Linking Psychological Attributes to Addiction and Improper Use of the Mobile Phone among Adolescents in Hong Kong[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 among adolescents in Hong Kong; (2) examine how demographics and psychological attributes (such as leisure boredom, sensation seeking, and self-esteem) of individuals are related to the addiction symptoms; and (3) explore how these attributes, mobile phone addiction symptoms, and social capital can predict improper use of the mobile phone. Data were gathered from a probability sample of 402 teenagers and young adult aged 14-20 in Hong Kong. Exploratory factor analysis identified four addiction symptoms: 'losing control and receiving complaints,' 'anxiety and craving,' 'withdrawal/escape,' and 'productivity loss.' Results show that the higher one scored on leisure boredom and sensation seeking, the higher the likelihood one was addicted. Conversely, subjects who scored high on self-esteem demonstrated less of such tendency. As hypothesized, subjects who scored low on self-esteem but high on sensation seeking reported the most *improper use* of the mobile phone (especially in snapping pictures stealthily when nobody notices).

Word count = 167

Key words: Addiction; Adolescents; Hong Kong; Leisure boredom; Mobile phone; Problem use; Self-esteem; Sensation seeking; Social capital

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Introduction

Considered a novelty when they appeared in 2000 in Japan, mobile phones with build-in cameras are rapidly gaining popularity worldwide. In the United States the number of mobile phone owners has climbed to 106 million, crossing the 50% threshold. Camera phones are even more ubiquitous in European markets, led by the United Kingdom where three out of every four mobile subscribers own a camera phone (Cellular News, 2007). According to a study by the Pew Internet and American Life Project, close to half (45%) of 12 to 17 year-olds own a mobile phone in the U.S., and 33 percent 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 percent) 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 percent), play electronic games (22 percent), surf the Internet (14 percent), and send/receive emails (8 percent). 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 personal privacy and addictive or problem use are growing. To date, there has been almost no study on whether mobile phone use is addictive.

Technological advances and miniaturization of the camera phone make it easier for people to capture their voyeuristic fantasies on camera. In recent days, more and more “upskirting” (i.e., images of the view up a woman's skirt) and “downblousing” (i.e., images of the view down a woman's blouse) incidents have been reported in the news and more

voyeurists have been caught especially when these images have turned up on Internet voyeur sites. Booksellers blame "digital shoplifting" for lost profits. Consumers go to bookstores and take pictures of pages of their favorite books and read them at home. In fact, as mobile phones proliferate, so do their abuses. It is unclear why people do not exercise self-control when use might be inappropriate, improper, or simply problematic.

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 are characterized by a heightened potential for recklessness, sensation seeking, and risk taking behaviors (Arnett, 1992). This study was established and centered upon the people directly involved with a modern syndrome – adolescents 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 interpersonal communication through voice or text (such as Short messaging service -- 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:

RQ_1: What mobile phone addiction symptoms can be identified among adolescents?

RQ_2: To what extent are adolescents addicted to mobile phone use and what are their profiles?

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 problematic 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, use of special phone features, and use of the mobile phone in inappropriate places 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.

$H_{1.2}$: Subjects who score high on leisure boredom will report a higher frequency of problem mobile phone use.

Sensation-seeking Behavior

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.

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 (Donohew, Lorch, & Palmgreen, 1991; Palmgreen, Lorch, Donohew, Harrington, D'Silva, & Helm, 1995; 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) take control of their lives; (2) express opposition to adult authority and conventional society; (3) deal with anxiety, frustration, and failure; (4) gain admission to peer groups and demonstrate identification with a youth subculture; (5) confirm personal identity; 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 use the mobile phone, there will also be inappropriate times to use its camera function. This study analyzed whether sensation seeking is related to adolescents' dependency and problem 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 report a higher proportion of problem use of the mobile phone (such as snapping pictures stealthily and using it in inappropriate places).

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 most involved in crime 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 report less problem use of the mobile phone.

RQ_3: How can mobile phone dependency symptoms be predicted by demographics, leisure boredom, sensation seeking, and self-esteem?

Social Capital

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. 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 the following research question:

RQ_4: How can demographics, leisure boredom, sensation seeking, self-esteem, mobile phone dependency symptoms, and social capital predict problem use of the mobile phone?

