Full length article

Avoidance or boredom: Negative mental health outcomes associated with use of Information and Communication Technologies depend on users' motivations

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ABSTRACT

Previous research shows that high Information and Communication Technology (ICT) use is associated with higher levels of anxiety, depression, and overall psychological distress; however, there are few relevant studies on this topic. The current study was conducted to explore the relationship between Internet and mobile phone use and mental health. In Study 1, participants were given questionnaires to assess their manner of mobile phone and Internet use and their levels of depression and anxiety. There were strong positive relationships between lower mental health and problematic ICT use, especially when people turned to ICTs to avoid negative experiences or feelings. However, when participants used ICTs merely to escape boredom, no link was found between ICT use and mental health problems. Study 2 was completed to observe how students utilize their mobile phones to cope or escape from feelings related to an anxiety-inducing situation. Results indicated that the mobile phone may offer a small "security blanket" effect, lowering the initial negative reaction to stress, although the pattern of stress over the course of the experiment was the same for participants in all groups. Our findings suggest that long term utilization of ICTs as an emotional coping strategy may have a negative influence on mental health and/or exacerbate mental health predispositions.

1. Introduction

In today's technology-saturated world, it is typical to see people with their devices in hand everywhere they go: at bus stops, on the street, in classrooms and movie theaters, on dates, at parties, during family gatherings, etc. And more often than not, people are not speaking into their mobile phones, but are rather focused down at them — texting, browsing the Internet, or playing games. Literally millions of applications or "apps" — interactive programs with various functions that can be downloaded onto phones — have been created to keep individuals occupied in any situation, and often lure people into spending hours of their day focused on screens as small as their palms: typing, reading, or playing. Considering how prevalent these devices are and how much of our attention we funnel into their screens, it is important to have a comprehensive understanding of how they affect people socially and psychologically, and to discuss the influences they might have on us in the long run.

1.1. Mobile phones and psychological distress

1.1.1. Anxiety

Research shows that high engagement with the mobile phone and the Internet is correlated with higher levels of anxiety, especially when that engagement is text-based instead of call-based. According to a study by Park and colleagues (Park, Hwang, & Huh, 2010) in Korea, individuals who were addicted to their mobile phones had higher rates of social anxiety. Upon exploring the reasons the adolescents engaged in texting, researchers found that participants felt more comfortable texting than having real life interactions (Park et al., 2010). A study done by Reid and Reid (2007) in the United Kingdom affirmed this relationship between anxiety and texting. They found that whereas lonely individuals preferred voice calls over texting, anxious participants preferred texting over voice calls. This may be, as Park and colleagues' study (2010) suggested, because the one-dimensional nature of texting is less cognitively and emotionally tolling than the more engaged behavior of voice-calling, thereby appearing more attractive to

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anxious individuals. Another study by Tamyra Pierce (2009) in California showed that there is a positive relationship between social anxiety and talking with others online and via text messaging.

Although it may be argued that the anxiety measured in these studies is the reason for the high mobile phone/Internet use in the first place and not a consequence thereof, high engagement with ICTs may exacerbate predispositions to anxiety, leading to the deepening of a kind of downward spiral. This may be because text-based communication such as the kind facilitated by mobile phones is a tolling process in itself often characterized by ambiguity and the misunderstandings and anxiety that accompany efforts to decipher it (Murdock, 2013; Thomée, Dellve, Härenstam, & Hagberg, 2010). Also, the substitution of face-to-face interaction for mediated communication means sacrificing opportunities for multi-layered social interactions, the practice of which could lead to improved socializing abilities, higher confidence, feelings of competence, and eventually decreased anxiety in social situations.

1.1.2. Depression

Another potential consequence of excessive mobile phone use is depression. Sanchez-Martinez and Otero (2009) found that intensive mobile phone use among Spanish adolescents was associated with depression, along with other behaviors such as smoking tobacco and excessive alcohol consumption (Sanchez-Martinez & Otero, 2009). Another study conducted by Thomée and colleagues in Sweden (Thomée, Harenstam, & Hagberg, 2011) controlled for other potential contributors to unhealthy psychological functioning such as relationship status, education level, and present occupation and still found that mobile phone use showed a significant relationship with depression, sleep disturbances, and current stress. In a Spanish study on the subject, Beranuy and colleagues (Beranuy, Oberst, Carbonell, & Chamarro, 2009) found a correlation between maladaptive Internet use and mental distress, and between maladaptive mobile phone use and mental distress.

Once again, it is possible that the relationship is reverse and that individuals with depression use mobile phones more intensively to tap into their social networks for help with coping, but research shows that stress combined with high texting leads to lower emotional wellbeing (Murdock, 2013) and that the frequency of mobile phone use has almost no association with perceived access to social support for men and no association for women (Thomée et al., 2011).

1.1.3. Escapism

Another trend observed in research is people reporting that they use mobile phones as a means of escape. Reid and Reid's study in the United Kingdom (2007) reported that anxious participants used texting as a diversion when they were bored or when they wanted to avoid some other activity. In a recent study with Indian university students (Nehra, Kate, Grover, Khenra, & Basu, 2012) 43% of participants agreed the mobile phone provides an escape from problems, and 70% agreed that the mobile phone helped them overcome bad moods such as feelings of inferiority, helplessness, guilt, anxiety, depression, etc. (Nehra et al., 2012). Another study on the gratifications sought by people who text showed that the second most common reason for texting (out of five) was for Relaxation/Escape (Grellhesl & Punyanunt-Carter, 2012). These findings about the utilization of phones for escape can also be supported by observation. In a variety of cultures and settings around the world, it is commonplace to observe people in uncomfortable or "awkward" situations turn to their mobile phones as a way to disengage or distract themselves from what is going on in real time around them, a behavioral pattern which can also be replicated during times of more intense distress.

