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# The Psychology of Smartphone: The Development of the Smartphone Impact Scale (SIS)

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**Abstract**

Smartphones are changing lives in a number of ways. However, the psychological literature has primarily focused on smartphone overuse, neglecting the impacts that are not strictly related to problematic use. The present research was aimed to develop a comprehensive self-report scale that accounts for the cognitive, affective, social, and behavioral impacts of smartphones in everyday life—the Smartphone Impact Scale (SIS). Study 1 ($N$ = 407) yielded a preliminary version of the scale, which was refined in Study 2 ($N$ = 601). The SIS is a 26-item scale that measures seven dimensions of smartphone impact. Results revealed meaningful associations between its subscales, psychosocial constructs, and daily usage of smartphones and apps. The SIS broadens the view of human–smartphone interaction by extending the concept of problematic smartphone use to further dimensions (e.g., emotion regulation) and introducing a proper measurement of underinvestigated smartphone impacts (e.g., tasks support). The implications of each SIS subscale are discussed.

**Keywords**

smartphone, scale development, technological addiction, smartphone psychosocial impact, smartphone use

In 2007, Steve Jobs announced the world's first smartphone, stating that the "iPhone is like having your life in your pocket. It's the ultimate digital device" (Kast, 2008). From that moment on, an impressive increase in sales (Bajpai, 2016) led to smartphones taking over the world. Today, there are an estimated 2.5 billion smartphone users worldwide (Statista, 2018), and smartphone penetration is above 60% in most developed countries. Smartphones allow a constant connection with the world by communicating with other people, reading news, enjoying entertainment, buying any object and service, and so on. These functionalities represent the basis of smartphone success and have made it essential for many people in their everyday lives. A few studies on actual smartphone usage have provided a clear picture of how important smartphones have become in today's world (e.g., Dscout, 2016]; Lee, Lee, Ko, Lee, & Kim, 2014). Indeed, people, on average, tap their screens 2,617 times a day, and the average time spent using smartphone exceeds 2 hours per day, with peaks of more than 4 hours. Recently, smartphones have captured the attention of social and clinical scholars who are trying to uncover the factors that make people so prone to using this device and the consequences of its use.

## *Smartphone Overuse and Smartphone Addiction*

Smartphone overuse, also referred to as problematic smartphone use (PSU), is defined as spending too much time using a smartphone, to the extent that it negatively affects different aspects of people's lives (Ding & Li, 2017). Accordingly, a number of negative outcomes have been associated with smartphone overuse. Smartphones are a primary driving distraction, and the most recent estimates indicate that these devices cause at least one of every four accidents on U.S. streets (National Safety Council, 2015). Prolonged smartphone sessions can provoke musculoskeletal damage, including back and neck pain (H.-J. Kim & Kim, 2015; Y.-G. Kim, Kang, Kim, Jang, & Oh, 2013; Park et al., 2015). Smartphone addiction was found to negatively affect academic performance (Hawi & Samaha, 2016; Samaha & Hawi, 2016). The more the time spent on smartphones, the lower the grade point average of college students, even after controlling for key demographic and psychological variables (Lepp, Barkley, & Karpinski, 2015). Moreover, Rozgonjuk, Saal, and Täht (2018) found that, in contrast with a deep approach oriented to understanding, a surface approach to learning was associated to PSU and frequency of social media use during university lectures.

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The likelihood of smartphone overuse and the adverse consequences that result from it have led scholars to focus on the phenomenon of PSU, generally labeling it as a behavioral (i.e., nonchemical) addiction. According to Marlatt, Baer, Donovan, and Kivlahan (1988), behavioral addictions are repetitive habit patterns associated with personal and social problems that might be subjectively experienced as out of one's control. Behavioral addictions that concern human–machine interaction are labeled technological addiction (Griffiths, 1995). Smartphone addiction falls under this wide range of phenomena, and it can be defined as excessive smartphone use that can interfere with users' daily lives (King & Dong, 2017; Lee, Chang, Lin, & Cheng, 2014). In this sense, Lin et al. (2016) have recently proposed a set of diagnostic criteria of smartphone addiction that include the following: (a) six symptom criteria (e.g., manifestation of withdrawal, presence of tolerance); (b) four functional impairment criteria (e.g., use of smartphone in hazardous situations, impairment of social relationships due to smartphone use); and (c) an exclusion criteria (i.e., smartphone addiction should not be accounted for by obsessive–compulsive disorder or by bipolar I disorder). However, there is an ongoing debate about whether technological devices can be considered addictive, and issues concerning the definition, etiology, course, diagnosis, and treatment of the supposed technological addictions are far from being addressed (for an overview, see Gentile, Coyne, & Bricolo, 2013). Moreover, research on this topic should rely on the operational definition of behavioral addiction (and its related exclusion criteria) given by Kardefelt-Winther et al. (2017) to avoid overpathologizing common behaviors (such as smartphone overuse) as behavioral addictions. Research on smartphone use is just at the beginning stage, and several processes should be investigated before considering it a possible behavioral addiction, including the identification of a neurophysiological basis for overuse.

Thus, we noted that the current self-report scales on the impact of smartphones in everyday life were primarily developed to measure the possible dimensions of smartphone addiction, with the aim of providing a practical tool to detect individuals at risk of smartphone overuse. Indeed, the Smartphone Addiction Scale (SAS; Kwon, Lee, et al., 2013), the Smartphone Addiction Inventory (SPAI; Lin et al., 2014), and the Smartphone Addiction Proneness Scale (SAPS; D. Kim, Lee, Lee, Nam, & Chung, 2014) focus on the measurement of PSU. Among others, these scales measure the two pharmacological criteria typical of addiction, as defined by the *Diagnostic and Statistical Manual of Mental Disorder–Fifth edition* (American Psychiatric Association, 2013), namely, tolerance and withdrawal. Although developed in Asian countries, the SAS and the SPAI have been adopted worldwide to measure smartphone addiction, demonstrating good psychometric properties across different cultures (Demirci, Orhan, Demirdas, Akpinar, & Sert, 2014; Lopez-Fernandez, 2017; Pavia, Cavani, Di Blasi, & Giordano, 2016). In addition to the SAS, SPAI, and SAPS, two other scales have recently been developed to assess specific aspects of human–smartphone interaction: the "Young Adult Attachment to Phone Scale" (YAPS; Trub & Barbot, 2016) and the "Nomophobia Questionnaire" (NMP-Q; Yildirim & Correia, 2015). These scales both measure smartphone attachment from different perspectives, again, using an addiction-oriented approach. Although these early scales have paved the way to measuring the psychological impact of smartphones, their framework is deeply rooted in the psychiatric tradition of substance use and dependence.

The adverse consequences of smartphone overuse are not negligible; indeed, a recent systematic review (Elhai, Dvorak, Levine, & Hall, 2017) has shown that PSU is related to depression, anxiety, stress, and low self-esteem, ranging from small to medium effects. Moreover, a recent study showed that PSU is associated to posttraumatic stress disorder symptoms, in particular with two symptom clusters, namely negative alterations in cognitions and mood and physiological arousal symptoms (Contractor, Frankfurt, Weiss, & Elhai, 2017). Still from an addiction perspective, scholars have shown links between PSU and the personality traits typically associated with substance use, such as impulsivity (Roberts, Pullig, & Manolis, 2015; Ryu & Cho, 2015) and specific Big Five traits. In particular, Lane and Manner (2011) showed that more extraverted individuals were more likely to own a smartphone and to use it for texting, whereas more agreeable ones preferred calling than texting. In a study on WhatsApp use, Montag et al. (2015) found that daily use of this instant messaging app was positively associated with extraversion and negatively with conscientiousness. Finally, Roberts et al. (2015) found that smartphone addiction was positively predicted by emotional instability, whereas conscientiousness seemed to negatively predict smartphone addiction via impulsivity.

However, limiting the perspective to addiction neglects other potentially significant psychological dimensions. Indeed, the available current research suggests a variety of psychological and social effects from smartphones that extend beyond the adverse consequences that are strictly related to the construct of addiction.

## *Moving Beyond the Addiction-Oriented Approach*

Given the pervasiveness and versatility of smartphones, dividing the world into addicted versus nonaddicted users seems simplistic and inadequate to describe the different nuances in which smartphones have an impact on people's everyday life. Smartphone use can be seen through the lenses of a recent conceptualization originated from the literature on Internet addiction, namely the *Compensatory Internet Use Theory* (CIUT; Kardefelt-Winther, 2014). The CIUT combines the research traditions on Internet addiction and motivations for Internet use, showing an interesting perspective that can account for the relationship between offline and online life. Specifically, Kardefelt-Winther (2014) claims that motivation is a key factor that mediates the link between psychosocial well-being and Internet use, so that the latter is seen as a coping strategy by which people try to compensate their psychosocial problems or unmet real-life needs. The actual advantage of the CIUT is that it can account for both positive and negative outcomes deriving from Internet use. Indeed, excessive Internet use is not seen as a compulsive, pathological phenomenon, but as a compensatory strategy that allows to cope with negative life events and that can also increase well-being.

Existing scales on smartphone addiction described in the previous paragraph are focused on detecting only dimensions that are clearly and uniquely related to an addiction-oriented approach to PSU, but there are a number of other smartphone impact dimensions that can be associated with both positive and negative outcomes of smartphone use. Given that smartphones made the Internet ubiquitous and that most of the activities on these devices need Internet connection, smartphone use can be interpreted through the CIUT. Indeed, the CIUT can offer guidance to explore psychosocial impacts of smartphones in everyday life that remain poorly investigated and need proper measurement. Scholars have just begun to look at a series of cognitive (i.e., smartphone anthropomorphization and awareness about adverse consequences related to overuse), affective (i.e., regulation of inner states), social (i.e., preference for online vs. offline communications and enhancement of romantic relationships), and behavioral (i.e., usefulness in daily activities) impacts of smartphones.

