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Unpacking Time Online: Connecting Internet and MMO use with
Psychosocial Well-being

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Abstract

By unpacking different forms of Internet and MMO use, the present study adopts a nuanced approach to examine the connections between online activities and psychosocial well-being. It combined self-reported survey data with unobtrusive behavioral data from server logs of a large virtual world, EverQuest II. Over 5,000 players were surveyed about how they use the Internet, their specific activities in the virtual world, and their psychosocial well-being. In-game communication networks were also constructed and analyzed. The results showed support for both time displacement and social augmentation effects for various activities. Whether Internet and MMO use were associated with negative or positive outcomes was largely dependent on the purposes, contexts and individual characteristics of users. The results suggest that Internet use and game play have significant nuances and should not be considered as monolithic sources of effects.

Key words: Internet use, online games, social impact, psychosocial well-being, media effects, virtual world

Unpacking Time Online: Connecting Internet and MMO Use with Psychosocial Well-being

One of the central questions concerning communication scholars and policy-makers is the psychosocial impact brought by the massive diffusion of new media technologies such as the Internet. The Internet has become an indispensable part of contemporary work and social life (Wellman & Haythornthwaite, 2002), with 80% of the American population now using it at a rate of 17 hours each week (Center for the Digital Future, 2009). Internet use is remarkably diverse, as it can involve various devices (such as computers and mobile phones), applications (such as web browsers and email clients) and activities. Yet until recently, studies of the Internet's impact have been dominated by an aggregate approach that associates gross time spent online with various psychosocial outcomes, regardless of the specific online activities (Shklovski, Kiesler, & Kraut, 2006). Of comparable relevance is the research on the effects of video games, an increasingly popular medium that now engages 97% of all teens (Lenhart, Kahne et al., 2008) and 53% of all adults in the United States (Lenhart, Jones, & Macgill, 2008). In particular, scholars have started to explore the psychosocial impact of a genre with growing popularity: networked games known as Massively Multiplayer Online games (MMOs). There are more than 45 million accounts within the virtual worlds in the West (White, 2009), with perhaps double that figure in Asia. But because within-game data has been unavailable, research has been limited to gross self-report measures of the volume of play. Just as with the larger phenomenon of Internet use, scholars are now increasingly aware of the complexity of these social game worlds (Steinkuehler & Williams, 2006; Williams, 2006c; Williams, Yee, & Caplan, 2008). Unlike traditional mass media, the content of these games is largely based on social interactions, and varies widely (Cole & Griffiths, 2007; Yee, 2006a). This study seeks to unpack these

monolithic approaches to Internet use and game play by examining particular kinds of Internet use and MMO game play, and in so doing to extend and refine existing conceptualizations of new media effects, as represented by the displacement and augmentation perspectives, and users' adaptive strategies of technology use, as represented by the social information processing (SIP) theory. Broad Internet use and game play both have established Computer-Mediated Communication (CMC) research traditions focusing on the psychosocial well-being of users, yet each can benefit from a more nuanced approach.

Since the popular adoption of the Internet in the 1990s, debate has ensued about the psychological and social impact of time spent online. This question persists because a decade of research on this topic has produced conflicting findings (e.g., Kraut et al., 2002; Kraut et al., 1998; Nie, 2001; Shklovski et al., 2006), and because the Internet itself—its forms, uses and image—has transformed drastically as well (Herring, 2004). As a result, scholars have repeatedly called for a more nuanced approach to study the relationship between Internet use and psychosocial outcomes (Bessiere, Kiesler, Kraut, & Boneva, 2008; Caplan, 2003; Shklovski et al., 2006; Williams, 2007). In recent years a general trend in the field of new media studies has emerged that focuses on specific uses and effects. For example, large-scale national surveys have started to break down total time online and to scrutinize various kinds of technology adoption and use with increasing detail (e.g., Center for the Digital Future, 2009; Lenhart, 2009; Lenhart, Jones et al., 2008). Studies have demonstrated that the patterns of technology appropriation differ significantly across various user groups, and specific uses may result in different outcomes (see, e.g., Bessiere et al., 2008; Hargittai, 2007; Hargittai & Hinnant, 2008; Kwak, Skoric, Williams, & Poor, 2004; Lee, 2009).

A parallel case has developed over the same time period for the uses and effects of video games. A large body of research has focused on testing the possible negative impacts of playing video games on players' physical and mental health (e.g., aggression; Anderson, 2004). The dominant approaches have included either surveys or short-term lab experiments. Surveys correlate self-reported measures of playing time with psychosocial outcomes. For example, Bartholow, Sestir & Davis (2005) found a positive correlation between self-reports of video game violence exposure and aggressive behavior, controlling for personality traits. Similarly, using players' self-reports of play time and level of social engagement, Williams (2006a) found that playing an immersive online game led to improved global outlook but erosion of existing friendship. In addition to the obvious causality issue, the survey approach has two major drawbacks. First, players' self-reports suffer from under-estimations. A comparison of self-reported use and actual use among game players showed systematic differences, and further differences between the genders (Williams, Consalvo, Caplan, & Yee, 2009). However, the larger confound is that the measures of game play are gross, and rarely differentiate between types of games or of play styles. With a universe of playable titles now over 30,000, dozens of genres, and myriad play options within most titles, it is unrealistic to assume that games have uniform effects. As a result, game "use" or "exposure" has become a monolithic input variable, which may explain why so many studies reach differing conclusions (Anderson, 2004; Browne & Hamilton-Giachritsis, 2005; Sherry, 2001). The laboratory approach typically associates 15 to 30 minutes of play time recorded in single-player lab sessions with self-reported attitudinal and behavioral measures (e.g., Anderson & Dill, 2000). This method is useful for measuring the short-term effect of isolated game play, but as games have become more social and more networked, the approach loses external validity. Methods must change with the times, and in this

case accommodate a myriad of persistent, massive, interactive, and social game play experiences.

In recent years, gaming has become one of the most common online activities. The 2009 Digital Future Report shows that 33% of Internet users in the U.S. play online games (Center for the Digital Future, 2009). When looking at different age groups, 76% of all teens and 23% of all adults are online gamers (Lenhart, Jones et al., 2008). Perhaps the most emblematic games of this trend are the sophisticated and persistent virtual worlds known as MMOs. These are 3D graphical environments where millions of players participate and interact with each other through avatars (Williams et al., 2008; Yee, 2006a). Among all online gamers, MMO players are especially active and engaged, as 89% play at least a few times a week and nearly half (49%) play every day or almost every day (Lenhart, Jones et al., 2008), with research showing typical hours played per week between 23 and 27 (Griffiths, Davies, & Chappell, 2004; Williams et al., 2008; Yee, 2006a). Yet, systematic research on the impact of MMO play has been very limited (Griffiths et al., 2004; Williams et al., 2008). Clearly, as every single player is able to create unique experiences within the same MMO, it is essential to consider the multitude of motivations and activities and their respective impact, rather than to assume that game play is a homogeneous causal agent.

