

Leisure Boredom, Sensation Seeking, Self-esteem, Addiction Symptoms and Patterns of Mobile Phone Use ¹

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Abstract

The purpose of this study is to (1) identify addiction symptoms that are uniquely associated with mobile phone use; (2) examine how demographics and psychological attributes (such as leisure boredom, sensation seeking, and self-esteem) of individuals are related to these addiction symptoms; and (3) explore how these attributes, mobile phone addiction symptoms, and social capital can predict patterns of mobile phone use. Using a probability sample, a telephone survey was conducted with 624 young adults between the ages of 14-28. Exploratory factor analysis identified four common mobile phone addiction symptoms: 'losing control and receiving complaints,' 'anxiety and craving,' 'withdrawal/escape,' and 'productivity loss.'

Results show that the higher one scored on sensation seeking and leisure boredom, the higher the likelihood one was addicted to the mobile phone. Conversely, subjects who scored high on self-esteem -- who perceived themselves as being in control -- demonstrated less of a tendency to be addicted. Regression results also indicate that sensation seeking played the largest role in mobile phone addiction, while gender, self-esteem, and leisure boredom appeared to have a lesser but significant influence. In particular, those who were female and had low self-esteem were the most vulnerable.

Time spent with friends face-to-face was the strongest predictor of overall *use* of the mobile phone in minutes per day. This means that the more time one spent with family and friends, the more one would use the mobile phone. This indicates that there is no decline or displacement of face-to-face interaction despite the increased use of the mobile phone.

Mobile phone use may, in fact, facilitate or coordinate face-to-face interaction. As expected, heavy users of the mobile phone tended to exhibit more addiction symptoms (such as losing

control & receiving complaints and experiencing anxiety or craving). Regression results also show that those who used the mobile phone more in minutes per day were those who scored high on sensation seeking, and were older, but less educated. Furthermore, it is interesting to note that females tended to spend longer time on each call while those who were older and high on self-esteem talked to a larger pool of people on a regular basis using their mobile phones. This suggests that, as a social technology, the mobile phone has become a popular communication utility and a relationship facilitator.

Addiction symptoms were found to be the most powerful predictors for *features use* of the mobile phone. Heavy feature users of the mobile phone, for sending/receiving SMS, for entertainment, and for information, tended to be those who often felt anxious and even lost without their mobile phones, experienced a higher sense of losing control, and often received complaints from family and friends. Contrary to what was hypothesized, psychological attributes, such as leisure boredom, sensation seeking, and self-esteem, were not significantly linked to features used except for entertainment. Specifically, those who scored high on sensation seeking were those who often enjoyed the entertainment functions of sending and receiving pictures, playing electronic games, and downloading ring tones on their mobile phones. The insignificant relationship between the use of SMS and psychological attributes indicates that SMS has become a preferred method of communication for young adults despite what psychological state they are in. Demographically, young and educated females tended to use SMS more, while the entertainment features attracted the young and the information functions captivated the educated for online news and/or utilizing it as a video phone.

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Introduction

According to a study by the Pew Internet and American Life Project, 45% of 12 to 17 year-olds have mobile phones in the U.S., and 33% have used a mobile phone to send text messages (Lenhart, Madden, & Hitlin, 2005). Of those who often do texting on their mobile phone, almost one in three (29%) teenagers use it to communicate with their parents. In another cell phone use study by Pew (Rainie & Keeter, 2006), it was reported that teenagers often use their mobile phone to take still pictures (28%), play electronic games (22%), surf the Internet (14%), and send/receive emails (8%). Playing with features on the mobile phone (including reading online news and downloading songs, wallpaper, and ring tones) appears to have become the adolescent leisure phenomenon in recent years. As the phones get cheaper and more sophisticated, sales of mobile phones to teenagers become more common. However, as the mobile phones become more compact, concerns about problem use are growing. To date, there has been almost no study on whether mobile phone use is addictive or dependence-forming.

A significant number of adolescents experience leisure boredom and dissatisfaction, which have been implicated in drug use and delinquency. Past research has consistently reported that, in comparison to other life stages, teenagers and young adults are characterized by a heightened potential for recklessness, sensation seeking, and risk taking behaviors (Arnett, 1992). Craving has also been the target of research and treatment intervention in many addictive disorders, including substance misuse (e.g., O'Malley et al., 1991; Volpicelli et al., 1992). Taken from Costa and McCrae (1985), craving refers to the inability to control urges such as those for food, cigarettes, or possessions. This study was established and centered upon the people directly involved with a modern syndrome – adolescents and young

adults for whom the mobile phone had come to dominate their lives and interests. The investigation aims to examine whether certain factors could be isolated as instrumental in the development of such a syndrome. Due to a lack of past research in this area, theoretical constructs in psychology, such as leisure boredom, sensation seeking, and self-esteem, will be used as the basis from which to explain addiction symptoms and problem mobile phone use.

Theoretical Frameworks

Mobile Phone Addiction

This research was initiated based upon previous studies (Beard, 2002; Beard & Wolf, 2001; Chak & Leung, 2004; Griffiths, 1998, 2000; Katz & Akhus, 2002; Leung, 2004; Ling, 2004; Scherer, 1997; Young, 1996, 1998, 1999) which indicated that some online users were becoming addicted to the Internet in much the same way that others became addicted to gambling, drugs, and alcohol. Traditionally, the concept “addiction” was based on a medical model and is properly reserved for bodily and psychological dependence on a physical substance – and not a behavioral pattern. Recent research has argued that addiction should be widened to cover a broader range of behaviors (Lemon, 2002; Orford, 2001; Shaffer, 1996). As a subset of behavioral addiction, Griffiths (1996) proposed the concept of technological addiction, which is operationally defined as human-machine interaction and is non-chemical in nature. Despite whether the excessive use of various technologies, such as Internet surfing, TV watching, and computer gaming, can be or should be called an “addiction,” scholars have argued that excessive use of technology can be considered problematic (Griffiths, 1998; Griffiths & Hunt, 1998; Shotton, 1989). Today, as the capability of the mobile phone becomes more and more sophisticated and multifunctional, adolescents and young users are becoming increasingly dependent or “addicted” to this technology not only for mediated interpersonal communication through voice or text (such as SMS), but also as a tool for

seeking information online, for entertainment, relaxation, passing time, picture and video taking, expression of status and identity, and other yet-to-be invented applications.