From a cognitive perspective, the literature has well documented how people are prone to anthropomorphize (i.e., ascribe humanlike characteristics) nonhuman agents (Epley, Waytz, Akalis, & Cacioppo, 2008), highlighting the positive and negative consequences of parasocial relationships that might arise from such a phenomenon. Observing this phenomenon from the CIUT perspective, the lack of chances to interact with others might motivate people to compensate their need for social connection by using their smartphone as a social surrogate, ascribing human features to it. Although it has been demonstrated that there is a tendency to anthropomorphize technological devices (Luczak, Roetting, & Schmidt, 2003), research on this topic is limited to the study of W. Wang (2017), who found that chronic loneliness was weakly and positively associated with a proneness to anthropomorphize smartphones. Finally, despite the focus on negative aspects, existing scales did not account for individual awareness about the adverse consequences of smartphone pervasiveness. This dimension might be particularly important when PSU is detected because it might allow researchers to distinguish those individuals who recognize it as an actual problem (and might look for help) from those who did not realize it at all and must first become aware of it. Indeed, being aware of smartphone negative impact might constitute a CIUT-like motivation to reduce smartphone use or to keep it under control.

Smartphones and their functionalities might be used to regulate internal states and, specifically, to cope with negative emotions, escape from boring situations, or avoid unpleasant activities. Within the CIUT framework, this means that people might find a way to compensate their negative inner states by using the smartphone (e.g., playing games or surfing the Internet to distract themselves from offline problems). Moreover, the use of smartphone to regulate emotions was theorized by Billieux (2012), who described four pathways that can originate problematic mobile phone use, one of which (i.e., the impulsive pathway) is mainly driven by maladaptive emotion regulation. In line with this interpretation, Grellhesl and Punyanunt-Carter (2012) have found that the second most reported reason for texting was "relaxation and escape," whereas "socialization and affection," supposedly the main functionality of texting, was rated as the sixth reason. Consistently, Panova and Lleras (2016) have found that smartphone use after an experimentally induced anxiety situation initially reduced the perceived stress. Moreover, Hoffner and Lee (2015) asked their participants to imagine that they lost their smartphones; the authors reported that the extent to which the participants missed common smartphone functionalities (i.e., interpersonal contacts, social support, entertainment, and information) was positively associated with using the device as a method of coping with negative emotions.

From a social perspective, recent studies have shown that loneliness and social anxiety are positively related to smartphone addiction (Bian & Leung, 2015; Enez Darcin et al., 2016). This phenomenon aligns with the study by J.-H. Kim (2017), who found that lonely individuals tend to rely more on smartphone-mediated communication than face-to-face interactions to alleviate their loneliness, both increasing the likelihood to develop PSU and decreasing their perceived social support. Thus, from a CIUT perspective, loneliness can motivate people to find a way to connect with other people through their smartphone. Moreover, individuals who experience high anxiety in real-life interactions, might prefer virtual and more "safe" ways to connect with others, which are made easily available by smartphones (i.e., instant messaging or social networking apps). Although the SAS (Kwon, Lee, et al., 2013) includes a dimension that addresses the importance of smartphone-mediated relationships (i.e., *Cyberspace-oriented relationships*), no measures that directly compare online and offline communication with others have been developed yet. Currently, the literature has particularly focused on phubbing, which is snubbing face-to-face interactions in favor of those mediated by a smartphone, showing that "phubbed individuals experience a sense of social exclusion" (David & Roberts, 2017, p. 155) that has harmful consequences on romantic relationships (Roberts & David, 2016; X. Wang, Cie, Wang, Wang, & Lei, 2017). Nevertheless, new technologies can also improve sociability when they are used to support deep offline relationships (Waytz & Gray, 2018), such as intimate ones. According to Billieux (2012), maintenance of relationships with partner, family, and friends represents another path that can lead to problematic mobile phone use, typical of individuals with low self-esteem and insecure attachment, who need to be constantly connected with significant others to obtain reassurance. However, the positive effects of a smartphone in developing and maintaining a relationship with a partner are often neglected and lack proper measurement, even though phone calls and texting (within the context of a couple) were found to be positively related to the quality of a relationship (Morey, Gentzler, Creasy, Oberhauser, & Westerman, 2013).

As for romantic relationships, smartphones can support daily activities (e.g., increasing efficiency in studying/working, helping to recall information) and users might be strongly motivated to use their device to facilitate daily tasks; however, the focus on PSU has led to neglecting the positive effects and improvements that this device has brought into everyday lives. These behavioral aspects deserve to be investigated and measured because they might play a fundamental role in smartphone usage.

## The Present Research

The novelty of the smartphone phenomenon, the predominance of an addiction-oriented theoretical approach, and the resultant focus on the adverse consequences of PSU have driven research to a partial view of the psychosocial impact of smartphones. Although a growing number of studies are expanding the boundaries of the fragmented literature currently available, there are a lack of instruments able to properly address and measure different smartphone impacts. Hence, this obstructs the possibility of assembling an overview of the smartphone phenomenon and systematically studying it. To broaden the perspective of existing measures from the theme of dependence to a wider range of impacts, the present research (in line with the CIUT framework; Kardefelt-Winther, 2014) developed a brief, comprehensive, psychometrically valid measure that can account for the cognitive, affective, social, and behavioral impacts of smartphones in everyday lives. More specifically, the Smartphone Impact Scale (SIS) aimed at (a) improving the existing measurement of PSU and (b) introducing dimensions of impact that move beyond the addiction perspective. Such an instrument could provide researchers with a comprehensive tool to investigate human–smartphone interactions.

## Study 1

Study 1 was designed to develop a preliminary version of the Smartphone Impact Scale (SIS-PV). Specifically, an item pool was generated to cover different aspects of smartphone impact, and it was administered to a representative sample of smartphone users. The specific aims of Study 1 were to (a) identify the latent dimensions of the impact underlying the item pool, (b) evaluate the dimensions' reliability, and (c) investigate the convergent validity with an existing measure of smartphone addiction, namely the SAS (Kwon, Lee, et al., 2013).

### Method

*Participants and Procedure.* The present study was conducted in Italy on a sample of Italian native speakers. The following inclusion criteria were set: (a) participants must have a smartphone that was connected to the Internet for at least 6 months, and (b) they must be 18 years old or older. Snowball sampling was used to recruit 675 participants who volunteered for the present study. Participants received a link to an online survey on Qualtrics© (Provo, UT, USA) and were initially presented with an information sheet, a consent form (both approved by the Ethics Committee of the University of Milano, Bicocca), and self-reported questions to assess the inclusionary criteria. Only participants who declared that they had received all information about the study, consented to participate, and were compliant with both the inclusionary criteria were redirected to the study survey. All the participants were compliant with the two inclusionary criteria, but 198 participants were excluded from the analyses because they only partially completed the item pool. Moreover, 70 participants did not answer correctly at least at one of four attention check items (e.g., "This is a control question. Mark 'Strongly agree' and move on") that were selected from the "Directed Questions Scale" (DQS; Maniaci & Rogge, 2014) and embedded into the questionnaire; thus, they were excluded from the analysis. The final sample consisted of 407 participants (265 females, 128 males, and 14 nondeclared), ranging in age from 18 to 55 years ($M$ = 29.8, $SD$ = 10.6). However, 157 participants (39.9%) had a high school degree, 18 (4.5%) had a lower education level, whereas 218 (53.6%) had at least a bachelor degree (14 nondeclared). Concerning occupation, 150 participants (36.9%) were students, 136 (33.4%) were employed, 72 (17.7%) were both students and workers, and 18 (4.4%) were unemployed (31 nondeclared).

#### Materials

*Item pool for the SIS-PV.* Based on the growing literature on smartphone and technology presented in the introduction section and in line with the CIUT (Kardefelt-Winther, 2014), an initial pool of 244 items was generated by three psychologists with expertise in social psychology, clinical psychology, and psychometrics, respectively. As recommended by Hinkin (1998), in generating the items, particular attention was payed to (a) avoid double-barreled items, (b) avoid lead-

**Table 1.** The First 10 factors Extracted by the EFA.

| | Empirical eigenvalue | Percentage of explained variance | Percentage of cumulative variance | 95th Percentile of the simulated eigenvalues |
|---|---|---|---|---|
| Factor 1 | 32.37 | 18.71 | 18.71 | 2.75 |
| Factor 2 | 7.19 | 4.16 | 22.86 | 2.64 |
| Factor 3 | 5.53 | 3.20 | 26.06 | 2.58 |
| Factor 4 | 4.37 | 2.53 | 28.59 | 2.51 |
| Factor 5 | 3.37 | 1.95 | 30.53 | 2.46 |
| Factor 6 | 2.83 | 1.64 | 32.17 | 2.43 |
| Factor 7 | 2.76 | 1.59 | 33.76 | 2.38 |
| Factor 8 | 2.66 | 1.54 | 35.30 | 2.33 |
| Factor 9 | 2.22 | 1.28 | 36.59 | 2.30 |
| Factor 10 | 2.01 | 1.16 | 37.75 | 2.26 |

*Note*. EFA = exploratory factor analysis. Empirical eigenvalues and percentages of explained variance are reported along with the 95th percentile of the simulated eigenvalues.

ing questions, (c) use a limited number of reverse-scored items, and (d) keep the items as simple and short as possible. Specifically, the following topics were identified as important facets of the impact of smartphones on everyday life and were used as guidelines for item generation: (a) criteria related to psychological and physical addiction, loss of control of smartphone usage, attempts to reduce it, compulsive use, perception of others about one's own smartphone usage, and negative consequences related to smartphone overuse (e.g., distraction from daily activities, interference in face-to-face relationships); (b) nomophobia, the fear of being unable to use the smartphone and to connect with others; (c) smartphone as a means to regulate internal states and emotions (e.g., stress, anger, anxiety); (d) positive and negative influences of smartphones on social and romantic relationships; (e) usefulness of smartphones' specific functionalities in everyday life (e.g., take notes, schedule the agenda, simplify work/study); (f) anthropomorphization of the smartphone; and (g) awareness of positive and negative effects of smartphone usage. These facets represented the hypothesized dimensions measured by the SIS-PV.

