HOW INTERNET USE MAY AFFECT OUR RELATIONSHIPS
A Longitudinal Study of the Association between Compulsive Internet Use and Wellbeing
Abstract
Compulsive Internet use (CIU) has been linked to lower wellbeing, especially among adolescents. Yet, questions regarding the directionality of this association remain unanswered: CIU may influence wellbeing and vice versa. Theoretically, both directions are plausible, yet so far no studies have examined the directionality of these effects among adults. This article aims to shed light on the directionality of the relation between CIU and both positive and negative wellbeing, using a prospective, longitudinal sample of adults ($n = 398$). Over the course of four years, participants completed five assessments of their CIU and both positive and negative indicators of wellbeing. Participants were married couples who were recruited in the municipalities where they were married. CIU predicted increases in depression, loneliness and stress over time, and a decrease in happiness. No effect of CIU on the change in self-esteem was found. Further, happiness predicted a decrease in CIU over time. The results suggest CIU lowers wellbeing. This is important given that lowered wellbeing may affect health. Happiness is suggested to be a buffer for developing CIU.
An increasing number of people finds it hard to regulate their Internet use. As a result, they develop symptoms of compulsive Internet use (CIU): Internet use with addictive characteristics, including withdrawal reactions when Internet use is impossible (e.g., unpleasant emotions), lack of control over Internet use (e.g., use of the Internet despite the intention or desire to stop or to decrease the use), and cognitive and behavioral preoccupation with the Internet (van den Eijnden, Meerkerk, Vermulst, Spijkerman, & Engels, 2008). Many studies have shown that CIU is associated with lower psychological wellbeing (Chou, Condron, & Belland, 2005; Widyanto & Griffith, 2006). However, there is no consensus on the directionality of this association (e.g., Armstrong, Phillips, & Saling, 2000; Ha et al., 2007; Sum, Mathews, Hughes, & Campbell, 2008). While some researchers suggest that CIU causes lower wellbeing (e.g., Mooby, 2001), others argue that low wellbeing causes an increase in CIU (e.g., LaRose, Lin, & Eastin, 2003). Although both sides make theoretically compelling cases, it remains unclear which direction has the strongest effects over time.

Almost all studies on CIU and wellbeing use samples of adolescents or college students. We know surprisingly little about the link between CIU and wellbeing among adults (Byun et al., 2009, Chou et al., 2005; Kuss & Griffiths, 2011; Tokunaga & Rains, 2010; Widyanto & Griffith, 2006). This is surprising, given that, for example, in the Netherlands, a country which has the 8th highest Internet penetration rate in the world, (InternetWorldStats, 2011), adults are the largest group of Internet users (Centraal Bureau voor de Statistiek, 2013d). Furthermore, the 78.15% of the Dutch population is over 18 years of age, and only 7.11% of the Dutch population is a student of vocational or academic education (Centraal Bureau voor de Statistiek, 2014). The present study aims to explore the long-term directionality of the association between CIU and different indicators of wellbeing, using five consecutive surveys that were conducted over a four year period among adults.

Psychological wellbeing, sometimes referred to as psychological health or subjective wellbeing, is the evaluation of one’s quality of life or life satisfaction. It is positively related to physical health (Mechanic & Hansell, 1987) and better social functioning (Diener, 1984; Diener, Suh, Lucas, & Smith, 1999; Okun, Stock, Haring, & Witter, 1984). Given the independent contribution of positive and negative aspects of wellbeing for health and human functioning, psychological wellbeing is considered as comprising both dimensions. Typically, happiness, depression, stress, loneliness, and self-esteem are indicators of psychological wellbeing.
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(Augner & Hacker, 2011; Crocker, Luhtanen, Blaine, & Broadnax, 1994; Kang, 2007). The present study recognizes the multiple dimensions of wellbeing, and includes these diverse indicators to examine their relation with CIU.

Wellbeing and Compulsive Internet Use

CIU is often described as being incapable to control one’s Internet use (Chou & Hsiao, 2000; Johansson & Gotestam, 2004). Related terms in the literature are Internet addiction (e.g., Young, 1998), problematic (e.g., Caplan, 2002; Morahan-Martin & Schumacher, 2000) or pathological Internet use (e.g., Davis, 2001), and Internet dependence (e.g., Wang, 2001). Several studies have shown that CIU is negatively associated with different indicators of wellbeing: Compulsive Internet users are more depressed, stressed and lonely, less happy and have lower self-esteem (for recent reviews and meta-analyses see Byun et al., 2009; Chou et al., 2005; Tokunaga & Rains, 2010; Widyanto & Griffith, 2006).

Longitudinal studies yield mixed results. In a study of people’s first two years with a home Internet connection, greater use of the Internet increased depression and loneliness (Kraut et al., 1998). However, in the third year, these effects had dissipated (Kraut et al., 2002). This begs the question what kind of results can be expected now that people have been using the Internet for almost twenty years, and how wellbeing relates to compulsive, rather than frequent, use of the Internet.

