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Title

Humans' attachment to their mobile phones and its relationship with interpersonal attachment style

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## Abstract

Humans have a biological predisposition to form attachment to social partners, and they seem to form attachment even toward non-human and inanimate targets. Attachment styles influence not only interpersonal relationships, but interspecies and object attachment as well.

We hypothesized that young people form attachment toward their mobile phone, and that people with higher attachment anxiety use the mobile phone more likely as a compensatory attachment target. We constructed a scale to observe people's attachment to their mobile and we assessed their interpersonal attachment style.

In this exploratory study we found that young people readily develop attachment toward their phone: they seek the proximity of it and experience distress on separation. People's higher attachment anxiety predicted higher tendency to show attachment-like features regarding their mobile. Specifically, while the proximity of the phone proved to be equally important for people with different attachment styles, the constant contact with others through the phone was more important for anxiously attached people.

We conclude that attachment to recently emerged artificial objects, like the mobile may be the result of cultural co-option of the attachment system. People with anxious attachment style may face challenges as the constant contact and validation the computer-mediated communication offers may deepen their dependence on others.

Keywords: attachment, attachment styles, attachment anxiety, cell phone, cell phone attachment, mobile phone, human-mobile interaction, gender differences

## 1 Introduction

Bowlby (1969) claimed that humans and many animal species are born with an innate attachment system that motivates them to seek and maintain proximity to significant others. In many animal species, the functioning of this system is only observable in the context of parent–offspring attachment, the ultimate function of which is to protect against predators and maintain the supply of resources for the offspring if they remain in proximity to the parent(s). In humans, however, the attachment system plays an important role also in adulthood and in different kinds of relationships, e.g. in romantic relationships (Fraley, Brumbaugh, & Marks, 2005) or friendships (Markiewicz, Lawford, Doyle, & Haggart, 2006). It is supposed that in these cases the attachment system (originally organizing infant-mother attachment) has been co-opted by natural selection to serve other survival/reproduction functions (Fraley et al., 2005; Shaver & Hazan, 1988). Alternatively, humans' increased tendency to develop attachment relationship in adulthood and to various targets may be a by-product of their prolonged neotenus state (Fraley & Shaver, 2000). According to this theory, the attachment system continues to be sensitive to certain cues and is readily activated in contexts that resemble the infant-parent relationship or elicit similar feelings or behaviours (Fraley & Shaver, 2000). This may explain why people readily develop attachment even toward non-human targets, e.g. companion animals (Archer & Ireland, 2011; Zasloff & Kidd, 1994), places (Hidalgo & Hernandez, 2001; Scannell & Gifford, 2010; Wickler, 1976), material objects (Cipriani & Kreider, 2009; Myers, 1985) or God (Kirkpatrick & Shaver, 1992; Kirkpatrick, 1994). In all forms of attachment, the proximity of the attachment figure provides a sense of security to the individual, and the separation from the attachment figure results in separation stress (Bowlby, 1969; Hazan & Shaver, 1994).

According to Bowlby (1969), interactions with available and responsive attachment figures facilitate the optimal functioning of the attachment system and promote a sense of attachment security in the child. However, when attachment figures are not reliably available and supportive, the child develops defensive secondary attachment strategies by deactivating or hyperactivating the attachment system. These strategies are called *attachment avoidance* (maximizing autonomy and distance from others, avoiding intimacy) and *attachment anxiety* (compulsively seeking proximity and protection, hypersensitivity to signs of possible rejection or abandonment). Characteristic attachment strategies developed in childhood are supposed to continue into adulthood, forming the typical adult attachment style (*secure, anxious or avoidant*) of the individual that characterizes his/her attitudes and emotions towards close others.

When a primary attachment target is not available, another solution to attain security is to search for alternative attachment targets. People are thought to use compensatory attachment targets descending a hierarchy with the primary attachment figure at the top (Hazan & Shaver, 1994; Trinke & Bartholomew, 1997). The structure of the hierarchy can include non-human targets as well (Bowlby, 1969; Hazan & Shaver, 1994), e.g. material objects.

Many assume that one of the hallmarks of the human species is material culture (e.g. Dant, 1999; Schaik, Deaner, & Merrill, 1999). From religious fetishism (Dant, 1999) to the materialism of modern consumer society (Belk, 1985), we have a special interest in objects. However, attachment to objects has been scarcely studied, and its appearance in adulthood has been considered for long as a sign of pathology (Hooley & Wilson-Murphy, 2012; Winnicott, 1971). However, there is evidence which support that healthy, well-functioning adults also report significant emotional attachment to special objects (Myers, 1985; Wapner et al, 1990). The possession of these objects seems to be soothing or psychologically helpful in times of stress (George; 2013), contributes to better mood, higher life satisfaction (Sherman, 1991), greater psychological health (Wiseman & Watt, 2004) and facilitates attachment to the living environment (Cipriani & Kreider, 2009; Whitmore, 2001).