Methodology

Setting and Sampling

Data were gathered from a probability sample of 402 teenagers ranging in age from 14 to 20 (M=16.9) who responded to a telephone survey in August 2005. The 14-20 year olds were targeted because they were the heaviest users of the mobile phone in Hong Kong (Leung & Wei, 1999; Leung & Wei, 2000). With greater access to technology than any

previous generation, teenagers in Hong Kong are coming of age in parallel with the rapid growth and global adoption of mobile phones and other wireless devices (Leung, 2007). Seen as the trendsetters of future consumer technology use, combined with their substantial spending power, the young in Hong Kong are a focus of media attention and market research. As a desirable site for this study, Hong Kong enjoys one of the world's highest rates of mobile phone penetration at 138.5 percent in a territory of 6.9 million populations.[2] This is probably due to some mobile phone subscribers who have two or more SIM cards. In their 1999 study, Leung and Wei found that typical motivation factors to use mobile phones included mobility, immediacy, and instrumentality as the strongest instrumental motives, followed by intrinsic factor such as affection/sociability.

Telephone numbers were randomly drawn from the most recent edition of the territory telephone directory in Hong Kong.[3] 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 20), 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; 69.2 percent had a camera phone and 30.8 percent had a regular mobile phone. The sample consisted of 46 percent male respondents. The survey instrument was pilot tested using a freshmen class of 36 students at a medium size university before actual fieldwork. The survey instrument was revised based on the results of the pilot study. The response rate was 62.1 percent.

Measurement

Mobile Phone Addiction. The twenty-seven-item Mobile Phone Problem Use Scale (MPPUS)

developed by Bianchi & Phillips' (2005) was adapted to measure mobile phone addiction in this study. However, only seventeen items from MPPUS, 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 adapted from DSM-IV were also used by Young (1995) to develop her screening instrument for addictive Internet use. A five-point Likert scale was used on the seventeen-item MPAI scale with 1 = not at all, 2 = rarely, 3 = occasionally, 4 = often, and 5 = always. The reliability for the scale as indicated by Cronbach's alpha was remarkably high at .90.

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 .76. Evidence for the construct validity of the scale was provided by a significant negative relationship with self-esteem ($r = -.46$, $p<.001$) and a significant positive relationship with frequency ($r = .54$, $p<.001$) and depth of boredom ($r = .17$, $p<.01$).

Sensation-seeking. The adventure-seeking sub-scale, consisting 4 items, of the 4-dimension sensation-seeking scale, 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). Other sub-scales were excluded because they deal with behaviors such as

drinking, sex, and drug. 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 ten-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 .78.

Mobile Phone Call Usage Patterns. Respondents were asked three questions regarding the mobile phone call 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 five-point scale was used with 1 = never and 5 = very often on all the feature questions.

Problem Use of Mobile Phone. Problem use means use of the mobile phone in improper or inappropriate places such as in classes, meetings, libraries, etc. As a result, respondents were asked if they had and how often they (1) make/receive calls and SMS messages at inappropriate places or occasions such as in class, meetings, libraries, hospitals, churches, crowded elevators, and in theatres or concert halls and (2) stealthily snap a picture of others when nobody notices. Again, a five-point Likert scale was used with 1 = never and 5 = very often.

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 402 adolescents to identify mobile phone addiction symptoms and, as a composite, to assess their level of mobile phone addiction. The mean score for the seventeen-item MPAI was 39.93 and s.d. equals 12.74. As shown in Table 1, principal components factor procedure yielded a four-factor mobile phone addiction symptoms structure and accounted for 60.43 percent of total variance. The first factor was "*inability to control craving*," reflecting the inabilities of adolescents 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. "*Anxiety and feeling lost*" was the second factor. It included five items characterizing that adolescents felt anxious, lost, preoccupied, and had difficulty switching off their mobile phone. "*Withdrawal and escape*" was the third factor. It consisted of 3 items illustrating how adolescents used the mobile phone to escape from loneliness and feeling down and isolated. The fourth factor, *"productivity loss"* contained 2 items indicating that adolescents 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, this study identified four mobile phone addiction symptoms which 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.