In the, to our knowledge, only longitudinal study of CIU and wellbeing, incoming freshmen were recruited for a three-wave panel study in the summer before their first year of college (Tokunaga, 2012). Results showed that psychosocial problems such as loneliness and depression predicted later CIU, which in turn predicted later functional impairment (i.e., vocational impairment, impairment in friendships and in family relationships). All three waves were administered within half a year, from the summer before freshmen started college to the end of the first semester. At this time these young people probably underwent important life changes (e.g., moving away from their parents, living in a new environment), which may have affected the results and which limits the generalizability of these findings. Finally, a 2-wave study among adolescents aged 12 to 15 found that Internet use for communication purposes predicted an increase in depression six months later (van den Eijnden et al., 2008). Surprisingly, it also yielded an opposite effect: loneliness predicted a decrease of computer-mediated communication over time. Taken together, these results suggest that both directions of influence are plausible. Over time, CIU might affect wellbeing, but wellbeing might also affect CIU. However, there is no consensus in the literature.

Directionality of Effects

The literature provides theoretical reasons for both directions of influence. Wellbeing might affect CIU because people with low self-esteem may develop a preference for online over offline social interactions, which they experience as a safer way of expressing themselves.
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(Caplan, 2003; 2006). The preference for online interactions, in turn, may increase their dependence on the Internet, leading to CIU. Further, the consumption of different media can alter prevailing mood states, and people's selection of specific kinds of media content often serves to regulate their mood (Zillmann, 1988). Depressed individuals may therefore create media habits to alleviate depressed moods, leading to CIU (LaRose et al., 2003). Similarly, people may develop CIU because they use the Internet to dissociate and protect themselves from memories of loss, neglect, and abuse experienced in childhood (Schimmenti, Guglielmucci, Barbasio, & Granieri, 2012; Schimmenti, Passanisi, Gervasi, Manzella, & Famà, 2013). However, the opposite effect has also been described.

CIU might affect wellbeing because time spent online with weak ties, such as acquaintances, might substitute time spent on strong ties, such as family members (Nie & Erbring, 2000; Vitalari, Venkatesh, & Gronhaug, 1985). CIU may also negatively affect other life outcomes, including school or work performance. Such outcomes can isolate individuals from healthy social activities and increase their feelings of loneliness (Kim, LaRose, & Peng, 2009; Tokunaga, 2012). Finally, certain types of online content and online interactions may affect wellbeing. To illustrate, excessive use of social media might decrease one's self-esteem or lead to depression, because it provides content that can be used for social comparison (Pantic et al., 2011). Thus, according to the literature, both directional paths seem plausible. It may even be the case that they mutually reinforce each other, in that lower wellbeing may lead to more CIU, which in turn may decrease wellbeing even further. The present study sought to examine the directionality of the link between CIU and wellbeing.

The Present Study

Our study aims to shed light on the long-term directionality of the link between CIU and psychological wellbeing. Based on the existing literature, we expected to replicate the negative association between CIU and wellbeing, and extend these findings by exploring the long-term effects of CIU and wellbeing. Given that positive and negative indicators are partly independent of one another (Huppert & Whittington, 2003), and psychological wellbeing is considered a multi-dimensional construct, we examine both negative (i.e., depression, stress, and loneliness) and positive (i.e., happiness and self-esteem) indicators of wellbeing. Because the literature describes effects in both directions, we pose the research question: What are the long-term effects of CIU on wellbeing, and of wellbeing on CIU? To examine these associations as well as the directionality of effects, we use data from a 5-year prospective study among married adult couples. These couples were recruited through the municipalities in which they were married, and are representative of Dutch married couples. Married people make up 41.48% of all people in the Netherlands (Centraal Bureau voor de Statistiek, 2013). Therefore it is an important and representative group to study. Furthermore, CIU has adverse social and relational effects; not only does it contribute to greater loss of self-control, but it also undermines trust (Muusses, Finkenauer, Kerkhof & Righetti, 2013). These examples show
that married people are at risk for CIU related issues, which begs the question of how CIU and wellbeing are related in married people.

The longitudinal design of our study allows us to examine the long-term directional effects of CIU and wellbeing. However, directionality is not causality, and while the study can show order of effects, when we make statements about directionality, it should be clear we do not mean to suggest causality. Because the data is dyadic, we use analyses that correct for this non-independence of the data. Furthermore, we provide across-partner correlations for the variables of interest. Although our study is correlational, the results will contribute to our understanding of the importance of both directions.