To clinically define addictive use of the mobile phone, it is necessary to compare it against criteria for other established addictions. The American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (known as DSM) has established objective and measurable criteria for assessing "substance dependence" (American Psychiatric Association, 1994). The main diagnostic criterion is a maladaptive pattern of substance use, leading to significant psychological impairment. This impairment is manifested by seven symptoms from a list of conditions including withdrawal, tolerance, preoccupation with the substance, loss of control over the substance, more use of the substance than intended, continued consumption of the substance despite adverse consequences, and loss of interest in other social, occupational, and recreational activities.

Addictive mobile phone use can be regarded as an impulse control disorder that does not involve an intoxicant and is similar to pathological gambling. Bianchi & Phillips (2005) identified a number of signs that mobile phone addicts would exhibit and developed the mobile phone problem-use scale. It was found that dependents of mobile phones preoccupy themselves with the mobile phone (e.g., when out of range for some time, users become worried with the thought of missing a call); use the mobile phone for an increasing amount of time in order to achieve satisfaction; repeat unsuccessful efforts to control, cut back or stop mobile phone use; feel lost, restless, moody, depressed or irritable when attempting to cut down use of the mobile phone; stay on the mobile phone longer than originally intended; hide from family and friends, or others to conceal the extent of involvement with the mobile phone; and use the mobile phone as a way of escape from problems or to relieve a dysphoric mood (e.g., feeling of isolation, anxiety, loneliness, and depression).

Given the lack of similar research in this area, this study expands the work by Bianchi

and Phillips (2005) and seeks predictors from the addiction literature and other psychological theories such as leisure boredom, sensation seeking, and self-esteem in order to differentiate the addicts and the non-addicts and to explain usage patterns of mobile phones. Therefore, this study asked:

RQ₁: What mobile phone addiction symptoms can be identified among a group of adolescents and young adults?

RQ₂: Who are the mobile phone addicts and to what extent are adolescents and young adults addicted to mobile phone use?

Leisure Boredom

Perceptions of leisure as boredom are associated with negative affect, and can be manifested as beliefs that available leisure experiences are not sufficiently frequent, involving, exciting, varied, or novel (Iso-Ahola and Weissinger, 1990). Iso-Ahola & Weissinger argue that people were most satisfied with their life and leisure when they felt that they had an optimal amount of discretionary time for their activities. Leisure behavior is optimally arousing for it to be psychologically rewarding, especially when individuals perceive that they have just the right amount of time for leisure activities; not too much or too little. Thus, leisure boredom is a likely consequence of conflicting perceptions of having too much time available with too little to do (Hill & Perkins, 1985). In fact, Phillips (1993) has suggested that having an abundance of time is central to boredom.

Leisure boredom has been implicated in deviant activity involvement, particularly drug use and delinquency (Iso-Ahola & Crowley, 1991). Frequency and quantity of alcohol use among female college students has been found to be positively correlated with boredom susceptibility and adolescents who smoke report being more bored and less challenged than nonsmokers (Orcutt, 1984). In addition, young smokers perceive their leisure time as

qualitatively less fulfilling (Smith & Caldwell, 1989). Mattick & Baillie (1992) also found that adolescent smokers cite relaxation and relief from boredom as reasons for smoking.

Despite increased attention to adolescent leisure pursuits over the past two decades, researchers have generally overlooked leisure-related factors as correlates and causes of addictive use, and other deviant behaviors, with the mobile phone. This is surprising considering that such activities probably occur most often during leisure time and in leisure settings. In this study, relationships between leisure boredom and mobile phone dependency, social use, and use of special mobile phone features will be examined. Accordingly, the following hypotheses are posed:

- H_{1,1}: The higher the level of leisure boredom one experiences, the higher the likelihood one will be addicted to the mobile phone.
- H_{1,2}: The higher the level of leisure boredom one experiences, the more one will use the mobile phone.
- H_{1,3}: Subjects who score high on leisure boredom will report the highest amount of mobile phone features use.

According to optimal arousal perspective, individuals' motivation to seek out leisure activities and the activities they choose, vary according to their arousal levels. The psychological construct used to conceptualize this notion is Zuckerman, Kolin, Price, & Zoob's (1964) sensation-seeking motive.

Sensation-seeking Behavior

Past research suggested that sensation seeking has emerged as being capable of explaining a variety of behaviors, such as drug use, aggression, sex, skydiving, bungee jumping, body-contact sports, hiking and camping, or playing computer and video games (Zuckerman, 1979; 1994). Zuckerman's sensation-seeking scale (1979) measures individual

differences in sensation seeking along four dimensions: thrill and adventure seeking, experience seeking, disinhibition, and susceptibility to boredom. While the adventure-seeking dimension can be defined as a desire to engage in sports or other activities involving speed or danger (Zuckerman, Eysenck, & Eysenck, 1978), the experience-seeking dimension measures behaviors of pursuing new experiences through travel, music, art, and drug usage. The disinhibition dimension features behaviors that ignore social constraints such as fighting, seeking social stimulation through parties, social drinking, and a variety of sex partners. The susceptibility to boredom subscale measures the level to avoid boredom produced by unchanging circumstances.

Adolescence is a time for experimentation with rules, roles, and relationships. According to Jessor and Jessor (1977), adolescents purposely seek out risks. They suggest that such behaviors permit adolescents to: (1) deal with anxiety, frustration, and failure; (2) gain admission to peer groups and demonstrate identification with a youth subculture; (3) confirm personal identity; (4) express opposition to adult authority and conventional society; (5) take control of their lives; and (6) affirm maturity and mark a development transition into young adulthood. Further, Jessor and Jessor also explain the need for sensation seeking as a function of pleasure- or fun-seeking behaviors. The need for change, variety, and intensity of stimulation manifests itself in sensory, social, and thrill-seeking behaviors.