In a second step, to assess content validity, four graduate psychology students were provided with descriptions of the facets and asked to classify each item into one of them or declare the item as unclassifiable. One hundred and seventy-three items were correctly classified by three students out of four, reaching the minimum acceptable agreement index of 75% (Hinkin, 1998), thus they were included in the final item pool. This final pool was administered to Study 1 participants, who were asked to indicate their agreement with each statement on a 5-point Likert-type scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

*Smartphone Addiction Scale*. Among the existing smartphone scales, the SAS (Kwon, Lee, et al., 2013) is one of the most used instruments (e.g., Mok et al., 2014; Samaha & Hawi, 2016) and was chosen because of the variety of constructs that it measures. The SAS consists of 33 items that load onto six factors, namely, daily life disturbance ($\alpha$ = .66; $M$ = 1.85, $SD$ = 0.76), positive anticipation ($\alpha$ = .78; $M$ = 2.12, $SD$ = 0.70), withdrawal ($\alpha$ = .75; $M$ = 2.06, $SD$ = 0.82), cyberspace-oriented relationship ($\alpha$ = .73; $M$ = 1.83, $SD$ = 0.68), overuse ($\alpha$ = .61; $M$ = 2.92, $SD$ = 1.01), and tolerance ($\alpha$ = .73; $M$ = 2.34, $SD$ = 1.05). The response format is on a 6-point Likert-type scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). A total of seven participants (1.7% of the sample used in the analyses) did not complete the SAS. The items of the SAS were translated into Italian and then back-translated into English by a native English language translator.

*Other measures*. At the end of the survey, the participants were asked to provide sociodemographic information, including gender, age, and nationality.

## Results

*Dimensionality of the SIS-PV.* All analyses were conducted using SPSS software, version 24.0 (IBM Corp., 2016). No missing data were detected on the SIS-PV items. A parallel analysis (Horn, 1965) was initially used to identify the maximum number of latent factors that could be extracted from the item pool. Specifically, the eigenvalues extracted from 100 simulations were compared with those obtained empirically, retaining only the factors associated with an eigenvalue higher than the 95th percentile of the simulated ones. The results, reported in Table 1, indicated retaining eight factors. Then, an eight-factor exploratory factor analysis (EFA) was conducted using the principal axis factoring method with Promax oblique rotation. The solution explained 35.30% of the total variance. Factor correlations ranged from |.02| to |.60|, revealing high associations among some factors and confirming the adequacy of the oblique rotation.

**Table 2.** Eight-Factor Solution of the EFA in Order of Explained Variance.

| | F1, ER | F2, LC | F3, NP | F4, SC | F5, AN | F6, TS | F7, SR | F8, SA | *MI* |
|---|---|---|---|---|---|---|---|---|---|
| *Percentage of explained variance* | *22.9* | *5.4* | *4.7* | *3.2* | *2.7* | *2.5* | *2.4* | *2.1* | |
| When I'm very upset, the smartphone helps me get better | **.88** | −.09 | .02 | −.07 | .03 | .01 | .01 | .01 | *.83* |
| When I'm stressed, the smartphone helps me feel better | **.88** | .07 | −.13 | .03 | −.03 | .00 | −.03 | −.05 | *.81* |
| When I'm anxious, using my smartphone helps me feel better | **.87** | .04 | −.02 | .00 | −.01 | .03 | −.04 | .02 | *.82* |
| If I'm sad, using the smartphone makes me feel better | **.82** | −.04 | −.09 | −.04 | −.03 | −.07 | .06 | .04 | *.73* |
| If I'm very tense, using my smartphone helps me feel better | **.82** | .00 | .06 | .04 | −.01 | .03 | −.07 | −.04 | *.79* |
| When I'm angry, using smartphone makes me feel better | **.81** | .03 | −.08 | .07 | −.01 | −.03 | −.01 | −.02 | *.78* |
| If I'm aloof for something, using the smartphone makes me feel better | **.81** | .01 | .02 | −.03 | .01 | −.08 | .01 | .06 | *.76* |
| When I feel depressed, using my smartphone helps me feel better | **.80** | −.11 | .05 | −.02 | .01 | .05 | −.05 | .01 | *.77* |
| When I feel pressured, using the smartphone makes me feel better | **.79** | −.02 | .08 | −.06 | −.03 | −.01 | .01 | −.02 | *.77* |
| If something worries me too much, I use my smartphone to make myself feel better | **.78** | .07 | −.05 | .11 | .03 | −.03 | −.05 | .03 | *.72* |
| When I'm nervous, using my smartphone makes me feel better | **.77** | .01 | .00 | −.06 | .02 | −.02 | .06 | .05 | *.69* |
| When I'm feeling down, using the smartphone helps me feel better | **.77** | .06 | −.08 | .00 | .05 | .09 | −.03 | .06 | *.74* |
| If I had a hard day, using the smartphone helps me relax | **.75** | .13 | .03 | −.08 | −.02 | −.02 | −.07 | .02 | *.70* |
| In highly ansiogenic situations, using smartphones helps me feel better | **.67** | .00 | .11 | .04 | −.05 | .04 | −.08 | −.07 | *.64* |
| When I say or do something wrong with other people, using the smartphone helps me get on | **.65** | −.08 | .03 | .10 | .03 | −.02 | .13 | .04 | *.57* |
| When I get bored, the smartphone keeps me entertained | **.47** | −.04 | .11 | .06 | −.10 | .06 | .13 | −.05 | *.44* |
| Others tell me I spend too much time on the smartphone | −.04 | **.84** | −.14 | .02 | −.11 | .12 | −.09 | .09 | *.64* |
| Sometimes I have discussions with those around me about my excessive use of the smartphone | −.14 | **.74** | −.09 | .02 | −.07 | .08 | −.09 | .16 | *.52* |
| People around me often find my use of the smartphone excessive | −.04 | **.71** | −.12 | −.05 | −.08 | .10 | −.03 | .13 | *.50* |
| Even when I think I should stop, I still use my smartphone too much | .15 | **.59** | .02 | .06 | .08 | −.01 | −.01 | −.12 | *.54* |
| I do not realize how much time I spend on my smartphone | .17 | **.53** | −.02 | −.08 | .10 | .06 | .05 | −.06 | *.50* |
| I have to check my smartphone often, even when I have conversations | .00 | **.53** | .13 | −.02 | −.02 | −.08 | .04 | .08 | *.54* |
| I have tried several times to reduce the time spent on the smartphone but I did not succeed | .07 | **.52** | .04 | .02 | .15 | .01 | −.02 | −.01 | *.56* |
| I spend a lot of time using my smartphone | .11 | **.46** | .10 | −.03 | .22 | −.03 | .10 | −.12 | *.47* |
| I can keep track of the amount of time I use the smartphone | −.01 | **−.46** | −.03 | .00 | −.01 | .12 | −.05 | .03 | *.54* |

*(continued)*

**Table 2. (continued)**

| | F1, ER | F2, LC | F3, NP | F4, SC | F5, AN | F6, TS | F7, SR | F8, SA | *MI* |
|---|---|---|---|---|---|---|---|---|---|
| I can spend as much time as I want without checking my smartphone | .02 | **−.45** | −.29 | .02 | .03 | .10 | .01 | .04 | *.44* |
| If I find out my smartphone is affecting my life, I would not have any problems reducing the time using it | .06 | **−.45** | −.07 | −.09 | .08 | .09 | −.01 | .17 | *.50* |
| When I'm with my friends, I often feel the need to look at the smartphone | .06 | **.43** | .14 | .00 | −.08 | −.07 | .06 | −.05 | *.40* |
| I cannot stop using the smartphone even when there are more important things to do | .06 | **.38** | .10 | .01 | .11 | −.04 | .08 | −.01 | *.49* |
| When I walk down the street I do not pay attention because of the smartphone | .04 | **.35** | .05 | .01 | .12 | .06 | .06 | .05 | *.42* |
| I would panic if I realized I had forgotten the smartphone at home after going out to go to school/university/work | .05 | −.07 | **.79** | −.05 | .00 | .03 | −.01 | −.07 | *.80* |
| If the smartphone turns off, I feel lost | .01 | −.03 | **.72** | .00 | .04 | .06 | −.06 | .14 | *.66* |
| I'm terrified at the idea of losing my smartphone | −.02 | −.04 | **.67** | .07 | .05 | .09 | .02 | −.01 | *.65* |
| I never leave home without the smartphone, not even for short periods | −.05 | .03 | **.64** | −.04 | .00 | −.01 | −.09 | .03 | *.65* |
| If my smartphone has a problem (e.g., it does not turn on, it breaks) it is the only thing I can think about | .01 | .07 | **.60** | .04 | .00 | .01 | −.03 | .08 | *.61* |
| I'm scared to find myself alone in an open natural space (e.g., in the mountains, in a woods, open country) with an uncharged smartphone | .06 | −.08 | **.59** | −.04 | −.03 | −.11 | .02 | −.04 | *.62* |
| I would be able to spend a whole day without smartphone | .13 | −.14 | **−.55** | .01 | .10 | .16 | .04 | −.13 | *.43* |
| Losing the smartphone would be worse than losing the wallet | .04 | .04 | **.49** | .09 | −.04 | .06 | −.03 | −.07 | *.50* |
| I'm very annoyed when there is no signal or I have no connection | .11 | .07 | **.48** | .03 | −.04 | .10 | .01 | −.02 | *.46* |
| I always carry my smartphone with me | −.08 | .13 | **.44** | −.05 | −.02 | .02 | .08 | −.02 | *.50* |
| I prefer smartphone communications because I can interrupt it at any time, unlike those face-to-face | −.05 | −.03 | .04 | **.77** | −.07 | .07 | −.03 | .07 | *.61* |
| I prefer smartphone communications because you can decide if and when to intervene, unlike those face-to-face | .00 | .03 | −.01 | **.76** | −.04 | .04 | −.06 | −.02 | *.63* |
| I prefer to talk about my feelings via smartphone than face-to-face | .05 | −.02 | −.03 | **.73** | .04 | −.05 | .07 | −.01 | *.62* |
| I prefer to talk about my problems via smartphone than face-to-face | .04 | .07 | −.07 | **.70** | .06 | −.06 | −.01 | −.03 | *.58* |
| I can be more sincere with someone using the smartphone than I can face-to-face | .08 | −.03 | .07 | **.65** | −.03 | .01 | −.01 | −.08 | *.53* |
| I find it easier to keep virtual relationships than face-to-face relationships | −.05 | .02 | .00 | **.60** | .01 | −.02 | .08 | .13 | *.50* |
| If I do not use my smartphone, I feel more relaxed | −.07 | −.05 | −.02 | .01 | **.76** | .07 | −.01 | −.01 | *.60* |
| When I do not use the smartphone, I feel more serene | .11 | −.08 | −.06 | −.02 | **.67** | .04 | .04 | .08 | *.54* |
| When I do not use the smartphone, I feel better | .00 | −.08 | −.08 | .06 | **.64** | −.01 | −.08 | .01 | *.52* |
| The smartphone is an overwhelming device | −.16 | .14 | −.03 | .01 | **.57** | .01 | .07 | −.05 | *.49* |