Method

Participants
The data used for this study are derived from the VU University Panel on Marriage and Well-Being, a 5-wave, longitudinal study among newlywed couples in the Netherlands. In the five waves 199, 195, 190, 157, and 140 newlywed couples participated, respectively. At the first wave, the mean age of husbands (coded as 0) was 32.07 years ($SD = 4.86$) and the mean age of wives (coded as 1) was 29.20 years ($SD = 4.28$). Couples had been romantically involved on average for 5.71 years ($SD = 3.03$) and had been living together for an average of 3.81 years ($SD = 2.31$). The first wave of this study took place about one month after marriage (for more information, including ethical board, consent and assent procedures, see Finkenauer, Kerkhof, Righetti, & Branje, 2009; Pollmann & Finkenauer, 2009). Nearly all the couples (98.5% of the husbands and 96.4% of the wives) were Dutch.

Procedure
Participants were recruited via the municipalities in which they got married. The municipalities were average sized Dutch cities. Selection criteria were that (1) for all participants this was their first marriage, (2) at the first data collection, couples had no children from this marriage or from previous relationship partners, (3) both partners were between 25 and 40 years old, and (4) couples were heterosexual. Nineteen percent of the couples who were sent a letter of invitation to participate in the study agreed to participate. This response rate is similar to other studies recruiting participants from public records in the United States (e.g., Kurdek, 1993). The study was introduced to participants as a study on the influence of personal dispositions, behavior in the relationship, and partner perception on marital wellbeing in the first years of marriage. Wave one took place in 2005, 1-2 months after they got married. The following waves took place at one-year intervals. At the data collections, both members of the couple separately filled out an extensive questionnaire at home in the presence of a trained interviewer, who visited them at home. The interviewer’s presence ensured that partners independently completed the questionnaires without consulting each other.
The questionnaire took about 90 minutes to complete. At each data collection, after they completed the questionnaire, couples received 15 Euros and a small gift (e.g., pen-set, gift voucher). To increase commitment, we sent birthday cards to each participant. Also, participants were able to get updates about the progress of the study via the study website.

**Measures**

All measures were assessed in all five waves except loneliness, which was only measured in the last two waves. Therefore, all analyses concerning loneliness include only waves 4 and 5. All other analyses include all five waves. For details on the study see Finkenauer, Wijngaards-De Meij, Reis and Rusbult (2010); Kerkhof, Finkenauer and Muusses (2011); Muusses, Finkenauer, Kerkhof and Righetti (2013). Only scales relevant to the present hypotheses and research question are described below.

**Measures of Internet use**

**Compulsive Internet Use** (CIU) was assessed using a shortened version of the Compulsive Internet Use Scale (CIUS; Meerkerk, van den Eijnden, Vermulst, & Garretsen, 2009). For a description of the shortened scale and data supporting the reliability and validity of the scale, see Muusses et al., (2013). The items are: “How often…. (1) do you find it difficult to stop using the Internet when you are online? (2) do you continue to use the Internet despite your intention to stop? (3) do you prefer to use the Internet instead of spending time with others (e.g., partner, children, parents, friends)? (4) are you short of sleep because of the Internet? (5) do you feel restless, frustrated, or irritated when you cannot use the Internet?” (α for the five waves respectively .74, .81, .79, .82 and .84) (for descriptive statistics, see Table 1 and 2 and Figure 1).

To assess **Frequency of Internet use**, participants reported how many days per week and how many hours per day during these days they used the Internet for private purposes (as opposed to using the Internet for work). The product of the two questions resulted in a score for the frequency of Internet use, ranging from 0-686 (hours). Theoretically, the measure should have a maximum value of 168 (7 days in a week * 24 hours in a day). Consequently, the three participants who scored higher than the theoretical maximum probably misunderstood the question. Therefore, for the analyses that included frequency of Internet use, values higher than the theoretical maximum were replaced with missing values. Recoding the outlier values changed only 1 of the possible 28 results. The remaining 27 results did not change in significance or direction.

**Measures of personal wellbeing**

**Happiness** was assessed using Lyubomirsky and Lepper’s (1999) Subjective Happiness Scale. The questionnaire contained four items. The items are: 1) “In general, I consider myself.” (1 = not a very happy person to 7 = a very happy person); 2) “Compared to most of my peers, I
consider myself:” (1 = less happy to 7 = more happy); 3) “Some people are generally very happy. To enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?” (1 = not at all to 7 = a great deal); 4) “Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterization describe you?” (1 = not at all to 7 = a great deal). The scale showed good reliability in our study (Cronbach’s α for men = .78, .84, .78; .75, and .82; and for women = .76, .81, .79, .77, and .84 for all five waves respectively) and has good validity (Lyubomirsky & Lepper, 1999).

Depression was assessed using Radloff’s (1977) Center for Epidemiologic Studies Depression Scale (CES-D Scale). The scale contained 20 items, rated on a 4–point Likert scale; for example, “During the past week, I was bothered by things that usually don’t bother me.” [1 = Rarely or none of the time (less than 1 day); 2 = Some or a little of the time (1-2 days); 3 = Occasionally or a moderate amount of time (3-4 days); 4 = Most or all of the time (5-7 days)]. The scale showed good reliability (Cronbach’s α for men = .71, .87, .83, .78, and .85; and for women = .85, .85, .87 .87, and .85 for all five waves respectively).