Just as there are inappropriate times to seek out leisure activities to maintain the optimal arousal level, there will also be times to use the mobile phone features to get entertained, or to contact someone to escape from boredom. This study analyzed whether sensation seeking is related to adolescents' and young adults' social and features use of the mobile phone. As a result, the following hypotheses are formulated:

H_{2.1}: Subjects who score high on sensation seeking will exhibit a higher tendency to be addicted to mobile phone use.

H_{2.2}: Subjects who score high on sensation seeking will use the mobile phone more.

H_{2.3}: Subjects who score high on sensation seeking will report the highest amount of mobile phone features use.

Self-esteem

Self-esteem is a part of the “unwillingness to communicate syndrome” because individuals who have low self-esteem expect others to react negatively because they have an unfavorable concept of self (Infante, 1976). When individuals have low self-esteem, they lack self-confidence in general, and they have little faith that their stance on controversial issues is valid. As a result, they are less motivated to communicate because they expect to fail.

Adolescence is marked by a growing sense of self-identity. Adolescents’ self-perceptions of their capabilities could be expected to impinge on activity choices. Such perceptions and expectations have been conceptualized as the self-concept, a construct which has been regarded by psychological theorists as a major motivating factor in the control and direction of human behavior (Burns, 1979). Satisfaction with one’s current activities, appearance, and friendships contributes to a positive self-concept, while deficits in such areas lower the self-concept (Deaux & Wrightsman, 1988). Negative self-concept has been used to explain a wide array of deviant behaviors and has become an important feature in many explanations of delinquency (Oyserman & Markus, 1990). Past research has also found that perceptions of boredom in leisure activities increased with a corresponding decrease in perceived self-esteem, social competence, and leisure satisfaction (Iso-Ahola & Weissinger, 1990). Gordon and Caltabiano (1996) found that adolescents who were the heaviest substance users and may even develop addictive behavior were those who scored low on self-esteem and high on sensation seeking. As a result, we propose:

H_{3.1}: Subjects who score low on self-esteem (who perceive themselves as not being in

control) will demonstrate a higher tendency of one being addicted to the mobile phone.

H_{3,2}: Subjects who score high on self-esteem will use the mobile phone more for social reasons.

H_{3,3}: Subjects who score low on self-esteem will report the highest amount of mobile phone features use.

In discussing media use from the uses and gratifications perspective, Rubin (2002) argued that individual life-position attributes – such as personality or psychological health (e.g., leisure boredom, sensation seeking, loneliness, and depression) and situational variables (e.g., social interaction or size of social capital) – will affect our motives to communicate, our strategies for seeking information and diversion, and dependency on a medium. Here, social capital refers to the amount of communication that takes place among its members within their social network (Putnam, 1993). In general, the relationship between social capital and information and communication technologies (ICTs) seems to be an ambivalent one. High levels of social capital or strong, preexisting networks, for example, are seen to be a success factor in establishing electronic-based network (Fukuyama, 2001). At the same time, the existence of ICT creates networking infrastructure that encourages the formation of social capital (Calabrese and Borchert, 1996). Thus, the relationship between social capital and ICTs seems to be reciprocal. Since social capital is about connections among people, one obvious question is whether social capital affects the need for ICT (e.g., the mobile phone) in order to maintain their level of social engagement. In examining the addictive nature of the Internet, Wallace (1999) suggested that some psychological spaces of the Internet might be so attractive, so absorbing, that they may lead people into very heavy use, even compulsive overuse. A similar question could also be asked: what is it about the psychological spaces created by the mobile phone that draws out behavior that in extreme cases looks like an

addiction? Grounded in the mobile phone addiction construct, together with leisure boredom, sensation seeking, self-esteem, and social capital, this study examined their influences on addictive use of the mobile phone. Therefore, this study seeks to expand previous research by addressing a two-part research question:

RQ₃: How can demographics, leisure boredom, sensation seeking, self-esteem, mobile phone dependency symptoms, and social capital predict (a) social use and (b) features use of the mobile phone?

Methodology

Sample and Sampling Procedure

Data were gathered from a probability sample of 624 teenagers and young adults ranging in age from 14 to 28 ($M=19.4$) who responded to a telephone survey in August 2005. Telephone numbers were randomly drawn from the most recent edition of the territory telephone directory in Hong Kong. First by selecting a page, then selecting a column within the page, and finally selecting a name with a phone number in the column. All of the calls were made from a central location during the evening, with close supervision by trained research assistants at the Survey Research Laboratory using its Computer-Assisted Telephone Interviewing (CATI) system. Non-eligible respondents (i.e., younger than 14 and older than 28), numbers that were unobtainable, and numbers that were not answered after five attempts were excluded. In addition, eligible respondents had to be mobile phone users. The sample consisted of 51.8% male respondents. The survey instrument was pilot tested before the actual fieldwork was conducted. The response rate was 62.1%.

Measurement

Mobile Phone Addiction. The 27-item Mobile Phone Problem Use Scale (MPPUS) developed

by Bianchi & Phillips' (2005) was adapted to measure mobile phone addiction in this study. However, only 17 items, which contained eight revised items from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) for screening gambling problems, were used to create the composite *mobile phone addiction index* (MPAI). The eight items from DSM-IV were also used by Young (1996) to develop her screening instrument for addictive Internet use (see Appendix 1 for details). A 5-point Likert scale was used on the 17-item MPAI scale with 1 = not at all, 2 = rarely, 3 = occasionally, 4 = often, and 5 = always. The MPAI has a mean of 39.09, ranging from 17 to 85, and s.d. = 12.13. The Cronbach's alpha was remarkably high at .89.