*(continued)*

**Table 2. (continued)**

| | F1, ER | F2, LC | F3, NP | F4, SC | F5, AN | F6, TS | F7, SR | F8, SA | *MI* |
|---|---|---|---|---|---|---|---|---|---|
| I felt better when I had a normal mobile phone | −.03 | .15 | −.01 | .00 | **.51** | −.19 | −.09 | .01 | *.45* |
| When I use the smartphone too much, I feel dizzy | .05 | .02 | .09 | −.09 | **.46** | .06 | −.01 | .00 | *.51* |
| The smartphone helps me remember what I have to do | −.04 | −.11 | .05 | .04 | .15 | **.64** | .01 | −.03 | *.50* |
| Without my smartphone I would not be able to remember my appointments | −.10 | −.03 | .08 | .06 | .19 | **.61** | −.03 | −.01 | *.51* |
| The smartphone makes me faster and more efficient in work and/or study | .04 | −.04 | −.14 | .01 | −.07 | **.60** | −.06 | .05 | *.51* |
| My performance in studying/working has improved since I used the smartphone | .08 | −.01 | .02 | −.02 | −.07 | **.55** | −.03 | .07 | *.45* |
| My smartphone helps me perform tasks faster | .04 | .07 | .01 | −.13 | −.05 | **.52** | .01 | −.09 | *.44* |
| The smartphone helps me in the day-to-day activities | −.06 | .15 | .06 | .00 | −.13 | **.44** | .10 | −.08 | *.42* |
| The smartphone helps me carry out tasks that I would otherwise not know how to complete | .05 | .13 | −.08 | .02 | −.09 | **.44** | .12 | −.06 | *.46* |
| The relationship with my partner would be affected by the absence of the smartphone | −.14 | .05 | −.07 | .02 | −.01 | .02 | **.81** | .07 | *.54* |
| The smartphone helped me (or helps me) keep my relationship alive | .07 | −.05 | −.06 | .01 | −.07 | −.03 | **.78** | .03 | *.65* |
| An important part of my relationship with my partner comes from smartphone communication | .03 | .00 | .04 | −.01 | .05 | .03 | **.77** | −.01 | *.63* |
| The smartphone is conscious | −.02 | .02 | .10 | −.04 | .09 | .03 | .02 | **.67** | *.45* |
| The smartphone perceives the stimuli that I send | .16 | −.08 | .10 | −.01 | .06 | .05 | .03 | **.59** | *.41* |
| The smartphone feels emotions | −.04 | .04 | −.02 | .11 | −.03 | −.05 | −.03 | **.54** | *.44* |
| The smartphone comes with free will | .04 | .13 | −.08 | −.02 | −.03 | −.08 | .02 | **.47** | *.43* |
| The smartphone understands me | .09 | −.02 | .03 | .02 | −.07 | −.05 | .12 | **.46** | *.43* |

*Note*. EFA = exploratory factor analysis; ER = emotion regulation through smartphone usage; LC = loss of control of smartphone use; NP = nomophobia; SC = smartphone-mediated communication; AN = awareness of smartphone negative impact; TS = smartphone tasks support; SR = smartphone support to romantic relationships; SA = smartphone anthropomorphization; MI = marker index. Loadings of the final solution on 67 items and MI of the initial solution on 173 items are reported.
Primary loadings are highlighted in bold, whereas percentage of explained variance and marker index are italicized.

Item loadings were evaluated by computing the marker index (Gallucci & Perugini, 2007), an item selection method that compares primary and secondary loadings to avoid cross-loadings and reach the clearest solution. A total of 67 items exceeded the recommended marker index cutoff of .40 (Gallucci & Perugini, 2007); hence, they were considered to be good indicators of their respective factors. The results, which are reported in Table 2, confirmed that each item had a clear primary loading on one factor and secondary loadings close to zero on the other factors. A further eight-factor EFA conducted on the 67 selected items explained 45.95% of variance, with factor correlations that ranged from |.05| to |.52|. The identified factors are described below, in order of the explained variance. Factor 1 was loaded by 16 items that refer to the use of smartphone as a method of coping with negative internal states, thus, it was called "Emotion regulation through smartphone usage." Factor 2 was loaded by 10 items related to either the inability to be without smartphone or the negative consequences deriving from problems with smartphone's functionalities; thus, it was called "Nomophobia." Factor 3 included 14 items that refer to a great amount of time spent on smartphone, its interference with daily life and social relationships, and failures in controlling smartphone usage; thus, it was called "Loss of control of smartphone use." The six items that loaded on Factor 4 recall the awareness of the negative influences of smartphones in everyday life and the positive consequences that are derived from smartphone nonuse; thus, it was called "Awareness of smartphone negative impact." The five items included in Factor 5 refer to the ascription of human-like characteristics to smartphones; thus, it was called "Smartphone anthropomorphization." Factor 6 gathered three items related to smartphone usefulness in creating and maintaining sentimental relationships;

**Table 3.** Descriptive Statistics and Pearson Correlations Between the Dimensions of the SIS-PV (In Rows), in Order of Explained Variance, and the SAS (In Columns).

| | *M* (*SD*) | DD | PA | WD | CR | OU | TO |
|---|---|---|---|---|---|---|---|
| Emotion regulation through smartphone usage | 2.23 (0.96) | .40* | .71* | .54* | .50* | .50* | .45* |
| Loss of control of smartphone use | 2.19 (0.74) | .55* | .44* | .67* | .55* | .68* | .78* |
| Nomophobia | 2.90 (0.90) | .30* | .47* | .68* | .47* | .56* | .38* |
| Smartphone-mediated communication | 1.73 (0.84) | .34* | .40* | .42* | .47* | .38* | .29* |
| Awareness of smartphone negative impact | 3.13 (0.80) | .36* | −.13 | .00 | −.06 | .12 | .27* |
| Smartphone tasks support | 3.02 (0.77) | .16 | .40* | .27* | .23* | .33* | .18* |
| Smartphone support to romantic relationships | 2.40 (1.18) | .31* | .34* | .33* | .31* | .33* | .22* |
| Smartphone anthropomorphization | 1.25 (0.46) | .17 | .30* | .27* | .32* | .08 | .18* |

*Note*. SIS-PV = preliminary version of the Smartphone Impact Scale; SAS = Smartphone Addiction Scale; DD = daily-life disturbance; PA = positive anticipation; WD = withdrawal; CR = cyberspace-oriented relationship; OU = overuse; TO = tolerance.
*$p < .00104$.

thus, it was called "Smartphone support to romantic relationships." Factor 7 was loaded by six items that refer to the preference for communications through smartphones rather than face-to-face interaction; thus, it was called "Smartphone-mediated communication." Finally, the seven items from Factor 8 focused on the usefulness of different smartphone functionalities in everyday life; thus, it was called "Smartphone tasks support."

Cronbach's alpha was computed for each latent factor to assess internal consistency. The highest Cronbach's alpha was observed for *emotion regulation through smartphone usage* ($\alpha = .96$), followed by *loss of control of smartphone use* ($\alpha = .87$), *nomophobia* ($\alpha = .86$), *smartphone-mediated communication* ($\alpha = .86$), *smartphone support to romantic relationships* ($\alpha = .82$), *awareness of smartphone negative impact* ($\alpha = .77$), *smartphone tasks support* ($\alpha = .75$), and *smartphone anthropomorphization* ($\alpha = .68$).

*Convergent Validity.* Scores of each SIS-PV subscale were computed, averaging the responses of the items that loaded onto their respective dimensions. Table 3 displays the means and standard deviations of the SIS-PV subscales and their correlations with the SAS dimensions. Mean scores ranged from 1.73 to 3.13, except for *Smartphone anthropomorphization*, which showed a very low value indicating a strong floor effect. Given the multiple correlations estimated, the Bonferroni correction was applied to the *p* value, dividing the ordinary cutoff of .05 for the number of coefficients estimated (i.e., 48), thus lowering the level of significance at $p < .00104$. List wise deletion was used to handle missing data. *Loss of control of smartphone use, nomophobia, emotion regulation through smartphone usage*, and *smartphone-mediated communication* showed the highest correlation coefficients, with all the dimensions of the SAS, suggesting that these factors were the most related to PSU. In particular, *loss of control of smartphone use* showed the high associations with *withdrawal, tolerance*, and *overuse*, which are typical dimensions of addiction. In contrast, *awareness of smartphone negative impact* showed low to zero correlations with the majority of the SAS dimensions, indicating that being aware or not aware of the smartphone's negative influence on everyday life was relatively independent from the problematic use of the device. The other SIS-PV dimensions showed low to moderate correlation coefficients with those of the SAS.