Stress was assessed using a short form of the Cohen, Kamarck and Mermelstein (1983) Perceived Stress Scale (PSS). The questionnaire contained 11 items. An example item is “In the last month, how often have you been upset because of something that happened unexpectedly.” (1 = never to 5 = very often). The scale showed good reliability (Cronbach’s α for men = .77, .85, .81; .87, and .85; and for women = .84, .86, .87, .86, and .88 for all five waves respectively).

Self-esteem was assessed using the Rosenberg’s (1965) Self-Esteem scale. The scale contained 10 items, rated on a 5-point Likert scale; for example, “I feel that I’m a person of worth, at least on an equal plane with others.” (1 = does not apply to 7 = does apply). The scale showed good reliability (Cronbach’s α for men = .78, .86, .85, .85, and .82; and for women = .79, .84, .87 .87, and .86 for all five waves respectively).

Loneliness was assessed only in wave 4 and 5, using the de Jong Gierveld and van Tilburg (1999) Loneliness Scale, measuring overall, emotional, and social loneliness. The scale contained 11 items. An example item is “In the last month, how often have you been upset because of something that happened unexpectedly.” (1 = yes, 2 = more or less, 3 = no). The scale showed good reliability (Cronbach’s α for men = .77 and .81; and for women = .87 and .88 for both waves respectively).

Finally, to be able to control for Commitment, we assessed commitment using the Rusbult, Martz and Agnew (1998) Scale (8 items; Cronbach’s α for men = .86, .90, .93, .93, and .94; and for women = .91, .91, .93 .93, and .93 for all five waves respectively).

Strategy of Analysis
Data provided by a given participant on multiple research occasions are non-independent, as is data that results from two partners in a given relationship. Accordingly, we analyzed
our data using hierarchical linear modeling (Raudenbush & Bryk, 2002). This technique accounts for the nonindependence of observations by simultaneously examining variance associated with each level of nesting, thereby providing unbiased hypothesis tests. Following recommended procedures for couples data, we represented intercept terms as random effects and represented slope terms as fixed effects (Kenny, Mannetti, Pierro, Livi, & Kashy, 2002).

To test for longitudinal effects, we performed multilevel residualized lagged regression analyses. In these analyses, we regressed each criterion variable onto the earlier predictor and the earlier measure of the criterion. These analyses allowed us to assess the extent to which the predictor variable accounts for the change in the criterion over time. We performed lagged analyses, in which we simultaneously predict Time 2 criteria from Time 1 predictors, Time 3 criteria from Time 2 predictors, Time 4 criteria from Time 3 predictors and Time 5 criteria from Time 4 predictors.¹

Results

Descriptive Analyses

As suggested by the literature (Chou et al., 2005), gender was significantly associated with CIU indicating that men were more likely to use the Internet compulsively than women (see Table 3). We also found some associations between gender and the wellbeing variables. Consistent with the literature (Kessler, McGonagle, Swartz, Blazer, & Nelson, 1993; Kling, Hyde, Showers, & Buswell, 1999; Lundberg, 2002), women reported more depression and stress and less self-esteem, but we found no associations with gender for happiness and loneliness (see Table 3).

The means and standard deviations as well as the individual and cross-partner correlations of the main variables are presented in Table 2. Apart from the main variables' significant within persons correlations, it is interesting to note that CIU in one partner is positively associated with the other partner's stress. Put differently, the more one partner uses the Internet compulsively, the more stressed is the other partner (and vice versa). Furthermore, happiness, stress and loneliness are correlated within couples. That is, when one partner is happy, stressed, or lonely, the other partner is more likely to be happy, stressed, or lonely too.

Apart from suggesting gender effects for CIU and the wellbeing effect separately, the literature does not suggest that the relations between CIU and wellbeing differ for men and women, and husband-wife dyads should thus be treated as indistinguishable. To test if the data supports the idea that the dyads should be treated as indistinguishable, we performed preliminary analyses to explore possible moderation by participant gender, by including main effects and

¹ The results for the longitudinal dyadic data using hierarchical linear models and lagged analyses are displayed in beta’s. These beta’s can be considered measures of effect. Effect sizes for these results were not provided, because to our knowledge, no suitable measure of effect size is commonly used with these types of analyses.
interaction effects for gender to the analyses testing all possible main effects of the variables. Importantly, none of the 15 possible associations of the main variables of interest changed in direction or level of significance when adding gender as a main effect or interaction term. Therefore, we omitted participant gender from the analyses and treated dyad members as indistinguishable.

To ensure that the relation between CIU and the indicators of wellbeing was not attributable to commitment, we also controlled for commitment in our main analyses. None of the associations changed in significance or direction (positive or negative), indicating that commitment did not change the relation between CIU and wellbeing.

