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Switch on to games: Can digital games aid post-work recovery? ☆ ☆



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ABSTRACT

Recovery is a necessary factor in avoiding work-related strain and in feeling prepared for the next day of work. In order for recovery to be successful, an individual must experience psychological detachment from work, relaxation, mastery experiences and a sense of control, all of which have been argued to be assisted by digital game use. However, it is unclear whether these associations will be greater for certain digital game genres, or whether this would extend to other recovery-related outcomes, for instance work home interference (WHI), where the stress from work interferes with home-life. These factors may be vital in determining whether interventions aimed at improving recovery using digital games would be effective, and what form these should take. The present research surveyed 491 participants and found that the total number of hours spent playing digital games per week was positively correlated with overall recovery. Correlations varied with genre, highlighting the importance of game characteristics in this relationship: first person shooters and action games were most highly correlated with recovery. Moreover, digital game use was not related to a reduction in work-home interference. When restricting the analysis to gamers who report to have developed online relationships, online social support mediated the relationship between digital game use and recovery. Results are discussed in terms of how digital games may be utilised to improve recovery and reduce work-related stress.

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1. Introduction

The rise in mobile technologies has facilitated tele-working which in turn has enabled people to combine work with other commitments. This has had both financial and personal benefits for individuals by enabling those who may otherwise have been excluded to contribute to the workforce. For instance, the increased flexibility provided by the ability to work from anywhere, at any time, has allowed many to work around other responsibilities such as childcare, to work despite health complaints or to avoid lengthy and expensive commutes.

However, the negative impacts of the resulting always-on culture are well documented. For example, [Stawarz et al. \(2013\)](#) looked at tablet use and argued that these devices tend to encourage people to engage in work activities even when they had planned to undertake a leisure activity. Such activities can have negative consequences because, even for those who enjoy their employment, recovery is a necessary factor in avoiding work-related strain and in feeling prepared for the next day of work. In

order for recovery to be successful, an individual must experience psychological detachment from work, relaxation, mastery experiences and a sense of control ([Sonnentag and Fritz, 2006](#)).

Research suggests active pastimes involving some mental engagement are better as distractions from work stresses than passive ones ([Sonnentag and Fritz, 2007](#)). While it is clear that a large number of activities may therefore be suitable for this purpose, many of these require substantial time to be completed, preventing them from being possible for those who may be most at risk of suffering the consequences of insufficient recovery. For instance, sport and exercise have been highlighted to be especially useful in promoting recovery ([Sonnentag, 2001](#)), although for some, taking time out of an evening to pursue a sport regularly may simply not be feasible due to time or location constraints. It is therefore important to identify possible other methods of recovery promotion that can be performed easily and that can be integrated into existing schedules.

As one of the possible factors in declining post-work recovery is the introduction of mobile technologies ([Derks et al., 2012](#)), we were interested in whether the devices that can impede this process may also be key to reversing this. Digital games of all kinds are now available on a number of different devices, from smartphones, to tablets, to laptops. One widely held description of digital games is that constructed by [Juul \(2005\)](#), namely that they contain formal rules, have variable and quantifiable outcomes (with different outcomes associated with different values), involve

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players directly influencing the outcomes, to which the player feels attached and have consequences that are negotiable and optional. This makes digital games ideal candidates for promoting recovery.

Previous research has shown that playing digital games contribute to all four aspects of recovery (Reinecke, 2009a, 2009b), and Reinecke hypothesises this may be due to the online social support now provided by many digital games. However this has not been directly investigated, nor has it been established whether this enhanced recovery also results in improvements in related factors, such as a reduction in work-home interference.

We report the results of a questionnaire study that surveyed a total of 491 people. Our findings showed that the total number of hours spent playing digital games per week was positively correlated with overall recovery. Analysis of the subscales indicated that this relationship could be attributed to increased relaxation and psychological detachment experienced by those who spent a higher number of hours playing. We also demonstrate that for gamers who report to have developed online relationships, online social support enhanced the beneficial relationship between digital game use and recovery. Results are discussed in terms of how digital games may be utilised to improve recovery and reduce work-related stress.

1.1. Related work

The unprecedented rise in the popularity of digital games over the last few decades has triggered an increased appreciation of the potential benefits of this activity. Far from being the waste of time gaming was once perceived to be, research has identified potential applications in improving life satisfaction, well-being (e.g. McGonigal, 2012; Przybylski et al., 2010; Ryan et al., 2006), mental health (Wilkinson et al., 2008) and even cognition (Green et al., 2012), to name only a few. Unlike alternative interventions in these areas that may improve the measured outcome but not be engaging for the user, digital games stand to be an enjoyable activity in their own right, and have been argued to result in significantly greater retention rates (e.g. Mark et al., 2008).

An area that has received only limited attention in terms of the potential application of digital games is occupational health. With up to 28% of workers within the European Union experiencing work-related stress (Health and Consumer Protection Directorate-General, 2005), it is one of the most common work-related health issues (Paoli, 1997). Estimates suggest that the resultant absenteeism of work stress costs employers between £353 and £381 million per year (Mackay et al., 2004). On an individual level, repeated exposure to work related stress and associated psychosocial risk factors may result in more general health problems, ranging from sleep disturbances to heart problems (Goldstein, 1995; Karasek et al., 1981; Karasek and Theorell, 1990; Toomingas et al., 1997; Theorell et al., 1998) and even to death (Kivimaki et al., 2006).