## Study 2

The present study was devised to complete the development process of the SIS. The main aim was to confirm the factor structure found in Study 1 and, based on the results and on theoretical considerations, shorten the scale to increase its usability. Once the final version of the SIS was developed, its dimensionality and psychometric properties were tested. Finally, we investigated the association between the SIS dimensions and psychosocial constructs that might be related to PSU, human–smartphone interaction, and smartphone usage regarding daily time spent on the device as well as its specific functionalities/apps. Based on the results on convergent validity reported in Study 1, we hypothesized that the dimensions more correlated to PSU (i.e., *loss of control of smartphone use, nomophobia, smartphone-mediated communication*, and *emotion regulation through smartphone usage*) would show the highest associations with personality traits commonly related to addictions (i.e., conscientiousness, neuroticism, and impulsivity), psychosocial variables negatively related to well-being (i.e., depression, anxiety, stress, loneliness, perceived social support, and threat of basic needs), smartphone daily use, and the majority of smartphone functionalities. On the contrary, the other SIS dimensions were expected to show lower associations with such personality traits and psychosocial constructs, as they measure smartphone impacts that should not be directly linked to PSU. Beyond this general prediction, specific hypotheses were advanced on the associations between the SIS dimensions and smartphone functionalities. Dimensions focused on online social relationships (i.e., *smartphone-mediated communication* and *smartphone support to romantic relationships*) were hypothesized to correlate especially with instant messaging apps and social networking sites. As a coping strategy, *emotion regulation through smartphone usage* was expected to correlate with functionalities that allows mind-wandering and distraction from negative life situations (e.g., music and video apps, games, navigation on the Internet, social networking sites). Functionalities that help users in daily and work activities (e.g., calendar and notes apps, e-mail, navigation systems) were hypothesized to correlate with *smartphone tasks support. Awareness of negative smartphone impact* was expected to show negative or no correlations with the most addictive functionalities, such as instant messaging apps, social networking sites, and games.

## Method

*Participants and Procedure.* The present study was conducted in Italy on a sample of Italian native speakers. The same inclusion criteria from Study 1 were used. Snowball sampling was used to recruit 841 participants who volunteered for the present study. As in Study 1, the participants received a link to an online survey on Qualtrics© (Provo, UT, USA) and were initially presented with an information sheet, a consent form (both approved by the Ethics Committee of the University of Milano–Bicocca), and self-report questions to assess inclusionary criteria. Only the participants who confirmed having received all study information, consented to participate, and were compliant with both the inclusionary criteria were redirected to the study survey. No missing data were allowed as a forced-choice function was used to ensure each item was responded. All the participants were compliant with the two inclusionary criteria; however, 104 participants did not consent to the study terms and a further 138 did not correctly answer at least one of three attention check items that were selected from the DQS (Maniaci & Rogge, 2014); thus, they were not included in the analysis. The final sample consisted of 601 participants (403 females, 194 males, and 4 nondeclared) ranging in age from 18 to 55 years ($M$ = 29.1, $SD$ = 9.3). Indeed, 272 participants (45.3%) had a high school degree, 69 (11.5%) had a lower education level, whereas 256 (52.6%) had at least a bachelor degree (4 nondeclared). Concerning occupation, 184 participants (30.6%) were students, 254 (42.2%) were employed, 95 (15.8%) were both students and workers, and 37 (6.2%) were unemployed (31 nondeclared).

*Materials.* In addition to the SIS and the same sociodemographic questions used in Study 1, the following constructs were assessed.

*Big Five personality traits*. The Big Five were assessed using the Big Five Inventory (John & Srivastava, 1999; Italian adaptation: Ubbiali, Chiorri, Hampton, & Donati, 2013), a 44-item scale that measures openness ($\alpha$ = .80; $M$ = 3.60, $SD$ = 0.63), conscientiousness ($\alpha$ = .84; $M$ = 3.65, $SD$ = 0.70), extraversion ($\alpha$ = .84; $M$ = 3.16, $SD$ = 0.76), agreeableness ($\alpha$ = .66; $M$ = 3.69, $SD$ = 0.55), and neuroticism ($\alpha$ = .82; $M$ = 3.18, $SD$ = 0.76) on a 5-point Likert-type scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*).

*Impulsivity*. Impulsivity was assessed using the subscale of negative urgency ($\alpha$ = .88; $M$ = 2.36, $SD$ = 0.60) of the UPPS-P Impulsive Behavior Scale (Lynam, Smith, Whiteside, & Cyders, 2006; Italian adaptation: Fossati et al., 2016), the dimension most related to substance use and addiction (Lynam, 2011). The scale consisted of 12 items on a 4-point Likert-type scale that ranges from 1 (*strongly agree*) to 4 (*strongly disagree*).

*Depression, anxiety, and stress*. The short version of the Depression Anxiety Stress Scales (DASS-21; Henry & Crawford, 2005; Italian adaptation: Bottesi et al., 2015) was used to measure depression ($\alpha$ = .88; $M$ = 1.64, $SD$ = 0.60), anxiety ($\alpha$ = .81; $M$ = 1.43, $SD$ = 0.48), and stress ($\alpha$ = .88; $M$ = 2.07, $SD$ = 0.64). The DASS-21 consisted of 21 items (7 per construct) to be answered on a 4-point Likert-type scale, where 0 indicates *did not apply to me at all* and 3 indicates *applied to me very much or most of the time*.

*Loneliness*. The short UCLA Loneliness Scale (Hughes, Waite, Hawkley, & Cacioppo, 2004; Italian adaptation: Boffo, Mannarini, & Munari, 2012), a three-item instrument that uses a 4-point Likert-type scale ranging from 1 (*never*) to 4 (*often*), was used to assess perceived loneliness ($\alpha$ = .77; $M$ = 1.56, $SD$ = 0.52).

*Basic needs satisfaction*. A short version of the Need Threat Scale (NTS; Williams, Cheung, & Choi, 2000) was used to assess the threat of four fundamental psychological needs, namely belonging, control, self-esteem, and meaningful existence. A short NTS consisted of 12 items (three for each dimension) on a 5-point scale, ranging from 1 (*not at all*) to 5 (*extremely*) ($\alpha$ = .87; $M$ = 3.18, $SD$ = 1.04). The

Italian adaptation of the NTS was retrieved from Brambilla and Riva (2017).

*Perceived social support.* Social support was measured through the Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet, & Farley, 1988; Italian adaptation: Sestito, Cozzolino, Menna, Ragozini, & Sica, 2008), a 12-item scale with a response format ranging from 1 (*strongly disagree*) to 5 (*strongly agree*) ($\alpha = .91$; $M = 5.58$, $SD = 1.07$).

*Smartphone usage.* At the end of the survey, the participants were asked to provide some information about their smartphone usage. The average daily time spent using their smartphone was assessed through an open-ended question. Then, a series of questions on a response format from 1 (*never*) to 5 (*always*) were devised to measure the frequency at which specific smartphone functionalities are used, giving participants some examples. The functionalities were phone calls and SMS ($M = 3.03$, $SD = 0.95$), calendar and notes ($M = 2.65$, $SD = 1.15$), camera ($M = 3.26$, $SD = 1.02$), e-mail ($M = 3.20$, $SD = 1.16$), instant messaging (e.g., WhatsApp, Telegram, Messenger; $M = 4.38$, $SD = 0.78$), social networks (e.g., Facebook, Twitter, Instagram; $M = 3.53$, $SD = 1.34$), navigation systems (e.g., Google Maps, Waze; $M = 3.02$, $SD = 1.04$), Internet browsers (e.g., Google Chrome, Firefox; $M = 3.44$, $SD = 1.03$), music and videos (e.g., music and video players, Spotify, YouTube; $M = 2.46$, $SD = 0.98$), and games ($M = 1.97$, $SD = 1.17$).

## Results

*Confirmatory Factor Analyses on the SIS-PV.* Confirmatory factor analysis (CFA) was conducted on the SIS-PV to test the factor structure that emerged from Study 1 using M*plus* version 7 (Muthén & Muthén, 2015). Given that 12 items of the SIS showed an asymmetry higher than |1.0| and that the Mardia test yielded significant multivariate skewness ($M = 520.82$, $SD = 3.29$, $p < .001$) and kurtosis ($M = 4608.46$, $SD = 6.28$, $p < .001$), maximum likelihood with robust standard errors (i.e., MLR) was used as estimator in the following analyses to avoid problems related to data nonnormality. Before running the CFA, a null model in which all variables were uncorrelated to one another was tested to identify the fit indices to be considered in the further analysis. Indeed, a null model with a root mean square error of approximation (RMSEA) smaller than .158 suggests that incremental fit indices (i.e., the comparative fit index [CFI] and the Tucker–Lewis index[TLI]) of any model tested on the same set of variables and sample cannot mathematically reach acceptable values; thus, they are completely uninformative (Kenny, 2015). The null model conducted on the SIS-PV yielded a RMSEA of .120, indicating that only absolute indices should be used to evaluate the fit of the following CFA: the RMSEA, the probability of close fit associated with the RMSEA (Cfit of RMSEA), and the standardized root mean square residual (SRMR). A model adequately explains the data when the RMSEA is lower than .08 (better if lower than .05), the Cfit of RMSEA is nonsignificant (better if higher than .50), the SRMR is lower than .08 (Brown, 2015; Kline, 2015). The CFA showed excellent fit indices (RMSEA = .046, Cfit of RMSEA = 1.00, SRMR = .057), confirming the factor structure found in the previous study. Table 4 reports standardized item loadings that ranged from |.44| to |.89|.

*Scale Reduction and Dimensionality of the Final SIS.* To proceed to the scale reduction, the items were evaluated from both statistical and theoretical standpoints. Specifically, for each of the factors, the items were selected based on the magnitude of factor loadings showed in the former CFA and their representativeness of the construct measured. As a trade-off between reliability and scale brevity, we aimed at selecting four items per construct. This was not possible for *smartphone support to romantic relationships*, because only three items were derived from Study 1. Moreover, the selection procedure led to retain only the three items of *loss of control of smartphone use* that were related to one's perception about how others evaluate his or her own smartphone overuse. Finally, the strong floor effect showed by *smartphone anthropomorphization* in Study 1 and in the present study ($M = 1.28$, $SD = 0.52$), led us to drop this dimension. A total of 26 items (reported in Table 4) were included in the final version of the SIS. The detailed procedure followed for the item selection is reported in the supplementary material (available online) of the present article.

