four recovery experiences?

Pearson correlations between all variables measured in the current study (including those not incorporated into the main analyses) can be found in the Supplementary Materials. In order to address RQ2-4, six multiple linear regressions were conducted in RStudio, each of which had one of the recovery variables (REQ-Detach, REQ-Relax, REQ-Control, REQ-Mastery, REQ-Overall and ADACL-Arousal) as the criterion variable. For each regression model, the five components of immersion (IEQ-CI, IEQ-EL, IEQ-RWD, IEQ-Ch, IEQ-Con) served as the predictor variables and were entered into

**Table 3: Regression coefficients for models predicting recovery experiences with immersion components as predictor variables (RQ2).**

Variable	REQ-Detachment		REQ-Relaxation		REQ-Mastery		REQ-Control	
	B	SE	B	SE	B	SE	B	SE
Intercept	6.952*	1.726	10.397***	1.760	-0.014	2.110	7.833**	2.527
IEQ-CI	0.190*	0.080	0.181***	0.052	0.090	0.062	-0.145	0.074
IEQ-EI	-0.094	0.092	-0.063	0.060	0.341***	0.071	0.311***	0.085
IEQ-RWD	-0.007	0.080	-0.074	0.052	0.134*	0.062	0.097	0.074
IEQ-Ch	0.039	0.162	0.006	0.105	0.080	0.125	0.190	0.150
IEQ-Con	0.137	0.155	0.122	0.100	-0.190	0.120	-0.012	0.144

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < 0.001$

the regression model simultaneously. Unstandardised regression coefficients for each of these models can be found in Tables 3-5. Scatterplots and normal Q-Q plots were examined and no issues with non-linearity, homoscedasticity or non-normally distributed residuals were detected. To examine for multicollinearity amongst the predictor variables, Variance Inflation Factors (VIFs) were computed for all predictors in each regression model. All VIFs were  $< 3$ , below the threshold ( $VIF > 5$ ) with which multicollinearity is thought to be a concern for the model [22].

**5.3.1 RQ2-H1: Psychological detachment will be positively predicted by (a) cognitive involvement, (b) emotional involvement and (c) real-world dissociation, but not (d) challenge or (e) control.** The overall model for predicting psychological detachment was significant ( $F(5,69) = 2.93$ ,  $p = 0.018$ , Adjusted  $R^2 = .116$ ). As can be seen in Table 3, H1 was partially supported, with cognitive involvement found to positively predict the experience of psychological detachment. However, contrary to our expectations, psychological detachment was unrelated to both emotional involvement and real-world dissociation. As predicted, neither challenge nor control were significantly associated with psychological detachment.

**5.3.2 RQ2-H2: Relaxation will be positively predicted by (a) cognitive involvement, (b) real-world dissociation (c) and control, and negatively predicted by (d) emotional involvement and (e) challenge.** The model with relaxation as the criterion variable was significant overall ( $F(5,69) = 5.50$ ,  $p < .001$ , Adjusted  $R^2 = .233$ ). In line with H2, cognitive involvement was a significant predictor, with individuals who were more cognitively involved in their games experiencing greater relaxation (see Table 3). However, none of the other IEQ components exhibited a significant relationship with relaxation. As such, the data did not support the remaining predictions outlined in H2.

**5.3.3 RQ2-H3: Mastery will be positively predicted by (a) cognitive involvement, (b) challenge and (c) control, but not (d) emotional involvement or (e) real-world dissociation.** Overall, the regression model predicting mastery was significant ( $F(5,69) = 15.84$ ,  $p < .001$ , Adjusted  $R^2 = .501$ ). However, both immersion components that were predicted in H3 to be unrelated to mastery (emotional involvement and real-world dissociation) were in fact significant

positive predictors (see Table 3). By contrast, cognitive involvement, challenge and control were all unrelated to mastery, meaning the positive relationships predicted in H3 were not found.

