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Conditionally Helpful? The Influence of Situation-, Person-, and Device-Specific Factors on Maternal Smartphone Use for Stress Coping and on Coping Effectiveness

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Abstract

Smartphones are omnipresent in the daily lives of parents and provide access to multiple resources in stressful situations. Thus, smartphones might be valuable coping tools. Previous research has mostly focused on the negative effects of parental phone use. In the present study, we investigated how mothers use smartphones for coping with stress and whether their phone use for coping is effective. We also explored factors on different levels (situation, person, device) which could influence phone use and coping effectiveness. Building on a one-week experience sampling study with over 200 mothers and multilevel models, we found that in stressful situations while being with children, mothers used their smartphones mostly for emotion-focused coping such as self-distraction and taking a break. Problem-focused coping was less prevalent. Mothers reporting increased cognitive phone salience used it more for coping with stress. Phone use for coping compared to no use related to lower stress decrease. No person-, situation-, or device-specific factors moderated the effects of phone use on coping effectiveness. Using positive phone content, however, was associated with increased perceived coping efficacy. Our results suggest that phone use is not generally successful for coping, but that momentary device-specific factors such as content characteristics might determine whether phones can be used for coping in an effective way.

Keywords: coping with stress; maternal smartphone use; digital well-being; experience sampling method; mood management

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Introduction

Smartphones are integrated into most parts of daily life and are thus “carried into an unprecedented range of situations” (Humphreys et al., 2018, p. 2795). A growing body of research focuses on how this omnipresence influences a user’s well-being (Kushlev & Leitao, 2020). One of the most frequently assessed associations is the relationship between smartphone use and stress, which is mainly found to be positive (Vahedi & Saiphoo, 2018).

One reason for this positive relationship could be that due to the multitude of resources smartphones offer, they are used more intensively when people need to cope with increased stress (Carolus et al., 2019).

Overall, knowledge about how individuals use smartphones in stressful situations and the kind of use which offers benefits is still limited as previous studies primarily assessed stress and smartphone use on a general level and did not examine situational device usage (Wolfers, Festl & Utz, 2020). In this study, we assessed how smartphones are used in stressful situations and explored the circumstances under which this use is effective. We examined these relationships in a context where smartphone use is particularly critically discussed: when parents use their smartphones while parenting.

Although smartphone use in any social situation is seen critically, this is especially true for parental phone use while being with their children (Moser et al., 2016; Wolfers, 2021). In news outlets and campaigns, the negative outcomes of parental smartphone use are problematized, and parents are encouraged to use their phones less (e.g., Christakis, 2018; Bundeszentrale für gesundheitliche Aufklärung, 2016; Lisickis, 2020). Supporting these negative views, several studies found parental smartphone use to be associated with lower maternal sensitivity and a decreased quality of parent-child interaction (Vanden Abeele et al., 2020; Wolfers, Kitzmann, et al., 2020). However, multiple studies also found that parents evaluate parenting websites, instant messengers, and social networking sites as valuable resources to find information and social support (Brady & Guerin, 2010; Lupton et al., 2016). These easily accessible resources might be particularly helpful for parents of young children who experience many stressful situations during their everyday lives (Deater-Deackard, 2004). Accordingly, first qualitative studies suggested that the readily available resources accessible via smartphones might be particularly valuable when parents are confronted with stressful situations (Radesky et al., 2016; Wolfers, 2021).

Connecting literature on stress management, mobile media use, and well-being in general as well as for the parenting context in particular, the present study provides an in-depth look into parental smartphone use in stressful situations. Specifically, we focused on mothers as they are still the primary caregivers in most societies (Craig & Mullan, 2011). In our research, we employed an innovative experience sampling approach to explore the overarching research questions of how mothers use their phones for coping with stress and which person-, situation-, and device-specific factors affect mothers' use of smartphones for coping with stress and the effectiveness of this use.

Smartphones as Tools for Coping With Stress

According to the transactional model of stress and coping, stressful situations arise if the demands placed upon an individual exceed the available resources (Lazarus & Folkman, 1984). Coping behaviors include all "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (Lazarus & Folkman, 1984, p. 141). According to the transactional model, individuals appraise the stressfulness of a situation in the first appraisal. In the second appraisal, the available coping options are evaluated. The model assumes that both appraisal processes can take place simultaneously and are interconnected (Lazarus & Folkman, 1984). Moreover, these appraisals can take place both consciously and purposefully but also automatically and unconsciously (Lazarus, 1999). Traditionally, coping options have been understood as different coping strategies, defined as the "objectives or intents of coping responses" (Compas et al., 2001, pp. 88–89). They are broadly differentiated into problem-focused strategies that aim to solve the stress-evoking problem and into emotion-focused strategies directed at calming stress-induced emotions (Lazarus & Folkman, 1984). In a literature review, Wolfers and Schneider (2020) suggested conceptualizing coping tools as an additional dimension of coping options which they define as "instruments through which (a) a coping goal can be achieved and (b) a coping behavior can be performed" (p. 13). According to this conceptualization, individuals *combine* coping strategies (e.g., distraction, social support, active coping) and coping tools to cope with stress. Like meeting friends or leaving the room, smartphones are coping tools that individuals can use to implement different coping strategies.

Studies have suggested that parents use the resources provided by their smartphones when confronted with stress (McDaniel & Radesky, 2018; Radesky et al., 2016). In qualitative studies, parents reported using their smartphones to find parenting-related information, seek social support, find resources for active coping, and distract themselves from stressful instances (Torres et al., 2021; Wolfers, 2021). Other studies reported that parents turn to Internet resources to search for information and find social support when they are confronted with stressors related to their roles as parents (Plantin & Daneback, 2009), suggesting that parents combine smartphones with problem-focused and emotion-focused coping strategies. However, research on smartphone

use in stressful situations is still limited as many studies did not focus on stress or did rely on overall phone use reports (e.g., use in the past week). These overall ratings can result in recall biases, as smartphone use has become highly habitual, and thus, might often be used automatically (Boase & Ling, 2013). As a first step, our study aimed at descriptively assessing how often mothers use smartphones for coping with stress (**RQ1**) and with which coping strategies mothers combine their smartphones (**RQ2**).

The Coping Effectiveness of Smartphones

A critical question is whether individuals use their smartphones effectively when confronted with stress. Previous research was inconclusive. Researchers working on “smartphone addiction” often treat smartphone use for coping as a dysfunctional way of coping, contributing to addictive behavior (e.g., Chiu, 2014; Gökçearsan et al., 2018). Other studies, however, reported that smartphones can be used effectively to cope with negative emotions and stress (e.g., Hoffner & Lee, 2015; Melumad & Pham, 2020; Rodríguez-Hidalgo et al., 2020).

It is also possible that an overall relationship between smartphone use for coping and coping effectiveness was not found because the effectiveness of smartphones is highly dependent on contextual factors (Kushlev & Leitao, 2020). The “fallacy of uniform efficacy” (Bonanno & Burton, 2013) describes the attempt to classify a coping option as more or less successful across all situational circumstances. Wolfers and Schneider (2020) argued that this fallacy also applies to research on media use for coping. Overall, it is still unclear if smartphones help or disturb effective coping and it seems questionable if there is a uniform relationship at all. We therefore openly explored if smartphone use for coping is associated with coping effectiveness (**RQ3**).

Rather than only assessing the overall coping effectiveness of smartphones, we adopted a contextual approach, that emphasized the need to consider the contexts in which a stressful situation—and smartphone use—takes place (Folkman & Moskowitz, 2004; Wolfers & Schneider, 2020). Building on the distinction of Vanden Abeele (2021), we assessed how person-, situation-, and device-specific factors affect how mothers use their smartphones to cope with stress and whether this device use is effective.

Person-, Situation-, and Device-Specific Factors

Recent conceptualizations of digital well-being and smartphone use emphasized that there are different levels of factors that influence smartphone use and its effects (e.g., Humphreys et al., 2018; Vanden Abeele, 2021). In this paper, we built on the digital well-being framework of Vanden Abeele (2021) which defines digital well-being as a subjective state in which the benefits and drawbacks of mobile connectivity are optimally balanced. Digital well-being is produced in interaction with “affective and cognitive states” such as stress (Vanden Abeele, 2021, p. 8). In our context, digital well-being means that parents use their smartphones successfully to cope with stress.

According to Vanden Abeele (2021), three levels of factors with stable and momentary parts have an influence on whether or not digital well-being is achieved. *Person-specific factors* include stable personality traits and less stable, momentary factors such as affective and cognitive states, including stress. We focused on stable person-specific factors, while the momentary factor of stress builds our study's context. *Device-specific factors* include the configuration of the device, which is based on user choices together with factors determined by programmers and other external actors. Vanden Abeele (2021) distinguishes between more stable characteristics of the device such as installed apps and momentary characteristics such as notifications. We also understood the used content with its characteristics as momentary device-specific factors. As a third level, Vanden Abeele (2021) names *context-specific factors*. Stable context-specific factors include the cultural context. Momentary context-specific factors include the social roles and the associated obligations salient in a specific situational context, such as being in the parenting role, and other situational characteristics (Vanden Abeele, 2021). We focused on the momentary context-specific factors which we will name *situation-specific factors* below.