*Dimensionality and Psychometric Properties of the SIS.* As for the previous CFA on the SIS-PV, an initial Mardia test and a null model were run. Whereas the Mardia test confirmed the need to use maximum likelihood with robust standard errors (multivariate skewness: $M = 32.54$, $SD = 0.88$, $p < .001$; multivariate kurtosis: $M = 725.85$, $SD = 3.14$, $p < .001$), the null model yielded a RMSEA of .177, indicating that incremental fit indices (i.e., CFI and TLI, respectively) must be considered to evaluate model fit. Values higher than .95 of both CFI and TLI indicate optimal fit (Brown, 2015). As expected, the CFA yielded excellent fit indices (CFI = .95, TLI = .94, RMSEA = .043, Cfit of RMSEA = .99, SRMR = .043), confirming the hypothesized factor structure. Standardized item loadings ranged from .50 to .91 and are reported in Table 4. Generally, loadings were higher than those resulted from the CFA on the SIS-PV, especially those of *loss of control of smartphone use*, indicating the higher degree of homogeneity of this latent construct compared with its former version.

**Table 4.** The Results of the CFAs Conducted on the SIS-PV and SIS: Standardized Loadings (λ) Are Reported.

| | SIS-PV λ | SIS λ |
|---|---|---|
| Loss of control of smartphone use | | |
| I do not realize how much time I spend on my smartphone | .45 | — |
| I have to check my smartphone often, even when I have conversations | .60 | — |
| I can keep track of the amount of time I use the smartphone | −.53 | — |
| Others tell me I spend too much time on the smartphone | .73 | .88 |
| People around me often find my use of the smartphone excessive | .73 | .91 |
| I have tried several times to reduce the time spent on the smartphone but I did not succeed | .63 | — |
| If I find out my smartphone is affecting my life, I would not have any problems reducing the time using it | −.53 | — |
| When I walk down the street I do not pay attention because of the smartphone | .44 | — |
| I can spend as much time as I want without checking my smartphone | −.56 | — |
| I spend a lot of time using my smartphone | .65 | — |
| When I'm with my friends, I often feel the need to look at the smartphone | .57 | — |
| I cannot stop using the smartphone even when there are more important things to do | .66 | — |
| Even when I think I should stop, I still use my smartphone too much | .76 | — |
| Sometimes I have discussions with those around me about my excessive use of the smartphone | .70 | .82 |
| Nomophobia | | |
| If my smartphone has a problem (e.g., it does not turn on, it breaks), it is the only thing I can think about | .66 | .70 |
| I'm terrified at the idea of losing my smartphone | .69 | .70 |
| I would be able to spend a whole day without smartphone | −.46 | — |
| I always carry my smartphone with me | .44 | — |
| I never leave home without the smartphone, not even for short periods | .50 | — |
| If the smartphone turns off, I feel lost | .73 | .74 |
| I'm scared to find myself alone in an open natural space (eg in the mountains, in a woods, open country) with an uncharged smartphone | .49 | — |
| I'm very annoyed when there is no signal or I have no connection | .61 | — |
| Losing the smartphone would be worse than losing the wallet | .62 | — |
| I would panic if I realized I had forgotten the smartphone at home after going out to go to school/university/work | .67 | .66 |
| Smartphone-mediated communication | | |
| I can be more sincere with someone using the smartphone than I can face-to-face | .67 | — |
| I prefer smartphone communications because I can interrupt it at any time, unlike those face-to-face | .60 | — |
| I prefer to talk about my feelings via smartphone than face-to-face | .81 | .81 |
| I find it easier to keep virtual relationships than face-to-face relationships | .72 | .72 |
| I prefer to talk about my problems via smartphone than face-to-face | .83 | .86 |
| I prefer smartphone communications because you can decide if and when to intervene, unlike those face-to-face | .74 | .70 |
| Emotion regulation through smartphone usage | | |
| When I'm feeling down, using the smartphone helps me feel better | .66 | — |
| If something worries me too much, I use my smartphone to make myself feel better | .73 | — |
| When I'm stressed, the smartphone helps me feel better | .78 | — |
| When I'm angry, using smartphone makes me feel better | .81 | .81 |
| When I feel depressed, using my smartphone helps me feel better | .83 | — |
| When I feel pressured, using the smartphone makes me feel better | .83 | .82 |

*(continued)*

**Table 4. (continued)**

| | SIS-PV λ | SIS λ |
|---|---|---|
| When I'm very upset, the smartphone helps me get better | .88 | — |
| If I'm very tense, using my smartphone helps me feel better | .88 | — |
| When I say or do something wrong with other people, using the smartphone helps me get on | .77 | — |
| If I'm sad, using the smartphone makes me feel better | .87 | .88 |
| When I'm nervous, using my smartphone makes me feel better | .89 | .89 |
| When I get bored, the smartphone keeps me entertained | .56 | — |
| When I'm anxious, using my smartphone helps me feel better | .88 | — |
| If I had a hard day, using the smartphone helps me relax | .76 | — |
| If I'm aloof for something, using the smartphone makes me feel better | .87 | — |
| In highly ansiogenic situations, using smartphones helps me feel better | .76 | — |
| Smartphone support to romantic relationships | | |
| The relationship with my partner would be affected by the absence of the smartphone | .76 | .76 |
| An important part of my relationship with my partner comes from smartphone communication | .83 | .83 |
| The smartphone helped me (or helps me) keep my relationship alive | .80 | .80 |
| Smartphone tasks support | | |
| The smartphone makes me faster and more efficient in work and/or study | .54 | — |
| The smartphone helps me carry out tasks that I would otherwise not know how to complete | .57 | — |
| The smartphone helps me remember what I have to do | .58 | .81 |
| My performance in studying/working has improved since I used the smartphone | .65 | — |
| My smartphone helps me perform tasks faster | .71 | .50 |
| Without my smartphone I would not be able to remember my appointments | .48 | .68 |
| The smartphone helps me in the day-to-day activities | .68 | .59 |
| Smartphone anthropomorphization | | |
| The smartphone understands me | .61 | — |
| The smartphone perceives the stimuli that I send | .61 | — |
| The smartphone is conscious | .79 | — |
| The smartphone comes with free will | .61 | — |
| The smartphone feels emotions | .66 | — |
| Awareness of smartphone negative impact | | |
| When I do not use the smartphone, I feel better | .69 | .73 |
| When I use the smartphone too much, I feel dizzy | .49 | — |
| If I do not use my smartphone, I feel more relaxed | .65 | — |
| I felt better when I had a normal mobile phone | .56 | .66 |
| The smartphone is an overwhelming device | .57 | .51 |
| When I do not use the smartphone, I feel more serene | .72 | .72 |

*Note*. CFA = confirmatory factor analysis; SIS-PV = preliminary version of the Smartphone Impact Scale; SIS = Smartphone Impact Scale. All the loadings are significant at the .001 level.

Factors reliability was estimated using McDonalds' (1999) *Omega* to overcome Cronbach's alpha limitations, specifically the violation of tau-equivalence (Dunn, Baguley, & Brunsden, 2013). Descriptive statistics, *Omega* (ω), and correlations among the SIS dimensions are reported in Table 5. *Omega* ranged from .74 to .91, indicating good to excellent internal consistency of the factors. The highest mean was observed for *smartphone tasks support*, and the lowest was for *smartphone mediated-communication*. Most correlation coefficients were significant and positive, revealing weak to moderate associations among the SIS dimensions. The highest correlation coefficient was detected between *nomophobia* and *emotion regulation through smartphone usage* ($r$ = .50), followed by that between *nomophobia* and *loss of control of smartphone use* ($r$ = .40). The only exception to the positive associations among factors was represented by *awareness of smartphone negative impact*, which did not significantly correlate with

**Table 5.** Descriptive Statistics, McDonalds' Omega (ω) and Pearson Correlations Among the Dimensions of the SIS.

| | *M* (*SD*) | ω | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|---|
| (1) Loss of control of smartphone use | 2.01 (1.15) | .91 | 1 | | | | | |
| (2) Nomophobia | 2.85 (1.04) | .79 | .40** | 1 | | | | |
| (3) Smartphone-mediated communication | 1.85 (0.95) | .85 | .25** | .33** | 1 | | | |
| (4) Emotion regulation through smartphone usage | 2.22 (1.07) | .92 | .29** | .50** | .39** | 1 | | |
| (5) Smartphone support to romantic relationships | 2.36 (1.13) | .84 | .24** | .26** | .36** | .25** | 1 | |
| (6) Smartphone tasks support | 3.41 (0.88) | .75 | .15* | .36** | .12* | .20** | .21** | 1 |
| (7) Awareness of smartphone negative impact | 3.03 (0.85) | .74 | −.16* | −.11 | −.14* | −.20* | −.05 | −.08 |

*Note.* SIS = Smartphone Impact Scale.
$^{*}p < .05$. $^{**}p < .01$.

**Table 6.** Pearson Correlations Between the Dimensions of the SIS (In Columns) and the Psychosocial Constructs and Smartphone Usage (In Rows).

| | LC | NP | SC | ER | SR | TS | AN |
|---|---|---|---|---|---|---|---|
| Psychosocial constructs | | | | | | | |
| Extraversion | .06 | −.01 | −.26* | −.06 | −.07 | .12 | −.01 |
| Agreeableness | −.03 | −.04 | −.10 | −.11 | −.04 | −.04 | .06 |
| Conscientiousness | −.18* | −.06 | −.18* | −.14 | −.19* | .02 | −.07 |
| Neuroticism | .26* | .27* | .20* | .21* | .10 | .01 | .11 |
| Openness | −.09 | −.06 | −.09 | −.07 | .02 | .17* | .11 |
| Impulsivity | .33* | .31* | .18* | .26* | .10 | .05 | .04 |
| Depression | .12 | .11 | .21* | .10 | .08 | −.04 | .19* |
| Anxiety | .22* | .24* | .15* | .19* | .17* | .03 | .12 |
| Stress | .19* | .18* | .14 | .15 | .10 | .04 | .16* |
| Loneliness | .13 | .16* | .29* | .14 | .17* | −.05 | .05 |
| Perceived social support | .03 | .01 | −.23* | −.10 | −.11 | −.12 | .03 |
| Threat of basic needs | .15* | .16* | .27* | .13 | .12 | −.04 | .10 |
| Smartphone functionalities | | | | | | | |
| Phone calls and SMS | .01 | .02 | −.16* | −.03 | −.05 | .16* | −.03 |
| Calendar and notes | .08 | .18* | −.03 | .05 | .04 | .54* | −.02 |
| Camera | .19* | .23* | .06 | .15* | .05 | .17* | −.01 |
| E-mail | .07 | −.01 | .02 | −.04 | .10 | .22* | .11 |
| Instant messaging | .21* | .21* | .13 | .16* | .25* | .20* | .01 |
| Social networks | .31* | .24* | .24* | .28* | .23* | .10 | −.03 |
| Navigation systems | .14 | .14 | .08 | .05 | .07 | .19* | .07 |
| Internet browsers | .16* | .12 | .18* | .09 | .17* | .16* | .00 |
| Music and videos apps | .22* | .16* | .16* | .20* | .17* | .09 | −.04 |
| Games | .17* | .11 | .21* | .22* | .10 | .01 | −.17* |
| Smartphone daily usage | .27* | .23* | .18* | .20* | .20* | .07 | .00 |

*Note.* LC = loss of control of smartphone use; NP = nomophobia; SC = smartphone-mediated communication; ER = emotion regulation through smartphone usage; SR = smartphone support to romantic relationships; TS = smartphone tasks support; AN = awareness of smartphone negative impact.
$^{*}p < .00031$.

