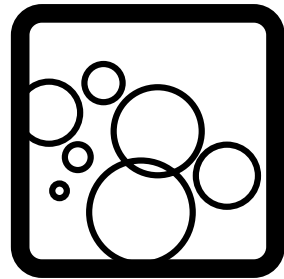# Pwned by the Internet

Explorative research into the causes and consequences of compulsive internet use

Gert-Jan Meerkerk

Pwned* by the Internet

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*The term "pwned" (or owned, own3d, Owned, pwnd, pwn3d etc.) is an internet slang word used commonly in gaming circles to acknowledge a form of superiority through the downfall of another group, be it another gaming clan, or a single user. This can be in the context of winning an online game, a debate on a forum, or attaining a successful hacking, as well as the signature to a rebuttal, such as "You got Owned!" to announce the defeat of another user on the internet in the form of a debate or flame war. The term originated in computer security, as a slang term for a computer system having full control, figuratively "ownership", compromised; "I own your computer". (http://en.wikipedia.org/wiki/Owned)

Pwned by the Internet

Explorative research into the causes and consequences
of compulsive internet use

Bezeten van het Internet

Een onderzoek naar de oorzaken en gevolgen
van compulsief internetgebruik

Proefschrift

ter verkrijging van de graad van doctor aan de
Erasmus Universiteit Rotterdam
op gezag van de rector magnificus

Prof.dr. S.W.J. Lamberts

en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op
donderdag 20 september 2007 om 13.30 uur
door
Gert-Jan Meerkerk
geboren te Rotterdam

ERASMUS UNIVERSITEIT ROTTERDAM

Promotiecommissie

Promotor
Prof.dr. H.F.L. Garretsen

Overige leden
Prof.dr. G.M. Schippers
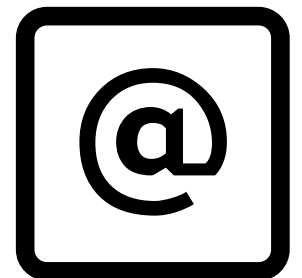Prof.dr. I.D. de Beaufort
Prof.dr. P. Muris

Copromotor
Dr. R.J.J.M. van den Eijnden

Voor Jannes en Mathis

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Introduction

Chapter 1

Introduction

Internet use in the Netherlands

The first internet service provider (ISP) in the Netherlands (XS4ALL) started to provide internet access to private persons in 1993. A few years later, in 1996, less than 5% of the Dutch households had internet access. Now, 10 years later, this figure has risen to nearly 80%, which implies that about 11,000,000 Dutch inhabitants now have access to the internet (CBS, 2005). Worldwide, the internet penetration is about 16%, which corresponds with about 1,000,000,000 internet users. The Netherlands, therefore, is one of the countries with the highest internet penetrations, together with countries like the USA, Canada, Hong Kong, South Korea, Japan, Singapore, and the Scandinavian countries (http://www.internetworldstats.com). Also, with regard to the dissemination of broadband access, the Netherlands is among the top 5 countries in the world with about 70% of the households having internet access using an ADSL or cable modem (CBS, 2005).

Initially, internet was the domain of the so-called 'nerds'. Meanwhile, however, the internet-using population in the Netherlands more or less resembles the general population. Differences in internet access and frequency of use between, for example, males and females, or between different age groups, have diminished, although females still make slightly less use of the internet than males (71% daily users among females versus 78% among males), and older individuals are still less involved in the internet than youngsters (52% daily users among individuals aged 65 to 75 years versus 81% daily users among those aged 12 to 25 years). Furthermore, internet use is positively related to educational level with 67% daily users among individuals with a low educational level and 86% daily users among individuals with a high educational level. Three out of four internet users aged 12 to 75 years go on the internet on a daily basis and 95% uses the internet at least once a week. Adolescents aged 12 to 25 years make use of the internet the most, with more than 80% of the youngsters being online every day and 97% at least once a week (CBS Statline, data 2005).

Internet use has become an important time-absorbing activity with an average of seven hours per week online for individuals aged 12 years and older. However, there are large differences in the amount of time spent online. Males spend more time online than females (9 versus 6 hours per week), with young males aged 15 to 24 years spending most time online (11 hours per week), which is considerably more than their female counterparts who spend on average 7 hours per week online. Females aged 65 years and older spend the least time online with on average 2 hours per week (CBS Statline, data 2004).
Some internet functions, such as email and general information searching, are more or less equally popular across various demographic categories. The popularity of other internet functions differs considerably among, for example, males and females, or among different age groups. Especially among the latter the differences are large. For example, 83% of the adolescents aged 12 to 25 years indicated they used a chat function in the past 3 months, whereas only 32% of the individuals aged 25 to 45 years indicated they used a chat function. Similarly, 83% of the youngsters aged 12 to 25 years used the internet in the past three months to download games, pictures, music or software, whereas only 55% of the adults aged 25 to 45 years used this function. The differences between males and females concern downloading, buying and selling, and searching news, all of which are done more often by males. Unfortunately, no data are available on the amount of time spent on online gaming or on online erotica (CBS Statline, data 2005).

Overall, it can be concluded that the internet now plays an important role in the lives of the majority of the Dutch population, especially in the life of youngsters. It has provided individuals with, or at least lowered thresholds to, new sources of communication, information, and entertainment. As such, the internet cannot be regarded as an independent entity but rather as an elaborate means to satisfy a broad variety of human needs. Internet can satisfy the need for information, but also the need for friendship and sexual intimacy, the need for communication, belonging to and affiliation with others, or the need to compete with others and find approval, respect, and recognition.

Compulsive internet use

Although there are obviously many positive aspects related to the development of the internet, for more than 20 years indications have been emerging that some people can become overly attached to computers and certain internet functions, resulting in serious psychological, social, and professional dysfunctioning (Davidson & Walley, 1984; Goldberg, 1997). The idea that the internet, or at least certain internet functions, might be addictive, initially met a lot of skepticism: "... IAD (internet addiction disorder) is not a disorder and IAD does not exist; there is little research to show otherwise (and much of that is done poorly)" (Grohol, 1995). Or as Hughey put it: "I prefer to think of these people (internet addicts, GJM) as pioneers. Eventually, we will all be "connected" all the time. A new age has arrived. Let's not invent DSM IV classifications for those who are just a little ahead of the rest of us in embracing the future" (Hughey, 1997). Meanwhile, however, it is recognized that certain internet functions may indeed bear an addiction risk and that internet functions such as online erotica, internet games, and online chatting are "activities that may carry greatest future risk for behavioral addiction" (Orford, 2005). Nonetheless, research in the field of 'internet addiction' is still explorative and no consensus has been attained on the validity and reliability of the construct or on its causes and consequences. There is even no agreement on which term to use for the phenomenon. In the literature the behavior is referred to as internet addiction (Young, 1998), pathological

internet use (Davis, 2001), problematic internet use (Caplan, 2002), internet dependency (Wang, 2001), or excessive internet use (Yang, Choe, Baity, Lee, & Cho, 2005). However, we prefer the term compulsive internet use (CIU) because from our perspective it is not the internet itself that is addictive, but rather certain online activities (e.g. chatting, gaming, or searching online erotica). The addictive use of such internet functions in turn, becomes manifest in a compulsive use of the internet.
Clearly, the research on CIU is still in its initial phase. One of the prerequisites for further research is the development of a reliable, valid, and easy to administer instrument to assess the severity of CIU.

Prevalence of compulsive internet use

Although it is largely unclear how many people may be affected by the detrimental effects of internet use, i.e. prevalence figures are reported to range from less than 1% (Nichols & Nicki, 2004) to almost 40% (Leung, 2004), it is clear that during the last decade for many individuals the role of the internet in daily life (both in quantitative and qualitative sense) has risen exponentially and there is no reason to believe that this development will stop soon. On the contrary, in large parts of the less-developed world internet is still a relatively unknown medium, the technical developments (e.g. computer speed and data transmission capabilities) still grow exponentially (Moore's law[1]), wireless applications gain more and more ground, and the assimilation with the traditional media such as radio, television and print media, is still in its initial phase. In other words, the technological revolution of the internet has only just begun and its full impact on the way individuals communicate with each other and build social structures, entertain, and inform themselves, is yet fully to emerge. How these developments affect the addictive qualities of internet functions remains to be seen, but given the knowledge hitherto, it is not unlikely that the addictive qualities will increase and that correspondingly the prevalence figures of CIU will increase. An earlier study of our research group showed that about 25% of the addiction care and mental healthcare workers have already encountered individuals asking for help with their internet-related problems (Meerkerk, Laluan, & Eijnden, 2003). Given the ever-increasing use of the internet, the prevalence of CIU can be expected to rise in the future, signaling a growing need for the development of treatment programs and training of employees of addiction care and mental healthcare organizations. Moreover, prevalence figures of the Netherlands may give an indication of what may be expected in other countries where the development of the internet has not yet reached the same level as here.

Addictive potential of various internet functions

The specific characteristics that make certain internet functions addictive have been described by several authors (Cooper, 1998; Orford, 2005; Young, Pistner, O'Mara, & Buchanan, 1999). Cooper's 'Triple A engine'

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[1] In 1965 Gordon Moore, co-founder of Intel, observed that the number of transistors per square inch on integrated circuits (a rough measure of computer processing power) had doubled every year since the integrated circuit was invented. Moore predicted that this trend would continue for the foreseeable future. In subsequent years the pace slowed down a bit but the complexity of integrated circuits has doubled every 18 months. Most experts, including Moore himself, expect Moore's Law to hold for at least another two decades (http://en.wikipedia.org/wiki/Moore's_law, http://www.webopedia.com/TERM/M/Moores_Law.html).

describes how access, affordability, and anonymity ameliorate the addictive qualities of online erotica. Similarly, Young and colleagues' 'ACE model' (anonymity, convenience, and escape) describes properties of internet functions that heighten the addictive potential. Finally, Orford stated that availability, the possibility to rapidly achieve an intense emotional reward, and the element of continuity, are features that can make (online) activities addictive. Applied to the internet in general, the models mentioned above can be summarized to indicate that the internet is an easy, highly accessible and cheap way to instantly satisfy a variety of needs. The subjective anonymity lowers thresholds and stimulates disinhibition (Suler, 2004), and because of the continuous nature of the internet, the internet can be used for repetitive behavior, which enables the user to withdraw from daily life and escape from problems (coping). However, it is unlikely that the internet has a uniform and universal effect on all its users. It makes more sense to focus on the function of the internet that is used (as well as the personal circumstances and social resources of the user) and the reason why this function is used (Bessière, Kiesler, Kraut, & Boneva, 2004; Weiser, 2001). Clearly not all internet functions will have the same addictive potential.

Internet use and psychosocial wellbeing

Besides addiction, (heavy) internet use has also been associated with social isolation, loneliness, depression, and low psychosocial wellbeing in general. As early as 1998 indications were found in the well-known longitudinal Homenet study (Kraut et al., 1998) that greater use of the internet was associated with a decline in participants' communication with family members in the household, a decline in the size of the social circle, and an increase in depression and loneliness. However, the study has been criticized heavily (Grohol, 1998), and replications by Kraut (2002) and by other researchers (Wästlund, Norlander, & Archer, 2001) failed to confirm the conclusion that heavy internet use generally causes a decrease in psychosocial wellbeing. Still, many studies have demonstrated a relation between (compulsive) internet use and indicators of low psychosocial wellbeing such as shyness, self-esteem, loneliness and depression (Armstrong, Phillips, & Saling, 2000; Caplan, 2002, 2003; Chak & Leung, 2004; Engelberg & Sjoberg, 2004; Morahan-Martin & Schumacher, 2000; Morahan Martin, 1999; Nalwa & Anand, 2003; Nichols & Nicki, 2004; Petrie & Gunn, 1998; Whang, Lee, & Chang, 2003; Yang & Tung, 2004; Young & Rodgers, 1998). The causal relationship between internet use, CIU, and psychosocial wellbeing needs further exploration as it may clarify, for example, whether certain states of psychosocial wellbeing or personality traits make individuals vulnerable to CIU, or whether CIU can lead to a decline in psychosocial wellbeing.

Overall, it is clear that the impact of the internet on society is growing and that internet use and CIU are related to psychosocial wellbeing. Especially for adolescents, who are generally heavily involved in using the internet (particularly online communication applications such as the MSN messenger) and for whom negative effects on psychosocial wellbeing may have long-lasting consequences, the relationship between internet use, CIU, and psychosocial wellbeing is of great importance.

Aim of the present thesis

Taking the above together emphasizes the need to answer major questions such as: what is CIU, how can it be measured, how many people does it concern, which internet functions have the highest addition risk, which people are more vulnerable to develop CIU, and what are the causes and consequences of CIU. This

is the first Dutch research to address these questions. Because of the explorative nature of the research, some of the answers presented in this thesis may be preliminary.

In the following, an overview is presented of the research questions and the characteristics of the studies that are presented in this thesis.

Overview of the research questions and characteristics of the studies

The present thesis describes the research findings of three studies that relate to the above questions. Both cross-sectional and longitudinal studies were conducted to address the following research questions:

1. What constitutes CIU and how can the severity of CIU be assessed?
2. What is the prevalence of CIU in the general internet using population and how stable is CIU over time?
3. What is the association between CIU and the use of various internet functions (e.g. chatting, gaming, and online erotica)?
4. What is the relation between internet use, CIU, and psychosocial wellbeing?
5. What aspects of personality are related to the vulnerability to develop CIU?

To answer these questions, three studies were conducted. Table 1 presents an overview of the three studies, the samples that were used, and the research questions that were addressed in these studies.

Table 1 Characteristics of the studies, research questions, and corresponding chapters within this thesis

	Study 1	Study 2	Study 3
Sample	Representative sample of adult heavy users	Convenience sample	Sample of students aged 12 to 15 years
Design	Longitudinal	Cross-sectional	Longitudinal
Method	Online questionnaire	Online questionnaire	Paper and pencil questionnaire
Research question	1, 2, 3	1, 5	3, 4, 5
Chapter	2, 3, 4, 6	2, 6, 7	5

The first study concerned a two-wave longitudinal study with a 1-year interval among a representative sample of adult heavy internet users. The data of the first measurement were used for the development of the instrument to assess CIU (the compulsive internet use scale: CIUS), the assessment of the prevalence of CIU, the cross-sectional analyses of the association between CIU and various internet functions, and the relationship between indicators of psychosocial wellbeing and CIU. The second measurement was used to replicate the findings of the first measurement regarding the CIUS, to assess the chronicity of CIU, to study the relationship between CIU and indicators of psychosocial wellbeing, and for longitudinal analyses of the association between CIU and various internet functions.

The second study was compiled by a questionnaire on the website of our institute (www.ivo.nl) in which individuals could participate on their own initiative. This non-representative but large convenience sample was used to replicate the findings regarding the CIUS, to test the stability of the CIUS across relevant subgroups, and to assess the relationship between CIU and personality features and between CIU and indicators of psychosocial wellbeing.

The third study had a two-wave longitudinal design with an interval of 6 months and was conducted using a paper and pencil questionnaire in a classroom setting. Participants were students in the eighth grade of four schools for secondary education. The data were used to study the relationship between internet use (i.e. online communication) and CIU, and between online communication and psychosocial wellbeing.

Outline of the thesis

Chapter 2 addresses the development of the compulsive internet use scale (CIUS). It presents figures on the factorial stability, the validity, and the reliability of the newly developed scale (research question number 1).

Chapter 3 presents the results of research on the prevalence of CIU in the general population and the stability of CIU over time (research question number 2).

Chapter 4 presents the results of research on the association between CIU and various internet functions (research question number 3).

Chapter 5 presents the results of research on the relationship between various internet functions (e.g. online communication), CIU, and psychosocial wellbeing among adolescents (research question number 3 and 4).

Chapters 6 and 7 present the results of research on the relationship between psychosocial wellbeing and personality on the one hand, and CIU on the other (research question number 4 and 5). Chapter 6 addresses the factors related to psychosocial wellbeing (depressive symptoms, self-esteem, and loneliness) and the personality features of the Big Five, and Chapter 7 focuses on the personality features impulsivity and sensitivity to reward and to punishment.

Finally, **Chapter 8** describes the main findings of the studies and presents the conclusions and some theoretical implications of these findings.

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chapter 2

The Compulsive Internet Use Scale (CIUS): some psychometric properties
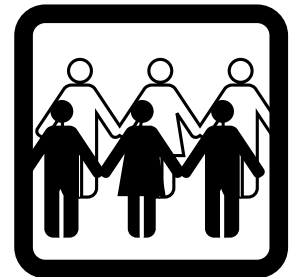
Chapter 2

The Compulsive Internet Use Scale (CIUS): some psychometric properties

Submitted for publication as
Meerkerk, GJ, Van den Eijnden, RJJM, Vermulst, AA, and Garretsen, HFL. The Compulsive Internet Use Scale (CIUS): some psychometric properties.

Abstract
The aim of the present study was to develop a short and easy to administer, psychometrically sound and valid instrument to assess the severity of compulsive internet use. First, a set of criteria was determined based on the literature. Subsequently, the internal consistency and convergent validity of these criteria were determined, and the set was tested as a one-factor solution in two representative samples of heavy internet users (Study 1 and 2) and in one large convenience sample of internet users (Study 3). A total of 447 heavy internet users aged 18 years and older who used the internet at least 16 hours per week and had internet access at home for at least one year participated in the first study. In the second study, 229 heavy internet users who met the same criteria participated, and 17,000 unselected internet users participated in the third study. In the three studies respondents were asked about their online behavior and gave subjective reports of problems and addictive feelings related to internet use. The Online Cognition Scale (OCS) was included for concurrent validity in the first study. The newly developed Compulsive Internet Use Scale (CIUS) contains 14 items ratable on a 5-point Likert scale. The instrument showed good factorial stability across time and across different (sub) samples. The internal consistency is high and high correlations with concurrent and criterion variables demonstrate good validity. It can be concluded that the CIUS is a psychometrically sound, valid and easy to administer instrument to assess the severity of Compulsive Internet Use.

Introduction
The legitimacy of the concept compulsive internet use[2], sometimes also referred to as internet addiction (Young, 1998b), pathological internet use (Davis, 2001a), problematic internet use (Caplan, 2002), internet dependency (Wang, 2001), or excessive internet use (Yang, Choe, Baity, Lee, & Cho, 2005), has been the subject of animated discussions since the mid-1990s (Davis, 2001b; Griffiths, 1998, 1999; Grohol, 1995; Holden, 2001; Hughey, 1997; Mitchell, 2000; Morahan Martin, 2005; Orzack, 1998; Shaffer, 2002; Shaffer, Hall, & Vander Bilt, 2000). Nevertheless, anecdotal reports have made clear that some internet users can become overly attached to the use of certain internet applications, resulting in psychological, social and professional impairment (Griffiths, 2000; Hall & Parsons, 2001; Orzack & Orzack, 1999; Sattar & Ramaswamy, 2004; Stein, Black, Shapira, & Spitzer, 2001; Young, 1996). Although there are aspects of this kind of online behavior that are different from the traditional view of addiction (e.g. there are no physical withdrawal symptoms), it can be argued that CIU has many similarities with substance abuse and pathological gambling according to the DSM-IV criteria (APA, 1994). For example, compulsive internet users have been reported to frequently stay online longer than intended and continue their online behavior despite knowledge of problems caused or aggravated by the use of the internet (Young, 1996), or to have unsuccessfully tried to decrease the time spent on the internet (Sattar & Ramaswamy, 2004). More and more it is recognized that certain online activities, such as online gaming, chatting and online erotica, are "activities that may carry greatest future risk for behavioural addiction" (Orford, 2005, p. 4). These reports, the ever-increasing number of internet users, and the rapid increase of broadband access, emphasize the need for further research in the field of CIU.

One of the prerequisites for such research is the availability of a reliable, valid, and practical instrument to assess the severity of CIU. Several instruments to assess CIU are available, e.g. the Internet Addiction Test (IAT) (Young, 1998a; Young), the Internet Diagnostic Questionnaire (IDQ) (Young, 1998b), the Internet-Related Addictive Behavior Inventory (IRABI) (Brenner, 1997), the Generalized Problematic Internet Scale (GPIUS) (Caplan, 2002), the Internet Addiction Scale (IAS) (Nichols & Nicki, 2004), the Chen Internet Addiction Scale (CIAS) (Ko, Yen, Chen, Chen, & Yen, 2005b), and the Online Cognition Scale (OCS) (Davis, Flett, & Besser, 2002). However, none of these instruments has gained general acceptance and none of these instruments was available in the Dutch language. Moreover, only few of the instruments were in some way validated or tested in large general populations, and the instruments tested most thoroughly were of such length that combining the instrument with other measures would result in such a long questionnaire that it would hinder optimal response rates (Casro, 1998; Edwards, Roberts, Sandercock, & Frost, 2004). Therefore, it was decided to develop a new, short and easy to administer instrument to measure CIU.

A major difficulty in developing such a diagnostic instrument is the "conceptual chaos" (Shaffer, 1997) in the field of addictions, dependencies, compulsions, and impulse-control disorders. The absence of

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[2] We prefer the term compulsive internet use because we think that one is not so much addicted to the internet itself but rather to certain online activities (e.g. chatting, gaming, or searching online erotica), which, in turn, becomes manifest in a compulsive use of the internet.

consensus on a universal theoretical framework, or on definitions, criteria and core elements, makes it difficult to define the criteria for CIU. However, relevant criteria may be found in adaptations of the seven criteria for substance dependence and the ten criteria for pathological gambling in the DSM-IV (APA, 1994). Furthermore, in the field of behavioral addictions, Griffiths (1999), elaborating on the work of Marks and of Brown (Brown, 1991, 1993; Marks, 1990), formulated six criteria that have to be met in order to call a certain behavior an addiction. In the present study, an examination of the DSM-IV criteria for Dependence and Pathological Gambling, and the criteria for Behavioral Addictions as formulated by Griffiths (1999) was used as a starting point to develop a new instrument to assess CIU. The criteria for Dependence and Pathological Gambling and the criteria for Behavioral Addictions are listed in Table 1.

Table 1 Criteria for DSM-IV Dependence, DSM-IV Pathological Gambling and Behavioral Addiction as formulated by Griffiths (1999)

DSM-IV Dependence	DSM-IV Pathological Gambling	Behavioral Addiction (Griffiths)	Compulsive Internet Use
Tolerance	Larger stake for desired excitement	Tolerance	
Withdrawal symptoms	Restless or irritable when cutting down or stopping	Withdrawal symptoms	Withdrawal symptoms
More or longer intake than intended			Loss of control
Desire or unsuccessful efforts to cut down or control use	Unsuccessful efforts to control, cut down or stop	Relapse	
Much time for obtaining, using or recovering	Preoccupation	Salience	Preoccupation / Salience
Sacrifice of important social, occupational or recreational activities	Jeopardizing or losing relationship, job or career opportunity		
Continuation of use despite insight into negative consequences		Conflict	Conflict
	Mood modification / coping	Mood modification	Coping
	Lying to conceal involvement		Lying to hide internet use
	Chasing		
	Illegal activities for financing		
	Relying on others for financing		

Examination of the three subsets in Table 1 reveals that some criteria are more or less identical across the subsets (i.e. Tolerance and Withdrawal symptoms), and that some of the other criteria are comparable and refer to a common underlying aspect. Only the three Pathological Gambling criteria Chasing, Illegal activities for financing and Relying on others for financing are applicable solely to gambling. The DSM-IV Dependence and Pathological Gambling criteria More or longer intake than planned and Desire or unsuccessful efforts to cut down or control use, and the Behavioral Addiction criterion Relapse, reflect

the loss of control over behavior. Similarly, the DSM-IV Dependence criteria Much time for obtaining, using and recovering and Sacrifice of important social, occupational or recreational activities resemble the criterion Preoccupation and Jeopardizing or losing relationship, job or career opportunity of Pathological Gambling, and Salience of the Behavioral Addictions. The last DSM-IV Dependence criterion, Continuation despite insight into negative consequences, is missing in the criteria for Pathological Gambling but resembles the Behavioral Addiction criterion Conflict. Mood modification (which can also be referred to as coping) is missing in the criteria for DSM-IV Dependence but appears in both the criteria for Pathological Gambling and the criteria for the Behavioral Addictions. Finally, the DSM-IV Pathological Gambling criterion Lying to conceal involvement is not represented in one of the other subsets, though it does resemble the Behavioral Addiction criterion Conflict. Analysis of the three subsets of criteria therefore results in seven criteria that may be applicable to CIU: Tolerance, Withdrawal symptoms, Loss of control, Preoccupation/Salience, Conflict, Coping and Lying about involvement.

The dimensions mentioned above were compared to the results of an explorative study among self-declared 'internet addicts' (Meerkerk, Laluan, & Eijnden, 2003). Within the framework of this qualitative study, 17 internet users who considered themselves addicted to the internet and reacted to a call-up in a national newspaper, were extensively interviewed. The results of these interviews revealed that loss of control, in terms of an inability to limit the time spent online, was the most characteristic feature. Once online, respondents found it difficult to stop, saturation did not seem to exist, and online sessions were stopped only because of inevitable obligations or exhaustion. Some even called their internet use a compulsion; they felt they had to be online. Several respondents described efforts to diminish or stop internet use, usually with little or only limited success. Preoccupation was the next most characteristic feature. The internet played an important role, even when not online, e.g. they looked forward to their next session and preferred internet use to other (previously favorite) social or leisure activities. Some respondents reported agitation and unrest when unable to go online, resembling withdrawal symptoms. Several respondents were frequently remorseful because the time online had not brought them satisfaction and was perceived as wasted (intrapersonal conflict), and in several cases the compulsive behavior had caused conflicts on domains such as study or work, domestic activities, or social and partner relations (interpersonal conflict). Respondents did not admit they used the internet to deal with personal problems or as a means to improve negative mood states, but it was remarkable that many respondents were having a difficult time and showed signs of low psychosocial wellbeing. The latter was confirmed by the results of diagnostic instruments revealing feelings of depressions, loneliness, and tenseness. Finally, tolerance and lying about involvement were never mentioned and did not seem to play an important role. Overall, the results resembled the cases described in literature (Griffiths, 2000; Hall & Parsons, 2001; Orzack & Orzack, 1999; Sattar & Ramaswamy, 2004; Stein et al., 2001; Young, 1996) and confirmed that some internet users can become overly involved in the use of the internet resulting in interference with personal wellbeing and causing or aggravating psychological, social and work-related problems.

On the basis of the examination of the DSM-IV criteria for Dependence and Pathological Gambling and the criteria for Behavioral Addictions as formulated by Griffiths (1999), and the results of our qualitative study among self-declared 'internet addicts' (Meerkerk et al., 2003), 14 items (see Appendix) were formulated that convey the typical symptoms of CIU: loss of control rendered as spending more time online

than intended and unsuccessful efforts to diminish use of the internet (items 1, 2, 5 and 9); preoccupation rendered as thinking of the internet even when not online (mental preoccupation) and as preferring internet use above other activities (behavioral preoccupation) (items 4, 6 and 7); withdrawal symptoms rendered as feelings of unrest and agitation when unable to go online (item 14); coping or mood modification rendered as using the internet to relief negative affective states (items 12 and 13); and, finally, conflict rendered as conflicts with important others because of internet use (interpersonal) and as feelings of guilt and remorse (intrapersonal) (items 3, 8, 10 and 11). Note that tolerance and lying to conceal involvement were not incorporated in the scale; these dimensions were omitted because they appeared not to be typical for CIU, neither in the cases described in literature nor in our own qualitative study. The items are rated on a 5-point Likert scale ranging from 0 (never) to 4 (very often) to produce a scale with a reasonable range.

We present here the results of three separate studies. In the first study, the one-factor structure of the scale will be tested and other psychometric qualities will be determined. Furthermore, the instrument will be validated against one of the aforementioned instruments, the well-documented and validated OCS (Davis et al., 2002), and against other measures (concurrent and construct validity). The second study aims to verify the findings of the first study, and to replicate and extend validation of the instrument using a longitudinal design (factorial invariance over time). Finally, in the third study, the results will be tested in a large convenience sample of internet users. Overall, we present the development of a short and easy to administer instrument to assess CIU, i.e. the Compulsive Internet Use Scale: CIUS.

Study 1
Overview
The purpose of this study was to evaluate the one-factor structure and internal consistency of the CIUS. A second aim was to examine the concurrent validity of the CIUS with help of an other instrument to measure pathological internet use: the Online Cognition Scale (OCS) (Davis et al., 2002). We expect substantial correlations between the CIUS and the scales of OCS. Because CIU is time consuming we also expect a positive relation between the CIUS and time spent online (construct validity).

Methods
Procedure
The data for this study were gathered by means of an online survey, carried out in 2002 among a sample of 1,000 participants from a large existing online panel (www.opinieland.nl). Participants were selected who a) were at least 18 years old, b) had internet access at home for at least one year and, c) spent on average between 16 and 100 hours a week online for private purposes (information about the time online was known from previous surveys). The latter criterion was set up to ensure that the sample contained enough compulsive internet users for useful statistical analyses reasoning that the prevalence of CIU is higher among internet users who spent much time online (please note that time spent online is not a criterion for CIU). Furthermore, by employing this time criterion internet users who report internet related complaints on the CIUS but use the internet infrequently were excluded from the sample. The sample was stratified on age, sex, and educational level to make the sample representative for the Dutch internet using population who meet the inclusion criteria. Of the 1,000 selected participants 447 (44,7%) responded.

Instruments
The CIUS consisted of 14 items (see Appendix). To avoid sequence effects, the items of the CIUS and the OCS (see below) were presented to each participant in a random order. The Online Cognition Scale (OCS (Davis et al., 2002)) measured pathological internet use (PIU). The OCS consists of 36 items ratable on a 7-point Likert scale ("totally disagree" to "totally agree") with 4 subscales: Loneliness/Depression (6 items, alpha = .74), which involves feelings of worthlessness and depressive cognitions related to the internet; Diminished impulse control (10 items, alpha = .82), which involves obsessive cognitions about the internet and an inability to reduce internet use despite the desire to do so; Distraction (7 items, alpha = .85), which involves using the internet to be distracted from a stressful event, task, or stream of thought; and, finally, Social comfort (13 items, alpha = .86), which relates to the use of the internet to reach out to others and increase one's social network. The four subscales show high intercorrelations (.60 to .72) and can be summarized in a total sum score (alpha = .94) measuring PIU. For measuring time spent online, the respondents were asked how many days per week they went online for private purposes (8-point scale: "every day" to "less than once a week") and, how many hours they spent online on a typical day they used the internet (8-point scale: "seven hours ore more" to "less than one hour"). The average number of hours per week online was estimated by multiplying the number of days per week with the number of hours per typical day.