(* Insert Table 1 about here *)

Profiles of the Mobile Phone Addicts

To assess the extent to which adolescents are addicted to the mobile phone, Young's classic definition of Internet addiction was adopted; in which a total of eight items from seventeen that are most conceptually equivalent to Young's (1996) screening instrument on Internet addiction were employed. According to this classical measure, 27.4 percent in our sample can be classified as mobile phone addicts. This means that more than a quarter of the 402 mobile phone teenage users were mobile phone dependents. To further distinguish the mobile phone addicts and non-addicts, a stepwise discriminant analysis procedure was ordered. Results in Table 2 suggest that adolescents addicted to the mobile phone were distinguished (in the order of the strength in the structure coefficients) by scoring higher in features use of the mobile phone (e.g., sending/receiving e-mail/SMS/MMS; reading news; and keeping their mobile phone on at bed time), in general use (i.e., higher overall use of the mobile phone in minutes per day), and in leisure boredom and sensation seeking when compared to the non-addicted users. More specifically, the mobile phone addicts spent about 56.54 minutes a day more on the mobile phone (t = -6.49, p < .001) than the non-addicted. On average, addicted mobile phone users spend 108.51 minutes a day on the mobile phone while the non-addicted spend 51.97 minutes. The function correctly classified 74.1 percent 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 81.87 minutes per day. This figure was about 4.65 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 (age from 14 to 20 with M = 16.9), 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. 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 seventeen-item MPAI. Further analyses on the relationships between leisure boredom and mobile phone addiction symptoms, such as inability to control craving and productivity loss, were also found to be significantly linked. Thus, $H_{1.1}$ received strong support. Likewise, $H_{1.2}$ proposed that subjects who score high on leisure boredom will report the highest amount of problem mobile phone use. But, as shown in Table 4, no significant relationship was found between leisure boredom and use of the mobile phone to snap pictures stealthily and use of the mobile phone in inappropriate places. Thus, $H_{1.2}$ was rejected.

(* Insert Table 3 & 4 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. Further bivariate analyses between

sensation seeking and addiction symptoms also show significant results. Thus, $H_{2.1}$ was also supported. $H_{2.2}$ proposed that subjects who score high on sensation seeking will report a higher degree of problem use of the mobile phone. Results in Table 4 supported such a hypothesis because sensation seeking was significantly related to snapping pictures stealthily when nobody notices and use in inappropriate places such as in class, meetings, libraries, hospitals, and churches.

$H_{3.1}$ 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. 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. Finally, $H_{3.2}$ hypothesized that subjects who score high on self-esteem will report less problematic use of the mobile phone. Correlational results in Table 4 supported this hypothesis as the relationships between self-esteem and snapping pictures stealthily was significant but the use of mobile phones in inappropriate places were only marginal.

Leisure Boredom, Sensation Seeking, Self-esteem and Mobile Phone Addiction

Regression results in Table 3 show that sensation seeking was one of the strongest predictors in influencing mobile phone addiction followed by self-esteem and leisure boredom. This means that adolescents, who are most vulnerable or easily become addicted to the mobile phone, are generally those who scored high in sensation seeking and leisure boredom, and had a low self-esteem. In examining the predictive power of the three psychological variables on the four dimensions of the mobile phone addiction symptoms, data show that sensation seeking seemed most influential. Self-esteem was also a powerful predictor. Specifically, self-esteem was predictive of inability to control craving and feeling

anxious and lost. Finally, leisure boredom was also significantly linked to symptoms such as inability to control craving and productivity loss. In addition to psychological variables, size of social capital, especially in time spent with friends and classmates yesterday, and mobile phone addiction index were also linked – the larger the social circle, the higher the likelihood that they would be getting addicted. As regard to addiction symptoms, regression analyses also show that the more time youngsters spent with friends and classmates yesterday, the more they will exhibit addiction symptoms -- such as inability to control craving, feeling anxious, lost, and turning to the mobile phone to help ease isolation and loneliness. Demographically, being female seemed to indicate having the most vulnerability to exhibiting symptoms especially in inability to control craving and withdrawal and escape. The amount of variance explained ranged from 5 percent to 14 percent.

Improper Use of the Mobile Phone

To assess what predicted problem use of the mobile phone, two parallel regression equations were analyzed, using snapping pictures stealthily and the use of a mobile phone in inappropriate places, as dependent variables. Results in Table 4 show that adolescents who scored low in self-esteem and high in sensation seeking tended to be those who enjoyed taking pictures sneakily. No mobile phone addiction symptoms were significantly associated with the secret behavior of snapping pictures of others when it is unnoticed. Use of the mobile phone in inappropriate places such as in class, meetings, libraries, hospitals, and churches tended to be linked to mobile phone addiction symptoms such as inability to control craving, having anxiety and feeling lost, withdrawal and escape, productivity loss, and a larger social capital. However, use of the mobile phone in inappropriate places was not associated with psychological variables. These two equations explained 5 percent to 27 percent of the variance.