*nomophobia, smartphone support to romantic relationships*, and *smartphone tasks support*, and it was negatively associated with the remaining dimensions.

*Associations With Psychosocial Constructs and Smartphone Usage.* Table 6 reports correlations of the SIS with psychosocial constructs and smartphone usage, computed using

SPSS, version 24.0 (IBM Corp., 2016). Given the multiple correlations estimated, the Bonferroni correction was applied to the *p* value, dividing the ordinary cutoff of .05 for the number of coefficients estimated (i.e., 161), thus lowering the level of significance at $p < .00031$.

Concerning psychosocial constructs, *loss of control of smartphone use, nomophobia, smartphone-mediated communication*, and *emotion regulation through smartphone usage* showed a similar pattern of correlations characterized by positive associations with neuroticism, impulsivity, and anxiety. In addition, each of these dimensions showed specific associations with other psychosocial constructs. *Loss of control of smartphone use* was negatively associated with conscientiousness and positively with stress and threat of basic needs. *Nomophobia* showed positive correlations with stress, loneliness, and threat of basic needs. *Smartphone-mediated communication* was positively associated with loneliness and threat of basic psychological needs, and negatively with extraversion and perceived social support. *Emotion regulation through smartphone usage* did not show any other significant correlation in addition to those with impulsivity, neuroticism, and anxiety. As hypothesized, compared with these four dimensions, the other SIS factors revealed fewer and lower associations with psychosocial constructs. *Smartphone support to romantic relationships* was negatively linked to conscientiousness and positively to anxiety and loneliness. A positive correlation was found between *smartphone tasks support* and openness, whereas *awareness of smartphone negative impact* positively correlated with depression and stress.

Daily time spent on the device was positively associated with all the SIS dimensions, except *smartphone tasks support* and *awareness of smartphone negative impact. Loss of control of smartphone use* and *nomophobia* showed similar patterns of correlations with smartphone specific use. In particular, both these dimensions correlated with instant messaging apps, social networking sites, smartphone camera, and music and video apps. Moreover, *loss of control of smartphone use* correlated with the use of Internet browsers, whereas *nomophobia* with calendar and notes apps. *Smartphone-mediated communication* showed a negative correlation with phone calls and SMS and positive correlations with social networking sites, games, Internet browsers, and music and video apps. *Emotion regulation through smartphone usage* was especially associated with social networking sites and showed lower, but still significant, correlations with games, music and video apps, instant messaging apps, and smartphone camera. *Smartphone support to romantic relationships* was primarily associated not only with instant messaging apps and social networking sites but also with Internet browsers and music and video apps. *Smartphone tasks support* revealed significant and positive associations with the majority of the smartphone functionalities and an especially high correlation with calendar and notes apps. On the contrary, *awareness of smartphone negative impact* revealed only a negative association with games.

## General Discussion

The present research aimed at broadening the view of human–smartphone interaction, developing a comprehensive and psychometrically valid self-report scale to address smartphone impact in everyday life, the SIS. To achieve this goal, we reviewed the psychological literature on smartphones, specifically focusing on smartphone cognitive, affective, social, and behavioral impacts that still lacked a proper measurement. In Study 1, we administered an item pool to a sample of adult smartphone users. We obtained a 67-item scale that measured eight factors that demonstrated good external validity with the SAS. In Study 2, this preliminary scale was reduced to obtain the SIS, a 26-item scale that measures the following seven dimensions of smartphone impact: *loss of control of smartphone use, nomophobia, smartphone-mediated communication, emotion regulation through smartphone usage, smartphone support to romantic relationships, smartphone tasks support*, and *awareness of smartphone negative impact*. The analysis of the SIS dimensionality yielded excellent fit indices and its subscales demonstrated good to excellent reliability. Moreover, its dimensions showed meaningful associations with a series of psychosocial constructs related to PSU and human–smartphone interaction, as well as with self-reported use of smartphone and its primary functionalities.

### Improving the Current Measurement of Problematic Smartphone Use

Regardless of whether the debate concerning technological addiction (Gentile et al., 2013) will be solved in favor of the actual existence of smartphone addiction, the importance of addressing negative impacts related to smartphone overuse is undeniable and a comprehensive scale on smartphone impact cannot neglect it. Thus, the SIS included four dimensions that measure constructs related to PSU, namely *loss of control of smartphone use, nomophobia, smartphone-mediated communication*, and *emotion regulation through smartphone usage*. The link between these dimensions and PSU is confirmed by their associations with the SAS subscales (Kwon, Lee, et al., 2013), which were particularly high especially between *loss of control of smartphone use* and *nomophobia* and the SAS subscales that measure tolerance and withdrawal. Moreover, personality traits that were previously identified as predictors of PSU, such as impulsivity, neuroticism, and low conscientiousness (Roberts et al., 2015; Ryu & Cho, 2015), were associated with these four SIS dimensions.

Although PSU is already addressed by a series of other self-report instruments (D. Kim et al., 2014; Kwon, Kim, Cho, & Yang, 2013; Lin et al., 2014; Yildirim & Correia, 2015), the aforementioned subscales of the SIS introduced a number of novelties that were not taken into account previously. Compared with existing measures, *loss of control of smartphone use* measures smartphone overuse from a different perspective, addressing others perceptions about one's own smartphone use. Moving the focus from the self to others' perception of one's own behavior (and its related consequences) means measuring the metaperception of the respondent's behavior. This might partially overcome problems related to self-reporting smartphone overuse that could influence the measurement of the construct, such as the lack of awareness about one's own behavior and biases in the estimation of smartphone use. Indeed, comparing self-reported and objective measures of smartphone use, Andrews, Ellis, Shaw, and Piwek (2015) showed that people tend to underestimate time spent and number of accesses to their smartphone. Asking participants to state what other people think about their own smartphone use might reduce possible biases related to self-judgment. The negative association with conscientiousness (a predictor of PSU; Roberts et al., 2015) and the positive ones with anxiety, stress, and threat of basic needs (common outcomes of PSU; Bian & Leung, 2015; Elhai, Dvorak, et al., 2017) further support the link between the metaperception of smartphone overuse and PSU. Moreover, *loss of control of smartphone use* showed the highest association with daily smartphone usage among the SIS dimensions and was positively correlated with the use of most smartphone functionalities, confirming its key role in determining the overuse of the device.

The *nomophobia* subscale addresses negative cognitive and emotional reactions associated with the inability to use the smartphone. Contrarily to the NMP-Q (Yildirim & Correia, 2015), which explores different subdimensions of nomophobia (being specifically developed for this construct), the SIS subscale has the advantage to measure nomophobia with only four items while maintaining good reliability levels. This is in line with the general aim of this research, which was to provide researchers with a brief and comprehensive self-report scale to measure several impacts of smartphone use in everyday life. *Nomophobia* showed positive associations with anxiety, stress, loneliness, and threat of basic needs, characteristics that are typically related to these new kind of phobia (Bragazzi & Del Puente, 2014). Beyond the correlation with daily smartphone use, *Nomophobia* showed remarkable associations with social networking and instant messaging apps, consistently with the literature that considers the lack of connection with others and the inability to use social media as the core of the construct (Bragazzi & Del Puente, 2014; Griffiths & Kuss, 2017; Yildirim & Correia, 2015).

In contrast with the two dimensions described above, *smartphone-mediated communication* and *emotion regulation through smartphone usage* do not derive from existing measures and do not necessarily have a negative connotation. Indeed, from the CIUT perspective (Kardefelt-Winther, 2014), behaviors measured by both these dimensions can, to some extent, represent adaptive coping strategies that people use to compensate real-life problems and unmet needs.

*Smartphone-mediated communication* describes the preference for communication mediated by smartphone rather than face-to-face. Although existing scales address the impacts of smartphones on social relationships, this new dimension emphasizes the comparison between online and offline communication, which is particularly important from a health promoting perspective. Indeed, lonely individuals who prefer communicating through smartphones might be more likely to develop PSU (J.-H. Kim, 2017). As the dimension focused on virtual social relationships, social networking was the functionality most correlated with *smartphone-mediated communication*. Moreover, it was positively related with loneliness and threat of basic needs, and negatively related with social support and extraversion. Indeed, introverted and lonely individuals, being less involved in face-to-face relationships, might have difficulties in self-disclosure (Sloan & Solano, 1984); thus, they might rely more on social media for bonding and bridging social capital (Bian & Leung, 2015), leading them to develop psychological distress outcomes, such as depression and anxiety (Grav, Hellzèn, Romild, & Stordal, 2011). However, in some circumstances, this construct might detect adaptive rather than maladaptive behavior. According to Waytz and Gray (2018), online communication can benefit sociability when it deepens already existing offline relationships or when deep offline engagement is difficult to attain. From the CIUT perspective (Kardefelt-Winther, 2014), these situations can be considered as motivational factors that induce individuals to cope with the need to connect with others. In this fashion, when other people are physically distant or a large amount of their specific relationships are maintained through the smartphone (e.g., groups of friends on WhatsApp), low to moderate preference for online communication is expected. This enables individuals to maintain their social connections or to complement offline engagement.