The eight items that are most conceptually equivalent to Young's screening instrument on Internet addiction (as shown in Table 1 and Appendix 1) include the following: (a) "when out of range for some time, you become preoccupied with the thought of missing a call" which may have some relation to Young's (1) "feeling preoccupied with the Internet"; (b) "you can never spend enough time on your mobile phone" may have its origins in the same state of mind as (2) "feel a need to use the Internet with increasing amount of time to achieve satisfaction"; (c) "you have attempted to spend less time on your mobile phone but are unable to" could have strong ties with (3) "unsuccessful efforts to control, cut back, or stop your Internet use"; (d) "feel restless and anxious if you have not checked for messages or switched on your mobile phone for some time" may resemble (4) "feel restless, moody, or irritable when attempting to cut down or stop Internet use"; (e) "find yourself engaged on the mobile phone for longer period of time than intended" may be very close to (5) "stay online longer than originally intended"; (f) "you find yourself occupied on your mobile phone when you should be doing other things, and it causes problems" may originate from (6) "you have jeopardized or risked the loss of a significant relationship, job, educational, or career opportunity because of the Internet"; (g) "you have tried to hide from others how much time

you spend on your mobile phone” could be linked to (7) “you have lied to family members, a therapist, or others to conceal the extent of your involvement with the Internet”; and (h) “you have used your mobile phone to make yourself feel better when you were feeling down” may resemble (8) “use the Internet as a way of escaping from problems or of relieving a distressed mood (e.g., feelings of helplessness, guilt, anxiety, depression).”

(* Insert Table 1 about here *)

Leisure Boredom. To assess perceptions of boredom in leisure, the Leisure Boredom Scale (LBS: Iso-Ahola & Weissinger, 1990), containing 16 items that ask people to indicate how they feel about their leisure time (i.e., non-work hours), was used. LBS is potentially usable in clinical and applied research involving examination of leisure dysfunctions such as lethargy, substance abuse, and vandalism. The scale items (e.g., “For me, leisure time just drags on and on; leisure time activities do not excite me”) were used on a 5-point scale ranging from strongly disagree (1) to strongly agree (5), with high scores indicating greater leisure boredom. The factor structure of the LBS was examined and the results indicated the existence of a single factor with a high internal consistency reliability of .78. Evidence for the construct validity of the scale was provided by a significant negative relationship with self-esteem ($r = -.48, p < .001$) and a significant positive relationship with frequency ($r = .57, p < .001$) and depth of boredom ($r = .25, p < .001$).

Sensation-seeking. The sensation-seeking scale, consisting of 4 items, was adapted from Zuckerman, Eysenck, & Eysenck, (1978) to assess desire to engage in sports-related and other activities involving speed or danger (Cronbach’s alpha = .78). Respondents were asked if they would participate in the following activities: flying an airplane, sky diving, downhill skiing, and bungee jumping. A 5-point scale was used with 1 = would never try and 5 = often

do.

Self-esteem. The 10-item Rosenberg Self-esteem Scale was used to assess this construct. It is a brief measure with high test-retest internal reliability and validity of .80 - .84 (Kivimaki & Kalimo, 1996). In the current study, Cronbach's alpha was .80.

Usage Patterns. Respondents were asked 3 questions regarding the mobile phone usage pattern: (1) how much time each day (in minutes) do you find yourself communicating with someone on the mobile phone? (2) How many minutes on average do you spend on each call? and (3) How many people do you talk to on the mobile phone on a regular basis?

Features Use. Three most common features in the mobile phone are for texting, entertainment, and information seeking. To assess texting, respondents were asked "how often do you send/receive SMS/MMS/e-mail messages?" For entertainment, respondents were asked "how often do you take/send/receive pictures, play electronic games, record video/audio, or download ring tones on your mobile phone?" And for information seeking, they were asked "how often do you read online news?" A 5-point scale was used with 1 = never and 5 = very often on all the feature questions.

Social Capital. To measure social capital, respondents were asked to report the estimated active time they met together face-to-face with (a) family and relatives and (b) friends and schoolmates in minutes the previous day.

Findings

Mobile Phone Addiction Symptoms

The mobile phone addiction index (MPAI) scale was developed to collect responses from 624 adolescents and young adults to identify mobile phone addiction symptoms and to assess their level of mobile phone addiction. As shown in Table 1, principal components factor procedure yielded a four-factor mobile phone addiction structure and accounted for

57.73% of total variance. The first factor was “*inability to control craving,*” which consisted of seven items reflecting the inabilities of adolescents and young adults to hide from others the amount of time they spent on the mobile phone, to avoid complaints they received from friends and family on their compulsive mobile phone use, and to evade loss of sleep due to excessive use. This factor had an eigenvalue of 6.2 and explained 36.48% of the total variance. The reliability of these seven items as indicated by Cronbach’s alpha was high at .83. “*Anxiety and feeling lost*” was the second factor (eigenvalue = 1.47, 8.62% of variance, $\alpha = .76$). It included four items characterizing that young adults and adolescents felt anxious, lost, preoccupied, and had difficulty switching off their mobile phone. “*Withdrawal and escape*” was the third factor (eigenvalue = 1.12, 6.56% of variance, $\alpha = .81$). It consisted of 3 items illustrating how adolescents and young adults used the mobile phone to escape from loneliness and feeling down and isolated. The fourth factor, “*productivity loss*” (eigenvalue = 1.03, 6.07% of variance, $\alpha = .60$) contained 3 items indicating that adolescents and young adults found that excessive use of the mobile phone has caused problems in their lives, decreased productivity, and diverted attention from pressing issues that they should be facing.

As a whole, these four factors were conceptually consistent with the theoretical origins described in the diagnostic criteria of pathological gambling in DSM-IV. The original DSM measure for pathological gambling was based on eight items; however, this study employed 17.

Profiles of the Mobile Phone Addicts

To assess the extent to which adolescents and young adults are addicted to the mobile phone, Young’s definition of Internet addiction was adopted. First, the eight items that are most conceptually equivalent to Young’s (1996) screening instrument on Internet addiction (as described on p. 11) were selected. The 5-point Likert scale used in the eight items of the

MPAS scale were converted to a “yes” or “no” binary scale. To convert, responses on these items with “3 = occasionally,” “4 = often,” or “5 = always” were recoded to “1 = yes.”

Otherwise, responses with “1 = not at all” or “2 = rarely” were recoded to “0 = no.”

According to Young (1996), respondents are considered “addicted” to the Internet when answering “yes” to five (or more) of the eight “yes” or “no” questions for addictive Internet use. Similarly, participants in this study were considered mobile phone addicts when they responded in the same fashion. Young (1996) stated that the cut off score of “five” was consistent with the number of criteria used for pathological gambling and was seen as an adequate number of criteria to differentiate normal from pathological addictive mobile phone use. Results based on Young’s definition indicated that 28.7% in our sample can be classified as mobile phone addicts ($M = 3.10$, $s.d. = 2.21$). This means that over a quarter of the 624 adolescents and young adults are currently mobile phone dependents.