Even for those who derive enjoyment from their work, recuperation and recovery is still a necessary and important factor in feeling prepared for the next day and in being able to appreciate free time. Recovery has been defined as “the process of replenishing depleted resources or rebalancing suboptimal systems” (Sonnentag and Zijlstra, 2006, p. 331) and research suggests that activities pursued outside work can be highly influential in whether or not recovery is successful (Demerouti et al., 2007). The ability and opportunity to recover from work related stress is one of the most significant influences on resultant physical and mental health (De Vries-Griever, 1992), and for the majority of workers, recovery is a vital component of positive health (Zijlstra and Sonnentag, 2006) and of avoiding the negative outcomes of work related stress (Sluiter et al., 2003; van Amelsvoort et al.,

2003). Over a prolonged period of time, the need for recovery can result in psychological distress, health problems (Jansen et al., 2002) and result in illness-related absence from work (Rydstedt et al., 2009).

In order for recovery to be successful, several aspects must be present. Sonnentag and Fritz (2007) identified these to be psychological detachment from work, relaxation, mastery experiences and control. Psychological detachment refers to the experience of not only being physically away from work, but also being in a separate place mentally (Sonnentag and Bayer, 2005; Sonnentag and Fritz, 2007; Etzion et al., 1998). This involves being free from job-related activities and not ruminating about work, allowing the demands on the psychological processes employed during working hours to be rested (Sonnentag and Fritz, 2007). Relaxation on the other hand, is identified by positive affect and low activation (Stone et al., 1995), and contributes to improved recovery due to prolonged activation mediating the relationship between work stress and health complaints (Brosschot et al., 2005). Mastery experiences are opportunities for the individual to learn and gain proficiency in areas outside of work, which help to improve mood and develop proficiencies (Fritz and Sonnentag, 2006). Finally, control refers to the ability to control free time activities, which can impact on the experience of competence and self-efficacy, especially if an individual has little control during working hours (Sonnentag and Fritz, 2007).

The absence of these factors following work can be detrimental. For instance, if there is no opportunity for psychological detachment, individuals may continue to ruminate about work-related events or tasks and this will negatively impact recovery, as well as other factors such as sleep quality (Fritz and Sonnentag, 2006; Rook and Zijlstra, 2006; Sonnentag and Bayer, 2005). Current technologies encourage workers to be connected to work at all times, limiting the opportunities to disengage from work. For optimum health and occupational experiences, individuals need to be able to mentally disengage from their employment, reduce the related psychological and physiological activation, take part in challenging activities outside of their work and finally, feel a sense of agency.

One other potential outcome of poor recovery is an increase in work-home interference (WHI), which refers to the issue of when the roles and demands of employment interfere with those of the home domain (Van Hoofe et al., 2006). Digital behaviours such as frequent checking of email on a mobile device can increase the level of WHI experienced (Derks and Bakker, 2012; Waller and Ragsdell, 2012). Consequently, WHI is associated with symptoms such as tiredness (Van Hoofe et al., 2006) and problems sleeping (Geurts et al., 1999), known outcomes of unsuccessful recovery experiences. Two central causes of WHI, namely work-induced strain and high time demands (Van Hoofe et al., 2006), have been found to negatively impact on health if a solution is not reached (Ursin, 1980), making this an important factor in reducing health complaints of employees.

Due to this conceptualisation, WHI usually refers to the negative experience of work impacting on home-life. However, some have argued that this can also occur in a positive manner, for instance, having to adopt an organised approach at work may encourage an individual to adopt similar strategies to deal with family finances (Geurts and Demerouti, 2003). This has led to the development of measures such as the Survey Work-home Interaction-Nijmegen (SWING; Geurts et al., 2005) including subscales relating to both positive and negative WHI, as well as those relating to the reverse situation, namely when home impacts on the work domain (home-work interference, HWI).

Although, for some, digital game play may represent the antithesis of productive employment, the aforementioned benefits have been argued to also extend into the domain of work.

Reinecke (2009a, 2009b) argues that existing research highlights the potential for digital games to meet the four requirements for recovery. For example, for many individuals, digital games provide an immersive environment (Jennett et al., 2008; Tamborini and Skalski, 2006; Vorderer et al., 2006), requiring high levels of interactivity and attentional resources for success (Klimmt and Hartmann, 2006). Players report feeling more relaxed after digital game play (Sherry et al., 2006; Yee, 2006) and digital games by their very nature allow players to exert a high level of control. Not only do players have the opportunity to directly interact with their environment, but in doing so in the correct way (i.e. by meeting the in-game challenges or performing relevant tasks), they are receiving positive feedback and acknowledgements of their performance. The accrual of these achievements, in the face of increasing levels of difficulty, results in a sense of mastery (Klimmt and Hartmann, 2006).

