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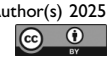
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Navigating Social Pressure to Be Available: The Roles of Mindfulness and Need Experiences in Messenger Users' Well-/Ill-Being

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Abstract

In a digitally connected world, the perceived expectation to always stay available via mobile messenger services places unique demands on users. This paper addresses the question of how and when so-called availability pressure leads to variations in messenger users' well-/ill-being. Drawing on the Integrative Model of Mobile Media Use and Need Experiences, it conceptualizes the satisfaction versus frustration of fundamental needs (autonomy, competence, relatedness) as mediators and the health-promoting personality trait mindfulness as a moderator. This model was tested across a 7-day-long diary study ($N = 229$) and a 2-factorial online experiment ($N = 166$). Both pre-registered studies are in line with the model's assumption that availability pressure can lead to specific need experiences, which in turn predict different facets of well-/ill-being. Although we identified limited moderating effects, being mindful (Study 1) and cultivating mindfulness (Study 2) were positively related to need satisfaction and well-being and negatively related to need frustration and ill-being. This highlights the complex consequences of availability pressure and the importance of individual coping mechanisms. Future

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research should refine theoretical models like the Integrative Model of Mobile Media Use and Need Experiences and explore additional health-promoting personality traits to better understand digital well-being in the era of mobile connectivity.

Keywords
Mobile communication, smartphone, availability pressure, well-being, mindfulness, coping

Living in a permanently online and connected world (Vorderer et al., 2018), almost every adult internet user frequently engages in computer-mediated communication (CMC) via mobile messenger services such as WhatsApp (We Are Social & Hootsuite, 2024). Precisely the mobile nature of these technologies—smartphones being always at hand, in our pockets, or by our bedside—enables users to stay almost permanently reachable. Consequently, mobile devices are used constantly throughout the day (Schnauber-Stockmann & Mangold, 2020), and, for many users, checking their smartphone for incoming messages is the last activity before going to sleep (Exelmans & van den Bulck, 2016). As with every newly invented technology (Orben, 2020), concerns arise about how such permanent usage behavior affects users' well-/ill-being (Martela & Sheldon, 2019), covering both experiences of optimal functioning (e.g., positive affect and vitality) and malfunctioning (e.g., stress). Despite the technology panic dominating the social discourse, meta-reviews concerning the relationship between CMC and well-/ill-being found evidence not only for negative but also for non-significant and even positive correlations (High et al., 2023; Meier & Reinecke, 2021). One explanation for these inconsistent findings lies in the different experiences mobile messenger users encounter: on the one hand, it can help users maintain important relationships and get in contact with others whenever and wherever they want, thus strengthening their sense of relatedness and well-being (Hall & Baym, 2012; Reinecke et al., 2014). On the other hand, to offer the same for their social network, users also have to be permanently available to others; this can decrease users' sense of autonomy and thus harm their well-being (Halfmann & Rieger, 2019; Hall, 2017). Such need conflicts are specifically due to perpetual contact and mobile connectivity (e.g., Arnold, 2003; Katz & Aakhus, 2002; Ling, 2004) and have been summarized as the *mobile connectivity paradox*, the "experience of being caught between autonomy and a loss of control, which becomes visible in people's ambivalence towards mobile connectivity in their everyday lives" (Vanden Abeele, 2021, p. 934). To investigate these subjective challenges and experiences in the era of mobile connectivity (Vanden Abeele, 2021; Vanden Abeele & Nguyen, 2022) and put these inconclusive empirical findings in a broader theoretical context, the present article applies the Integrative Model of Mobile Media Use and Need Experiences (IM³UNE; Schneider et al., 2022; Figure 1) to the use of mobile messenger services. More specifically, it focuses on one specific demand—availability pressure—and users' mindfulness as a health-promoting trait by asking how and for whom availability pressure relates to well-/ill-being.[1]