To further distinguish the mobile phone addicts and non-addicts, a canonical discriminant analysis procedure was ordered. Results in Table 2 suggest that adolescents and young adults addicted to the mobile phone were distinguished (in the order of the strength in the structure coefficients) by scoring higher in leisure boredom and sensation-seeking, more general use (i.e., higher overall use of the mobile phone in minutes per day and staying longer on each call in minutes), and more features use of the mobile phone (e.g., sending/receiving e-mail/SMS/MMS; taking/sending/receiving pictures; recording video and audio; reading news; downloading ring tones and games; and keeping their mobile phone on at bed time) when compared to the non-addicted users. More specifically, the mobile phone addicts spent about 54.5 minutes a day more on the mobile phone ($t = -3.71$, $p < .001$) than the non-addicted. On average, addicted mobile phone users spend 108.82 minutes a day on the mobile phone while the non-addicted spend 54.41 minutes. The function correctly classified 71.7% of the cases.

As a whole, irrespective of whether they are mobile phone addicts or not, the average time on the mobile phone for the sample was 84 minutes per day. This figure was about 4.77 times more than Bianchi & Phillips' (2005) study at 17.62 minutes per day. This is probably due to the age difference, as the present study focused on adolescents and young adults (age from 14 to 28 with $M = 19$), while the Bianchi & Phillips' (2005) study was from ages 18 to 85 with the mean age equaling 36. Unlike any other, a mobile phone is the medium of choice for mediated interpersonal communication for adolescents and young adults. This new generation is at the heart of a new youth culture treating the mobile phone as a companion, where in profound and fundamental ways they play, communicate, shop, and spend their leisure time very differently than their parents.

(* Insert Table 2 about here *)

Hypotheses Testing

$H_{1.1}$ predicted that the higher the level of leisure boredom one experiences, the higher the likelihood one will be dependent on the mobile phone. As expected, bivariate results in Table 3 show that leisure boredom was significantly related to the 17-item MPAI ($r = .13$, $p < .01$). Further analyses on the relationships between leisure boredom and mobile phone addiction symptoms, such as inability to control craving ($r = .18$, $p < .001$) and productivity loss ($r = .17$, $p < .001$), were also found to be significantly linked. Thus, $H_{1.1}$ received strong support. $H_{1.2}$ proposed that the higher the level of leisure boredom one experiences, the more one will use the mobile phone. Results in Table 4 show that relationships between leisure boredom and amount of use in minutes per day, length of call in minutes per call, as well as number of people talked to regularly were all insignificant. Therefore, $H_{1.2}$ failed to receive any support. Similarly, $H_{1.3}$ hypothesized that the higher the level of leisure boredom one

experiences, the more mobile phone features one will use on a typical day. However, no significant relationships were found in Table 5 between leisure boredom and use of mobile phone features such as texting in SMS/MMS for interpersonal communication, taking/sending/ receiving pictures, playing electronic games and downloading ring tones for entertainment, and reading online news for information. As a result, H_{1.3} was not supported.

(* Insert Tables 3, 4, & 5 about here *)

H_{2.1} hypothesized that subjects who score high on sensation seeking will exhibit a higher tendency to be addicted to the mobile phone. As shown in Table 3, the relationship between sensation seeking and MPAI was significant ($r = .17, p < .001$). Further bivariate analyses between sensation seeking and addiction symptoms also show significant results. Thus, H_{2.1} was also supported. Contrary to an insignificant relationship between leisure boredom and usage pattern of mobile phone, results in Table 4 show that sensation seeking and overall use of mobile phone in minutes per day were found to be significantly related ($r = .15, p < .001$). The higher the sensation-seeking one scores, the more the mobile phone will be used. Therefore, H_{2.2} was supported. H_{2.3} predicted that subjects who score high on sensation seeking will report the highest amount of mobile phone features use. As shown in Table 5, correlation relationships between sensation seeking and use of mobile phone features for entertainment ($r = .22, p < .001$) and for information ($r = .12, p < .01$) were significant. Thus, these results supported H_{2.3}.

H_{3.1} predicted that subjects who score high on self-esteem (those who perceive themselves as being in control) will demonstrate less tendency than those who are dependent towards mobile phone addiction. Results in Table 3 indicate that self-esteem and MPAI were negatively and significantly linked ($r = -.19, p < .001$). This suggests that people who perceive

themselves as being in control will be less likely to be a mobile phone addict. As a result, H_{3,1} was confirmed. Furthermore, H_{3,2} proposed that subjects who score high on self-esteem will use the mobile phone more. Data in Table 4 show that self-esteem was significantly related to the number of people who talk regularly via the mobile phone ($r = .15, p < .001$) but the average length of each call was significantly shorter ($r = -.09, p < .05$). This suggests that confident people with a high self-esteem generally enjoy a large social circle but they only spend a short time on the mobile phone; just sufficient to achieve their ends. However, the amount of mobile phone use (in minutes per day) was not linked to self-esteem. Thus, H_{3,2} was only partially supported. According to H_{3,3}, it was proposed that subjects who score low on self-esteem will report the highest amount of mobile phone features use. Results in Table 5 seem to provide partial support for this hypothesis as self-esteem was found only significantly and negatively related to entertainment ($r = -.13, p < .01$; e.g., taking/sending pictures, electronic games, and ring tone downloads).