**5.3.4 RQ2-H4: Control will be positively predicted by (a) cognitive involvement, (b) emotional involvement (c) real-world dissociation, and (d) control and negatively predicted by (e) challenge.** The regression model predicting the recovery experience of control was significant ( $F(5,69) = 5.95$ ,  $p < .001$ , Adjusted  $R^2 = .251$ ). As can be seen in Table 3, H4 was partially supported, as emotional involvement was a significant predictor of control. However, there was no evidence for relationships with the other components of immersion expected to positively predict control (cognitive involvement, real-world dissociation and control). Moreover, the challenge component of immersion, which was predicted to have a negative relationship with control, was not a significant predictor in the regression model.

## 5.4 RQ3: How is the experience of immersion whilst gaming related to overall post-work recovery experience?

The overall model predicting overall recovery experience reached statistical significance ( $F(5,69) = 12.66$ ,  $p < .001$ , Adjusted  $R^2 = .440$ ). Both cognitive and emotional involvement were significant predictors (see Table 4), with participants who experienced greater involvement having a stronger overall recovery experience. Real-world dissociation, challenge and control were all non-significant predictors of recovery experience.

## 5.5 RQ4: How is the experience of immersion whilst gaming related to post-work energetic arousal?

The model constructed to predict energetic arousal was significant ( $F(5,69) = 5.68$ ,  $p < .001$ , Adjusted  $R^2 = .240$ ). As can be seen in Table 5, only cognitive involvement was a significant predictor, with greater involvement associated with greater energetic arousal. None of the remaining components of immersion demonstrated significant relationships with energetic arousal.

**Table 4: Regression coefficients for model predicting overall recovery experience with immersion components as predictor variables (RQ3).**

Variable	B	SE
Intercept	25.168***	5.179
IEQ-CI	0.316*	0.152
IEQ-EI	0.495**	0.174
IEQ-RWD	0.150	0.152
IEQ-Ch	0.315	0.308
IEQ-Con	0.057	0.295

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < 0.001$

**Table 5: Regression coefficients for model predicting energetic arousal with immersion components as predictor variables (RQ4).**

Variable	B	SE
Intercept	8.819	4.714
IEQ-CI	0.366*	0.139
IEQ-EI	0.264	0.159
IEQ-RWD	-0.118	0.139
IEQ-Ch	-0.176	0.280
IEQ-Con	0.087	0.268

\*  $p < .05$

## 6 DISCUSSION

This study aimed to investigate how the player experience of immersion whilst gaming shapes post-work recovery. A thematic analysis of the qualitative data demonstrated the existence of a process not yet identified in the existing literature: immersion optimisation for post-work recovery. We have defined this construct as the strategies employed by a player to achieve the level of immersion required for their recovery needs. Additionally, the thematic analysis demonstrated that immersion whilst gaming for recovery can be beneficial in certain contexts and for certain people, but that this is not always the case. This ‘noisy’ relationship between immersion and recovery may also be reflected in the quantitative analyses where the majority of the hypothesised relationships were not observed. Potential reasons for each of these unexpected findings are discussed below, but in a general sense, given the complexities identified in the thematic analysis it is perhaps unsurprising that straightforward, linear relationships were difficult to observe. Nonetheless, some clear relationships were identified, most notably between cognitive involvement and recovery. This can be observed in Figure 2, a visual representation of the quantitative findings, which demonstrates that cognitive involvement was predictive of four of the six recovery variables (psychological detachment, relaxation, overall recovery experience and energetic arousal). This finding is in line with the theoretical assumption that digital games can support post-work recovery due to their ability to capture the attention of players [41].