**Predicting Key Model Variables Cross-Sectionally**

Using hierarchical linear modeling, the critical relations were tested for all five time points (Time 1, 2, 3, 4 and 5) simultaneously, except for loneliness, which was only tested in wave 4 and 5. CIU was significantly negatively associated with happiness and self-esteem, and significantly positively with depression, stress, and loneliness (see Table 3). Furthermore, to test the validity of our model, we tested whether it held above and beyond Internet frequency, by including main effects and interaction effects for Internet frequency to the analyses. None of the effects of CIU changed in significance or direction, and Internet frequency was not significantly related to any of the wellbeing indicators.

**Longitudinal Analyses**

As described in our strategy of analysis, to test the effects longitudinally and explore the change over time in the criteria, we performed multilevel residualized lagged analyses. In these analyses the earlier independent variable was regressed on the dependent variable one year later, controlling for the dependent variable one year earlier. All effects were tested while controlling for the earlier measure of the criterion variable (e.g., earlier CIU predicts later happiness, while controlling for earlier happiness). Each effect therefore predicts the change in the dependent variable.

We tested both the effects of CIU on the wellbeing variables, as well as the opposite direction: the effects of the wellbeing variables on CIU. Firstly, CIU was found to significantly predict the changes in happiness, depression, stress and loneliness ($\beta_{\text{happiness}} = -0.05, p = .04; \beta_{\text{depression}} = 0.06, p = .03; \beta_{\text{stress}} = 0.05, p = .04; \beta_{\text{loneliness}} = 0.13, p = .01$) but not for self-esteem (see Table 4). In the opposite direction, happiness predicted the change in CIU over time ($\beta = -0.06, p < .01$), but none of the other wellbeing indicators predicted the change in CIU over time (see Table 4).

**Discussion**

This study investigated the long-term directionality of the relationship between CIU and psychological wellbeing using an adult sample. Previous research found negative relations between CIU and wellbeing (for recent reviews and meta-analyses see Byun et al., 2009, Chou
et al., 2005; Tokunaga & Rains, 2010; Widyanto & Griffith, 2006). This study replicated these findings on a range of wellbeing indicators, both positive and negative: Compulsive Internet use was negatively related to happiness and self-esteem, and positively related to depression, stress, and loneliness.

Crucially extending these findings, the current study examined the directionality of the long-term associations. Longitudinally, the data showed stronger support for the suggestion that CIU affects wellbeing over time, than that wellbeing affects CIU: CIU predicted changes in depression, stress, and loneliness positively, and the change in happiness negatively. No effect of CIU on changes in self-esteem was found. These results suggest CIU decreases people’s wellbeing. Happiness however, did predict the change in CIU negatively over time, suggesting happiness could protect people from developing CIU.

**Compulsive Internet Use Lowers Psychological Wellbeing**

Our findings provide support for the suggestion that CIU contributes to a decline in psychological wellbeing. In particular, we found that CIU predicted greater depression, stress, and loneliness over time. Previous research suggests several reasons as to why this may happen. One is that the more time people spend online, the less time they spend on real life interactions such as communication with offline significant others (Kraut et al., 1998). This may give rise to feelings of isolation and disconnection, which are often associated with depression and loneliness (Kim et al., 2009; Moody, 2001; Tokunaga, 2012). Another reason why CIU may be associated with low wellbeing is that the Internet exposes a person to different forms of aversive experiences. Prolonged and excessive use of social media has been shown to lead to negative feelings about the self and even depression, because it evokes social comparison (Pantic et al., 2011). In support of this explanation, Krasnova, Wenninger, Widjaja and Buxmann (2013) found that the relation of life satisfaction and Facebook use was mediated by envy, particularly among passive users. Furthermore, the intensity of passive following was likely to reduce a user’s life satisfaction in the long run because it triggered this type of upward social comparison.

Our results show that CIU has the strongest effect on loneliness compared to the other indicators of wellbeing. This provides support for previous studies that show that extensive use of the Internet, even for communication purposes, leads to loneliness (Kraut et al., 1998; Moody, 2001). An explanation may be that people high on CIU displace time spent on strong ties offline with time spent on weak ties online (Moody, 2001). Note, though, that we measured loneliness only in the last two waves, so we know less about the stability and robustness of this effect than for the other wellbeing indicators.

Our results did not provide support for Tokunaga’s (2012) findings that loneliness and depression predicted CIU over time. Tokunaga’s sample included incoming college freshmen. Measures were administered from before they started college until the end of the first semester of their first year. The present study was conducted among newlywed adults from
about two months after marriage until the fifth year of marriage. Apart from different time lags, we can also speculate that the difference in results could be explained by differences between the samples and their life stages. Going to college and getting married are two significant events that may have very different implications for the lives of individuals (e.g., going to college means being away from family and friends vs. getting married means having a constant companion). Also, emotional stability tends to increase across the adult life span (Brose, Scheibe, & Schmiedek, 2012), which could account for greater vulnerability of college students to loneliness and depression.