Predicting Mobile Phone Use

To assess how demographics, leisure boredom, sensation seeking, self-esteem, mobile phone addiction symptoms, and social capital can predict patterns of mobile phone use, three regression analyses were conducted. Results in Table 4 show that heavy use of a mobile phone in minutes per day was significantly linked to addiction symptoms, especially in the inability to control craving ($\beta = .21, p < .001$) and having anxiety and feeling lost ($\beta = .10, p < .05$). Scoring high in sensation seeking ($\beta = .18, p < .05$) was also predictive of the amount of mobile phone use. Being older ($\beta = .10, p < .05$), less educated ($\beta = -.11, p < .05$), and often got together with family/relatives ($\beta = .13, p < .001$) and friends/classmates ($\beta = .23, p < .001$) indicated those who used the mobile phone for more minutes per day. These seven predictors explained 21% of the total variance. Data also show that exhibiting greater inability to control

craving ($\beta = .22, p < .001$) in the use of the mobile phone, being female ($\beta = -.10, p < .05$), and spent a lot of time with friends/classmates face-to-face ($\beta = .09, p < .05$) were also those who spent more minutes on each call. Finally, findings also reveal that adolescents who talked regularly to a large number of people on the mobile phone tended to be older ($\beta = .26, p < .001$) and scored high in self-esteem ($\beta = .14, p < .01$). The last two regression equations explained 8% and 9% of the variance respectively.

Predicting Features Use

In predicting features use, three separate regression analyses were conducted examining the predictive power of demographics, psychological variables, and addiction symptoms on three dependent measures – use of the mobile phone for texting, for entertainment, and for information seeking. Results in Table 5 show that heavy users of texting features (such as SMS/MMS/e-mail) were those who exhibited more addictive symptoms such as feeling anxious and feeling lost without the mobile phone and the thought of missing a call ($\beta = .26, p < .001$), having trouble controlling craving ($\beta = .21, p < .001$), and withdrawal and escape ($\beta = .12, p < .01$), but did not feel they had productivity loss due to excessive texting ($\beta = -.09, p < .05$). Demographically, heavy texters seemed to be younger, educated, and often females. However, no psychological predictors such as leisure boredom, sensation seeking, and self-esteem were found significant. Similar to SMS texting, having addiction symptoms such as inability to control craving ($\beta = .20, p < .001$) and use of the mobile phone to withdraw and escape when feeling lonely and isolated ($\beta = .09, p < .05$) appeared to be significantly related to heavy use of entertainment features of the mobile phone. High sensation seekers ($\beta = .17, p < .001$) seemed to use the mobile phone for entertainment more so than others. In terms of age and social capital, they tended to be young ($\beta = -.12, p < .05$) and often got together with friends and classmates ($\beta = .12, p < .01$).

Furthermore, highly educated ($\beta = .10, p < .05$) and being socially active ($\beta = .09, p < .05$) users who often used the mobile phone for information seeking, such as reading news online, tended to be those who experienced great trouble in controlling craving ($\beta = .23, p < .001$) and experienced a significant decrease in productivity ($\beta = .11, p < .05$) as a direct result of the time spent on the mobile phone for information. The three regression equations explained 27%, 18%, and 9% of the variance respectively for SMS use, for entertainment, and for information seeking.

Conclusions & Discussion

Psychometric Properties of the MPAS

One of the major aims of this study was to identify the underlying structure of adolescent mobile phone addiction symptoms. Specifically, our data yield four clearly identifiable factors: inability to control craving, feeling anxious and lost, withdrawal and escape, and productivity loss. Principal components factor analysis results appear to provide adequate construct validity of the Mobile Phone Addiction Scale (MPAS) and accounted for 57.7% of the variance. Although, one factor, productivity loss, shows a relatively low reliability alpha of .60, the total scale alpha coefficient was very high at .89. If the three items in the productivity loss factor are removed, it only yields an overall alpha of .88 for MPAS, which does not substantially improve total scale alpha coefficient. Thus, this is not seen as sufficient evidence to warrant the exclusion of this factor. Furthermore, this factor was intended to capture an extreme consequence of mobile phone addiction – loss in productivity -- and should be expected to produce somewhat deviant responses. Therefore, the data demonstrate that the scale is internally consistent and such reliability is a necessary precondition for assessment of validity. Moreover, not only is the 17-item MPAS able to provide a wealth of contextual information relating to adolescent mobile phone addiction, but

the data also yielded clear evidence for the multi-factorial nature of mobile phone addiction symptoms – four distinct factors representing an array of domains of adolescents’ behavioral consequences from mobile phone addiction.

As a whole, MPAS (both the index MPAI and the four-symptom subscales) correlated mostly in the hypothesized manner with measures of psychologically meaningful constructs such as leisure boredom, sensation seeking, and self-esteem. These constructs cover a wide array of theoretically and practically important factors relevant for influencing mobile phone addiction in general. The fact that most constructs were significantly correlated in the predicted manner lends credence to the validity and usability of the instrument.

Effects of Psychological Attributes on Mobile Phone Addiction

In line with our hypotheses, the mobile phone addiction index (MPAI) and addiction symptom subscales were inversely related to self-esteem and directly related to sensation seeking and leisure boredom. This means that the higher one scored on sensation seeking and leisure boredom, the higher the likelihood one would be addicted to the mobile phone. Conversely, subjects who scored high on self-esteem -- who perceived themselves as being in control -- demonstrated less of a tendency to be addicted. While high sensation seekers (HSS) reported more addiction symptoms (such as inability to control craving, feeling anxious and lost, withdrawal/escape, and loss in productivity), those who scored high on leisure boredom experienced only inability to control craving and loss in productivity. Past research suggests that unless leisure is optimally arousing, it is experienced as boredom especially when having too much time available with too little to do (Iso-Ahola, 1980). According to Iso-Ahola & Weissinger (1991), limited leisure opportunities have been major contributing factors to leisure boredom. This seems logical because as it was found in the study, the longer the leisure boredom state the individual experiences, the higher the likelihood of the person being

addicted to the mobile phone.

It is also interesting to note that sensation seeking and self-esteem played the largest role in mobile phone addiction, while gender and leisure boredom appeared to have a lesser but significant influence. In particular, those who were female and had low self-esteem were the most vulnerable. These results seem to support the notion that adolescents like to experiment with rules, roles, and risks, often times, to deal with anxiety and boredom to purposely seek pleasure, variety, and stimulation through the use of the mobile phone. Furthermore, this finding is also in line with Gordon and Calabiano (1996) that adolescents who were the heaviest substance abuser and may have developed addictive behavior were those scored low on self-esteem and high on sensation seeking.