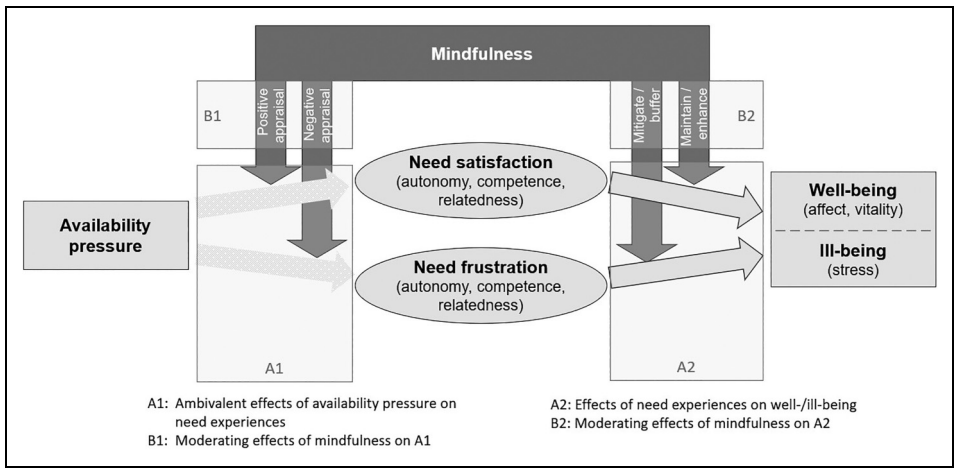

Figure 1. Adapted Version of the Integrative Model of Mobile Media Use and Need Experiences (IM³UNE; Schneider et al., 2022).

Theoretical Background

Availability Pressure

The affordances of mobile technologies—particularly their portability and real-time communication capabilities—reinforce mutual expectations: as we carry our smartphones with us at all times and everywhere, we expect others to do the same. This inevitably leads to the perception that availability is taken for granted (Ling, 2012), implying that users experience social pressure to be permanently available to others (e.g., Hall, 2017). In line with this argument, previous research has shown that users believe they are expected to answer messages and calls quickly and check their devices for new notifications regularly (Bayer et al., 2016; Mai et al., 2015). This so-called availability pressure is inherently tied to mobile technologies, thus constituting a byproduct of mobile media use. Importantly, users can both benefit and suffer from this experience: on the one hand, giving in to availability pressure can interrupt users' ongoing tasks (Elhai et al., 2021; Meier, 2021) and thus lead to goal conflicts (Halfmann et al., 2024). On the other hand, violating this availability norm by *not* using the smartphone has also been associated with negative emotions, such as guilt (Halfmann et al., 2025). Moreover, availability can also create positive feelings of being connected to others (e.g., Hall et al., 2023; Taylor & Bazarova, 2021). Such conflicting findings can be addressed by conceptualizing availability pressure as an individually appraised mobile media demand rather than a pathogenic stressor per se.

The Concepts of Well- and Ill-Being

Referring to recent two-continua models (e.g., Meier & Reinecke, 2021), we argue that availability pressure can affect two distinct psychological experiences—optimal

functioning (i.e., well-being) and malfunctioning (i.e., ill-being). Concerning messenger users' well-being, we focus on two different experiences: firstly, affect—defined as individuals' moods and emotions representing their evaluations of specific events (Diener et al., 1999)—can be separated into positive affect (e.g., joy, happiness) and negative affect (e.g., sadness, anger). Secondly, vitality describes the "experience of possessing energy and aliveness" (Ryan & Frederick, 1997, p. 530). As an indicator of ill-being, we consider stress as the perceived "imbalance between environmental demands and individual motives and abilities" (Elo et al., 2003, p. 444). Messenger users might experience stress when they receive a high number of incoming messages and/or anticipate the sender's expectation of a quick response, thus perceiving incoming messages as "unpredictable, uncontrollable, and overloading" (Cohen et al., 1983, p. 387). We selected these well-/ill-being indicators as they have frequently been used in prior research (for more details, see below). This enables us to situate our research within the existing literature and to examine whether these contradictory findings might be explained by those mechanisms specified within the IM³UNE.

Need Experiences as Mediating Mechanisms

According to self-determination theory (SDT; Ryan & Deci, 2017), the satisfaction of three fundamental needs—autonomy, competence, and relatedness—is a genuine human striving, vital to flourishing and well-being. The theoretical conceptualizations and mechanisms are fleshed out in one of SDT's mini-theories, the basic psychological needs theory (BPNT; Martela & Sheldon, 2019; Vansteenkiste et al., 2020), which differentiates between satisfying and frustrating these fundamental needs. Drawing on BPNT, the IM³UNE applies these key mechanisms linking mobile media demands and well-/ill-being (Schneider et al., 2022). Autonomy satisfaction refers to the experience of self-endorsement and volition of one's activity, competence satisfaction involves feeling effective and capable in dealing with one's environment, and relatedness satisfaction reflects the sense of being cared for and valued by close others (Vansteenkiste & Ryan, 2013). In contrast, autonomy frustration involves feelings of being pushed in an unwanted direction, competence frustration is characterized by experiences of failure or ineffectiveness, and relatedness frustration describes feelings of disconnection or social exclusion (Vansteenkiste et al., 2020). As outlined by Vansteenkiste and Ryan (2013), satisfying and frustrating these needs represent qualitatively different experiences: whereas frustrating fundamental needs involves low need satisfaction, the mere lack of need satisfaction does not always lead to experiences of need frustration. Concerning the effects of these experiences, Martela and Sheldon (2019) postulated that need satisfaction primarily explains the positive state of well-being, whereas need frustration is the main driver of ill-being. These assumptions have been empirically supported in numerous studies (Ryan et al., 2022). Importantly, cross-paths are also possible, such that need satisfaction may be negatively related to ill-being indicators (Vansteenkiste & Ryan, 2013)—although these effects are expected to be less pronounced. Transferring these associations to the context of mobile media use, the IM³UNE argues that these need experiences mediate the relationship between mobile media demands, such as availability pressure, and well-/ill-being (Schneider et al., 2022).