Finally, *emotion regulation through smartphone usage* accounts for the use of smartphones to cope with negative emotions. A few prior studies have noted the possible role of smartphones in regulating inner states (Grellhesl & Punyanunt-Carter, 2012; Hoffner & Lee, 2015; Panova & Lleras, 2016); however, no scales have been developed thus far. Consistently with the core of the constructs, *emotion regulation through smartphone usage* showed positive associations with the use of specific apps whose functions have been related to emotion regulation and avoidance coping, such as social networks (Hormes, Kearns, & Timko, 2014), music and videos apps (Hutchinson, Baldwin, & Oh, 2006; Moore, 2013), and mobile games (Li, Zou, Wang, & Yang, 2016; Loton, Borkoles, Lubman, & Polman, 2016). Moreover, according to the pattern of correlations between psychosocial factors and *emotion regulation through smartphone usage*, it is arguable that more neurotic, impulsive, or anxious individuals use their smartphone as a method of escaping/avoiding negative inner states (Contractor, Weiss, Tull, & Elhai, 2017; Gunthert, Cohen, & Armeli, 1999; Hofmann, Sawyer, Fang, & Asnaani, 2012; Schreiber, Grant, & Odlaug, 2012). This is generally considered to be a maladaptive coping strategy that is associated with a number of negative outcomes, including addiction (e.g., Thomas, Allen, Phillips, & Karantzas, 2011; Wingo, Baldessarini, & Windle, 2015). However, low to moderate levels of this construct might not necessarily have a negative connotation. Indeed, the use of smartphone to overcome negative inner states can be interpreted as a distraction strategy that can have the positive effect to free the mind from the source of negative feelings, preventing the use of more dysfunctional strategies, such as rumination (Riva, 2016). Thus, the construct underlying *emotion regulation through smartphone usage* might represent a good coping strategy to improve current mood, though future studies are needed to assess its effectiveness.

### *Moving Beyond Problematic Smartphone Use*

In a world in which smartphones are ubiquitous and have constantly increased their usefulness in many areas of life, there is the need to measure potentially positive smartphone impacts as well as outcomes deriving from smartphone nonuse, two themes that have received little attention so far. Accordingly, the SIS included three dimensions that deal with these smartphone impacts and that do not constitute facets of PSU, namely *smartphone support to romantic relationships, smartphone tasks support*, and *awareness of smartphone negative impact*. Indeed, the correlations between the SAS and these three dimensions were much lower than those found when considering the other SIS factors. Moreover, these three dimensions did not show significant correlations with personality traits typically associated with addiction (e.g., neuroticism, impulsivity), with the exception of an unexpected negative association between *smartphone support to romantic relationships* and conscientiousness, which deserves attention in future studies.

*Smartphone support to romantic relationships* captures the usefulness of smartphone in developing and maintaining intimate relationships. A few studies have highlighted the role of smartphone in romantic (long distance) relationships (Hertlein & Ancheta, 2014; Morey et al., 2013). Consistently, the two highest correlations between this dimension and smartphone use were found with instant messaging and social networking apps, highlighting its importance in communicating with the partner and thus determining daily smartphone usage. Moreover, *smartphone support to romantic relationships* was positively associated with both loneliness and anxiety, two psychosocial constructs that are widely involved in social relationships and attachment processes (Hazan & Shaver, 1987).

*Smartphone tasks support* concerns the use of smartphone as a mean to manage daily activities and deal with regular duties. As for psychosocial constructs, this dimension showed only a positive correlation with openness. This finding is in line with research that indicated a higher acceptance and intention to use technologies by individuals high in openness to experience (Deveraj, Easley, & Crant, 2008; Nov & Ye, 2008). As hypothesized, *smartphone tasks support* was positively associated with the use of a series of smartphone functionalities that helps individuals in manage daily activities. The highest correlation was found with calendar and notes apps, but a number of other process-oriented functionalities (i.e., content-based functionalities; Contractor, Weiss, & Elhai, 2019; Elhai & Contractor, 2018; Elhai, Hall, Levine, & Dvorak, 2017) were associated with this dimension. Some of these further functionalities (i.e., e-mail apps, navigation systems) showed significant correlations only with *Smartphone tasks support*, supporting its construct validity. This pattern of correlations might be especially useful in addressing specific use of smartphone, suggesting that *Smartphone tasks support* might predict the use of specific functionalities. Nevertheless, the lack of a significant association with smartphone daily usage suggests that the use of smartphone to support daily activities does not influence time spent using the device.

Although the CIUT concerns the use of technology as a way to compensate psychosocial problems or unmet real-life needs, both *smartphone support to romantic relationships* and *smartphone tasks support* can be seen through its lenses. Indeed, even though maintaining intimate relationships and manage daily tasks do not necessarily concern dealing with adverse life situations, they still constitute motivations underlying the use of smartphone as a mean to satisfy unmet needs. In this fashion, we propose that the CIUT can be broadened to embrace a wide range of situations in which technology can offer opportunities to deal with real-life needs, irrespectively of the valence of the situations that rise motivations to use technology.

*Awareness of smartphone negative impact* measures individuals' recognition of negative effects of smartphone nonuse in daily life, with a specific focus on emotions. Consistently with the perception of the pervasiveness of the device and its aversive effects, results showed positive associations with depression and stress. Moreover, no significant associations were found with self-reported smartphone usage, except a negative, unexpected correlation with gaming apps that deserves attention in future studies. Finally, among the SIS subscales, *awareness of smartphone negative impact* showed the lowest correlation coefficients with smartphone addiction factors measured by the SAS. In our opinion, this result is particularly important from a health-promoting perspective because it suggests that individuals who are characterized by PSU may or may not be aware of it. Being aware of one's own behavior (and the risks related to it) is the first step to changing that behavior. Prior research has highlighted that individuals with an addiction generally show impaired self-awareness about the addiction, which leads them to deny their dependence problems (Moeller & Goldstein, 2014; Verdejo-Garcìa & Pérez-Garcìa, 2008). Moreover, as claimed by the main theories on behavior change (e.g., Prochaska & Velicer, 1997; Schwarzer, 2008), individual awareness of the causes and consequences of a specific risky behavior is a fundamental cognitive antecedent implied in the process of behavior change. Thus, we argue that the assessment of *awareness of smartphone negative impact* might be particularly important in individuals with PSU because it would provide a measure of the extent to which they are conscious of their problem, allowing customized interventions.

## Conclusions

The present research broadened the view of human–smartphone interaction, developing a brief, comprehensive self-report scale that measures behavioral, social, affective, and cognitive impacts of smartphone in everyday life—the SIS. The SIS improves the existing measures of PSU by introducing new related factors and extends beyond the debated construct of smartphone addiction, addressing new, under-investigated impacts that lack proper measurements. The improvements in the measurement of human–smartphone interactions introduced by the SIS can be summarized by three main points. First, we extended the concept of PSU by considering the role of smartphone in coping with negative emotions and addressing preference for online versus offline communications. Second, we accounted for the positive impacts of smartphone (i.e., supporting romantic relationships and daily activities). Third, we introduced the measurement of a cognitive dimension that could play a role in the treatment and prevention of PSU, namely awareness about the negative impacts of the device.

Overall, the SIS is potentially useful both for theoretical and applied purposes. Researchers could benefit from this comprehensive measure of smartphone impacts by considering the antecedents (e.g., personality traits, situational factors) and consequences (positive and negative psychosocial outcomes) of smartphone usage. From the applied point of view, this scale could be adopted in school settings to explore the potentials (supporting technology-mediated communication for special educational needs) and risks (assessing pervasiveness of the device in students' life) of smartphone in developmental populations. In organizational settings, where smartphone can serve as a working instrument, the SIS might be useful to weight potentials (e.g., task support, improving communication within working groups) and negative impacts (e.g., coworkers' metaperception of smartphone overuse) of this device. Thus, the theoretical and applied usefulness of the SIS lies in the inclusion of both problematic and potentially adaptive impacts of smartphone use.

The primary limitation of the present research is the lack of an objective measurement of smartphone use. Future research should investigate the real, unbiased associations between the SIS subscales and each of the functions/applications conveyed by smartphone as well as actual daily use, providing strongest evidence of convergent validity. Second, a complete validation of the SIS will require repeated administrations of the scale to evaluate test–retest reliability and assess the stability of the subscales' scores over time. Third, given that our sample was self-selected and population representativeness was not assessed, future research is needed to extend the generalizability of our findings.

Beyond addressing these issues, a number of future directions were hypothesized. First, studies are needed to test whether the SIS performs differently in different populations. Specifically, the SIS dimensionality (as well as its associations with psychosocial constructs and smartphone use) should be replicated in samples with different age (e.g., digital natives vs. digital immigrants), culture (e.g., developed vs. developing countries), and levels of smartphone use. Second, longitudinal studies are needed to investigate whether and how the SIS dimensions change over time and whether these changes are predicted by specific psychosocial constructs and predict differences in smartphone use. Finally, the SIS dimensions can be used to identify clusters of individuals characterized by different profiles of smartphone impacts, detecting the typologies of users at risk to develop PSU. These profiles could be then compared with profiles derived from the two main typologies of smartphone usage, namely process (i.e., content-based consumption of media) and social (i.e., functionalities that involve interactions among users) use, to deepen the relationship between smartphone impacts and its actual use and to identify more specific categories of smartphone users (Contractor et al., 2019; Elhai & Contractor, 2018; Elhai, Hall, et al., 2017).

Overall, despite the need for future research to address the aforementioned issues and to test its applied usefulness in specific contexts, the SIS was demonstrated to be a valid and reliable self-report scale that can account for the various impacts of smartphones in everyday life over and beyond existing measures of PSU.

### Authors' Note

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

## Declaration of Conflicting Interests

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## Supplemental Material

Supplemental material for this article is available online.

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