In this paper, we studied coping effectiveness in a context where several of these factors were held constant (i.e., only stressful situations while being in the parenting role) and identified and tested other factors that could influence how parents use smartphones for coping with stress on each level. We focused on a range of factors based on results from previous studies and on theoretical considerations that we assumed to be relevant to our specific context of parental smartphone use in stressful situations.

Person-Specific Factors in Using Phones for Coping With Stress

Looking at person-specific factors, we focused on how cognitively and physically salient a phone is for an individual and on the individual's phone use self-regulation skills which we conceptualized as stable factors. We assumed that parents for whom the phone is highly salient use the phone more often in stressful situations. Wolfers and Schneider (2020) suggested that in a situation of overload, an individual will more likely turn to a coping option that is already "top of mind" and therefore salient. In fact, study results suggested that problematic forms of digital media use developed because individuals started to turn to a certain highly salient type of media whenever they were stressed (McNicol & Thorsteinsson, 2017; Plante et al., 2019).

For many users, mobile media as an access point to the online world are highly salient, which means that users are cognitively engaged with the online world even if they are not using an Internet-enabled device (Reinecke et al., 2018). Previous research has shown that the cognitive salience of online content is positively related to stress (Freytag et al., 2021). There is no direct evidence associating the salience of online content with coping. However, building on Wolfers and Schneider (2020), we assumed that users who are highly cognitively engaged with their phones (i.e., for whom online content is highly salient on a cognitive level) use their device to cope with stress more often (**H1a**).

In addition, a smartphone is also a touchable device that, unlike other media such as television, can be placed nearly everywhere in the room (Richardson, 2007). Many people have their phones very close to them most of the time (Dey et al., 2011). Thus, a smartphone is not only cognitively but also *physically* salient. We argue that in a stressful situation, which is—by definition—a situation of overload, a tool that is in sight or touch will be used more often. Thus, we assumed that individuals for whom their smartphone generally has a higher physical salience use it more often for coping with stress (**H1b**). To clearly distinguish this concept from cognitive salience, we focused on the physical presence of the phone and did not include emotional bonds to the phone such as smartphone attachment (Konok et al., 2017).

Another person-specific factor discussed by research on phone use and well-being is phone use self-regulation (Halfmann & Rieger, 2019).¹ Individuals sometimes struggle to control desires to check their phones or to end phone use even when it interferes with other current goals (Hofmann et al., 2017). In a qualitative interview study, the ability to regulate phone use emerged as an important prerequisite for successful use of phones for coping with stress (Wolfers, 2021). Mothers, for example, described that phone use only helped when they managed to end their phone use once their coping goal was reached (e.g., after sought information was found, a social media newsfeed was checked). Moreover, mothers reported feeling the urge to use their phone even in situations in which they knew their use would not help them (e.g., checking for medical problems would only proliferate stress). We, therefore, expected a moderation effect between coping effectiveness and the ability to regulate phone use such that phone use for coping is more positively/ less negatively² related to coping effectiveness for those with higher phone use self-regulation skills (**H2**).

Situation-Specific Factors in Using Phones for Coping With Stress

Wolfers and Schneider (2020) argued that situational factors must receive more attention to avoid judging phone use for coping as uniformly effective or ineffective. In the present study, we thus focused on three situational factors: urgency, importance, and control.

Situational urgency describes the sense that somebody has to respond quickly to situational circumstances (Stephens et al., 2013). It needs to be noted that urgency differs from stress intensity as it refers primarily to characteristics of the situation while stress intensity refers to the individual's state. In Wolfers' (2021) study, mothers reported using their phones more for coping if they felt high pressure to do something about the stressful situation. They, for example, turned to Internet resources when an illness of their child got worse, and they needed to know quickly whether more severe steps such as going to the hospital were necessary. In another study assessing parental Internet use, parents similarly emphasized the benefits of the Internet in providing quick access to information and social support if these resources are urgently needed, such as at nighttime (Strange et al., 2018). Based on the mother's descriptions from both studies indicating that phones are particularly helpful in situations that require urgent action, we assumed that mothers use their phones more (**H3a**) and more effectively (**H3b**) in urgent situations.

The importance of a stressful situation is determined by an individual's perception of the relevance of the stress-evoking problem (e.g., financial stressors might be more important than being late for meeting a friend). In Wolfers' (2021) study, mothers reported that in important situations, they do not quickly access resources via their smartphones but rather look for personal contact with experts such as doctors. Similarly, in the study by Strange et al. (2018), parents described Internet resources as unhelpful for important topics such as breastfeeding and sleeping behavior. Thus, both studies suggested that smartphones are more likely to be used in less important situations because they are perceived as less effective in important situations. Assuming that the respondents' assessment is correct, we further assumed that smartphones are less effective coping tools in more important situations. We, therefore, hypothesized that smartphones are used less in important situations (**H4a**) and that in more important situations, phone use relates to decreased coping effectiveness (**H4b**).

As a third factor, we assessed situational control, defined as an individual's ability to influence stress-evoking circumstances. Control is the most prominent situational factor studied in the context of stress and coping (Folkman & Moskowitz, 2004). According to the coping fit hypothesis, situational control determines which coping strategies are more effective: In situations with low control, problem-focused strategies should be less effective because the individual *cannot* solve the stressful problem, while they should be more adaptive in situations with high individual control (Park et al., 2004). Situational control was rarely studied in the context of media use for coping. As smartphones can be used for both problem- and emotion-focused coping strategies it is not clear how the coping effectiveness of phone use differs for various levels of situational control. We therefore openly asked if the association of phone use for coping and coping effectiveness depends on the perceived situational control (**RQ4**).

Device-Specific Factors in Using Phones for Coping

Last, we turned to the smartphone itself. Smartphones are metamedia that incorporate different constituent media (i.e., applications; Humphreys et al., 2018). Metamedia offer individuals the opportunity to do a wide range of things. However, these usage possibilities depend on how an individual configures and personalizes a device (Humphreys et al., 2018). Referring to Vanden Abeele (2021), we differentiated between more stable features, namely phone personalization, and momentary features of smartphone content, namely valence and semantic affinity.

Smartphones can be easily personalized to increase their personal relevance for an individual (Blom & Monk, 2003), for example by downloading apps and adapting the screen so particular apps can be accessed more quickly (Böhmer & Krüger, 2013). Personalization of a device could be important in the coping process as choices for or against specific apps determine which options are easily accessible (Melumad & Pham, 2020; Vanden Abeele, 2021). In three qualitative studies on mobile phone personalization, Blom and Monk (2003) found that more frequent phone users tended to personalize their phones more and that ease of use was one of the main described effects of personalization. Based on these findings, we assumed that participants who have personalized their phones more use them more often for coping with stress (**H5**).

Moreover, personalization should also lead to easier and more effective use (Blom & Monk, 2003). Indeed, in an experimental study, Melumad and Pham (2020) showed that participants who could use their own smartphones recovered more quickly after a stress-inducing task compared to participants who could only use the smartphone of somebody else. This finding implies that personalization of devices should help when individuals are confronted with stress. We therefore hypothesized that phone personalization moderates the relationship between phone use for coping and coping effectiveness such that phone use for coping is more positively/less negatively related to coping effectiveness for those who have more strongly personalized their phones (**H6**).

While differentiating person-, situation-, and device-specific factors is helpful in terms of classification, those factors might also influence each other (Vanden Abeele, 2021). In particular, it is likely that the characteristics of a situation influence which smartphone content is used. We therefore examined how the momentary device-specific factors relate to the situation-specific factors. We built on the media characteristics discussed in Zillmann's (1988) mood management theory to investigate momentary device-specific factors. Specifically, we focused on valence and semantic affinity.

Mood management theory predicts that in stressful situations individuals choose media content that is more positive and semantically different from the current stressors (Zillmann, 1988). Positive and semantically different media content is also assumed to be more effective in reducing stress than negative or semantically related

content (Zillmann, 1988). Mood management theory focuses on changing emotions or moods and not on changing problems. Stevens and Dillman Carpentier (2017) therefore argued that emotion-focused coping is related to coping behavior in line with mood management theory, while approach or problem-focused coping is not. We connected this to the coping-fit hypothesis which states that emotion-focused coping should occur in less controllable situations (Park et al., 2004).

More specifically, we argued that in less controllable situations, media choices according to mood management theory are more likely. We thus assumed that in less controllable situations, individuals choose more positive (H7.1a) content that is semantically different from the stress-evoking problem (H7.2a). Building on mood management theory, we additionally assumed that in less controllable situations choosing positive content (H7.1b) that is semantically different from the stress-evoking problem (H7.2b) is also related to increased coping effectiveness. We assumed that the same applies to less important situations, as addressing the stress-triggering problem should be less central in less important situations making media selection for mood management more likely. Thus, we also assumed that individuals choose positive (H8.1a) and semantically different (H8.2a) content and that using positive (H8.1b) and semantically different (H8.2b) content is also more effective in less important situations.