One of the most prevalent material objects of modern society is the mobile phone. The number of active mobile subscriptions exceeds the total world population (Ericsson, 2014; Kemp, 2014). The amount of time spent on mobile use also increases, especially with the spreading of smartphones and with the much more functions they can offer. In the USA people use their smartphones 3.3 hours a day in average, and in young adults aged between 18 and 24 this number is 5.2 hours a day (Salesforce Marketing Cloud, 2014). Many authors assume that mobile phone or smartphone use can become an addiction as it is accompanied by addictive features like withdrawal, tolerance, etc (e.g. Walsh, 2014). However, mobile phone addiction is not an accepted diagnostic category (it has not been included in the DSM-5; American Psychiatric Association, 2013). Additionally, there is no standard measure for this type of addiction and there is no consensus about terminology: many terms are used for the phenomena such as mobile phone addiction, mobile phone dependence, excessive mobile use or problematic mobile use (e.g. Bianchi & Phillips, 2005; Hong, Chiu, & Huang, 2012; Toda, Monden, Kubo, & Morimoto, 2006).

Besides these concerns, it seems that some degree of dependence on the mobile phone is a general and increasingly prevalent phenomenon. For example, according to a survey in 2013, 79% of smartphone owners keep their phone with them for all but two hours of their waking hours, and one quarter of smartphone users cannot even recall the last time their phone was not

within ear shot (Levitas, 2013). About two thirds of mobile users report distress on being separated from the phone (left at home, run out of battery, etc.) which phenomenon is called „nomophobia” (Bivin, Mathew, Thulasi, & Philip, 2013; King et al., 2013; SecureEnvoy, 2012) and this proportion is even higher in young adults (Sharma, Sharma, Sharma, & Wavare, 2015). These proportions suggest that dependence on mobile phones is not an extremity or a disorder but a normative phenomenon which may have biological basis and function.

Vincent (2006) claimed that investment into the phone (e.g. personalization like adjusting individual background picture, ringtone, etc.) leads to attachment to the phone (although she uses the term ‘attachment’ not in a Bowlbian but in a broader sense). The phone can be considered as a store of memories and social connections (in the forms of phone numbers, photos, messages, etc.). Thus, the phone does not simply enhance our social life but also embodies it (Vincent, 2006). In line with this, Srivastava (2005) regarded the mobile phone as a social object which gives users the impression that they are constantly connected to the world and therefore feel less alone. Ribak (2009) considered the mobile phone as a transitional object which is especially important in the teenager-parent relationship by providing a way of negotiating between dependence and independence. Cheever, Rosen, Carrier, & Chavez (2014) and Clayton, Leshner, & Almond (2015) demonstrated that separation from the phone resulted in increased anxiety; however, they did not interpret this result in an attachment framework.

As mentioned above, attachment to objects can be interpreted as compensatory attachment strategies when primary attachment targets are not available (Bowlby, 1969; Hazan & Shaver, 1994). In line with this assumption, attachment to objects has been reported mainly in cases when important social relationships (primary attachment targets) are diminished (e.g. in nursery home: Wapner et al., 1990; Cipriani & Kreider, 2009), momentarily not available (e.g. in war: George, 2013) or lost (photos and reminiscences of dead loved ones, e.g. Cipriani & Kreider, 2009). The perceived unreliability of primary attachment figures also triggers compensatory attachment to objects in general, and to the mobile phone as well: participants primed with uncertainty about their relationships reported increased attachment to their belongings, greater separation stress from their absent phone and increased motivation to reunite with it (Keefer, Landau, Rothschild, & Sullivan; 2012). Thus, the mobile phone may also function as a compensatory attachment target providing a sense of security and substituting for the person’s social connections. At the same time, it has a relationship-facilitating function with which primary attachment relationships can be maintained and fostered. Perhaps the latter facilitates the former: as the mobile phone represents a relationship-maintaining tool and a store of social

connections and memories, it may become more easily a target of compensatory attachment than other material objects.

As uncertainty about the primary attachment figure's availability seems to contribute to the use of compensatory attachment strategies (e.g. attachment to objects), we expect that those who are permanently uncertain about closely related people's responsiveness are especially susceptible to form attachment to objects. People with anxious attachment style are hypersensitive to signs of possible rejection or abandonment, and they constantly perceive others as being unavailable and unresponsive. In line with our expectation, it was found that those who have higher level of attachment anxiety show an increased attachment to objects (Hooley & Wilson-Murphy, 2012; Keefer et al., 2012) and brands (Proksch, Orth, & Bethge, 2013), and that hoarders (who have higher levels of emotional over-involvement with inanimate objects; Nedelisky & Steele, 2009) are higher in attachment anxiety and avoidance than non-hoarders (Medard & Kellett, 2014). Regarding the mobile phone, there is no data on whether people with insecure attachment style use more the mobile as a compensatory attachment target. However, Billieux (2012) also assumed that attachment anxiety can contribute to excessive mobile phone use. In the empirical field, Ge (2014) found that mobile phone addiction was positively correlated with attachment anxiety, and two studies (Drouin & Landgraff, 2012; Weisskirch & Delevi, 2011) reported an association between anxious attachment and sending sexual text messages on the phone. However, Morey & Gentzler (2013) did not find an association between attachment anxiety and the frequency of mobile use.

In contrast to attachment anxiety, attachment avoidance has been reported to have no (Ge, 2014) or negative (Jin & Peña, 2010; Morey & Gentzler, 2013) association with mobile use frequency/addiction. Instead, people with avoidant attachment style prefer email communication over phone (Morey & Gentzler, 2013) which offers a greater psychological distance and less intimacy.