The present study focuses on both areas of inquiry, using a unique dataset that combines demographic and attitudinal data collected from a large survey conducted within an MMO, as well as behavioral data recorded with unobtrusive server logs. The combination of attitude and behavioral data allows a deeper and more nuanced examination of the relationship between online activities and players' psychosocial well-being than has been possible to date.

We begin by looking more closely at the theories and mechanisms that are thought to underpin Internet and game effects. These in turn suggest both attitudinal and behavioral measures that will allow for better theory testing. By employing these measures, the paper finds that there are indeed a range of both positive and negative outcomes associated with Internet and MMO use. These are predicted in part by standard measures of time spent, demographics and personality traits, but also by more precise measures of social interactions, motivations and activity types.

Displacement or Augmentation?

Do new technologies take the place of valuable social and community activities, or do they augment and supplement them? Following Putnam's (2000) observation that social capital and community involvement in the United States are on a long-term decline, some scholars are concerned that Internet use would encroach on time that was previously spent with family and close friends and left many feeling lonelier (Nie, 2001; Nie & Erbring, 2002). They view online and offline activities as a zero-sum equation. Because of the "inelasticity of time" (Nie, 2001, p. 420), individuals spend time online at the expense of reducing their time on offline social activities. Therefore, the Internet inevitably makes people more isolated and reduces social capital. The displacement hypothesis received early support as researchers found that greater use of the Internet was associated with declines in social involvement and psychological well-being (Kraut et al., 1998). This approach, however, assumes that Internet use is not social, or at least less social than other activities, such as TV viewing. This assumption has been criticized because it fails to recognize that the Internet could serve as a site for some degree of social and communicative activities (Williams, 2006b).

In contrast, the social augmentation argument praises the potential of the Internet to supply an additional avenue of social interaction. In this approach, not only could the Internet enhance one's everyday communication with family and friends locally and over a distance (e.g., Wellman, 2001), it could also enlarge one's existing social network by bringing together people with shared interest and values in virtual communities (e.g., Horrigan, Rainie, & Fox, 2001). The social augmentation argument has also received consistent support from empirical studies (Boase, Horrigan, Wellman, & Rainie, 2006; Cole, Suman, Schramm, Bel, & Aquino, 2000; Katz & Aspden, 1997; Katz & Rice, 2002; Kraut et al., 2002; Quan-Haase, Wellman, Witte, & Hampton, 2002).

The conflicting results from the above studies examining the impact of time online have prompted scholars to question the underlying assumptions of both sides of the debate. At their extremes, both perspectives downplay differentiated perceptions of media properties and differentiated media use by individuals. The Internet is a malleable medium that allows for both social and asocial use. People are not passively dictated to by technology, but actively appropriate technology to accomplish their own goals (Bargh & McKenna, 2004). This is consistent with social information processing (SIP) theory, which argues that social relationship developments coalesce in computer-mediated and face-to-face contexts over time, because users actively appropriate and develop adaptive strategies to use communication technology to suit their relational goals (Walther, 1992, 1996). A meta-analysis of studies on this subject reveals that the effect size of Internet use is so small that the Internet has shown hardly any impact on social interaction at all (Shklovski et al., 2006). The reason might be that social connectivity-enhancing and -weakening activities simply cancel each other out. For example, one might use the Internet to rekindle old friendship through interactions on social network sites and personal

blogs, which enhances social involvement, but at the same time one may also spend considerable time playing an online game alone, which displaces interactions with the existing social network offline. In other words, psychosocial effects may be occurring in both directions, but our methods may not have been nuanced enough to show where and why. If SIP theory is correct, users are actively choosing and adapting to various Internet options. Another potential problem has been in non-standard operationalizations of where effects occur. For example, Nie and Erbring (2002) measured social life exclusively offline, including the time spent talking face to face or on the phone with friends and family. When reporting the social augmentation effects, studies (e.g., Boase et al., 2006; Katz & Aspden, 1997) often cite evidence such as increased participation in online organizations, more friends created online, and extensive email communication with significant ties, most of which pertain exclusively to the online population. Only when both online and offline outcomes are measured would it be possible to assess the overall changes brought by Internet use and trace the origin of such changes (Williams, 2006b). Therefore, it is essential to consider how people use the Internet and connect the differentiated uses and motivations to psychosocial outcomes, which should include both offline and online components.

Unpacking Internet Use

There is no single established typology of differentiated Internet use in the extant literature. One approach takes a medium-centric view and assumes that using that medium (e.g., instant messengers) is a homogenous activity. For example, one study examined the use of a social network site (Facebook) and its effects on college students' bridging and bonding social capital (Ellison, Steinfield, & Lampe, 2007). A second approach centers on the goals and activities associated with one medium or a collection of media and explores their psychosocial

impact. For example, one study examined the extent to which people make new friends online and how that particular activity reconfigures existing social networks (Di Gennaro & Dutton, 2007). Another study disaggregated Internet use according to different purposes, such as communicating with friends, and then examined the impact of a wide variety of online activities on depression (Bessiere et al., 2008).

In keeping with SIP theory, we adopt Bessiere et al's purpose-oriented approach to categorize Internet use. This approach avoids the technological deterministic assumption that people always use one medium in the same way (e.g., socially or non-socially). Instead, it focuses on users' practices within their everyday context. Moreover, we do not specify a priori a set of relationship between types of online activities and psychosocial impact. SIP theory suggests that motivations will drive particular uses. Even though some activities seem inherently social (e.g., making friends online) and others are often carried out in solitude (e.g., online shopping), such use may well result in unintended outcomes, as a few empirical studies have already demonstrated (e.g., Caplan, 2003).

In addition, previous studies have suggested that demographics, personality, and existing social resources could all confound the relationship between raw Internet use and psychosocial outcomes. For example, the HomeNet studies conducted by Kraut and colleagues found that age and gender were both associated with people's psychosocial outcomes (Kraut et al., 2002; Kraut et al., 1998). Perhaps more importantly, Internet access and usage patterns have lead researchers to speculate that the effects of Internet use might be mediated or moderated by personality traits and existing social resources. On the one hand, Kraut et al (2002) postulate a "rich-get-richer" hypothesis that people who are highly sociable and who have social resources will reap more social benefits because they are likely to use the Internet to communicate. Consistent with the

hypothesis, they found that extraverts and those with higher levels of initial social support had positive outcomes as a result of Internet use. Introverts and those with less initial social support were found to experience more isolation, suggesting a corollary model of “poor-get-poorer.” On the other hand, McKenna and Bargh (2000) suggest a compensation model in which the Internet provides a social domain that is most beneficial for those with scarce social resources in the offline realm. This compensation model also received some support from empirical studies (e.g., Bessiere et al., 2008). Combining all these confounding factors, we ask the exploratory questions:

RQ1: How are different types of Internet use associated with people’s psychosocial well-being?

RQ2: How do demographics, personality, and existing social conditions moderate the effects?