Effects of Psychological Attributes on Level of Mobile Phone Use

In terms of use, this study found that the more time one spent with family and friends, the more one would use the mobile phone. This indicates that there is no decline or displacement of face-to-face interaction despite the increased use of the mobile phone. Mobile phone use may, in fact, facilitate or coordinate face-to-face interaction. As expected, regression results also show that those who used the mobile phone more in minutes per day were those who scored high on sensation seeking, were older, less educated, and tended to exhibit more addiction symptoms (such as losing control, receiving complaints and experiencing anxiety or craving). The relatively strong relationship between sensation seeking and daily mobile phone use is consistent with the argument made by Donohew and his colleagues that high sensation seekers seek out arousal in mediated stimuli as well as in their real-world experience (Donohew et al., 1991; Palmgreen et al., 1995). Consistent with the literature, low self-esteem did not predict the level of mobile phone use (Bianchi & Phillips, 2005). As a result, the present study supports our initial prediction that differential

use of the mobile phone depends on personality tendencies.

Furthermore, it is also worthy to note that females tended to spend longer time on each call, while those who were older and high on self-esteem talked to a larger pool of people on a regular basis using their mobile phones. This suggests that, as a social technology, the mobile phone has become a popular communication utility and a relationship facilitator.

Effects of Psychological Attributes on Mobile Phone Features Use

Addiction symptoms were found to be the most powerful predictors for features use of the mobile phone. Heavy feature users of the mobile phone (such as sending/receiving SMS, for entertainment, and for information) tended to be those who often felt anxious and even lost, experienced a higher sense of losing control without their mobile phones, and often received complaints from family and friends.

Contrary to what was hypothesized, psychological attributes, such as leisure boredom, sensation seeking, and self-esteem, were not significantly linked to features used except for entertainment. Specifically, HSS tended to spend more time on the mobile phone especially on playing electronic games, downloading ring tones, and sending/receiving pictures. This finding may be explained by the fact that high sensation seekers gravitate toward the mobile phones that offer more opportunities to satisfy their need for stimulation. In doing so, HSS can maintain their optimal arousal levels, especially through the varied, novel, and risky behaviors in their leisure by engaging in the entertainment functions of the mobile phone (Gordon & Calabiano, 1996). This is especially true and provides strong support for Arnett's (1992) proposal that adolescence is marked by higher levels of sensation seeking. The insignificant relationship between the use of SMS and psychological attributes indicates that SMS has become a preferred method of communication for young adults despite what psychological state they are in. Demographically, young and educated females tended to use

SMS more, while the entertainment features attracted the young and the information functions captivated the educated for online news.

Limitation and suggestions for future Studies

Of significance, this study has indicated that mobile phone addiction is most likely to occur when the addiction is not perceived as being too great. This supposition was most clearly demonstrated through the insignificant relationships between leisure boredom and most addiction symptoms' subscales. It is also important to note that since the addiction questionnaire may contain some questions that were embarrassing or not applicable to them, particularly the younger adolescents or girls (e.g., learn to fly an airplane, parachute jumping, and try snow skiing), the overall result may have been affected. Despite its limitation, this study is one of the first to report the systematic development and psychometric evaluation of a comprehensive mobile phone addiction instrument – the MPSA. One major aim of this research in developing the scale was that it be widely applicable in future studies investigating the impacts of mobile phone addiction. Future research should focus on adaptive versus maladaptive patterns of adolescent mobile phone use and, as such, would provide some directions with regard to the focus of intervention on strategies aimed at reducing addictive use of mobile phones in adolescents.

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Table 1: Factor Analysis of Mobile Phone Addiction

	Mean	SD	Factors			
			1	2	3	4
<i>Inability to Control Craving</i>						
1. You have been told that you spend too much time on your mobile phone	1.85	1.11	.790			
2. Your friends and family complained about your use of the mobile phone	1.98	1.20	.774			
3. You have tried to hide from others how much time you spend on your mobile phone (7)*	1.84	1.00	.640			
4. You find yourself engaged on the mobile phone for longer period of time than intended (5)*	2.46	1.17	.583			
5. You can never spend enough time on your mobile phone (2)*	2.03	1.04	.576			
6. You have attempted to spend less time on your mobile phone but are unable to (3)*	2.02	1.09	.520			
7. You lose sleep due to the time you spend on your mobile phone	1.85	1.12	.517			
<i>Feeling Anxious & Lost</i>						
8. When out of range for some time, you become preoccupied with the thought of missing a call (1)*	2.70	1.26		.728		
9. You feel anxious if you have not checked for messages or switched on your mobile phone for some time (4)*	2.55	1.27		.723		
10. You find it difficult to switch off your mobile phone	2.60	1.42		.691		
11. You feel lost without your mobile phone	2.80	1.36		.648		
<i>Withdrawal/Escape</i>						
12. You have used your mobile phone to talk to others when you were feeling isolated	3.10	1.29			.839	
13. You have used your mobile phone to talk to others when you were feeling lonely	3.18	1.29			.824	
14. You have used your mobile phone to make yourself feel better when you were feeling down (8)*	2.62	1.24			.705	
<i>Productivity Loss</i>						
15. You find yourself occupied on your mobile phone when you should be doing other things, and it causes problem (6)*	2.46	1.17				.807
16. Your productivity has decreased as a direct result of the time you spend on the mobile phone	2.02	1.05				.741
17. There are times when you would rather use the mobile phone than deal with other more pressing issues	2.18	1.21				.424
Eigenvalue			6.20	1.47	1.12	1.03
Variance explained (%)			36.48	8.62	6.56	6.07
Cronbach's Alpha			.83	.76	.81	.60

Notes:

Scale used: 1 = Not at all; 2 = Rarely; 3 = Occasionally; 4 = Often; and 5 = Always; N = 624

* Items marked with '*' resemble or are equivalent to the 8-item Young's Internet addiction diagnostic scale (see Appendix 1).