### 6.1 Immersion Optimisation

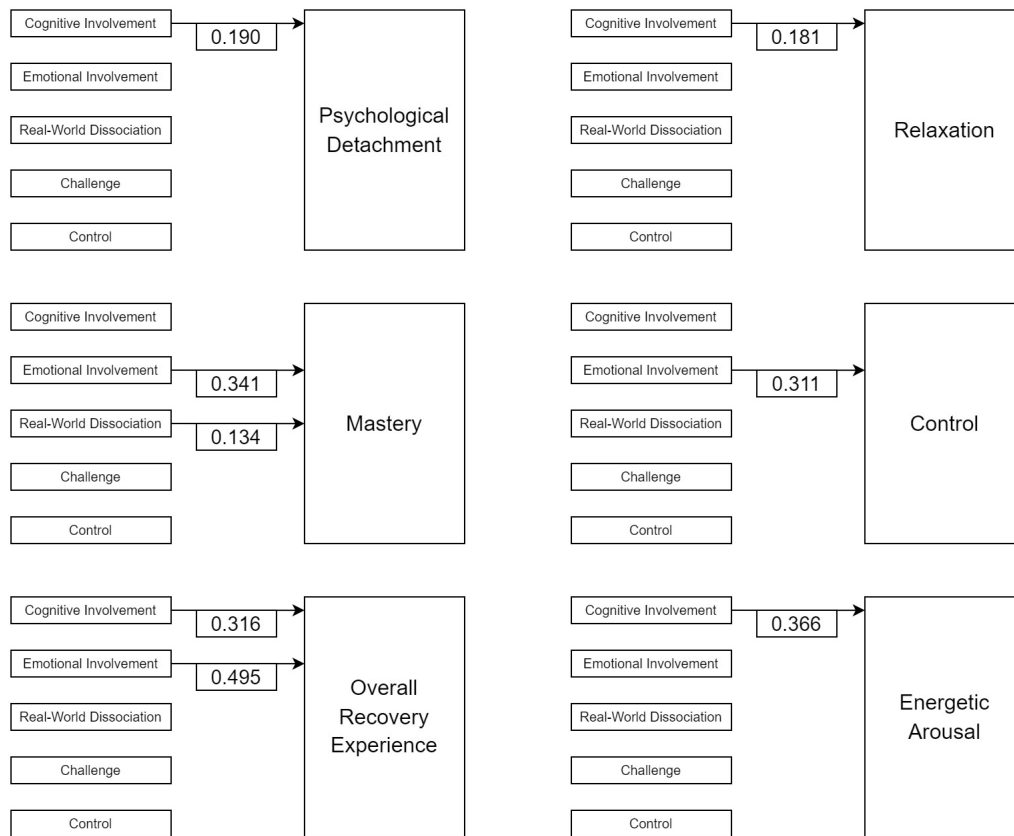
One of the ways in which immersion was found to impact post-work recovery was via the process of immersion optimisation, whereby participants curated immersive experiences during their post-work gameplay episode that maximised their recovery. Participants reported three means of engaging in immersion optimisation: (1) their choice of game, (2) the manipulation of gameplay mechanics and (3) the adoption of gameplay styles. All three of these optimisation methods were used by participants to calibrate their levels of immersion for post-work recovery, for example, in order to achieve their preferred level of challenge.

Outside of the context of games, there is evidence that people optimise their selection of non-interactive media, such as television viewing, for recovery purposes [84]. For example, bored individuals will choose more stimulating television programmes, whereas stressed individuals prefer more relaxing television options [9]. However, our findings show that there are methods other than one’s selection of game that can be used for optimisation, namely by leveraging gameplay mechanics and styles. Thus, the findings provide empirical support for the arguments made by [23], who suggest that players of digital games might “select and modify situations to meet their emotional goals” (p.136). This might also contribute to the finding that games are a more effective recovery activity than non-interactive media [16, 45, 81] because there are additional ways in which they can be optimised other than simply choosing what to play.

### 6.2 Immersion & Recovery

For those who optimised their levels of immersion during their post-work play episode, our other findings demonstrate how this process could impact recovery. For example, both the quantitative and qualitative data indicate that cognitive involvement plays a key role when gaming for recovery. As hypothesised, cognitive involvement was predictive of psychological detachment; in keeping with the notion that this player experience makes demands on one’s mental capacities, leaving limited capacity for work-related thoughts [41]. The qualitative data coheres with this idea as the theme “Immersion as a Post-Work Distraction” indicated that experiencing high levels of cognitive involvement served as a distraction from reality, including work-related concerns. As well as psychological detachment, cognitive involvement was also found to be predictive of relaxation. The relationship between cognitive involvement and relaxation is in line with the argument that because games are found by many to be inherently relaxing [21, 58, 82], a greater effortful engagement with them should increase the experience of relaxation. Finally, cognitive involvement also predicted overall recovery experience and energetic arousal, which can be attributed to its relationships with psychological detachment and relaxation.