Participants
Respondents were on average aged 38.5 (SD 12.5) years, and about half (49.4%) of them were male. Most of them (55.0%) were married or living together with a partner, about one-third (32.9%) lived alone and 8.9% was still living with their parent(s). About two-thirds (62.6%) worked part-time or fulltime, about one quarter (23.5%) was unemployed or retired, and the remainder (13.9%) were students. Most respondents had middle (43.6%) or high (39.6%) education, 16.8% had lower education. The respondents were not the so-called 'newbies'; on average they had internet access at home for 5.0 (SD 2.9) years. Most (83.3%) respondents reported to be online every day for private purposes, and the majority (62.8%) spends 2 - 4 hours on the internet on an online day. On average, the respondents spend 27.2 (SD 12.4) hours per week online.

Results
Factor structure and internal consistency
The item pool was analyzed with help of confirmatory factor analysis (CFA) using LISREL 8.52 (Jöreskog & Sörbom, 1996). The use of CFA is justified because our theory and research aim was directed at the development of a one-factor scale. For evaluation of the one-factor model we used two fit measures recommended by others: the Root Mean Square Error of Approximation (RMSEA; (Byrne, 1998)), and the Comparative Fit Index (CFI) of Bentler (Marsh, Balla, & McDonald, 1988). RMSEA is used to assess approximate fit (preferably with values less than or equal .05, but values between .05 and .08 are indicative of fair fit (Kaplan, 2000, p. 113-114). CFI is a comparative fit index, values above .95 are preferred (Kaplan, 2000, p. 107), but should not be lower than .90 (Kline, 1998, p. 131). The use of chi-square tests and the resulting p-value are less adequate to evaluate the fit of a model (Hayduk, 1996, p. 197). At first, confirmatory factor analysis with one factor did not show an optimal fit: $\chi^2(90) = 418.13$, RMSEA = .094 and CFI = .944. Correlating the error variances of item 1 with item 2, item 6 with item 7, item 8 with item 9, item 10 with item 11, and item 12 with item 13 resulted in a good fit with RMSEA around .05 and CFI > .95 with standardized factor loadings

between .48 and .69 (Table 2). The correlated error variances of these items are defensible because each pair of items shows some overlap in content. Items 1 and 2 (problems to stop with the internet); items 6 and 7 (thinking about or looking forward to using the internet); items 8 and 9 (use the internet less often or spend less time on the internet); items 10 and 11 (rush through (home) work or neglect daily obligations); items 12 and 13 (go on the internet when feeling down or to escape from sorrows or negative feelings). Finally, the internal consistency in terms of Cronbach's alpha (Table 2) was high (.89).

Validity: Correlations with concurrent and criterion variables
Pearson correlations were computed between the CIUS and the OCS scales. All correlations were high and significant with $p < .001$. The correlation with OCS Lonely/depressed was .60, with OCS Diminished impulse control .73, with OCS Distraction .59, with OCS Social comfort .53, and with the OCS total score .70. Apparently, the CIUS resembles most the OCS subscale Diminished impulse control. Time spent on internet, finally, was positively correlated with CIU: $r = .33$, $p < .001$.

Table 2 Factor loadings, fit indices and Cronbach α for Studies 1, 2 and 3

	Item		Study 1	Study 2	Study 3
1	Difficult to stop using the internet		.69	.70	.73
2	Continue to use the internet despite intention to stop		.68	.61	.65
3	Others say you should use the internet less		.58	.59	.61
4	Prefer to use the internet instead of spending time with others		.67	.64	.66
5	Short of sleep because of the internet		.63	.64	.59
6	Thinking about the internet, even while not online		.55	.64	.62
7	Looking forward to the next internet session		.61	.58	.66
8	Think you should use the internet less often		.61	.61	.54
9	Unsuccessfully tried to spend less time on the internet		.64	.56	.56
10	Rush through (home) work in order to go on the internet		.59	.61	.60
11	Neglect daily obligations because prefer to go on the internet		.56	.52	.62
12	Go on the internet when feeling down		.48	.55	.56
13	Use the internet to escape from sorrows or negative feelings		.49	.45	.56
14	Feel depressed or irritated when cannot use the internet		.53	.69	.66
		Cronbach α	.89	.89	.90
		N	447	304	16925
	Fit indices:	$\chi2$	160.3	208.5	3497.0
		df	72	72	72
		dRMSEA	.053	.084	.054
		CFI	.984	.966	.986

Study 2
Overview
The first aim of this study was to replicate the one-factor solution derived from Study 1 with help of confirmatory factor analysis. To verify the stability of the factor model of Study 1, we tested whether parameters of the one-factor model of Study 1 (factor loadings, factor variances and error variances) are invariant over time. We further examined again the internal consistency of the CIUS.

Methods
Participants, procedure, and instruments
All 447 participants of Study 1 were invited one year later to participate in the second online survey in which the CIUS was again used to measure CIU. About half (51%, n = 229) responded and completed the question-naire. Non-response analyses, conducted to test for differences between the 229 responders and 218 non-responders, revealed no significant differences for age, gender, marital status, occupational status, educational level, years of internet access at home, hours per week online, score on the CIUS, and score on the OCS.

Results
Factor structure, factorial invariance, and internal consistency
Confirmatory factor analysis on the 14 items with one factor and including the five correlated error terms mentioned in Study 1, showed an acceptable fit in terms of CFI (> .95). The RMSEA value was rather high (.084) indicating a fair fit (Table 2). The factor loadings were between .45 and .70.
To test the stability of the factor model, we compared the factor models of Study 1 (T1) and Study 2 (T2) based on the 229 respondents who responded in both studies. Two factor models were combined in one model; one at T1 and one at T2 and the latent variables (factors) were correlated. The same five correlated error variances were defined in both factor models. Moreover, the error variances of corresponding items at T1 and T2 were correlated. The first step was to create a baseline model with no equality constraints between model parameters, the noninvariant model. The second step was to constrain the factor loadings to be equal (Λ invariant), the third step additionally to constrain the variances of the factors ($\Lambda\Phi$ invariant), and the fourth step additionally to constrain the error variances ($\Lambda\Phi\,\Theta\delta$ invariant). The results are given in Table 3, from which we may conclude that the factor loadings and factor variances are invariant over time ($\Delta\chi^2$ (13) = 19.80, $p > .05$ and χ^2 (1) = .33, $p > .05$, respectively), but the error variances are not ($\Delta\chi^2$ (19) = 58.36, $p < .001$). In addition, the correlation between the two factors at T1 and T2 in the longitudinal factor model was .83, indicating a high level of stability over time.

Table 3 Tests of invariance constraints for the models of Studies 1 and 2

	χ^2	df	RMSEA	CFI	$\Delta\chi^2$	Δdf	p
noninvariant model	617.96	325	.060	.971			.000
Λ invariant	637.76	338	.059	.970	19.80	13	.100
$\Lambda\Phi$ invariant	638.09	339	.059	.971	.33	1	.566
$\Lambda\Phi\,\Theta_\delta$ invariant	696.45	358	.062	.967	58.36	19	.000

Despite the relatively low number of respondents in relation to the number of parameters to be estimated in the longitudinal sample (n=229 respondents with 68 parameters), we found considerable evidence for factorial invariance of the latent variable CIU over time in terms of factor loadings and factor variances. For factorial invariance it is widely accepted that equality of error variances/covariances is the least important demand (Byrne, 1998). Kline (1998, p. 224-225) reports that a common practice for testing measurement or factorial invariance is to constrain the factor loadings to be equal across groups. Finally, the internal consistency (Cronbach's alpha) of the CIUS of Study 2 was high (.89).

Study 3

Overview
The first aim of this study was to replicate the one-factor solution in a large convenience sample of internet users. The second aim concerns the factorial invariance of CIU for different subgroups: do the items compromising CIU operate equivalently across different subgroups? In other words, is the measurement model group invariant (Byrne, 1998)? We decided to study factorial invariance across gender, age, and heavy versus non-heavy internet users. Gender and age are the most obvious variables. The choice to compare heavy and non-heavy users has to do with the samples. Studies 1 and 2 are based on a representative group of heavy internet users (more than 16 hours a week online), Study 3 is a self-selection (convenience) sample of all internet users. One way to test factorial invariance between heavy and non-heavy users is to compare Study 1 and/or Study 2 with the non-heavy users of Study 3 (about 40% of the total sample). However, the samples sizes are very unequal (n=447 of Study 1 versus 6,770 of Study 3). An additional problem is that a large sample size will always lead to significant results. We decided to compare heavy and non-heavy users within Study 3 where the ratio heavy and non-heavy users is 60 : 40%. The third aim was to examine the internal consistency, and the fourth aim was to validate the CIUS with some additional items concerning time spent on the internet and subjective problems concerning internet use (construct validity). We expected positive relations between these topics and CIU.

Methods

Procedure
This sample was compiled by an online questionnaire on the website of our institute. The questionnaire was put online at the end of 2003. Publicity for internet addiction in the popular press, with a link to the self-test on our website, yielded a large number of respondents. By the end of 2004 more than 17,500 respondents had completed the questionnaire. Considerable effort was put into cleaning the data: respondents who did not finish the questionnaire or gave obvious erratic answers were taken out of the database. Respondents with identical answers on all items of several instruments of the questionnaire were thoroughly scrutinized and in case of doubt taken out of the database. Finally, a database with 16,925 respondents was used for analyses.

Participants
Respondents were aged 11 to 80 (M = 25.3, SD = 10.0) years. The age distribution was very skewed with 20% younger than 18 and 50% younger than 22 years; males were overrepresented (77.4%). Many respondents (37.2%) were still living with their parents, about one quarter (25.4%) lived alone, and about one third (35.3%) lived with a partner or had a partner but lived alone. Most respondents had middle (46.8%) to high (40.8%) education, 12.5% had lower education. About half (50.8%) of the respondents were students and 40.7% was working. The remaining 8.5% was unemployed or retired. Almost all respondents (98.7%) had access to the internet at home and generally for a longer period, on average 5.5 (SD 2.5) years. Most respondents (73.0%) were online every day and the majority (61.7%) spent 2 - 4 hours on the internet on an online day. On average the respondents were spending 22.5 (SD 21.0) hours per week online.

Instruments
CIU and time spent online were measured as in the previous studies. Further, subjective problems concerning internet use was assessed by including two questions: Do you experience your internet use as a problem? (1 = not at all to 4 = very problematic), and Do you feel or have you ever felt addicted to the internet? (1 = not addicted, 2 = maybe addicted, 3 = was addicted, 4 = is addicted).

Results

Factor structure, factorial invariance and, internal consistency
Confirmatory factor analysis on the 14 items and one factor with the same five correlated error variances as in Studies 1 and 2 showed a homogeneous factor with substantial factor loadings ranging from .54 to .73 and good fit: RMSEA around .05 and CFI > .95 (Table 2). These results are in accordance with those of Studies 1 and 2.

Factorial invariance across gender
The results for testing invariance across gender are given in Table 4. Based on chi-square difference tests we would conclude that factor loadings ($\Delta\chi^2$ (13) = 147.80, p < .001), factor variances ($\Delta\chi^2$ (1) = 73.97, p < .001), and error variances ($\Delta\chi^2$ (19) = 330.76, p < .001) are noninvariant across gender. However, it is well known that with increasing sample size every small difference will become statistically significant. Hence, in line with the conclusion of Marsh 41, we should ignore the significant chi-square results. An apparently more appropriate question is whether the lack of invariance is sufficiently small to justify the conclusion that the tested parameters are reasonably invariant across groups 41. The goodness-of-fit measures (RMSEA and CFI) showed hardly any differences between the noninvariant model and the constrained models (RMSEA ranges from .052 to .053, CFI from .985 to .987). Therefore, our conclusion is that the factor loadings, factor variances, and error variances are reasonably invariant across gender.

Table 4 Tests of invariance constraints for male and female respondents in Study 3

	χ^2	df	RMSEA	CFI	$\Delta\chi^2$	Δdf	p
noninvariant model	3491.88	144	.053	.987			.000
Λ invariant	3639.06	157	.052	.986	147.18	13	.000
$\Lambda\Phi$ invariant	3713.03	158	.053	.986	73.97	1	.000
$\Lambda\Phi\,\Theta_\delta$ invariant	4043.79	177	.052	.985	330.76	19	.000

Factorial invariance across age

Four age groups were created with about 25% of the respondents in each group. The ranges of the age groups were 11 - 18, 19 - 22, 23 - 29, and ≥ 30 years. The multigroup analyses for testing differences between the four age groups are summarized in Table 5. The first three models show good fitting models (RMSEA ranges from .054 to .056 and CFI from .984 to .985). The fit of the fourth model is somewhat outside the range of the other three (.062 and .975, respectively), but still has acceptable values for a good fit, indicating that factorial invariance across age exists.

Table 5 Tests of invariance constraints for four age groups in Study 3

	χ^2	df	RMSEA	CFI	$\Delta\chi^2$	Δdf	p
noninvariant model	3916.44	288	.056	.985			.000
Λ invariant	4218.30	327	.054	.984	301.86	39	.000
$\Lambda\Phi$ invariant	4266.84	330	.054	.984	48.54	3	.000
$\Lambda\Phi\Theta_\delta$ invariant	6499.78	387	.062	.975	2232.94	47	.000

Factorial invariance of heavy and non-heavy internet users

Two groups were formed, internet users with a lower level of internet use (less than 16 hours a week) and a higher level of internet use (16 hours a week or more). The results for testing invariance across the two groups are given in Table 6. RMSEA ranges from .052 to .053 and CFI from .983 to .985 for the first three models. The fourth model testing invariance of error variances show values for RMSEA (.069) and CFI (.969) that are not in the range of the first three models but still have acceptable values for good fit. Conclusion is that factorial invariance across heavy and non-heavy internet users is fair to good. Finally, the internal consistency (Cronbach's alpha) of the CIUS in this convenience sample was .90.

Table 6 Tests of invariance constraints for low and high internet use in Study 3

	χ^2	df	RMSEA	CFI	$\Delta\chi^2$	Δdf	p
noninvariant model	3445.05	144	.053	.985			.000
Λ invariant	3664.24	157	.052	.984	219.19	13	.000
$\Lambda\Phi$ invariant	3844.20	158	.053	.983	179.96	1	.000
$\Lambda\Phi\Theta_\delta$ invariant	6934.78	177	.069	.969	3090.58	19	.000

Validation: correlations with criterion variables

Pearson correlations were computed between the CIUS and time spent online and the two questions about subjective problems concerning internet use. All correlations were substantial and significant with p < .001. The correlation with time spent on internet was .42, with respondent's own experience of problematic internet use .45, and with respondent's feeling to be addicted .52.

Discussion and conclusion

Compulsive internet use (CIU), or 'internet addiction' as some authors refer to it, is increasingly recognized as a valid construct like, for instance, pathological gambling. However, much research is still needed to unravel causes, consequences and mechanisms involved. The development of a psychometrically sound and validated diagnostic instrument, as presented here, may further facilitate this research.
The present study resulted in a short and easy to administer questionnaire: the Compulsive Internet Use Scale (CIUS). The CIUS was designed to measure severity of CIU and originates from an analysis of the criteria for Dependence and Obsessive-Compulsive disorder as found in the DSM-IV (APA, 1994), other literature on behavioral addictions (Griffiths, 1999), and from interviews with self-declared internet addicts (Meerkerk et al., 2003). From this analysis of criteria, a questionnaire was developed and tested in three different samples. The one-factor solution showed factorial invariance across time, gender, age, and heavy versus non-heavy internet use. This implies that the 14 items assess the factor equally well across time and in different sub-samples. The internal consistency was high in all three samples indicating a high reliability. High correlations with the OCS (Davis et al., 2002), especially with the OCS subscale diminished impulse control, and high correlations with subjective reports of problems related to internet use, and the subjective state of internet addiction, demonstrated concurrent and construct validity. Finally, construct validity was confirmed by the clear correlation with the amount of time spent online. However, the fact that the latter correlation was not high in absolute terms indicates that CIU is more than solely spending a lot of time online.

The 14 items of the CIUS represent the core elements of compulsive or addictive behavior as far as applicable to internet use (loss of control, preoccupation, conflict, withdrawal symptoms and coping) and relates particularly to the compulsive and impulse control elements of the behavior. Although it is clear that CIU is merely a term covering several forms of compulsive or addictive-like behaviors, like for instance sexually compulsive behavior on the internet (Cooper, Scherer, Boies, & Gordon, 1999; Griffiths, 2004; Putnam, 2000) or online game addiction (Chiu, Lee, & Huang, 2004; Danforth, 2003; Johansson & Gotestam, 2004; Ko, Yen, Chen, Chen, & Yen, 2005a; Sattar & Ramaswamy, 2004), the internet is the means by which these compulsive or addictive behaviors are realized or facilitated and lived out. This implicates that an instrument that aims at measuring CIU can reflect the severity of the underlying compulsion or addiction. The CIUS may therefore be useful for further study of the phenomenon and for identifying groups at risk.

The CIUS is not the only instrument available, other well-defined instruments including the GPIUS (Caplan, 2002) or the OCS (Davis et al., 2002) are also applicable. An important advantage of the CIUS is its briefness. Online questionnaires should not exceed 20 minutes (shorter is better) (Casro, 1998; Edwards et al., 2004) in order to reach optimal response rates. The briefness of the CIUS makes it possible to combine the CIUS with other measures in an online setting without threatening response rates. A second important advantage of the CIUS is its one-dimensionality. Other instruments, like, for example, the GPIUS and the OCS are multidimensional instruments and consider CIU a multidimensional construct. Although these dimensions are highly intercorrelated, the presentation of more than one dimension suggests a different theoretical starting point than that of the CIUS. The CIUS is a one-dimensional instrument characterizing CIU predominantly as an inability to restrain from internet use. In our view, aspects such as loneliness/depression, which make up one of the four dimensions of the OCS, are precursors or results of CIU, rather than in-

extricable parts of it. The one-dimensionality of the CIUS simplifies its use and makes the theoretical framing more unequivocal, as CIU is regarded separately from constructs such as psychosocial wellbeing.

Some shortcomings of the present research should be addressed. First, in the questionnaire the element of tolerance was omitted. In part the reasoning was that (with regard to the number of hours spent online) there is a natural limit to the amount of time one can possibly spend online providing a natural limit to the development of tolerance. Furthermore, qualitative research among self-declared internet addicts did not reveal tolerance as a key feature. In addition, some addiction theorists argue that tolerance may not be a key mechanism of (psychological) addiction (Robinson & Berridge, 2003). However, tolerance may develop with regard to the content rather than the time spent online. For instance, compulsive internet users who engage in searching sexually explicit stimuli may find themselves searching more and more extreme stimuli. Moreover, because the role of tolerance in addiction is not yet fully understood, it may have been better, in retrospect, to include items on tolerance in the questionnaire. Second, the questionnaire could be improved by mirroring several items and by adding some verification items to avoid answer tendencies and unmask unserious respondents. Third, the studies presented here included procedures to assess convergent validity but procedures to assess other forms of validity (e.g. predictive and concurrent validity) need to be addressed in future research.

In conclusion, this study has led to the development of a reliable and valid instrument to measure CIU. Because of its conciseness, the CIUS is very suitable for online administration in combination with other measures, and may therefore be of help for further studying various aspects of the relatively new phenomenon, which, in view of the still increasing use of the internet, may become more and more important in the near future.

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chapter 3

Prevalence and Stability of Compulsive Internet Use in the Netherlands
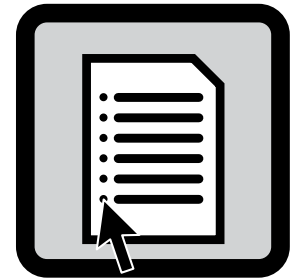
Chapter 3

Prevalence and Stability of Compulsive Internet Use in the Netherlands

Abstract

The aim of the present study was to assess the prevalence and stability of compulsive internet use in the Netherlands. The study has a two-wave longitudinal design with an interval of one year. The first measurement comprised 447 adult heavy internet users who used the internet at least 16 hours per week and had internet access at home for at least one year. For the second measurement the same participants were invited again, of whom 229 (51%) responded. Compulsive internet use of the respondents was assessed by means of an online questionnaire containing the Compulsive Internet Use Scale (CIUS). Based on our study population, the prevalence of compulsive internet use in the Netherlands is estimated to be 0.9% of adult internet users (↓ 67,500 individuals). Compulsive internet use is a relatively stable phenomenon as the majority of compulsive users still show signs of compulsive internet use after one year. Compulsive internet use is a relatively rare phenomenon; however, because the number of internet users and broadband access is ever increasing, the actual number of compulsive internet users is considerable. Moreover, compulsive internet use appears to have a chronic character.

Introduction

The emergence of the internet has had a tremendous influence on societal developments and the availability of information and entertainment online is literally overwhelming. As a result, the way people fill in their leisure time, communicate with each other, or search for information has changed radically. The majority of internet users utilizes these unique benefits of the internet without losing control over their behavior and do not get 'caught in the net'. A small minority of internet users, however, seems extremely sensitive to the rewarding features of certain internet applications and develops compulsive internet use (CIU).

Not much is known about the prevalence of CIU. As far as we know, no studies have attempted to assess the prevalence of CIU in the general (internet using) population, although several studies have reported diverse prevalence figures in various specific populations. Table 1 presents an overview of several of these studies and demonstrates the variety in prevalence figures, terms (e.g. internet addicts, internet dependence, pathological internet users, etc.) and research populations (typically students) that were studied. The reported prevalences range from less than 1% among university students (Nichols & Nicki, 2004) to almost 40% among a probability sample of so-called Netgeners (adolescents aged 16-24 years) (Leung, 2004). This article reports the results of a study that aims to assess the prevalence of CIU among the general adult internet using population in the Netherlands. The study has a longitudinal design, thereby also facilitating conclusions on the stability or chronicity of CIU, and on the incidence and remission. By using a validated instrument for assessing CIU and a representative sample of 'heavy users', for the first time a reasoned prevalence estimation of the Dutch situation will be presented. The Netherlands is one of the top ten countries with regard to internet penetration and has one of the highest broadband penetration rates (Internet World Stats. Usage and population statistics, 2005). The Dutch situation, therefore, may be exemplary for other countries where the internet is well integrated in society, or may give an idea of how CIU may develop in the near future in countries where the internet is not yet common practice.

Methods
Procedure
The study had a two-wave longitudinal design with an interval of one year. The data were gathered by means of two online measurements (T1 baseline, and T2 one year later), carried out among experienced adult heavy users of the internet. We made use of an existing online panel, which contains over 100,000 voluntary subscribers, who receive (on average once a month) an invitation to participate in a survey. As a reward, the respondents participate in a sweepstake and support charitable organizations. From this panel, for T1 a sample of 1,000 participants was selected who meet three inclusion criteria: participants 1) had to have access to the internet at home for at least one year, 2) had to be at least 18 years old, and 3) had to use the internet on average at least 16 and maximally 100 hours a week (information about the time spent online was known in advance from previous panel surveys). Moreover, the sample was stratified on age, gender and education level to make the sample representative for the Dutch internet using population who meet the inclusion criteria. The inclusion criteria ensured that the sample contained only experienced users of the internet and that novice users, who might experience 'beginner's fascination', were excluded. The lower limit of 16 hours per week was used to raise the likelihood that the sample contains enough compulsive internet users for meaningful statistical analyses, reasoning that it is very unlikely that internet users who spent only a few hours per week online use the internet compulsively. The upper limit of 100 hours per week was used to exclude users who proclaim to use the internet at such a high rate that the actual amount of time spent behind the computer could not be meant. In 2003, according to the internet barometer of Blauw Research (www.blauw.nl), 12% of the general Dutch internet using population complied with these criteria.

Table 1 Prevalence figures of various studies

Author	Term	Prevalence	Population
Anderson (Anderson, 2001)	Internet dependents	9.8%	American college students
Bai (Bai, Lin, & Chen, 2001)	Internet addicts	15%	Visitors to a virtual mental health clinic
Bellamy (Bellamy & Hanewicz, 2001)	High internet predisposition	16%	American undergraduate and graduate university students
Chak (Chak & Leung, 2004)	Internet addicts	14.7%	Chinese convenience sample and secondary school students
Charlton (Charlton, 2002)	Pathological computer users	8.4%	English Students
Chou (Chou & Hsiao, 2000)	Internet addicts	5.9%	Taiwanese college students
Dinicola (Dinicola, 2004)	Pathological internet users	7%	American college students
Fabian (Fabian, Pillok, Ritter, & Hoyer, 2002)	Pathological internet use	6%	Hungarian convenience sample
Greenfield (Greenfield, 1999)	Internet addicts	6%	Convenience sample
Johansson (Johansson & Gotestam, 2004)	Internet addicts At risk internet use	1.98% 8.68%	Representative sample of the Norwegian youth
Kaltiala (Kaltiala Heino et al., 2004)	Internet addicts	< 2%	Representative sample of 12-18 year-old Finns
Kubey (Kubey, Lavin, & Barrows, 2001)	Psychologically dependents (self-report)	9.26%	American university students
Leung (Leung, 2004)	Internet addicts	37.9%	Probability sample of Netgeners (adolescents aged 16-24 years) in Hong Kong
Lin (Lin & Tsai, 2002)	Internet dependents	11.69%	Taiwanese high school students
Morahan-Martin (Morahan-Martin & Schumacher, 2000)	Pathological internet users	8.1%	American college students
Nalwa (Nalwa & Anand, 2003)	Dependents	18%	Indian public school children
Nichols and Nicki (Nichols & Nicki, 2004)	(Possible) Internet addicts	< 1%	Canadian university students
Wang (Wang, 2001)	Severe internet addicts Light internet addicts	4.0% 27.9%	Australian university students
Whang (Whang, Lee, & Chang, 2003)	Internet addicts Possible internet addicts	3.5% 18.4%	Korean convenience sample
Yang (Yang & Tung, 2004)	Internet addicts	13.8%	Taiwanese high school adolescents

In November 2002, participants received an email which invited them to surf to a website where the questionnaire could be completed in about 10 minutes. Non-responders received reminders after two and four weeks. One year after the first measurement the procedure was repeated (T2) and all respondents to the first measurement received an email, inviting them to visit a website to fill out an online questionnaire following the same procedure as during the first measurement.

Instruments
The online questionnaires for T1 and T2 contained, among others, demographic and internet use variables and the Compulsive Internet Use Scale (CIUS (Meerkerk, Eijnden, Vermulst, & Garretsen, submitted), see Appendix).
Internet use was measured by asking the respondents "How many days per week are you online for private purposes?" (8-point scale: "every day" to "less than once a week") and "How many hours do you spend online for private purposes on a typical day that you use the internet?" (8-point scale: "seven hours or more" to "less than one hour"). Based on these two questions, the average number of hours per week was calculated by multiplying the number of days per week by the number of hours per typical day.
A recently developed and validated scale, the CIUS (Meerkerk et al., submitted), assessed compulsive internet use. The CIUS has 14 items on a 5-point Likert scale ("Never" to "Very often") and scores between 0 and 56 (see Appendix). The scale has a high reliability (T1 and T2 alpha = .89) and includes the aspects loss of control, preoccupation, withdrawal symptoms, coping and conflict with regard to the use of the internet (for more details see (Meerkerk et al., submitted)). Although CIU is not an all or nothing phenomenon, but may exist in a variety of severities, in order to estimate prevalence figures in a population a cut-off point has to be specified which dichotomizes respondents into compulsive and non-compulsive internet users. This makes the determination of a cut-off point, to some extent, arbitrary, also because there is no external golden standard that can be used for calibration, nor a general rule for the determination of the cut-off point. We reasoned that for internet use to be called compulsive, the behavior specified in the 14 items of the CIUS should play an important role in the life of the internet user. This should be the case when the behavior occurs on average at least "sometimes", which implicates a cut-off score of 14 items x 2 ("sometimes") = 28.

Sample and non-response
Of the 1,000 participants who received an invitation to volunteer in the first measurement (T1), 447 (44.7%) responded. Because all participants were part of an access panel, information on age, gender and education level was available from previous surveys. Attrition analyses were conducted in order to test possible differences between the responders and non-responders. Logistic regression analyses revealed significant differences between responders and non-responders for all three variables. Responders were slightly older (38.5 year vs. 36.9 year, OR 1.01, 95% CI 1.00, 1.02), more often female (51% vs. 43%, OR 1.37, 95% CI 1.06, 1.77), and slightly higher educated (4.2 vs. 4.0, OR 1.09, 95% CI 1.00, 1.18, on a 7-point scale ranging from "Lower education" to "University education"). To control for these differences, a weight factor was constructed for the calculation of the prevalence of CIU. This makes the results indicative for adult Dutch internet users, who have an internet connection at home for at least one year, and who use the internet on average between 16 and 100 hours per week.

For the second measurement (T2), one year after the first measurement, all 447 respondents of the first measurement were approached again and invited to fill out the second online questionnaire. About half of them (51%, n = 229) responded and filled out the questionnaire. Attrition analyses were conducted in order to test possible differences between the responders and dropouts (n = 218). The logistic regression analyses revealed no differences on the demographic variables age, gender, and education level, and on the score on the CIUS, score on the Online Cognition Scale (OCS) (Davis, Flett, & Besser, 2002), and the duration of internet access at home. A small difference was found for number of hours online per week; responders spend on average more time online than non-responders (26.6 hours per week vs. 24.2 hours per week, OR 1.02, 95% CI 1.00, 1.04).

Statistics

The prevalence analyses are conducted on the weighted (see Sample and non-response) T1 sample (nT1 = 446). For the analyses regarding the incidence, remission and chronicity of CIU, only the data of the respondents who completed both the T1 and T2 questionnaire were used (nT1-T2 = 229). In all analyses p < .05, unless otherwise noted. The statistical program used was SPSS 12.0.