Our study is the first empirical study which investigates people's mobile use in an attachment framework. Thus, our first aim was to collect data on young people's attachment to their mobile phone and to investigate different aspects of mobile attachment (i.e. relationship-facilitating function and attachment to the object itself). Secondly, we were also interested in how attachment style influences attachment to the phone, and which aspect of mobile attachment is more important for people with different attachment styles. We assumed that for people with anxious attachment style both attachment functions of the mobile phone (relationship-facilitating function and compensatory attachment to the object) would be more important than to others, as they constantly need to be in contact with others and tend to use compensatory

attachment strategies to gain a sense of security. Our additional aim was to explore the effect of some other independent variables on mobile attachment and mobile usage: gender and type of the phone (smartphone versus traditional cell phone).

### ***1.1 Hypotheses***

We assumed that attachment to the mobile phone would have different aspects: e.g. the relationship-maintaining aspect could have been separated from the compensatory attachment to the object itself.

Additionally, we expect that people with high attachment anxiety (but not with high attachment avoidance) (1) show higher proximity-seeking and separation stress in connection with their mobile phone (which is indicative of compensatory attachment to the phone), (2) show a higher need to be constantly in contact with others through the phone and (3) (as a consequence of these) they use the phone more frequently than other people.

We assume also that because smartphones give more opportunity to be in contact with others (as they allow to communicate and contact via different communication channels and media, like Social Network Sites, chat, call, short message service etc.) and also more opportunity for the storing of social memories and connections (e.g. photos, individual ringtones, etc.), they may become more easily targets of attachment, so the possession of a smartphone may be associated with higher proximity-seeking and separation stress behaviour related to the mobile, and a more frequent use of it.

We assume that there are gender differences in mobile use: women use the phone more for communication, and men use it more for playing games (see Sánchez-Martínez & Otero, 2009). Additionally, as women have been reported to use mobile phone more intensely (e.g. Sánchez-Martínez & Otero, 2009), we expect that they show higher proximity-seeking and separation stress in connection with their mobile phone (which is indicative of compensatory attachment to the phone).

## 2 Method

### 2.1 Participants

142 Hungarian people (48 men and 94 women) participated in this study. Participation criterion was that participants had to be between 19 and 25 years old. We chose this age group because this is the first adult generation that has grown up with cell phone access so they are considered cell phone “natives” (Forgays, Hyman, & Schreiber, 2014). Additionally, this age group is particularly vulnerable to problematic mobile use (e.g. Augner & Hacker, 2012). Besides that participants had to be in this age continuum we asked no information about their exact age. Participants were recruited on the Internet, on Facebook. The study has been carried out in accordance with national and international ethical guidelines. The filling out of the questionnaires was anonym so the study does not violate respondents' privacy. Informed consent was included in the introductory letter of the questionnaire. The Ethical Committee of Eötvös Loránd University provided a written ethical approval for the study.

### 2.2 Materials

*Demographic questions:* We asked participants about their gender, and whether their cell phone is Internet-enabled or not (referred to as „type of the phone” in the followings, and the two types as “smartphone” versus “traditional phone”).

*Mobile Usage Scale (MUS):* We constructed this scale to investigate which specific activities participants usually use their phones for, such as calling, texting (short message service: SMS), multimedia messaging service (MMS), browsing the Internet, etc. (Appendix A). Participants had to rate on a 5-point Likert scale how frequently they use the phone for a specific activity, ranging from 1 (very rarely) to 5 (very often).

*Mobile Attachment Scale (MAS)* (see Appendix B): We constructed this scale to measure attachment-like features of mobile phone usage. We included items regarding different aspects of social attachment, like proximity seeking or separation stress (Ainsworth et al., 1971; Bowlby, 1969) with regards to the phone, and items specifically from the topic of mobile dependence /nomophobia like e.g. the fear of running out of battery (e.g. Bivin et al., 2013; Toda et al., 2006). Participants had to rate these statements (10 items) according to how characteristic they are to them, ranging from 1 (not characteristic at all) to 5 (very characteristic).

*Adult Attachment Scale (AAS;* Collins & Read, 1990; see Appendix C; the Hungarian translation can be found in *75 papír-ceruza teszt [75 paper and pencil tests]*, n.d.): the scale contains 18

items. AAS is based on a dimensional view of attachment and it originally contains three subscales: *closeness* (the degree to which a person is comfortable with closeness and intimacy), *dependence* (the extent to which a person feels he/she can depend on others or expect them to be available when needed) and *anxiety* (the extent to which a person is worried about being abandoned or unloved).

From these three subscales Collins (1996) derived two main scales: *anxiety* (six items) and *avoidance* (12 items). We used these two derived scales in the analysis. *Avoidance* means attachment avoidance, and it is the reverse of the original *dependence* and *closeness* scales. The advantage of using these two dimensions is that they fit to other attachment models (e.g. Brennan, Clark, & Shaver, 1998; Griffin & Bartholomew, 1994). Items are rated by the subjects on a 5-point Likert scale from 1 (not at all characteristic) to 5 (very characteristic).