For the other dimensions of immersion, their impact on post-work recovery was less clear. For example, real-world dissociation was not found to be predictive of psychological detachment (which had been hypothesised on the basis that this immersion dimension makes mental demands that preclude work-related thoughts [41]), relaxation (which was expected based on existing research demonstrating that losing track of time whilst gaming is relaxing [80]) or control (which had been predicted based on the notion that a



**Figure 5: Statistically significant regression coefficients for predictions of recovery variables.**

greater sense of in-game agency, which is enhanced by real-world dissociation [12], increases the recovery experience of control [41]). The qualitative data offers potential answers for these unexpected findings. The theme “Immersion as a Post-Work Distraction” indicated that real-world dissociation had complicated relationships with post-work recovery. For some, being mentally transported into the game world served as a positive distraction which reduced their work-related thoughts. However, for others, the distraction associated with real-world dissociation was perceived negatively because losing their awareness of time prevented them from completing their other responsibilities. This finding suggests the possibility that some of the participants who experienced real-world dissociation had a negative appraisal of their gaming episode because they felt it was a procrastinatory activity. This negative appraisal could have interfered with their ability to successfully recover from work. This interpretation is supported by [44] who found that when gamers interpreted their gameplay as procrastinatory they experienced guilt which impeded their ability to recover. As a result of these potential individual differences in appraisals of post-work real-world dissociation, it might not be possible to observe a straightforward statistical relationship between this facet of immersion and recovery experiences. However, this interpretation is speculative at present; future research is required which assesses players’ appraisals of

their post-work gaming in order to ascertain whether it moderates the relationships between immersion and recovery variables.

Other dimensions of immersion, such as challenge, had a similarly complex relationship with post-work recovery. For instance, based on the qualitative data, “The Mastery-Relaxation Dichotomy” theme was identified whereby these two recovery experiences required diametrically opposed player experiences; whereas mastery experiences were founded on high levels of challenge, relaxation required a low-challenge experience. This theme is consistent with existing research which has identified that challenge during games is necessary to experience the basic psychological need of competence [31, 36] (which can be considered analogous to mastery) and that games perceived as low in challenge are more relaxing [81].

However, the dichotomy identified in the qualitative data was not reflected in the quantitative data. Contrary to our predictions, challenge was not found to relate positively to mastery nor negatively to relaxation. Without further investigation, it is difficult to state why this unexpected finding might have arisen. One speculative explanation is that there existed unidentified moderator variables. One potential moderator could be the social context of play as, unlike single player games, multiplayer games are not typically found to be relaxing [74]. Many of our participants played multiplayer games (e.g., *Apex Legends*, *Among Us*, *League of Legends*, *New World*) and perhaps for these individuals their choice of game precluded

relaxation from occurring, irrespective of the level of challenge they experienced. We did not ask participants to report whether they played games in single- or multi-player nor could we carry out exploratory analyses using their reported game choices as there were examples of games with the option for both social and non-social play (e.g., *Animal Crossing: New Horizons*). Future research should explicitly ask participants for the social context of their gameplay, and any other potential moderators, when examining the relationships between challenge and recovery experiences.

Another unexpected finding relating to challenge was its non-significant relationship with control, where a negative association had been predicted. This lack of a relationship is inconsistent with Wulf and colleagues' [81] findings, where a game perceived as more demanding was found to elicit lower levels of control. The authors interpreted this as evidence that challenging games reduce players' sense of control over the game environment. It is unclear though why a similar effect was not observed for participants in the present study. However, it is worth noting that Wulf et al. used Tetris as the game stimulus. Tetris represents a relatively constrained environment with a limited number of actions available to the player at any given time, combined with a discrete and objective failure state. Perhaps in such game environments, when faced with high levels of challenge, control is impacted because there are few alternative actions available. By contrast, many participants in this study played unconstrained games with open worlds (e.g., *Elden Ring*, *No Man's Sky*) and likely had alternative choices of actions in the face of difficulties or failure. Consequently, high-challenge experiences while playing these games may not have reduced their feelings of control.