This behavior falls into the category of *avoidance coping* which research has shown is a generally unhealthy way to handle problems, especially over the course of time. Individuals who engage in avoidance coping experience more stress and symptoms of depression later on in their lives (Holahan, Moos, Holahan, Brennan, & Schutte, 2005; Seiffge-Krenke & Klessinger, 2000), are more likely to experience burnout in stressful work contexts (Leiter, 1991), and tend to have lower self-esteem than those who do not engage in avoidance coping (Chapman & Mullis, 1999; Mitchell & Hodson, 1983).

1.1.4. The current study

With the aforementioned research and findings as a foundation, the current studies will further expand the literature on this subject by exploring the relationship between maladaptive mobile phone and Internet use — use that is not purely functional but rather involves prioritizing the ICTs over other activities or in vivo social interactions, being emotionally attached to ICTs, and seeking comfort in them — with psychological problems such as anxiety and depression in a sample of US college students. Because research has suggested that ICT devices could also be utilized for escape from negative emotional experiences or situations (Demirci, Akgonul, & Akpinar, 2015; Grellhesl & Punyanunt-Carter, 2012; Nehra et al., 2012) and it has been shown that avoidance coping is associated with decreased mental health (Chapman & Mullis, 1999; Holahan et al., 2005; Leiter, 1991; Mitchell & Hodson, 1983; Seiffge-Krenke & Klessinger, 2000), the current studies tested the hypothesis that using the mobile phone and/or Internet as a tool for this form of emotional escapism is associated with higher depression and anxiety.

Importantly, the questionnaires chosen for the purposes of measuring maladaptive Internet and mobile phone use (the CERM, CERI, and IAT discussed in the following section) allowed us to disentangle two possible forms of escapism: escapism from normal boredom (the kind arising during periods of time that lack stimulating activities) and escapism from negative emotional situations (i.e., a specific form of avoidance coping). We predicted that the latter, but not the former, form of escapism would be related to mental health issues as avoidance coping has shown to have negative psychological consequences, whereas the former manner of use falls in the category of distraction from a lack of stimulation or a desire for entertainment, which have not been associated with psychopathology.

Two related studies were conducted. The first study utilized questionnaires on the manner of mobile phone use (CERM) and Internet use (CERI and IAT) as well as the degree of anxiety (MASQ-A) and depression (MASQ − D) in order to observe if there were any relationships between these measures in our sample of college students, and with a focus on items pertaining to escapism in particular. The second study was a follow-up to the first, expanding on the correlational results by using an experimental design to observe in a real setting how college students rely on their mobile phones during an experience of heightened anxiety.

2. Study 1 − Questionnaire study

2.1. Methods

2.1.1. Participants

The participants for the study were initially 375 undergraduate University of Illinois at Urbana-Champaign students enrolled in Psychology courses. 57 were dropped from the analysis due to incomplete questionnaire responses. The remaining 318 participants were 157 males and 161 females. All participants signed up for the study voluntarily via the Subject Pool website (SONA). They

were awarded 1 h of course credit for their participation. Although data on age was not collected, participants were all students pursuing a Bachelor's degree, therefore the age range is assumed to be between 17 and 21.

2.1.2. Materials

The materials for this study were four questionnaires: the Questionnaire About Experiences Related to the Internet (originally CERI: Cuestionario de Experiencias Relacionadas con Internet) (Beranuy, Chamarro, Graner, & Carbonell, 2009).), the Questionnaire About Experiences Related to the Cell Phone (originally CERM: Cuestionario de Experiencias Relacionadas con el Móvil) (Beranuy, Chamarro, et al., 2009; Beranuy, Oberst, et al., 2009), the Mood and Anxiety Symptom Questionnaire (MASQ) to measure anxiety and depression (specifically the Anxious Arousal and Anhedonic Depression subscales) (Watson & Clark, 1991, 1995), and the Internet Addiction Test (IAT) (Young, 1998) with a Likert-type scale from 1 to 5. The CERM and CERI were translated into English via a collaborative effort between the authors of the current article and the creators of the original Spanish questionnaires in Spain (Carbonell and colleagues, see Beranuy, Chamarro, et al., 2009a; Beranuy, Oberst, et al., 2009b; Carbonell et al., 2012). We conducted a series of forward and backward translations with professors and students proficient in English and Spanish until a final version was achieved and approved by all translating parties. The English translations can be found in the Appendix for future reference. The web host used for the questionnaires and data collection was Qualtrics.com.

To measure maladaptive mobile phone use we used the mean score of the 10 item CERM scale, which has two factors: conflicts and communicative/emotional use, and has shown good reliability (Cronbach's alpha = .805) (Carbonell et al., 2012). To measure maladaptive Internet use we used the mean score of the 10 item CERI scale, which also comprises two factors: intrapersonal conflicts and interpersonal conflicts, and has similarly strong reliability (Cronbach's alpha = .776) (Carbonell et al., 2012). In Beranuy et al.'s study on the construct validity of both scales (2009), it was shown that the CERI assessed intra- and inter-personal conflicts due to maladaptive Internet use, whereas the CERM showed more sensitivity to issues with emotion-related communication. Internet addiction was measured via the 20 item IAT, which has shown to have a high degree of construct validity (Panayides & Walker, 2012). The depression index was computed using a 21 item Anhedonic Depression subscale of the MASQ questionnaire. Similarly, the anxiety score was computed using a 17 item Anxious Arousal subscale of the MASQ questionnaire. Our use of these sub-tests of the MASQ questionnaire is in accordance with their well-established use in the literature (Nitschke, Heller, Imig, McDonald, & Miller, 2001; Bredemeier et al., 2010).

2.1.3. Procedure

The participants signed up for the study online on the University of Illinois subject pool website and completed the questionnaire on the Qualtrics.com web host. Consent was required in order for the questionnaire to start and after submission the responses were anonymously recorded by the website. Participants completed the survey remotely from their own location.

2.2. Study 1 results

Pearson correlation coefficients were computed in order to determine the relationships between the variables of maladaptive mobile phone use, maladaptive Internet use, Internet addiction, depression, and anxiety (see Table 1). Statistically significant correlations were found between all measures, with the strongest

Table 1
Pearson correlations for the questionnaires – study 1.