These connections are not just theoretical, as Reinecke (2009a) found in a questionnaire study that the ability for games to contribute to recovery is a significant part of the gaming experience. Playing digital games was also found to elicit all four aspects of the recovery experience, both at home and during working hours (Reinecke, 2009a, 2009b), and those that gained the most in terms of recovery experience were more likely to continue to use games for this purpose. Not only do digital games allow individuals to meet the needs for recovery, but this also manifests in indicators of successful recovery outcomes in regards to energetic arousal and cognitive performance (Reinecke et al., 2011).

Moreover, Reinecke (2009a) reported a negative correlation between the use of digital games for recovery and social support, a pattern also reflected in the workplace (Reinecke, 2009b), indicating that those receiving less social support were more likely to play digital games for the purpose of recovery. Although this is concerned with whether individuals seek out games to help recover from work rather than what the role of social support is in the relationship between game use and actual recovery outcomes, this still has relevancies to the present research. For instance, Reinecke (2009a) suggests that one underlying reason for the capability of digital games to improve recovery is due to the social interactions involved in many modern day games and the social support derived as a result of these interactions. Social support in offline contexts has been identified as highly influential in recovery (Lazarus and Folkman, 1984; Schwarzer and Knoll, 2007) and other related research has proposed that one of the ways leisure activities provide stress relief is due to the companionship they encourage (Iwasaki and Mannell, 2000). Therefore, individuals that do not have a supportive network of friends or family may be required to find alternative methods of recovery. Digital games may provide alternative sources of support from other players and members of gaming communities. This has been well supported in the literature and a number of studies have confirmed that games, particularly those in online or massively multiplayer genres, can be a rich source of social interaction and potential relationships, creating sources of social support and capital (Cole and Griffiths, 2007; Collins and Freeman, 2013; Hussain and Griffiths, 2009; Kaye and Bryce, 2012; Trepte et al., 2012; Zhong, 2011). In line with this reasoning, it is possible that those without a strong offline support network may turn to certain digital games to provide the emotional support required for recovery to be successful through online interactions. However, whether online social support does indeed mediate the relationship between digital game use and recovery is still yet to be directly tested and remains only speculation.

While the potential relationship between digital game use and recovery has therefore been investigated, there are several additional aspects that require further investigation. In these previously discussed studies, digital game use was seen as a unified experience,

irrespective of what genre was played. It has been argued that huge variations in terms of outcomes and player experiences exist between genres (Shen and Williams, 2011), and therefore certain genres may be more effective than others in promoting positive recovery. As such, several researchers have noted the need for a distinction between the types of games played as the experience or consequences of playing a strategy game, for example, are likely to be very different from those associated with first person shooters (Van Rooij et al., 2010). This is in line with research focusing on other media, for example films, for which investigating films in general would not prove useful at all compared to focusing on particular genres.

Reinecke (2009a) suggests that immersion and narrative within digital games play important roles in promoting successful recovery, and if this is indeed the case, games featuring these elements more prominently (for example action or massively multiplayer online role playing games) will be more highly correlated than those that generally do not have strong narratives or immersive properties (for example, party or casual games). Moreover, it is still unclear whether this connection with recovery extends to related issues, such as WHI. Considering the strong correlations between WHI and recovery, digital games may impact on WHI as well. At the time of writing, no research has directly assessed this.

To summarise, although the connection between digital game use and post-work recovery has been previously investigated, this requires further study to ascertain whether certain game genres show stronger relationships with recovery than others (and so consequently may be more useful in actively promoting more effective recovery), and also to investigate whether this extends to negative WHI, which is an increasing issue. Moreover, the claim that this connection is at least in part due to the social support offered by many games also required more direct investigation.

The following hypotheses were made:

1. When directly compared, gamers will be significantly higher in recovery outcomes and the recovery experience (including all four subscales), and will be significantly lower in negative (undesirable) WHI than non-gamers.
2. The extent of digital game use will be positively correlated with recovery outcomes and the recovery experience (including all four subscales) as well as negatively correlated with negative (undesirable) WHI.
3. Different genres of game will have differential correlations with recovery and negative WHI.
4. The connection between video game use and recovery will be mediated by online social support in the form of online social capital.

2. Method

A total of 491 participants aged between 18 and 70 ($M=36.83$, $S.D.=14.93$) completed the questionnaire, 48.9% of whom were female. Participants were recruited through adverts on social networking sites, mailing lists and online forums relating to a variety of employment areas and hobbies, including gaming. Forums were identified by searching for active forums relating to the higher order occupations of the Wage Indicator Tree. The mailing lists used were mostly university based and attempts were made to include an advert in occupational e-mail newsletters as well. The human resources departments of a variety of large companies were also contacted and asked to distribute the questionnaire to employees, although most refused. A total of 55.2% played digital games of some kind, and amongst those who did, the average number of hours spent playing digital games per week was 15.46 ($S.D.=14.91$), ranging from 1 to 102 h. The means and standard deviations for each genre can be found in Fig. 1. The