Concerning the first path of this mediation, the IM³UNE postulates that mobile media demands generate variations in need experiences—without specifying the positive versus negative valence of these effects. Empirical evidence testing this path is inconclusive, with few studies addressing need frustration and heterogeneous findings regarding need satisfaction: for instance, availability pressure has been significantly associated with increased competence and relatedness satisfaction, but decreased autonomy satisfaction (Reinecke et al., 2014); with decreased autonomy and competence satisfaction, but not with relatedness satisfaction (Halfmann & Rieger, 2019); and with increased satisfaction of all three needs (Li & Chan, 2024). The existing literature provides theoretical arguments for hypothesizing a link between availability pressure and need experiences. Yet, given these inconsistent empirical findings, the positive versus negative valence of these associations remains unclear. We therefore posed the following research questions:

- How is availability pressure related to the satisfaction (**RQ1**) and frustration (**RQ2**) of the needs for **(a)** autonomy, **(b)** competence, and **(c)** relatedness?

Empirical evidence concerning the second path of the mediation shows that users' need experiences can predict facets of well-/ill-being. For instance, need satisfaction was positively associated with affect, vitality, and life satisfaction, but negatively associated with depression, anxiety, and stress (e.g., Bauer et al., 2017; Grieve et al., 2013; Halfmann & Rieger, 2019; Meier, 2018). In contrast, need frustration was positively related to depression, anxiety, and stress, but negatively associated with life satisfaction and vitality (e.g., Gilbert et al., 2023; van de Casteele et al., 2024). Thus, the following hypotheses are posed:

- Satisfying the needs for **(a)** autonomy, **(b)** competence, and **(c)** relatedness is positively related to messenger users' (**H1**) affect and (**H2**) vitality but negatively related to (**H3**) perceived stress.
- Frustrating the needs for **(a)** autonomy, **(b)** competence, and **(c)** relatedness is negatively related to messenger users' (**H4**) affect and (**H5**) vitality but positively related to (**H6**) perceived stress.

So far, the mediating role of need experiences has only been supported for the satisfaction of fundamental needs (e.g., Halfmann & Rieger, 2019). Extending these findings, the following hypotheses are proposed:

- Satisfying the needs for (**a**) autonomy, **(b)** competence, and **(c)** relatedness mediates the effect of availability pressure on (**H7**) affect, (**H8**) vitality, and (**H9**) stress.
- Frustrating the needs for (a) autonomy, (b) competence, and (c) relatedness mediates the effect of availability pressure on (**H10**) affect, (**H11**) vitality, and (**H12**) stress.

Mindfulness as a Moderating Mechanism

The IM³UNE (Schneider et al., 2022) also focuses on users' personality as an important boundary condition by introducing three health-promoting traits (i.e., mindfulness,

meaningfulness, and self-control). As previous research especially highlighted the relevance of mindfulness—both in general (Weinstein et al., 2009) and in the context of mobile media use (Hefner & Freytag, 2024)—the present article focuses on this trait, defined as the awareness that arises through "paying attention in a particular way: on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994, p. 4). The IM³UNE describes two ways in which mindfulness facilitates coping with availability pressure.

In a first step, mindfulness is conceptualized as a moderator in the interplay of mobile media demands and need experiences. Following Schneider et al. (2022), mindful users should appraise such demands as non-stressors that are less likely perceived as need-frustrating and more likely perceived as need-satisfying. Addressing availability pressure as a mobile media demand, it can be assumed:

- Messenger users' (**H13**) trait mindfulness moderates the association between availability pressure and need experiences in such a way that more mindful users experience more satisfaction of the needs for **(a)** autonomy, **(b)** competence, and **(c)** relatedness, but less frustration of the needs for **(d)** autonomy, **(e)** competence, and **(f)** relatedness.