	CERM	CERI	IAT	MASQ-D	MASQ-A
CERM	1				
CERI	.562[a]	1			
IAT	.520[a]	.791[a]	1		
MASQ-D	.194[a]	.306[a]	.330[a]	1	
MASQ-A	.452[a]	.392[a]	.577[a]	.225[a]	1

CERM – Cuestionario de Experiencias Relacionadas con el Móvil (Questionnaire About Experiences Related to the Cell Phone).
CERI – Cuestionario de Experiencias Relacionadas con Internet (Questionnaire About Experiences Related to the Internet).
IAT – Internet Addiction Test.
MASQ-D – Mood and Anxiety Symptom Questionnaire – Depression.
MASQ-A – Mood and Anxiety Symptom Questionnaire – Anxiety.
[a] Significant at .01 level.

relationships being between Internet addiction and anxiety ($r = .577$, $p < 0.01$), maladaptive mobile phone use and maladaptive Internet use ($r = .562$, $p < 0.01$) maladaptive mobile phone use and anxiety ($r = .452$, $p < 0.01$), Internet addiction and depression ($r = .330$, $p < 0.01$), and maladaptive mobile phone use and depression ($r = .194$, $p < 0.01$). The full set of correlations can be found in Table 1. Sex effects were found only for mobile phone behavior, with females having a higher incidence of maladaptive mobile phone use than males (mean CERM score for females was 1.90, compared to 1.71 for men, t(316) = −3.74, p < 0.001).

We also wanted to test the hypothesis that using ICTs as a means of escaping from negative emotional or cognitive experiences (by activating the maladaptive behavior of avoidance coping) is positively associated with depression and anxiety. In order to do so, single items from the CERI, CERM, and IAT that pertained to escapism were individually correlated with the depression and anxiety subsets of the MASQ. The escapism item on the CERI was, "When you have problems, do you connect to the Internet to help you evade them?" The escapism item on the IAT item was, "How often do you block out disturbing thoughts about your life with soothing thoughts of the Internet?" Both of these items measure the use of a strategy for emotional avoidance coping (it is important to note that although the questions pertained to the Internet, most mobile phones used by young people in the US are smartphones (Smith, 2015) which allow Internet access at any time). In contrast, the escapism item on the CERM was, "When you get bored, do you use your cell phone as a form of distraction?" We view this last item as indexing a strategy for fighting normal boredom.[1]

As expected, the results showed statistically significant correlations for the CERI escapism item with anxiety ($r = .276$, $p < 0.01$) and depression ($r = .289$, $p < 0.01$) and the IAT escapism item with anxiety ($r = .278$, $p < 0.01$) and depression ($r = .407$, $p < 0.01$). In contrast, the CERM (boredom) escapism item was not significantly correlated with anxiety ($r = .058$, $p = 0.300$) nor depression ($r = −.022$, $p = 0.691$). (See Table 2). We then statistically compared the correlations regarding emotional avoidance with the ones associated with boredom. For anxiety, the .276 correlation between emotional escapism in the CERI and anxiety was significantly different from the .058 correlation between boredom in the CERM

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[1] Although using a single-item measure for assessing a construct (here, the emotional escapism item in the IAT and CERI or the boredom escapism in CERM) is not optimal due to higher variability in the measures, the questionnaires that are used in the literature include these items, therefore we sought to capitalize on them. Note that there are various studies in the social psychology literature that have studied (and used) single-item responses (see Robins, Hendin, & Trzesniewski, 2001; Gosling, Rentfrow, & Swann, 2003; Rammstedt & John, 2007).

Table 2
Pearson correlations for Escapism items and mental distress − study 1.

	Depression	Anxiety	CERM escape	CERI escape	IAT escape
MASQ-D	1				
MASQ-A	.225[b]	1			
CERM Escape	-.022	.058	1		
CERI Escape	.276[b]	.289[b]	.128[a]	1	
IAT Escape	.278[b]	.407[b]	.036	.474[b]	1

CERM − Cuestionario de Experiencias Relacionadas con el Móvil (Questionnaire About Experiences Related to the Cell Phone).
CERI − Cuestionario de Experiencias Relacionadas con Internet (Questionnaire About Experiences Related to the Internet).
IAT − Internet Addiction Test.
MASQ-D − Mood and Anxiety Symptom Questionnaire − Depression.
MASQ-A − Mood and Anxiety Symptom Questionnaire − Anxiety.
  [a] Significant at .05 level.
  [b] Significant at .01 level.

and anxiety (Z = 2.83, p = 0.0047, two-tailed). Similarly, the .278 correlation between emotional escapism in the IAT and anxiety was significantly different from the .058 correlation between boredom in the CERM and anxiety(Z = 2.85, p = 0.0044, two-tailed). Similarly, the correlations with depression were significantly larger for the CERI and IAT emotional escapism scores than for the CERM boredom score (Z = 4.01, p = 0.0001 and Z = 5.7, p < 0.0001). In sum, we have significant evidence to conclude that the two types of escapism (emotional vs. boredom) are differently related to mental health outcomes.

This suggests that the use of ICTs for escape is maladaptive only when users are attempting to escape negative feelings, thoughts, or experiences, and thereby recruit the ICTs as a kind of therapeutic tool. It is somewhat satisfying to observe that using ICTs as strategic tools to fight boredom or seek entertainment is not linked with increased scores in anxiety and depression scales. Together, these results suggest that there is a specific maladaptive strategy being used by individuals prone to depression or anxiety problems in the way the engage with their ICTs: using them to avoid emotionally distressing situations or thoughts. Knowing that avoidance coping is linked with negative mental health outcomes over the long term (Chapman & Mullis, 1999; Holahan et al., 2005; Leiter, 1991; Seiffge-Krenke & Klessinger, 2000), at-risk individuals may be (unwittingly) worsening their mental health through this maladaptive use of their ICTs.