Results

Prevalence

The average score on the CIUS of all respondents at T1in the weighted sample was 13.5 (SD 9.3) points with a minimum of 0 and a maximum of 47 points. Of the respondents, 50% had a score of 12 or lower. Using a cut-off score of 28 (as specified in the Methods section) resulted in a prevalence of CIU of 7.4% among the respondents (the heavy users) of this weighted sample. Bearing in mind that 12% of the general Dutch internet using population complies with the inclusion criteria for this study, and assuming that CIU is not prevalent among non-heavy users, implies that CIU is manifest among 0.9% of all internet users aged 18 years and older. An estimated 75% (www.cbs.nl) of the 10 million Dutch inhabitants aged 18 to 65 years uses the internet. This implies that there are about 67,500 compulsive internet users in the Netherlands.

As can be expected, the compulsive internet users, as defined by the application of the cut-off point, spent much more time online than the non-compulsive users: 34.5 hours vs. 24.5 hours (OR 1.06, 95% CI 1.03, 1.09). The difference is mainly caused by the number of days online per week rather than the number of hours online per day. Furthermore, compulsive internet users were on average younger than non-compulsive users: 35.7 year vs. 40.3 year (OR 0.96, 95% CI 0.93, 1.00). There were no differences between the compulsive and non-compulsive internet users with regard to the duration of internet access at home, and the demographic variables gender and education level.

Incidence and remission

For these analyses the unweighted data of the respondents who completed both questionnaires (n = 229) were used. As can be seen in Table 2, the majority, i.e. 8 of the 14 (57%) compulsive internet users at T1, still – or again – used the internet compulsively at T2. The average CIUS score of these 'chronics' hardly changed. For the remaining 6 (43%) the CIUS score dropped below the cut-off point. However, the average CIUS score of these 'recoverers' was still higher than that of the other non-compulsive users at T2. This

implicates that CIU has a rather chronic character. Furthermore, from the 215 non-compulsive users at T1, 3 (1.4%) developed CIU during a one-year period. The incidence of CIU among heavy users can therefore be estimated to be about 1.4%. The CIUS score of this 'incidence group', however, was at T1 already higher than that of the other non-compulsive users at T1, indicating that the compulsive use of the internet was already in a developmental stage at T1. The largest group were the 'resistants' who remained non-compulsive users and whose mean CIUS score hardly changed.

Table 2 Incidence and remission of compulsive internet use, number of respondents and mean scores on the Compulsive Internet Use Scale

| | | CIU T2 | | Total |
		No	Yes	
CIU T1	No	212 CIUS T1: 11.4 CIUS T2: 10.0	3 CIUS T1: 23.7 CIUS T2: 29.4	215 CIUS T1: 11.6 CIUS T2: 10.3
	Yes	6 CIUS T1: 30.7 CIUS T2: 16.4	8 CIUS T1: 36.3 CIUS T2: 35.5	14 CIUS T1: 33.9 CIUS T2: 27.3
Total		218 CIUS T1: 12.0 CIUS T2: 10.2	11 CIUS T1: 32.8 CIUS T2: 33.8	229 CIUS T1: 13.0 CIUS T2: 11.3

Discussion

The goal of this study was to estimate the prevalence of CIU in the general Dutch internet using population, and to study the stability of the phenomenon over a one-year period. The prevalence in the study sample, which can be regarded representative for experienced adult heavy internet users (aged 18 years or older, having internet access at home for at least one year, and using the internet between 16 and 100 hours per week) appeared to be 7.4%. This figure can be extrapolated to 0.9% in the adult general Dutch internet using population, which corresponds with about 67,500 compulsive internet users. Furthermore, CIU appears to be a rather stable phenomenon over time. More than half of the compulsive internet users still show signs of CIU after a one-year period of time. Finally, the incidence of CIU among heavy users is estimated to be about 1%.

Some limitations of the present study should be discussed. The main limitations pertain to the definition of the cut-off point and the generalisation of the study results to the general Dutch internet using population. First, the definition of the cut-off point. As mentioned before, CIU should not be considered an all or nothing phenomenon, and therefore defining a cut-off point is always to some extent arbitrary. In addition, because there is no golden standard for comparison purposes, a chosen cut-off point cannot be validated or calibrated. Finally, there is no general rule for the determination of a cut-off point which can be used as a guideline. Some authors, e.g. Davis et al. (Davis et al., 2002) or Caplan (Caplan, 2002) prefer not to define a cut-off point for their instrument (the OCS and the GPIUS, respectively). Others do define a cut-off point but use differing methods and rationalizations. For example, Young (Young, 1998 Young, 1999 #76)

stated that respondents have to answer 'yes' to 5 or more of 8 dichotomous criteria of the Diagnostic Questionnaire to be classified as dependents. Kaltiala Heino and colleagues (Kaltiala Heino, Lintonen, & Rimpela, 2004) tailored criteria analogously to the criteria of pathological gambling and defined those who fulfilled 4 or more of 7 criteria (covered with 9 trichotomous statements) as internet addicts. Nalwa and Anand (Nalwa & Anand, 2003) using the OCS (36 items, 7-point Likert scale), identified dependents and non-dependents using the mean $\pm$ SD as the criterion for selection. Lin and Tsai (Lin & Tsai, 2002), as a final example, utilized a cut-off score of 80 on the Taiwanese version of the Internet Addiction Scale (29 items, 4-point Likert scale) to distinguish dependents and non-dependents, without explaining why the cut-off score of 80 was chosen. All this indicates that there is no consensus on how to define the cut-off point for CIU. In line with other authors (e.g. Nichols and Nicki (Nichols & Nicki, 2004)) and based on the assumption that with this score the compulsivity of the use of the internet will be substantial and mean-ingful, we set the cut-off score at 28; this score corresponds with 'sometimes' as the average answer on the 14 items of the CIUS. We assume that based on this score (and higher), the behavior revealed from the items of the CIUS will be prevalent and influential in the internet user's life. However, the cut-off score may be rather stringent, preventing false-positives on the one hand, but perhaps underestimating the preva-lence on the other hand.

Second, the generalisation of the study results to the general Dutch internet using population. The gener-alisation is based, firstly, on the assumption that the study sample is representative for the Dutch heavy internet user that meets the inclusion criteria and, secondly, on the assumption that CIU does not occur in the part of the population that does not comply with the inclusion criteria. To make the sample representa-tive for the general Dutch internet using population user that meets the inclusion criteria, a weight factor was construed that counteracted the effects of selective non-response on the variables age, gender and education level; however, no checks could be performed for other variables. Finally, we assumed that CIU does not occur in internet users who do not meet the inclusion criteria. However, CIU may of course occur among internet users younger than 18 years, and among internet users who have access to the internet at home for less than one year. The actual number of compulsive internet users in the Netherlands may therefore be larger when adolescents and novice users are included. In addition, infrequent internet users (< 16 hours per week) may also have the problems that the items of the CIUS address. However, we assume that these problems are not truly internet related when the internet is not used at least a couple of hours per day. In conclusion, because of the methodological limitations of the study the presented prevalence figure may be an underestimation of the actual prevalence; the figure of 0.9% should therefore be seen as the lower limit.

Although the prevalence figure may be regarded as being relatively low, because of the ever-increasing number of internet users the actual number of compulsive internet users in the general population is substantial. In addition, because broadband access is increasing the number of compulsive internet users may increase rapidly in the coming years. From other addictions it is known that it may take several years for an addiction to develop, and that several years may pass before professional help is sought for. From our own observations (Meerkerk, Laluan, & Eijnden, 2003) we know that the Dutch addiction care and mental health care organisations are already receiving requests to help compulsive internet users. In the

near future, these numbers may rise substantially and attention should be paid to the development of therapeutic interventions for those in need of help. In this regard, it can be noted that, although sounding paradoxical, several web-based online counselling initiatives have already been developed (Ookita & Tokuda, 2001; Young, 2005). Since it seems that people become addicted to certain applications of the internet, for instance searching pornography or gaming (Meerkerk, Eijnden, & Garretsen, accepted), and not to the internet in general, online counselling may be an effective way to reach compulsive internet users without yielding a new risk.

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predicting

Predicting Compulsive Internet Use

It's all about sex!

Chapter 4

Predicting Compulsive Internet Use
It's all about sex!

Abstract

Aim of the present study was to assess the predictive power of various Internet applications on the development of Compulsive Internet Use. The study has a two-wave longitudinal design with an interval of one year. The first measurement contained 447 adult heavy Internet users who used the Internet at least 16 hours per week and had Internet access at home for at least one year. For the second measurement, all participants were invited again of whom 229 responded. By means of an online questionnaire, the respondents were asked about the time spent on various Internet applications and Compulsive Internet Use. On a cross-sectional basis, gaming and erotica seem the most important Internet applications related to Compulsive Internet Use. On a longitudinal basis, spending a lot of time on erotica predicted an increase in Compulsive Internet Use one year later. It can be concluded that the addictive potential of the different applications varies; erotica appears to have the highest potential.

Introduction

The construct of Compulsive Internet Use (CIU), also referred to as Internet Addiction (Young, 1999b; Young, 2004), Internet Dependence (Wang, 2001; Yuen & Lavin, 2004), Problematic Internet Use (Quayle & Taylor, 2004; Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000) or Pathological Internet Use (Davis, 2001; Dinicola, 2004), has gained considerable acceptance within the last decade. Since the first parodying report by Goldberg (Goldberg, 1997), some ten years ago, increasing numbers of studies have addressed the phenomenon that certain persons use the Internet compulsively which can lead to serious problems with regard to psychosocial and professional functioning. Most commonly the behavior is referred to as Internet

addiction, suggesting that it is the Internet in itself that is addictive, rather than the actual application with which the user is involved. On the other hand, several researchers have differentiated between various forms of CIU. Young and colleagues (Young, 1999a; Young, Pistner, O'Mara, & Buchanan, 1999), for example, conducted a survey among 35 therapists who have treated clients suffering from cyber-related problems. Qualitative results gleaned from the study suggest that five specific subtypes of CIU can be categorised: cyber-sexual addiction, cyber-relationship addiction, net compulsion (obsessive online gambling, shopping, or day trading), information overload (compulsive web surfing or database searches) and computer addiction (obsessive computer game playing). Similarly, Davis (2001) distinguishes in his Cognitive-Behavioural Model of Pathological Internet Use specific pathological Internet use (PIU) and generalized PIU, where the former refers to pathological use of the Internet for a particular purpose (such as online sex or online gambling), and the latter to a general, multidimensional overuse of the Internet. According to Davis, specific PIU is content-specific and exists independent of multiple Internet functions; it would also exist in the absence of the Internet. Generalized PIU on the other hand, involves a general, multidimensional overuse of the Internet and may include online procrastination. Generalized PIU is often associated with chatting and related to the social aspect of the Internet; "The need for social contact and reinforcement obtained online results in an increased desire to remain in a virtual social life" (Davis, 2001, p. 187). Several authors have suggested that particularly applications that involve social interaction constitute a risk for developing CIU. For example, Caplan (2002) found in a sample of 386 undergraduate students that the preference for social benefits available online accounted significantly for the negative outcome of Internet use and suggested that the preference for computer-mediated social interaction plays a role in the etiology, development, and outcomes of generalized PIU. Chou and Hsiao (2000) found in a large sample of 910 university and college students that the Internet communication pleasure score (a measure relating, among others, to the use of the Internet for interpersonal communication) was the most powerful predictor of Internet addiction. Li and Chung (2006) studied in a relatively small sample of 76 college students the relationship between Internet function and Internet addictive behavior and found that the social function played the core role in the Internet addictive behavior. Ward (2001) studied 112 undergraduate and graduate students and found that communication applications were the central focus of involvement associated with problematic use. Young (1998) found in a convenience sample of 396 dependent Internet users and a control group of 100 non-dependent Internet users that non-dependents predominantly used those aspects of the Internet which allowed them to gather information (i.e., Information Protocols and the World Wide Web) and e-mail, whereas dependents predominantly used the two-way communication functions available on the Internet (i.e., chat rooms, MUDs, news groups, or e-mail). Finally, a longitudinal study among 663 Dutch adolescents from our own research group showed that instant messenger use and chatting in chat rooms were related to increases in compulsive Internet use 6 months later (Eijnden, Meerkerk, Vermulst, Spijkerman, & Engels, in press). Contrary to these findings, Widyanto and McMurran (2004) found no correlation between the type of Internet functions and participants' CIU in a convenience sample of 86 self-selected Internet users. In general, several studies have shown associations between the social function of the Internet and CIU, however, as far as we know only one study used a longitudinal design allowing for more definite conclusions on the direction of causation. Therefore, the present study aims to assess the addictive potential of the various Internet applications by examining the predictive power of the time spent on the various applications on (the development of) CIU within a longitudinal design. The results may contribute to the further understanding of the mechanisms behind CIU.

Methods

Procedure

The study had a two-wave longitudinal design with an interval of one year. The data were gathered in the Netherlands by means of two online measurements (T1 and T2), carried out among a representative sample of adult and experienced heavy users of the Internet: aged 18 years and older, having access to the Internet at home for at least one year, and using the Internet on average between 16 and maximally 100 hours a week. For a more detailed description of the sample see Meerkerk, v.d. Eijnden, and Garretsen (submitted). In November 2002, participants received an email which invited them to surf to a website where the questionnaire could be completed in about 10 minutes. Non-responders received reminders after two and four weeks. One year after the first measurement the procedure was repeated (T2) and all respondents to the first measurement received an email, inviting them to visit a website to fill out an online questionnaire following the same procedure as during the first measurement.

Instruments

The online questionnaires for T1 and T2 contained, among others, the following variables: demographics, Internet use and the Compulsive Internet Use Scale (CIUS (Meerkerk, Eijnden, Vermulst, & Garretsen, submitted)).

Internet use was measured by asking the respondents "How many days per week are you online for private purposes?" (8-point scale: "every day" to "less than once a week") and "How many hours do you spend online for private purposes on a typical day that you use the Internet?" (8-point scale: "seven hours or more" to "less than one hour"). Based on these two questions, the average number of hours per week was calculated by multiplying the number of days per week by the number of hours per typical day. Furthermore, the respondents were asked how much time they spent on 11 (12 at T2) specific Internet applications (7-point scale: "none" to "more than 40 hours per week"), i.e. email, searching for information on the Internet, surfing the Internet, online gaming, chatting, buying on the Internet, gambling on the Internet, downloading from the Internet, Usenet, searching for erotic stimuli (erotica), dating on the Internet and, at T2, participation in an online forum.

A recently developed and validated scale, the CIUS (Meerkerk, Eijnden, Vermulst et al., submitted), assessed Compulsive Internet Use (see Appendix). The CIUS has 14 items on a 5-point Likert scale ("Never" to "Very often") and scores between 0 and 56. The scale has a high reliability (T1 and T2 Alpha = .89) and includes the aspects loss of control, preoccupation, withdrawal symptoms, coping and conflict with regard to the use of the Internet (for more details see Meerkerk et al. (submitted)).

Sample and non-response

Of the 1,000 participants who received an invitation to volunteer in the first measurement (T1), 447 (44.7%) responded. Because all participants were part of an access panel, information on age, gender and education level was available from previous surveys. An attrition analysis was conducted to test for possible differences between the responders and non-responders. Logistic regression analyses revealed significant differences between responders and non-responders for all three variables. Responders were slightly older (38.5 vs. 36.9 years, OR 1.01, 95% CI 1.00, 1.02), more often female (51% vs. 43%, OR 1.37, 95% CI 1.06, 1.77), and slightly higher educated (4.2 vs. 4.0, OR 1.09, 95% CI 1.00, 1.18, on a 7-point scale

ranging from "Lower education" to "University education"). For the second measurement (T2), one year after the first measurement, all 447 respondents of the first measurement were approached again and invited to fill out the second online questionnaire. About half of them (51%, n = 229) responded and filled out the questionnaire. An attrition analysis was conducted to test for possible differences between the responders and dropouts (n = 218). The logistic regression analyses revealed no differences in the demographic variables age, gender, and education level, and on the score on the CIUS, score on the OCS (Davis, Flett, & Besser, 2002), and number of years with Internet connection at home. A small difference was found for number of hours online per week; responders spend on average more time online than non-responders (26.6 hours per week vs. 24.2 hours per week, OR 1.02, 95% CI 1.00, 1.04).

Statistics

To analyze the addictive potential of the different applications, first Pearson correlation analyses were conducted with time spent on the different applications at T1 and T2, duration of Internet access at home, and CIUS scores as variables. Duration of Internet access at home was included because this variable may have an influence on CIU as exemplified in 'beginner's fascination'. To check for multi-collinearity, correlations between the various applications were calculated. Next, cross-sectional predictors of CIU were determined at T1 and T2, by conducting linear regression analyses with CIU at T1 and T2, respectively, as dependent variable, and time spent on the 11 Internet applications as independent variables. To control for demographic factors and duration of Internet access at home, the demographic variables gender, age and educational level, and access time were entered in Step 1 of the regression equation. To determine possible longitudinal predictors of CIU, linear regression analyses were conducted with CIU at T2 as dependent variable, and CIU at T1 and time spent on the 11 Internet applications at T1, as independent variables. Again, to control for demographic factors and duration of Internet access at home, the demographic variables gender, age and educational level, and access time were entered in Step 1 of the regression equation.

In all analyses $p < .05$, unless otherwise noted. Statistical program was SPSS 12.0.

Results

Internet applications

There were large differences in the time spent on the various Internet applications. Table 1 shows that some applications are hardly used (e.g. 97.5% of the respondents never gambles online and 84.5% never dates online) whereas other applications are used by almost all respondents (e.g. email, information searching and surfing). Much time is spent on email, downloading, chatting and surfing. Remarkable is that relatively few respondents report spending a lot of time on searching the Internet for sexual stimuli, although the pursuit of sexual interests over the Internet is reported to be very common among Internet users (Cooper, 1998; Cooper, McLoughlin, & Campbell, 2000). The intercorrelations between the various applications are generally weak (see Table 2), ranging from .431 (email – information seeking) to near zero (e.g. gaming - erotica). This indicates that the applications are relatively independent from each other and that multicollinearity will not disturb the prediction analyses.

Cross-sectional associations between Internet applications and CIU

Cross-sectional Pearson correlation analyses demonstrated large differences in the correlation between time spent on the applications and CIU (Table 3). Relatively high cross-sectional correlations (from .261 to .203 at T1, and .270 to .204 at T2) were found between CIU and chatting, gaming, and, dating. Cross-sectional linear regression analyses were conducted to find predictors of CIU in terms of time spent on the different applications. The results (Table 4) showed positive associations at T1 for gaming, chatting and erotica. In addition, there was a negative association between age and CIU indicating that the older the Internet user, the less likely that person is to show signs of CIU. The application factors explained 14% of the variance in CIU at T1. The results indicate that the more time spent on gaming, chatting and erotica, the more likely it is that the Internet user shows signs of CIU. The same analysis conducted with T2 variables showed a somewhat different pattern of results. Again, positive associations were found for gaming and erotica, but no association was found for chatting; however, a positive association was found for dating. No effects were found for the demographic variables. The application factors explain 15% of the variance in CIU at T2. The results of both cross-sectional regression analyses indicate that particularly gaming and erotica are associated with CIU. In other words, those who spent a lot of time on gaming and erotica have a higher risk to show signs of CIU. The evidence for chatting and dating is less evident.

Table 1 Time spent on Internet applications in percentage of respondents (T1)

	Time (in hours) spent on application per week				
	0	< 4	5 - 10	11 - 20	> 21
Email	0.2	48.8	27.4	9.8	13.8
Information	1.8	61.6	23.3	9.7	3.6
Surfing	3.4	58.8	21.9	10.0	5.9
Gaming	37.8	41.4	11.0	5.9	3.8
Chatting	30.6	36.7	13.3	8.6	10.8
Buying	42.4	54.6	2.0	0.7	0.2
Gambling	97.5	2.2	0.2	0	0
Downloading	17.4	46.4	15.6	11.1	9.5
Usenet	51.7	38.1	4.3	3.8	2.0
Erotica	65.7	28.7	3.6	1.6	0.4
Dating	84.5	12.1	1.8	1.1	0.4

Table 2 Correlations between time spent on Internet applications T1

	Email	Info.	Surfing	Gaming	Chatting	Buying	Gamble	Downl.	Usenet	Erotica	Dating
Email	1										
Info.	.431**	1									
Surfing	.267**	.386**	1								
Gaming	.077	.067	.135*	1							
Chatting	.363**	.202**	.343**	.250**	1						
Buying	.058	.170**	.182**	.034	.104	1					
Gamble	-.017	.008	-.008	.003	.070	.136*	1				
Downl.	.220**	.320**	.222**	.047	.244**	.203**	-.031	1			
Usenet	.261**	.316**	.128	-.027	.076	.162*	-.010	.193**	1		
Erotica	-.019	.039	.242**	.003	.043	.088	.014	.164*	.110	1	
Dating	.060	.058	.110	-.013	.176**	.114	.039	-.028	.144*	.263**	1

**: p < .01   *: p < .05

Table 3 Pearson correlations between time spent on applications and Compulsive Internet Use (CIU) at T1 and T2

	Cross-sectional correlations with CIU T1	Cross-sectional correlations with CIU T2	Longitudinal correlation with CIU T2
Chatting	.261 **	.223 **	.226 **
Gaming	.216 **	.204 **	.173 **
Dating	.203 **	.270 **	.158 *
Email	.199 **	.163 *	.124 n.s.
Erotica	.189 **	.193 **	.147 *
Surfing	.171 **	.152 *	.051 n.s.
Information search	.165 **	.127 n.s.	.089 n.s.
Usenet	.122 *	.099 n.s.	.056 n.s.
Downloading	.115 *	.048 n.s.	.021 n.s.
Buying	.105 *	.149 *	.155 *
Gambling	.066 n.s.	.108 n.s.	.044 n.s.
Forum	n.a.	.189 **	-
Access time at home	-.088 n.s.	-.093 n.s.	

**: p < .01   *: p < .05

Longitudinal associations between Internet applications and CIU

The longitudinal design of the study enables to determine predictors of CIU over a one-year period. First, Pearson correlation analyses were conducted showing significant correlations between chatting, gaming, dating, buying and erotica at T1, and CIU at T2 (Table 3). The results of the subsequent longitudinal regression analyses are shown in Table 4. The factors explain 61% of the variance in CIU at T2. Not surprisingly, the strongest association was found for the CIUS score at T1. In addition, a positive association was found for erotica. Apparently, spending a lot of time searching for erotic stimuli predicts an increase in CIU one year later. None of the other application factors reached significance, nor did the demographic factors add to the prediction of CIU.

Table 4 Cross-sectional and longitudinal linear regression analyses

	Cross-sectional T1		Cross-sectional T2		Longitudinal T1– T2	
	β	ΔR^2	β	ΔR^2	β	ΔR^2
Step 1						
- Age	-.110 *		-.045		-.044	
- Gender	-.031		.046		.032	
- Education	-.057		.000		-.008	
- Access time	-.068		-.088		-.086	
		.023		.015		.012
Step 2						
- CIU T1					.761 **	
- Email	.064		.026		.009	
- Information	.084		-.002		.021	
- Surfing	.026		-.017		-.086	
- Gaming	.143 **		.163 *		.043	
- Chatting	.130 *		.083		.017	
- Buying	.070		.072		.033	
- Gambling	.057		-.067		-.025	
- Downloading	-.022		-.015		-.042	
- Usenet	.067		-.035		-.048	
- Erotica	.124 *		.175 *		.132 *	
- Dating	.090		.175 *		.011	
- Forum	n.a.		.119		n.a.	
		.141		.149		.612

* p < .05   ** p < .01

Discussion

The main goal of the present study was to assess the relative addiction risk of several Internet applications. First of all, large differences were found in the popularity of the various applications. In terms of time spent on the application, e-mailing, downloading, chatting, and surfing are among the most popular. Consistently over the two measurements, the cross-sectional analyses demonstrated that CIU was associated with gaming and searching for erotic stimuli. In addition, CIU was associated with chatting at the first measurement, and dating at the second measurement. It appears that Internet users who spent a lot of time on particularly gaming and erotica, are at higher risk to use the Internet compulsively. The results of the longitudinal analyses are partly in line with these conclusions and demonstrated a clear association between CIU and searching for erotic stimuli; searching for erotic stimuli predicted an increase in CIU one year later. Using the Internet for sexual gratification should therefore be regarded as the most important risk factor for the development of CIU.

These findings are only partly in line with the findings of other studies, which reported that particularly applications that involve social interaction are associated with CIU (Caplan, 2002; Chou & Hsiao, 2000; Eijnden et al., in press; Li & Chung, 2006; Ward, 2001; Widyanto & McMurran, 2004). Clearly, searching for sexual stimuli on the Internet may involve social interaction, but may also exclusively involve non-interactive searching for pornography. Gaming may also involve social interaction, and social interaction appears to be one of the factors that motivates people to continue gaming (even when no monetary reward is involved) (Choi & Kim, 2004; Johansson & Gotestam, 2004), however, not all gaming implies social interaction. The finding that chatting was not always associated with CIU raises doubts about the relationship between social interaction and CIU. Further research is needed to study what qualities and aspects of social interaction contribute to the addictive potential of certain Internet applications.

The most relevant question with regard to the results of the present study relate to the how and why of the observed addictive potential of online sexual behavior. First, it is important to distinguish between the various sex-related uses of the Internet. Griffiths (2001) describes a number of different ways the Internet can be used for sexually-related purposes, for example: seeking out sexually-related material for educational use, buying or selling sexually-related goods for further use offline, seeking out material for entertainment/masturbatory purposes for use online, engaging in and maintaining online relationships via email and/or chat, seeking out sexual partners for a transitory or enduring relationship, seeking out individuals who then become victims of sexually-related crime (e.g. online sexual harassment, cyber stalking) and, exploring gender and identity roles. Not all of these activities may be done to excess or are potentially addictive; most likely using pornography for masturbatory purposes, engaging in online relationships, and engaging in sexually related Internet crime may be addictive (Griffiths, 2000).

The specific features of the Internet that make sexuality on the Internet so tempting have been described by, for example, Cooper (1998) and Young et al. (1999). Cooper's "Triple A engine" describes 3 typical features of sexual behavior via the Internet that contribute to its tempting qualities: Access, Affordability, and Anonymity. Access refers to how easy it is to connect to the Internet and to find, with a finger click, a variety of sexually stimulating audio, video or textual items. Moreover, these sexual stimuli are in abun-

dance, replenished daily, and often at no or little charge. Most importantly, one can engage in online sexual behavior anonymously (at least subjectively), which lowers thresholds and fosters disinhibition (see also Suler (2004)) without having to fear negative consequences. Young's "ACE model" (Anonymity, Convenience, and Escape), shares the anonymity feature and stresses furthermore the convenience of meeting others or finding sexually stimulating material on the Internet within the safe environment of one's own house. In addition, Young stresses that sexuality on the Internet can be used as a coping strategy to escape daily sorrows, or ameliorate a negative mood. Some even experience a kind of "high" (see also the flow experience (Chen, Wigand, & Nilan, 2000)).

Putnam (2000) gives a good description of the pathogenesis of online sexual compulsions for persons who are vulnerable through biological, psychological and/or social characteristics, and how the behavior is reinforced through operant conditioning and classical conditioning learning mechanisms. In brief, Putnam states that the vulnerability for the development of compulsive sexual behavior may originate from biological factors such as deviant testosterone and serotonin levels, or may develop in response to physical, sexual, family, or social trauma. In addition, personality disorders, mood and anxiety disorders, and substance abuse and dependence may contribute to the vulnerability to develop compulsive sexual behavior. These personal factors can make a person vulnerable to develop compulsive sexual behavior; however, the compulsive behavior may stay latent in the 'normal' offline world. The unique factors of the Internet (as described above as the Triple A engine and the ACE model) may trigger the latent compulsive behavior to become manifest when a predisposed person engages in sexual behavior on the Internet.

Through operant conditioning, the online sexual behavior increases in frequency and duration. The sexual arousal (possibly followed by masturbation and orgasm) serves as a positive reinforcer, and the distraction from negative mood states (coping) serves as a negative reinforcer. The reinforcement may be particularly strong due to the variable-ratio schedule of reinforcement. Eventually, classical conditioning occurs when the online sexual behavior is repeated and computer use is paired to sexual arousal. As a result, using the computer may elicit craving to engage in online sexual behavior (Putnam, 2000).

The above makes plausible the notion that for some vulnerable persons the specific qualities of the Internet facilitates the development of sexual compulsive behavior or a sex addiction. Indications for this personal sensitivity or vulnerability may be found in the psychosocial problems like loneliness, low self-esteem, or depressive symptoms, often related to CIU (Armstrong, Phillips, & Saling, 2000; Engelberg & Sjoberg, 2004; Moody, 2001; Shapira et al., 2000; Yang & Tung, 2007). In line with this are the statements of, for example, Shaffer and colleagues (Shaffer, 2002; Shaffer, Hall, & Vander Bilt, 2000) and Griffiths (1999) who proclaim that CIU merely reflects other forms of psychopathology. This reasoning also shows that the term Internet addiction is inappropriate and misleading, as it is not the Internet in itself that is addictive, but the specific application, e.g. searching sexual stimuli. However, it is the Internet that is used compulsively to perform these behaviors, which legitimates the use of the term Compulsive Internet Use. Finally, some limitations of the present study need addressing. The first shortcoming concerns the division of the Internet activities into 11 (12 at T2) applications. Although carefully constructed, the division did not result in 100% unique and non-overlapping applications. For example, searching for sexual stimuli

may include solistic activities like searching for erotic pictures, as well as engaging in a more interaction-oriented activity like maintaining an erotic online relationship through chat or other online communication channels. Furthermore, chatting was presented as one application, not differentiating between online communication with total strangers in public chat rooms, and online communication with friends through the use of messengers like MSN or Yahoo Messenger. Therefore, it is recommended that future research should further differentiate between the various applications to identify which aspects of Internet use are potentially addictive. A second limitation regards the reliability of the self-reports on searching sexual stimuli. Considering the vast supply of pornographic websites and the popularity of sex on the Internet (Cooper, 1998; Cooper et al., 2000), one would expect spending time searching for erotic stimuli on the Internet to be mentioned more often than was the case in the present study. Socially desirable answer tendencies may have caused underreporting on searching for erotica and may have masked the effects of searching for erotica on CIU.