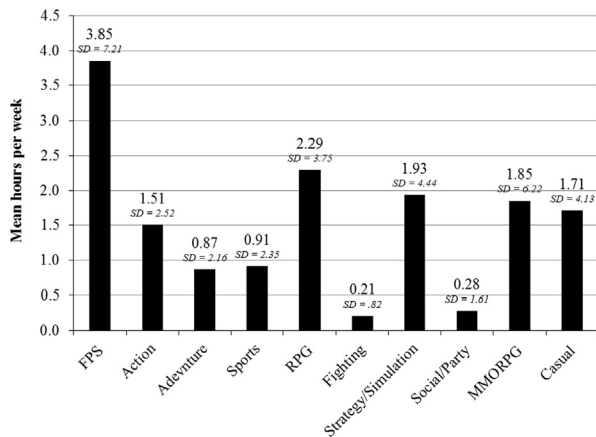


Fig. 1. Mean number of hours spent playing digital games per week, separated by genre. FPS=first person shooters, RPG=role playing games, MMORPG=massively multiplayer online role playing games.

number of hours worked per week ranged from 5 to 90 ($M=39.88$, $S.D.=12.28$).

2.1. Materials

2.1.1. Recovery

The need for recovery scale (van Veldhoven and Broersen, 2003) was used to measure the presence of unsuccessful or incomplete recovery, and this comprised 11 items ($\alpha=.86$). Participants answered ‘yes’ or ‘no’ depending on whether they agree with statements such as “I find it difficult to relax at the end of a working day”. One item was reverse scored and a high score indicated a high need for recovery.

The Recovery Experience Questionnaire (Sonnetag and Fritz, 2007) was also included ($\alpha=.88$), which consisted of 16 items answerable on a five-point likert scale ranging from 1 (I do not agree at all) to 5 (I fully agree). This assessed whether or not the individual meets the four requirements for recovery, and as such divided into four subscales, psychological detachment ($\alpha=.86$), relaxation ($\alpha=.89$), mastery ($\alpha=.86$) and control ($\alpha=.89$), all comprising of four items each. This provided additional information to the need for recovery scale, as it indicated in which areas those in need of more successful recovery were deficient.

2.1.2. Work strain

The Job Content Questionnaire (Karasek et al., 1998) was also included to measure job stress. This consisted of 27 items. For the first 24, participants indicated their agreement to a statement about their job using a four point scale ranging from 1 (strongly disagree) and 4 (strongly agree). The remaining three items required more specific responses and although all ranged from 1 to 5, what these referred to differed with each question. For example, for the question “During the past year, how often were you in a situation where you faced job loss or layoff?”, the answer scale was 1 (never), 2 (faced possibility once), 3 (faced possibility more than once), 4 (constantly), 5 (actually laid off). These measured seven subscales, skill discretion (5 items), decision making authority (three items; $\alpha=.77$), psychological demands (four items), supervisor social support (four items; $\alpha=.93$), co-worker social support (four items; $\alpha=.87$), physical job demands (one item) and job security (four items).

2.1.3. WHI

Work-home interference was measured by the Survey Work-home interference Nijmegen (SWING; Geurts et al., 2005)

measure, consisting of a total of 22 items. This measures work-home and home-work interference, both in terms of positive (e.g. “You are better able to keep appointments at home because your job requires this as well”) and negative (“You are irritable at home because your work is demanding”) influence. Negative WHI (when work impacts on home-life in an undesirable manner; $\alpha=.88$) was the main focus of the investigation, but scores for positive WHI (when work impacts on home-life but in a positive way, such as encouraging an individual to be more organised at home; $\alpha=.72$) and both positive ($\alpha=.76$) and negative ($\alpha=.80$) home-work interference (when home impacts on the work domain) were included as well. Participants indicated how often they experienced each scenario, choosing from 0 (never), 1 (sometimes), 2 (often) and 3 (always).

2.1.4. Digital game use

Digital game use was assessed in a variety of ways. Participants were required to estimate how many hours they spent playing digital games of any kind (in any format) per week, as well as the frequency with which they play them and the average number of hours of each gaming session. Participants also selected the genres they play and estimated the proportion of their gaming time spent on these games. The genres included on the questionnaire were first person shooters, action, adventure, sports, role playing games (RPGs), fighting, strategy/simulation, social/party, massively multiplayer online role playing games (MMORPGs) and casual games. The breakdown of genres in this manner is in line with current conceptualisations and has been used successfully before (e.g. Collins and Freeman, 2013)

2.1.5. Social support

The degree of social support was measured by the Internet Social Capital Scale (ISCS; Williams, 2006), which was used primarily due to having subscales relating to online and offline capital. Although online social capital was the most important for the present investigation, it was deemed useful to include the offline scale as well to replicate previous findings focusing on this kind of social support. This scale consists of 40 items, with 20 assessing online social capital ($\alpha=.83$) and 20 assessing offline social capital ($\alpha=.84$). These items were identical, except for the words “offline” and “online” in the question.

2.1.6. Demographics

A number of questions assessing basic demographics were also included, such as age, gender, occupation and approximate salary.

2.2. Procedure

Participants were incentivised by a prize draw for one of the six £50 Amazon vouchers. Measures were completed as an online questionnaire which took an average of 27 min to complete and once it was finished, participants were given feedback on their scores as well as general advice on how to improve recovery and reduce work home interference.