The data did not provide support for the long-term directionality of the link between CIU and self-esteem found among adolescents. Research shows that self-esteem stability tends to increase gradually throughout adulthood (Robins & Trzesniewski, 2005; Trzesniewski, Donnellan, & Robins, 2003). It is possible that self-esteem among adults is relatively stable, making it less susceptible to the long-term effects of CIU.

Furthermore, it is important to highlight that the negative impact of CIU in our study was not limited to the individual. Our findings showed that within couples, CIU and stress were correlated. This result indicates that the more one partner uses the Internet compulsively, the more stressed the other partner is. Theoretically, there are many different reasons that this relation may exist. Just one example is that the characteristics of CIU make people less trustworthy and responsive partners. By losing control over their Internet use, they may fail to meet agreements with their partner (such as picking the children up from school in time), which might increase the partners’ stress level. Additionally, within couples, happiness, stress, and loneliness were correlated. These results indicate that one’s personal low wellbeing is associated with the low wellbeing of the partner. Intuitively, such a situation may intensify low wellbeing, contributing to a downward spiral of negative emotions (Peterson & Seligman, 1984). This suggests that when CIU takes time away from social activities with offline significant others, it may lead not only to the decline of one’s own well-being (Moody, 2001), but may also affect the wellbeing of other people in the social network.

The Bidirectional Relationship of Compulsive Internet Use and Happiness

Given that CIU is associated with increases in depression, stress, and loneliness over time, intuitively one would expect CIU to have the opposite effect on happiness. The results support this, and showed that CIU had a long-term negative effect on happiness. However, happiness differed from the other indicators of psychological wellbeing, because it also predicted a decrease in CIU over time.

We found that an increase in happiness predicted lower CIU over time. This finding indicates that the happier people are, the less prone they are to becoming compulsive Internet users. Why may this be the case? Fredrickson’s broaden-and-build theory of positive emotions (2001) might provide a plausible explanation for this association. According to this theory,
positive emotions broaden people’s momentary thought-action repertoires and build people’s personal resources. These personal resources function as reserves, improving people’s ability to cope and survive. The present study suggests that happiness may broaden people’s repertoire of behaviors and build personal resources including self-regulatory resources, making them less susceptible to CIU.

Taking happiness as the starting point, our results suggest that low levels of happiness can lead to an increase in CIU. Consistent with previous findings, unhappy individuals may seek contexts where they can experience stimulating experiences. The Internet can provide such contexts (Caplan, 2003; 2006). Zillman (1998) asserted that media use has the ability to alter one’s mood and emotional states, and that individuals choose media content to get the desired mood. By using the Internet, individuals are able to experience immediate pleasure, thereby regulating their mood and emotional states. On social network sites, for instance, users receive encouragement from their online social network, which may add to positive feelings (Kuss & Griffiths, 2011). The incentive of consciously gratifying a need through media use motivates media consumption behavior that may eventually become a conditioned response to certain moods. These automatic media behaviors threaten self-regulation (Palmgreen, Wenner, & Rosengren, 1985). Lower self-control (akin to self-regulation) increases CIU over time (Muusses et al., 2012). Therefore, once self-regulation is impaired by media habits to alter one’s mood, one is more prone to CIU.

According to Lyubomirsky (2008) one of the determinants of sustainable happiness is engagement in intentional and effortful activities. These activities are resistant to adaptation/habituation effects and they can create a self-sustaining cycle of positive change (Lyubomirsky, 2008). Positive activity increases positive emotion, which in turn, enhances wellbeing (Lyubomirsky & Layous, 2013). This provides further support to the proposition that positive emotion builds psychological resilience and triggers upward spirals of positive emotions (Fredrickson, 2001). Thus, happiness could build resilience towards developing CIU. Because the present study showed that happiness could be a protective factor against CIU, it points to the importance of intentional engagement in activities, preferably outside of the Internet, to attain happiness. Furthermore, when Internet use becomes compulsive, it becomes less intentional and effortful. The compulsive Internet user loses control over the Internet behavior and the Internet use becomes a habit more than a conscious choice. This type of behavior might get in the way of the intentional and effortful activities that are the determinants of sustainable happiness. While the above described implications are tenable assumptions, more research is needed to examine our suggestions on the protective role of happiness on CIU (and on problematic Internet use in general) and the impact of CIU on the downward spiral of negative wellbeing.
Strengths and Limitations
Previous research shows strong support for a negative relation between CIU and wellbeing. The present study sought to circumvent shortcomings of existing research by examining the directionality of the link between CIU and wellbeing among a considerable sample of adults with five measurements over a period of four years.
To get a better understanding of the relationship of CIU and psychological wellbeing, it was important to tease apart different components of psychological wellbeing. Our study included both positive indicators (i.e., happiness and self-esteem) and negative indicators (i.e., depression, stress, and loneliness) of psychological wellbeing. We found that CIU predicted positive and negative indicators in the predicted direction. Importantly, we found that happiness also predicted a decrease in CIU over time. These processes had thus far not been studied simultaneously. Our findings emphasize the need to look at both sets of indicators because they coexist but are partly independent from each other (Hupert & Whittington, 2003).
This study contributes to the literature by focusing on adult Internet users. While Kraut et al. (1998) also studied adults, there are notable differences from the sample of this research. Most importantly, they did not look at CIU but at frequency of Internet use. Later research showed that almost all substantial negative effects are related to CIU rather than frequency of Internet use (e.g. Kerkhof et al., 2011). Another difference is the experiences the samples have had with the Internet. While Kraut et al.'s (1998) study included adults in their first and second years of Internet use in a time when Internet technology was relatively new, the current sample has been exposed to the Internet for a much longer period of time. A lot of applications, such as social network sites, were not yet available during the earlier research. Much like Kraut et al.'s (1998) study that examined people in the same household (a large part of whom are in a relationship or married), this study examined married couples. Although married people are one of the largest demographics, future research might include adult or elderly single users. One could imagine the relation between CIU and wellbeing might be different for this group of people. One example is that perhaps loneliness is a bigger reason for single people to use the Internet compulsively. Although the current research provides knowledge about adult Internet users and their wellbeing not yet present in the literature, more research is needed to investigate the impact of different internet applications, and crucially whether the link between CIU and wellbeing changes with longer use of the Internet.