In conclusion, the present study demonstrated that not all applications of the Internet have an addictive potential. Using the Internet for predominantly sexual gratification could be empirically linked to an increase of compulsive use of the Internet in a one year period. It may be that the persons who engage compulsively in searching sexual gratification through the Internet had a latent vulnerability for becoming overly attached to sexual explicit stimuli, but that this vulnerability would never have resulted in compulsive behavior if the Internet had not brought them in contact with an abundance of sexually explicit stimuli. Further research should therefore address the question whether biological deviances, personality disorders, and/or psychosocial problems are a priori more prevalent among persons developing CIU.

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Online Communication, Compulsive Internet Use and Psychosocial Well-being among Adolescents: A Longitudinal Study

Chapter 5

Online Communication, Compulsive Internet Use and Psychosocial Well-being among Adolescents: A Longitudinal Study

Abstract

The aim of the present study was to investigate the relationships between adolescents' online communica-tion and compulsive internet use (CIU), depression and loneliness. The study had a two-wave longitudinal design with an interval of 6 months. The sample consisted of 663 students, 318 male and 345 female, aged 12 to 15 years. Questionnaires were administered in a classroom setting. The results show that instant messenger use and chatting in chat rooms are positively related to CIU 6 months later. Moreover, in agree-ment with the well-known HomeNet study (Kraut et al., 1998), instant messenger use is positively associ-ated with depression 6 months later. Finally, loneliness is negatively related to instant messenger use 6 months later.

Introduction

In the last decade, the internet has become a widely used communication medium. Almost all Dutch adolescents use the internet for interpersonal communication, and 84% uses the internet for real time online communication, such as instant messaging and chatting in chat rooms (Valkenburg & Peter, 2005). Instant messaging has become the most popular online communication function both in the Netherlands (Valkenburg & Peter, 2005) and in the USA (Subrahmanyam, Greenfield, Kraut, & Gross, 2001). In contrast to e-mail, instant messaging and chatting are forms of online communication whereby users see the

message instantly, as soon as the sender hits the 'return' key. Moreover, in contrast to chatting in chat rooms, instant messaging mainly reflects communication between persons who know each other; i.e. the use of instant messaging functions (e.g. ICQ, MSN-messenger) requires that both users actively program each other's IM address. The aim of the present study was to investigate the relationships between adolescents' online communication (i.e. email use, instant messaging and chatting in chat rooms) and their psychosocial well-being.

Among psychologists as well as in the public media there is an ongoing debate about the impact of online communication on the psychosocial well-being of adolescents. On the one hand, communication via the internet could have positive consequences, for example by increasing social support, by enabling easier connections with friends, or by facilitating the formation of new relationships (Kraut et al., 2002; Parks & Roberts, 1998). The internet may also offer a relatively safe place to have social interaction without requiring the social skills demanded in in-person interactions (Ybarra, Alexander, & Mitchell, 2005), which may be particularly beneficial for otherwise isolated teenagers (McKenna & Bargh, 1998). On the other hand, there is a growing concern about excessive internet use and its potential harmful effects on the psychosocial well-being of youngsters. Several studies have already addressed the potential addictive properties of the internet (Beard, 2005; Beard & Wolf, 2001; Brenner, 1997; Caplan, 2002; Davis, 2001; Griffiths, 2002; Morahan-Martin & Schumacher, 2000; Young, 1996; Young, 1998).

It is also suggested that some adolescents become so involved with certain applications of the internet that they are no longer capable of controlling their online activity, implying that these youngsters have developed symptoms of compulsive internet use (CIU) (Chou & Hsiao, 2000; Johansson & Gotestam, 2004; Morahan-Martin & Schumacher, 2000; Wang, 2001), in the literature also referred to as internet addiction (Young, 1998), problematic internet use (Caplan, 2002; Morahan-Martin & Schumacher, 2000), pathological internet use (Davis, 2001), and internet dependence (Wang, 2001). Compulsive internet use has been described by core criteria such as (1) experiencing unpleasant emotions when internet use is impossible, (2) continuation of internet use despite the intention or desire to stop or cut down the use, (3) using internet to escape from negative feelings, (4) internet use dominates one's cognitions and behaviors, and (5) internet use results in conflict with others, or in self-conflict (Meerkerk, Van den Eijnden, Vermulst, & Garretsen, 2005).

Online communication is suggested to play a central role in the development of CIU (Caplan, 2003; Chou & Hsiao, 2000; Ward, 2001; Young, 1997). The interactive aspects of the internet are thought to be particularly attractive, creating an atmosphere for developing a compulsive tendency to seek out companionship, sexual excitement, and to alter identities (Young, 1997). In agreement with this notion, a study among Taiwanese college students found that a high score on communication pleasure was related to internet dependence (Chou & Hsiao, 2000). Furthermore, Caplan (2003) found that students' preference for online (rather than face-to-face) social interaction was related to CIU. In contrast, a study among Norwegian adolescents showed associations between CIU and both communication and information applications of the internet (Johansson & Gotestam, 2004). The significance of the latter study is, however, limited

because of the cross-sectional nature of the data; i.e. a longitudinal study would provide more meaningful associations between internet functions and CIU. Therefore, using a longitudinal research design, the present study tested the assumption that online communication, rather than other internet applications (e.g. information seeking and gaming), is positively related to future CIU (Hypothesis 1).

Besides the risk of developing symptoms of CIU, frequent online communication may directly reduce the psychosocial well-being of adolescents. A key study on psychosocial consequences of internet use, the HomeNet study, confirmed that adolescent internet use is associated with a decrease in well-being (Kraut et al., 1998). This two-year prospective study demonstrated that teenagers who spent more time online experienced a greater decline in social and psychological well-being during the first year of access to the internet. Those who were lonely and depressed beforehand were not more attracted to the internet; rather, the study suggested that using the internet in itself was related to a decrease in social well-being. The authors speculated that an adolescent's heavy usage of the internet for online communication led them to forsake critical relations with local friends and family for weak relations with strangers (the social displacement hypothesis). However, a three-year follow-up study among the same sample showed that these negative effects on well-being had dissipated over time (Kraut et al., 2002).

Since the 1998 study by Kraut and colleagues, several researchers have addressed this issue. Most of these studies found no relationship between the frequency of internet use and psychosocial well-being (Gross, 2004; Gross, Juvonen, & Gable, 2002; Sanders, Field, Diego, & Kaplan, 2000; Wastlund, Norlander, & Archer, 2001). However, a few studies did report a relationship between internet use and psychosocial well-being. A cross-sectional study by Ybarra and colleagues (Ybarra et al., 2005) revealed that the intensity of internet use differentiated adolescents reporting depressive symptoms from their asymptomatic peers; moreover, adolescents who reported using the internet particularly for e-mailing or chatting, more often experienced symptoms of depression. In addition, Weiser (2001) studied reasons and goals for using the internet, and found two empirical robust dimensions, i.e. Socio-Affective Regulation (SAR) and Goods and Information Acquisition (GIA). He showed that internet use driven by SAR (e.g. meeting new people, meeting others, or looking for romance) was negatively related to psychological well-being, i.e. loneliness, depression and life satisfaction. internet use driven by GIA (e.g. staying well informed), however, was positively related to psychological well-being.

Although these studies imply a negative relationship between online communication and psychosocial well-being, because of their cross-sectional design they give no indication about the direction of the associations. The question remains, therefore, whether, in agreement with the study by Kraut and colleagues (Kraut et al., 1998), online communication leads to a decline in psychosocial well-being, (e.g. because online communication decreases the amount of real life time spent with important others), or whether low psychosocial well-being leads to an increase in online communication. As stated before, online communication may be a particularly safe way for those adolescents who have insufficient social skills or who experience social anxiety (Ybarra et al., 2005). Also, both mechanisms may operate simultaneously. To gain insight into this question of bi-directionality, a longitudinal research design is required. However, since the

1998 study of Kraut et al., for as far as we know, only two longitudinal studies have been conducted (Kraut et al., 2002; Bessière, Kiesler, Kraut & Boneva, 2004). The results of both studies showed that online communication is related to a decrease in psychological well-being among introverts and those who receive low levels of social support, whereas the psychological well-being of extraverts and those with more social support tend to benefit from online communication (referred to by the Kraut et al. as the 'rich get richer' model). Although Kraut et al. (1998; 2002) and Bessière et al. (2004) examined the pathways whereby online communication is related to changes in well-being, they did not test or control for the opposite pathway whereby well-being may be related to changes in online communication. Thus, from their two longitudinal studies, no inferences can be made about the relative importance of the two paths. The present study addresses this shortcoming by examining both pathways simultaneously within a longitudinal research design. It is hypothesized that a positive relationship exists between online communication on the one hand, and depression and loneliness on the other (Hypothesis 2). Moreover, we tested the two aforementioned pathways, i.e. the hypothesis that online communication is positively related to future depression and loneliness (Hypothesis 3), and the hypothesis that depression and loneliness are positively related to future online communication (Hypothesis 4).

As stated before, there is some empirical support for the assumption that those with less social resources experience more negative outcomes of online communication than those with high social resources (Bessière et al., 2004; Kraut et al., 2002). This suggests that adolescents who feel lonely would not profit from online communication, and might even be harmed by frequent online communication (the 'poor get poorer' model). In agreement with this assumption, it was found that close online relationships with people encountered online was related to feelings of depression (Wolak, Mitchell, & Finkelhor, 2003), and that online communication with people with whom one has no close affiliation was related to feelings of loneliness and social anxiety (Gross et al., 2002). Based on these results, it is hypothesized that the association between online communication and future feelings of depression is stronger for adolescents high in loneliness, compared to adolescents low in loneliness (Hypothesis 5).

Finally, the aforementioned hypotheses will be tested separately for boys and girls. Although gender differences in internet use seem to decrease in time, it has been reported that online communication is particularly popular among girls (Kraut et al., 1998; Subrahmanyam, Kraut, Greenfield, & Gross, 2000). More importantly, some studies suggest differential associations between online communication and psychosocial well-being (Wolak et al., 2003; Ybarra et al., 2005). For instance, a stronger negative relationship between depressive symptoms and online communication with strangers has been found for boys than for girls (Ybarra et al., 2005).

In sum, the innovative aspects of the present study are: (1) the focus on correlations between important internet applications (including e.g. instant messenger use) and increases in CIU, (2) the focus on the bi-directionality of the relationship between online communication functions and adolescents' psychosocial well-being, (3) the longitudinal design with a large sample of early adolescents, and (4) the use of rigorous statistical model tests using Structural Equation Modeling.

Methods

Sample and procedure

Data were collected among students in the eighth grade of four schools located in the southern part of the Netherlands. Prior to data collection, all school principals and teachers granted permission. Parent's permission was gathered by means of passive informed consent, i.e. parents received a letter in which they were informed about the fact that their child's' school was participating in a study on internet use and well-being, and that a questionnaire would be administered during school hours. If parents did not agree with the participation of their child, they could either contact the school board or the researchers. Data collection consisted of written questionnaires filled out in the classroom setting. To administer the questionnaires in class, teachers received careful instruction about the coordination of the survey, including guidelines to guarantee the privacy of participants while filling out the questionnaire. Furthermore, teachers were asked to remind the students about the confidential aspect of participation in this study. A total of 708 students participated. The present study included two measurements: T1 (November 2003) en T2 (June 2004, i.e. with an interval of 6 months.

Only data of participants who participated in both T1 and T2 were used for the present analyses; 663 students participated in both measurements (94%). Attrition analyses were conducted to test possible differences between the selected participants and the dropouts. A logistic regression analysis showed no significant differences for age, gender, cultural background, education level, CIU and depressive symptoms. Of the final sample of 663 participants, 318 were male and 345 female with an age range of 12 to 15 years (M = 13.37, SD = .57). Most of the participants were of Dutch origin; 8% was having a foreign background, having at least one parent being born in a foreign country, mainly Turkey and Morocco (2%), or Surinam or the Netherlands Antilles (2%). Of the sample, 8% was involved in lower secondary education (i.e. a vocational training), 32% was involved in intermediate secondary education (i.e. preparatory college), and 60% was in higher secondary education (i.e. pre-university education).

Measures

Online communication and other internet functions

Participants were asked to indicate how often they engage in the following internet behaviors: 1) seeking information, 2) surfing, 3) gaming, 4) searching for pornography, 5) downloading music, films, software etc., 6) e-mail, 7) chatting in chat room, and 8) instant messaging. Answers could be given on a 5-point scale ranging from 1 = 'less than once a week' to 5 = '(almost) daily'. The investigated online communication applications were e-mail, instant messaging and chatting. For these three functions an additional question was asked about the importance of these forms of communication for keeping in contact with friends and peers; the response scale ranged from 1 = 'absolutely unimportant' to 5 = 'very important'.

Compulsive internet use

To measure CIU the shortened version of a recently developed and validated scale was used; the Compulsive Internet Use Scale (CIUS) (Meerkerk et al., 2005). This shortened version consists of 10 items identifying the core features of CIU (Table 1). Answers had to be given on a 5-point scale ranging from 1 = 'never' to 5 = 'very often'. The internal consistency of the scale was good (Cronbach's alpha = .82 at T1, and .85 at T2). Factor loadings of the scale items ranged from .47 to .68 at T1, and from .48 to .79 at T2 (Table 1).

Depressive symptoms

To assess depressive symptoms, the Depressive Mood List developed by Kandel and Davies was used (1982, 1986). On a 6-item scale, respondents were asked to report negative feelings over the last 12 months. Examples of items are: 1) How often did you feel unhappy, sad, or depressed? and 2) How often did you feel nervous or tensed? This scale has been extensively used and sufficient psychometric properties have been shown in terms of internal consistency, reliability and stability over time (Kendall, Cantwell, & Kazdin, 1989). We used the Dutch version of the Depression Mood List (Engels, Finkenauer, Meeus, & Dekovic, 2001); Cronbach's alpha was .75 (T1) and .78 (T2).

Loneliness

Feelings of loneliness were assessed using the 10-item Loneliness Scale developed by Russell and colleagues (Russell, Peplau, & Cutrona, 1980), containing 5 positive and 5 negative items. Examples of items are: 1) I am feeling alone, 2) I do not have real friends, and 3) There are people who really understand me. Negative items were recoded before summing the 10 items into a scale. The internal consistency of the scale was high; Cronbach's alpha was .85 (T1) and .90 (T2).

Table 1 Item Descriptions and Factor Loadings of the Compulsive Internet Use Scale

	Item description	Factor loading T1	Factor loading T2
1	How often do you continue to use the internet despite your intention to stop?	.61	.79
2	How often do you find it difficult to stop using the internet when you are online?	.68	.72
3	How often are you short of sleep because of the internet?	.64	.48
4	How often do you think you should use the internet less often?	.55	.55
5	How often do others (e.g. parents, friends) say you should use the internet less?	.57	.60
6	How often do you prefer to use the internet rather than spending time with others (e.g. friend, parents)?	.59	.51
7	How often have you unsuccessfully tried to spend less time on the internet?	.56	.50
8	How often do you look forward to your next internet session?	.63	.64
9	How often do you think about the internet, even while not online?	.47	.61
10	How often do you feel bad when you cannot use the internet?	.50	.66

Strategy of Analysis

Before analysis, we inspected the data file for missing values. Of the 663 respondents 3 showed missing values in a systematic way, meaning that values were missing on 21 of the 38 variables used for our analyses; these respondents were removed from the data file. For the remaining data from 660 respondents, the mean percentage of missing values per variable was 1.1% (range .2 to 4.2%). The missing values were replaced by values estimated by the Expectation Maximization algorithm in SPSS, which is a method to obtain Maximum Likelihood estimates when some data are missing (Allison, 2002). To test the aforementioned hypotheses we used structural equation modeling (SEM) with help of the

software package MPLUS (Muthén & Muthén, 2002). The advantage of SEM over e.g. regression analysis is that measurement errors can be separated from the true latent variables and (as a consequence) estimated structural relationships between latent variables are more valid. Moreover, structural relations are estimated simultaneously and fit indices are important indicators for the fit of the model.

In order to test Hypothesis 1 that online communication, more than other internet applications, is related to increases in CIU, we used a MIMIC (Multiple Indicators Multiple Causes) model (Bollen, 1989, p.331; Kaplan, 2000). The model should be seen as a regression model with internet functions as independent variables (multiple causes) and CIU (measured by multiple indicators) as the dependent one, see Figure 1. The main difference from a standard regression analysis is that the dependent variable (CIU) is a latent variable. Independent variables were free to correlate. Indicators for a latent variable are usually the individual items (in our case 10 items for CIU), but for reasons described below we replaced items by three parcels (subsets of items). Three models were tested: two cross-sectional models at T1 and T2, and a longitudinal one with internet functions at T1 related to CIU at T2.

To test Hypotheses 2, 3 and 4 regarding the relationship between online communication (e.g. e-mail, chatting and instant messaging) and depression and loneliness, we used SEM with latent variable modeling. E-mail, chatting and instant messaging were latent variables measured by two items each, i.e. an item on how often one uses these internet functions, and an item on the importance of these forms of communication. Depression and loneliness were latent variables measured by two and three parcels, respectively. Structural relations of depression and loneliness with the three online communication variables were tested.

Additionally, the associations between online communication, CIU, depression and loneliness were examined using cross-lagged panel analyses (Finkel, 1995). The aim of cross-lagged analysis with panel data is to determine the causal ordering between variables of interest (Finkel, 1995, p.23). Cross relations over time enable to test causal predominance. For example, is instant messaging the 'cause' of depression, or can depression be seen as the 'cause' of instant messaging (Byrne, 1998, p. 352). However, the direction of the cross relations over time is only an indication for causal predominance. The present study is restricted to two waves, but models with three or more waves finding consistent cross relations over time are more convincing about causal ordering of variables. To examine the reciprocal relations over time, error terms of corresponding parcels or indicators are allowed to correlate (Byrne, 1998, pp. 359-360). At both T1 and T2, four latent variables were defined: instant messaging measured by two items, CIU measured by three parcels, depression (two parcels), and loneliness (three parcels). Stability relations over time between corresponding latent variables and cross relations were tested.

Moderation effects of loneliness (Hypothesis 5) and gender on the cross-lagged associations between online communication applications and depression and loneliness have been tested using multigroup analyses (Bollen, 1989). The cross-lagged model for boys was compared with the cross-lagged model for girls. Gender differences in cross-lagged relations were tested using chi-square difference tests. For loneliness, two groups were formed using a median split resulting in a group with lower scores on loneliness and a group with higher scores on loneliness (for a description of this procedure, see Harakeh, Scholte, Vermulst, de Vries, & Engels, 2004). The scores for loneliness were based on the original measure of loneliness at T1, consisting of 10 items. Differences between the two groups were also tested with chi-square difference tests.

Parceling

For the above-mentioned analyses we used the latent variables CIU, depression and loneliness at T1 and T2. The latent variables were measured by 10, 6 and 10 items, respectively. Testing structural relations between latent variables with this relatively high number of items would lead to an excessive number of parameters to be estimated in relation to the sample size. For this reason we replaced the original items by parcels to reduce the number of the parameters to be estimated. Parcels are the mean or the sum of subsets of items of a latent variable. Here we computed the means of the subsets of items. The parcels were derived as follows. First we performed exploratory principal factor analyses with oblique rotation on the items of a scale. Despite the one-dimensional character of the scales we forced a two or three factor solution. The choice for a two or a three factor solution was dependent on the quality of the factor pattern. We strived for factor solutions with high loadings on one of the factors on low cross loadings. For CIU we constructed three factors pointing to three aspects of CIU: intention to use internet (factor 1: items 3, 6, 8, 9 and 10, Table 1), intention to use the internet less often (factor 2: items 4, 5 and 7) and continuing the use of internet despite the intention to stop (factor 3: items 1 and 2). These three factors or parcels have a satisfying reliability at T1 and T2 (range .74 to .80). For depression we constructed a two factor solution. The first factor consisted of 4 items and contained items expressing the feeling of being unhappy, sad, or depressed, the second factor consisted of 2 items expressing the feeling of being nervous or tensed. The reliability of the parcels derived in this way ranged from .66 to .74. Loneliness was split into three factors. The first factor (3 items) expressed feelings of being alone, isolated and withdrawn, the second factor (3 items) expressed the presence of other people who are understanding and supporting, the third factor (4 items) the presence or absence of friends and significant others. The reliability ranged from .73 to .84. In this way we reduced the 26 items for the three latent variables to 8 parcels. Bandalos and Finney state that in applications where the focus is on structural relationships and the latent variables are one-dimensional, the use of item parcels is defensible (Bandalos & Finney, 2001).

All SEM models were tested with help of the Maximum Likelihood estimation method. We used two fit measures recommended by several authors: (a) the root mean square error of approximation (RMSEA; Byrne, 1998), and (b) the Comparative Fit Index (CFI) of Bentler (Marsh, Balla, & McDonald, 1988). RMSEA is used to assess approximate fit, preferably with values less than or equal to .05, but values between .05 and .08 are indicative of a fair fit (Kaplan, 2000, p.113-114). CFI is a comparative fit index; values above .95 are preferred (Kaplan, 2000, p. 107) but should not be lower than .90 (Kline, 1998, p. 131).

Results
Characteristics of the sample
Of the participants, 99% reported using the internet, and 97% reported to have access to internet at home. The mean hours of internet use was 8 hours a week (SD = 8.85) at the first measurement, and 10 hours a week (SD = 9.90) at the second measurement. Almost all participants (93%) communicated online, particularly with the instant messenger (84% at T1 and 89% at T2) and e-mail (85% at T1 and 87% at T2). A minority reported to chat in chat rooms (35% at T1 and 30% at T2). Instant messaging was also the most frequently used form of online communication; 49% (T1) to 55% (T2) of the respondents used the instant messenger on a daily basis, compared with 19% (T1) and 13% (T2) using e-mail, and 5% (T1) and

3% (T2) using chat rooms. No gender differences were found for the online communication applications instant messaging and chatting (Fs < 1), but girls use e-mail more often than boys (M = 2.98 and M = 2.73, respectively; Φ (1,685) = 6.14, π < .05).

Table 2 shows correlations, means and standard deviations of all the internet functions at T1 and T2. Of all internet applications, instant messaging is used most frequently, followed by (2) downloading, (3) e-mail use, (4) surfing, (5) gaming, (6) information seeking, (7) chatting and (8) searching for pornography.

Table 2 Correlations, Means and Standard Deviations of internet functions at T1 and T2

		1	2	3	4	5	6	7	8	Mean	SD
1	Information	(.41)	.23	.11	.05	.12	.25	-.02	.16	2.60	.83
2	Surfing	.26	(.49)	.42	.22	.39	.18	.13	.33	2.71	1.22
3	Gaming	.18	.50	(.54)	.24	.27	.14	.20	.20	2.54	1.37
4	Pornography	.16	.13	.22	(.44)	.26	.08	.12	.10	1.21	.66
5	Downloading	.21	.44	.42	.20	(.67)	.29	.16	.52	3.11	1.52
6	E-mail	.29	.39	.32	.14	.48	(.56)	.12	.39	2.72	1.18
7	Chatting	.08	.30	.31	.28	.28	.32	(.40)	.16	1.49	.92
8	Inst. Messaging	.19	.45	.38	.12	.57	.59	.29	(.66)	3.94	1.40
	Mean	2.48	2.68	2.52	1.14	2.88	2.84	1.65	3.67		
	SD	.87	1.27	1.35	.52	1.62	1.32	1.11	1.53		

Note: The associations, means and SDs at T1 are depicted below the diagonal (T2 above the diagonal). At the diagonal correlations of corresponding internet functions are given between T1 and T2.

Prediction of compulsive internet use by online communication and other internet functions
Figure 1 presents the standardized regression weights and fit results of predicting CIU from the eight internet functions, resulting from testing MIMIC models using SEM at T1, T2 and longitudinally. The factor loadings of the three parcels of CIU are reported in the addendum and show high values.

The MIMIC models had a good fit with CFI ≥ .95 and RMSEA ≤ .05. The cross-sectional models showed that CIU is especially associated with chatting and instant messaging, and to a lesser extent with e-mailing. The only non-communication function related (both at T1 and T2) to CIU is downloading. The two important correlates in the cross-sectional models (i.e. chatting and instant messaging) are also the two significant precursors of CIU in the longitudinal model. The proportions of explained variance of CIU is rather high and ranges from .46 (T1) to .34 (T2) and .31 (longitudinal). The conclusion is that chatting and instant messaging are important predictors of CIU 6 months later.
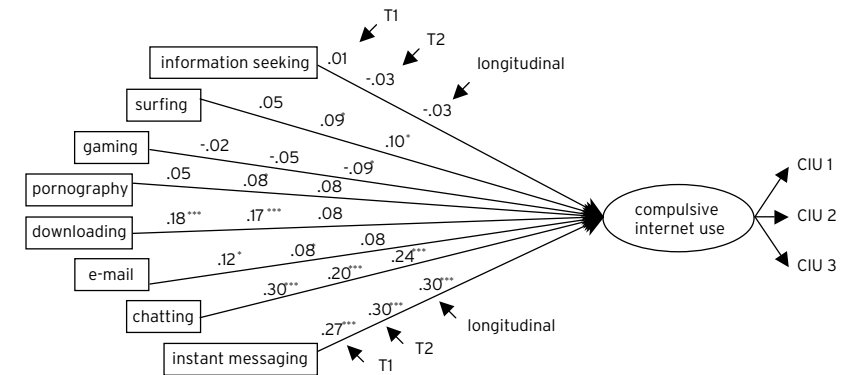
Note: The longitudinal model related the 8 internet applications at T1 to compulsive Internet use at T2. At T1 R^2 = .46, at T2 R^2 = .34, and longitudinal R^2 = .31.
*) p < .05   **) p < .01   ***) p < .001
χ^2 (16) = 40.58, p = .001, RMSEA = .048, CFI = .975 (T1);
χ^2 (16) = 41.80, p = .000, RMSEA = .050, CFI = .969 (T2);
χ^2 (16) = 32.24, p = .010, RMSEA = .039, CFI = .980 (longitudinal).

Figure 1 MIMIC model with Internet Functions as Predictors of Compulsive Internet Use at T1, T2 and Longitudinal Standardized Regression Weights, Explained Variances and Fit Results.

Online communication and psychological well-being
The structural relations between e-mail, chatting and instant messaging, and depression and loneliness are tested in one model at T1, T2 and longitudinally. The results are given in Figure 2. The fit of the models are all acceptable with CFIs > .95, RMSEAs around .05. The factor loadings of the parcels and indicators and the correlations between latent variables are given in the addendum. The factor loadings are high. The correlations between the three communication variables are positive and in the expected direction. The correlations between depression and loneliness are ≥.40. Figure 2 shows that instant messaging has a significant relationship with depression at T1, T2 and between T1 and T2, and no significant relationship with loneliness. Participants who often engaged in instant messaging reported higher levels of depression in both cross-sectional and longitudinal analyses. However, the proportion of explained variance in depression is not very high and ranges from .06 to .07. It can be concluded that instant messaging is positively associated with feelings of depression 6 months later. Because no associations were found for e-mail and chatting, the following analyses were only conducted for instant messaging.

Instant messaging, compulsive internet use and psychological well-being
The relationships between instant messaging, CIU and psychological well-being were tested simultaneously using a cross-lagged panel model (Figure 3). Instant messaging, CIU, depression and loneliness were the latent variables measured at T1 and T2. The fit of the model is good with RMSEA < .05 and CFI > .95. To avoid complex models, factor loadings and correlations between disturbance terms (unexplained variances) of latent variables are omitted in Figure 3 and presented in the addendum. The factor loadings are high (see the addendum). At T1, correlations between loneliness and instant messaging and between loneliness and
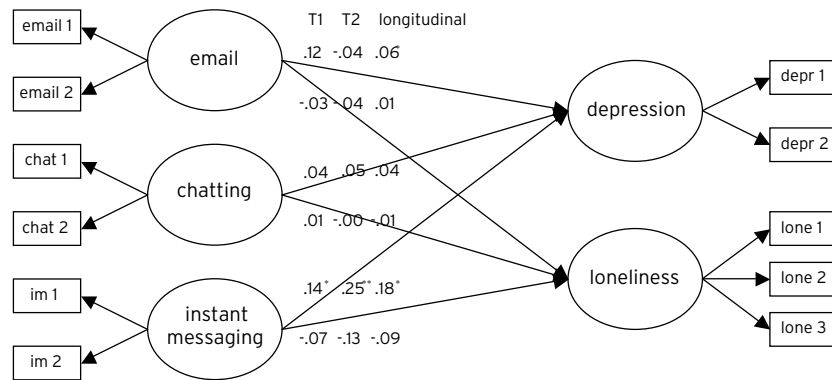
Note: The longitudinal model related the three online communication applications at T1 to depression and loneliness at T2. For depression, R^2 = .07 (T1), R^2 = .06 (T2), and R^2 = .06 (longitudinal). For loneliness, R^2 = .0 (T1), R^2 = .02 (T2), and R^2 = .01 (longitudinal).

*) p < .05   **) p < .01   ***) p < .001

χ^2 (31) = 71.58, p = .000, RMSEA = .045, CFI = .980 (T1);

χ^2 (31) = 119.88, p = .000, RMSEA = .066, CFI = .960 (T2);

χ^2 (31) = 97.88, p = .000, RMSEA = .057, CFI = .973 (longitudinal).

Figure 2 E-mail, Chatting and Instant Messaging as Predictors of Depression and Loneliness at T1, T2 and Longitudinal Standardized Regression Weights, Explained Variances and Fit Results.

CIU were non-significant. Instant messaging had a high correlation with CIU. Feelings of depression were moderately associated with instant messaging. Finally, higher levels of depressive feelings were associated with more CIU and more loneliness. At T2, correlations between disturbance terms of the four latent variables are given in the addendum; these correlations can be seen as partial correlations between the latent variables controlling for their common causes at T1 (Kline, 1998, p. 114). The correlations between the disturbance terms at T2 are very low, indicating that correlations between the latent variables at T2 are mainly explained by the latent variables at T1.