In a second step, Schneider et al. (2022) shed light on the conditions under which need experiences result in either well- or ill-being. The underlying argument is that being mindful can help mobile media users cope with experiences of low need satisfaction and even need frustration. Consequently, it was hypothesized:

- Trait mindfulness moderates the association between need satisfaction and well-/ill-being in such a way that for more mindful users less satisfaction of the needs for **(a)** autonomy, **(b)** competence, and **(c)** relatedness leads to more positive affect (**H14**) and (**H15**) vitality, but less (**H16**) stress, compared to those low in this trait.
- Users' trait mindfulness weakens the association between the frustration of the needs for **(a)** autonomy, **(b)** competence, and **(c)** relatedness and (**H17**) affect, (**H18**) vitality, and (**H19**) stress.

These research questions and hypotheses were tested in two pre-registered studies. All data and material referred to in the following sections are publicly available in the Open Science Framework (OSF; see https://osf.io/92jw6/).

Study 1 (S1)

Method

Procedure. We conducted a pre-registered (https://osf.io/sqvca) diary study from August 16 to 23, 2020.[2] A pre-diary questionnaire was used to collect demographic, trait, and control variables (person level). Over the following week, participants received personalized links to seven diary questionnaires accessing all (in)dependent,

mediating, and control variables (situation level). They were asked to participate shortly before bedtime and received a €10 voucher for answering a minimum of six diary questionnaires.

Participants. The pre-diary questionnaire was distributed among 246 German messenger users via social network sites and personal networks. Applying certain exclusion criteria (see pre-registration), the final sample ($N = 229$) corresponds to the pre-registered sample size. Participants showed a high response rate ($M = 6.16$, $SD = 1.34$) and filled in 1,411 questionnaires. They were mainly female (61%), on average 26 years old ($SD = 6.14$, range = 18–58), highly educated (48% completed a university degree), and most frequently in training or studying (62%).

Measures

Pre-Diary Questionnaire. Trait mindfulness was measured using the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003). The participants responded to five items (e.g., "I find it difficult to stay focused on what's happening in the present," McDonald's $\omega = .76$; $M = 2.82$, $SD = 0.77$) on a 5-point agreement scale. Moreover, this questionnaire contained several demographic and control variables (see OSF file "S1_codebook").

Diary Questionnaire. Perceived availability pressure was assessed using the Social Pressure Scale (Reinecke et al., 2017). Participants rated their agreement with four items (e.g., "Today, I felt a social obligation in my private life to be constantly available") on a 5-point scale ($\omega = .92$, $M = 1.95$, $SD = 0.99$).

Following Meier (2018), single items were used to measure need satisfaction (relatedness: "I felt close and connected to other people who are important to me," $M = 3.47$, $SD = 1.08$; competence: "I was successful, even with difficult things," $M = 3.16$, $SD = 1.03$; autonomy: "I had the freedom to do things the way I wanted to," $M = 3.87$, $SD = 1.01$; and frustration (relatedness: "Other people have rejected or excluded me," $M = 1.36$, $SD = 0.74$; competence: "I felt like I failed at something or wasn't good at something," $M = 1.70$, $SD = 1.01$; autonomy: "I have felt a lot of pressure from others that I would have preferred to do without," $M = 1.69$, $SD = 0.97$) while using mobile messengers on a 5-point agreement scale.

Using the valence dimension of the Self-Assessment Manikin (Bradley & Lang, 1994), participants were instructed to choose one of five pictures that best described their affective states throughout the day ($M = 3.79$, $SD = 0.89$). To indicate their daily level of vitality, they answered seven items (e.g., "Today I felt full of energy and spirit") adapted from Ryan and Frederick (1997) on a 5-point agreement scale ($\omega = .93$, $M = 3.23$, $SD = 0.92$). Participants' daily levels of stress were assessed using a single item (i.e., "Stress means a situation in which a person feels tense, restless, nervous or anxious or is unable to sleep at night because his/her mind is troubled all the time. Did you feel this kind of stress this day?"; Elo et al., 2003), ranging from 1 (*not at all*) to 5 (*very much*; $M = 2.38$, $SD = 1.18$). Importantly, all well-/ill-being indicators were conceptualized as state

variables, as the IM³UNE assumes situational fluctuations depending on availability pressure and need experiences.

Pearson correlations between variables recorded on a daily level can be found in the R Markdown (section "descriptive and bivariate analyses").