3. Study 2 − Experiment

3.1. Purpose

After finding strong correlations for decreased mental health and increased use of ICTs as emotion-coping/avoidance tools, we sought to further explore the relationship between mobile phone use and psychological state in an experimental setting. We designed a manipulation to test the theory that students use the mobile phone as a coping tool when feeling anxious. We theorized that if indeed people find some form of emotional relief in their ICTs, it may be the case that having access to ICTs during anxiety-provoking situations increases people's resilience to stress and anxiety (at least over the short term). If that is the case, this reinforcing short-term relief would explain why people turn to their ICTs to avoid emotional distress in the first place.

Participants were divided randomly into three separate groups, each instructed differently about what they could do while sitting for 10 min in an experimentally-induced anxious state. Only the participants in group B were allowed to use their mobile phone during that period.

We had two specific hypotheses:

1. That having access to the mobile phone would increase participants' resilience to the anxiety-inducing manipulation, thereby decreasing the effectiveness of the manipulation in the first place (the "security blanket" hypothesis)
2. That students in the mobile phone condition would exhibit the greatest decrease in anxiety out of all three groups after the waiting period because they would have used their mobile phone as a coping mechanism.

3.2. Method

3.2.1. Participants

The participants for the study were initially 84 undergraduate University of Illinois at Urbana-Champaign students enrolled in Psychology courses. Participants were randomly assigned to one of three separate groups: in Group A, participants were not allowed to use or have access to any devices (mobile phone or computer) during the waiting period after the stress induction; in Group B, participants were allowed to have access to and use their mobile phones during that period; and in Group C, participants were allowed to use a simple computer game but not their mobile phones during the waiting period. 12 participants (2 from group A, 2 from group B, and 8 from group C) were dropped from the final analysis because there was a notable problem in the conditions of their experiment such as unanticipated noise in the room or other similar confounding factors. In group C, we also excluded participants who did not engage with the computer game during the break. Because of the high level of phone engagement of participants in group B, we imposed this exclusion criteria to have a more comparable control group. That being said, one participant from Group B was also dropped due to engaging with his mobile phone too briefly. Although we excluded him from the initial analysis the main results were unaffected irrespective of whether he was included in the sample or not. The remaining 72 participants were 28 males and 44 females. All participants signed up for the study voluntarily via the Subject Pool website. They were awarded 1 h of course credit for their participation.

3.2.2. Materials

The questionnaires used in this study were the aforementioned CERM, CERI, and MASQ along with a Spielberger State-Trait Anxiety Inventory − Short (STAI-Short) (Marteau & Bekker, 1992) to measure anxiety at three time points during the experiment. The participants completed the study in a small room in the university's psychology building with only a chair, desk, and computer as furnishing.

3.2.3. Procedure

The study began with the participant filling out the consent form. At this point, the participants were alternately assigned into experimental groups by the researcher (i.e. one participant in Group A, the next in Group B, the next in Group C, etc.). The participants were then given a STAI-short questionnaire to complete, to measure their anxiety at the beginning of the experiment. Afterwards, each participant was asked to leave their backpack/purse in the waiting area before continuing with the study. Two groups of participants were told that they were not allowed to have their mobile phones with them (groups A and C) and should leave them with their belongings in the waiting area until the end of the study. Group B was told that they could keep their mobile phone and were allowed to use it if they so chose.

After this, the participants were led into a smaller room where

they could have privacy while completing the experiment. At this point the participants were provided with a prompt by the researcher which instructed them to write a paragraph about a personal flaw or weakness of theirs which bothered them. They were informed that the paragraph they wrote would afterwards be taken to two clinical psychology graduate students in another room who would read and analyze it as a part of their training and then conduct a video-recorded interview with the participant about their written response. The participants were told that they would have 5 min to complete the writing assignment starting the moment the researcher exited the room. All information about the clinical students and the interview was false, designed solely to induce anxiety.

Once the participants were given the prompt, the experimenter left the room and started a 5 min timer. At the end of the 5 min, the experimenter entered the room and retrieved the written paragraph from the participant, informing them that it would now be taken to two clinical psychology graduate students in another room who would need 10 min to process it before calling the participant in for the interview. The participant was then given the STAI-short once again to measure anxiety. While the participant completed the questionnaire, the experimenter left the room and pretended to drop off the response (in reality, the response was folded closed immediately and never read by the experimenter or anybody else).

Upon returning from the "clinical students' room" the experimenter told participants in Group A that they would have to wait for 10 min without their mobile phone and with no other distractors available to them. Participants in Group B were told they would have to wait in the room with the option of using their mobile phone if they so chose, but no other sources of distraction were provided. The participants in Group C were told they could play a Minesweeper game set up on the computer if they so chose. It is important to note that no participant in any of the conditions was instructed on what they should do while they waited, all behavior was voluntary.

After 10 min of waiting time, the participants were asked to fill out the final STAI−short questionnaire to measure their anxiety levels. Afterwards, the participants were informed that there would not really be an interview and that no part of the study had been or would be filmed. The participants were then asked to fill out the CERM and CERI about their mobile phone and Internet use respectively, the MASQ for their levels of anxiety and depression, and an additional paper questionnaire asking how many minutes out of 10 they thought they had spent on the game or phone (for groups B and C). Once all the questionnaires were completed, the participants were debriefed about the true nature of the study. Their self-reflection was returned to them to do with as they pleased and they were informed that it was not read by any of the researchers. The experiment concluded with the researcher giving the participant a debriefing form.