Unpacking MMO Use

Even though MMOs boast more than 45 million subscribers in the West (White, 2009), MMO use has not become a topic of systematic research until recently (Williams, 2006a; Yee, 2006b) and its psychosocial implications still remain largely unclear. Just like more general Internet use, MMO use is often associated with negative social consequences by the popular press. A recent news article made the time displacement argument, warning “Britons could be jeopardising their health” because people spend more time in virtual worlds and thus become physically and socially disengaged (Beckford, 2009). However, studies have found that MMOs are highly social environments where players interact and create meaningful relationships, which constitutes a considerable component of enjoyment (Cole & Griffiths, 2007). Steinkuehler and Williams (2006) suggest that MMOs have the promise to function as virtual “third places”

(Oldenburg, 1997) as they provide vibrant sites for social interaction and engagement. In keeping with the SIP tradition, many accounts of virtual world use show players adapting the tools they are given to building relationships (Castronova, 2005; Taylor, 2006) – even if the quality of those relationships is often questionable (Williams, 2006a).

Just like Internet use more generally, MMOs foster informal sociability and cultivate virtual communities, but their net social impact is dependent upon the relative quality of offline social activities that are displaced by game play. Researchers have long ago demonstrated the important support function of friendships and relationships. The “buffering hypothesis” (Cohen & Hoberman, 1983) provides an explanatory mechanism for the positive association between social relationships and individuals’ psychosocial well-being. The existence of social networks and the resources they provide can protect us from potentially harmful effects of the inevitable stresses of life. So, if the quality of online community or social support is lower than that found offline, we might predict that players who give up one for the other would end up less social support, resulting in increased loneliness. Prior work on Internet use has suggested that demographics, personality and existing social resources might mediate outcomes (Kraut et al., 2002; Kraut et al., 1998). In the few studies examining the social impact of MMOs, extroversion was found to play a role (Williams, 2006a) but the effects of other variables remain untested.

Another important but rarely studied confounding variable is the context of MMO play. In particular, do people play with newly-found acquaintances in the game or with family and friends they already know offline? The former appears to be the default assumption in most discussions concerning the social impact of MMOs (e.g., Ducheneaut, Yee, Nickell, & Moore, 2006), but some empirical studies suggest the increasing prevalence of the latter scenario (Williams et al., 2006). In a survey of over 900 EverQuest players, Cole and Griffith (2007)

found that 26% of them played with real-life family and friends. A recent Pew survey also found that 65% of game-playing teens play with other people who are in the same room, and of teen online gamers, 47% play with people they know offline (Lenhart, Kahne et al., 2008). Because the effects of MMO play could depend upon the relative social benefits of online game play and displaced offline activities, the context of play may significantly alter the social dynamics. In other words, if MMO play becomes a shared activity with one's existing social ties, it integrates with the existing spaces of social connectivity and further complicates the equation of online and offline social impact.

Similar to Internet use, MMO use consists of myriad highly personalized activities. Following the same SIP-driven theoretical frame, we again take a purpose-oriented approach with MMO activities and examine their psychosocial implications. Prior work has established an inventory of three major MMO motivations that can be used within the SIP framework: achievement, social and immersion motivations (Yee, 2006a, 2006b). The achievement motivation includes advancement, analyzing game mechanics, and competition. The social motivation includes chatting and casual interactions, developing support relationships, and teamwork. The immersion motivation includes exploration, role-playing, avatar customization, and escapism. These different motives might drive players to use virtual world tools in different ways, so we ask:

RQ3: How are different motivations of MMO play associated with people's psychosocial well-being?

RQ4: How do demographics, personality, existing social conditions, and the context of game play moderate the effects?

Among all of the possible MMO activities, we are especially interested in the implications of players' social interactions, which would be critical in determining whether MMOs could live up to their promise of promoting informal sociability and building virtual communities. The most important aspect of players' interactions is in-game communication. Previous research shows that communications among MMO gamers are predominantly socioemotional, rather than task-oriented, which suggests that in-game communication plays a key role in supporting relationship dynamics (Pena & Hancock, 2006). Two dimensions of in-game communication, namely communication frequency and network size, are indicators of the intensity and breadth of interactions, respectively (Monge & Contractor, 2003). It has been shown that the existence of one's social network as well as substantive interactions generated among social ties not only exert a positive main effect on psychosocial well-being, but also buffer people from negative events (Cohen & Wills, 1985). However, this contradicts Nie's displacement logic, which would dictate that within-game communication would have to come at the expense of real-world communication, which is assumedly more substantive. Therefore, we have a test of the critical case, with one theory predicting positive outcomes and another negative:

RQ5: Are MMO players' in-game communication frequency and network size positively or negatively associated with their psychosocial well-being?

Method

In this study, we gathered data from a popular MMO, *EverQuest II (EQII)* that is representative of the MMO genre. *EQII* launched in November of 2004 as the sequel to *EverQuest*, and features game rules and goals that are similar to other mainstream MMOs on the market, such as *World of Warcraft*. The game operator, Sony Online Entertainment, facilitated

the distribution of a survey to a large sample of players in the game and also provided server-side data from the game's large back-end databases. Based on both pieces of player data, we were able to build a comprehensive dataset of over 5,000 *EQII* players, with self-reported data from the in-game survey as well as unobtrusively collected behavioral data from game servers.

Participants and Procedure

In this study we focused on the player as the unit of analysis. Although some players used multiple characters, prior research suggests that these players tend to have a "main" character that is played most often (Williams et al., 2006). The main character for each player account was identified by cross-checking the game database. These characters then populated the sampling frame and were evenly distributed across the four game servers. Potential respondents were invited and directed to a secure web survey if they logged into the game within the survey time window. Respondents were given a special in-game item, the "Greatstaff of the Sun Serpent," created by Sony as a unique incentive for completing the survey. The item was desirable for all players regardless of their classes and levels because of its rarity and usefulness in combat. The survey lasted around 25 minutes. Based on previous survey studies in this area using cash incentives or no incentive (Yee, 2006b), it was expected that the planned sample size of 7,000 respondents would be reached in one or two weeks. Instead, the data collection process only took two days, proving that the special in-game item was desirable for all and an effective tool for recruitment. With these procedures, the current sample covered a large majority of possible players. It is not a true random sample and contains some self-selection bias, but is stronger than a typical convenience sample.

We then identified all the survey respondents by their unique account number within *EQII*, and linked the survey data with player data collected from game's back-end databases.

After removing cases with missing values on any of the variables below, the remaining sample size was around 5,000 for most analyses. The participants were predominantly male (80.80%), with an average age of 31.16 years, have slightly larger household income ($Mean = \$84,715$ /year) and more education than the general American population (for a detailed description of player demographics and comparison with the general U.S. population, see Williams et al., 2008). These means are in accordance with previous surveys of MMO players (Griffiths et al., 2004; Yee, 2006a). All player data were recorded anonymously as no real-world identifying information was attached to the data.

Measures

Psychosocial well-being. We measured six different aspects of psychosocial well-being that included both online and offline components. The theoretical foundation of these measures is Cohen's "buffering" hypothesis (Cohen & Wills, 1985). Each measure is a typical outcome of buffering (or lack thereof) or an input into the process. Each is also a replicated measure from the HomeNet studies (Kraut et al., 2002; Kraut et al., 1998), which used them for the same purpose: loneliness, family communication time, family communication quality, sense of community online, sense of community from neighborhood, and sense of community from work or school. Loneliness was assessed using the 20-item UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980). Respondents were asked to rate these items on a 4-point scale (Never =1, Rarely =2, Sometimes =3, Always =4) and those scores were later combined by taking their sum ($\alpha = .92$).