3. Results

3.1. Comparisons

Digital game players (those who reported playing at least 1 h/week of any kind of digital game; $n=275$) were significantly lower in negative WHI ($U=24,560.5$, $p<.01$) and need for recovery ($U=24,591$, $p<.01$), as well as higher in recovery experience ($U=22,120.5$, $p<.01$), than those who did not play any digital games ($n=216$). This included the subscales of psychological

detachment ($U=21,627.5$, $p < .01$) and relaxation ($U=20,567$, $p < .01$). Means are summarised in Table 1.

3.2. Correlations

To investigate this relationship further, a correlational analyses (Kendall's Tau) was performed on the digital game player subset only ($N=275$), including a breakdown of how many hours were spent playing each genre of digital game. As would be expected following the results of the comparisons, the total number of hours spent playing digital games was positively correlated with recovery experience ($\tau=.122$, $p < .01$) and the subscales of psychological detachment ($\tau=.118$, $p < .01$) and relaxation ($\tau=.121$, $p < .01$).

Correlations between the questionnaire measures and different digital game genres can be found in Table 2. first person shooters (FPSs) use was the only genre to show a positive correlation with the overall recovery experience score ($\tau=.116$, $p < .01$), and was also positively correlated with the subscales of relaxation ($\tau=.101$, $p < .05$) and control ($\tau=.093$, $p < .05$). Other genres did, however, also show positive correlations with aspects of the recovery experience, for instance action games and RPGs were also correlated with relaxation ($\tau=.101$, $p < .05$ and $\tau=.097$, $p < .05$ respectively), and MMORPGs were related to mastery ($\tau=.122$, $p < .05$). Sports games, however, demonstrated a negative relationship with mastery ($\tau = -.148$, $p < .01$). There were no correlations with the need for recovery scale.

As for the subscales of the SWING scale, the total number of hours spent playing digital games was positively related to

positive HWI ($\tau=.167$, $p < .01$), but also negative HWI ($\tau=.102$, $p < .05$). In terms of digital game genres, FPS appear to be particularly important once again, with positive correlations with positive HWI ($\tau=.126$, $p < .01$) and negative HWI ($\tau=.094$, $p < .05$). Social and Party games showed a similar relationship with positive HWI ($\tau=.105$, $p < .05$) and RPG games with negative HWI ($\tau=.123$, $p < .05$).

3.3. Multiple regression

To assess what factors most contribute to the recovery experience, and the individual role of digital game use, a multiple regression analysis was employed. The total RE score was entered as the dependent variable (see Table 3). As previous research has indicated that job strain and social support are both highly influential in recovery, these variables were included alongside digital game use, using forced entry. The order was dictated by the relative importance of each variable in recovery as indicated by previous research. Although the present study was especially interested in the contribution of online social capital through digital game use, previous research has established the importance of offline social capital (with little if any consideration of online equivalents) and this is therefore the kind of social support included.

Alternative models were constructed, using subscales of the RE measure as the dependent variables, and game total as the predictor, although these were substantially less successful in explaining the data. For instance, for psychological detachment, the number of hours spent playing digital games only explained .015% of the variance. Similarly, the R^2 value for the model relating to relaxation was .016 ($F_{1,267}=4.374$, $p=.037$). Unsurprisingly considering the lack of significant correlations between digital game

Table 1
Means and standard deviations for digital game players and non-players.

	Digital game players, M (S.D.)	Non-digital game players, M (S.D.)
WHI negative	6.81 (4.85)	8.03 (4.95)
HWI negative	1.87 (1.99)	1.90 (2.06)
WHI positive	4.97 (3.25)	5.01 (3.44)
HWI positive	4.50 (3.40)	4.20 (3.13)
Need for recovery	5.40 (3.42)	6.37 (3.36)
Recovery total	58.24 (10.89)	53.34 (11.69)
Recovery psychological detachment	16.54 (5.31)	14.00 (5.08)
Recovery relaxation	12.12 (2.79)	10.47 (3.32)
Recovery mastery	14.01 (3.78)	13.83 (4.05)
Recovery control	15.49 (3.84)	15.04 (4.25)

Table 2
Kendall's Tau correlation coefficients between digital game use according to genre and measures of recovery and WHI.

Game genre	Need for recovery	Recovery experience					SWING scale			
		Total	PD	Relaxation	Mastery	Control	WHI Negative	HWI Negative	WHI Positive	HWI Positive
FPS	-.062	.116**	.087	.101*	.027	.093*	-.067	.094*	.063	.126**
Action	-.054	.085	.066	.101*	.054	.026	-.073	.091	.032	.057
Adventure	.055	-.004	.019	.068	-.040	-.030	-.016	.026	.009	.027
Sports	-.086	-.074	.039	-.084	-.148**	-.058	-.091	-.001	-.013	-.027
RPG	.031	.060	.040	.097*	.011	.024	.015	.123*	-.012	.009
Fighting	-.072	.054	.049	.016	.067	.034	-.042	-.010	.009	.036
Strategy/simulation	-.044	.081	.062	.082	.035	.028	-.033	.026	.039	.046
Social/party	-.035	.052	.096	.006	-.038	.064	-.039	.012	.077	.105*
MMORPG	.031	.084	.016	.063	.122*	.054	.035	.022	.076	.094
Casual	.028	-.005	.048	.055	-.057	-.013	.057	.021	.066	.055

Note: Digital game use was measured in hours per week. FPS=first person shooter, RPG=role playing, MMORPG=massively multiplayer online role playing games. PD=psychological detachment, WHI=work home interference, HWI=home work interference.