The stability over time of the latent variables is shown in Figure 3. Instant messaging and CIU showed a very high level of stability with weights of .77 and .75, respectively, and depression and loneliness to a lesser degree with weights of .65 and .58, respectively. This result is in agreement with the proportion of explained variance of the four variables at T2 (.63, .66, .46 and .34, respectively). Three cross-lagged paths were significant (Figure 3). Instant messaging at T1 is positively associated with CIU at T2 (β = .09, π < .05), and with depression at T2 (β = .10, π < .05). In addition, loneliness at T1 is negatively related to instant messaging at T2 (β = -.12, π < .001). Thus, it seems more plausible that instant messaging affects CIU and depression than that CIU and depressive feelings affect instant messaging. Similarly, it seems more likely that loneliness affects instant messaging than the other way around.
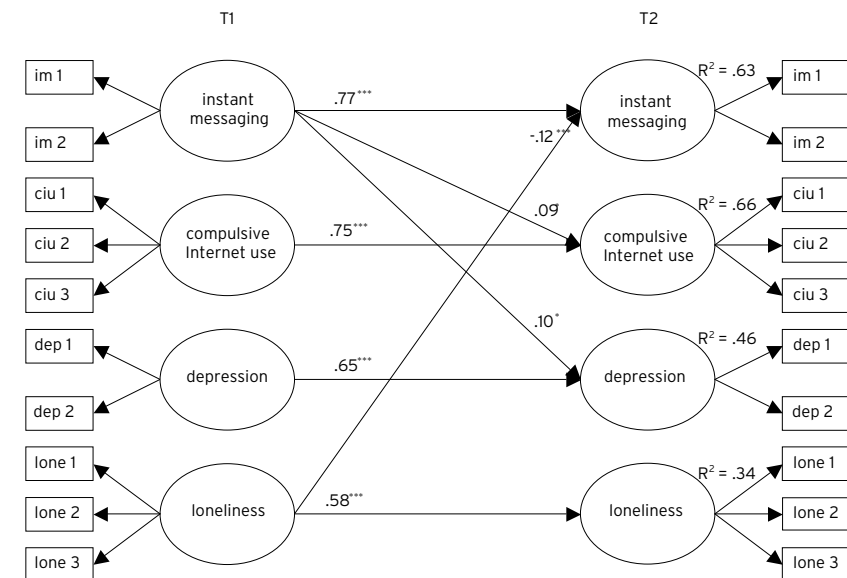
*) p < .05   **) p < .01   ***) p < .001

χ^2 (143) = 325.05, p = .000, RMSEA = .044, CFI = .972

Figure 3 Cross lagged panel model with associations over time between instant messaging, compulsive internet use and psychosocial well-being (depression and loneliness)

Moderating effects of gender and loneliness on compulsive internet use and psychosocial well-being

Moderating effects of gender on the relationship between instant messaging and CIU, depressive symptoms and loneliness were examined with multigroup analyses. The same model as depicted in Figure 3 has been tested separately for boys and girls. The path from instant messaging at T1 to CIU at T2 was non-significant for boys (β = .05, n.s.), but significant for girls (β = .14, p < .05). The path from instant messaging at T1 to depression at T2 was significant for boys (β = .15, p < .05), but not for girls (β = .06. n.s.). The path from loneliness at T1 to instant messaging at T2 was significant both for boys (β = -.13, p < .05) and for girls (β = -.11, p < .05). On basis of these results we may infer that gender moderates the relationship between instant messaging on the one hand, and CIU and feelings of depression on the other. Instant messaging has a positive association with later CIU for girls and with later feelings of depression for boys. However, testing differences between boys and girls with respect to these three paths revealed no significant difference between instant messaging at T1 and CIU at T2 ($\Delta\chi^2$ (1) = 1.08, ns), instant messaging at T1 and depression at T2 ($\Delta\chi^2$ (1) = .94, ns), or for loneliness at T1 with instant messaging at T2 ($\Delta\chi^2$ (1) = .22, ns). These results indicate that the possible moderating effects of gender are not substantial when using rigorous model testing.

Moderating effects of loneliness are also tested with multigroup analyses. First, loneliness was removed from the model in Figure 3 and the new model was tested for the complete sample. The relations between instant messaging at T1 and CIU at T2 and depression at T2 were still significant (π < .05) with values of .08 and .09, respectively. The model showed a good fit: χ^2 = 119.86, df = 61, RMSEA = .038, CFI = .987.

The next step was to compare the low loneliness group with the high loneliness group. Results showed that the path from instant messaging T1 to CIU T2 was marginally significant for the low loneliness group (β = .12, π = .078) and not significant for the high loneliness group (β = .06, n.s.). The path from instant messaging T1 to depression T2 was not significant for the low loneliness group (β = .07, n.s.), but was significant for the high loneliness group (β = .12, π < .05, one-sided). Testing differences between the low and high loneliness groups with the help of chi-square differences yielded no significant differences: $\Delta\chi^2$ (1) = .52, n.s., for the path instant messaging T1 – CIU T2 and $\Delta\chi^2$ (1) = .44, n.s., for the path instant messaging T1 – depression T2. These results show no significant evidence for the moderating role of loneliness on the relations between instant messaging T1 and CIU T2 and depression T2 when using rigorous model testing. The same applies for the differences between boys and girls under the condition of low loneliness and the condition of high loneliness. Comparing these four groups simultaneously showed that girls under the condition of low loneliness showed a significant relation between instant messaging at T1 and CIU at T2 (β = .19, π < .05) and boys under the condition of high loneliness a significant relation between instant messaging at T1 and depression at T2 (β = .16, π < .05, one-sided). Chi-square difference tests over the four groups, however, showed no significant differences with $\Delta\chi^2$ (3) = 1.77, n.s., for the path instant messaging T1 – CIU T2 and $\Delta\chi^2$ (3) = 1.24, n.s., for the path instant messaging T1 – depression T2. In conclusion, although the present data provide some support for the idea that girls low in loneliness are particularly vulnerable to develop CIU whereas boys high in loneliness are particularly vulnerable to develop feelings of depression, these results are not substantial when using rigorous model testing.

Discussion

The present study is one of the first to examine the association between different internet functions, including online communication applications, and the development of CIU among adolescents within a longitudinal design. As shown in the present study, instant messaging proved to be the most popular form of online communication among young adolescents, as well as the most frequently used internet application.

In line with Hypothesis 1, the findings of the present study show that frequent online communication is positively related to CIU 6 months later. However, only real time communication functions, i.e. instant messaging and chatting were associated with CIU, indicating that adolescents who frequently engage in instant messaging and chatting have a higher incidence of CIU 6 months later. Furthermore, partly supporting Hypothesis 2, a positive relationship was found between instant messenger use and feelings of depression. However, such a relation was not found for e-mailing and chatting in chat rooms, and not found for feelings of loneliness. With regard to this association between instant messenger use and depression, the present data confirm Hypothesis 3 that instant messaging is positively related to feelings of depression 6 months later, but do not support Hypothesis 4 that feelings of depression are related to instant messaging 6 months later. Thus, adolescents who spent more time communicating by instant messaging showed a higher incidence of CIU after 6 months. These data suggest that excessive use of the instant messenger may be a risk for the psychological well-being of adolescents. Finally, the present data do not convincingly support Hypothesis 5, i.e. that the association between instant messaging and depressive symptoms would be stronger for adolescents high in loneliness than for those low in loneliness. Although the pathway from instant messaging to feelings of depression was significant for the high loneliness

group and not for the low loneliness group, no conclusions can be drawn about the moderating role of loneliness since group differences were not significant. Similarly, no conclusions can be drawn about the moderating role of gender. Although the data suggest that instant messaging is positively related to later CIU for girls but not boys, and that instant messaging is related to later depressive symptoms among boys but not girls, the results after rigorous testing are not convincing.

An unexpected finding was that feelings of loneliness were negatively related to instant messenger use 6 months later, indicating that those high in loneliness seem to engage in instant messenger use less often than those low in loneliness. Thus, consistent with the findings of Kraut and associates (Kraut et al., 1998), no empirical support was found for the assumption that lonely teenagers would be more attracted to online communication applications than their less lonely counterparts. Instead, lonely teenagers seem to withdraw from instant online communication. In accordance with these findings, it has been suggested that feelings of loneliness may evoke an avoidant coping style in which communication with others is further evaded (Seepersad, 2004). There may even be a downward spiral whereby a person's use of avoidance to cope with loneliness leads to increased loneliness and further avoidance (Rubenstein & Shaver, 1982). Indeed, Seepersad (2004) found that lonely youth tend to cope in an avoidant way with loneliness and prefer to use the internet for entertainment functions rather than communication functions. Similarly, social anxiety is reported to be negatively related to online communication (Valkenburg & Peter, 2006). As far as we know this is the first study to convincingly show that, in adolescents, the use of online communication applications (particularly instant messaging and chatting) are related to later CIU. More than other internet functions, instant online communication seems to evoke compulsive tendencies, reflected by symptoms such as loss of control, preoccupation with the internet, and internet use resulting in conflict with others or in self-conflict. For some youngsters, this medium seems so appealing that the desire to use it for online communication overrules the desire for face-to-face interactions. However, although it may be at the expense of real-life social interactions, no indication was found that excessive instant online communication would increase feelings of loneliness. Nevertheless, instant messaging seems to evoke feelings of depression among some of the users. Thus, the present study is in agreement with the findings of the HomeNet study (Kraut et al., 1998) for depression, indicating that adolescent internet use is associated with a decrease in well-being. Moreover, although no clear conclusion can be drawn about the moderating role of loneliness, the present findings are more in agreement with the 'poor get poorer' than with the 'rich get richer' model (Kraut et al., 2002).

How to explain the fact that depressive symptoms seem to increase among adolescents who make excessive use of the instant messenger? As discussed before, it has been suggested that frequent online communication may displace valuable everyday social interaction with family and friends, with negative implication for users' psychosocial well-being (the social displacement hypothesis). This would imply that online communications would particularly relate to depression when they involve 'weak tie' relationships (e.g. strangers and acquaintances) as opposed to 'strong tie' relationships (e.g. close friends and family members) (Subrahmanyam et al., 2000). Indeed, studies have shown a negative association between online communication with strangers and psychosocial well-being among adolescents (Valkenburg & Peter, 2005; Ybarra et al., 2005) and adults (Bessière et al., 2004). For instance, in their longitudinal study

among adults, Bessière et al. showed that online communication is only related to an increase in depressive affect under the condition that the communication is directed towards meeting new people, and not under the condition of communicating with family and friends. This may also provide an explanation for the 'poor get poorer' model; i.e. it seems plausible that lonely and socially isolated adolescents, more than their socially integrated peers, communicate online to meet new people. Online communication might evoke feelings of depression, at least among socially isolated youngsters, because these youngsters rely on internet communication to obtain social support (LaRose, Eastin, & Gregg, 2001), while such support is hard to obtain from the 'weak tie' relationships met online. In addition, the study by Ybarra (2004) showed that youth low in psychosocial well-being are more likely to report being the target of internet harassment. Since youngsters low in psychosocial well-being would seek more interaction with persons exclusively known online (Ybarra, 2004; Ybarra et al., 2005), the risk of harassment will be higher for this group. Although adolescents generally communicate with peers already known to them when using the instant messenger, there are some indications that the number of ´weak tie´ relationships when using this medium is rising. Personal communication with young adolescents revealed that they often have more than 50 or 100 addresses in their messenger list, and that these addresses are frequently exchanged among each other. This practice may promote an increase in instant messenger communication with strangers and unfamiliar others.

However, contrasting both the 'rich get richer' model and the 'poor get poorer' model, Bessière et al. (2004) showed that online communication to meet new people was associated with an increase in depressive affect among those initially high in social resources (cf. the social displacement hypothesis), and that online communication to meet new people was related to a decrease in depressive affect among those initially low in social resources. The authors argued that these latter results confirm the social compensation hypothesis, i.e. that online communication with strangers can help to build social resources for those who lack these resources in the offline world (Bessière et al. 2004). The literature, thus, shows contradictory results with regard to the impact online communication with 'weak tie' relations has on the psychosocial well-being of lonely and socially isolated individuals. Future research should address the conditions under which adolescents low in social resources either benefit from or get harmed by online communication with people met online.

Finally, the question arises why depressive symptoms do not seem to increase among adolescents who excessively chat in chat rooms, an application which (more than instant messaging) reflects communication with strangers. In this regard it should be noted that chatting in chat rooms is much less popular among adolescents than instant messaging: only 3 to 5% of the adolescents visits a chat room on a daily basis, whereas 49 to 55% of the adolescents uses the instant messenger on a daily basis. Moreover, adolescents may have less expectations about persons they meet in chat rooms (e.g. they may hold lower expectations about obtaining social support), since chatting generally reflects communication with total strangers.

Future research should investigate the processes underlying the relationships found between instant messenger use and depression, and should address the mediating role of the strength and familiarity of online relationships, and the mediating role of internet provocations and harassments. Because of

the physical distance and perceived anonymity, online communication may more easily evoke verbal aggression than face-to-face communication, and this verbal aggression may particularly target socially vulnerable youngsters.

Finally, we would like to discuss some limitations of the present study. First of all, this study exclusively examined short-term associations between online communication and well-being, i.e. the effects after a 6-month interval. As was shown by Kraut et al., (Kraut et al., 2002), negative short-term effects may dissipate over a longer period of time. Furthermore, this explorative study focused mainly on young adolescents aged 12 to 15 years. A similar study is needed among older adolescents (e.g. aged 16-19 years) to test whether the associations between online communication and well-being differ between early and late adolescents. Because one of the developmental tasks in teenagers is to establish and maintain social relationships with friends and/or romantic partners, it might be assumed that having contact predominantly with unknown people on the internet may lead to personal and/or social problems in young adulthood. However, this assumption is highly speculative because no study has investigated the long-term effects of internet use on the social development of adolescents. A long-term prospective design would also allow to examine the stability and change in internet functions and CIU. If, for instance, there is high variation in CIU over time (even over relatively short period of time) the prolonged negative effects of compulsive use might be less widespread.

Although we embedded our questions on internet use within a broader questionnaire on health and social behaviors, the lack of anonymity while filling out the forms in a class room setting may have caused some underreporting of internet use, particularly among the heavy users or those who experience feelings of depression. It would be worthwhile to replicate our study and fill out the forms in a more anonymous setting, as well as among adolescents and their close friends. We assume that multi-informant data on personal matters will be more reliable when gathered among peers than among parents.

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Addendum

Factor Loadings of Parcels/Indicators and Correlations between Latent Variables at T1, T2 (Model 3) and Longitudinal (Model 1 and 2).

		T1	T2	Longitudinal
Model 1 (Figure 1)				
factor loadings	parcels/indicators			
CIU	ciu 1	.80	.78	.78
	ciu 2	.68	.61	.61
	ciu 3	.81	.84	.85
Model 2 (Figure 2)				
factor loadings				
e-mail	email 1	.75	.80	.76
	email 2	.57	.57	.56
chatting	chat 1	.85	.80	.86
	chat 2	.55	.59	.54
instant messaging	im 1	.79	.74	.82
	im 2	.85	.88	.81
depression	depr 1	.90	.97	.91
	depr 2	.52	.57	.61
loneliness	lone 1	.67	.80	.80
	lone 2	.50	.65	.65
	lone 3	.95	.90	.89
correlations				
e-mail	x	chatting	.48	.19	.47
e-mail	x	instant messaging	.66	.46	.66
chatting	x	instant messaging	.40	.30	.40
depression	x	loneliness	.40	.44	.45
Model 3 (Figure 3)				
factor loadings				

Continued:

			T1	T2	Longitudinal
instant messaging		im 1	.83	.83	
		im 2	.80	.79	
CIU		ciu 1	.80	.76	
		ciu 2	.68	.63	
		ciu 3	.81	.85	
depression		depr 1	.84	.91	
		depr 2	.61	.66	
loneliness		lone 1	.76	.82	
		lone 2	.51	.65	
		lone 3	.84	.87	
correlations					
instant messaging	x	CIU	.64	.14	
instant messaging	x	depression	.26	.10	
instant messaging	x	loneliness	-.08	-.02	
CIU	x	depression	.41	.12	
CIU	x	loneliness	.08	.07	
depression	x	loneliness	.47	.27	

n.s. = not significant. The correlations at T2 in Model 3 are correlations between the disturbance terms

relationship

The Relationship between Personality, Psychosocial Wellbeing and Compulsive Internet Use: The Internet as Cyber Prozac?
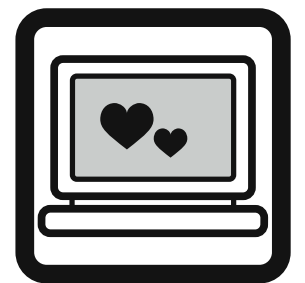
Chapter 6

The Relationship between Personality, Psychosocial Wellbeing and Compulsive Internet Use: The Internet as Cyber Prozac?

Abstract

The internet has specific features that increase the risk for vulnerable people to develop compulsive internet use (CIU). The present study evaluated factors associated with personality traits (i.e. the Big Five dimensions) and psychosocial states (i.e. loneliness, depressive symptoms and self-esteem) that may account for this vulnerability. We also explored the possibility that the predictive value of the personality traits and psychosocial states is moderated by the function for which the internet is used. The results show that the main predictor of compulsive internet use among the personality traits is low emotional stability, and among the psychosocial states depressive symptoms. However, comparison of the predictive value of the personality traits and psychosocial factors showed that the psychosocial factors are much more important in predicting compulsive internet use than the personality traits. A moderating effect of the three main internet functions (erotica, chatting, gaming) was not found.

Introduction

Addictions are traditionally linked to the use or abuse of mind-altering chemicals such as heroin, cocaine, and alcohol. The last decades, however, a broader view of addictions is emerging including so-called behavioral addictions such as, gambling addiction, excessive eating, excessive exercising, hypersexuality or sex addiction and, most recently, compulsive internet use (CIU), sometimes also referred to as 'internet addiction'.

In his recent review on problem gambling and other behavioral addictions Orford (2005) identifies, next to gambling, shopping and eating, online pornography, online gaming, and online chatting as activities that may carry the greatest future risk for behavioral addiction. Features of these internet functions that heighten the addiction risk are, according to Orford, easy availability, the possibility to rapidly achieve an intense emotional reward, and the characteristic of continuity making it possible to persist in the behavior. These features resemble the aspects of the Triple A Engine (Accessibility, Affordability and Anonymity) described by Cooper (1998) and the ACE model (Anonymity, Convenience and Escape) described by Young and colleagues (1999), which also stress some of the specific features of the internet that give certain functions addictive properties.

The combination of the three models mentioned above offers a comprehensible description of the unique factors of the internet that make certain functions highly entrapping for those sensitive to the rewards that can be obtained with a finger click: i.e. internet users can easily, in abundance and at low cost find instant satisfaction for a variety of needs. At the same time (subjective) anonymity lowers thresholds and fosters disinhibition (Suler, 2004). Finally, the possibility to engage in the behavior for a prolonged time enables the user to escape real-life daily problems (coping). However, even though in some countries the majority of the population uses the internet, and many may experience compulsive symptoms in the early stages of using the internet or when upgrading to a broadband connection (i.e. beginners fascination or enchantment see Grohol (1999) for a critical appraisal), only a small minority of internet users seems to exhibit symptoms of CIU over a prolonged period of time (Meerkerk, Eijnden, & Garretsen, submitted). Similar to drug use, where some users become addicted whereas others maintain control, some persons appear to be more vulnerable than others to develop CIU. In an earlier study (Meerkerk, Eijnden, & Garretsen, 2006) we hypothesized that vulnerability to develop CIU may be linked to certain biological, psychological, and/or social characteristics. The present study aimed to establish which psychological characteristics (in terms of the Big Five personality trait dimensions) and which psychosocial state factors (depressive symptoms, loneliness, and self-esteem) correlate with CIU. Because one could hypothesize that, for example, self-esteem plays an important role in the development of compulsive online gaming, or loneliness in the development of compulsive chatting, we also explored whether the relationship of personality dimensions and psychosocial factors with CIU is moderated by the function for which the internet is used.

Previous studies have mainly demonstrated an association between CIU and psychosocial and personality state factors such as (low) self-esteem (Armstrong, Phillips, & Saling, 2000; Caplan, 2002; Yang & Tung, 2004), (high) sensation seeking or impulsivity (Davis, Flett, & Besser, 2002; Lin & Tsai, 2002), (high) shyness (Caplan, 2002; Chak & Leung, 2004; Yang & Tung, 2004; Yuen & Lavin, 2004), (high) depression (Caplan, 2002, 2003; Davis et al., 2002; Petrie & Gunn, 1998; Whang, Lee, & Chang, 2003; Yang & Tung, 2004; Young & Rodgers, 1998), (high) loneliness (Caplan, 2002, 2003; Davis et al., 2002; Engelberg & Sjoberg, 2004; Morahan-Martin & Schumacher, 2000; Morahan Martin, 1999; Nalwa & Anand, 2003; Nichols & Nicki, 2004; Pawlak, 2002; Whang et al., 2003), (external) locus of control (Chak & Leung, 2004), and (high) procrastination (Davis et al., 2002). A connection between CIU and several psychiatric symptoms has also been demonstrated: Yoo and colleagues (2004) found an association between CIU and attention deficit hyperactivity disorder (ADHD), and Shapira and colleagues (2000) associated CIU with

colleagues (2005) found that excessive internet users showed more psychiatric symptoms on the SCL-90-R (Derogatis, Lipman, & Covi, 1973), particularly obsessive-compulsive and hostility symptoms. Therefore, it can be concluded that CIU seldom occurs in isolation and is most often accompanied by other psychosocial complaints and/or psychiatric symptoms (co-morbidity).

The relationship between personality trait dimensions (e.g. the Big Five personality dimensions) and CIU has been studied less extensively. Danforth (2003), studying the relationship between personality traits (measured with a 7-factor variant of Goldberg's Big Five model (Goldberg, 1999)) and online game addiction, found addicted players to be less emotionally stable, more negative (scoring higher on negative valence), and to perceive themselves as less attractive than non-addicted players and controls. Yang and colleagues (2005) used the 16-Factor Personality Questionnaire (Cattell, 1995) and also found excessive internet users to be emotionally less stable. Furthermore, excessive internet users appeared to be more imaginative (vs. practical), more self-sufficient (vs. group oriented), and more creative compared to the non-excessive users. However, Engelberg and Sjoberg (2004), using a Big Five personality inventory in a small sample of 41 students, could not find any link between Big Five personality dimensions and CIU. Overall, compulsive internet users appear to have more psychological complaints than non-compulsive internet users, notably depressive symptoms, loneliness, low self-esteem, and shyness. It remains largely unclear, however, whether CIU can be linked to certain personality dimensions, although emotionally less stable personalities seem to be more vulnerable for the development of CIU. Finally, few studies have taken into account the different internet functions and their impact on the relationship between personality dimensions and psychosocial factors and CIU. The present study aims to clarify the relative importance of personality trait dimensions and psychosocial state factors in predicting CIU. In addition, the moderating role of internet functions on the relationship between personality dimensions and psychosocial factors on the one hand and CIU on the other, is evaluated by taking into account three major internet functions that can be linked to CIU. These are, according to Orford (2005) and in line with our own research (Meerkerk et al., 2006), erotica, chatting, and gaming. More specifically the research questions are: 1) which personality trait dimensions and psychosocial state factors predict CIU, 2) what is the relative importance of these dimensions/factors in predicting CIU, and 3) are the relationships between personality dimensions, psychosocial factors and CIU moderated by time spent on the internet functions erotica, chatting, and gaming. By analyzing the impact of these combinations of factors, the study aims to increase the knowledge of personality and psychosocial variables that relate to CIU.

Methods

Procedure

The sample was compiled by an online questionnaire on the website of our research institute. The questionnaire, which could be completed in about 20 minutes, was put online as a self-test at the end of 2003. Respondents who completed the questionnaire received feedback about the extent of compulsivity of their internet use at the end of the survey. Publicity for internet addiction in the popular press, with links to the self-test on our website, yielded a large number of respondents. By the end of 2004, more than 17,500 respondents had completed the questionnaire. Considerable effort was put into cleaning the data (see also Birnbaum (2004) for a discussion on the quality of web-based data collection): respondents who did not finish the questionnaire or gave obvious erratic answers were taken out of the database. Respondents

with identical answers on all items of several instruments of the questionnaire were thoroughly scrutinized and in case of doubt taken out of the database. Finally, a database with 16,925 respondents was used for analyses.

Instruments

The online questionnaire contained, among others, the following variables: demographics (age, gender, and educational level), time spent on various internet functions, the Compulsive Internet Use Scale (CIUS) (Meerkerk, Eijnden, Vermulst, & Garretsen, submitted), Russell's Loneliness scale (UCLA) (Russell, Peplau, & Cutrona, 1980), Rosenberg's Self-esteem scale (Rosenberg, 1989), Kandel's Depressive Mood List (Kandel & Davies, 1982, 1986) and, the Quick Big Five (QBF), a compact personality questionnaire (Vermulst & Gerris, 2005). These variables and instruments are discussed in more detail below.

The demographic variable educational level was assessed with a question relating to the highest completed level of education providing four answer categories: lower, average or higher vocational or general training, and scientific training.

Respondents were asked to specify their five favorite internet functions choosing from a list of 11 entries: email, searching for specific information, surfing, gaming, chatting, buying online, gambling online, downloading (music, video, software etc.), Usenet, erotica, and dating. For their five favorite functions, the respondents indicated the hours spent per week on a 7-point scale (0, less than 1, 1 to 4, 5 to 10, 11 to 20, 21 to 40, and more than 40 hours).

The CIUS was used to assess Compulsive Internet Use. The CIUS has 14 items on a 5-point Likert scale ("Never" to "Very often") and scores from 0 to 56. The scale has a high reliability (alpha = .90) and includes the aspects loss of control, preoccupation, withdrawal symptoms, coping, and conflict with regard to the use of the internet. Sample items are: 'How often do you find it difficult to stop using the internet when you are online?' and 'How often do you look forward to your next internet session?' (for more details see Meerkerk, van den Eijnden, Vermulst and Garretsen (submitted)).

A Dutch translation of the revised UCLA Loneliness Scale (Russell et al., 1980) assessed loneliness (10 items, 5-point Likert scale: "totally disagree" to "totally agree"). The scale has a high reliability, alpha = .87, and contains items such as 'I feel left out by others' and 'I feel strongly united with my friends' (reversed). Self-esteem was measured with the 10 items (4-point Likert scale: "Strongly agree" to "Strongly disagree") of a Dutch translation of Rosenberg's self-esteem scale (Rosenberg, 1989). The scale has a high reliability (alpha = .88) and includes items such as 'I take a positive attitude toward myself' and 'All in all, I am inclined to feel that I am a failure' (reversed). Finally, to assess depressive symptoms, the six items (alpha = .82) of the Depressive Mood List (DML) developed by Kandel and Davies were used (Kandel & Davies, 1982, 1986). Respondents were asked to report negative feelings (e.g. 'Feeling unhappy, somber, and dejected' and 'Feeling nervous and tense') over the last 12 months on a 5-point Likert scale: "Never" to "Always". We used the Dutch version of the Depressive Mood List, which has been validated by Engels and colleagues (2001).

The Quick Big Five (QBF) is a shortened Dutch translation of Goldberg's 100 adjective list (Goldberg, 1992) and measures the five personality dimensions Extraversion (alpha = .89), Conscientiousness (alpha = .88), Agreeableness (alpha = .85), Emotional stability (alpha = .84), and Resourcefulness (alpha = .78). It was developed to assess these dimensions in a reliable and valid way with as few items as possible, to minimize the burden on the respondent. The test consists of 30 items that can be answered within five minutes and is therefore well suited for online distribution. Each personality dimension is measured with six adjectives and the respondent has to rate each adjective on a 7-point scale ("completely incorrect" to "completely correct"). Sample items are: kind (Agreeableness), talkative (Extraversion), organized (Conscientiousness), anxious (Emotional Stability) and imaginative (Openness) (Vermulst & Gerris, 2005).

Participants

Respondents were aged 11 to 80 (M = 25.3, SD = 10.0) years. The age distribution was very skewed with 20.0% younger than 18 and a median of 22 years. Males were overrepresented (77.4%). Most respondents were moderately (46.8%) to highly (40.8%) educated, 12.5% only had lower education. Almost all respondents (98.7%) had access to the internet at home, on average for 5.5 (SD 2.5) years. Most respondents (73.0%) were online every day and the majority (61.7%) spent 2 - 4 hours on the internet on a typical online day. On average a respondent spent 22.5 (SD 21.0) hours per week online, mostly on downloading and chatting.

Statistical analyses

The predictive value of the five dimensions of the QBF personality inventory and the three psychosocial factors (loneliness, self-esteem, and depressive symptoms) on CIU, and the moderating role of the three internet functions (erotica, chatting, and gaming), was determined by means of linear regression analyses. First, a regression equation was built with the five personality dimensions; second, a regression equation was built with the three psychosocial factors; and, third, a regression equation was built with the five personality dimensions and the three psychosocial factors entered simultaneously. Next, to assess the moderating effect of the three internet functions, a regression equation was built with the significant personality dimensions and psychosocial factors from the previous analysis, the variables representing the time spent on the three internet functions, and the interaction terms between the internet functions and the personality dimensions and psychosocial factors entered simultaneously. From the final model all variables that did not significantly contribute to the prediction if CIU were excluded (removed and re-analyzed). In all equations the variables age, gender, and educational level were entered in Step 1 of the equation to control for the demographic variables. Interactions were defined as the product of two independent variables. To avoid multicollinearity problems, the independent variables were centered before computing the interaction terms in equations with interaction effects involved. Given the large sample size, a stringent test of statistical significance was employed: $p < .0001$, corresponding with $t > 3.90$.

Results

The analyses (Table 1) revealed moderate to high correlations between several of the independent variables; notably the three psychosocial variables depressive symptoms, loneliness, and self-esteem have high intercorrelations (.52 to .60). Furthermore, some of the personality dimensions and psychosocial factors were highly correlated; for example, QBF emotional stability and depressive symptoms (-.61), QBF extraversion and loneliness (-.57), and QBF emotional stability and self-esteem (.52). The correlations between the variables representing the time spent on the three internet functions were relatively low (.07 to .21) indicating that spending much time on one function does not necessarily mean that much time is spent on the other functions also. In addition, the correlation between the CIUS and time spent on the three internet functions was relatively low (.16 to .35) indicating that CIU involves more than merely spending a lot of time on certain internet functions.