Family communication time was measured by asking the respondents to think about the family members they interact the most and the next most. They were then asked to indicate how many minutes a day (0 to 1440) they typically interact with each of the two family members. We then took the sum of the two values as the total family communication time. Family

communication quality was measured by asking the respondents to rate the quality of their communication with each of the two family members on a 5-point scale (Poor =1, Below Average =2, Neither Good Nor Bad =3, Good =4, Excellent =5), and the average value was taken as family communication quality. As there were quite a few cases with missing values of family communication time, we did a missing value analysis and found that those who did not indicate their family communication time tended to report slightly lower family communication quality ($Mean = 4.08$, compared with those who indicated family communication time, $Mean = 4.24$, $df = 3415.5$, $t = 6.50$, $p < .001$).

The players' sense of community was measured for their online connections, from their neighborhood, and from their work or school by asking the participants to rate the following statements on a 3-point scale (No = 1, It depends = 2, Yes = 3): "The people (I have met online/in my neighborhood/I work or go to school with) give me a sense of community."

Internet use. We included a general variable measuring the amount of time spent online every week as well as a series of variables measuring different online activities, again replicated from the HomeNet studies (Kraut et al., 2002; Kraut et al., 1998). Time spent online in general was measured by asking the participants "How many hours do you spend using the Internet or email in a typical week, not counting when you do it for work?"

Different online activities were individually measured on a 5-point Likert scale by asking how frequently in the past week participants used a computer or Internet for (1) "finding information about local events," (2) "finding information about national or international events," (3) "meeting someone new," (4) "communicating with someone faraway," and (5) "communicating with friends in the local area." The first two items were later combined into one composite item measuring information-gathering activities, and an exploratory factor analysis

showed that they both loaded heavily on a single factor (factor loadings = 0.84 and 0.88 respectively). The resulting Internet use measures were similar to those used by Bessiere et al (2008) except that their item on general entertainment was dropped as we included specific items measuring online game use.

MMO use. Time spent in *EQII* was measured by calculating the average number of hours per week spent in *EQII* from the logs generated by the game servers. We also measured the time spent on games other than *EQII* by asking “How many hours per week do you usually play other video games?”

Motivations to play *EQII* were assessed by a condensed 10-item version of Yee’s inventory of MMO motivations (Williams et al., 2008; Yee, 2006b). In Yee’s (2006) original study, he generated 40 questions based on qualitative information of players as well as previous literature on player types (Bartle, 1996). Two rounds of principal components analyses were used to first extract 10 components, which were then reduced to three factors: achievement, social and immersion motivations (Yee, 2006b). The 10 components derived in Yee’s first round of analysis were included as items in this study. The respondents were asked to indicate on a 5-point scale the importance of each item when they play *EQII* (Not Important At All =1; Extremely Important =5). Results from factor analysis showed that the same three factor structure in Yee’s study was reproduced here. Factor scores were then saved and used in the analyses.

Player communication. We measured player communication by two dimensions: the communication frequency and the size of their communication networks. A week of in-game player chat records (with content removed) were gathered from *EQII* server databases. For each player, we computed the total number of messages sent and received as well as the number of

unique partners they received messages from (“indegree”) and sent messages to (“outdegree”). Because of the high correlation between messages sent and received ($r = .67, p < .001$) and between indegree and outdegree ($r = .75, p < .001$), in the final analysis we used messages received and indegree to capture the intensity and network size of player communication.

Control variables. We asked respondents to indicate their gender and age. For personality, we measured people’s level of extroversion with an updated and abridged version of the extroversion subscale of the Revised Eysenck Personality Questionnaire (EQPR-A; Francis, Brown, & Philipchalk, 1992) ($\alpha = .78$). To control for existing social conditions and context of play, we asked respondents to indicate whether they had been diagnosed with depression, whether they regularly played *EQII* with a family member or romantic partner, and whether they played *EQII* with a friend or friends that they knew offline before joining the game. We also created another binary variables measuring whether they played with existing social ties (either family or friends), which was included in models predicting loneliness and sense of community derived in various contexts.

Analysis

To answer the main research questions, hierarchical regression models were used to show the basic model of effects, and then a more nuanced one: For every psychosocial outcome variable, we present (1) a basic model with control variables and the variable with total time spent on the Internet or *EQII*, and (2) a full model with additional variables measuring differentiated activities and motivations. The context of play and its interaction terms were further added in a third block to models involving MMO use and player communication.

Results

Descriptive statistics for the major study variables are presented in Table 1 and zero-order correlations can be found in Table 2. On average, participants were mostly heavy Internet users as they spent a total of 29.57 hours online every week (excluding work time) and an average of 25.86 hours was spent on *EQII*. Yet, because of the possibility of multitasking, the time spent on *EQII* and the time spent on other online activities were not necessarily mutually exclusive.

[INSERT TABLE 1 & 2 HERE]

Internet Use

Table 3 gives the results of the main regression models used to answer the research question about the general and differentiated Internet use and psychosocial well-being. Block 1 (Model 1 for all dependent variables) examined the impact of Internet use in general. When gender, age, previous diagnosis of depression and extroversion were controlled, more time spent online was found to predict more loneliness ($Beta = .09, p < .001$), more family communication time ($Beta = .06, p < .001$), worse family communication quality ($Beta = -.05, p < .001$), more sense of community online ($Beta = .15, p < .001$), and less sense of community derived from the neighborhood ($Beta = -.06, p < .001$), workplace and school ($Beta = -.08, p < .001$), but most of the effect sizes were quite small.

Block two (Model 2 for all dependent variables) added the different kinds of Internet use to the models. This block decreased the standard errors of the models and significantly improved the explained variance ($p < .001$) across all the dependent variables, although the changes in magnitude were small. This suggests that how people use the Internet contributes to the prediction of psychosocial outcomes over and above time spent online. In particular, meeting

new people online was related to more loneliness ($Beta = .14, p < .001$), shorter family communication time ($Beta = -.05, p = .004$) with worse quality ($Beta = -.10, p < .001$), even though it was strongly associated with better sense of community online ($Beta = .08, p < .001$). Communicating with family and friends local and afar showed mixed effect or no effect, with a slightly positive overall influence on psychosocial well-being. Notably, people who use the Internet for information-gathering purpose also experienced less loneliness ($Beta = -.05, p < .001$), longer ($Beta = .09, p < .001$) and better ($Beta = .09, p < .001$) communication with family, and enhanced sense of community from neighborhood ($Beta = .08, p < .001$), workplace and school ($Beta = .07, p < .001$).