### **2.3 Procedure**

The data collection began in September 2012 and ended in October 2012. Participants filled out the questionnaires on an online interface that took approximately 10-15 minutes. They were allowed to fill in the questionnaires at any place with Internet access. The questionnaires had to be filled in at once as subjects could not save them for subsequent editing.

### **2.4 Statistical analysis**

Assumptions of statistical tests were considered prior to the analyses (SPSS 18.0.0.). If the analysis and our data required, the appropriate transformation was applied to normalise distribution.

Principal component analyses were made with Varimax rotation on items of the mobile usage (MUS) and mobile attachment (MAS). Items that had 0.4 or greater loading on a particular factor were retained (Tabachnick & Fidell, 2001). Component scores were used for the further GLM analyses.

To test whether mobile usage (MUS) and attachment (MAS) was influenced by adult attachment dimensions, gender and type of the phone, we used general linear models (GLMs) with mobile attachment (MAS) total score/ MAS component scores/ MUS component scores as dependent variables, adult attachment scales (AAS) as covariates and gender and type of the phone as fixed factors. Initial models included the above main effects and all two-way interactions. We used bidirectional stepwise model selection based on p-values: we reduced the full model by excluding the variable with the highest p-value in a stepwise manner until only

significant ( $p < 0.05$ ) effects remained. The effects of previously excluded variables were re-checked by adding them one-by-one to the minimum adequate model. The argument in favour of the GLM method is that it tests more hypotheses at once hereby reducing the Type I error. Additionally, we tested also gender differences in all individual MUS items with Mann-Whitney tests and applied Bonferroni correction because of multiple comparisons.

### 3 Results

#### 3.1 Descriptive analysis and reliability of the scales

The descriptives of the MUS items are presented in Table 1. One item, MMS was excluded because of low variance in the data (from the 5 response options only two were chosen). The descriptives of the MAS items are presented in Table 2. The internal consistency of the scales was acceptable: the Cronbach's alfa was 0.71 for MUS and 0.77 for MAS.

|                       | N   | Median | Minimum | Maximum | Lower quartile | Upper quartile |
|-----------------------|-----|--------|---------|---------|----------------|----------------|
| <b>Calls</b>          | 142 | 4      | 2       | 5       | 4              | 5              |
| <b>SMS</b>            | 142 | 4      | 1       | 5       | 3              | 5              |
| <b>MMS</b>            | 141 | 1      | 1       | 2       | 1              | 1              |
| <b>Browsing</b>       | 142 | 1      | 1       | 5       | 1              | 4              |
| <b>Social Network</b> | 142 | 1      | 1       | 5       | 1              | 4              |
| <b>Chat</b>           | 140 | 1      | 1       | 5       | 1              | 2              |
| <b>Games</b>          | 142 | 1      | 1       | 5       | 1              | 2              |

**Table 1 Descriptives (sample size, median, minimum-maximum and quartiles) of the Mobile Usage Scale items (MUS)**

|                           | N   | Median | Minimum | Maximum | Lower quartile | Upper quartile |
|---------------------------|-----|--------|---------|---------|----------------|----------------|
| <b>Checking</b>           | 142 | 4      | 1       | 5       | 3              | 5              |
| <b>Separation</b>         | 142 | 4      | 1       | 5       | 3              | 5              |
| <b>Proximity at night</b> | 141 | 5      | 1       | 5       | 4              | 5              |
| <b>Go_home</b>            | 142 | 3      | 1       | 5       | 2              | 4              |
| <b>Mobile_see</b>         | 141 | 2      | 1       | 5       | 1              | 4              |
| <b>Nervous</b>            | 138 | 2      | 1       | 5       | 1              | 3              |
| <b>Nerv_other</b>         | 142 | 3      | 1       | 5       | 2              | 4              |
| <b>Worry</b>              | 142 | 3      | 1       | 5       | 2              | 4              |
| <b>Uneasy</b>             | 142 | 1      | 1       | 5       | 1              | 2              |
| <b>Debate</b>             | 142 | 1      | 1       | 5       | 1              | 1              |

**Table 2 Descriptives (sample size, median, minimum-maximum and quartiles) of the Mobile Attachment Scale items (MAS). For the full description of the scale items see Appendix B**

### **3.2 Principal component analysis of Mobile Usage Scale and Mobile Attachment Scale items**

The principal component analysis of the remaining 6 MUS items resulted in two components (Eigenvalue>1) which accounted for 67.3% of the total variance. Items such as using the phone for browsing the web, chatting, visiting social networking sites and playing games loaded highly on the first component (43.8%). We labelled this component as *Smart Mobile Phone Use* (as these functions are those which can be executed via personal computers and notebooks). Items using the phone for calls and SMS loaded highly on the second component (23.5%), so we labelled it as *Traditional Mobile Phone Use* (Table 3).

|                       | Components             |                              |
|-----------------------|------------------------|------------------------------|
|                       | Smart Mobile Phone Use | Traditional Mobile Phone Use |
| <b>Browsing</b>       | <b>,906</b>            | ,023                         |
| <b>Chat</b>           | <b>,862</b>            | -,083                        |
| <b>Social Network</b> | <b>,846</b>            | ,093                         |
| <b>Games</b>          | <b>,582</b>            | ,048                         |
| <b>Calls</b>          | -,006                  | <b>,842</b>                  |
| <b>SMS</b>            | ,056                   | <b>,832</b>                  |