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). Although, one factor, productivity loss, shows a relatively low reliability alpha of .62, the total scale alpha coefficient was very high at .90. If the two items in the productivity loss factor are removed, it also yields an overall alpha of .90 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 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 & Crowley, 1991). According to Iso-Aloha & 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 and more addiction symptoms, such as craving and productivity loss, will be exhibited.

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, older, less educated, 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 Caltabiano (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 Problem Use of Mobile Phone

As hypothesized, subjects who scored low on self-esteem but high on sensation seeking reported the most problem use of the mobile phone (especially for snapping pictures stealthily). At the same time, subjects who exhibited most of the addiction symptoms tended to be those who were least inhibited in their mobile phone use regardless of where they were. More importantly, the study also found that the larger the social capital one enjoyed (i.e., the more opportunities taken to spend time with classmates, family, and friends face-to-face), the higher the likelihood that one would use the mobile phone in inappropriate places. This may suggest that adolescents see mobile phones as a symbol of individuality that helps social networking and expresses their identity in a ubiquitous way (Ling, 2004: p. 111). Mobile phones, increasingly personalized with character logos, various wallpaper, ring tones, colorful stickers, and snap-on phone covers, will be further popularized into a communication of choice for this cohort of users.

Furthermore, the negative relationship between self-esteem and secretly taking pictures with the camera phone when others are not paying attention suggests the possibility that low self-esteem endows adolescents with a poor or negative self-concept. Such a negative self view, a major motivating factor controlling and directing human behavior (Burns, 1979), has been used to explain a wide array of deviant behaviors especially delinquency (Oyserman & Markus, 1990). These results provide strong support to past research by demonstrating that adolescents low in self-esteem and high in sensation seeking engaged most heavily on this form of problem use of the mobile phone. Demographically,

being female, older, less educated were predictive of mobile phone addiction – but not for improper use. This may be explained that using the mobile phone in inappropriate places is almost part of the teen culture in Hong Kong with over 36 percent of the respondents admitted that they had often or very often made/received calls in crowded elevators or public transport.

Like a range of other technologies, children and young adults have indeed been avid adopters of mobile phone. Because of their prevalence and availability, their portability, their intricate incorporation into the patterns of everyday life, and increasingly, their function as media, mobile phones have posed considerable challenges, in addition to being addictive, for the conduct and regulation of private and public spheres (Ling & Pedersen, 2005). Undoubtedly, mobile phones offer the possibilities for coordination of activities and greater independent communication with peers; at the same time, children's addictive use of the technology can often be associated with a number of social problems. First, there is the high level of debt incurred by young users in owning and using a mobile due to uncontrollable use of the service. Second, there is possibility that teenagers are turning into a generation of illiterates – because many youngsters now write in abbreviated acronyms, graphic accents, emoticons, and lingo in SMS (short messaging service) rather than in Standard English. These ways of writing are often spontaneous, short, imprecise, and tend to have typos and grammatical errors – although they do speed up response time. Often times, the problem is that there is now a feeling in some schools that pupils' freedom of expression should not be inhibited. Third, there are also the moral panics about the introduction of camera phones for illicit purposes such as the potential use by teenagers for "happy slapping"[4] -- the phenomenon of people slapping someone in the face while filming their reaction with a mobile phone. The most disturbing instance of happy slapping is the report of a grievous craze in which groups of teenagers armed with camera phones slap or mug unsuspecting

children or passerby while capturing the attack. Such attack was not only filmed on mobile phones but was also circulated on the Internet. Digital bullying especially those committed with mobile phones remain almost exclusively something that is associated with children and young people. Parents, educators, psychologists, social workers, and policy makers should be aware of the threats that mobile phones might bring to young children, aside from knowing the danger of being addicted, especially the fundamental threats to our cultural values, sociability, and accepted norms of communication.