As well as the absence of certain predicted relationships, our analysis also indicated relationships between the immersion dimensions and recovery variables that were not expected. For example, both emotional involvement and real-world dissociation were unexpectedly found to be predictive of mastery. We interpret mastery's relationship with emotional involvement as a reverse correlation because beating in-game challenges has been found to lead to an affective response [31]. Consequently, the relationship between emotional involvement and overall recovery experience should also be interpreted with caution. The relationship between real-world dissociation and mastery is similarly difficult to interpret given the lack of theoretical and empirical support. However, we offer a speculative interpretation based on the notion that experiencing real-world dissociation is thought to increase the sense of agency over one's in-game actions [12]. Perhaps when players experience stronger ownership over their in-game actions, facilitated by an increase in real-world dissociation, they feel a greater sense of mastery from the successful outcomes of these actions.

### 6.3 Ethical Implications

Within the context of work, HCI researchers are becoming increasingly critical of the role of labour and capitalism, with the primary concern being that technologies are being designed in the service of profits rather than to benefit their users [20]. Consequently, research which addresses issues pertaining to work should consider the ethical implications for the labour force. For instance, it

is possible that employers might use our findings to justify recommending, or even enforcing, the use of games to recover from work strain. This approach could have the unfortunate consequence of de-incentivising employers from introducing preventative measures which address the causes of work stress (e.g., low pay, job instability [32]). We strongly urge that our findings should not be perceived as a "free pass" for employers to continue using harmful working conditions and practices. Rather, we hope that this study aids those who are experiencing work stress in the immediate present to better understand how to recover effectively from day-to-day stresses, complimenting existing HCI research which is working towards improving and reimagining the conditions under which we work [34, 52].

### 6.4 Limitations and Future Work

There are three main limitations to the present study. The first limitation pertains to the composition of the study sample, which was predominantly male. Given that the proportion of male gamers is estimated to be 49-56% [67], our sample may not be representative. As such, it is unclear to what extent these findings generalise to the wider population who might be using games for recovery. The second limitation is that, due to the use of regression analysis, this study is unable to establish a causal relationship between the experience of immersion and post-work recovery. While the qualitative analysis indicated that immersion was impacting post-work recovery, we cannot say this for certain. As such, future research should be experimental in nature, comparing versions of a game designed to elicit high and low levels of immersion, to establish whether differences in recovery are observed. The third limitation is that the use of a survey limited our ability to explore the construct of immersion optimisation in more depth. For example, in the descriptions of recovery episodes which did not mention immersion optimisation, it was unclear whether the process was not occurring or instead was simply not sufficiently salient for participants to include in their reflections. Furthermore, the data cannot speak to whether there are contextual factors that influence immersion optimisation beyond those mentioned by participants, such as having specific recovery needs arising from particular work activities. To address this limitation, we plan in a future study to use a diary study methodology and explicitly ask participants to reflect upon their optimisation of immersion for recovery purposes. This approach will hopefully increase both the frequency and richness of participants' reflections upon their immersion optimisation.

### 6.5 Design Implications

Through using experimental and diary methodologies to extend this work and address the limitations raised, we will be able to develop more concrete implications for creators of serious games designed to ameliorate work-related stress [38] and for researchers looking to identify commercially available games with recovery potential [40]. However, we tentatively suggest two potential implications, caveated by the need for further supporting research. Firstly, games which are being used for recovery purposes should incorporate features that facilitate cognitive involvement, such as being played in a first-person perspective [18], given that this dimension of immersion demonstrated the most consistent relationships with

recovery variables. Secondly, when gaming for recovery, players should have access to features that provide them with the flexibility required for immersion optimisation to take place. For example, the inclusion of difficulty modes would allow players to increase or decrease their sense of challenge, depending on whether they had a greater need for mastery or relaxation.

## 7 CONCLUSION

Existing studies examining the restorative potential of particular player experiences have neglected the role of immersion and failed to examine these processes in real-world contexts. To address this gap in the literature, we conducted a mixed-methods survey study in which participants reflected upon the impact of immersion when gaming for post-work recovery. Our results suggest that experiencing digital game immersion is broadly beneficial for recovery and that people actively optimise this player experience in order to maximise the restoration of their internal resources following a day at work. These findings deepen our understanding of the role of immersion in restorative play and the mechanisms by which digital games promote post-work recovery.

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