[INSERT TABLE 3 HERE]

MMO Use

Table 4 gives the results of the main regression models used to answer the research question about general and differentiated MMO use and psychosocial well-being. For clarity of presentation, we omitted models predicting sense of community from neighborhood (Model 1: Adjusted $R^2 = .04, F = 40.16, SE = 0.79$; Model 2: Adjusted $R^2 = .05, F = 35.36, SE = 0.78$) and sense of community from co-workers or schoolmates (Model 1: Adjusted $R^2 = .04, F = 40.75, SE = 0.72$; Model 2: Adjusted $R^2 = .05, F = 32.58, SE = 0.71$); both models showed similar patterns to the models predicting family communication quality. For models with controls and aggregated time on *EQII* and other games only, time spent on *EQII* was associated with more loneliness ($Beta = .04, p < .001$), poorer family communication quality ($Beta = -.04, p < .001$), but more sense of community online ($Beta = .06, p < .001$). Time spent on other video games had the same effect, suggesting that the displacement effects were not *EQII*-specific and were common across games. Those effects were also very small.

As with the Internet-based findings, block two decreased the standard errors of the models while improving the explained variance slightly ($p < .001$ for R^2 change across all the dependent variables). Players' inclination to socialize and develop support relationships was related to an enhanced sense of community online ($Beta = .35, p < .001$), more loneliness ($Beta = .03, p = .03$) and less family communication time ($Beta = -.05, p = .01$). The achievement motivation was related to less loneliness ($Beta = -.04, p < .001$) and better family communication quality ($Beta = .06, p < .001$), while the immersion motivation was associated with increased loneliness ($Beta = .11, p < .001$), more family communication time ($Beta = .08, p < .001$) with better quality ($Beta = .03, p = .03$), and more sense of community online ($Beta = .04, p = .003$).

[INSERT TABLE 4 HERE]

For models predicting family communication time and quality, block three further added one variable measuring whether participants played *EQII* with their family and its interaction term with time on *EQII* (see Table 4). In this interaction model, time within *EQII* was negatively associated with family communication time with marginal significance ($Beta = -.05, p = .09$) for those who did not play with their family. However, the interaction effect was particularly strong ($Beta = .12, p < .001$), suggesting a displacement effect for one group and an augmentation for the other. In other words, if people did not play with their family, their time spent on *EQII* may encroach on family communication time; for people who were playing with their family, time spent on *EQII* may increase their family communication time. The model predicting family communication quality showed a similar pattern. In general, time within *EQII* was negatively associated with family communication quality, but such an effect was weaker for those playing with family. Taken together, these findings indicate that MMOs provide an alternative venue for family communication, but offer displacement when playing without family.

For models predicting loneliness and sense of community online, we added one variable measuring whether participants play *EQII* with their existing social ties (including both family and friends) and its interaction term with time in *EQII* (see Table 4). People who played with existing social ties tended to be less lonely than people who played with strangers ($Beta = -.08, p < .001$), but no significant interaction was found. The social context of *EQII* play did not affect sense of community derived online.

Player Communication

Table 5 reports the models used to answer the research question about player communication and psychosocial well-being. Communication intensity, as measured by the frequency of messages received, and the communication network size, as measured by the number of unique partners one received messages from, were individually included in the models to predict loneliness and sense of community derived online. Both the message frequency and the network size were positively associated with loneliness ($Beta = .04, p = .002$; $Beta = .06, p < .001$), while message frequency also predicted more sense of community online ($Beta = .05, p < .001$). To investigate the effect from the social context of playing, we added one variable measuring whether participants played *EQII* with their existing social ties (including both family and friends) and its interaction terms with player communication. For both models with messages received and network size as predictor variables, people playing with their existing social ties tended to have a lower level of estimated loneliness than people playing with strangers when other factors are held equal ($Beta = -.10, p < .001$; $Beta = -.08, p < .001$), but we did not find any significant interaction effect.

[INSERT TABLE 5 HERE]

Discussion

Using a large-scale dataset of differentiated Internet and MMO use, the current study took a nuanced approach to explore the psychosocial impact of online activities among online gamers. Similar to past studies, aggregated time spent online and in MMO had a very small overall impact. Instead, the psychosocial effects of using the Internet and MMOs depended on people's purposes, personalities, and the context of using the technology. Because our psychosocial outcomes include six different components, it is possible to discern the patterns of change with respect to the locus of interaction (online versus offline), the type of ties (stranger versus family and friends), and the nature of relationships (weak versus strong). Specifically, using the Internet for meeting new people was associated with increased loneliness, worse family communication, and more sense of community online, but using Internet for communication with family and friends had a positive impact on well-being. This suggests the concurrence of both the displacement phenomenon that online interactions with strangers can displace time spent on more meaningful social activities with offline friends and family, and the augmentation phenomenon that using the Internet to communicate with one's existing social ties can enhance the level of social engagement. It also shows that, in accordance with SIP theory, people were actively using these media for social purposes. Information-gathering activities also predicted significantly better psychosocial outcomes. Among MMO players, social gamers tended to develop a better sense of community online, but at the same time were more likely to feel lonely. The achievement motivation had an overall positive psychosocial impact, while the immersion motivation was associated with more loneliness as well as longer and better family communication. The intensity of player communication and the size of their in-game network were associated with more loneliness. The impact of MMO use was moderated by the context of

game play, as time spent on *EQII* was beneficial for players who played *EQII* with their family but deleterious for those who did not. Overshadowing nearly all of these findings was the importance of personality. The extroversion variable was dominant in most of the models in predicting psychosocial well-being, which is consistent with Kraut et al.'s (2002) "rich-get-richer" hypothesis that extroverts tend to garner more social benefits from Internet use, and its corollary "poor-get-poorer" hypothesis that introverts may become even more isolated.

Aggregate Versus Nuanced Approaches

The hierarchical regression models used in this study offer a direct comparison between an aggregate approach and a more nuanced one. When using the total time spent online, regardless of the specific purposes and activities, as one predictor of psychosocial outcomes, our finding is in agreement with the time displacement argument. However, for all these dependent variables except the sense of community online, the displacing effect of time online is extremely small—much smaller than the impact of demographic and personality variables, such as extroversion. This is consistent with meta-analytical finding on the social impact of aggregated time online (Shklovski et al., 2006). However, when the standard time measure was decomposed into different online activities, these types of differentiated Internet use often exerted influence in opposite directions, and the magnitude of such influence was comparable or sometimes larger than that of total time online (see Table 3). As such, the results support the conjecture that the small effect size of total time online found in prior and the current studies could be a result of social connectivity-enhancing and -weakening activities canceling each other out. Internet impact models that ignore these components are therefore likely to mask complex underlying processes.

The results from models predicting MMO use showed a remarkably similar pattern (see Table 4). Time spent within *EQII* was associated with more loneliness, worse family communication quality and better sense of community derived online, again clearly supporting a displacement argument. Time spent in other games exhibited identical effects, indicating that the displacement process was not *EQII*-specific and occurs across all games. But while these effects were statistically significant, they were substantively very small, especially when compared to the other predictors. In particular, the standardized coefficient for extroversion was roughly 10 times that of time spent. In another parallel to the general Internet effects model, when MMO use was disaggregated into different types of motivations, each component of MMO use exerted influence in various directions. And again, those were often with a larger magnitude than the standard time measure.