Within stress research, research on urgent situations is still scarce. It seems reasonable to assume that urgent situations inherently require confrontation of the stressor. However, urgency could also be associated with a high-stress intensity. Such higher stress levels may first have to be regulated on the emotional level requiring positive and not stressor-related content. We thus openly explored the relationship between content features and situational urgency (RQ5).

Table 1. Factors Assumed to Impact Parental Smartphone Use and Coping Effectiveness of Smartphone Use in Stressful Situations.

Person-specific factors	Situation-specific factors	Device-specific factors
Cognitive salience of the phone (H1a)	Importance (H3, H8)	Stable
Physical salience of the phone (H1b)	Urgency (H4, RQ5)	Phone personalization (H5, H6)
Phone use self-regulation skills (H2)	Control (RQ4, H7)	Momentary Valence of the used content (H7.1a, H7.1b, H8.1a, H8.1b, RQ5) Semantic affinity of the used content (H7.2a, H7.2b, H8.2a, H8.2b, RQ5)

Table 1 shows an overview of the assessed factors on the different levels. For an overview of all hypotheses and research questions see Table A5 in the Appendix. All hypotheses and research questions, the study design, analyses, and final models were pre-registered under <https://osf.io/v8y9f>. Deviations from the pre-registrations were outlined in detail <https://osf.io/aw2kd/>.

Methods

Procedure

We conducted an experience sampling study with mothers in Germany using the application movisensXS version 1.5.8 (movisens GmbH, 2020). The application can only be installed on smartphones based on Google's operating system Android which had a market share of 81% (Kantar Worldpanel, 2021) in Germany in 2020. Interested participants were informed about the study design, participation criteria, and the movisensXS app. Participants who did not fulfill participation criteria (i.e., no Android smartphone, no children) were informed and excluded in this pre-screening step. After participants gave their consent, we provided a step-by-step guide about how to install the app. Respondents were able to start the study between November 4, 2020 and November 23, 2020. After filling in a pre-survey, participants were asked to answer four questionnaires a day for one week resulting in a maximum of 28 questionnaires per participant. In the end, participants answered a post-survey. We rewarded participants according to how many questionnaires they completed (up to 48.80 €).

We sampled stressful situations. We used a quasi-experience sampling design (Schnauber-Stockmann & Karnowski, 2020) with surveys at fixed time points which is recommended for concrete, infrequent events such as

stressful situations (Conner & Lehman, 2012). To minimize recall error, we asked participants to report about the last two hours before filling in the questionnaire. Reminders for the daily questionnaires were sent at predefined time points at 9 am, 12.30 pm, 4 pm, and 7.30 pm. Participants could delay the survey by up to 35 minutes. The study was approved by the ethics committee of the Leibniz-Institut für Wissensmedien Tübingen (LEK 2020/047).

Participants and Situations

Mothers with at least one child born on or after January 1, 2014, were recruited via personal contacts, notices at different locations, and mailing lists of childcare or family centers all over Germany. We also recruited on social media (Twitter, Facebook, Reddit) by posting in relevant parenting groups, asking accounts with many followers to post and using a Facebook advertisement. In total, 234 participants installed the app and filled in the pre-survey of which 209 also completed the post-survey.

The 234 participants answered 4,948 daily questionnaires, resulting in an overall compliance rate of 76% (range: 0–100%). Thirty-nine of these questionnaires were not filled in completely and in three instances, filters did not work correctly. These questionnaires were removed. Of the remaining situations, participants reported having experienced a stressful situation in 2,024 instances (41%), of which 1,653 (82%; 34% of the whole sample) were experienced while being with their children (final Level-1 sample). In total, 16 participants did not report on any stressful situation while being with their children leading to a final Level-2 sample of 218 mothers.

Participants in the final sample were on average 33.10 years old ($SD = 4.22$) and had between one and five children ($M = 1.72$, $SD = 0.89$). The youngest child was on average 1.78 years old ($SD = 1.52$). About 61% of our sample reported having completed a university degree, which is higher than the figure of 31% for women between the ages of 30 and 35 in Germany (Autorengruppe Bildungsberichterstattung, 2020). Of the 218 participants, 196 lived with another parent of one of their children, 17 were single mothers, 6 lived with a partner who was not a parent of one of their children, and two with other family members (multiple choices possible). Most of our sample was on parental leave or stayed at home full-time (45%) or worked part-time (34%). About 8% were in an educational program and 9% were working full-time.

For the most important dependent measures in our study (phone use for coping, coping effectiveness), we found low to medium Intraclass Correlations Coefficients (ICC) of 0.16–0.34 in a pretest. According to Arend and Schäfer (2019), a sample size of 200 and 28 time points would be sufficient to detect small effect sizes for L1 predictors with ICCs in this range. For L2 predictors and cross-level interactions, only medium-sized effects can be detected for a small ICC. Given budgetary restrictions, we had aimed at maximizing power but recruiting at least 200 mothers. This goal could be fulfilled in the present study.

Measures

Descriptives of all measures can be found in Table A1. For the wording of the questions see Table A6. For an overview of all measured constructs see OSF.

Situational Level Variables (Experience Sampling Questionnaires)

Experiencing a stressful situation. Mothers indicated whether they experienced a stressful situation in the last two hours. They were instructed to also report on situations that were only “a bit stressful”. Mothers who indicated having experienced a stressful situation were then asked to answer questions concerning the stressful situation and their coping behaviors.

Phone use in stressful situations. Participants answered whether they had used their smartphone during the stressful situation, using a dichotomous item (483 yes/1,170 no). Mothers were instructed to only answer with yes if they used the phone themselves as opposed to giving the phone to their child.

Phone use features. If participants indicated having used their smartphone, they rated the valence of the content they used on a scale from 1 (*negative*) to 5 (*positive*; $M = 3.75$, $SD = 0.96$). To measure semantic affinity, they indicated if the content was related to the stressful situation on a scale from 1 (*not at all*) to 7 (*very strongly*; $M = 2.91$, $SD = 2.26$).³

Coping effectiveness. We used two measures for coping effectiveness: Stress change and perceived coping efficacy (PCE). To assess stress change, participants were asked how stressed they felt during the experienced stressful situation on a scale from 1 (*not at all*) to 5 (*very much*) and how stressed they felt after the situation had ended on the same 5-point scale. To calculate the change in stress, we subtracted the initial stress level from the stress level at the end ($M = -1.05$, $SD = 1.12$, range -4 to $+3$). Negative values indicate a stress decrease. To assess PCE, participants indicated if what they did or thought in the situation helped them cope with the stress on a scale from 1 (*did not help*) to 5 (*helped well*; $M = 3.05$, $SD = 1.16$).

Coping strategies. Coping strategies were measured using a shortened version of the Brief COPE (Carver, 1997; translated by Knoll et al., 2005), adapted to the parental situation. The questionnaire included one item of each of the strategies self-distraction, active coping, emotional social support, giving up, instrumental social support, venting, positive reappraisal, planning, humor, information seeking, taking a break, and information avoidance respectively. For each strategy, respondents first indicated whether or not they used it (*yes/no*). In addition, participants indicated whether or not they used their phone for each individual strategy (*yes/no*).

Characteristics of the situation. Situational control was measured by asking participants if they felt they could influence the situation on a scale from 1 (*not at all*) to 5 (*very much*; based on Perrez & Reicherts, 1992; $M = 2.76$, $SD = 1.13$). For importance, participants rated the importance of the stress-inducing problem on a scale from 1 (*not important*) to 5 (*very important*; Thies & Kordts-Freudinger, 2019; $M = 3.00$, $SD = 1.21$). Urgency was measured by asking participants how urgently they needed to act in the situation on a scale from 1 (*not at all*) to 5 (*very much*, $M = 3.59$, $SD = 1.04$).

Individual Level Variables (Pre-Survey)

Cognitive and physical salience. We measured cognitive salience with the salience subscale of the online vigilance scale (Reinecke et al., 2018) adapted to smartphones ($M = 2.22$, $SD = 0.87$, $\alpha = .87$, example item: *My thoughts often drift to smartphone content*). Physical salience was measured by asking participants five self-developed items on a scale from 1 (*does not apply*) to 5 (*does apply*, $M = 3.06$, $SD = 0.95$, $\alpha = .82$). Example items include: *My smartphone usually is placed in such a way that I can see it* and *When I'm away from home, I always have my smartphone readily available, for example, in my pants pocket*.

Phone personalization. Personalization of the smartphone was measured using the scale of Böhmer and Krüger (2013). Participants indicated how often they, for example, *had installed apps in the last month*. We added the item *changed the settings of apps*. Categories were recoded to reflect the mean of the choice text: 0 (*0 times*), 1.5 (*1–2 times*), 4 (*3–5 times*), 8 (*6–10 times*), and 11 (*more than 10 times*; $M = 1.22$, $SD = 1.03$, $\alpha = .64$). While Cronbach's alpha was low, a confirmatory factor analysis showed a good fit (see OSF). Thus, we decided not to drop any items.