3.3. Study 2 − Results

3.3.1. Anxiety at baseline

To determine whether the initial anxiety levels between the three groups were statistically matched, we used a between-subject ANOVA. As can be seen in Fig. 1, although Group C had a numerically higher STAI score at time 1, it was not significantly different from the STAI scores of Groups A and B, $F_{(2,69)} = 1.447$, $p = 0.242$. To verify this, we also computed two independent sample t-tests at time 1 between this group and Groups A and B. Neither of the t-tests was significant: $t(46) = 1.372$, $p = 0.177$ between A and C, and $t(45) = 1.54$, $p = 0.131$ between B and C.
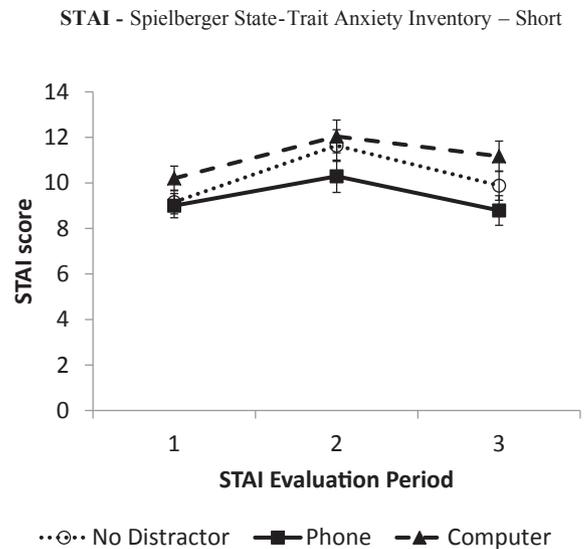

STAI - Spielberger State-Trait Anxiety Inventory − Short

Fig. 1. Anxiety trajectory in Groups A (No distractor), B (Phone allowed) and C (Computer Game allowed) as a function of time during the experiment. The second evaluation period is immediately after the stress-inducing manipulation and the third evaluation is at the end of the 10 min waiting period after the stressor. Error bars indicate the standard error of the between-subject means. **STAI -** Spielberger State-Trait Anxiety Inventory − Short.

3.3.2. Security blanket hypothesis

The security blanket hypothesis is based on the idea that ICTs provide participants with a coping strategy (specifically avoidance coping) when faced with emotionally charged events, like the acute-stress manipulation here. Therefore, having access to ICTs might improve the emotional resilience of participants to these types of events by acting as a tool for psychological/attentional escape.[2]

To test this, we computed the ratio of participants who reported no increase in their STAI questionnaire after the stress-inducing manipulation over the entire number of participants in that group. Our results showed that people in Group B (mobile phone) were 64% more likely than the participants in group A (no distractor) to not show elevated anxiety right after the stress-inducing manipulation (STAI-2). A chi-square test demonstrated that the number of stressed (11) vs. non-stressed (13) participants in Group B was significantly different from the expected proportions, as indexed by Group A responses (18 stressed, 7 non-stressed), $\chi(1) = 7.261$, $p = 0.007$. This is evidence that mobile phones can function as a security blanket in times of stress by increasing people's resilience to anxiety-provoking events. In contrast, there was no difference between the number of stressed (15) vs. non-stressed (8) participants in Group C compared to Group A, $\chi(1) = .90$, $p = 0.342$. The lack of a difference between Groups A and C makes sense since participants in Group C do not have their phones at the time of the acute-stress manipulation nor do they know yet that they will have access to a distracting computer game to pass the time, so they are psychologically in the same state as participants in Group A.

Group B also maintained the lowest overall anxiety throughout

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[2] To be sure, we cannot distinguish whether it was the fact of having access to their ICTs that decreased the anxiety response to the stressor in participants in group B or, in contrast, whether it was the fact of losing access to their ICTs in groups A and C that increased those participants' anxiety response to the stressor. Further research is needed to disentangle those two possibilities, but at this point, they both are in line with our security blanket hypothesis.

the experiment. A one-way ANOVA with mean anxiety as a variable and experimental group as a factor revealed a marginally significant effect of group. Group B's mean anxiety was 9.37 compared to group A's mean of 10.23 and group C's mean of 11.14, $F(2,69) = 2.46$, $p = 0.093$. A follow-up test also showed that Group B's anxiety was significantly lower than Group C's, $t(45) = 2.23$, $p = 0.031$.

Additional evidence supporting the reliance on mobile phones during anxious states is that 82% of participants in Group B who experienced a rise in anxiety after the manipulation reported using their mobile phone 100% of the 10 min waiting period even though they were not specifically instructed to do so (75% if we consider the participant dropped for low use). Out of those that did not experience a rise in anxiety, only 54% reported using the mobile phone the entire time. On the other hand, in Group C (the other distractor condition) only 53% of participants who experienced a rise in anxiety reported engaging with the computer game 100% of the time in contrast to 25% of participants who did not experience a rise in anxiety (42% vs 18% respectively if we include the participants dropped due to very low computer game use in the calculation). It would appear that mobile phones have unique comforting capabilities that draw and keep the attention of users moreso than other distractors, especially those users who are experiencing heightened anxiety.

3.3.3. Questionnaire correlations and comparison with study 1

The scores on the CERM, CERI, and MASQ questionnaires showed very similar relationships as in Study 1, thereby confirming its findings about the strong relationship between higher ICT use and increased likelihood of mental health problems (see Table 3).

3.3.4. Pattern of stress in participants throughout the experiment

The anxiety trajectory data for each of the three groups is presented in Fig. 1.

In group A, we observed that time (there were 3 time points at which state stress was measured via STAI) was significantly related to anxiety as indexed by differences in the STAI measures, $F(2, 48) = 9.16$, $p < 0.001$. More specifically, pairwise comparisons showed a significant increase in anxiety from time 1 to time 2 (9.1 increased to 11.6, $p < 0.001$), indicating that the increase in anxiety was significant in this group. This initial increase in anxiety was followed by a significant decrease in anxiety from time 2 (11.6) to time 3 (9.9) ($p = 0.01$), indicating an almost complete return to baseline (time 1 and time 3 did not significantly differ from one another, $p = 0.20$).

In group B, the same analysis revealed a similar anxiety trajectory. In this group too, anxiety differed across the session, $F(2, 46) = 5.36$, $p = 0.008$. More specifically, pairwise comparisons indicated that once again, we observed a significant increase in

anxiety from time 1 (9.0) to time 2 (10.3) ($p = 0.031$). This decrease was followed by a significant decrease at time 3 (8.7) ($p = 0.01$). Time 1 and 3 were again not significantly different from each other ($p = 0.51$).