Conclusions
This study explored the directionality between CIU and psychological wellbeing among adults. Previous studies mostly focused on adolescents and researched the relationship between CIU and wellbeing using a cross-sectional design. In this research, the direction of the relationship was researched using longitudinal data of a sample of adult married couples. Given the independent contribution of positive and negative indicators of wellbeing to health
and human functioning, psychological wellbeing was examined using both positive indicators (happiness and self-esteem) and negative indicators (depression, stress and loneliness). The results revealed that CIU lowers wellbeing over time. The higher the CIU, the more depressed, stressed, and lonely, and the less happy participants became. Furthermore, while self-esteem and CIU were related in studies among adolescents, no such relation occurred in the present research among adults. This result implies that different processes due to developmental stage might be at hand for adults and adolescents. Importantly, happiness prevented CIU over time. Thus, while CIU seems to make adults more vulnerable to decreases in wellbeing, positive wellbeing seems to protect individuals from developing CIU in the long run.

Table 1

**Means and SD’s of the variables over time**

<table>
<thead>
<tr>
<th>Wave</th>
<th>Internet frequency Mean (SD)</th>
<th>CIU Mean (SD)</th>
<th>Happiness Mean (SD)</th>
<th>Depression Mean (SD)</th>
<th>Stress Mean (SD)</th>
<th>Loneliness Mean (SD)</th>
<th>Self-esteem Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.98 (11.51)</td>
<td>1.57 (.54)</td>
<td>5.72 (.86)</td>
<td>1.35 (.30)</td>
<td>2.06 (.49)</td>
<td>4.05 (.44)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>18.3 (75.68)</td>
<td>1.62 (.61)</td>
<td>5.67 (.91)</td>
<td>1.37 (.32)</td>
<td>2.11 (.49)</td>
<td>4.08 (.46)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>12.35 (53.25)</td>
<td>1.63 (.54)</td>
<td>5.69 (.86)</td>
<td>1.36 (.31)</td>
<td>2.12 (.48)</td>
<td>4.12 (.47)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>15.15 (59.57)</td>
<td>1.61 (.57)</td>
<td>5.66 (.85)</td>
<td>1.36 (.29)</td>
<td>2.05 (.49)</td>
<td>1.21 (.30)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>17.51 (64.33)</td>
<td>1.60 (.57)</td>
<td>5.60 (.91)</td>
<td>1.36 (.30)</td>
<td>2.08 (.48)</td>
<td>1.21 (.31)</td>
<td></td>
</tr>
</tbody>
</table>

Note: CIU = Compulsive Internet use; Happiness = Subjective Happiness Scale; Depression = Center for Epidemiologic Studies Depression Scale; Stress = Perceived Stress Scale; Loneliness = Loneliness Scale; Self-esteem = Self-Esteem scale.