Limitations & Suggestions for Future Research

First, spending time with friends face-to-face may be considered a normal developmental step among adolescence -- important for their identity development. As a result, the heavy use of the mobile phones may in fact be a natural developmental behavior. In light of this, interpretation of these findings should be conducted with caution. Future research should widen the scope of this study by comparing results of different age groups and to examine other dependent variables such as academic performance and social networks as a result of addictive use of the mobile phone. Second, it is important to note that since the addiction questionnaire may contain some questions that were embarrassing or not applicable to respondents, particularly the younger adolescents or girls (e.g., learn to fly an airplane and parachute jumping), the overall result may have been affected. Furthermore, the significant links between sensation seeking and self-esteem and problem use, as well as the significant relationships between inability to control craving, feeling anxious and lost, and withdrawal/escape and use of the mobile phone in inappropriate places, have clear implications for treatment and intervention. Intervention strategies need to focus on helping addicts slow down their decision-making process so that they can appreciate the potential risks of their behavior. Treatment also needs to assist addicts in developing coping skills that

will allow for more effective control of impulsivity. Future studies should focus on adaptive versus maladaptive patterns of adolescent mobile phone use and, as such, would provide some directions for educators and parents 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

	Factors				Mean	SD
	1	2	3	4		
Inability to Control Craving						
1. Your friends and family complained about your use of the mobile phone	.772				2.06	1.23
2. You have been told that you spend too much time on your mobile phone	.746				1.97	1.18
3. You have tried to hide from others how much time you spend on your mobile phone (7)*	.660				1.89	1.02
4. You have received mobile phone bills you could not afford to pay	.610				2.17	1.39
5. You find yourself engaged on the mobile phone for longer period of time than intended (5)*	.591				2.49	1.19
6. You have attempted to spend less time on your mobile phone but are unable to (3)*	.589				1.98	1.09
7. You can never spend enough time on your mobile phone (2)*	.583				2.09	1.07
Feeling Anxious & Lost						
8. When out of range for some time, you become preoccupied with the thought of missing a call (1)*		.720			2.62	1.27
9. You find it difficult to switch off your mobile phone		.713			2.57	1.42
10. You feel anxious if you have not checked for messages or switched on your mobile phone for some time (4)*		.691			2.50	1.27
11. You feel lost without your mobile phone		.671			2.77	1.36
12. If you don't have a mobile phone, your friends would find it hard to get in touch with you		.663			3.62	1.29
Withdrawal/Escape						
13. You have used your mobile phone to talk to others when you were feeling isolated			.847		2.64	1.27
14. You have used your mobile phone to talk to others when you were feeling lonely			.786		3.08	1.28
15. You have used your mobile phone to make yourself feel better when you were feeling down (8)*			.620		3.21	1.29
Productivity Loss						
16. You find yourself occupied on your mobile phone when you should be doing other things, and it causes problem (6)*				.818	1.86	.97
17. Your productivity has decreased as a direct result of the time you spend on the mobile phone				.771	2.06	1.04
Eigenvalue	6.63	1.47	1.15	1.03		
Variance explained	39.01	8.63	6.76	6.03		
Cronbach's Alpha	.84	.80	.81	.62		

Notes:
Scale used: 1=Not at all; 2=Rarely; 3=Occasionally; 4=Often; and 5=Always; N=402
* Items marked with '*' resemble or are equivalent to the 8-item Young's Internet addiction diagnostic scale.

Table 2:
Discriminant Analysis of Mobile Phone Addicts with Psychological Variables, Mobile Phone Usage Pattern, Features Used, and Demographics as Predictors [a]

Predictors	Structure Coefficients
Psychological Variables	
Leisure boredom	.33***
Sensation seeking	.27***
Self-esteem	-.14
Mobile Phone Calls Usage Pattern	
Amount of use (in minutes per day)	.53***
Average length of each call (in minutes)	.23
Number of people talk to regularly	.24
Features Used [b]	
Send SMS/MMS/e-mail	.63***
Receive SMS/MMS/e-mail	.50
Take pictures	.29
Send/receive pictures	.31
Record video/audio	.35
Read news/surf the Internet	.53***
Play electronic games	.12
Download ring tones/games	.35
Turn it off when you go to bed	-.38***
Demographics	
Age	-.03
Gender	-.03
Education	.02
Eigenvalue	.32
Canonical correlation	.49
Degree of freedom	6
Wilks' Lambda	.76
Significance	p<.001
Group Centroids	
Addicts	-.39
Non-addicts	.83
Cases correctly classified	74.1%

Notes: A stepwise procedure was used to identify the significant discriminating variables in the order of their contribution. Structure coefficients are reported.