* $p < .05$.
** $p < .01$.

Table 3
Multiple regression model summary for recovery experience as the dependent variable and job strain, offline social capital and game total as the predictors.

Variable	B	SE B	β	t
Constant	42.578	4.327		9.840**
Job strain	-4.956	1.654	-.173	-2.995**
Offline social capital	.249	.049	.292	5.091**
Game total	.138	.041	.193	3.385**

Note: $R^2=.160$, $\Delta R^2=.150$, $F=16.572$ ($p < .01$).

** $p < .01$.

use and the other two subscales, game use was not found to be a significant predictor of scores on these measures.

To follow up the significant correlations between game use and positive HWI, a regression model was also constructed using these variables (see Table 4). Job strain was not found to be a significant predictor and so was removed from the model.

3.3.1. Mediation analyses

Individuals reporting to play digital games and have online relationships were then selected for a mediation analysis to determine whether online social support mediated the relationship between digital game use and recovery. Due to the large number of zero scores in the digital game use variable, non-players could not be included. Similarly, digital game players who did not report having online friendships or interactions ($n=53$) were also excluded, as inclusion lead to violation of the assumption of normally distributed residuals.

Intercorrelations between the variables are summarised in Table 5.

It was found that online social capital did indeed mediate the relationship between digital game use and recovery experience (see Fig. 2); the beta and alpha values of a regression model including only digital game use as a predictor and recovery experience as the dependent variable ($\beta=.104$, $S.E.=.046$, $p=.046$) were higher than when online social capital was included in the model ($\beta=.072$, $S.$

Table 4

Multiple regression model with HWI as the dependent variable and offline social capital and the total number of hours spent playing digital games per week as predictors.

Variable	B	B SE	β	t
Constant	-1.903	1.215		-1.566
Offline social capital	.073	.016	.266	4.652**
Game total	.057	.013	.249	4.348**

Note: $R^2=.129$, $\Delta R^2=.123$, $F=19.753$ ($p<.01$).

** $p<.01$

Table 5

Intercorrelations between variables included in the mediation analysis.

	Recovery experience	Digital game use	Online social capital
Recovery experience			
Digital game use	.154*		.183**
Online social capital	.311**		

Note: Digital game use was measured in number of hours per week.

* $p<.05$.

** $p<.01$.

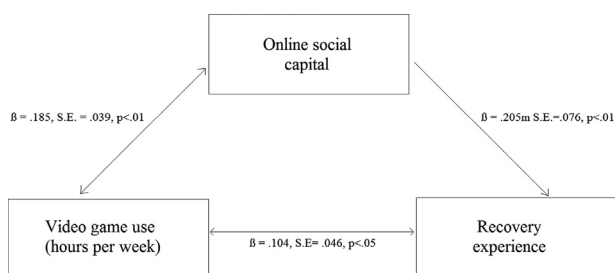


Fig. 2. Mediation model showing the relationship between digital game use, online social capital and recovery experience.

$E=.048$, $p=.135$), which was confirmed by a significant Sobel value (2.345, $p<.05$).

4. Discussion

This study aimed to investigate the relationship between digital game use, recovery and WHI. It was predicted that greater digital game use would be associated with better recovery experience, a lower need for recovery and reduced WHI. This was only partially supported. As this was one of the only studies to directly investigate the association between digital game use across genres on WHI and general recovery, these findings contribute a further understanding to how recovery and WHI could be improved through accessible, non-time consuming and enjoyable activities.

Gamers were found to have an overall lower need for recovery, lower negative WHI and had a more effective recovery experience, particularly in relation to the subscales of relaxation and psychological detachment, than non-gamers. These findings were very much in line with the hypotheses and support previous research that suggest digital games are related to more successful recovery (Reinecke, 2009a, 2009b) and that they contribute positively to mood and relaxation (Jennett et al., 2008; Sherry et al., 2006). However, Reinecke (2009a, 2009b) suggests that associations between digital game use and all aspects of the recovery experience should be present, although mastery and control were unrelated in the present findings.

Moreover, some of the differences between gamers and non-gamers were not evident in the other analyses incorporating the extent of digital game use. For instance, there were no significant correlations between the number of hours spent playing digital games per week and the need for recovery measure, nor negative WHI, both of which ran counter to predictions. What this may indicate is that the differences noted in the comparative analyses arose as a result of other distinguishing factors. For instance, if an individual plays digital games, this may be due to the ability and inclination to take time to themselves and to pursue hobbies, and it may be this that reduces WHI and the need for recovery rather than the activity itself. Although gamers and non-gamers did not differ in job strain, non-gamers did have significantly higher skills discretion, job demands and decision latitude, suggesting that they may be in higher positions at work and have greater responsibilities, thus having more restrictions in the way of successful recovery.