In the first regression equation, the five QBF variables were entered in Step 2 of the analyses, while controlling for the demographic variables in Step 1 (ΔR^2 for the demographic variables was .04). All QBF variables except resourcefulness predicted CIU, explaining 13% of variance (ΔR^2 = .13 and total adjusted R^2 including the demographic variables .18). Table 2 shows that emotional stability (β = -.24) was the most important predictor, followed by conscientiousness (β = -.14), agreeableness (β = -.13), and extraversion (β = -.06). The results show that CIU is found more often among people low on emotional stability and to a lesser extent among those low on conscientiousness, agreeableness, and extraversion.

In the second regression equation, the three psychosocial variables (depressive symptoms, loneliness, and self-esteem) were entered in Step 2 of the analyses while controlling for the demographic variables in Step 1. The results (Table 2) show that all three psychosocial variables contributed significantly to the prediction of CIU (ΔR^2 = .23, total adjusted R^2 = .27). Having depressive symptoms (β = .36) was the best predictor, followed by loneliness (β = .14) and self-esteem (β = -.05). These results show that CIU is more common among people with depressive symptoms, and to a lesser extent among those who feel lonely and who have low self-esteem.

In the third regression equation, the personality and psychosocial variables were entered simultaneously to assess the relative importance of the state and trait variables. The results (Table 2) show that adding the QBF personality variables to the psychosocial variables hardly increased the explained variance (ΔR^2 = .24, an increase of .01 compared to the results of equation 2; total adjusted R^2 = .28). Moreover, the betas of the psychosocial variables hardly changed whereas the betas of the QBF personality variables decreased considerably. When the personality and psychosocial variables were combined, depressive symptoms were the best predictor (β = .34), followed by loneliness (β = .15) and conscientiousness (β = -.10).

To explore the moderating effect of the three internet functions, a final regression equation was built with the four QBF personality variables emotional stability, conscientiousness, agreeableness, and extraversion, the two psychosocial variables depressive symptoms and loneliness, the three internet functions, and the interaction terms between the internet functions and the personality and psychosocial variables entered

Table 1 Correlations between dependent and independent variables

	CIUS	QBF Extra version	QBF Agreeableness	QBF Conscientiousness	QBF Emotional stability	QBF resourcefulness	Loneliness	Self-Esteem	Depressive symptoms	Time erotica	Time chatting	Time gaming
CIUS	1											
QBF Extraversion	-.20	1										
QBF Agreeableness	-.23	.39	1									
QBF Conscientiousness	-.21	.04	.24	1								
QBF Emotional Stability	-.31	.44	.23	.08	1							
QBF Resourcefulness	-.11	.28	.45	.18	.12	1						
Loneliness	.32	-.57	-.50	-.09	-.40	-.26	1					
Self-Esteem	-.36	.47	.42	.21	.52	.33	-.58	1				
Depressive symptoms	.44	-.39	-.30	-.15	-.61	-.15	.52	-.60	1			
Time erotica	.16	-.08	-.07	-.06	-.04	.01	.13	-.06	.12	1		
Time chatting	.35	-.00	-.02	-.13	-.09	-.04	-.01	-.13	.09	.07	1	
Time gaming	.23	-.02	-.06	-.12	.01	-.06	.01	-.05	-.01	.09	.21	1

All | r | ≤ .02 are not significant (p < .01)

simultaneously. As before, the demographic variables were entered in Step 1. The results (Table 2) show that the variables representing the time spent on the three internet functions contributed considerably to the prediction of CIU (ΔR^2 = .09), indicating that the amount of time spent on erotica, chatting, and gaming is related to CIU. The relationship within this sample was strongest for chatting (β = .25), followed by gaming (β = .14) and erotica (β = .08). The results also show that the contribution of the interaction terms to the prediction of CIU was very limited (ΔR^2 = .004), with none of the interaction terms reaching significance (data not shown). Therefore, no difference could be shown in the relationship between personality dimensions or psychosocial factors and CIU for the three internet functions. Within the final model, depressive symptoms were shown to be the strongest predictor (β = .31), followed by time spent on chatting (β = .25), loneliness (β = .15), and time spent on gaming (β = .14). The predictive value of the personality trait dimensions in the final model was limited.

Table 2 Results of the regression analyses

Variable	β	t	ΔR^2	Adj. R^2
Equation 0 Controls			.04	.04
- Gender	.06	7.42		
- Age	-.18	-22.95		
- Education	-.07	-9.60		
Equation 1 QBF Personality			.13	.18
- Extraversion	-.06	-7.11		
- Conscientiousness	-.14	-18.72		
- Agreeableness	-.13	-15.31		
- Emotional stability	-.24	-29.56		
- Resourcefulness	.03	3.35		
Equation 2 Psychosocial factors			.23	.27
- Depressive symptoms	.36	41.27		
- Loneliness	.14	15.89		
- Self-esteem	-.05	-5.31		
Equation 3 QBF Personality and psychosocial factors			.24	.28
- Extraversion	.05	5.67		
- Conscientiousness	-.10	-14.54		
- Agreeableness	-.03	-4.10		
- Emotional stability	-.03	-3.90		
- Resourcefulness	.03	3.64		
- Depressive symptoms	.34	35.71		
- Loneliness	.15	15.64		
- Self-esteem	-.03	-3.49		
Final equation			.33	.37
- Extraversion	.04	4.93		
- Conscientiousness	-.08	-11.70		
- Agreeableness	-.04	-5.06		
- Emotional stability	-.04	-5.05		
- Depressive symptoms	.31	36.36		
- Loneliness	.15	17.42		
- Time spent on chatting	.25	37.05		
- Time spent on gaming	.14	22.03		
- Time spent on erotica	.08	12.48		

Discussion

The present study aimed to identify the factors associated with vulnerability for CIU in terms of personality traits and psychosocial state factors, and to explore whether the prediction of CIU in terms of these traits/ states is moderated by the function for which the internet is used (e.g. chatting, gaming, or erotica). Among the Big Five trait dimensions especially emotional stability, and to a lesser extent conscientious- ness and agreeableness, predicted CIU. This is in line with, for example, Danforth (2003) and Yang and colleagues (2005), who also found that the personality dimension emotional stability predicted CIU. Among the three psychosocial factors, particularly depressive symptoms, and to a lesser extent loneliness and self-esteem, predicted CIU. This is in agreement with many other studies that showed a relationship between depressive symptoms and CIU (Caplan, 2002, 2003; Davis et al., 2002; Petrie & Gunn, 1998; Whang et al., 2003; Yang & Tung, 2004; Young & Rodgers, 1998). Interestingly, evaluation of the relative predictive value of the Big Five personality dimensions and the three psychosocial factors showed that the psychosocial factors are much more important for the prediction of CIU than the personality trait factors. More specifically, having depressive symptoms was by far the most important predictor, followed by loneliness and the QBF factor conscientiousness. Apparently, for the prediction of CIU, the state variable depressive symptoms is much more important than the trait variable emotional stability. The conclusions of Danforth (2003) and Yang and colleagues (2005) that the personality feature emotional stability is important in the prediction of CIU, may therefore be explained by the lack of more state-oriented depres- sion measures in their studies. Finally, in line with the remarks of Orford (2005) and our own findings (Meerkerk et al., 2006), chatting, gaming and erotica could be associated with CIU. However, because no differences in predictive value between the three internet functions was found, having depressive symptoms is the most important predictor of CIU, irrespective of whether one uses the internet for chatting, gaming, or searching erotica.

Some limitations of the study should be addressed. The study makes use of a very large data set, gathered through voluntary participation; as such, this convenience sample has no representative value. Nevertheless, because of the large number of respondents the data set is very suitable for correlational analyses, even though the sample consists mainly of adolescents. Finally, because the study is based on self-reports (albeit with guaranteed anonymity) certain questions (especially those concerning erotic intentions) may have been biased because of socially desirable answering tendencies.

The results of the study raise questions about the nature of the relationship between depressive symptoms and CIU. Several hypotheses can be proposed. First, it could be assumed that psychosocial complaints develop as a result of CIU. The problems that may result from CIU with regard to relationships with (offline) friends, family or partner, or at work, together with the perception that one is unable to control the use of the internet, supports the hypothesis that CIU leads to psychosocial complaints. However, on this point research results are contradictory. Supporting this hypothesis is the well-known (but also heavily criticized (Grohol, 1998)) longitudinal Homenet study (Kraut et al., 1998). Kraut and colleagues reported that when people spend increasingly more time on the internet this leads over time to an increase in depressive symptoms and loneliness. However, in a follow-up study a few years later, Kraut and colleagues reported that the negative effects had faded (Kraut et al., 2002). Moreover, Wästlund and colleagues (2001), trying

to replicate the study of Kraut et al., found no support for the hypothesis that internet usage would lead to a reduced psychological wellbeing. Still, a longitudinal study by our group on the relationships between adolescents' online communication and CIU, depression, and loneliness (Eijnden, Meerkerk, Vermulst, Spijkerman, & Engels, submitted), suggested that heavy instant messenger use is associated with increases in depression 6 months later.

A second hypothesis could be that pre-existing psychopathologies (such as depressive symptoms or loneliness) make internet users more vulnerable to the development of CIU. Within this line of reasoning, the specific features of the internet (Cooper, 1998; Orford, 2005; Young et al., 1999) entrap internet users who are vulnerable because of their psychological problems, to monomaniacally pursue instant satisfaction of short-term basic needs as a way to deal with stressors or negative affect (i.e. coping, mood elevation, or affect regulation). Meanwhile procrastination is fostered and more adequate coping behavior directed at long-term goals is hindered. In other words, people experiencing psychological problems may more easily get 'caught in the web' because of the easy way out that the internet offers. Several researchers, e.g. Davis and Caplan (Davis, 2001; Davis et al., 2002); (Caplan, 2002), suggest that pre-existing psychosocial problems, together with associated maladaptive cognitions about the self (self- focused rumination, self-doubt, low self-efficacy, and negative self-appraisals), predispose an individual to develop CIU. The results of the present study, showing that negative personality trait dimensions (particu- larly low emotional stability) predict CIU, also support the hypothesis that CIU is the result of pre-existing psychological problems.

A third hypothesis is that both CIU and psychosocial problems are different manifestations or symptoms of one (underlying) psychological disorder. From this perspective, results from our previous study (Eijnden et al., submitted) indicating that heavy instant messenger use is associated with increases in depressive symptoms (implying that CIU causes psychological problems), and the results of the present study showing that negative personality trait dimensions predict CIU (implying that CIU is the result of psychological problems), may become less contradictory than at first glance. From this perspective, one could hypo- thesize that personality traits like low emotional stability make heavy internet users more vulnerable to develop psychological problems because they try to cope with these problems by using the internet as an easy way out. Although in some instances this strategy may be successful (in the beginning), in other cases the strategy may prove to be (eventually) inadequate and contribute to a further deterioration of the situation; psychological problems and CIU potentiate each other in a circular way.

More (longitudinal) research is needed to further elucidate the relationship between personality, psycho- social wellbeing, and CIU. The importance of this research is stressed by the ever-increasing number of internet users (for figures see, for example, www.internetworldstats.com), the rise of the prevalence of depressive disorders (Hasin, Goodwin, Stinson, & Grant, 2005; Kessler et al., 2003), and the results of the present study which emphasize the central relationship between depressive symptoms and CIU.

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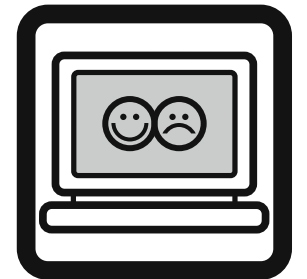
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related

Is Compulsive Internet Use related to Sensitivity to Reward and Punishment, and Impulsivity?

Chapter 7

Is Compulsive Internet Use related to Sensitivity to Reward and Punishment, and Impulsivity?

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and Impulsivity?

Abstract

Aim of the present study was to examine whether the personality correlates sensitivity to reward and to punishment, and impulsivity predict compulsive internet use (CIU). Furthermore, the predictive value of these personality correlates was compared to the predictive value of factors relating to psychosocial wellbeing. The results showed that particularly rash spontaneous impulsivity predicts CIU and that this personality factor is more important than psychosocial wellbeing factors. Sensitivity to reward, which is supposed to play a role in craving processes associated with substance abuse and eating disorders, could not be related to CIU. The data suggest that internet users who are characterized by an impulsive personality feature, are less able to control their use of the internet, which makes them more vulnerable to develop CIU.

Introduction

From a behaviorist point of view, the internet can be seen as a giant web of individually tailored Skinner boxes where the behavior of its users is reinforced through classical and operant conditioning mechanisms. Through positive intermittent reinforcement, the behavior is gradually shaped and the user becomes increasingly skilled to find stimuli on the internet that suits and pleases him or her most. The behavior resembles, in this regard, short-odds continuous gambling practices. These conditioning mechanisms have been described as an explanation for compulsive online sexual behavior (Putnam, 2000)

and compulsive online gaming (Yee, 2001), but may be applicable more generally to compulsive online behavior, because practically all internet users can find rewarding stimuli on the internet. The crux of compulsive internet use (CIU) may even, in part, be found in the vast variety of instantly rewarding stimuli that easily, in abundance, and at no or low cost, can be found online (see also Orford (2005), Cooper (1998), Young and colleagues (1999), and Meerkerk and colleagues (submitted) for a description of the unique factors that make the internet highly entrapping). Although these rewarding stimuli are ubiquitous on the internet and the majority of the population in industrialized countries has access to the internet (for example, almost 80% of the Dutch households has internet access; www.cbs.nl), only a small minority of internet users develops compulsive online behavior (Meerkerk, Eijnden, & Garretsen, submitted). Apparently, there are individual differences in the vulnerability to develop CIU.

The literature on CIU (or internet addiction, as it is sometimes referred to, see for a discussion e.g. Holden (2001), Mitchell (2000) and Orford (2005)) suggests that individual differences in the vulnerability to develop CIU can, at least in part, be explained by factors indicating low psychosocial wellbeing such as depression, low self-esteem, and loneliness (Caplan, 2002; Davis, Flett, & Besser, 2002; Meerkerk, Van den Eijnden et al., submitted; Whang, Lee, & Chang, 2003; Yang & Tung, 2004; K. Young & R. Rodgers, 1998). The causal nature of the relationship between low psychosocial wellbeing and CIU, however, still needs further clarification (Davis, 2001; Meerkerk, Van den Eijnden et al., submitted). In addition, individual differences in the vulnerability to develop CIU might be related to personality. Research into the relationship between personality and CIU is still relatively sparse (see also Meerkerk et al. (submitted)), although some studies including a Big Five personality questionnaire (Danforth, 2003; Engelberg & Sjoberg, 2004) or the 16-Factor Personality Questionnaire (Yang, Choe, Baity, Lee, & Cho, 2005; K. S. Young & R. C. Rodgers, 1998) showed that emotionally less stable personalities seem to be more vulnerable to develop CIU.

An unreclaimed theoretical perspective that may explain individual differences in the vulnerability to develop and maintain CIU is Gray's neuropsychological reinforcement sensitivity theory of personality (RST) (Gray, 1987; Gray, 1991). As far as we know, this perspective has not yet received any attention in the literature on CIU, although it provides an interesting and promising viewpoint. In brief, Gray's original RST postulated anxiety and impulsivity as the two basic and independent biologically-based dimensions in motivation and personality. These dimensions reflect the functioning of two brain systems that regulate approach and withdrawal/avoidance behavior in response to environmental stimuli. The behavioral inhibition system (BIS) reacts in response to stimuli of punishment or termination of reward, and evokes feelings of fear (negative affect) and withdrawal/avoidance behavior. The behavioral activation (or approach) system (BAS) reacts in response to stimuli of reward or termination of punishment and evokes positive affect and approach behavior. According to RST, differences in personality reflect differences in the sensitivity to punishment and reward (BIS and BAS, respectively) (Corr, 2004; Dawe & Loxton, 2004).

Originally, Gray hypothesized that both sensitivity to punishment and sensitivity to reward (Gray labeled the latter "impulsivity") are one-dimensional traits. With regard to sensitivity to punishment there is considerable agreement (Franken & Muris, in press-b) that this is indeed a one-dimensional trait, characterized by fear and anxiety, and conceptually near to neuroticism (Jorm et al., 1999). Sensitivity to

reward or impulsivity, on the other hand, seems to be at least bi-dimensional. Subsequent authors have made a distinction between reward sensitivity and impulsivity (Dawe, Gullo, & Loxton, 2004; Dawe & Loxton, 2004; Franken & Muris, in press-b; Smillie & Jackson, in press). Impulsivity, according to these authors, is related to rash and spontaneous behavior without thinking of risks or future consequences, and includes constructs such as novelty seeking, sensation seeking, behavioral undercontrol and disinhibition. Sensitivity to reward or drive, on the other hand, does not necessarily imply rash and spontaneous behavior but is a more deliberate and goal-directed approach behavior. In short, there is consensus that sensitivity to punishment is a one-dimensional construct (conceptually near to neuroticism), but that impulsivity is at least bi-dimensional, pertaining to reward sensitivity or drive on the one hand, and rash spontaneous impulsivity on the other.

Various forms of addictive behavior have been related to impulsivity and reward sensitivity measures, notably alcohol and drug abuse (see for an overview Dawe et al. (2004)) and eating disorders (Loxton & Dawe, 2001). Dawe and Loxton (2004) argue that the two impulsivity-related components reward sensitivity or drive, and rash spontaneous impulsiveness should be considered in both the explanation of the development and the maintenance of addictive behavior. They hypothesize that "reward sensitivity/drive plays a role in cued-cravings and motivation to use drugs, but that rash spontaneous impulsiveness influences actual drug-taking behavior and the inability to discontinue use in light of negative consequences." (p.347). The conjunction of heightened reward sensitivity and rash spontaneous impulsivity leads in this model to drug abuse and dependence (Dawe et al., 2004).

The model described above leads to several assumptions when applied to internet behavior and CIU. First, the internet offers an enormous variety of sometimes highly rewarding stimuli that can be obtained by simply clicking a button. Therefore, we expect that, compared to people low in sensitivity to reward, high sensitive individuals will engage more in reward-seeking behavior on the internet. Consequently, we expect a positive association between CIU and reward sensitivity (hypothesis 1). In addition, once online, it is easy to repetitively find rewarding stimuli and internet users can administer themselves endless arrays of individually-tailored rewarding stimuli. Because one of the most characteristic problems of people suffering from CIU is spending more time online than intended (i.e. they are unable to control the use of the internet), we also expect a positive association between CIU and impulsivity (hypothesis 2). Several studies have shown an association between CIU and the personality factor emotional stability or neuroticism (Danforth, 2003; Meerkerk, Van den Eijnden et al., submitted; Yang et al., 2005) and between CIU and factors indicating low psychosocial wellbeing (Caplan, 2002; Davis et al., 2002; Meerkerk, Van den Eijnden et al., submitted; Whang et al., 2003; Yang & Tung, 2004; K. Young & R. Rodgers, 1998). Because psychosocial wellbeing is conceptually linked to neuroticism and emotional stability, and because sensitivity to punishment is related to neuroticism and emotional stability, we expect a positive association between sensitivity to punishment and CIU (hypothesis 3). Finally, the hypothesized associations may be moderated by the specific function for which the internet is used, or by the level of psychosocial wellbeing. Therefore, the moderating effects of the three main risky internet functions (i.e. gaming, chatting and searching online erotica (Meerkerk, Eijnden, & Garretsen, 2006; Orford, 2005)), and the moderating effects of significant psychosocial wellbeing variables will be examined.

In summary, the present study examines whether the constructs of sensitivity to punishment and to reward, and impulsivity can contribute to the explanation of individual differences in the vulnerability to develop CIU. It is hypothesized that high levels of reward and punishment sensitivity and high levels of rash spontaneous impulsivity are associated with CIU. Moreover, since earlier studies reported psychosocial wellbeing to be an important predictor of CIU, it is tested whether sensitivity to punishment and reward, and impulsivity contribute more to the prediction of CIU than factors related to psychosocial wellbeing.

Methods

Procedure
Data for the study were gathered by means of an online survey, carried out among a sample of 'heavy users'. From an existing online panel (http://www.opinieland.nl), respondents were selected who a) were at least 18 years old, b) had internet access at home for at least one year, and c) spent on average at least 16 hours per week on the internet for private purposes (information about the time spent online was known from previous surveys). The latter criterion was included to ensure that the sample contained enough compulsive internet users for useful statistical analyses, reasoning that the prevalence of CIU is higher among internet users who spent much time online. Respondents participated in a sweepstake and supported charitable organizations as a reward for participation in the study.

Instruments
Besides the instruments to assess CIU, sensitivity to punishment and reward, and impulsivity (which are discussed below) the online questionnaire contained demographic variables (age, gender, and education) and variables related to internet usage. Respondents were asked to specify the amount of time (average number of hours per online day and average number of days online per week) spent online in general. Based on these quantity/frequency figures, the average number of hours per week online was calculated. In addition, respondents were asked to specify the amount of time in hours per week spent on 12 specific internet functions, namely: email, searching information, surfing, gaming, chatting, reading or participating in a forum, buying through the internet, gambling on the internet, downloading music, videos or software, searching erotica, Usenet, and dating.

The Compulsive Internet Use Scale (CIUS (Meerkerk, Eijnden, Vermulst, & Garretsen, submitted)) was used to measure CIU. The CIUS consists of 14 items (see Appendix) on a 5-point Likert scale ("Never" to "Very often") and has a high internal consistency (Cronbach's alpha in the current sample = .89). The scale taps on loss of control, preoccupation, withdrawal symptoms, coping, and conflict with regard to the use of the internet. Sample items are 'How often do you find it difficult to stop using the internet when you are online?' and 'How often do you feel restless, frustrated or irritated when you cannot use the internet?' (for more details see Meerkerk, Eijnden, Vermulst et al. (submitted)).

We used a validated Dutch version of the BIS/BAS scales (Franken, Muris, & Rassin, 2005) to assess reward and punishment sensitivity. The BIS/BAS consists of 20 items (+ 4 filler items) (4-point Likert scale, "totally agree" to "totally disagree") and contains the Behavioral Inhibition Scale (BIS, 7 items) and the Behavioral Approach System Scale (BAS, 13 items). The latter scale can be subdivided in 3 subscales: Fun Seeking

(BAS-fun, 4 items), Reward Responsiveness (BAS-reward, 5 items), and Drive (BAS-drive, 4 items). Sample items are: 'If I think something unpleasant is going to happen, I usually get pretty "worked up"' (BIS), 'When I get something I want, I feel excited and energized' (BAS-reward), 'When I want something, I usually go all out to get it' (BAS-drive), and, 'I crave excitement and new sensations' (BAS-fun). Cronbach's alpha in the current sample of the BIS scale was .79, of the BAS-fun scale .57, of the BAS-reward scale .65, and of the BAS-drive scale .70.

A revised version (Franken et al., 2005) of a Dutch translation (Claes, Vertommen, & Braspenning, 2000) of the Dickman Impulsivity Inventory (DII) (Dickman, 1990) assessed impulsivity. The DII consists of 23 dichotomous ("yes" "no") items and contains the subscale functional impulsivity (11 items, Cronbach's alpha in the current sample = .82) and the subscale dysfunctional impulsivity (12 items, Cronbach's alpha = .81). Sample items are: 'I feel uncomfortable when I have to make a quick decision' (DII functional impulsivity, reversed item) and 'I often say and do things without considering the consequences' (DII dysfunctional impulsivity).

Psychosocial wellbeing was represented by the scales loneliness (Russell, Peplau, & Cutrona, 1980), life satisfaction (Pavot & Diener, 1993), depressive symptoms (Kandel & Davies, 1982, 1986), and self-esteem (Rosenberg, 1989). The scales were highly intercorrelated (between .54 and .68, p < .01, see Table 1) and had, in the current sample, high internal consistencies; Cronbach's alpha for loneliness was .88, for life satisfaction .89, for depressive symptoms .86, and for self-esteem .90. Sample items are: 'I feel left out' (loneliness), 'I am satisfied with my life' (life satisfaction), 'Felt unhappy, sad, or depressed' (depressive symptoms), and 'I wish I could have more respect for myself' (self-esteem, reversed item).

Participants
The sample contained 304 respondents aged 19 to 78 years (M = 40.4, SD = 12.3). Males and females were equally well represented with 49.3% (n = 150) and 50.7% (n = 154), respectively. A total of 15% had lower educational training, 42% middle, and 42% higher educational training. Respondents spent on average 24.9 hours per week (SD = 13.2) on the internet for private purposes, mostly on e-mail, searching information, and surfing.

Statistical analyses
First, simple Pearson correlation coefficients were calculated between internet use, psychosocial wellbeing, and personality variables. Next, the predictive value of the independent variables was determined by means of linear regression analyses with CIU as dependent variable, using Method Enter. Because of the sometimes high intercorrelations between the independent variables and the exploratory nature of the current study, some of the analyses were repeated using Method Stepwise to reveal the best predictor. First, a regression equation was built with the sensitivity to reward and punishment scales; second, a regression equation was built with the impulsivity scales; and third a regression equation was built with the four variables relating to psychosocial wellbeing. Next, the significant terms of the previous analyses were entered simultaneously in a regression equation. Finally, to examine the moderating effects of specific internet functions and of psychosocial wellbeing on the relationship between CIU and sensitivity to reward

and punishment and impulsivity, a regression equation was built including the interaction terms with time spent on gaming, chatting and searching online erotica, and psychosocial wellbeing.
In all equations the variables age, gender, and educational level were entered in the first step of the equation to control for demographic variables. Interactions were defined as the product of two independent variables. To avoid multicollinearity problems, the independent variables were centered (valuecentered = valueoriginal - mean) before computing the interaction terms in equations with interaction effects involved.

Results

Correlation analyses Pearson correlation analyses (Table 1) revealed clear correlations between the dependent variable CIU and the independent variables sensitivity to punishment (BIS) and both impulsivity scales. Reward sensitivity (BAS) appeared to correlate less strong to CIU; BAS-reward and BAS-fun were weakly correlated and BAS-drive was not correlated to CIU. The correlations among the independent variables were as expected from previous studies. Specifically, functional and dysfunctional impulsivity were uncorrelated, as were sensitivity to reward and sensitivity to punishment, except BIS and BAS-reward, which showed a moderate positive correlation. Furthermore, sensitivity to punishment (BIS) showed a clear negative correlation with functional impulsivity and a positive correlation with dysfunctional impulsivity. BAS-drive was mainly correlated with functional impulsivity and BAS-fun mainly with dysfunctional impulsivity. The three BAS-subscales showed high intercorrelations. Finally, the scales relating to psychosocial wellbeing (especially depressive symptoms and self-esteem) correlated clearly with sensitivity to punishment (BIS) and both impulsivity scales (particularly functional impulsivity), and much lower to sensitivity to reward (BAS).

Predictive value of the sensitivity to reward and punishment scales The first regression equation explored the predictive value of the sensitivity to reward and punishment scales (BIS/BAS). The demographic variables appeared not to predict CIU (Table 2, equation 0). The results (Table 2, equation 1a) showed a clear relationship between sensitivity to punishment (BIS) and CIU (β = .25), but no significant results for the sensitivity to reward (BAS) subscales. Because of the high intercorrelations between the three BAS subscales, the analysis was repeated using Method Stepwise. The results of this analysis (Table 2, equation 1b) revealed that, besides sensitivity to punishment (BIS), also BAS-fun predicted CIU (βBAS-fun = .12). However, the contribution of the sensitivity to reward and punishment scales (BIS/BAS) to the explanation of CIU was limited (adj. R^2 = .06).

Predictive value of impulsivity scales The second regression equation explored the predictive value of the two impulsivity scales (functional and dysfunctional impulsivity). The results (Table 2, equation 2) showed that both scales clearly contributed to the explanation of CIU (βfunctional impuls. = -.26, βdysfunctional impuls. = .26, adj. R^2 = .13).

Predictive value of the psychosocial wellbeing scales The four psychosocial wellbeing scales (loneliness, life satisfaction, depressive symptoms and self-esteem) were entered in the third regression equation. The results (Table 2, equation 3a) showed that the psychosocial wellbeing variables contributed to the

explanation of CIU (adj. R^2 = .08), but that only self-esteem reached significance (β = -.17). Because of the high intercorrelations between the psychosocial wellbeing scales, the analysis was repeated using Method Stepwise to determine the most important predictor. The results (Table 2, equation 3b) confirmed that self-esteem was the best predictor of CIU (β = -.29).

Predictive value of the significant results entered simultaneously Next, the significant results of the previous analyses (BIS and BAS-fun, functional and dysfunctional impulsivity, and self-esteem) were entered simultaneously in a regression equation. The results (Table 2, equation 4a) revealed relationships between CIU and both impulsivity scales and self-esteem. Sensitivity to punishment (BIS) and sensitivity to reward (BAS-fun) did not reach significance. The analysis was again repeated using Method Stepwise revealing the final regression equation (Table 2, equation 4b). Equation 4b makes clear that CIU is predicted by dysfunctional impulsivity (β = .23), functional impulsivity (β = -.19), and self-esteem (β = -.14). Note that the combination of the impulsivity scales and self-esteem hardly increased the explained variance in CIU, in comparison to the equation with only both impulsivity scales (R^2 = .14 and R^2 = .13, respectively). However, the three variables did seem to contribute uniquely to the explanation of variance in CIU. Predictive value of the interaction terms In a final analysis, interaction terms between both impulsivity scales and self-esteem, and between both impulsivity scales and time spent on the internet functions chatting, gaming, and erotica were calculated and entered in two regression analyses. The results (data not shown) did not reveal a significant contribution of one of the interaction terms.

Table 1 Correlations between internet use variables, psychosocial wellbeing, and personality variables.