Table 2:
Discriminant Analysis of Mobile Phone Addicts with Psychological Variables, Mobile Phone Usage Pattern, Features Used, and Demographics as Predictors^a
 (N=545)

Predictors	Structure Coefficients
<i>Psychological Variables</i>	
Leisure boredom	.30***
Sensation seeking	.30***
Self-esteem	-.29
<i>Mobile Phone Usage Pattern</i>	
Amount of use (in minutes per day)	.54***
Average length of each call (in minutes)	.39***
Number of people talk to regularly	.17
<i>Features Used^b</i>	
Send SMS/MMS/e-mail	.57***
Receive SMS/MMS/e-mail	.50***
Take pictures	.36***
Send/receive pictures	.36***
Record video/audio	.38***
Read news/surf the Internet	.56***
Play electronic games	.25
Download ring tones/games	.45***
Turn it off when you go to bed	-.35***
<i>Demographics</i>	
Age	.12
Gender	-.02
Education	.05
<hr/>	
Eigenvalue	.23
Canonical correlation	.43
Degree of freedom	15
Wilks' Lambda	.81
Significance	p<.001
<hr/>	
Group Centroids	
Addicts	.71
Non-addicts	-.33
Cases correctly classified	71.7%

Notes: ^a The composite *mobile phone addiction index* (MPAI), which consists of 8 items conceptually similar to Young's Internet addiction scale, was used with data ranged from 0 to 8. Respondents were considered "addicted" to the mobile phone when answering "yes=1" to five (or more) of the eight "yes" or "no" questions for addictive mobile phone use. Addicts were dummy coded as 1 and non-addicts as 0.

^b Scale used on these items: 1=Never; 5=Very often.

Table 3: Correlation of Demographics, Leisure Boredom, Sensation Seeking, Self-Esteem, and Mobile Phone Addiction

	Mobile Phone Addiction Index (MPAI) ^a	Mobile Phone Addiction Symptoms			
		Inability to Control Craving	Feeling Anxious & Lost	Withdrawal/ Escape	Productivity Loss
<i>Demographics</i>					
Age		-.08*	.11**		
Gender (male=1)	-.11**	.11**			
Household monthly income					
Education		-.10**			
<i>Psychological Variables</i>					
Leisure boredom	.13**	.18***			.17***
Sensation Seeking	.17***	.18***	.08*	.16***	.11**
Self-esteem	-.19***	-.22***	-.14**		-.15**

Notes:

^a This is a composite measure of all 17 mobile phone addiction symptom items; the higher the score, the higher the tendency of one having the symptoms.

* Figures are Pearson coefficients.

* # $p < .1$; * $p < .05$; ** $p < .01$; *** $p < .001$

Table 4: Regression of Demographics, Leisure Boredom, Sensation Seeking, Self-Esteem, Mobile Phone Dependency Symptoms, and Social Capital on Patterns of Mobile Phone Use

Predictors	Patterns of Mobile Phone Use					
	Minute of use per day		Minute of use per call		Number of people talk to regularly	
	r	β	r	β	r	β
<i>Demographics</i>						
Age		.10*			.27***	.26***
Gender (male=1)			-.13**	-.10*	.11**	
Household monthly income					.11**	
Education	-.09*	-.11**	-.08*		.10*	
<i>Psychological Variables</i>						
Leisure boredom						
Sensation Seeking	.15***	.18*				
Self-esteem		.07#	-.09*		.15***	.14**
<i>Mobile Phone Dependency</i>						
Inability to control craving	.36***	.21***	.27***	.22***		
Feeling anxious & lost	.29***	.10*	.16***			
Withdrawal/escape			.16***		.11**	
Productivity loss			.14***		.08*	
<i>Social Capital</i>						
Time spent with family/relative yesterday		.13***				
Time spent with friends/classmates yesterday		.23***		.09*		
R^2		.23		.10		.11
Final adjusted R^2		.21		.08		.09

Notes:

* Figures are Pearson's r and standardized beta coefficients.

$p < .1$; * $p < .05$; ** $p < .01$; *** $p < .001$; N=624

Table 5: Regression of Demographics, Leisure Boredom, Sensation Seeking, Self-Esteem, Mobile Phone Dependency, and Social Capital on Features Use

Predictors	Features Use					
	Interpersonal Communication ^a (SMS)		Entertainment ^b		Information ^c	
	r	β	r	β	r	β
Demographics						
Age		-.19***	-.14***	-.12*		
Gender (male=1)	-.20***	-.14***				
Household monthly income				.07#		
Education	.10*	.20***	-.12**		.09*	.10*
Psychological Variables						
Leisure boredom						
Sensation Seeking			.22***	.17***	.12**	
Self-esteem			-.13**			
Mobile Phone Dependency						
Inability to control craving	.39***	.21***	.34***	.20***	.28***	.23***
Feeling anxious & lost	.40***	.26***	.24***		.16***	
Withdrawal/escape	.32***	.12**	.25***	.09*	.14***	
Productivity loss	.17***	-.09*	.18***		.22***	.11*
Social Capital						
Time spent with family/relative yesterday						
Time spent with friends/classmates yesterday	.17***	.11**	.18***	.12**	.13**	.09*
R^2		.29		.20		.11
Final adjusted R^2		.27		.18		.09

Notes:

^a How often do they send/receive SMS/MMS/e-mail messages? Scale: 1=Never and 5=Very often.^b How often do they send/receive pictures, play electronic games, or download ring tones on your cellular phones? Scale: 1=Never and 5=Very often.^c How often do they read online news? Scale: 1=Never and 5=Very often.

* Figures are Pearson's r and standardized beta coefficients.

$p < .1$; * $p < .05$; ** $p < .01$; *** $p < .001$; N=624

Appendix 1: Young's Internet Addiction Diagnostic Criteria

1. Do you feel preoccupied with the Internet (i.e., think about previous on-line activity or anticipate next on-line session)?
 2. Do you feel the need to use the Internet with increasing amounts of time in order to achieve satisfaction?
 3. Have you repeatedly made unsuccessful efforts to control, cut back, or stop Internet use?
 4. Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop Internet use?
 5. Do you stay on-line longer than originally intended?
 6. Have you jeopardized or risked the loss of a significant relationship, job, educational or career opportunity because of the Internet?
 7. Have you lied to family members, a therapist, or others to conceal the extent of your involvement with the Internet?
 8. Do you use the Internet as a way of escaping from problems or of relieving a distressed mood (e.g., feelings of helplessness, guilt, anxiety, and depression)?
-