# 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. 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.

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.

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. Past research has found that the heaviest substance users or addicts tended to be those who scored high on sensation seeking and leisure boredom and low on self-esteem (Gordon & Caltabiano 1996; Iso-Ahola & Crowley, 1991; Iso-Ahola & Weissinger, 1990). As a result, theoretical constructs, such as leisure boredom, sensation seeking, and self-esteem, will be used as the basis from which to explain addiction symptoms and 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. In particular,

this study asked: (1) what mobile phone addiction symptoms can be identified among a

group of adolescents and young adults? And (2) who are the mobile phone addicts and to

what extent are adolescents and young adults addicted to mobile phone use?

*Leisure Boredom*

Research suggests that unless leisure is optimally arousing, it is experienced as boredom (Iso-Ahola, 1980), and that individuals who experience high levels of leisure boredom may engage in deviant activities such as substance use (Iso-Ahola & Crowley, 1991). 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 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 is related to other forms of addiction and 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. Furthermore, leisure boredom may also be correlated with adolescent participation in crime (Mukherjee & Dagger, 1990).

(* Insert Figure 1 About Here *)

Despite increased attention to adolescent leisure pursuits over the past decades, researchers have generally overlooked leisure-related factors as correlates and causes of addictive use, and other deviant behaviors, with the mobile phone. Increasingly, the mobile phone allows adolescents, while having not much to do, to be engaged in a number of activities, such as texting in SMS, gaming, accessing the internet, reading online news, shooting and viewing pictures or video, among others. 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, phone use, and use of special features in the mobile will be examined. Accordingly, as illustrated in Figure 1, we anticipate that the higher the level of leisure boredom one experiences, the higher the likelihood one will be addicted to the mobile phone ($H_{1.1}$), subjects who score high on the level of leisure boredom will report a higher frequency of phone calls on the mobile phone ($H_{1.2}$), and subjects who score high on leisure boredom will report a higher amount of mobile phone features use ($H_{1.3}$).

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' phone calls and features use of the mobile phone. We predict, as shown in Figure 1, that subjects who score high on sensation seeking will exhibit a higher tendency to be addicted to mobile phone use ($H_{2.1}$); subjects who score high on sensation seeking will have a higher frequency of phone call on the mobile phone ($H_{2.2}$); and subjects who score high on sensation seeking will report a

higher amount of mobile phone features use (H$_{2.3}$).

In conceptualizing the interrelationships between sensation seeking, mobile phone addiction symptoms, and level of mobile phone use, it is logical to think that differences in the level of mobile phone addiction may be conditional on different levels of novel or complex sensations or experiences people seek. Mobile phone addicts may be profoundly affected by sensation seeking needs and find themselves exhibiting more addiction symptoms. As a result, they may make more mobile phone calls and use more the features of the mobile phone. To understand this relationship, a simple causal path model may be appropriate to provide a better sense in which the effect of sensation seeking on level of mobile phone use may in fact be mediated through variations in mobile phone addiction of the individuals. As illustrated in Figure 1, this means that high in sensation seeking may be a cause of increased level of mobile phone addiction (i.e., Path a) which in turn may raise the overall level of mobile phone use (i.e., Path b). Therefore, an exploratory relationship can be tested according to this conceptualization. The goal of such test is to investigate if mobile phone addiction symptoms was mediating significantly and causing a reduction in the direct effect of sensation seeking on the level of mobile phone use (i.e., Path c) without eliminating the relation between sensation seeking and use of the mobile phone. If such reduction is significant, it demonstrates that a mobile phone addiction symptom is potent and the possible mediation effect is indeed present. Similarly, addiction symptoms can also be tested as possible mediators when leisure boredom and self-esteem are treated as independent variables.

### 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 that 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 ($H_{3.1}$); subjects who score high on self-esteem will report a higher frequency of phone calls on the mobile phone ($H_{3.2}$); and subjects who score low on self-esteem will report a higher amount of mobile phone features use ($H_{3.3}$) (see Figure 1 for details).

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

**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. The 14-28 year olds were targeted because they were the heaviest users of the mobile phone in Hong Kong (Leung & Wei, 1999). Telephone numbers were randomly drawn from the most recent edition of the territory telephone directory. All of the calls were made from a central location using a 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 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 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 (1996) to develop her screening instrument for addictive Internet use. 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 Cronbach's alpha was remarkably high at .89.

*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.

*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 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.

*Mobile Phone Call Usage Patterns*. Respondents were asked 3 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 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, as a composite, to assess their level of mobile phone addiction. As shown in Table 1, principal components factor procedure yielded a four-factor mobile phone addiction symptoms 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 (M = 2.00, s.d. = .78). "*Anxiety and feeling lost*" was the second factor (eigenvalue = 1.47, 8.62% of variance, α = .76, M = 2.66, s.d. = 1.01). 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, α = .81, M = 2.97, s.d. = 1.15). 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 facto*r, "productivity loss"*

(eigenvalue = 1.03, 6.07% of variance, α = .60, M = 2.22, s.d. = .79) 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. The mean score for the 17-item mobile phone addiction index (MPAI) was 39.73 with s.d. = 12.12.

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 and young adults are addicted to the mobile phone, Young's classic definition of Internet addiction was adopted; in which a total of eight items from 17 that are most conceptually equivalent to Young's (1996) screening instrument on Internet addiction were employed. According to this classical measure, 28.7% in our sample can be classified as mobile phone addicts. This means that over a quarter of the 624 adolescents and young adults were 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 composite of 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 phone calls will be reported in using 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 phone call usage patterns of the 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 higher 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 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 report higher frequency in mobile phone calls. 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 a higher 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 phone calls using the mobile phone, three regression analyses were conducted. Results in Table 4 show that heavy

use of mobile phone calls 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 calls. 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 calls 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 and young adults 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.