		1	2	3	4	5	6	7	8	9	10	11	12	13
1	CIUS	1												
2	Internet hours/week	,289(**)	1											
3	Loneliness	,241(**)	,047	1										
4	Life satisfaction	-,259(**)	-,129(*)	-,537(**)	1									
5	Depressive symptoms	,295(**)	,089	,550(**)	-,560(**)	1								
6	Self-esteem	-,313(**)	-,108	-,617(**)	,559(**)	-,675(**)	1							
7	BIS	,269(**)	,044	,321(**)	-,268(**)	,548(**)	-,549(**)	1						
8	BAS reward	,117(*)	,004	-,227(**)	,089	,022	,069	,203(**)	1					
9	BAS drive	,101	-,030	-,172(**)	,118(*)	-,087	,116(*)	-,112	,447(**)	1				
10	BAS fun	,176(**)	,061	-,028	-,084	,062	-,049	,058	,431(**)	,464(**)	1			
11	BAS total	,164(**)	,013	-,179(**)	,054	-,005	,060	,055	,776(**)	,818(**)	,790(**)	1		
12	Funct. Impulsivity	-,252(**)	-,048	-,425(**)	,295(**)	-,432(**)	,506(**)	-,398(**)	,075	,245(**)	,167(**)	,208(**)	1	
13	Dysfunct. Impulsivity	,308(**)	,071	,147(*)	-,153(**)	,238(**)	-,286(**)	,242(**)	,100	,151(**)	,374(**)	,261(**)	-,057	1

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed). N=304

Table 2 Predictors of compulsive internet use (regression analyses)

Variable	β	t	Adj. R^2
Equation 0 Controls			.00
- Gender	.05	.87	
- Age	-.08	-1.36	
- Education	-.04	-.76	
Equation 1a Sensitivity to reward and punishment (BIS/BAS)			.06
- BIS	.25	4.10a	
- BAS-reward	-.05	-.69	
- BAS-drive	.07	1.05	
- BAS-fun	.10	1.57	
Equation 1b Sensitivity to reward and punishment (BIS/BAS)			.06
- BIS	.23	3.97a	
- BAS-fun	.12	2.05c	
Equation 2 Impulsivity			.13
- Functional impulsivity	-.26	-4.66a	
- Dysfunctional impulsivity	.26	4.78a	
Equation 3a Psychosocial wellbeing			.08
- Loneliness	.10	1.26	
- Life satisfaction	-.01	-.15	
- Depressive symptoms	.08	.93	
- Self-esteem	-.17	-1.97c	
Equation 3b Psychosocial wellbeing			.08
- Self-esteem	-.29	-5.14a	
Equation 4a Sensitivity to reward and punishment (BIS/BAS), Impulsivity and psychosocial wellbeing			.15
- BIS	.04	.67	
- BAS-fun	.10	1.65	
- Functional impulsivity	-.20	-2.99b	
- Dysfunctional impulsivity	.19	3.18b	
- Self-esteem	-.12	-1.66c	
Equation 4b Final equation			.14
- Functional impulsivity	-.19	-2.94b	
- Dysfunctional impulsivity	.23	4.09a	
- Self-esteem	-.14	-2.09c	

*) p < .05   **) p < .01   ***) p < .001
χ^2 (143) = 325.05, p = .000, RMSEA = .044, CFI = .972

Discussion

Aim of the current study was to explore whether the constructs sensitivity to reward and to punishment, and impulsivity explain individual differences in the vulnerability to develop CIU, and to compare the predictive value of these constructs to the predictive value of factors related to psychosocial wellbeing. Functional and dysfunctional impulsivity, as measured by the DII (Dickman, 1990), appeared to have a substantial predictive value and confirmed our second hypothesis that individuals with heightened rash spontaneous impulsivity (as measured by the subscale dysfunctional impulsivity) have a higher chance to use the internet compulsively, as compared to individuals scoring lower on rash spontaneous impulsivity. The relationship between rash spontaneous impulsivity and CIU appeared not to be influenced by specific internet functions, nor by psychosocial wellbeing.

In contrast, sensitivity to reward (BAS) did not clearly predict CIU, although a minor effect of the BAS subscale Fun Seeking was found. BAS Fun Seeking has been reported to be correlated to measures of substance use and abuse (Franken & Muris, in press-a; Jorm et al., 1999; Loxton & Dawe, 2001); however, the predictive value of BAS Fun Seeking appeared limited within the current study. Apparently, CIU is not robustly related to reward sensitivity and our first hypothesis is therefore not confirmed.
The third hypothesis that high sensitivity to punishment (BIS) predicts CIU was confirmed in the present study. This result is not surprising given the results of previous studies indicating a relationship between the personality dimension emotional stability and low psychosocial wellbeing on the one hand and CIU on the other (Caplan, 2002; Danforth, 2003; Davis et al., 2002; Meerkerk, Van den Eijnden et al., submitted; Whang et al., 2003; Yang et al., 2005; Yang & Tung, 2004; K. Young & R. Rodgers, 1998). Both emotional stability and psychosocial wellbeing are linked to neuroticism, which is conceptually similar to sensitivity to punishment (Jorm et al., 1999).

In addition, the current study again confirmed the relationship between psychosocial wellbeing and CIU found in previous studies. More specifically, individuals with low self-esteem have a higher chance to show signs of CIU as compared to individuals with high self-esteem. However, the predictive value of psycho-social wellbeing was smaller than in a previous study by our research group (Meerkerk, Van den Eijnden et al., submitted). In that study more than 20% of variance in CIU was explained by psychosocial wellbeing factors, while in the current study only 8% was explained. Moreover, impulsivity appeared to be more important for the prediction of CIU than psychosocial wellbeing.

Overall, dysfunctional and functional impulsivity appeared to be good predictors of CIU. To interpret these results, we first take a closer look at the concepts of dysfunctional and functional impulsivity. According to Smillie and Jackson (in press), functional impulsivity is conceptually similar to sensitivity to reward. Reward sensitivity, in their view, is characterized not only by a heightened sensitivity to rewarding stimuli, but also by a diminished behavioral inhibition. This implies a negative correlation between functional impulsivity and the behavioral inhibition correlates (BIS), which is indeed found in the present study, and is in concordance with the findings of, for example, Franken and Muris (in press), who found functional impulsivity to be the opposite of BIS. This reasoning also explains why the previously found effect of the sensitivity to punishment (BIS) measure was excluded when the functional impulsivity measure was

also included in the equation. In short, functional impulsivity may reflect heightened reward sensitivity in combination with lowered sensitivity to punishment. Dysfunctional impulsivity, on the other hand, represents impulsivity in its common conceptualization; that is, rash spontaneous impulsive behavior disregarding consequences, and can largely be distinguished from measures of reward sensitivity (Franken & Muris, in press-b; Smillie & Jackson, in press).

Dawe and Loxton (2004) proposed a model to explain the vulnerability to binge eating disorders including rash spontaneous impulsivity and reward sensitivity. Heightened reward sensitivity is supposed to play a role in the initiation of binge cravings, and rash spontaneous impulsivity contributes to the actual disin-hibited behavior and loss of control during a binge episode. The results of the present study only partially confirm this explanation for CIU. The results show a positive relationship between rash spontaneous impulsivity and CIU, reflecting the difficulty many compulsive internet users have to control their use of the internet. On the other hand, the results did not show a positive relationship between reward sensitivity and CIU. However, we did not explicitly investigate CIU-related cravings, which prohibit speculations about the relationship between reward sensitivity and CIU-related cravings. Nevertheless, since impulsivity may be regarded as a relatively stable personality trait, the results suggest that heightened impulsivity reflects a vulnerability to develop CIU.

A limitation of the present study is that, although the impulsivity measures appeared to be the best predictor of CIU, the variance explained by the impulsivity measures is moderate (about 13%). Another limitation is that we had no measure of internet-related craving. This would have allowed us to examine the suggestion that reward sensitivity would be related to internet-related craving (Dawe & Loxton, 2004). A further limitation of the study may be found in the relatively low reliability of the sensitivity to punish-ment and reward scales, which had rather low Cronbach's alphas in the present sample.

In sum, the present study showed that the concept of rash spontaneous impulsivity adds to the explanation and understanding of CIU. It seems that individuals with heightened impulsivity are more vulnerable to develop CIU; i.e. they are less able to resist the impulse to continue clicking the next button, even when aware of negative consequences. The sensitivity to reward component, which causes cue-elicited craving in substance abusers, does not seem to play an important role with regard to CIU. This may explain why the complaints of compulsive internet users are dominated by complaints about loss of control; i.e. using the internet longer than intended. It may be that CIU can best be characterized as an impulse control disorder instead of a compulsion. However, further longitudinal research is needed to explore the role of impulsivity and sensitivity to punishment and reward in predicting the development of CIU.

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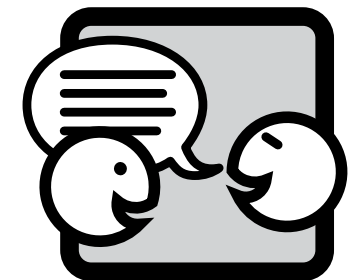
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chapter 8

summary

Summary, discussion and conclusion

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Introduction

The legitimacy and validity of the newly emerged diagnosis 'internet addiction' (Young, 1998) is still controversial (Davis, 2001b; Griffiths, 1998, 1999; Grohol, 1995; Holden, 2001; Hughey, 1997; Mitchell, 2000; Morahan Martin, 2005; Orzack, 1998; Shaffer, 2002; Shaffer, Hall, & Vander Bilt, 2000). However, anecdotal reports have made clear that there are internet users who have become overly attached to the use of certain internet applications, resulting in psychological, social and professional impairment (Griffiths, 2000a; Hall & Parsons, 2001; Orzack & Orzack, 1999; Sattar & Ramaswamy, 2004; Stein, Black, Shapira, & Spitzer, 2001; Young, 1996). Although there are aspects of this kind of online behavior that are different from the traditional view of addiction (e.g. there are no physical withdrawal symptoms), it can be argued that internet addiction, or compulsive internet use (CIU) as we prefer to call it, has many similarities with substance abuse and pathological gambling according to the DSM-IV criteria (APA, 1995). For example, compulsive internet users have been reported to frequently stay online longer than intended, to continue their online behavior despite knowledge of problems caused or aggravated by the use of the internet (Young, 1996), and to have unsuccessfully tried to decrease the time spent on the internet (Sattar & Ramaswamy, 2004).

The present thesis presents the results of a series of studies on CIU. These studies elaborated on earlier research conducted at the IVO, which started in 2001 (Meerkerk, Laluan, & Eijnden, 2003). Aims of the present studies were:

1. To develop and validate an instrument to assess the severity of CIU
2. To estimate the prevalence of CIU in the Netherlands and to assess the stability of CIU over time
3. To assess the association between CIU and the use of various internet functions. In other words, to assess the addictive potential of various internet functions
4. To study the relationship between internet use, CIU, and psychosocial wellbeing
5. To study aspects of personality that are related to the vulnerability to develop CIU.

In the following, the results of the studies on CIU are briefly summarized and concise answers to the research questions mentioned above are given.

Summary of main findings

Development and validation of an instrument to assess compulsive internet use (Chapter 2)
In order to assess the prevalence of CIU, or to determine the relationship between CIU and personality or psychosocial correlates, it is necessary to have an instrument that is capable of quantifying the severity of CIU. Due to the short history of the phenomenon of CIU and the initial skepticism among researchers, at the starting point of this research only few instruments were available and none of them had been translated into the Dutch language. Moreover, these existing instruments were generally not validated or tested in general populations, or were simply too long for administration in an online setting in combination with other measures. Therefore, it was decided to develop a new, short and easy to administer questionnaire, based on the criteria for substance abuse and pathological gambling of the DSM-IV (APA, 1995), the criteria for behavioral addiction as described by Griffiths (Griffiths, 1999), and the insights gained through interviews with self-declared 'internet addicts' (Meerkerk et al., 2003).
The newly developed Compulsive Internet Use Scale (CIUS, see Appendix) contains 14 items rated on a 5-point Likert scale. The items tap on loss of control (spending more time online than intended and unsuccessful efforts to diminish use of the internet), preoccupation (thinking of the internet even when not online and preferring internet use above other activities), withdrawal symptoms (feelings of restlessness and agitation when unable to go online), coping or mood modification (using the internet to relieve negative affective states), and conflict (conflicts with important others because of internet use, and feelings of guilt and remorse).

The one-factor structure of the CIUS was tested in three different samples and showed factorial invariance across time, gender, age, and heavy versus non-heavy internet use. Moreover, the CIUS proved to be highly internal consistent (Cronbach's alpha ↓ 0.90) and (convergent) validity was demonstrated by high correlations with another instrument to measure CIU: the well-documented and validated OCS (Davis, Flett, & Besser, 2002), notably the OCS subscale Diminished impulse control. These results indicate that the CIUS is a stable and reliable instrument to measure CIU, which makes it a useful instrument for further study of the phenomenon.

Prevalence of compulsive internet use in the Netherlands and the stability of compulsive internet use over time (Chapter 3)
The first deployment of the newly developed instrument was the assessment of the prevalence of CIU in the Netherlands. This prevalence study was conducted in a longitudinal setting, thereby enabling some (precautionary) conclusions with regard to the chronicity of CIU.
Of utmost importance for the reliability of the assessment of the prevalence of CIU is the validity of the cut-off point and the representativeness of the sample. For the establishment of a cut-off point, it is important to realize that CIU is not an 'all or nothing' phenomenon; a relatively large group of internet users will exhibit minor symptoms of CIU, and a smaller group will show more severe signs of CIU. The prevalence of CIU is therefore dependent on what is considered severe symptoms and will always, to some extent, be arbitrary. For the present study, internet use was labeled compulsive if the symptoms, tapped on in the 14 items of the CIUS, are experienced on average more often than 'sometimes'. In our view, this indicates that the internet dominates the life of the user and that normal life is disrupted.

The study sample was compiled by selecting respondents from a large online panel who were at least 18 years old and used the internet for private purposes at least 16 hours per week. By restricting the sample to these so-called heavy users, it was ensured that the sample contained enough compulsive internet users for useful statistical analyses, reasoning that the prevalence of CIU is higher among internet users who spent much time online. Furthermore, internet users who would report internet-related complaints on the CIUS but use the internet infrequently, were excluded from the sample by employing this time criterion. The sample was stratified for age, gender, and educational level, in order to make the sample representative for the Dutch internet using population who meet the inclusion criteria. The same respondents were approached again one year later to assess the course of CIU. A weight factor was construed to counteract non-response bias.

The results of the study show that about 7% of the study population suffers from CIU. Assuming that the sample is representative for the Dutch heavy users of the internet, the figure can be extrapolated to the general Dutch internet-using population resulting in a prevalence of CIU of about 1%, which corresponds with about 67,500 compulsive internet users in the Netherlands (in the year 2003). The second measurement one year later revealed that more than half of the compulsive internet users of the first measurement were also compulsive users at the second measurement, suggesting that for more than half of the compulsive internet users CIU is a chronic condition.

Addictive potential of various internet applications (Chapter 4)

Not all internet functions appear to have addictive qualities. For example, several studies have found indications that internet functions involving social interaction (computer mediated communication, CMC) bear the largest addictive risk (Caplan, 2002; Chou & Hsiao, 2000; Li & Chung, 2004; Ward, 2001; Young, 1998). Others suggest that online erotica may be addictive (Cooper, Scherer, Boies, & Gordon, 1999; Griffiths, 2004; Stein et al., 2001). Aim of the present study was to compare the addictive risk of various internet functions among adults.

The relative addictive risk of various internet functions was assessed by relating, both cross-sectionally as well as longitudinally, the amount of time spent on various internet functions to the severity of CIU among a sample of adult internet users. Cross-sectional analyses showed a relationship between CIU and the amount of time spent on gaming, searching for online erotica, and chatting. Apparently, people who spend a lot of time on gaming, erotica, or chatting, have a higher chance to use the internet compulsively. Longitudinal analyses were partially in line with these results; people who spent a lot of time on searching online erotica at the first measurement appeared to have a higher chance to use the internet compulsively one year later. Searching online erotica, therefore, appears to have the largest addictive potential among adult internet users. The addictive qualities of internet functions involving gaming and chatting could longitudinally not be replicated.

Online communication, compulsive internet use, and psychosocial wellbeing among adolescents (Chapter 5)

Internet use is particularly widespread among adolescents. For many youngsters, the instant messenger (IM) has become the favorite communication technology. However, as stated before, internet functions involving social interaction are suggested to have a relatively strong addictive potential. In addition, it has been suggested that online communication may have an adverse effect on offline communication with family members and close friends, thereby increasing feelings of loneliness and depression: the social displacement hypothesis (Kraut et al., 1998). Aim of the present study was to investigate the relationship between various internet applications, among which online communication functions, and CIU among adolescents. Moreover, the aim of the study was to investigate the relationship between online communication and psychosocial wellbeing.

These relationships were examined by means of a longitudinal study among 660 pupils aged 12 to 15 years. Firstly, the results show that frequent IM use and frequent chatting in chat rooms longitudinally predict CIU, indicating that adolescents who frequently engage in instant messaging and chatting have a higher incidence of CIU six months later. Because the predictive power of instant messaging and chatting was tested together with other internet functions (such as gaming, surfing, and downloading), the results confirm findings of previous studies that especially internet functions involving social communication bear a relatively large addiction risk. Secondly, the results show that frequent IM use is longitudinally related to depressive symptoms, indicating that adolescents who spent much time communicating via instant messengers, showed a higher incidence of depressive symptoms six months later. Thirdly, loneliness was longitudinally associated with a decrease in IM use. Thus, lonely adolescents appeared to use IM to a lesser extent six months later, which refutes the idea that lonely youths may particularly benefit from the advantages of IM.

Personality, psychosocial wellbeing, and compulsive internet use (Chapter 6)

Although the majority of the population in the industrialized world has access to the internet (http://www.internetworldstats.com), only a small minority of internet users appears to develop CIU. Apparently there are individual differences in the vulnerability to develop CIU. Previous studies have shown that CIU is correlated with various indicators of psychosocial wellbeing such as self-esteem, depression and loneliness (Armstrong, Phillips, & Saling, 2000; Caplan, 2002; Yang & Tung, 2004), and with personality measures such as emotional stability (Danforth, 2003; Yang, Choe, Baity, Lee, & Cho, 2005). These findings suggest that the vulnerability to CIU is related to low psychosocial wellbeing and low emotional stability. Aim of the present study was to test this assumption by identifying personality factors (in terms of the Big Five personality dimensions) and indicators of psychosocial wellbeing (loneliness, self-esteem, and depressive symptoms) that are related to CIU.

This cross-sectional study made use of a large convenience sample of 17,000 participants and confirmed the results found in the literature. Of the five personality dimensions, especially low emotional stability correlated with CIU, and of the psychosocial wellbeing indicators, especially having depressive symptoms correlated with CIU. Analyses in which both personality and psychosocial wellbeing factors were combined, showed that the association between CIU and psychosocial wellbeing was much larger than the association between CIU and personality. Although these concepts are related, low psychosocial wellbeing state factors

are apparently more important than personality traits (such as low emotional stability) when it comes to vulnerability to CIU.

Compulsive internet use and sensitivity to punishment and reward, and impulsivity (Chapter 7)
Several studies have shown a relationship between sensitivity to reward and impulsivity on the one hand, and problematic alcohol use, drug use, and eating disorders on the other hand. It is hypothesized that high reward sensitivity plays a role in craving and motivation to use drugs, and that impulsivity plays a role in the uncontrolled use of drugs (Dawe, Gullo, & Loxton, 2004; Dawe & Loxton, 2004). Because the internet is a continuous and almost infinite source of rewarding stimuli, it was hypothesized that compulsive internet users would be more sensitive to reward and be more impulsive than non-compulsive internet users. Furthermore, sensitivity to punishment is conceptually near to neuroticism and low emotional stability (Jorm et al., 1999). Because in other studies CIU and low emotional stability have been found to be related, it was hypothesized that compulsive internet users would also be more sensitive to punishment. Cross-sectional analyses confirmed the hypotheses that compulsive internet users are more impulsive and more sensitive to punishment than non-compulsive users. However, contrary to our hypothesis, compulsive internet users did not show a higher sensitivity to reward. Impulsivity appeared to be the strongest predictor of CIU, even stronger than psychosocial wellbeing. The results suggest that compulsive internet users are characterized by an inability to resist the impulse to continue using the internet. CIU may therefore be characterized as an impulse control disorder.

Table 1 presents an overview of the main findings and the corresponding chapters of the present thesis.

Table 1 Overview of the main findings of the present thesis

Main findings	Chapter
• The CIUS is a one-dimensional, reliable, and valid instrument to assess the severity of CIU.	2
• About 1% of the adult Dutch internet using population meets the criteria for CIU, and for about half of them CIU seems to be a chronic state.	3
• Among adults, spending a lot of time on online erotica increases the chance of future CIU. Among adolescents, spending a lot of time on instant online communication (Instant Messenger use and chatting) increases the chance of future CIU.	4, 5
• Adolescents who frequently use instant messaging have a higher chance of having depressive symptoms six months later.	5
• The use of online communication seems to decrease (within 6 months) among lonely adolescent internet users.	5
• Adult internet users having a low psychosocial wellbeing have a higher chance to be a compulsive user of the internet.	6, 7
• Adult internet users with the personality trait low emotional stability are more vulnerable to CIU.	6, 7
• Adult internet users with an impulsive personality are more vulnerable to CIU.	7

General discussion
Limitations of the studies within this thesis
The present thesis presents the results of a series of studies on CIU. These studies were the first on this subject in the Netherlands, and also internationally the number of studies addressing CIU is still rather limited. Although the studies presented here do provide valuable insights into this newly emerged phenomenon, a few general limitations need to be addressed. Some of these limitations refer to the theoretical origins of the concept, others to more practical or methodological aspects. Overall, these limitations should be kept in mind when interpreting the results of the studies.

First it should be mentioned that there is no generally accepted theoretical framework with regard to addiction, dependence, compulsion, and impulse control disorders (Shaffer, 1997). Although it is clear that all these phenomena share mutual characteristics, with CIU showing signs similar to several of these disorders, the absence of consensus on a universal theoretical framework, or on definitions, criteria and core elements, severely hinders the development of a theoretical starting point for the study of CIU. Instead, the established criteria of other addictions were used as a starting point, but a firm theoretical basis is still lacking.

Second, ideally the establishment of the construct validity of a test instrument (i.e. the CIUS) should involve both convergent and discriminant validity procedures. Although the inclusion of another instrument for measuring CIU, the well-documented and validated OCS (Davis et al., 2002), did allow conclusions about the convergent validity, no conclusions could be drawn on the discriminant validity or other forms of validity (e.g. predictive and concurrent validity). These limitations are of course associated with the aforementioned limitations, the lack of theoretical foundation, and are not uncommon for studies in the explorative phase of a newly emerged phenomenon. Another limitation of the CIUS is that there are no data available about the test-retest reliability of the CIUS. These limitations imply that conclusions based on the present data have to be interpreted with care.

The third limitation concerns the establishment of the cut-off point needed for the prevalence assessment. It should be clear that using the CIUS, or any other instrument to divide a population into compulsive versus non-compulsive users, does not do justice to the continuous nature of the phenomenon. Any prevalence estimation should therefore be interpreted with care.

The fourth limitation is a general limitation of survey research using self-reports and concerns the social desirability bias. Although several studies have demonstrated that the internet is very suitable for survey research, especially in populations with a high internet penetration (Bethlehem, 2005; Link & Mokdad, 2005; Wood, Griffiths, & Eatough, 2004), the results of the present surveys, especially the low reported use of online erotica, suggest that also in online surveys, which seem to optimally guarantee anonymity, social desirability may play a role.

The fifth and last research limitation to be discussed here relates to the question of causality; is CIU the result or cause of low psychosocial wellbeing? Even though a longitudinal design was used in two studies, respondents were not (and can not) randomly be assigned to varying levels of internet use. Individuals self-

select into high or low internet use groups and self-select the ways they use the internet. Even with good control variables, a selection bias cannot completely be ruled out. As a result, no definite answer regarding causality can be given.

Theoretical implications

The present thesis tries to add to the further understanding of the newly emerged phenomenon compulsive internet use (CIU) by developing an instrument to assess the severity of CIU, by estimating the prevalence of CIU among the internet-using population, by comparing the addictive qualities of various internet functions, by exploring the relationship between online communication and psychosocial wellbeing, and by examining individual differences in personality factors that may account for the vulnerability to develop CIU.

The compulsive internet use scale (CIUS) was developed to measure the severity of CIU. The CIUS is not the only instrument available for the assessment of the severity of CIU. Other instruments, such as the GPIUS (Caplan, 2002), the OCS (Davis et al., 2002), the IAS (Nichols & Nicki, 2004), or the IAT (Widyanto & McMurran, 2004), all have been psychometrically validated to at least some extent and are applicable as well. However, these instruments are all relatively long, which makes them less suitable for online administration as lengthy questionnaires threaten optimal response rates (Casro, 1998). The CIUS on the other hand, is a short instrument containing only 14 items. This conciseness makes it especially suitable for research purposes using online administration in combination with other measures. Furthermore, instruments like, for example, the GPIUS and the OCS are multidimensional instruments and consider CIU a multidimensional construct. Although these dimensions are highly intercorrelated, the presentation of more than one dimension suggests a different theoretical starting point than that of the CIUS. The CIUS is a one-dimensional instrument characterizing CIU predominantly as an inability to restrain from internet use. In our view, aspects such as loneliness/depression, which make up one of the four dimensions of the OCS, are precursors or results of CIU, rather than inextricable parts of it. The uni-dimensionality of the CIUS simplifies its use and makes the theoretical framing more unequivocal, as CIU is regarded a separate construct, next to psychosocial wellbeing.

The results of the prevalence study presented in this thesis showed that only a small minority of about 1% of the Dutch internet users has developed severe CIU. Compared to several other studies, the result of our study shows a relatively low prevalence figure. For example, Niemz and colleagues reported a prevalence of Pathological Internet Use (PIU) of 18.3% among university students (Niemz, Griffiths, & Banyard, 2005), Nalwa and Anand reported a prevalence of PIU of 18% among 16-18 year old school children in India (Nalwa & Anand, 2003), and Leung reported a prevalence of internet addiction of 37.9% among a probability sample of 16-24 year old so-called Netgeners (owners of a PC with internet access at home) in Hong Kong (Leung, 2004). However, other studies revealed prevalence figures that are more in accordance with our figures; for example, Johansson and Götestam found a prevalence of internet addiction of 2% among a representative sample of 12-18 year old Norwegian youth (Johansson & Götestam, 2004), Kaltiala Heino and colleagues reported a prevalence of internet addiction of almost 2% among a representative sample of 12-18 year old Finns (Kaltiala Heino, Lintonen, & Rimpela, 2004), and Nichols and Nicki reported a prevalence of possible internet addiction of less than 1% among undergraduates (Nichols & Nicki, 2004).

Obviously there are two major reasons that complicate the comparison of the results of various prevalence studies: first, the definition of the phenomenon, the corresponding criteria, and the definition of the cut-off point, and second, the samples used in these studies. A comparison of the various prevalence studies shows that there is not yet consensus on the terminology, on the criteria that have to be met, or on the cut-off point. Consequently, the various prevalence figures relate to various slightly different constructs. Second, the samples that are used in the various studies concern different populations with different internet penetrations and different grades of internet use. Typically, the study samples contained students or pupils among whom internet use is much more prevalent and extensive than among the general population. Correspondingly, the prevalence of CIU in such samples is higher than in the general population. The prevalence study presented in this thesis appears to be one of the first aiming at assessing the prevalence of CIU in the general internet-using population.

The addictive properties of certain internet functions may be related to specific features of these functions which have been described by several authors (Cooper, 1998; Orford, 2005; Young, Pistner, O'Mara, & Buchanan, 1999). According to these authors the specific features of addictive internet functions are: easy availability, accessibility and affordability, the aspect of anonymity inducing disinhibition (Suler, 2004), the possibility to rapidly achieve an intense emotional reward and, in combination with the aspect of continuity, the possibility to persist in the behavior. These latter features resemble the features of addictive continuous short odds gambling games, such as fruit machines. Obviously, there are large individual differences in what constitutes an emotional reward. For a substantial group, having an online sexual experience will be highly rewarding (Cooper, McLoughlin, & Campbell, 2000; Cooper et al., 1999). For others, gathering information on a specific subject might be highly appealing. Therefore, the addictive properties of internet functions are likely to diverge.

Several studies have shown that particularly functions involving online social interaction and functions pertaining to online erotica bear a relatively high addiction risk (Caplan, 2002; Chou & Hsiao, 2000; Cooper, 1998; Griffiths, 2000b; Li & Chung, 2004; Putnam, 2000; Ward, 2001; Young, 1998). The results of the Dutch studies presented in this thesis largely confirm the results found in the international literature. Among adults, clear indications were found that searching online erotica increases the chance of future CIU, whereas among adolescents frequent use of instant messengers and chat functions increased the chance of future CIU. These results suggest that there are differences in the addictive qualities of internet functions between adults and adolescents. In part, however, these differences may be explained by the difference in the use of internet functions; among adolescents the use of instant messengers is much more common than among adults, who at the time of the study (2002-2003) mainly used email for online communication. The addictive properties of email seem to be lower than of instant messengers, probably because instant messaging and chatting deliver a much more instant gratification. In the near future, differences in the use of instant messengers between adults and adolescents may diminish, possibly resulting in an increase of online communication-related CIU among adults. Future research is needed to reveal whether instant messaging is indeed more addictive for adolescents than for adults.

The results of the studies presented in this thesis pertaining to the relationship between personality and psychosocial wellbeing on the one hand, and CIU on the other, also largely confirm the results of studies found in the international literature, i.e. there is a clear relationship between CIU and indicators of low psychosocial wellbeing and personality features such as low emotional stability. The question arises whether it is possible to define causes and consequences, i.e. can one say that low psychosocial wellbeing or a low emotional stability increases the vulnerability to CIU, or the other way round, can one say that CIU causes a decrease in psychosocial wellbeing? (Assuming that CIU can cause a decrease in emotional stability as well is implausible because emotional stability is supposed to be a rather stable personality feature.) The first hypothesis is adopted by, for example, Davis and Caplan, who argue that pre-existing psychosocial problems and maladaptive cognitions about the self predispose an individual to develop CIU (Caplan, 2002; Davis, 2001a; Davis et al., 2002). This could be explained by assuming that the internet may be used as a way to (inadequately) cope with psychosocial problems by using the internet for mood elevation, affect regulation and escape. By using the internet for these reasons, internet use may become even more rewarding and correspondingly the addictive potential may increase, eventually leading to CIU. The second hypothesis, regarding the negative effect of CIU on psychosocial wellbeing, is, for example, in line with the results of the longitudinal Homenet study (Kraut et al., 1998). Kraut and colleagues found that greater internet use, predominantly for communication, was associated with a decline in psychosocial wellbeing. An explanation for this could be that, due to heavy internet use or CIU, existing ties with (offline) friends, family, and important others are neglected, resulting in a decrease of social support. Together with problems due to the neglect of work or school, the notion of dependency and inability to change one's behavior, and possible negative online experiences due to online harassment, may lead to a decrease of psychosocial wellbeing.