In group C, we once again found the same pattern, $F(2, 44) = 6.94$, $p = 0.002$. Anxiety increased from time 1 (10.2) to time 2 (12.0) ($p = 0.001$) and was followed by an almost significant decrease at time 3 (11.3) ($p = 0.064$), which corresponded to an almost complete return to baseline ($p = 0.084$). All three groups show the same pattern of stress fluctuation (a spike in anxiety after the anxiety-inducing manipulation, followed by a decrease in anxiety from time 2 to time 3, at the end of the 10-min waiting period).

Finally, we also ran a mixed analysis, with Group as a between group factor and Time as within group factor on the STAI scores to assess whether there was a differential response to the stress manipulation (indicated by time 2 increases) as a function of whether participants had their mobile phones or not during the stress-inducing manipulation. As expected, Time had a significant effect on Anxiety, $F(2,138) = 19.6$, $p < 0.001$, with STAI at Time 2 being significantly larger than at Times 1 and 3, and no meaningful difference between Times 1 and 3. Critically, the Group by Time interaction failed to reach significance, $F(2,102) = 1.18$, $p = 0.323$. In sum, what we observed is that stress levels followed the same general trajectory in all groups and that this stress trajectory is not much affected by whether participants have access to their mobile phone, a neutral distractor like a simple computer game, or use nothing at all to distract themselves with.

We also ran a similar analysis to see whether Group B's use of their mobile phone during the waiting period produce a larger relief in anxiety (indicated by the decrease at time 3) than the one experienced by Group A participants, but we found no evidence of a benefit there either, $t(47) = .31$), $p = 0.75$, perhaps because anxiety at time 2 was already smaller in Group B than in Group A (at least numerically). In sum, these results indicate that there was no significant difference in how well participants responded to the acute-stress manipulation across the entire experiment, no matter whether they were allowed to keep and use their mobile phone during the experiment or not.

That said, as mentioned beforehand, Group B was able to maintain a lower level of anxiety throughout the experiment than Groups A and C (see Fig. 1), and fewer participants in Group B responded to the stress manipulation. We should acknowledge as well that there is a visual pattern in the data suggestive of a blunted

Table 3
Pearson correlations for questionnaires – study 2.

	CERM	CERI	MASQ-ANX	MASQ-DEP
CERM	1			
CERI	.664[b]	1		
MASQ-ANX	.330[b]	.397[b]	1	
MASQ-DEP	.343[b]	.317[b]	.283[a]	1

CERM – Cuestionario de Experiencias Relacionadas con el Móvil (Questionnaire About Experiences Related to the Cell Phone).
CERI – Cuestionario de Experiencias Relacionadas con Internet (Questionnaire About Experiences Related to the Internet).
IAT – Internet Addiction Test.
MASQ-D – Mood and Anxiety Symptom Questionnaire – Depression.
MASQ-A – Mood and Anxiety Symptom Questionnaire – Anxiety.
  [a] Significant at .05 level.
  [b] Significant at .01 level.

Table 4
Correlations of interest - study 2.

	STAI 2	STAI 3
CERI 4 – Group A	.575[b]	.323
CERI 4 – Group B	.675[b]	.533[b]
CERI 4 – Group C	.284	.065
MASQ-DEP – Group A	.722[b]	.675[b]
MASQ-DEP – Group B	.191	.332
MASQ-DEP – Group C	.559[b]	.699[b]
MASQ-ANX – Group A	.156	.275
MASQ-ANX – Group B	.493[a]	.529[b]
MASQ-ANX – Group C	.131	.237

CERM – Cuestionario de Experiencias Relacionadas con el Móvil (Questionnaire About Experiences Related to the Cell Phone).
CERI – Cuestionario de Experiencias Relacionadas con Internet (Questionnaire About Experiences Related to the Internet).
IAT – Internet Addiction Test.
MASQ-D – Mood and Anxiety Symptom Questionnaire – Depression.
MASQ-A – Mood and Anxiety Symptom Questionnaire – Anxiety.
  [a] Significant at .05 level.
  [b] Significant at .01 level.

response in Group B (compared to Groups A and C) at Time 2. Thus, it is possible that we failed to observe a significant Group × Time interaction because the anxiety measure we used may have been overly noisy and required a larger sample than the one we used to reveal such an effect.

3.3.5. Correlations of interest

An experiment of this type on the topic of ICT use, stress, and psychology has been rare in the literature, therefore our study was very much exploratory in nature. We conducted Pearson correlations on the different questionnaires, certain questions of interest, and anxiety responses for the three groups. Among them, a few significant results surfaced (See Table 4).

1. The Escapism item on the CERI ("When you have problems, do you connect to the Internet to help you evade them?") was substantially correlated with the score on STAI 2, the anxiety state after the anxiety-inducing manipulation was given, in groups A and B. In group A, the correlation was $r = .575$ ($p = 0.003$), and in group B, $r = .675$ ($p < 0.001$). Although the correlation failed to reach significance in group C, it was in the same direction, $r = .284$ ($p > 0.05$), and it is quite likely that a better powered study (i.e., one with a larger sample size for this group) would have found a statistically significant result.[3] The correlations in groups A and B are very high, and given our sample size, we can detect them conclusively and reliably.