*Testing Possible Mediation Effect*

A comparison of the correlations and the regression analyses in Table 4 shows that the beta coefficients are often lower than the correlations or not significant at all between mobile phone addiction symptoms and mobile phone use variables. Given the fact that psychological variables, such as sensation seeking, correlate significantly with addiction, this relationship suggests mediation. This indicates that the links between the psychological variables and mobile phone use may be mediated by mobile phone addiction. According to Baron and Kenny (1986), the necessary conditions for partial or full mediation are direct relationships (as shown in Figure 1) between (1) the proposed mediator and the exogenous variable (i.e., Path a), (2) the proposed mediator and the dependent variable (i.e., Path b), and (3) the exogenous and dependent variable (i.e., Path c). Further, the sufficient condition for partial

mediation is that including the mediator variable or variables weakens the relationship between the exogenous and dependent variables. To test the possible mediation effect of addiction on mobile phone use, a series of bivariate regressions using sensation seeking (the exogenous), the composite mobile phone addiction index (the mediator), and the amount of mobile phone use in minutes per day (the dependent variable) were conducted. Leisure boredom and self-esteem were excluded in the test as they were not significant predictors in minutes of use per day (as shown in Table 4). In this study, reductions in the standardized beta of 10% were accepted as representing substantively nontrivial evidence for partial mediation. Results show that inclusion of addiction (MPAI) as mediator variable reduced the relationship of sensation seeking with mobile phone use by 46.6%. Thus, it can be concluded that mobile phone addiction does partially mediate the effects of sensation seeking on mobile phone use.

*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 (β = .20, p<.001) and use of the mobile phone to withdraw and escape when feeling lonely and isolated (β = .09, p<.05) appeared to be significantly related to heavy use of entertainment features of the mobile phone. High sensation seekers (β = .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 (β = -.12, p<.05) and often got together with friends and classmates (β = .12, p<.01). Furthermore, highly educated (β = .10, p<.05) and being socially active (β = .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 (β = .23, p<.001) and experienced a significant decrease in productivity (β = .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**

*Mobile Phone Addiction Scale*

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. 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.

***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, 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-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.

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 and young adults 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 Mobile Phone Calls Usage Patterns***

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). Therefore, 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 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 & Caltabiano, 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*

First, 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. Second, spending time with friends face-to-face may be considered a

normal developmental step among adolescence and young adults -- important for their

identity development. 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. Furthermore, the significant links between patterns of mobile phone call

and sensation seeking, inability to control craving, and feeling anxious and lost 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**

| | Mean | SD | Factors 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| ***Inability to Control Craving*** | | | | | | |
| 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 | | | |
| ***Feeling Anxious & Lost*** | | | | | | |
| 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 | | |
| ***Withdrawal/Escape*** | | | | | | |
| 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 | |
| ***Productivity Loss*** | | | | | | |
| 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.

**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 |
|---|---|
| ***Psychological Variables*** | |
| Leisure boredom | .30*** |
| Sensation seeking | .30*** |
| Self-esteem | -.29 |
| ***Mobile Phone Usage Pattern*** | |
| Amount of use (in minutes per day) | .54*** |
| Average length of each call (in minutes) | .39*** |
| Number of people talk to regularly | .17 |
| ***Features Used*** [b] | |
| 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*** |
| ***Demographics*** | |
| Age | .12 |
| Gender | -.02 |
| Education | .05 |
| | |
| Eigenvalue | .23 |
| Canonical correlation | .43 |
| Degree of freedom | 15 |
| Wilks' Lambda | .81 |
| Significance | p<.001 |
| Group Centroids | |
| Addicts | .71 |
| Non-addicts | -.33 |
| Cases correctly classified | 71.7% |

Notes: [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.

**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 |
| *Demographics* | | | | | |
| Age | | -.08* | .11** | | |
| Gender (male=1) | -.11** | .11** | | | |
| Household monthly income | | | | | |
| Education | | -.10** | | | |
| | | | | | |
| *Psychological Variables* | | | | | |
| 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

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**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 Calls | | | | | |
|---|---|---|---|---|---|---|
| | Minute of use per *day* | | Minute of use per *call* | | Number of people talk to regularly | |
| | r | β | r | β | r | β |
| ***Demographics*** | | | | | | |
| Age | | .10* | | | .27*** | .26*** |
| Gender (male=1) | | | -.13** | -.10* | .11** | |
| Household monthly income | | | | | .11** | |
| Education | -.09* | -.11** | -.08* | | .10* | |
| | | | | | | |
| ***Psychological Variables*** | | | | | | |
| Leisure boredom | | | | | | |
| Sensation Seeking | .15*** | .18* | | | | |
| Self-esteem | | .07# | -.09* | | .15*** | .14** |
| | | | | | | |
| ***Mobile Phone Addiction Symptoms*** | | | | | | |
| Inability to control craving | .36*** | .21*** | .27*** | .22*** | | |
| Feeling anxious & lost | .29*** | .10* | .16*** | | | |
| Withdrawal/escape | | | .16*** | | .11** | |
| Productivity loss | | | .14*** | | .08* | |
| | | | | | | |
| ***Social Capital*** | | | | | | |
| 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 | 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 Addiction Symptoms* | | | | | | |
| 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

Figure 1: Effects of Leisure Boredom, Sensation Seeking, and Self-esteem on Addiction Symptoms and Mobile Phone Use