The results of the studies presented in this thesis do not unequivocally support one of the two hypotheses. There were clear indications that personality features such as low emotional stability and sensitivity to punishment (which is conceptually related to neuroticism and low emotional stability (Jorm et al., 1999)) predict CIU. Assuming that these personality features are stable over time, these findings support the first hypothesis that pre-existing psychopathologies make an individual more vulnerable to develop CIU. However, the longitudinal study among adolescents indicated that loneliness (a typical indicator of psychosocial wellbeing) predicted a decrease in the use of instant messaging, thereby, at least in part, contradicting the first hypothesis. Moreover, the longitudinal study among adolescents also indicated that frequent instant messenger use predicted an increase in depressive symptoms six months later. Although the longitudinal design does not permit definite conclusions regarding causality (see 'Limitations of the studies'), the cross-lagged analyses did show that it is more plausible that frequent instant messenger use increases depressive feelings than the other way around. Therefore, these results are in agreement with the results of the Homenet study (Kraut et al., 1998) and, at least partly, support the second hypothesis that CIU has a negative effect on psychosocial wellbeing.

In summary, the studies of the present thesis suggest a bidirectional path between emotional stability and psychosocial wellbeing on the one hand, and frequent internet use and CIU on the other. An alternative explanation may be found in individual differences with regard to internet usage patterns and (initial)

state of psychosocial wellbeing; the effects of using the internet may be dependent on how it is used and personal characteristics (e.g. social resources) may affect the relationship between internet use and psychosocial wellbeing (Bessière, Kiesler, Kraut, & Boneva, 2004). Combining both perspectives may lead to the conclusion that frequent internet use can magnify existing tendencies and make latent problems become manifest. Frequent internet use and depressive tendencies seem to aggravate each other in a circular way, and meanwhile frequent internet use may gradually develop into CIU. However, one of the problems with regard to a final conclusion is the overlap between the concepts frequent internet use and CIU. Frequent internet use does not necessarily implicate CIU, CIU on the other hand, does implicate frequent internet use. Further research is needed to clarify this highly relevant subject that affects a substantial part of the (adolescent) population.

A final important finding, seldom described in the literature, is the relationship between the personality trait impulsivity and CIU. Several studies have described a relationship between impulsivity and various forms of addictive behavior and eating disorders (Dawe et al., 2004; Dawe & Loxton, 2004; Loxton & Dawe, 2001). The results of the study pertaining to the relationship between impulsivity and CIU showed that impulsivity and CIU are also positively related. Dawe and Loxton theorize that impulsivity contributes to disinhibited behavior and loss of control (Dawe & Loxton, 2004). The present findings support this rationale as an explanation for the vulnerability to CIU, i.e. CIU seems to be characterized by the inability of an individual to resist the impulse to click the mouse button.

Practical implications
Overall, it can be concluded that CIU seems to affect only a small minority of the general population. However, due to the large number of internet users, the actual number of compulsive internet users is still considerable. Groups at risk seem to be those with an impulsive personality, those who already suffer from low psychosocial wellbeing, or those who are inclined to develop symptoms of low psychosocial wellbeing because of a specific personality structure characterized by a low emotional stability. Within specific populations, for example students or adolescents, internet use is much more prevalent and extensive, and therefore considerably more individuals may be affected. The risk for youngsters may further be increased because of their heightened susceptibility due to the immaturity of the frontal cortical and subcortical monoaminergic brain systems, which is hypothesized to underlie adolescent impulsivity as a transitional trait behavior. On the one hand these neurodevelopmental processes seem to be functional through enhancing the learning drive, on the other hand these processes may make adolescents more vulnerable to addictive behaviors (Chambers & Potenza, 2003). It is the combination of heightened susceptibility, the sheer popularity among youngsters of internet in general and applications with a high additive risk such as online instant communication in particular, and the severity of possible consequences of CIU, both in terms of detrimental effects on academic performance and of disturbed psychosocial development, that make CIU among adolescents of utmost concern. An additional complicating factor is that the internet has become an essential part of adolescents' life, as a source for information and entertainment, as well as the favorite means for communication with peers. This implies that plain abstinence from the internet is not a desirable goal for those afflicted.

It is beyond the scope of this thesis to discuss prevention and treatment strategies. Nevertheless, the present thesis may add to the recognition that compulsive internet use or internet addiction, as it is often called in popular speech, is something to be taken seriously. The appearance of the internet has undoubtedly many advantages as it has dramatically expanded the possibilities for individuals to communicate with each other, to entertain themselves, and to find information on practically every subject imaginable. This thesis may add to the recognition that not only more and more people own a computer, have internet access and enjoy the benefits of technological evolution, but also that some people have lost control over their internet use and are "owned" by the internet.

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Samenvatting

Inleiding

Het internet bestaat nog geen twee decennia maar is in deze korte tijd uitgegroeid tot één van de belangrijkste bronnen voor informatie, communicatie en amusement voor een inmiddels zeer grote groep mensen[1]. In Europa heeft ongeveer 40% van de inwoners de beschikking over internet en in Nederland zelfs bijna driekwart van de inwoners (www.internetworldstats.com). De Nederlandse internetpenetratie behoort daarmee tot de hoogste ter wereld, samen met die van landen als de Verenigde Staten, Australië, Zuid-Korea, Hong Kong, Singapore en de Scandinavische landen.

Hoewel de grote meerderheid van de internetgebruikers gebruik maakt van de vele mogelijkheden die het internet biedt zonder daarbij problemen te ontwikkelen, verschenen al in de begindagen van het internet berichten over de mogelijke negatieve gevolgen van de opkomst van het internet. Zo zou het internet bijdragen aan de individualisering en vereenzaming in de maatschappij (Kraut et al., 1998). Bovendien verschenen, in eerste instantie op het internet zelf maar later ook in de populaire en wetenschappelijke pers, berichten over mensen die verslaafd aan het internet zouden zijn geraakt (OReilly, 1996; Young, 1996). Hoewel er vooral vanuit de wetenschappelijke wereld aanvankelijk sceptisch op dit nieuwe fenomeen werd gereageerd (Grohol, 1995; Hughey, 1997), leeft inmiddels ook bij gevestigde wetenschappers het idee dat door de komst van het internet ernstige gedragsverslavingen kunnen ontstaan (Orford, 2005) en levert een zoektocht naar 'internet addiction' met wetenschappelijke zoekmachines meer dan 120 hits op, waarvan meer dan 10 uit het jaar 2007.

In het voorliggende proefschrift worden de resultaten beschreven van drie onderzoeken naar compulsief internetgebruik[2] die zijn uitgevoerd met financiële steun van de Stichting Volksbond Rotterdam. Deze studies bouwen voort op eerder onderzoek naar 'internetverslaving' dat in 2001 is gestart (Meerkerk, Laluan, & Eijnden, 2003).
De doelen van de drie studies die in dit proefschrift worden beschreven zijn: 1) het vaststellen van criteria voor compulsief internetgebruik en het ontwikkelen en valideren van een instrument waarmee de ernst van compulsief internetgebruik kan worden vastgesteld, 2) het schatten van de prevalentie en incidentie van compulsief internetgebruik binnen de Nederlandse internetgebruikende populatie en het vaststellen van de mate waarin compulsief internetgebruik een chronisch verloop kent, 3) het onderzoeken van de relatie tussen compulsief internetgebruik en het gebruik van verschillende internetfuncties (bijvoorbeeld chatten, gamen en online erotica), 4) het onderzoeken van de relatie tussen internetgebruik, compulsief

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[1] Het totaal aantal internetgebruikers wereldwijd ligt naar schatting op ruim 1,1 miljard, zo'n 18% van de wereldbevolking (www.internetworldstats.com).

[2] Aangezien internetgebruikers niet zo zeer verslaafd kunnen raken aan het internet zelf, als wel aan één van de toepassingen van het internet (b.v. gamen, chatten of het zoeken naar online erotica), geven de auteurs er de voorkeur aan te spreken van compulsief internet gebruik i.p.v. internetverslaving.

internetgebruik en psychosociaal welzijn en 5) het onderzoeken van de relatie tussen verschillende persoonlijkheidskenmerken en de vatbaarheid voor de ontwikkeling van compulsief internetgebruik. In het hierna volgende wordt een korte samenvatting gegeven van de belangrijkste resultaten van de drie bovengenoemde onderzoeken.

De ontwikkeling van een meetinstrument (hoofdstuk 2)
Doel van deze fase van het onderzoek was te komen tot een kort, betrouwbaar en gevalideerd instrument (vragenlijst) waarmee de ernst van compulsief internetgebruik vastgesteld kan worden. Op basis van de criteria voor middelenafhankelijkheid en pathologisch gokken uit de DSM-IV (APA, 1994), de door Griffiths (1999) beschreven algemene criteria voor gedragsverslavingen, en de kennis opgedaan tijdens een kwalitatief onderzoek onder zelfverklaarde 'internetverslaafden' (Meerkerk et al., 2003) is een set van 14 items ontwikkeld. Vervolgens is deze lijst opgenomen in een online enquête die door 447 volwassen veelgebruikers van het internet is ingevuld. De lijst is vervolgens geanalyseerd met behulp van confirmatieve factor analyse en betrouwbaarheidsanalyses. Uit deze analyses bleek dat de set van 14 items (de Compulsive Internet Use Scale: CIUS, zie Appendix) een intern consistente lijst (Cronbach's alfa .89) vormt. De factoriële stabiliteit is in verschillende samples getoetst en de correlatie met de Online Cognition Scale (OCS) (Davis, Flett, & Besser, 2002), een ander instrument waarmee compulsief internetgebruik gemeten kan worden, is bepaald. Uit de resultaten bleek dat de één-factor structuur stabiel was over verschillende samples naar leeftijd, geslacht en mate van internetgebruik en over de tijd. Daarnaast bleek de CIUS hoog te correleren met de OCS. Geconcludeerd mag worden dat de CIUS een eenvoudig af te nemen, betrouwbaar, stabiel en valide instrument is om de ernst van compulsief internetgebruik vast te stellen.

De prevalentie van compulsief internetgebruik in Nederland (hoofdstuk 3)
Verschillende internationale studies rapporteren de mate waarin compulsief internetgebruik (of internetverslaving, internet afhankelijkheid, pathologisch internetgebruik) voorkomt. Uit een vergelijking van deze studies komt naar voren dat er geen consensus is over de criteria waaraan moet zijn voldaan om te kunnen spreken van compulsief internetgebruik. Daarnaast zijn vele onderzoeken uitgevoerd in niet-representatieve steekproeven (vooral onder studenten). De gerapporteerde prevalenties variëren dan ook van minder dan 1% in een groep universitaire studenten (Nichols & Nicki, 2004) tot bijna 40% in een steekproef van jongeren tussen de 16 en 24 jaar (Leung, 2004).
Doel van het uitgevoerde prevalentieonderzoek was te komen tot een beredeneerde en betrouwbare schatting van het aantal compulsieve internetgebruikers in Nederland. Daartoe is het nieuw ontwikkelde instrument - de CIUS - toegepast in een representatieve steekproef van de Nederlandse internetgebruikers. Twee aspecten zijn van groot belang voor de betrouwbaarheid van uitspraken over de prevalentie: de representativiteit van de steekproef en de validiteit van het afkappunt van het instrument. Voor het prevalentieonderzoek is gebruik gemaakt van een steekproef van 447 volwassen internetgebruikers uit een groot panel (www.bloomerce.nl) die door stratificatie en weging van de respondenten representatief is voor de Nederlandse volwassen bevolking van veelgebruikers (minstens 16 uur per week online) van het internet. De respondenten zijn met een tussenliggende periode van één jaar twee maal door middel van een online enquête benaderd. Door deze herhaalde meting kunnen ook uitspraken gedaan worden over de stabiliteit of chroniciteit van compulsief internetgebruik.

Om de prevalentie vast te stellen moet ook een afkappunt voor het instrument worden bepaald. Het is belangrijk zich te realiseren dat er bij compulsief internetgebruik geen sprake is van een alles of niets verschijnsel; internetgebruikers kunnen in meer of mindere mate last hebben van compulsief gedrag. Een relatief grote groep zal enigszins last hebben en een kleinere groep zal substantieel last hebben. De prevalentie van compulsief internetgebruik is dan ook afhankelijk van wat men onder substantiële of ernstige symptomen verstaat en is daarmee per definitie altijd enigszins arbitrair. Getracht is het afkappunt zodanig te kiezen dat enkel die gevallen geïdentificeerd worden waarbij sprake is van een dusdanig ernstige vorm van compulsief internetgebruik dat het normale leven ontwricht wordt en het internetgebruik een grote invloed heeft op het psychosociaal welbevinden van de betrokkene.

Uit het onderzoek komt naar voren dat bij ongeveer 7% van de respondenten uit de steekproef gesproken kan worden van compulsief internetgebruik. Wanneer de resultaten van de steekproef geëxtrapoleerd worden naar de totale groep Nederlandse internetgebruikers zou 0,9% van de Nederlandse internetgebruikers compulsief van het internet gebruik maken. Dit komt overeen met ongeveer 67.500 compulsieve internetgebruikers. Compulsieve internetgebruikers brengen meer tijd door online dan niet-compulsieve internetgebruikers (de compulsieve gebruikers in de onderzochte sample waren gemiddeld bijna 35 uur per week online) en bleken daarnaast ook jonger dan de niet-compulsieve gebruikers. Geen verschillen werden gevonden voor de tijd dat men over een internetaansluiting beschikte of voor geslacht en opleiding. Uit de herhaalde meting één jaar later bleek dat meer dan de helft van de compulsieve gebruikers van de eerste meting ook ten tijde van de tweede meting het internet compulsief gebruikte. Compulsief internetgebruik lijkt daarmee voor ongeveer de helft van de groep chronisch van aard te zijn.

Het verslavingspotentieel van verschillende internetfuncties (hoofdstuk 4)
Compulsief internetgebruik wordt vaak aangeduid met de term internetverslaving, wat suggereert dat het internet zelf verslavend zou zijn. Aan de andere kant hebben verschillende onderzoekers onderscheid gemaakt tussen verschillende vormen van compulsief internetgebruik. Zo onderscheidde Young vijf verschillende subtypes: cyber-seksverslaving, online relatieverslaving, online gokken/kopen verslaving, surf of online informatie verslaving en gameverslaving (Young, 1999; Young, Pistner, O'Mara, & Buchanan, 1999). Davis onderscheidde 'specifiek pathologisch internetgebruik' en 'algemeen pathologisch internetgebruik' waarbij de eerste refereert aan het pathologische gebruik van een bepaalde toepassing (bijvoorbeeld online erotica of gokken) en de tweede aan een algemeen multidimensioneel pathologisch gebruik van het internet (Davis, 2001). Verschillende onderzoekers hebben gesuggereerd dat vooral de internettoepassingen waarbij sociale interactie een belangrijk onderdeel vormt het grootste verslavingsrisico hebben. Doel van deze fase van het onderzoek was empirisch vast te stellen of het verslavingsrisico van bepaalde toepassingen groter is dan dat van andere.
De verslavende eigenschappen van bepaalde internetfuncties kunnen worden gerelateerd aan verschillende aspecten van het internet zoals de eenvoudige beschikbaarheid, toegankelijkheid en veroorloofbaarheid, het aspect van anonimiteit die ook ontremming in de hand werkt, het aspect van de directe emotionele beloning en, samenhangend met het aspect van de continuïteit, de mogelijkheid repetitief gedrag te vertonen. Het is duidelijk dat er grote verschillen tussen personen zullen zijn in wat emotioneel belonend is. Voor sommigen zal dat een online erotische ervaring zijn en voor anderen het verzamelen van informatie

over een specifiek onderwerp. Uit verschillende studies is gebleken dat vooral sociale interactie (zoals met de instant messenger) en online erotica een relatief hoog verslavingspotentiaal hebben.

Het verslavingspotentieel van de verschillende toepassingen is vastgesteld door in een longitudinaal onderzoek respondenten te vragen naar de tijd die ze aan de verschillende online toepassingen besteden en deze te relateren aan de mate van compulsief internetgebruik. Uit de cross-sectionele resultaten blijkt dat internetgebruikers die relatief veel tijd besteden aan gamen, het zoeken naar online erotica en chatten, een grotere kans hebben compulsief van het internet gebruik te maken. Longitudinaal blijkt alleen het besteden van veel tijd aan online erotica een toename in compulsief internetgebruik een jaar later te voorspellen. Dat wil zeggen dat de internetgebruikers die veel tijd aan online erotica besteden een jaar later een grotere kans te hebben het internet compulsief te gebruiken. Online erotica lijkt bij volwassen Nederlanders daarmee het grootste verslavingspotentieel te hebben.

De relatie tussen online communicatie, compulsief internetgebruik en psychosociaal welbevinden onder jongeren (hoofdstuk 5)

Nagenoeg alle jongeren gebruiken het internet als communicatie medium en meer dan 80% maakt daarbij gebruik van programma's zoals de MSN of Yahoo messenger (zogenaamde instant messengers) waarmee 'in real time' gecommuniceerd kan worden. Instant messaging wordt vooral gebruikt voor communicatie met vrienden en bekenden en blijkt voor veel jongeren het belangrijkste communicatie-middel geworden te zijn, belangrijker dan bijvoorbeeld de mobiele telefoon. Aan de ene kant zou verwacht kunnen worden dat deze uitbreiding van de communicatiemogelijkheden een positief effect heeft op het psychosociaal welbevinden van de gebruikers. Online communicatie maakt het bijvoorbeeld gemakkelijker om met vrienden te communiceren, waarbij geografische of financiële beperkingen geen rol meer spelen. Daarnaast kunnen gemakkelijker en veiliger nieuwe relaties worden aangegaan waarbij minder een beroep wordt gedaan op de sociale vaardigheden die offline belangrijk zijn. Dit laatste zou vooral gunstig kunnen zijn voor jongeren die voorheen in een sociaal isolement leefden, zoals erg verlegen of sociaal angstige jongeren. Aan de andere kant blijkt uit sommige onderzoeken dat vooral internettoepassingen waarbij sociale interactie een rol speelt potentieel verslavend zijn. Daarnaast zou het intensief gebruik van online communicatie een negatieve uitwerking kunnen hebben op de offline communicatie met familie en naaste vrienden, en daarmee wellicht ook op het psychosociaal welbevinden.

Voor dit longitudinale onderzoek werden 663 scholieren van 12 tot 15 jaar oud op 4 scholen voor voort-gezet onderwijs klassikaal met behulp van een schriftelijke vragenlijst twee maal ondervraagd met een tussenliggende periode van 6 maanden. Doel van het onderzoek was de relatie te onderzoeken tussen internetfuncties, waaronder online communicatie, en compulsief internetgebruik onder jongeren. Een tweede doel was de relatie te onderzoeken tussen online communicatie en psychosociaal welzijn. Uit de resultaten blijkt ten eerste dat het veelvuldig gebruik van instant messengers een toename in compulsief internetgebruik voorspelt. Tevens bleek veelvuldig gebruik van instant messengers gerelateerd te kunnen worden aan een toename in depressieve klachten. Tot slot bleek eenzaamheid longitudinaal gerelateerd te kunnen worden aan een afname van instant messenger gebruik. Deze resultaten suggereren dat het excessieve gebruik van een instant messenger een negatieve invloed heeft op het psychosociaal

welbevinden van scholieren. Daarnaast bleken eenzame jongeren minder gebruik te gaan maken van instant messaging, wat de suggestie weerlegt dat juist eenzame jongeren zouden profiteren van de voor-delen van instant messaging (het 'the poor get poorer' model). Een mogelijke verklaring zou kunnen liggen in het feit dat instant messengers vaak gebruikt worden voor zogenaamde 'weak tie' relaties welke weinig bijdragen aan het gevoel van 'social support'.

De relatie tussen compulsief internetgebruik en persoonlijkheidsfactoren en psychosociaal welbevinden (hoofdstuk 6)

Verschillende kenmerken van het internet versterken het verslavingspotentieel. Zo biedt het internet de gebruiker de gelegenheid op een eenvoudige en goedkope wijze een zeer grote hoeveelheid prikkelende stimuli te krijgen die kunnen zorgen voor een directe bevrediging van bepaalde behoeftes. Daarnaast zorgt de schijnbare anonimiteit op internet ervoor dat drempels lager worden en de internetgebruiker ongeremd kan toegeven aan de behoeftes die hij of zij voelt. Tot slot kan door het continue karakter van het internet de gebruiker zich van het alledaagse leven afsluiten en daarmee zijn dagelijkse problemen ontlopen (coping).

Hoewel in sommige landen, waaronder Nederland, inmiddels een meerderheid van de bevolking toegang heeft tot internet, blijkt slechts een kleine minderheid van de internetgebruikers compulsief internet-gebruik te ontwikkelen. De studie die in hoofdstuk 5 wordt besproken, had als onderzoeksvraag of er bepaalde persoonlijkheidskenmerken en indicatoren van psychosociaal welbevinden zijn die in verband staan met de gevoeligheid voor compulsief internetgebruik. Uit een literatuuronderzoek bleek dat verschil-lende indicatoren van laag psychosociaal welbevinden (bijvoorbeeld self-esteem, depressieve klachten en eenzaamheid) samenhangen met compulsief internetgebruik. De onderzoeken naar de relatie tussen persoonlijkheid en compulsief internetgebruik zijn veel geringer in aantal en gaven geen eenduidig beeld, al zijn er aanwijzingen dat een lage emotionele stabiliteit de kans op compulsief internetgebruik vergroot.

In het uitgevoerde onderzoek werd gebruik gemaakt van een zeer grote zogenaamde convenience steek-proef. Dat wil zeggen dat de data verzameld werden met behulp van een online vragenlijst op de website van het IVO die kon worden ingevuld door een ieder die de website bezocht. Door de publiciteit rondom compulsief internetgebruik, waarbij ook veelvuldig de naam van het instituut werd genoemd, hebben uiteindelijk bijna 18.000 respondenten de vragenlijst ingevuld. De respondenten kregen onder andere een persoonlijkheidsvragenlijst (de Quick Big Five) en vragen over eenzaamheid, depressieve klachten en self-esteem voorgelegd.

De resultaten bevestigden de bevindingen uit de literatuur: van de persoonlijkheidseigenschappen hing vooral een lage emotionele stabiliteit samen met compulsief internetgebruik en van de indicatoren van psychosociaal welbevinden vooral het hebben van depressieve klachten. De invloed van de persoon-lijkheidseigenschappen bleek daarbij veel kleiner dan de invloed van psychosociaal welbevinden. Geen uitsluitsel kon verkregen worden over de causale relatie tussen beiden; het is zowel mogelijk dat compulsief internetgebruik een negatieve invloed heeft op het psychosociaal welbevinden, als dat een lage mate van psychosociaal welbevinden aanleiding geeft tot compulsief internetgebruik (bijvoorbeeld doordat mensen hun problemen of sombere gevoelens proberen te vergeten door te internetten: coping). Een

derde mogelijkheid is dat zowel het lage psychosociale welbevinden als het compulsieve internetgebruik beide manifestaties zijn van één onderliggend probleem.

De relatie tussen compulsief internetgebruik en de mate van gevoeligheid voor straf en beloning en impulsiviteit (hoofdstuk 7)
Het laatste onderzoek ging in op de vraag of de mate van impulsiviteit en de mate waarin mensen gevoelig zijn voor straf en beloning samenhangen met compulsief internetgebruik. De gevoeligheid voor straf en beloning zijn constructen die voortkomen uit de invloedrijke persoonlijkheidstheorie van Jeffrey Gray (1987; 1991). Gray's persoonlijkheidstheorie postuleert een tweetal onafhankelijke, biologische gebaseerde motivationele dimensies van persoonlijkheid: impulsiviteit en angst. Met impulsiviteit refereerde Gray aan de sensitiviteit van het Behavioral Activation Sytem (BAS) en met angst aan de sensitiviteit van het Behavioral Inhibition System (BIS). Het BAS reageert op belonende prikkels en zorgt voor toenaderings-gedrag. Het BIS reageert op aversieve prikkels en zorgt voor vermijdingsgedrag. Hoewel Gray impulsiviteit gelijkstelde aan de gevoeligheid van het BAS hebben latere auteurs een onderscheid gemaakt tussen de gevoeligheid voor beloning en impulsiviteit, waarbij impulsiviteit gezien wordt als de mate waarin iemand de neiging heeft te reageren zonder zich zorgen te maken over eventuele (negatieve) gevolgen. De gevoelig-heid voor straf wordt vaak gezien als een equivalent van neuroticisme. Uit de literatuur is bekend dat de gevoeligheid voor straf en beloning en impulsiviteit gerelateerd kunnen worden aan problematisch alcohol- en drugsgebruik. Aangezien het internet een eindeloze bron vormt van meer of minder belonende prikkels werd verwacht dat er een verband zou bestaan tussen compulsief internetgebruik en de gevoeligheid voor straf en beloning en impulsiviteit.

Uit de resultaten van dit cross-sectionele onderzoek bleek dat de gevoeligheid voor straf en impulsiviteit met compulsief internetgebruik samenhangt. De gevoeligheid voor beloning bleek niet samen te hangen met compulsief internetgebruik. De relatie tussen gevoeligheid voor straf (of neuroticisme) en compulsief internetgebruik is niet verrassend gezien de reeds uit de literatuur bekende relatie tussen psychosociaal welbevinden en compulsief internetgebruik en de conceptuele overeenkomst tussen gevoeligheid voor straf (of neuroticisme) en psychosociaal welbevinden. Daarnaast bleek er ook een positieve relatie te bestaan tussen impulsiviteit en compulsief internetgebruik. De resultaten laten zien dat compulsief internet-gebruik deels samenhangt met een lage mate van psychosociaal welbevinden en deels met een hoge mate van impulsiviteit. Meer dan 'gewone' internetgebruikers blijken compulsieve internetgebruikers de neiging te hebben om direct op prikkels te reageren zonder al te veel stil te staan bij eventuele (negatieve) gevolgen.

Slotbeschouwing (hoofdstuk 8)
Uit de gepresenteerde onderzoeken wordt duidelijk dat slechts een kleine minderheid van de algemene bevolking compulsief internetgebruik ontwikkelt. Door het grote aantal internetgebruikers betreft het echter uiteindelijk een grote groep mensen. Personen met een verhoogde impulsiviteit en personen met een verlaagd psychosociaal welzijn lopen een verhoogd risico compulsief internetgebruik te ontwikkelen. Door de combinatie van verhoogde impulsiviteit die jongeren eigen is, de grote populariteit onder jongeren van internet in het algemeen en toepassingen met een verhoogd verslavingsrisico in het bijzonder en de mogelijk ernstige gevolgen voor de verdere ontwikkeling maken dat compulsief internetgebruik onder

jongeren bijzondere aandacht vraagt. Het voert buiten het onderwerp van dit proefschrift preventie en behandeling van compulsief internetgebruikte te behandelen, maar wellicht heeft het huidige proefschrift wel bijgedragen aan meer begrip voor en acceptatie van compulsief internetgebruik als serieus te nemen verschijnsel.

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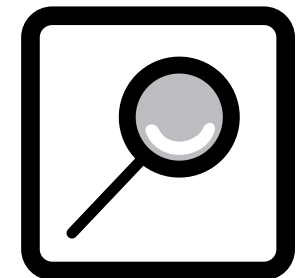
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appendix
CIUS

The Compulsive Internet Use Scale (CIUS)

Appendix

The Compulsive Internet Use Scale (CIUS)

Instruction
The following questions should be answered about your use of the internet for private purposes.
Answers can be given on a 5-point scale: (0) Never, (1) Seldom, (2) Sometimes, (3) Often, (4) Very often.

1. How often do you find it difficult to stop using the internet when you are online?
2. How often do you continue to use the internet despite your intention to stop?
3. How often do others (e.g. partner, children, parents, friends) say you should use the internet less?
4. How often do you prefer to use the internet instead of spending time with others (e.g. partner, children, parents, friends)?
5. How often are you short of sleep because of the internet?
6. How often do you think about the internet, even when not online?
7. How often do you look forward to your next internet session?
8. How often do you think you should use the internet less often?
9. How often have you unsuccessfully tried to spend less time on the internet?
10. How often do you rush through your (home) work in order to go on the internet?
11. How often do you neglect your daily obligations (work, school or family life) because you prefer to go on the internet?
12. How often do you go on the internet when you are feeling down?
13. How often do you use the internet to escape from your sorrows or get relief from negative feelings?
14. How often do you feel restless, frustrated, or irritated when you cannot use the internet?

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Curriculum Vitae

Gert-Jan Meerkerk was born in Rotterdam on June 21, 1963. After he finished high school in Eindhoven in 1983 he spend half a year traveling and working (grape picking) in southern Europe. In 1984 he started his study (clinical) psychology at the 'Katholieke Universiteit Nijmegen' (KUN, now Radboud University Nijmegen) where he obtained his masters degree in 1991. During the last year of his study he worked as a student assistant on a smoking cessation evaluation project. After graduation he started to work as a research assistant at the KUN on an evaluation project of drug free prison regimes, which he continued until he started at the Addiction Research Institute Rotterdam (IVO) in the end of 1994. Since than he was involved in several alcohol and behavioral addiction research projects at the IVO, such as research on the addictive qualities of the newly introduced scratch lottery in the Netherlands, research on the possibilities of the biological alcohol marker CDT as an innovative tool for general practitioners for early detection of alcohol related problems in general practice, and, since the end of 2000, research on the addictive properties of the internet, which resulted in the present thesis. Currently, he continues his research work on compulsive internet use at the IVO where he is also responsible for the coordination of the educational program on addiction.

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