**Table 3 Item loadings on the principal components of the Mobile Usage Scale (MUS)**

The principal component analysis of the MAS items resulted in three components (Eigenvalue >1), which accounted for 61.7% of the total variance. Items regarding the need of the phone being constantly close to the subject and the stress upon separation from the phone loaded highly on the first component (33.6%). Thus, we labelled this component as *Phone Proximity Seeking*. Items regarding the constant need for being in contact with people and the stress upon being unable to answer a call or reach somebody loaded highly on the second component (15.8%). Thus this component reflects the importance of not the phone itself but rather the connections it represents. We labelled this component as *Need for Contact*. The third component (12.4%) is characterized by the tendency to prefer mobile communication over live communication for discussing awkward things or for debates, so we labelled this component as

*Preference for Mobile Communication* (Table 4). One item (“Mobile\_see”) loaded almost equally on two components, so we did not include this item in the interpretation of the components.

|                           | Components              |                  |                                     |
|---------------------------|-------------------------|------------------|-------------------------------------|
|                           | Phone Proximity Seeking | Need for Contact | Preference for Mobile Communication |
| <b>Proximity at night</b> | <b>.748</b>             | -.208            | .058                                |
| <b>Separation</b>         | <b>.667</b>             | .389             | -.153                               |
| <b>Go_home</b>            | <b>.649</b>             | .392             | -.033                               |
| <b>Checking</b>           | <b>.608</b>             | .093             | .196                                |
| <b>Worry</b>              | -.181                   | <b>.793</b>      | .181                                |
| <b>Nerv_other</b>         | .249                    | <b>.774</b>      | .002                                |
| <b>Nervous</b>            | .515                    | <b>.603</b>      | .103                                |
| <b>Mobile_see</b>         | .400                    | .451             | .254                                |
| <b>Uneasy</b>             | .127                    | .059             | <b>.875</b>                         |
| <b>Debate</b>             | -.002                   | .132             | <b>.853</b>                         |

**Table 4 Item loadings on the principal components of the Mobile Attachment Scale (MAS). For the full description of the scale items see Appendix B**

### **3.3 Effects of Adult Attachment Scale, gender and type of phone on mobile usage and mobile attachment**

We used six GLMs with the MUS components (*Smart Mobile Phone Use, Traditional Mobile Phone Use*) scores, the MAS total score and the MAS components (*Phone Proximity Seeking, Need for Contact, Preference for Mobile Communication*) scores as dependent variables.

The GLM analysis with the *Smart Mobile Phone Function* component of the MUS as dependent variable revealed that the type of the phone had a main effect on it (Table 5), i.e. people with smartphones use the phone for smart phone functions more frequently than people with traditional phones. Attachment anxiety also had a significant main effect on this dependent variable (Table 5): people with higher attachment anxiety use the phone for smart phone functions more frequently than people with lower attachment anxiety. There were no significant interactions, and no significant main effect of attachment avoidance and gender on this dependent variable.

The GLM analysis with the *Traditional Mobile Phone Function* component of the MUS as dependent variable revealed that gender had a main effect on *Traditional Mobile Phone Function* (Table 5): women use the phone for traditional functions more frequently than men. There were no significant interactions, and no significant main effect of attachment scales and type of the phone on this dependent variable.

The GLM analysis with the MAS total score as dependent variable revealed that gender, the type of the phone and attachment anxiety had a significant main effect (Table 5): women, people with smartphones and people with higher attachment anxiety had higher mobile attachment (MAS) total score than men, people with traditional phones or with lower attachment anxiety. There were no significant interactions, and no significant main effect of attachment avoidance on MAS total score.

When *Phone Proximity Seeking* and *Preference for Mobile Communication* were the dependent variables, no significant main effect or interaction was found. However, when the dependent variable was *Need for Contact*, attachment anxiety had a significant positive main effect (Table 5): people with higher attachment anxiety scores have higher *Need for Contact* scores. The other independent variables had no significant main effects on *Need for Contact* and there were no significant interactions.

| <b>Dependent variable</b>                    | <b>Independent variables in the final model</b> | <b>Parameter estimate</b> | <b>Standard Error</b> | <b>Degrees of freedom</b> | <b>F</b> | <b>p</b> |
|--|---|---------------------------|-----------------------|---------------------------|----------|----------|
| <b>MUS_Smart Mobile Phone Function</b>       | <b>Type of phone (Tr→Sm)</b>                    | 1.57                      | 0.16                  | 1                         | 94.98    | <0.001   |
|  | <b>Attachment anxiety</b>                       | 0.18                      | 0.09                  | 1                         | 3.98     | 0.048    |
| <b>MUS_Traditional Mobile Phone Function</b> | <b>Gender (F→M)</b>                             | -1.47                     | 0.38                  | 1                         | 14.9     | <0.001   |
| <b>MAS total score</b>                       | <b>Gender (F→M)</b>                             | -0.26                     | 0.12                  | 1                         | 4.9      | 0.029    |
|  | <b>Type of phone (Tr→Sm)</b>                    | 0.32                      | 0.12                  | 1                         | 7.1      | 0.009    |
|  | <b>Attachment anxiety</b>                       | 0.17                      | 0.07                  | 1                         | 6.5      | 0.01     |
| <b>MAS_Need for contact</b>                  | <b>Attachment anxiety</b>                       | 0.38                      | 0.18                  | 1                         | 4.5      | 0.035    |