Phone use self-regulation skills. Participants reported on their phone use self-regulation skills by rating five statements on a frequency scale ranging from 1 (*never*) to 5 (*very often*). We adapted four items from the Compulsive Internet Use Scale (Meerkerk et al., 2009; German version: Peukert et al., 2012), measuring unsuccessful attempts to regulate smartphone use (e.g., *I find it difficult to stop using my smartphone*). We added one item describing successful regulation (*I put my smartphone away when I have achieved my goal*). All items were included in a mean index ($M = 3.40$, $SD = 0.89$, $\alpha = .86$).

Data Analyses

To test our hypotheses, we ran multilevel regression models for each dependent variable using the lme4 package (version 1.1.26; Bates et al., 2015) in R (version 4.0.3, R Core Team, 2020). First, we calculated models only including the random intercepts to assess the ICC. Then, the control variables were entered. Next, we added the independent variables of interest in a hierarchical procedure. We evaluated hypotheses based on model comparisons with and without the respective predictor variable in the respective step using a likelihood ratio test with $p < .05$ as significance level (using Full-Maximum-Likelihood estimation, ML). For linear models, the final model was estimated based on the more robust restricted maximum likelihood estimation (REML). As an additional criterion for hypothesis support, we used a $|t| > 2$ for the respective predictor in the final linear models and odds ratio confidence intervals which do not include 1 for the logistic regression (Gelman & Hill, 2007). Following Enders and Tofighi (2007), variables on the situational level were group mean centered and variables on the individual level were grand mean centered. We reported marginal and conditional r^2 based on Nakagawa and Schielzeth

(2013). For model diagnostics, we assessed model assumptions by looking at the distributions of residuals and variance inflation factors (see OSF).

Results

Descriptive Findings

In our first two research questions, we asked how mothers use smartphones to cope with stress. Of all 2,024 stressful situations, smartphones were used in 628 representing a 31% share. Focusing on the 1,653 stressful situations in which children were present, this share was slightly lower (29%; 483 situations) answering RQ1. In general, mothers reported applying active coping in about half of the situations while being with their children (53%). The second and third most applied strategies were planning (38%) and venting (19%). Self-distraction, emotional support seeking, instrumental support seeking, giving up, positive reappraisal, and taking a break were each employed in about one out of 10 situations (9–12%). Participants applied information avoidance (2%), information seeking (3%), and humor (3%) less frequently.

When looking at the strategies which participants applied by using a phone, these proportions differed greatly. Here, self-distraction was the most applied coping strategy (49%), followed by taking a break (27%). Active coping and emotional support were the third most prominent strategies (16%), followed by giving up (13%), information seeking (13%), planning (12%), and instrumental support (12%, see also Table A3). Thus, answering RQ2, phone use mainly was combined with the strategy of self-distraction and taking a break. While problem-focused coping strategies such as active coping and planning were also important, participants combined them less frequently with smartphones.

Multilevel Analyses

To answer our remaining research questions and hypotheses, we ran multilevel regression models. We report the results of the models for each dependent variable in the following sections. An overview of the decisions regarding each hypothesis can be found in the Appendix (Table A4).

Table 2. Multilevel Logistic Regression Analysis on Phone Use in Stressful Situations (Final Model).

Parameters	Estimate	SE	Fixed effects		
			z	OR	95% CI
Individual level					
Intercept	-1.07	0.09	-12.53	0.34	[0.29, 0.40]
Age	-0.01	0.02	-0.66	0.99	[0.95, 1.03]
Youngest child age	0.06	0.06	1.12	1.07	[0.95, 1.19]
Education	-0.08	0.17	-0.46	0.92	[0.66, 1.30]
Phone use frequency	0.21	0.12	1.75	1.23	[0.98, 1.55]
Cognitive Salience	0.37	0.10	3.54	1.45	[1.18, 1.78]
Physical Salience	-0.01	0.10	-0.14	0.99	[0.81, 1.20]
Personalization	0.05	0.06	0.82	1.05	[0.94, 1.17]
Situational level					
Urgency	-0.06	0.07	-0.80	0.95	[0.83, 1.08]
Importance	0.10	0.06	1.52	1.10	[0.97, 1.25]
Control	-0.09	0.06	-1.40	0.91	[0.81, 1.04]
R^2 (marginal/conditional)	.06/.19				
Random Intercept	SD = 0.73				

Note. 1,653 observations of 218 individuals. OR = Odds Ratio, CI = Confidence Interval. Individual-level predictors are grand mean centered, situation-level predictors are group mean centered. Model formula: $\text{phoneuse} \sim 1 + (1 | \text{participant}) + \text{age.mother} + \text{age.youngest.child} + \text{spu.general} + \text{educ.mother} + \text{physical.salience} + \text{cognitive.salience} + \text{coping.expectations} + \text{personalization} + \text{urgency} + \text{importance} + \text{control}$ [family = binominal].

Phone Use in Stressful Situations

For phone use in stressful situations as a dichotomous variable, we calculated logistic multilevel regression models. The ICC for situational phone use was 0.19. Confirming H1a, the cognitive salience of phones positively predicted phone use in stressful situations, $\chi^2(1) = 13.73, p < .001$. Different than assumed in H1b, physical salience was not related to phone use in stressful situations, $\chi^2(1) = 0.00, p = .948$. Similarly, H5 was rejected as phone personalization was not significantly related to situational phone use for coping, $\chi^2(1) = 0.68, p = .409$. Turning to situational predictors of phone use, neither urgency, $\chi^2(1) = 0.08, p = .772$, nor importance, $\chi^2(1) = 3.30, p = .069$, nor control, $\chi^2(1) = 1.93, p = .164$, significantly predicted if mothers used their phones in stressful situations, rejecting H3a, H4a, and answering RQ4. For the final model coefficients see Table 2.

Perceived Phone Use Features

Overall, mothers used rather positive ($M = 3.75, SD = 0.96$) and not stressor-related ($M = 2.91, SD = 2.26$) content on their phones when they were confronted with a stressful situation. The ICCs were 0.26 for valence and 0.16 for semantic affinity. In H7.1a and H8.1a, we proposed that positive content will be used more in less controllable and more important situations. Different than assumed in H7.1a and H8.1a, use of positive content did not depend on situational control, $\chi^2(1) = 2.12, p = .145$, or situational importance, $\chi^2(1) = 0.00, p = .969$, see Table 3.

Table 3. Multilevel Linear Regression Analysis on Perceived Content Features (Final Models).

Dependent variable	Positive valence			Semantic affinity		
	Fixed effects			Fixed effects		
Parameters	Estimate	SE	t	Estimate	SE	t
Individual level						
Intercept	3.73	0.06	66.65	2.91	0.13	23.03
Age	-0.02	0.01	-1.32	0.05	0.03	1.60
Youngest child age	-0.00	0.04	-0.01	0.03	0.09	0.38
Education	0.29	0.12	2.45*	-0.17	0.27	-0.65
Phone use frequency	-0.15	0.07	-2.10*	-0.05	0.16	-0.28
Situational level						
Urgency	0.04	0.05	0.80	0.23	0.12	1.89
Importance	-0.01	0.05	-0.29	0.42	0.12	3.63*
Control	0.06	0.05	1.22	-0.06	0.11	-0.56
R^2 (marginal/conditional)	.04/.26			.06/.23		
Random intercept	SD = 0.45			SD = 0.95		

Note. 483 observations of 153 individuals. Individual-level predictors are grand mean centered, situation-level predictors are group mean centered. Model formula: phone.content ~ 1 + (1|participant) + age.mother + age.youngest.child + spu.general + educ.mother + urgency + importance + control. *|t| > 2.0, indicates a significant effect (Gelman & Hill, 2007).

Answering RQ5, the use of positive content did also not depend on the level of situational urgency, $\chi^2(1) = 0.64, p = .424$. In H7.2a and H8.2a, we proposed that content related to the stressor will be used less in less controllable situations and less important situations. H7.2a was not confirmed: Situational control did not significantly predict semantic affinity of used content, $\chi^2(1) = 1.80, p = .179$. Finally, we confirmed H8.2a: In more important stressful situations, mothers reported using their smartphones more for stressor-related content, $\chi^2(1) = 22.38, p < .001$. Descriptively, content related to the stressor was also used more in more urgent situations, but this effect was not significant, $\chi^2(1) = 3.57, p = .059$.