Table 2

**Within and across partner correlations, means and SD’s for the assessed variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. CIU</td>
<td>.04</td>
<td>-.02</td>
<td>.01</td>
<td>.11**</td>
<td>-.03</td>
<td>-.03</td>
</tr>
<tr>
<td>2. Happiness</td>
<td>-.23**</td>
<td>.08**</td>
<td>-.03</td>
<td>-.05</td>
<td>-.04</td>
<td>.04</td>
</tr>
<tr>
<td>3. Depression</td>
<td>.16**</td>
<td>-.48**</td>
<td>.03</td>
<td>-.01</td>
<td>.01</td>
<td></td>
</tr>
<tr>
<td>4. Stress</td>
<td>.17**</td>
<td>-.49**</td>
<td>.67**</td>
<td>.10**</td>
<td>-.05</td>
<td>-.01</td>
</tr>
<tr>
<td>5. Loneliness</td>
<td>.15**</td>
<td>-.39**</td>
<td>.32**</td>
<td>.26**</td>
<td>.18**</td>
<td>-.04</td>
</tr>
<tr>
<td>6. Self-esteem</td>
<td>-.16**</td>
<td>.57**</td>
<td>-.49**</td>
<td>-.51**</td>
<td>-.28**</td>
<td>.04</td>
</tr>
<tr>
<td>M</td>
<td>1.60</td>
<td>5.67</td>
<td>1.36</td>
<td>2.08</td>
<td>1.21</td>
<td>4.09</td>
</tr>
<tr>
<td>SD</td>
<td>.57</td>
<td>.87</td>
<td>.30</td>
<td>.49</td>
<td>.30</td>
<td>.46</td>
</tr>
</tbody>
</table>

Note: CIU = Compulsive Internet use; Happiness = Subjective Happiness Scale; Depression = Center for Epidemiologic Studies Depression Scale; Stress = Perceived Stress Scale; Loneliness = Loneliness Scale; Self-esteem = Self-Esteem scale.

Note: The correlations on and above the diagonal are across partner correlations between model variables. The correlations below the diagonal line are within-individual correlations. Note: *p < .05, **p < .01.
### Table 3

**Hierarchical linear modeling β's over T= 1, 2, 3, 4 and 5**

<table>
<thead>
<tr>
<th></th>
<th>CIU</th>
<th>Gender</th>
<th>Frequency of Internet Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIU</td>
<td>-.20**</td>
<td>.12**</td>
<td></td>
</tr>
<tr>
<td>Happiness</td>
<td>-.12**</td>
<td>.03</td>
<td>-.02</td>
</tr>
<tr>
<td>Depression</td>
<td>.14**</td>
<td>.14**</td>
<td>.03</td>
</tr>
<tr>
<td>Stress</td>
<td>.14**</td>
<td>.16**</td>
<td>-.02</td>
</tr>
<tr>
<td>Loneliness</td>
<td>.10*</td>
<td>-.01</td>
<td>.01</td>
</tr>
<tr>
<td>Self-esteem</td>
<td>-.08**</td>
<td>-.16**</td>
<td>.02</td>
</tr>
</tbody>
</table>

Note: CIU = Compulsive Internet use; Happiness = Subjective Happiness Scale; Depression = Center for Epidemiologic Studies Depression Scale; Stress = Perceived Stress Scale; Loneliness = Loneliness Scale; Self-esteem = Self-Esteem scale.
Note: *p < .05, **p < .01.

### Table 4

**Residualized lagged analyses β’s for the predicted change in CIU by wellbeing factors, and predicted change in wellbeing factors by CIU**

<table>
<thead>
<tr>
<th>Criterion →Dependent variable</th>
<th>Criterion at earlier time point</th>
<th>Effect on change in dependent variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happiness →CIU</td>
<td>.70**</td>
<td>-.06**</td>
</tr>
<tr>
<td>Depression →CIU</td>
<td>.71**</td>
<td>.02</td>
</tr>
<tr>
<td>Stress →CIU</td>
<td>.71**</td>
<td>.03</td>
</tr>
<tr>
<td>Loneliness →CIU</td>
<td>.78**</td>
<td>.04</td>
</tr>
<tr>
<td>Self-esteem →CIU</td>
<td>.71**</td>
<td>-.04</td>
</tr>
<tr>
<td>CIU →Happiness</td>
<td>.65**</td>
<td>-.05*</td>
</tr>
<tr>
<td>CIU →Depression</td>
<td>.27**</td>
<td>.06*</td>
</tr>
<tr>
<td>CIU →Stress</td>
<td>.49**</td>
<td>.05*</td>
</tr>
<tr>
<td>CIU →Loneliness</td>
<td>.66**</td>
<td>.13**</td>
</tr>
<tr>
<td>CIU →Self-esteem</td>
<td>.71**</td>
<td>-.03</td>
</tr>
</tbody>
</table>

Note: CIU = Compulsive Internet use; Happiness = Subjective Happiness Scale; Depression = Center for Epidemiologic Studies Depression Scale; Stress = Perceived Stress Scale; Loneliness = Loneliness Scale; Self-esteem = Self-Esteem scale.
Note: *p < .05, **p < .01.
Figure 1

**Standardized mean values of the main variables over time**

Note: CIU = Compulsive Internet use; Happiness = Subjective Happiness Scale; Depression = Center for Epidemiologic Studies Depression Scale; Stress = Perceived Stress Scale; Loneliness = Loneliness Scale; Self-esteem = Self-Esteem scale.