**Table 5 Results of the general linear models (GLMs) with *Smart Mobile Phone Function* (MUS component) score, *Traditional Mobile Phone Function* (MUS component) score, mobile attachment (MAS) total score and *Need for Contact* (MAS component) score as**

**dependent variables, subscales (attachment anxiety and attachment avoidance) of the Adult Attachment Scale (AAS) as covariates, gender and type of the phone as fixed factors. Only the independent variables of the final models are presented, with direction of change of factor levels indicated in brackets (where applicable); Tr: traditional phone, Sm: smartphone, F: females, M: males.**

### ***3.4 Gender differences in mobile use***

Mann-Whitney tests with Bonferroni corrections were run to find gender differences in the individual MUS items. Results show that women use the phone more for calling (U=1661.5; p=0.006) and SMS (U=1483; p=0.001), while men use it more for playing games (U=1600; p=0.002), and the results remained significant after Bonferroni correction (adjusted significance level for 7 tests: 0.007).

## **4 Discussion**

### ***4.1 Attachment to the mobile phone and its different aspects***

The results show that young people readily form some kind of attachment to their mobile phone. The descriptive statistics (e.g. medians are 4 or 5 on the 5-point Likert scale) of the *Phone Proximity Seeking* items of the MAS (see the medians in Table 3) show that young people usually try to maintain proximity to the phone and feel distressed when they are separated from it. These traits are the two main indicators of attachment. The principal component analysis of the MAS suggests that this kind of (compensatory) attachment to the phone is independent from its relationship-facilitating function (*Need for contact*), and also from the preference of mobile communication in uneasy social situations.

We assume that – while attachment to e.g. romantic partners may be a product of evolutionary co-option of the infant-mother attachment system (see Introduction) – attachment to the mobile phone (and also to other recently emerged artificial objects, like robots, artificial agents; see e.g. Sung et al., 2007) may be the consequence of cultural co-option of the neuronal circuits of the attachment system (‘neural recycling hypothesis’, Dehaene & Cohen, 2007; see also Parkinson & Wheatley, 2015). This may be the reason why our relationship with the mobile phone shows many constraints and features that infant-mother attachment has (e.g. proximity-seeking, separation stress).

We do not say, however, that attachment to the mobile phone is the same in every aspect as attachment to animate targets. Objects (e.g. mobile phones) have no agency, and their presence can be fully controlled. The “responsiveness” they offer is “decoupled from the care and compassion people typically seek from a human caregiver”/ partner (Keefer et al., 2012, p 913). However, it is so reliable and controllable that it may be attractive for many people. Unlike other targets, objects are exceptionally reliable, being always present when we need them, and they can be completely controlled. This is in accordance with Winnicott's (1971) theory of transitional objects stating that children cope with the temporary absence of their caregivers with the reliable presence of a valued object (e.g. blanket). Because of complete controllability, the attachment styles (secure, avoidant, anxious) described in case of interpersonal (Bowlby, 1969) and interspecies (e.g. human-dog: Zilcha-Mano, Mikulincer, & Shaver, 2011) attachment are naturally irrelevant in connection with inanimate objects, such as the mobile phone. Despite the differences, we assume that viewing our behaviour toward the mobile phone in an attachment framework is useful as not only extreme behaviour (e.g. addiction or “problematic mobile use”) but also normal behaviour can be discussed and studied (additional benefits of using the attachment framework are discussed in ‘Future direction’ section).

#### **4.2 Interpersonal attachment style and mobile attachment**

The results partly support our hypotheses as people’s higher attachment anxiety predicted higher tendency to show attachment-like features regarding their mobile phone as expressed by a higher total score on MAS. When we analysed different aspects of mobile attachment (different components of the PCA) we found that higher attachment anxiety predicted higher scores on the *Need for contact* component, which means that for anxiously attached people the most important aspects of the phone is the relationship-facilitating function (being constantly connected to others). This may be the result of their constant fear of being abandoned or rejected. However, in contrast to our expectations, people’s higher attachment anxiety did not predict higher proximity seeking toward the phone which suggests that attachment anxiety does not necessarily lead to higher tendency to form compensatory attachment toward the phone (as an object). This is in contrast with previous findings that people with higher attachment anxiety show an increased attachment to objects (Hooley & Wilson-Murphy, 2012; Keefer et al., 2012). However, our negative result may be the consequence of a ceiling effect: people (independently of their attachment style) scored the *Phone Proximity Seeking* items so high that it could not be

significantly increased. It seems that the proximity of the phone is equally important for most of the people, but the constant contact with others through the phone is more important for anxiously attached people.