Coping Efficacy

We calculated two linear multilevel regression models for coping efficacy, one for PCE and one for stress change ($ICC_{PCE} = 0.22, ICC_{stress\ change} = 0.16$). In RQ3, we asked if coping efficacy differed between situations with and without smartphone use. Answering this question, phone use was not a significant predictor of PCE, $\chi^2(1) = 0.47, p = .492$. However, phone use did predict stress change such that phone use was associated with less stress decrease

compared to coping without phones, $\chi^2(1) = 8.02, p = .005$. The interaction between phone use and personalization did not influence any of the indicators for coping efficacy, PCE: $\chi^2(1) = 0.84, p = .359$, stress change: $\chi^2(1) = 0.18, p = .668$, rejecting H6. Similarly, the interaction between self-regulation skills and phone use did not influence coping efficacy, PCE: $\chi^2(1) = 0.27, p = .605$, stress change: $\chi^2(1) = 1.75, p = .185$, rejecting H2. In H3b and H4b, we expected significant interaction effects between phone use and the situational factors of urgency and importance, respectively. Both hypotheses were not supported, urgency and PCE: $\chi^2(1) = 0.17, p = .682$; urgency and stress change: $\chi^2(1) = 1.60, p = .206$; importance and PCE: $\chi^2(1) = 0.58, p = .448$, importance and stress change: $\chi^2(1) = 0.13, p = .718$. Referring to RQ4, we did not find significant interaction effects with situational control, PCE: $\chi^2(1) = 1.02, p = .313$, stress change: $\chi^2(1) = 0.39, p = .533$. Table 4 shows the coefficients of the final models.⁴

We additionally examined the relation between the characteristics of used content and coping efficacy. We ran multilevel regressions including the content features of valence and semantic affinity with the smaller sample of situations in which the phone was used. Valence of the used content was a positive predictor of PCE, $\chi^2(1) = 9.37, p = .002$. The more positive the used content was, the more effective participants perceived their coping efforts. Semantic affinity did not predict PCE significantly, $\chi^2(1) = 3.33, p = .068$. Neither of these factors significantly predicted stress change, valence: $\chi^2(1) = 0.59, p = .441$; semantic affinity $\chi^2(1) = 0.18, p = .673$. There were no significant interactions between the content used and the situational characteristics (see Table A4). Thus, H7b and H8b were not supported.

Table 4. Multilevel Linear Regression Analysis on Coping Efficacy (Final Models).

Dependent variable	Perceived coping efficacy			Stress change		
	Fixed effects			Fixed effects		
Parameters	Estimate	SE	t	Estimate	SE	t
Individual level						
Intercept	3.04	0.05	65.37	-1.07	0.04	-24.77
Age	0.01	0.01	0.61	-0.01	0.01	-0.79
Youngest child age	-0.01	0.03	-0.38	0.00	0.03	0.01
Education	0.19	0.10	1.94	-0.08	0.09	-0.83
Phone use frequency	-0.06	0.07	-0.94	0.02	0.06	0.29
Personalization	0.03	0.03	1.06	-0.03	0.03	-1.15
Phone self-regulation	-0.00	0.06	-0.03	-0.04	0.06	-0.79
Situational level						
Stress intensity T1				-0.67	0.03	-20.11
Phone use	-0.02	0.06	-0.33	0.17	0.06	2.93
Effort	-0.01	0.03	-0.43	0.12	0.03	3.95
Urgency	0.04	0.03	1.47	0.04	0.03	1.36
Importance	0.00	0.03	0.05	0.09	0.03	3.44
Control	0.27	0.03	10.16*	-0.13	0.03	-5.37
Interactions						
Perso*Phone use	0.03	0.04	0.78	0.02	0.04	0.56
Self-reg*Phone use	-0.04	0.07	-0.52	0.09	0.07	1.29
Urgency*Phone use	0.00	0.08	0.01	0.08	0.07	1.05
Importance*Phone use	-0.07	0.07	-0.93	0.01	0.07	0.22
Control*Phone use	-0.07	0.07	-0.99	-0.04	0.06	-0.63
R ² (marginal/conditional)	.06/.28			.17/.37		
Random Intercept	SD = 0.55			SD = 0.51		

Note. 1,653 observations of 218 individuals. Individual-level predictors are grand mean centered, situation-level predictors are group mean centered. Model formula: cop.eff ~ 1 + (1|participant) + age.mother + age.youngest.child + spu.general + educ.mother [+ Stress.T1] + personalization + self-reg.config + self-reg.skill + phone.use + urgency + importance + control + effort + phone.use*personalization + phone.use * self-reg.config + phone.use*self-reg.skill + phone.use*urgency + phone.use*importance + phone.use*control. *|t| > 2.0, indicates a significant effect (Gelman & Hill, 2007).

Discussion

Building on a contextual approach and using an experience sampling design, this study aimed to test which person-, situation-, and device-specific factors predict whether smartphones are used for coping and whether smartphone use for coping is successful. We focused on the parenting context in which smartphone use is particularly critically discussed (Moser et al., 2016; Wolfers, 2021). Our findings revealed three interesting points, which we discuss in more detail below: (1) the relationship between phone use and less stress decrease indicating that phone use for coping might be ineffective, (2) the relative importance of the person-, situation-, and device-specific factors suggesting which factors might be particularly interesting for future research, and (3) the correspondence of several findings with assumptions of mood management theory.

Phone Use as Ineffective Stress Response?

Phone use for coping was related to less stress decrease than coping without phones. In conjunction with adverse effects of phones on parent-child interactions (e.g., Vanden Abeele et al., 2020), one could interpret this finding to suggest that mothers should not use their smartphones while parenting, including no use in stressful situations. However, this result contradicts findings, according to which parents reported positive effects of using Internet resources for coping (e.g., Wolfers, 2021). It is, therefore, probably too early to completely discourage parental smartphone use.

Additional conditions such as the timing of the phone use could explain this contradiction. In the present study, we focused on phone use directly in stressful situations. Smartphones may be more likely to be used successfully for stress reduction when revisiting a problem sometime after the stressful situation or when using it for recovery in the evening, rather than for stress management directly in a situation. The timing of smartphone use remains of particular interest for future studies.

In our study, mothers used their smartphones mainly for emotion-focused coping strategies such as self-distraction. The relation between phone use and less stress decrease could also imply that mothers do not use their smartphones in an effective way. Previous research suggested that emotion-focused coping strategies could be less effective in reducing stress than problem-focused strategies (Deater-Deckard, 2004). When future studies further support the findings that phone use and emotion-focused strategies are on average less effective in reducing stress, training that focuses on the way mothers use their smartphones for coping could be developed to help mothers use their smartphone to their advantage. In the current state of research, we can conclude that phone use for stress reduction cannot be encouraged.

The Relative Importance of Person-, Situation-, and Device-Specific Factors

Building on a contextual approach (Vanden Abeele, 2021; Wolfers & Schneider, 2020), we investigated a complex set of person-, situation-, and device-specific factors that we assumed had an influence on phone use for coping and the relationship between phone use and coping effectiveness. Of the different predictors, only cognitive salience as a person-specific indicator emerged as a significant predictor of using a phone for coping. Thus, the previously reported relationship between stress and cognitive salience of online content (Freytag et al., 2021) might have been found because individuals with a higher cognitive salience of online content use their phones more for coping with stress. Physical salience (on the individual level) did not significantly relate to using phones for coping. Situationally high physical salience, however, could still be related to using phones for coping. Looking at situational variations in cognitive and physical salience remains, thus, important for future research. For discussing the null effect of phone personalization, it is important to note that the mean for the personalization measure was rather low ($M = 1.25$) which might be surprising given that all participants used their phone frequently. The low correlation with overall phone use frequency ($r = .15$, see Table A2) might indicate that today's smartphones do not require much personalization efforts on the part of the user in order to be used frequently and effectively.

Interestingly, the situational factors urgency, control, and importance did not predict phone use, which is somewhat in contradiction to qualitative results (Wolfers, 2021). A possible explanation might be that urgency, control, and importance only affect phone use in particular circumstances (e.g., when at home, when confronted with a specific stressor). Experience sampling studies entail the advantage that a detailed look into participants'

everyday life can be obtained, producing insights about behavior and feelings and the circumstances under which these occur (Conner & Lehman, 2012). However, as situational circumstances cannot be held constant, the role of single situational factors that might, in reality, depend on other situational circumstances is complex to investigate (Duvenage et al., 2019). Thus, looking at other situational factors and looking at combinations between the situational factors investigated here and other situational factors in controlled experimental settings remains important for future research.

None of the investigated moderation effects was significant. In our view, this does not mean that we should discard contextual approaches for investigating the relationship between coping and smartphone use. Our results could suggest that the factors we measured are not the most important ones. Future research should focus on other aspects such as differentiating between stressors (Duvenage et al., 2019). Another possibility is that the way we modeled the relationships—linear two-way interactions—does not represent how these factors affect the effectiveness of phones. For many factors, non-linear associations or three-way interactions are also conceivable. Modeling more complex structures affords a larger sample size and additional measures. Connecting phone use tracking data and experience sampling data could be a way of integrating more factors and more measurement points without overburdening participants in future studies. In addition, qualitative experience sampling approaches might be a way to identify processes and factors perceived as influential by smartphone users.

Our results suggested that momentary device-specific factors might be the most important ones for future research: Valence turned out to be significantly related to coping effectiveness. Other important momentary device-specific factors might be the way in which various constituent media are used (e.g., the messaging or posting function of social media sites, different conversation partners; Vanden Abeele, 2021) or which contents participants see (e.g., which news or posts).

For content providers and intervention efforts that focus on helping parents navigate their everyday life, it would be particularly valuable to study which content should be provided to help parents cope with stress. Investigating whether parents access parenting-related information and social support, for instance, or whether they mostly use general, non-parenting-related content could be important in order to develop meaningful content on websites and platforms which parents visit when looking for help.