The lack of correlations between digital game use and the need for recovery may also be due to the related discovery in the present study that digital games only assist with two out of the four aspects of recovery, and if not coupled with complimentary activities that assist with gaining a sense of mastery and control, cannot contribute to an overall lower need for recovery. This once again contradicts Reinecke (2009a, 2009b) claims that digital games impact on recovery in general. One possibility is that this relationship only exists for those more heavily involved in gaming communities. However, as Reinecke et al.'s (2011) lab study was able to demonstrate a casual impact of digital game use on both subjective and objective recovery, this appears unlikely. Therefore, it may be plausible that either these effects are short term or that overall game use may not be a useful measure in predicting recovery outcomes due to the differential effects of different kinds of games, making a unified outcome unlikely. This argument is somewhat supported by the discovery regarding that the number of hours spent playing different genres are correlated with different aspects of recovery, a point that will be discussed further later. Moreover, as all aspects of recovery were correlated with at least one genre, this is promising in terms of the possibility of using digital games to positively impact on recovery.

There are also other reasons why the present study may have failed to replicate the findings of Reinecke (2009a, 2009b), for instance, differences in the way in which the recovery experience measure was administered. Reinecke (2009, 2009b) used the same scale but requested participants complete it in relation to digital game use rather than generally, as in the original measure. However, the present study used the standard version as it was felt that understanding how digital game use correlates with overall recovery experience (rather than the perception of recovery experience during game play) would be more applicable and generalisable to other situations, for instance non-players who wish to improve their recovery. However, this may have been one cause of the disparity in findings.

The finding that no correlations between negative WHI and digital game use emerged also ran counter to predictions, and this was the case for all genres of digital game. However, the total number of hours spent playing digital games was positively correlated with positive HWI, referring to when aspects of home-life transfer to the work domain in a beneficial way. While this is not entirely in line with the hypotheses, this could be deemed to correspond somewhat with the notion that playing digital games in an individual's spare time may be advantageous in an occupational setting. Conversely, the positive correlation between digital game use and negative HWI, indicates that this may not be solely beneficial. The lack of previous research in this area restricts the extent to which this can be assessed to be a reliable finding or one that is supportive of existing literature, although research into other aspects of digital game use may provide some indication. For instance, MMORPGs have been argued to encourage the same leadership skills that are highly valued in the world of business, and therefore playing this kind of game may foster abilities that improve performance in an employment setting (Reeves and Malone, 2007). Along this reasoning, digital games may encourage approaches that could be beneficial in some occupations, such as organisation, decision making skills and prolonged concentration. Conversely, research into the impact of digital game use on sleep has suggested that playing digital games (in particular MMORPGs) negatively affects the quality of sleep and that gamers sometimes sacrifice sleep in order to play more (Griffiths et al., 2004; Smyth, 2007), indicating that pursuing this pastime may result in less productivity during the day. This is, of course, assuming that the relationship between digital game use and HWI is causal, which may not be the case. An alternative explanation could be that those with particularly stressful but rewarding home lives and who allow these to transfer into work-domains are more likely to play greater levels of digital games, but this is something that requires further investigation to ascertain.

These findings therefore suggest that despite the associations between digital games and some aspects of recovery, there appears to be no relationship with WHI as predicted, but that they are positively related to HWI. As this is one of the only studies to focus on this potential relationship, more research may wish to investigate whether this is context dependent, for instance relying on when in the evening digital games are played, or whether the home environment is conducive to this sort of activity.

As this study was also interested in what genres of game may be most effective in assisting recovery and reducing WHI, the number of hours spent playing each kind of game was also included in the analysis. These results indicated that FPSs were particularly influential, as the number of hours spent playing these games corresponded almost perfectly with the results of the overall game total, with the addition of a positive correlation with control. Other genres also showed differential correlations, supporting the notion that a breakdown of what kinds of games are being played may be important in establishing how digital games can be used to improve recovery across all four aspects. For

instance, MMORPGs were positively correlated with mastery and action and role playing games were related to relaxation. Manipulating the game content may consequently allow for there to be a game that successfully meets all four of the recovery criteria, and therefore, identifying what aspects of these games underlie these correlations may be an interesting focus for future research.

The discovery that online social capital did significantly mediate the relationship between digital game use and recovery experience is in line with the arguments of previous research (Reinecke, 2009a), and goes some way to suggest that the social nature of the games are an influential factor in recovery. However, it should be noted that 53 gamers did not have any online social capital, perhaps due to playing in offline formats or simply not engaging with the gaming community. Even when including these participants in the analysis, the relationships between recovery and digital game use remains, and therefore online social capital cannot account for this relationship entirely. The variance explained by social capital is also small, but the finding that it is still significant indicates that further research is warranted.

4.1. Implications

These discoveries have several implications. The most pertinent to the main hypotheses is that although digital game use in general is related to the relaxation and psychological detachment aspects of recovery, this does not appear to be the case for the other recovery criteria, nor the overall need for recovery. Therefore, although digital games may contribute positively to recovery, this does not necessarily result in associations with all aspects of the recovery experience or outcomes, although this needs to be replicated with objective measures to ascertain whether this is indeed the case.