The persistent contact the mobile offers seems to trigger ambivalent feelings in most people: e.g. while being able to contact others is one of the most liked qualities of the mobile, being continuously available for others' contact is also one of its most disliked qualities (Baron & Ling, 2007; Baron, 2008). In friendships the mutual expectation to maintain the relationship through the phone has contradictory consequences: it leads to dependence, which increases relationship satisfaction, but also to overdependence, which decreases satisfaction (Hall & Baym, 2011). The constant contact the mobile encourages and the expectations of friends to maintain relationships through the phone may lead to "hyper-coordination" (i.e. the experience of anxiety-provoking relational dependence; Ling, 2004) or "feelings of imprisonment and entrapment" (Baym, 2010; Hall & Baym, 2011). Thus, the mobile phone is a tool of negotiating between dependence and independence (Ribak, 2009). The degree how much people need dependence and independence is influenced by their attachment style, avoidant people need more independence, people with anxious attachment style need more dependence, and secure individuals between. Thus, for anxiously attached people the dependence the mobile offers may be a valued feature, while for secure and mostly for avoidant people it can cause feelings of overdependence and entrapment.

This raises the question whether mobile communication helps people with anxious attachment style to overcome their emotional difficulties or it just worsens the situation by increasing their dependence on others. According to Turkle (2006), the mobile phone (and Internet) gives us an opportunity to communicate "whenever we have a feeling", which may make us to be unable to reflect on our own emotions. As people with insecure attachment style have difficulties with self-reflection (Fonagy, Steele, Steele, Moran, & Higgitt, 1991; Fonagy, Steele, Steele, & Leigh, 1995; Fonagy & Target, 1997), the reliance on the outside validation of their inner states through the mobile (and Internet) communication may increase their dependence on others and may also expose them to the danger of e.g. 'oversharing'.

We have found a marginally significant association between mobile use frequency and attachment anxiety, but only in case of smart phone functions: anxiously attached people use the phone more for e.g. chatting or visiting social network sites, but do not use it more for calls or SMS-s. We suppose that because of their higher need for being constantly connected to others, people with anxious attachment style use the phone more. However, we would have expected that they would use the phone more also for calling and SMS-s, but the results do not

support this. In the literature, results are also contradictory: while some authors found an association between attachment anxiety and mobile phone addiction (Ge, 2014) or “sexting” (sending sexual text messages) on phone (Drouin & Landgraff, 2012; Weisskirch & Delevi, 2011), Morey & Gentzler (2013) did not find an association between mobile use frequency and attachment anxiety. It is possible that people with different attachment style use the phone with different motivations, but the amount of time they spend on it is almost the same. Alternatively, while the frequency of usage is the same, their usage could have different features, e.g. anxiously attached people may show more addiction-like features in their mobile use (Ge, 2014). Thus, frequency of use may not be a good indicator of the user’s attachment style, while other features like the need for contact through the phone are better.

#### ***4.3 Smartphones and mobile attachment/mobile usage***

We found that people owning a smartphone have a higher tendency to show attachment-like features to the phone (expressed by higher scores on the MAS). However, when we analyzed the attachment components separately, we found no significant effect of type of phone on these components. Thus, neither aspects of mobile attachment is prominently important for smartphone users, instead they have an increased tendency to develop attachment toward the phone in general. As far as we know no study has compared phone attachment of smartphone and traditional cell phone users, so this study is the first in this field. Neither do we know about any data on the ratio of mobile addiction/problematic mobile use between these two populations. However, an increase in the number of smartphone subscriptions and an increase in the intensity (duration, frequency, etc.) of mobile use (Ericsson, 2014) in recent years suggest that with the emergence of smartphones a more substantial engagement with the phone has emerged.

#### ***4.4 Gender differences in mobile usage and mobile attachment***

As expected, women used the phone more frequently for traditional functions: calling and SMS, which is in accordance with Sánchez-Martínez & Otero’s (2009) finding that women use the phone more to communicate. Similarly, females have been found to use the mobile phone more likely for social purposes (Bianchi & Phillips, 2005; Wei & Lo, 2006), compared to men who are more likely to use it for seeking information (Wei & Lo, 2006), for business purposes (Bianchi & Phillips, 2005) or for playing games (see our results or the results of Sánchez-Martínez & Otero, 2009). Perhaps because the phone is mainly a communication device, women have been reported to use the mobile phone more intensely (e.g. Billieux,

2008; Sánchez-Martínez & Otero, 2009; but see: Bianchi & Phillips, 2005), as they did in the case of the fixed phone (Fischer, 1994; Smoreda & Licoppe, 2000). Perhaps because the social function is more important for women, they have been reported to be more prone to experience dependence on the mobile phone (Billieux, 2008; Geser, 2006). Similarly, we found that women have a higher tendency to form attachment toward the phone than men.

#### ***4.5 Limitations of the study***

The aim of this exploratory study was to collect data for future more experimentally oriented research. It is possible that the items we included in the Mobile Attachment Scale do not cover all aspects of mobile attachment. For example, we did not include items regarding secure base and safe haven effects in connection with the mobile phone. Additionally, items may need to be rephrased for eliminating e.g. ceiling effect. Thus, a more rigorous scale development process with larger item pool would be important to carry out in the future, and further studies are needed to establish the psychometric properties (validity and reliability) of the scales.