Taken together, the set of results offers consistent patterns. With a measure of total time spent only, we might have concluded that the net psychosocial impact of Internet or MMO was negative, which supports the displacement argument, even if the effect sizes were very small. This conclusion would be essentially misleading, as it masks various underlying processes that involve unique Internet and MMO activities with more substantive effects that are constantly counteracting each other. As such, Internet use and MMO play should not be considered monolithic sources of effects. Their effects should be considered and evaluated more carefully by researchers and policy makers.

Displacement and Augmentation

There was support for both time displacement and social augmentation mechanisms, although which mechanism prevailed was largely dependent on the purpose and context of media use. The time displacement argument emphasizes that time spent online essentially takes away

time on other activities that involve more social interactions with family and friends. This was clearly not the case. However, what was obvious was that those online communities generated worse overall psychosocial outcomes, as they do not supply the kind of social support and buffering (Cohen & Wills, 1985) that their offline counterparts do. At the same time, the social augmentation argument emphasizes that the Internet provides an added venue for social interaction. There was consistent support for the idea that this mechanism dominates when people used the Internet to communicate with their preexisting social ties. Presumably, the Internet serves as an additional site of social interaction besides their conventional communication channels. Under the framework of SIP, players were actively using the messaging and interaction tools in *EQII* to maintain their social relationships.

Taken together, time displacement and social augmentation are describing two consequences of the same process. People allocate a certain portion of their time to Internet use or MMO play, and its psychosocial impact is determined by whether the benefits of such activities outweigh the “opportunity costs” of some offline interaction. Therefore, for the same activity, we may witness both displacement and augmentation effects for different groups. A key example is the moderating role of playing *EQII* with family members. Those players who played regularly with their family members tended to have longer family communication time with a slightly lower communication quality, because MMO play extends, rather than substitutes, family time together—although the results suggest that *EQII* as an alternative venue of family communication may not produce interactions as nurturing or meaningful as those from more conventional media. For those players who did not play with family members, their family communication time appeared to be significantly displaced by MMO play and the quality of their family communication took an even stronger hit. While the impact on family communication

time appears quite straightforward, the finding on family communication quality warrants further exploration. Is family time spent in MMOs better or worse than outside of it? The answer may depend on what kind of family time is reallocated as a result of MMO play and the relative quality of that family communication. One ethnographic study suggests that playing MMOs together with one's family members or romantic partners could become a socially fulfilling activity (Nardi & Harris, 2006). Yet, little is known about whether MMO play surpasses the experiences of, for example, watching TV or cooking together with family members. Our analysis reveals only the overall net effect without further depth. To make a substantive claim about the impact of MMO play on family communication, future research should investigate the relative quality of different types of family time in and outside of MMOs. Given the sizable proportion of gamers playing with their family members (Cole & Griffiths, 2007; Williams et al., 2008) and the growing number of subscriptions, this topic warrants further study.

Purposes, Contexts, and Individual Characteristics

So, how do types of online activities, MMO motivations, and player communication affect psychosocial well-being? The short answer is: It depends. It is clear now that the effects of Internet and MMO use are very much dependent on the purposes, contexts and individual characteristics of users. In other words, who they are, with whom they use the media and for what purposes collectively explain a sizeable portion of the consequences of use. Using the Internet to meet new people was detrimental to psychosocial well-being, which is consistent with previous research (e.g., Bessiere et al., 2008) and suggests that communicating with presumably weak ties online may displace one's time spent communicating with close ties. However, we did not explore the bridging aspects made possible by these weak ties, which might generate benefits totally apart from buffering (Burt, 1992; Granovetter, 1973).

Communicating with family and friends local and afar showed mixed effects or no effects, with a slightly positive overall influence on psychosocial well-being, which suggests that these types of Internet use may integrate with people's daily social interactions and have little displacement effect. Notably, people who used the Internet for information-gathering purposes also experienced less loneliness, longer and better communication with family, and enhanced sense of community from neighborhood, workplace and school. Different motivations for MMO play also lead to varied psychosocial outcomes. The social motivation showed a generally negative impact, even if it was associated with better sense of community online. The achievement motivation had a positive impact, while immersion motivation showed mixed effects.

Compared to the rest, players who used Internet to communicate with preexisting social ties and who play *EQII* with their family members were more likely to have positive psychosocial outcomes, and so were female, young, and extroverted individuals who did not have a history of depression. In particular, extroversion had a significant and negative effect on loneliness, with a substantial effect size that was larger than all the other predictors combined. This finding is consistent with the "rich-get-richer" phenomenon reported in previous literature, where extroverts with good social resources tended to become more socially involved and introverts experienced further social disengagement (Kraut et al., 2002; Williams, 2007).

The Communication Paradox

The original HomeNet study was entitled "Internet Paradox" because greater use of the Internet, a social technology, seemed to reduce social involvement and psychological well-being (Kraut et al., 1998). In this study, we found a "communication paradox" because social motivations for playing MMOs, player communication intensity, and player communication

network size were all associated with worse psychosocial outcomes. This is a paradoxical finding, because these communication activities are strong evidence that MMOs engage player interactions and promote sociability. Communication is a critical process for building social relationships and reducing stresses via buffering (Cohen & Wills, 1985), thus intensive communication is expected to improve, rather than undermine, psychosocial well-being. This finding also seems to be incompatible with the basic prediction of SIP theory that socioemotional communication may occur as much in computer-mediated environments as in face-to-face settings and thus fulfill users' relational goals (Pena & Hancock, 2006; Walther, 1992). How would more communication lead to less social involvement and more loneliness? One way to reconcile this finding with SIP theory is to consider the communication partners, a variable usually assumed to remain constant across communication contexts in most SIP studies. Another way is to examine individual differences and mediators that may affect the direct link between online social interactions and their psychosocial consequences. Based on these considerations, we offer two possible explanations of communication paradox in the following.

First, communication occurring online and offline may not generate the same psychosocial benefits. In Putnam's (2000) terms, "bridging" relationships are inclusive, broad but lack depth, while "bonding" relationships tend to be more exclusive, narrower and deeper. Because online spaces have lower costs for entry and exit than offline, relationships formed online tend to be shallower and broader (Galston, 1999). Williams (2007) found that Internet use was associated with more bridging social capital online but less bonding social capital offline. Following the same logic, it is possible that in-game communication takes place mostly between strangers and acquaintances, thus the communication paradox observed in this study is a result of gained bridging social capital online and loss of bonding social capital offline (Williams, 2007).

Such a finding suggests an opportunity to integrate SIP theory with the displacement perspective. Although SIP theory emphasizes users' agency in using and adapting communication technology to suit their relational goals, the theory usually assumes that the communication partners involved remain the same (Walther, 1992). In other words, communication partners are considered as a constant instead of a variable. SIP theory does not take into account, however, the user's changing social network and the possible displacement process that is taking place across different communication contexts. In other words, the players may be adjusting to the medium and will use it to form relationships with old and new contacts in their social networks. If these new connections do not buffer and support as well as the ones they replace, then there is a net negative impact on the person's overall psychosocial life.