2. The MASQ Depression score was significantly and strongly correlated with STAI 2 (right after the anxiety-inducing manipulation) and STAI 3 (after the waiting period) in groups A (with STAI 2: $r = .722$, $p < 0.000$; with STAI 3: $r = .675$, $p < 0.000$) and C (with STAI 2: $r = .559$, $p = 0.002$; with STAI 3: $r = .699$, $p < 0.000$) but not in B (with STAI 2: $r = .191$, $p = 0.371$; with STAI 3: $r = .332$, $p = 0.113$). The difference in the correlations observed between groups A and B were significant at STAI 2, $Z = 2.35$, $p = 0.0188$ (two-tailed), and approached significance at STAI 3, $Z = 1.56$, $p = 0.118$ (two tailed). This may be interpreted as converging evidence for the security blanket effect of ICTs; that is, as evidence that ICTs helped depressive participants in group B be more resilient to the stress-inducing manipulation. The differences in correlations between groups B and C approached but did not reach significance (at STAI 2: $Z = 1.4$, $p = 0.16$; at STAI 3: $Z = 1.67$, $p = 0.09$).[4]

3. In group B, MASQ Anxiety was correlated with the stress levels at STAI 2 ($r = .493$, $p = 0.014$) and STAI 3 ($r = .529$, $p = 0.008$) but there were no such significant correlations in the other groups (for group A, $r = .156$ at STAI 2 and $r = .275$ at STAI 3; for group C, $r = .131$ at STAI 2 and $r = .237$ at STAI 3).

3.4. Discussion

To address our hypotheses:

1. Having access to the mobile phone would increase participants' resilience to the anxiety-inducing manipulation, thereby decreasing the effectiveness of the stress-inducing manipulation in the first place (the "security blanket" hypothesis)

Our study showed that participants who kept their mobile

phones close at hand were less likely to react to a stressor. This effect could be similar to how young children hold on to blankets (so-called security blankets) or other familiar objects throughout the day because they provide them with a sense of comfort and safety while in an intimidating environment, increasing their resilience to stress or anxiety-provoking events (Passman, 1977). But becoming reliant on an external device for comfort can be maladaptive because healthier coping mechanisms do not have a chance to be properly developed, implemented, and practiced. Indeed, other coping strategies such as task-oriented coping, which involves analyzing the stressful situation and processing how to deal with it, has been shown to be correlated with lower anxiety and depression than avoidance- and emotion-oriented coping (Endler & Parker, 1990).

2. Students in the mobile phone condition would exhibit the greatest decrease in anxiety out of all three groups after the waiting period because they would have used their mobile phone as a coping mechanism.

The patterns observed in the data suggest no significant difference in the stress alleviating capabilities between a mobile phone, a neutral distractor, or nothing at all, or at the very least, our experiment did not have the statistical power to detect such a difference if it did exist. Previous research (Chiu, 2014; Murdock, 2013) and natural observation attest to the fact that people often reach for their mobile phones in times of discomfort or stress, perhaps as an attempt to distract themselves, isolate themselves from a stressful environment, or reach out to a support system. But the current study finds that this behavior is not a particularly effective coping mechanism since the trajectory of short-term stress was the same, independent of the method used to alleviate it.

4. General discussion

Study 2 offered insight on how people use their mobile phones in real time during a short-term stressful state. In addition, both Study 2 and Study 1 provided us with information on how mobile phone and Internet behavior is related to overall psychological wellbeing. It appears that what is considered maladaptive mobile phone and Internet use is strongly associated with higher anxiety and depression in US college students, supporting the results of other studies on this topic from around the world (Beranuy, Chamarro, et al., 2009; Beranuy, Oberst, et al., 2009; Murdock, 2013; Park et al., 2010; Pierce, 2009; Reid & Reid, 2007; Sanchez-Martinez & Otero, 2009; Thomée et al., 2010, 2011). Although this was a correlational finding and therefore does not imply causation, the experimental Study 2 showed that a majority of people who had their mobile phones available to them did turn to them after encountering a stressor. We propose therefore that high engagement with ICTs, especially as aids for escapism, may become a pattern that, over the course of time, could lead people to develop maladaptive coping mechanisms and negatively influence their psychological state, especially that of depression or anxiety predisposed individuals.

The association between emotional escapist behavior and psychological wellbeing is also supported by the fact that in Study 1, the questionnaire items about using the Internet to escape from negative feelings or experiences (CERI and IAT items) were significantly correlated with scores on anxiety and depression. Also, in Study 2, the Escapism item on the CERI was strongly correlated with the score on STAI 2 (the anxiety state right after the anxiety-inducing manipulation was given) in groups A and B (with a similarly positive correlation obtained in group C). This could mean that the tendency to engage in avoidance coping indicates being (by

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[3] The sample size needed to detect a .3 correlation with 80% power is 85 (far larger than we had in group C), whereas the sample size required to detect a .6 correlation with same power is 19, smaller than what we had in groups A and B.

[4] This failure to reach significance is not surprising given the relatively low number of observations per group and statistical comparisons of correlations require large samples for small differences (for instance, to reveal a significant difference between a correlation of .7 and one of .4 – a .3 difference-requires 42 observations per group to reach the .05 level in a two-tailed comparison).

nature) or becoming (over time) more reactive to stressors. On a more positive note, using ICTs just to kill time (when afflicted with boredom for example) is not related to negative mental health outcomes. This is an important result in and of itself because it should dampen the more general concern that the mere use of ICTs might be related to (or may even produce) negative mental health outcomes. Our data suggest this is not the case.

For people who already experience anxiety or depression, excessive or maladaptive use of the mobile phone may exacerbate symptoms. In Study 2, the MASQ Depression score was significantly and strongly correlated with STAI 2 and STAI 3 in groups A and C but not in B. This could imply that depressive individuals who are separated from their device can become more anxious when faced with a stressor, because they are accustomed to utilizing their device as a coping tool via its distraction functions or its use as a gateway to their support system. On the other hand, in Group B and not the other two, MASQ Anxiety was correlated with anxiety levels at STAI 2 and 3. This could imply that people who have anxious personalities and are thereby more reactive to stressors and social pressure in general (which are some of the defining features of anxiety) may experience higher anxiety during a stressful situation when simultaneously engaging with their phones, perhaps because they are processing the stimuli from the phone in combination with the stress they are experiencing from the manipulation, thereby cumulating in overall higher distress.