Additionally, our sample is limited in size and representativeness, e.g. all participants were Hungarian, Facebook-user, etc. A culturally/demographically varied and larger sample would be beneficial to use in future work.

#### ***4.6 Future directions***

Additional questionnaire studies are necessary to carry out to get a more subtle picture about mobile attachment (e.g. regarding secure base and safe haven effect). In addition, experimental studies are needed to validate the results and to show attachment to mobile phones in a behavioural and physiological level.

We hope that with this work we establish a new approach that views people's behaviour toward the mobile phone in an attachment framework rather than considering it as an abnormal/extreme behaviour (e.g. addiction). Additionally, the hypothesis that mobile attachment co-opts the same neuronal circuits as infant-mother or romantic attachment can be tested through neuroimaging studies and findings can widen our knowledge about neuronal recycling/ cultural repurposing with a case of a socioemotional phenomenon besides the purely cognitive skills (like reading, arithmetic; see e.g. Dehaene & Cohen, 2007; Sievers, Polansky, Casey, & Wheatley, 2012). And if we discover that our new kind of relationship with the mobile phone alters somehow our relationships with humans (as in case of other cultural skills which have been found also to shape the recycled neural circuits; Pegado et al, 2014; Ventura et al, 2013), new directions of future technology development should be considered in order to avoid/overcome negative consequences.

#### ***4.7 Conclusion***

In summary, our results suggest that 1) people show some form of attachment toward their mobile phone and 2) some features of their attachment to the phone are influenced by their interpersonal attachment style. Specifically, anxiously attached people need more contact through the phone, and perhaps because of this they use the phone more for smart phone functions (but not for traditional mobile phone functions). However, in contrast to our expectations, people with anxious attachment style do not show more proximity seeking and separation stress behaviour in connection with their phone, which suggest that they do not use the phone more as a compensatory attachment target than other people.

## 5 Appendix A

How often do you use your phone for the following functions?

|                         | 1- very rarely            | 5- very often |
|-------------------------|---------------------------|---------------|
| Calls                   | 1-----2-----3-----4-----5 |               |
| SMS                     | 1-----2-----3-----4-----5 |               |
| MMS                     | 1-----2-----3-----4-----5 |               |
| Browsing the Internet   | 1-----2-----3-----4-----5 |               |
| Social networking sites | 1-----2-----3-----4-----5 |               |
| Chat                    | 1-----2-----3-----4-----5 |               |
| Games                   | 1-----2-----3-----4-----5 |               |

## 6 Appendix B

To what extent are the following statements characteristic of you?

1-----2-----3-----4-----5

Not at all characteristic of me

Very characteristic of me

| Short name      | Item  |
|-----------------|---|
| Checking        | I regularly check my phone even if it does not ring.  |
| Separation      | I feel bad when I leave my phone at home/ when it runs out of battery.  |
| Night_proximity | My phone is within my reach even at night.  |
| Go_home         | If I left my phone at home, I would be willing to go home for it.   |
| Mobile_see      | When I sit down somewhere (e.g. in a cafe, a lecture, to a dining table, etc.), I put my phone at a visible place, within my reach. |
| Nervous         | I'm nervous if I cannot be reached on the phone.  |
| Nerv_other      | I'm nervous if I cannot get through somebody immediately.   |
| Worry           | If a close friend/ family member doesn't pick up the phone, I start to worry/ have a bad feeling.                                   |
| Uneasy          | I prefer talking about awkward things on the phone rather than face to face.  |
| Debate          | I prefer settling a dispute (with partner, family members, etc.) on the phone rather than face to face.                             |

## 7 Appendix C

### Adult Attachment Scale

Please read each of the following statements and rate the extent to which it describes your feelings about close relationships.

Please use the scale below by placing a number between 1 and 5 in the space provided to the right of each statement.

1-----2-----3-----4-----5

Not at all characteristic of me

Very characteristic of me

- (1) I find it relatively easy to get close to others. \_\_\_\_\_
- (2) I do not worry about being abandoned. \_\_\_\_\_
- (3) I find it difficult to allow myself to depend on others. \_\_\_\_\_
- (4) In relationships, I often worry that my partner does not really love me. \_\_\_\_\_
- (5) I find that others are reluctant to get as close as I would like. \_\_\_\_\_
- (6) I am comfortable depending on others. \_\_\_\_\_
- (7) I do not worry about someone getting too close to me. \_\_\_\_\_
- (8) I find that people are never there when you need them. \_\_\_\_\_
- (9) I am somewhat uncomfortable being close to others. \_\_\_\_\_
- (10) In relationships, I often worry that my partner will not want to stay with me. \_\_\_\_\_
- (11) I want to merge completely with another person. \_\_\_\_\_
- (12) My desire to merge sometimes scares people away. \_\_\_\_\_
- (13) I am comfortable having others depend on me. \_\_\_\_\_
- (14) I know that people will be there when I need them. \_\_\_\_\_
- (15) I am nervous when anyone gets too close. \_\_\_\_\_

(16) I find it difficult to trust others completely. \_\_\_\_\_

(17) Often, partners want me to be closer than I feel comfortable being. \_\_\_\_\_

(18) I am not sure that I can always depend on others to be there when I need them. \_\_\_\_\_

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