The second explanation comes from the theory of problematic use of Internet. Caplan (2003) found that people with problematic psychosocial predispositions may develop a preference for online, rather than face-to-face, social interaction, which in turn exacerbates their psychosocial conditions as they spend too much time using the Internet. In other words, the relation between psychosocial outcomes and Internet use is mediated by cognitive and behavioral variables such as preference for online socialization. Therefore, lonely and depressed people enter a cyclical process in which they use the Internet compulsively for social purposes, only to end up more lonely and depressed. As the current study does not have sufficient data on the specific communication partners, the nature of relationships maintained in the MMO, or on the prior psychological state, both explanations are subject to further investigation.

In contrast with the communication paradox, we also found that activities with no clear social implications are associated strongly with psychosocial well-being. For example, information-gathering activities were related to less loneliness and more family communication

time with better quality. A possible explanation is that information-gathering may trigger more meaningful communication among one's close and distant ties by providing opportunities for information-sharing (e.g., forwarding an interesting online news article to friends) and topics for informed discussion, thus solidifying social relationships. These findings again indicate that the pathways connecting online activities and psychosocial impact are not always straightforward or transparent.

Three limitations of this study warrant consideration. First, this study relied on mostly cross-sectional data and had no control condition, thus we cannot assess causality with confidence. Second, as we examined players from one specific MMO, it is unclear whether the results could be generalized to players in other virtual worlds or the entire online population. Studies have shown that MMO players are more likely to be heavy Internet users (Lenhart, Jones et al., 2008) and the demographic profile of our sample indicates a significant skew towards males. Additionally, an earlier study of the *EQII* population found that gamers deviate from the general U.S. population with regard to their mental health, with higher rates of depression and substance addition, but a lower level of anxiety (Williams et al., 2008). These differences should all be noted when interpreting the results. The best way to improve external validity is to replicate the current study in other virtual worlds and on populations with diverse background and characteristics. Third, the dataset used in this study is limited in that it only captures communication within the *EQII* game world, while interactions via other means, such as email and instant messaging, are not reflected in our analysis. This is an important limitation because interpersonal relationships are often sustained using multiple media and across various communication contexts (Haythornthwaite, 2002; Parks & Floyd, 1996). Lastly, of all the dependent variables examined in this study, only the loneliness models had a robust amount of

explained variance. Future studies are encouraged to explore these effects with refined measures and to consider other sources of variance.

Conclusion

Combining a large-scale survey of MMO players and their behavioral data collected in the game engine, this study explored the complex interplay between differentiated online activities and psychosocial outcomes experienced online and offline. There was support for both time displacement and social augmentation processes for various activities. More importantly, whether Internet and MMO use were associated with negative or positive outcomes was largely dependent on the purposes, contexts and individual characteristics of users. The Internet is a comprehensive technology that affords a wide range of functionalities. MMOs also offer extensive opportunities for exploration, socialization and achievement. They provide various levels of flexibility, allowing users to tinker with the technology, interact with each other, and create unique, spontaneous experiences (Zittrain, 2007). To a certain extent, the Internet and MMOs are what you make of them.

This study demonstrates the value of a nuanced approach in examining the impact of new media, as well as the usefulness of unobtrusive behavioral data. As we have shown, substantially different conclusions would have been drawn if an aggregated measure of media use, rather than differentiated activities, were used in the models. Moreover, a multi-dimensional approach to measure psychosocial outcomes provides insights into the patterns, as well as the possible causes, of the change in our increasingly mediated social lives.

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Bios:

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Table 1
Data Source, Mean and SD of Study Variables

Variables	Data Source	Mean	SD
Psychosocial Well-being			
Loneliness (20-80)	Survey	40.85	9.55
Family communication time (minutes/day)	Survey	328.00	399.78
Family communication quality (1-5)	Survey	4.18	0.86
Sense of community online (1-3)	Survey	2.43	0.71
Sense of community from neighborhood (1-3)	Survey	1.97	0.80
Sense of community from work/school (1-3)	Survey	2.41	0.74
Internet Use			
Time online (hours/week)	Survey	29.75	20.57
Information-gathering (1-5)	Survey	3.08	1.13
Meeting someone new (1-5)	Survey	2.20	1.19
Communicating w/ someone far away (1-5)	Survey	3.68	1.30
Communicating w/ someone local (1-5)	Survey	3.29	1.35
MMO Use			
Time on EQ2 (hours/week)	Game database	25.86	19.06
Time on other games (hours/week)	Survey	5.92	9.38
Social motivation (factor)	Survey	0.00	1.00
Achievement motivation (factor)	Survey	0.00	1.00
Immersion motivation (factor)	Survey	0.00	1.00
Player Communication			
Message frequency	Game database	160.99	327.99
Network size (indegree)	Game database	10.78	14.06
Controls			
Gender (Female =1)	Survey	0.20	0.40
Age	Survey	31.23	9.81
Previous diagnosis of depression	Survey	0.23	0.42
Extroversion (10-70)	Survey	41.58	10.10
Play with family (Yes=1)	Survey	0.66	0.47
Play with family or friends (Yes =1)	Survey	0.69	0.46

Table 2

Correlations Among Major Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1 Loneliness (20-80)	1.00																	
2 Family communication time (minutes/day)	-0.16	1.00																
3 Family communication quality (1-5)	-0.36	0.28	1.00															
4 Sense of community online (1-3)	<i>0.00</i>	<i>0.00</i>	<i>0.01</i>	1.00														
5 Sense of community from neighborhood (1-3)	-0.19	0.05	0.15	0.10	1.00													
6 Sense of community from work/school (1-3)	-0.20	<i>0.00</i>	0.11	0.23	0.26	1.00												
7 Time online (hours/week)	0.13	0.05	-0.07	0.14	-0.07	-0.10	1.00											
8 Information-gathering (1-5)	-0.12	0.08	0.14	0.05	0.13	0.11	-0.05	1.00										
9 Meeting someone new (1-5)	0.11	<i>-0.03</i>	-0.08	0.17	0.05	<i>0.02</i>	0.15	0.12	1.00									
10 Communicating w/ someone far away (1-5)	-0.03	0.03	0.05	0.24	0.05	0.06	0.17	0.21	0.36	1.00								
11 Communicating w/ someone local (1-5)	-0.08	<i>-0.01</i>	0.05	0.09	0.08	0.12	0.10	0.17	0.33	0.43	1.00							
12 Time on EQ2 (hours/week)	<i>0.02</i>	0.04	-0.06	0.06	<i>0.00</i>	-0.09	0.18	-0.05	0.03	0.03	-0.08	1.00						
13 Time on other games (hours/week)	0.10	-0.05	-0.08	<i>0.02</i>	-0.04	-0.04	0.26	-0.06	0.12	0.08	0.07	-0.07	1.00					
14 Social motivation (factor)	<i>-0.01</i>	<i>0.00</i>	0.05	0.36	0.10	0.10	0.15	0.04	0.29	0.28	0.19	0.08	<i>0.02</i>	1.00				
15 Achievement motivation (factor)	-0.07	<i>0.00</i>	0.07	0.03	0.08	0.06	0.06	<i>0.01</i>	<i>0.01</i>	<i>0.00</i>	0.07	0.12	-0.04	0.18	1.00			
16 Immersion motivation (factor)	0.11	0.07	0.04	0.17	0.03	<i>0.01</i>	0.13	0.08	0.18	0.16	0.13	-0.05	0.07	0.35	0.15	1.00		
17 Message frequency	0.03	<i>0.02</i>	-0.04	0.06	<i>0.00</i>	<i>-0.03</i>	0.12	-0.05	0.08	0.09	0.03	0.22	<i>0.00</i>	0.13	0.03	0.04	1.00	
18 Network size (indegree)	0.06	0.04	-0.06	<i>0.02</i>	<i>0.01</i>	-0.03	0.10	-0.09	0.06	<i>0.02</i>	<i>0.01</i>	0.23	<i>0.00</i>	0.12	0.07	<i>0.00</i>	0.71	1.00
19 Extroversion (10-70)	-0.48	0.07	0.18	0.08	0.18	0.17	-0.03	0.13	0.11	0.12	0.19	<i>0.00</i>	-0.03	0.20	0.13	0.04	0.06	0.04

Note: non-significant ($p > .05$) correlations are in italic.