Mood Management via Smartphone Use in the Everyday Life of Parents

In the present study, mothers used their smartphones in stressful situations mostly to distract themselves and take a break. Mothers also mostly used positive and stressor-unrelated content. These descriptive results indicated that mothers use their phones as predicted by mood management theory (Zillmann, 1988). Moreover, using positive content led to a higher perceived coping effectiveness, which confirms mood management theory's predictions that positive content can improve negative emotional states effectively (Zillmann, 1988). Thus, our results suggested that mood management theory—although this theory was developed before the rise of digital media—is well suited to the context of smartphone use in stressful situations. Moreover, our study suggests that in addition to experiments, experience sampling can be a useful design to test mood management using digital media in everyday life. As we did assess the content assessment and coping effectiveness at the same time and therefore cannot rule out that the direction of influence is different than assumed (i.e., content which was effectively used to cope being perceived as more positive) experience sampling designs which allow for testing of lagged effects might be valuable for future research.

Contrary to assumptions in mood management theory, mothers preferred content related to the stress-evoking problem when confronted with important problems. Theoretical extensions to mood management such as mood adjustment might be helpful to develop theoretical models which can explain more explicitly whether or when stressed individuals seek positive or negative information for problem-focused coping (Knobloch, 2003).

Limitations

While the selected experience sampling approach allowed us to study stressful situations shortly after they happened, our approach also had limitations. Experience sampling designs are very effortful for participants, making it more challenging to recruit representative samples. Accordingly, one limitation of the present study is the convenience sample in which mothers with less education were underrepresented. On the individual level (Level 2), we recruited a relatively large sample of 218 mothers. However, on the situational level (Level 1) our

sample was smaller than we expected as mothers, on average, completed only 7.5 questionnaires on stressful situations while being with children which resulted in a reduced power to detect especially small effect sizes and cross-level interactions (Arend & Schäfer, 2019). Thus, replication studies employing a larger and more diverse sample are warranted to draw more valid conclusions. Such larger samples on both levels would also allow testing random effects. Due to the low number of Level-1 units per person, we did not introduce random effects in our multilevel models.

Our design does not allow for causal claims as we cannot control other situational factors and cannot ensure the temporal sequence of causes and effects. In our questionnaire, we tried to follow the temporal logic of a stressful situation. However, it might have been hard for our participants to remember the exact time sequence of a situation. To test causal relations, experimental research is necessary.

Also, our measurements can be further improved. Although we asked mothers shortly after a situation had happened, we cannot rule out recall bias. Especially for smartphone content, tracking designs could improve this in future studies. Moreover, we asked participants to rate the content they saw on overall scales, for example, from positive to negative. Mothers who saw different contents might have used different heuristics to summarize these different experiences. While we think that overall, participant-reported content characteristics are a valuable way of capturing characteristics of the diverse content which is used via smartphones, our measures for these characteristics need further improvement.

Our study was conducted among mothers of young children. We chose this context because discussions around maternal or parental phone use were especially controversial. Also, for non-caregiving contexts, using phones to cope with stress might be a frequent and potentially helpful coping behavior (Carolus et al., 2019). It remains an open question if our results can be applied to different contexts and respondent groups.

Finally, our study included a high number of factors. Including many factors can reduce the power of analyses. However, as noted by many recent papers reviewing the field of smartphone use and wellbeing, the relationship between smartphone use and wellbeing is complex (Kushlev & Leitao, 2020; Vanden Abeele, 2021). Untangling these complex effects will likely require a mixture of approaches including larger studies, that encompass a larger number of factors, as well as smaller studies, which aim to test the impact of a smaller number of factors. Thus, our approach represents a critical part of this combination.

Conclusion

Smartphones are omnipresent in everyday life and are used under many different circumstances. Research, therefore, must choose methodological approaches that can map this complexity to answer the question of under which circumstances digital media influence people's wellbeing in what way. Our experience sampling study contributed to this aim by studying how person-, situation-, and device-specific factors determine if mothers of young children use smartphones to cope with stress and whether their smartphone use is effective. Our results showed that mothers for whom their smartphone is highly cognitively salient used it more for coping. Moreover, results indicated that maternal smartphone use patterns in stressful situations fit the predictions of mood management theory. Mothers used their smartphones mainly for emotion-focused coping aims, and they primarily used positive content. In terms of coping efficacy, smartphone use compared to non-use related to less stress decrease. Using positive content, however, contributed to effective coping. Thus, assessing what kind of content is used when smartphones are used for coping with stress may be most important to investigate for future studies. Based on the results of our and future studies, guidance for parents on how to use smartphones effectively can be developed. Using more positive content and reducing cognitive salience of smartphone content could be important building blocks for such directions. Building on our findings in general, we can encourage parents to reflect on whether their smartphone use hinders their coping efforts. Moreover, parents can be encouraged to access more positive content in their everyday life.

Footnotes

¹ Coping can be seen as a form of self-regulation as “regulation under stress” (e.g., Aldwin et al., 2011). Goal-directed regulation also includes other behaviors such as phone use self-regulation. For further discussions on self-regulation and coping see e.g., Aldwin et al. (2011).

² Note that we use this wording because the direction of the overall relationship between phone use and coping effectiveness is not clear (RQ3).

³ We initially planned to use a 5-point-scale for this measure. Due to changes in the question format after the last pretest, an error in the scale occurred so that the scale was measured on a 7-point scale.

⁴ Even when the other interaction effects were removed, none of the interaction effects was significant.

Conflict of Interest

The authors have no conflict of interests to declare.

Authors' Contributions

Lara N. Wolfers: conceptualization, methodology, investigation, data analysis, writing—original draft. **Sonja Utz:** funding acquisition, conceptualization, writing—review & editing. **Ruth Wendt:** conceptualization, writing—review & editing. **Jonas Honecker:** investigation, data curation, data analysis, writing—review & editing.

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Open Science Statement/Supplemental Material

Supplemental material, data, and code for this article is available through OSF (<https://osf.io/aw2kd/>). The study has been preregistered at <https://osf.io/v8y9f>.

Ethics Statement

This research was approved by the ethics committee of the Leibniz-Institut für Wissensmedien, Tübingen, Germany (LEK 2020/047). All participants received an informed consent about participation in the study and agreed to the sharing of their anonymized data.

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Appendix

Table A1. *Descriptive Findings for the Used Measures.*

	<i>N</i>	<i>M</i>	<i>CI (M)</i>	<i>SD</i>	<i>ICC</i>
Individual Level (L2)					
Cognitive Salience	228	2.20	[2.08, 2.31]	0.95	-
Physical Salience	228	3.05	[2.92, 3.17]	0.86	-
Phone personalization	228	1.25	[1.11, 1.38]	1.05	-
Phone use self-regulation skills	228	3.42	[3.30, 3.53]	0.89	-
Situational level (L1)					
Phone use in stressful situations	1,653	Yes = 1,170, No = 483			0.19
Valence (phone content) ¹	483	3.75	[3.66, 3.83]	0.96	0.26
Semantic Affinity (phone content) ¹	483	2.91	[2.71, 3.11]	2.26	0.16
Perceived coping effectiveness	1,653	3.05	[2.99, 3.10]	1.16	0.22
Stress T1	1,653	3.63	[3.59, 3.67]	0.90	0.17
Stress change	1,653	-1.05	[-1.10, -1.00]	1.12	0.16
Situational control	1,653	2.76	[2.71, 2.81]	1.13	0.24
Situational importance	1,653	3.00	[2.94, 3.06]	1.21	0.26
Situational urgency	1,653	3.59	[3.54, 3.64]	1.04	0.17

Note. Three questionnaires were excluded because they were incomplete and three questionnaires were excluded because the filters did not work correctly. There were no other missing values. ¹Including only the situations in which a phone was used.

Table A2. Correlation Matrix of the Level 1 and Level 2 Variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Individual Level (L2)																
1 Cognitive Salience	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2 Physical Salience	.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3 Phone personalization	.20	.20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4 Phone use self-regulation skills	-.64	-.47	-.20	-	-	-	-	-	-	-	-	-	-	-	-	-
5 Age	-.06	-.08	-.05	.05	-	-	-	-	-	-	-	-	-	-	-	-
6 Age youngest child	.02	.00	.09	-.02	.28	-	-	-	-	-	-	-	-	-	-	-
7 Education	.07	.10	-.02	-.05	.12	-.16	-	-	-	-	-	-	-	-	-	-
8 Phone use frequency	.39	.36	.15	-.45	.03	.08	.01	-	-	-	-	-	-	-	-	-
Situational level (L1)																
9 Phone use	.18	.09	.07	-.16	-.01	.06	-.01	.15	-	-	-	-	-	-	-	-
10 Valence (phone content) ¹	-.06	-.01	-.04	.12	-.06	-.08	.16	-.12	NA	-	-	-	-	-	-	-
11 Semantic Affinity (phone content) ¹	.05	.03	.15	-.03	.11	.10	-.04	-.01	NA	.01	-	-	-	-	-	-
12 Perceived coping effectiveness	-.03	.01	.03	.00	.02	-.03	.07	-.04	.00	.22	.13	-	-	-	-	-
13 Stress T1	.02	-.01	.09	-.03	-.07	.05	-.15	.04	.03	.03	.11	-.19	-	-	-	-
14 Stress change	.07	.02	-.03	-.05	-.03	.00	-.02	.03	.08	-.10	-.03	-.16	-.37	-	-	-
15 Situational control	.02	.05	.01	-.03	.04	.01	.09	.00	-.03	.05	-.03	.31	-.20	-.01	-	-
16 Situational importance	-.01	-.02	.06	.01	-.06	.02	-.16	.02	.07	.07	.20	.02	.24	.04	-.12	-
17 Situational urgency	-.02	.00	.05	.03	.00	.01	-.06	-.01	-.04	.09	.14	.04	.35	-.10	.02	.35

Note. $N(\text{Level } 2) = 218$ participants, $N(\text{Level } 1) = 1,653$ stressful situations. Correlations between Level 2 variables are calculated on Level 2, all other correlations are calculated on Level 1. ¹Only for stressful situations including phone use, $n(\text{Level } 1) = 483$ stressful situations.