[a] The classification of subjects into being addicts or non-addicts was carried out according to the classical definition of Young's (1996) Internet addiction scale, which consists of 8 items (from the 17) conceptually similar to the classical measure. Items were dichotomized and the data used 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; N = 402

*** $p<=.001$

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

Predictors	Mobile Phone Addiction Index (MPAI) [a]		Mobile Phone Addiction Symptoms							
			Inability to Control Craving		Feeling Anxious & Lost		Withdrawal/Escape		Productivity Loss	
	r	β	r	β	r	β	r	β	r	β
Demographics										
Age	.05	.08	-.10*	.02	.15**	.19**	.08	.15*	.00	-.01
Gender (male=1)	-.06	-.10*	-.09**	-.13**	-.05	-.09#	-.06	-.11*	.06	.03
Household monthly income	.07	.08#	.05	.08	.09	.08#	.06	.05	.03	.06
Education	.02	-.03	.02	.01	.06	-.06	-.02	-.12*	.03	.04
Psychological Variables										
Leisure boredom	.13**	.14**	.20***	.17**	.05	.02	.03	.03	.15***	.17**
Sensation Seeking	.17***	.21***	.18***	.21***	.09*	.10*	.14***	.16**	.11**	.11*
Self-esteem	-.19***	-.15**	-.21***	-.14*	-.12**	-.13*	-.06	-.06	-.12**	-.07
Social Capital										
Time spent with family/relative yesterday	-.04	-.05	-.03	-.04	-.11**	-.11*	-.07	-.08	-.02	-.09
Time spent with friends/classmates yesterday	.18***	.22***	.17***	.20***	.15***	.18***	.15***	.21***	.02	.04
R^2		.16		.16		.11		.11		.07
Final adjusted R^2		.14		.14		.09		.09		.05

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's r and standardized beta coefficients.

#*p*<=.1; **p*<=.05; ***p*<=.01; ****p*<=.001; N = 402

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

Predictors	Improper Use of Mobile Phone			
	Snap Pictures Stealthily [a]		Use at Inappropriate Places [b]	
	r	β	r	β
Demographics				
Age	-.08	-.04	.03	-.04
Gender (male=1)	-.04	-.05	-.08	-.05
Household monthly income	-.04	-.04	.09	.03
Education	-.10*	-.08	.06	.07
Psychological Variables				
Leisure boredom	.05	-.02	.06	-.02
Sensation Seeking	.10*	.09*	.12*	.04
Self-esteem	-.13**	-.12*	-.09#	.04
Mobile Phone Addiction Symptoms				
Inability to control craving	.16**	-.01	.44***	.16**
Feeling anxious & lost	.16**	.06	.44***	.20**
Withdrawal/escape	.18***	.09	.41***	.13*
Productivity loss	.10*	.03	.31***	.11*
Social Capital				
Time spent with family/relative yesterday	-.06	-.03	-.11*	-.04
Time spent with friends/classmates yesterday	.13*	.09#	.24***	.13**
R^2		.08		.30
Final adjusted R^2		.05		.27

Notes:

[a] How often do you snap a picture of others stealthily when nobody notices? Scale: 1=Never and 5=Very often

[b] How often do you make/receive calls and SMS in class, meetings, library, hospitals, churches, theatre/concerts, crowded elevators, or in an airplane while taxiing? 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 = 402

End Notes:

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[2] As of May 2007, the statistics for the mobile phone subscribers in Hong Kong is 9,584,557 units in a city with population of 6.9 million. Source: Office of Telecommunications Authority in Hong Kong.

[3] In Hong Kong, obtaining a mobile phone list is difficult if not impossible. This is because, on one hand, such information is proprietary to the 4-5 service providers – among them they are in fierce competition. On the other hand, they do have the legal responsibilities to protect the privacy of personal information. Selling or allowing customer information to be used for marketing or research purposes without prior consent would be unethical.

[4] The phenomenon of "happy slapping" is not typical in Hong Kong although there were more than 36% of the respondents did admit that they had slapped pictures of others before when nobody notices. However, only 2.5% admitted often or very often for such behavior.