Table 3

Linear Models Predicting Psychosocial Outcomes from Components of Internet Use (Standardized Regression Coefficients)

	Loneliness		Family communication time		Family communication quality		Sense of community online		Sense of community from neighborhood		Sense of community from work/school	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Gender (Female=1)	-0.11 ***	-0.11 ***	0.15 ***	0.15 ***	0.11 ***	0.10 ***	0.08 ***	0.06 ***	0.01	0.01	0.01	0.01
Age	-0.10 ***	-0.08 ***	0.01	-0.02	0.07 ***	0.05 ***	0.00	0.02	0.08 ***	0.07 ***	-0.01	-0.02
Previous diagnosis of depression	0.18 ***	0.17 ***	-0.03	-0.03	-0.12 ***	-0.11 ***	0.05 ***	0.04 ***	-0.05 ***	-0.05 ***	-0.07 ***	-0.07 ***
Extroversion	-0.47 ***	-0.47 ***	0.07 ***	0.07 ***	0.18 ***	0.16 ***	0.08 ***	0.06 ***	0.18 ***	0.16 ***	0.16 ***	0.14 ***
Time online (hours/week)	0.09 ***	0.08 ***	0.06 ***	0.07 ***	-0.05 ***	-0.05 ***	0.15 ***	0.10 ***	-0.05 ***	-0.06 ***	-0.08 ***	-0.09 ***
Information-gathering (1-5)		-0.05 ***		0.09 ***		0.09 ***		-0.01		0.08 ***		0.07 ***
Meeting someone new (1-5)		0.14 ***		-0.05 **		-0.10 ***		0.08 ***		0.03 *		-0.03
Communicating w/ someone far away (1-5)		0.00		0.01		0.04 *		0.20 ***		-0.01		0.01
Communicating w/ someone local (1-5)		-0.05 ***		-0.03		0.04 *		-0.03 *		0.04 **		0.08 ***
N	5656		3638		5099		5896		5858		5795	
SE	7.98	7.88	385.61	383.95	0.81	0.80	0.69	0.67	0.78	0.78	0.72	0.71
F	480.88	289.66	24.05	17.43	73.02	51.89	48.41	62.32	55.38	38.51	50.68	37.42
Adjusted R ²	0.30	0.31	0.03	0.04	0.07	0.08	0.04	0.09	0.04	0.05	0.04	0.05

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4

Linear Models Predicting Psychosocial Outcomes from MMO Motivations (Standardized Regression Coefficients)

	Loneliness		Family communication time		Family communication quality		Sense of community online	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Gender (Female =1)	-0.11 ***	-0.12 ***	0.15 ***	0.15 ***	0.10 ***	0.11 ***	0.08 ***	0.06 ***
Age	-0.12 ***	-0.11 ***	0.00	0.00	0.07 ***	0.09 ***	-0.02	0.05 ***
Previous diagnosis of depression	0.18 ***	0.17 ***	-0.03 †	-0.04 *	-0.12 ***	-0.12 ***	0.06 ***	0.04 ***
Extroversion (10-70)	-0.47 ***	-0.48 ***	0.08 ***	0.09 ***	0.19 ***	0.17 ***	0.08 ***	0.01
Time on EQ2 (hours/week)	0.04 ***	0.05 ***	0.03 †	0.03 †	-0.08 ***	-0.08 ***	0.06 ***	0.03 *
Time on other games (hours/week)	0.05 ***	0.04 ***	-0.02	-0.03	-0.04 **	-0.04 **	0.03 *	0.03 *
Social motivation (factor)		0.03 *		-0.05 *		0.02		0.35 ***
Achievement motivation (factor)		-0.04 ***		0.01		0.06 ***		-0.02
Immersion motivation (factor)		0.11 ***		0.08 ***		0.03 *		0.04 **
N	5359	5359	3450	3450	4806	4806	5571	5571
SE	7.99	7.92	387.21	386.01	0.81	0.81	0.70	0.65
F	369.52	262.73	18.68	15.26	62.56	45.16	19.99	103.65
Adjusted R ²	0.29	0.31	0.03	0.04	0.07	0.08	0.02	0.14
Block 3								
Time on EQ2 (hours/week)				-0.05 †		-0.12 ***		
Playing EQ2 w/ family				0.00		0.02		
Time on EQ2 X Playing w/ family				0.12 ***		0.06 †		
Time on EQ2 (hours/week)		0.07 ***						0.02
Playing w/ existing ties		-0.08 ***						0.01
Time on EQ2 X Playing w/existing ties		-0.03						0.01
SE		7.86		384.52		0.81		0.65
F		224.51		15.18		38.54		84.87
Adjusted R ²		0.31		0.04		0.08		0.14

† $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 5

*Linear Models Predicting Psychosocial Outcomes from Player Communication**(Standardized Regression Coefficients)*

	Loneliness		Sense of community online	
	Model 1	Model 2	Model 1	Model 2
Gender (Female =1)	-0.11 ***	-0.10 ***	0.08 ***	0.08 ***
Age	-0.12 ***	-0.11 ***	-0.02	-0.02
Previous diagnosis of depression	0.19 ***	0.19 ***	0.05 **	0.05 **
Extroversion (10-70)	-0.49 ***	-0.49 ***	0.08 ***	0.08 ***
Time on EQ2 (hours/week)	0.03 *	0.03 *	0.04 **	0.04 **
Time on other games (hours/week)	0.06 ***	0.07 ***	0.02	0.02
Messages frequency	0.04 **		0.05 ***	
Network size		0.06 ***		0.02
N	3786	3695	3931	3838
SE	7.94	7.93	0.69	0.69
F	244.61	240.64	13.31	11.27
Adjusted R ²	0.31	0.31	0.02	0.02
Block 3				
Messages frequency	0.02			
Playing w/ existing ties	-0.10 ***			
Messages frequency X Playing w/ existing ties	0.02			
Network size		0.07 **		
Playing w/ existing ties		-0.08 ***		
Network size X Playing w/ existing ties		-0.02		
SE	7.89	7.88		
F	197.77	193.87		
Adjusted R ²	0.32	0.32		

* $p < .05$, ** $p < .01$, *** $p < .001$