Table A3. Coping Strategies in General and With Using a Phone.

Coping strategies	General ¹ (n = 1,655)	Phone use ² (n = 483)	General only for phone use situations ¹ (n = 483)
Active coping	53 % (870)	16 % (79)	47 % (228)
Planning	38 % (624)	12 % (57)	37 % (178)
Venting	19 % (308)	8 % (40)	19 % (90)
Self-distraction	12 % (206)	49 % (237)	23 % (111)
Instrumental support	11 % (177)	12 % (60)	12 % (57)
Giving up	11 % (175)	13 % (61)	13 % (69)
Emotional support	10 % (173)	16 % (75)	14 % (69)
Positive reappraisal	9 % (153)	4 % (17)	9 % (44)
Take a break	9 % (153)	27 % (128)	13 % (64)
Nothing / Something else	8 % (137)	13 % (64)	7 % (35)
Information seeking	3 % (55)	13 % (62)	7 % (35)
Humor	3 % (46)	2 % (8)	3 % (13)
Information avoidance	2 % (39)	5 % (25)	4 % (17)

Note. ¹Question: *What did you do to deal with the stressful situation? Please check off all statements that apply to your thoughts and actions in the situation.* ²Question: *Have you used your smartphone for any of the following? Please check all statements that apply to your smartphone use.*

Table A4. Multilevel Linear Regression Analysis on Coping Efficacy Including the Content Features (Final Models).

Dependent variable	Perceived coping efficacy			Stress change		
	Fixed effects			Fixed effects		
Parameters	Estimate	SE	t	Estimate	SE	t
Individual level						
Intercept	3.07	0.07	44.77	-0.93	0.07	-14.30
Age	0.00	0.02	0.08	-0.00	0.02	-0.05
Youngest child age	-0.01	0.05	-0.23	-0.04	0.04	-0.84
Education	0.12	0.14	0.82	-0.12	0.14	-0.88
Phone use frequency	-0.01	0.10	-0.06	0.08	0.09	0.80
Personalization	0.09	0.07	1.33	-0.01	0.06	-0.16
Phone self-regulation	-0.06	0.09	-0.64	0.09	0.08	1.03
Situational level						
Stress T1				-0.75	0.08	-9.96*
Effort	-0.06	0.07	-0.87	0.08	0.07	1.12
Urgency	0.06	0.07	0.82	0.11	0.06	1.77
Importance	-0.06	-0.07	-0.87	0.14	0.06	2.48*
Control	0.25	0.06	4.32*	-0.15	0.05	-2.80*
Positive valence	0.17	0.07	2.51*	-0.04	0.06	-0.69
Semantic affinity	0.06	0.03	1.92	-0.01	0.03	-0.23
Interactions						
Positive valence*Control	-0.00	0.09	-0.01	-0.10	0.08	-1.20
Semantic affinity*Control	0.06	0.04	1.67	0.02	0.03	0.47
Positive valence*Importance	-0.02	0.08	-0.23	0.03	0.08	0.33
Semantic affinity*Importance	-0.02	0.03	-0.48	0.03	0.03	0.86
Positive valence*Urgency	0.17	0.09	1.78	-0.00	0.09	0.00
Semantic affinity*Urgency	-0.00	0.04	-0.06	-0.01	0.03	-0.23
R ² (marginal/conditional)	.08/.28			.04/.37		
Random Intercept	SD = 0.53			SD = 0.53		

Table A5. Hypotheses Overview.

	Hypothesis / Research question	Result
RQ1	How often are phones used for coping with stress?	In about 30% of situations
RQ2	With which coping strategies do mothers combine mobile phones?	Mostly emotion-focused coping (see Table A3)
RQ3	Is phone use for coping associated with coping effectiveness?	No for perceived coping efficacy; Yes, associated with less stress decrease
H1	Mobile phones are used more frequently for coping if they are a) cognitively salient, b) physically salient,	H1a supported, H1b rejected
H2	Phone use self-regulation skills moderate the relationship between phone use for coping and coping effectiveness such that phone use for coping is more positively/less negatively related to coping effectiveness for those with higher self-regulation skills.	Rejected
H3	Phones are a) used more and are b) more effective in stressful situations which are perceived as being more urgent.	Rejected
H4	Phones are a) used less and are b) less effective in stressful situations which are perceived as being more important.	Rejected
RQ4	Does the association of phone use for coping and coping effectiveness depend on the perceived situational control?	No
H5	Participants who have more strongly personalized their phone use it more often for coping.	Rejected
H6	Phone personalization moderates the relationship between phone use for coping and coping effectiveness such that phone use for coping is more positively/less negatively related to coping effectiveness for those who have more strongly personalized their phones.	Rejected
H7	In situations with lower situational control 7.1 more positive and 7.2 less stressor-related content is a) used more and is b) more effective.	Rejected
H8	In less important situations, 8.1 more positive and 8.2 less stressor-related content is a) used more and is b) more effective.	Rejected except H8.2a: supported
RQ5	Is there a relationship between content features and situational urgency?	No

Table A6. Question and Item Wording in the German Version Used in the Questionnaire and in an English Translation.

German Original, English translation, Source	Question and Item Wording
PRESURVEY	
Cognitive Salience	
<p><i>German</i> Reinecke et al., 2018; adapted to smartphones</p>	<p><i>Im Folgenden soll es darum gehen, wie Sie persönlich im Alltag mit Smartphone-Inhalten umgehen. Nachfolgend finden Sie dazu eine Reihe von Aussagen, die unterschiedliche Formen des Umgangs mit Smartphone-Inhalten beschreiben. Wenn wir dabei von Smartphone-Inhalten sprechen, meinen wir die Smartphone-Inhalte, mit denen Sie regelmäßig zu tun haben – Ihre Online-Kontakte in WhatsApp und Co., Ihre bevorzugten Websites, Communities, sozialen Medien. Bitte geben Sie zu jeder Aussage an, inwiefern diese auf Sie persönlich zutrifft. Skala: 1-5 Trifft nicht zu bis Trifft voll zu</i></p> <p><i>Meine Gedanken schweifen häufig zu Smartphone-Inhalten ab.</i> <i>Häufig beschäftigen mich Smartphone-Inhalte gedanklich auch dann, wenn ich gerade andere Dinge erledige.</i> <i>Es fällt mir schwer, mich gedanklich von Smartphone-Inhalten zu lösen.</i> <i>Auch wenn ich gerade mit anderen Leuten im Gespräch bin, denke ich im Hintergrund häufig darüber nach, was online wohl gerade passiert.</i></p>
<p><i>English</i> Reinecke et al., 2018; adapted to smartphones</p>	<p><i>The following questions pertain to how you personally handle smartphone content. Here you will find statements that describe various forms of dealing with smartphone content. When we say “smartphone-content”, we refer to smartphone content that you make use of on a regular basis (e.g., your WhatsApp or Snapchat contacts, your favorite websites, online communities, or social media). Please indicate how the following statements apply to you personally.</i></p> <p><i>Scale from Does not apply at all to Fully applies</i> <i>My thoughts often drift to smartphone content.</i> <i>I have a hard time disengaging mentally from smartphone content.</i> <i>Even when I am in a conversation with other people, I often think about what is happening online right now in the back of my mind.</i> <i>Often smartphone content occupies my thoughts, even as I am dealing with other things.</i></p>

Physical Salience

German
Self-developed

Im Folgenden soll es darum gehen, wie Sie persönlich im Alltag mit ihrem Smartphone umgehen. Nachfolgend finden Sie dazu eine Reihe von Aussagen, die unterschiedliche Formen des Umgangs mit ihrem Smartphone beschreiben. Bitte geben Sie zu jeder Aussage an, inwiefern diese auf Sie persönlich zutrifft.

Skala: 1-5 (Trifft nicht zu bis Trifft voll zu)

Wenn ich mich hinsetze, lege ich mein Smartphone so hin, dass ich es im Blick habe.

Wenn ich unterwegs bin, habe ich mein Smartphone immer griffbereit, zum Beispiel in meiner Hosentasche.

Mein Smartphone liegt meistens so, dass ich es sehe.

Wenn ich in meiner Wohnung in ein anderes Zimmer gehe, nehme ich mein Smartphone meistens mit.

Auch wenn ich etwas unternehme also zum Beispiel Sport mache, habe ich mein Smartphone immer in meiner Nähe.