The main conclusions of our study fall into two categories: the short-term and long-term effects of ICT use for the purpose of emotional escapism. College age students showed very strong correlations between maladaptive Internet and mobile phone use and depression and anxiety. Although several previous studies have shown or implied this association at varying degrees, there has been little conclusive understanding as to why exactly it exists. We believe that people use ICTs as a tool for avoidance coping, which in the short run can be moderately effective by helping individuals disengage from emotionally tolling experiences. However, this strategy can make individuals more vulnerable to mental health problems because it is a manner of dealing with problems that has proven detrimental to long-term psychological health. To test this hypothesis we ran Study 2 which showed that mobile phones do in fact have some sort of initial "security blanket effect" in stressful situations which make their use in these types of contexts reinforcing, however the actual experience of stress follows the same trajectory over the course of time irrespective of whether a mobile phone, other distractor, or nothing at all is used during the stressed state; thus the short-term benefit of using an ICT as an avoidance coping strategy is small and short-lived. Therefore, considering the minimal short-term benefits and the strong indication of long-term risk, this study suggests that high use of ICTs, especially for avoidance coping (whether intentional or unintentional), is maladaptive to psychological wellbeing.

5. Limitations

As with any study, our findings need to be considered within the context of the limitations of our methods and results. First, we did not gather more background information about our participants' typical ICT use (total connected time, number of connections per day, average connection time, etc). Such information would have provided a richer description of our population and perhaps a finer statistical analysis of the trends observed here.

Second, although we did have a large number of participants in Study 1, our per-group sample in Study 2 was much smaller, and perhaps with fewer participants than required to detect small effects in our experimental paradigm. As a result, it is difficult to conclude whether a small, but systematic, effect of mobile-phone access during stressful circumstances does exist and we simply lacked the power to detect it.

Third, the correlation that we observed between the emotional escapism items and negative mental health outcomes might simply reflect a correlation arising from a shared negative affect response in participants to both those single item questions and the questions in the longer MASQ instrument. That is to say, when asking people questions that relate to their negative affect (whether the question is inside the CERI, IAT or MASQ), one should expect a certain degree of covariation in those responses. Thus, more work is needed to further explore the emotional escapism correlation with negative mental health outcomes. We view our study as primarily an exploratory attempt at trying to identify the motivations for connecting to ICTs and their influence on mental health, therefore further research is necessary to confirm its findings and suggestions.

Finally, in Study 2, we did not directly monitor what students were doing on their mobile phones – whether texting a friend, browsing the Internet, playing a game, etc. – and this therefore introduced uncontrolled factors that may have influenced their reactions to the stressor. In retrospect, we could have also asked participants to report in detail how they had used their phone during the waiting period, but, given the small experimental sample, we doubted we could draw firm conclusions from those self-reports.

6. Conclusion

In 2015 there were 4.88 billion mobile phone users (Number of mobile phone users, 2015) around the world and 3 billion people using the Internet (Banks, 2015). The average global time spent online (accessed either from computers or phones) is 4.5 h per day with some countries using it for an average of over 6 (Banks, 2015). Considering the prevalence and growth of ICT use around the world, understanding how and to what extent they affect people's health and wellbeing is vital so that they can be optimally integrated into individual lives and society as a whole and so that negative consequences can be avoided or dealt with appropriately when they arise. This study is one of the first attempts to observe mobile phone use in a structured experimental environment. Its findings need to be further explored and elaborated on. However, the preliminary results are telling: whereas there is no correlation between ICT use and mental health when people use the device simply as a strategy to fight boredom, there is a strong negative association between ICT use and mental health when people use their devices as a coping tool during emotionally taxing situations. Our experimental findings suggest at least one possible mechanism modulating this negative correlation: people seem to be less vulnerable to becoming stressed in anxiety provoking situations when they have access to their ICT, which reinforces its use in these contexts. This suggests that there is a real (if small) emotional buffering effect afforded by ICTs. Perhaps because this short-lived effect exists, people end up turning to ICT use as an emotional avoidance strategy in a more frequent pattern which may lead to or exacerbate mental health problems in the long run. The current study makes an important contribution to this field as it is one of the first and only studies to use an experimental manipulation in conjunction with a correlational approach in order to explore more deeply the motivations and gratifications behind ICT use. We hope the insights gained from our findings will inspire more research of this kind.

Appendix

CERI — English Translation

Questionnaire About Experiences Related to the Internet
 Below you will find some statements about your Internet usage. Read each statement carefully and indicate how often it happens. Note the response that comes closest to your own experience.

1. How often do you make new friendships online?
2. How often do you abandon things that you are doing in order to be online longer?
3. Do you think that your academic or work performance has been negatively affected by your use of the Internet?
4. When you have problems, do you connect to the Internet to help you evade them?
5. How often do you anticipate your next connection to the Internet?
6. Do you think that life without the Internet is boring, empty, and sad?
7. Do you get angry or irritated when somebody bothers you while you are connected to the Internet?
8. When you are not connected to the Internet, do you feel agitated or uneasy?
9. When you navigate the Internet, does time pass without you noticing?
10. Is it easier or more comfortable for you to interact with people through the Internet as opposed to in person?

CERM — English Translation

Questionnaire About Experiences Related to the Cell Phone
 Below you will find some statements about your mobile phone usage. Read each statement carefully and indicate how often it happens. Note the response that comes closest to your own experience.

1. Have you ever been at risk of losing an important relationship, a job, or an academic opportunity due to your cell phone use?
2. Do you think that your academic or work performance has been negatively affected by your cell phone use?
3. To what extent do you feel anxious when you do not receive messages or calls?
4. Do you suffer from trouble sleeping due to issues related to your cell phone?
5. Do you feel the need to spend more and more time on the phone to feel satisfied?
6. Do you think that life without your cell phone is boring, empty and sad?
7. Do you get angry or irritated when somebody bothers you while you are using your cell phone?
8. Do you stop hanging out with friends in order to spend more time using your cell phone?
9. When you get bored, do you use your cell phone as a form of distraction?
10. How often do you say things via your cell phone that you would not say in person?

Scale: Almost never, Sometimes, Often, Almost always.

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