However, some genres showed different relationships with the criteria of recovery, and so this does not entirely rule out the potential for specific games to be highly effective in allowing individuals to meet all four criteria. This is especially the case considering that all aspects of recovery were correlated with at least one genre of digital game. These findings also indicate that perhaps using the total number of hours spent playing digital games in general may be inappropriate, considering the substantial variations in the kinds of in-game tasks and challenges.

Moreover, the related lack of association between digital games and WHI suggests that digital game use does not have a significant impact on the division between home and work environments. However, as this is the first study that has addressed this, more research is required to assess whether this is replicable and evident in alternative populations. The significant relationships with HWI indicate that despite this, there may still be the potential for digital game use to benefit (and perhaps also hinder) performance in the workplace, but more research will be needed to identify the direction and underlying reasons for this relationship.

The importance of online social capital indicates that should digital games be introduced as a method of improving recovery, a social or community component may be an important feature to include. This discovery also has wider reaching implications, as research on the role of social support on recovery is yet to address whether this social support needs to be from offline communities, or of online ones would foster the same positive outcomes. Despite assertions that online relationships are inferior to offline equivalents in terms of quality and purpose (Parks and Roberts, 1998), it is increasingly being acknowledged that they are in fact experienced in very similar ways and are held as equally emotionally rich and important to those that develop them (Cole and Griffiths, 2007). This therefore contributes to the debate concerning whether online capital is as beneficial as offline capital, as it may still aid recovery.

Overall, this research forms the basis for future studies assessing the potential for digital games to be used in occupational settings to improve recovery. The results would indicate that game choice will be a particularly important aspect in whether this is likely to be successful. Although these findings would appear that the extent of digital game use does not relate to WHI, the discovery that gaming and non-gaming populations do differ on this factor may be something worth investigating further.

4.2. Limitations

Despite these interesting findings, there are several limitations that need to be addressed. The study aimed to recruit a wide variety of professions in order to investigate general trends irrespective of the particular features of the role. While this allows for the findings to be more easily generalised, it does mean that aspects of individual roles or industries could not be taken into account in the present analyses. Moreover, the vast majority of participants were recruited through online forums, mostly those relating to occupations and gaming. This means that only those interested enough in their job roles or in gaming to actively participate in corresponding online communities would have seen the advertisements for the study, contributing to the issue of self-selection. Although attempts were made to recruit through other means (e.g. employer distributed e-mails), these were largely unsuccessful. However, it is unlikely that those participating in online communities would differ so substantially from other samples that these results would not be relevant.

The self-report nature of the study should also be taken into consideration, as although recovery and WHI are suitably subjective to make this approach appropriate, perceptions may still be influenced by transient factors such as mood, context and isolated events. Future studies may therefore wish to use these findings as the basis for further investigations using day-to-day diaries or objective measures of recovery success.

In terms of social capital, it must also be noted that the conclusions are drawn on the assumption that the online social capital evident in the gaming sample was indeed derived from game-related contexts, which may not be the case. Therefore, future research may wish to supplement questionnaire data such as this with interviews to ascertain whether the online relationships to which they are referring are indeed accrued through the games played.

One potentially influential factor that was not included in the present study was motivations for playing digital games. For instance, *Kaye (2011)* proposes a model of gaming outcomes that hold variations in motivations, contexts and experiences as vital in predicting a potentially diverse range of outcomes. Therefore, it may be that those playing for different reasons stand to benefit in different ways, a sentiment echoed by *Yee (2001)*, who argued for three ‘types’ of players, separated by their motivations. These are broadly achievement based, social and immersion. This may be particularly relevant to the present investigation as, for example, those who play for achievement may experience greater recovery in terms of mastery and control, whereas those falling into the immersion category may instead benefit more in terms of relaxation and psychological detachment. Therefore, future studies may wish to include a measure of motivations and player types in order to gain a fuller understanding of the interplay between digital game use and recovery.

Including measures of other hobbies may have also been beneficial. A wide range of experiences, activities and pastimes have been related to improved recovery and reduced WHI, including sports, general media use and other leisure activities. Digital game use is likely to occur alongside a number of different hobbies and in a variety of different combinations. For instance, while two individuals

may appear similar in terms of the extent of their digital game use, if one is spending additional time relaxing with their family whereas the other is spending their free time working, there will undoubtedly be a difference in their resultant recovery and WHI. Therefore, collecting data on how free time is divided between activities will allow for the relative contribution of digital games to be established further.

4.3. Conclusions

In conclusion, digital games were found to correlate with some aspects of recovery but did not appear to have an impact on overall recovery outcomes. Although no correlations were found between digital game use and WHI, as this is the first study exploring this, more research is needed to ascertain whether this is the case when using alternative measures or samples, as well as further investigating the relationships with HWI and how these could be harnessed for beneficial occupational outcomes. These results also highlight the importance of breaking digital game use into specific genres, and demonstrates that future research should continue to do this and explore individual game characteristics that could be exploited to make recovery more efficient.

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