English

The following questions are about how you personally use your smartphone in everyday life. Below you will find a series of statements that describe different ways of using your smartphone. For each statement, please indicate the extent to which it applies to you personally.

Scale: 1-5 (Strongly disagree to Strongly agree)

When I sit down, I place my smartphone so that I can keep an eye on it.

When I'm outside, I always have my smartphone at hand, for example in my pants pocket.

My smartphone is usually in a place where I can see it.

When I go to another room in my apartment, I usually take my smartphone with me.

Even when I'm out doing something, such as sports, I always have my smartphone close by.

Phone Personalization

German
Translated and adapted
from Böhmer and Krüger,
2013

Wenn Sie an den letzten Monat denken, wie oft haben Sie die folgenden Aktivitäten ungefähr ausgeführt?

Skala: 0 Mal, 1-2 Mal, 3-5 Mal, 6-10 Mal, Mehr als 10 Mal

Ich habe neue Apps installiert.

Ich habe App-Icons neu angeordnet (z.B. auf den Startbildschirm verschoben).

Ich habe Apps deinstalliert.

Ich habe Einstellungen in Apps verändert.

English

Adapted from Böhmer and
Krüger, 2013

Thinking about the last month, approximately how often did you do the following activities?

Scale: 0 times, 1-2 times, 3-5 times, 6-10 times, more than 10 times.

I installed new apps.

I rearranged icons (e.g., moved them to the home screen).

I uninstalled apps.

I changed settings in apps.

Phone Use Self-Regulation Skills

German
Peukert et al., 2012;
adapted to smartphone
use
Last item: self-developed

Im Folgenden geht es darum, wie Sie selbst Ihre Smartphone-Nutzung einschätzen. Bitte geben Sie jeweils an, wie häufig die Aussagen auf Sie zutreffen.

Skala: 1-5 nie bis sehr häufig

Es fällt mir schwer, meine Smartphone-Nutzung zu beenden.

Ich nutze das Smartphone weiter, obwohl ich es gerade weglegen wolle.

Andere sagen mir, ich solle mein Smartphone weniger häufig nutzen.

Ich habe erfolglos versucht, weniger Zeit mit meinem Smartphone zu verbringen.

Ich lege mein Smartphone weg, wenn ich mein Ziel erreicht habe (z.B. eine Nachricht fertig geschrieben habe).

English

Meerkerk et al., 2009;
adapted to smartphone
use
Last item: self-developed

The following is about how you yourself assess your smartphone use. Please indicate how often each statement applies to you.

Scale: 1 never to 5 very often

I find it difficult to stop using my smartphone.

I continue to use my smartphone despite my intention to stop.

Others say I should use my smartphone less.

I have unsuccessfully tried to spend less time on my smartphone.

I put my smartphone away when I have reached my goal (e.g., finished writing a message).

EXPERIENCE SAMPLING QUESTIONNAIRE

Situation Selection

German

Haben Sie in den letzten zwei Stunden eine einigermaßen stressige Situation erlebt? Stressige Situationen können durch verschiedene Dinge ausgelöst werden, z.B. durch Konflikte mit Kindern oder Partner/in, durch Zeitdruck, schlechten Schlaf oder durch Krankheiten.

Bitte berichten Sie auch Situationen, die für Sie nur ein bisschen stressig waren. Beziehen Sie sich bitte auf die letzten beiden Stunden direkt bevor Sie den Fragebogen beantworten, egal wann Sie an den Fragebogen erinnert wurden.

- ja, ich habe eine stressige Situation erlebt

- nein, ich habe keine stressige Situation erlebt

English *Have you experienced a somewhat stressful situation in the last two hours? Stressful situations can be caused by different things, e.g. through conflicts with children or partners, through time pressure, bad sleep quality, or through illnesses.*

Please also report on situations which were only a bit stressful for you. Refer to the last two hours before you answer this questionnaire regardless of when you have been sent the reminder about the questionnaire.

Yes, I have experienced a stressful situation
No, I have not experienced a stressful situation

Stress intensity 1

German *Wenn Sie an die stressige Situation denken, die Sie erlebt haben: Wie haben Sie sich während der Situation gefühlt?*
Von 1 (gar nicht) bis 5 (sehr stark)
Gestresst

English *When you think about the stressful situation you experienced: How did you feel during the situation?*
From 1 (not at all) to 5 (very much)
Stressed

Situational Control

German
Perrez and Reicherts, 1992 *Hatten Sie das Gefühl, die Situation beeinflussen zu können?*
Von 1 (gar nicht) bis 5 (sehr)

English
Perrez and Reicherts, 1992 *Did you feel you could influence the situation?*
From 1 (not at all) to 5 (very much)

Situational Importance

German
Translated from Thies and
Kordts-Freudinger, 2019 *Wie wichtig war das Problem, das die stressige Situation ausgelöst hat?*
Von 1 (gar nicht wichtig) bis 5 (sehr wichtig)

English
Thies and Kordts-
Freudinger, 2019 *How important was the problem that caused the stressful situation?*
From 1 (not at all important) to 5 (very important)

Situational Urgency

German
Self-developed *Hatten Sie das Gefühl, dass Sie in der stressauslösenden Situation dringend handeln mussten?*
Von 1 (nein, überhaupt nicht) bis 5 (ja, sehr stark)

English
Self-developed *Did you feel that you had to act urgently in the stressful situation?*
From 1 (no, not at all) to 5 (yes, very strongly)

Coping Strategies

German
Adapted from Knoll et al.,
2005
Updated through Wolfers,
2021 *Was haben Sie getan, um mit der stressigen Situation umzugehen? Bitte kreuzen Sie alle Aussagen an, die auf Ihr Denken und Handeln in der Situation zutreffen.*
Yes/No
Ich habe...
...etwas unternommen, um mich abzulenken
...mich darauf konzentriert, etwas an meiner Situation zu verändern
...aufmunternde Unterstützung von anderen gesucht
...es aufgegeben, mich mit der aktuellen Situation zu beschäftigen
...andere Menschen um Hilfe und Rat gebeten
...meinen Gefühlen freien Lauf gelassen
...versucht, etwas Gutes in dem zu finden, was passiert ist
...versucht, mir einen Plan zu überlegen, was ich tun kann
...Witze darüber gemacht
...nach Informationen gesucht
...eine Pause gemacht
...aktiv vermieden, dass ich etwas mit Bezug zur Situation sehe
Keine der anderen Optionen.

English
Adapted Carver, 1997 *What did you do to cope with the stressful situation? Please check all statements that apply to your thoughts and actions in the situation.*
Yes/No
I ...
...turned to other activities to take my mind off things
...concentrated my efforts on doing something about the situation I'm in
...sought emotional support from others
...gave up trying to deal with the current situation
...asked other people for help and advice

... said things to vent my unpleasant feelings
... looked for something good in what has happened
... tried to come up with a strategy about what to do.
...made jokes about it
...looked for information
...took a break
...actively avoided seeing anything related to the situation I was in
None of the other options.

Phone Use in Stressful Situations

German Haben Sie während oder direkt nach der stressigen Situation Ihr Smartphone verwendet?
Wenn Sie es nicht selbst verwendet, aber Sie es einem Ihrer Kinder gegeben haben, dann antworten Sie bitte mit "Nein".
Ja, ich habe es selbst genutzt.
Nein

English Did you use your smartphone during or directly after the stressful situation?
If you didn't use it yourself, but gave it to one of your children, then please answer "no".
Yes, I used it.
No.

Phone Use Features: Valence

German Wie würden Sie die Smartphone-Inhalte, die Sie genutzt haben, beschreiben?
Mit Inhalte meinen wir, was Sie gesehen oder gehört haben, also zum Beispiel Nachrichten bei WhatsApp, Informationsseiten, Inhalte von Spielen, Gespräche am Telefon, usw.
Skala von 1 (negative) bis 5 (positive)

English How would you describe the smartphone content you used?
By content, we mean what you saw or heard, for example, messages on WhatsApp, information pages, content from games, conversations on the phone, etc.
Scale from 1 (negative) to 5 (positive)

Phone Use Features: Semantic Affinity (Asked Directly After the Valence)

German Die Inhalte hatten Bezug zur stressigen Situation
Skala 1 (Gar nicht) bis 7 (sehr stark)

English The content was related to the stressful situation
Scale 1 (not at all) to 7 (very strongly)

Stress After the Situation Has Ended (Second Variable for Stress Change)

German Wie gestresst haben Sie sich gefühlt, als die Situation vorbei war?
Wenn die Situation noch nicht vorbei ist, geben Sie bitte an, wie gestresst Sie sich jetzt gerade fühlen.
Skala von 1 (gar nicht) zu 5 (sehr stark)

English How stressed did you feel when the situation had ended?
Scale from 1 (not all) to 5 (very much)

Perceived Coping Efficacy

German Hat das, was Sie in der Situation gedacht und getan haben, geholfen, den Stress zu bewältigen?
Skala von 1 (nicht geholfen) bis 5 (gut geholfen)

English Did what you thought or did in the situation make you feel better?
Scale from 1 (Did not help) to 5 (Helped a lot)

About Authors

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