Results

We analyzed the nested data (observations within persons) by performing multilevel analyses (Hox, 2010) using the statistics software R. The package lme4 (Bates et al., 2022; version 1.1-35.5) was used to estimate multilevel regression models for each outcome variable. Within these models, situation-level predictors were group-mean-centered, and person-level predictors were grand-mean-centered. We applied a bottom-up model-building strategy by first calculating the random-intercept-only models and gradually adding predictor and control variables. We controlled for standard demographic variables (i.e., age, gender, educational level) to account for potential sample biases due to our non-representative convenience sample, as well as for theoretically relevant variables (i.e., general frequency of messenger use, availability preferences, daily working hours) that are likely to influence participants' perceptions of availability pressure, need experiences, and well-/ill-being. To allow comparisons across models, the final models include all control variables (and not only, as pre-registered, the significant ones).[3] Further statistical information can be found in the Online Appendix (Table A1; Figures A1–A12) and in the R Markdown (see OSF).

Availability Pressure–Need Experiences Relations. Availability pressure was significantly related to four out of six need experiences: it was negatively associated with autonomy satisfaction (RQ1a) and positively associated with relatedness satisfaction (RQ1c), autonomy frustration (RQ2a), and competence frustration (RQ2b).

Need Experiences–Well-/Ill-Being Relations. Specific need experiences were significantly related to well-/ill-being indicators: as hypothesized, satisfying the needs for competence and relatedness (H1b/c) was positively associated and frustrating these needs (H4b/c) was negatively associated with affect. Autonomy satisfaction and frustration were not significantly associated with affect, thereby rejecting H1a and H4a. For vitality, we identified positive associations with the satisfaction of all three needs (H2a/b/c) and negative ones with competence and relatedness frustration (H5b/c). Contradicting H5a, autonomy frustration was not significantly related to vitality. Stress was positively associated with autonomy and competence frustration (H6a/b), but not with the remaining four needs experiences. Thus, H3a/b/c and H6c were rejected.

Availability Pressure–Need Experiences–Well-/Ill-Being Relations. Different need experiences mediated the associations between availability pressure and well-/ill-being indicators: as hypothesized, we identified a positive indirect relationship between availability pressure and affect via relatedness satisfaction (H7c) and a negative one via competence frustration (H10b). In line with H8a/c and H11b, there were indirect relationships between

availability pressure and vitality via autonomy satisfaction (negative), relatedness satisfaction (positive), and competence frustration (negative). Consistent with H12a/b, we found positive indirect relationships between availability pressure and stress via autonomy and competence frustration. However, the remaining mediating paths were nonsignificant, leading to a rejection of H7a/b, H8b, H9a/b/c, H10a/c, H11a/c, and H12c.

Mindfulness as a Moderator. Trait mindfulness moderated the relationships between availability pressure and three need experiences: in line with H13a/d/e, probing the interaction revealed that availability pressure satisfied the need for autonomy more and frustrated the needs for autonomy and competence less when being mindful. In contrast to H13b/c/f, no significant interactions between availability pressure and mindfulness emerged when explaining variance in competence satisfaction, relatedness satisfaction, or relatedness frustration. Mindfulness also played a moderating role in the interplay between need satisfaction and well-/ill-being: as postulated, those users who had less competence satisfaction experienced more positive affect (H14b) and less stress (H16b) the more mindful they were. However, as the remaining relationships were not moderated by mindfulness, H14b/c, H15a/b/c, and H16a/c were rejected. Concerning the relationship between need frustration and well-/ill-being, mindfulness moderated three out of nine: as hypothesized, trait mindfulness weakened the associations between relatedness frustration and affect (H17c), competence frustration and vitality (H18b), as well as those between autonomy frustration and stress (H19a). However, contrasting H17a/b, H18a/c, and H19b/c, mindfulness did not moderate the remaining relationships.

Discussion

The results of S1 align with the IM³UNE's (Schneider et al., 2022) assumption that availability pressure leads to variations in need experiences (Figure 1, Figure A1), which are, in turn, differentially associated with well-/ill-being (Figure 1, Figure A2). However, given the diary study design, these relationships cannot be interpreted causally. For instance, it remains unclear whether perceived availability pressure led to variations in need experiences or rather different levels of need experiences affected the perception of availability pressure. Furthermore, only a few hypotheses about the mediating relationships (7 out of 18) were supported by the data. A possible explanation might be that unaccounted third variables, beyond those we controlled for, could have biased the relationships. Moreover, as data were collected in August 2020, participants' experiences of need frustration and their use of mobile communication might have been shaped by the circumstances of the COVID-19 pandemic. It is also worth discussing that the moderating roles of trait mindfulness were only supported in one-third of the associations (8 out of 24). This might be explained in two different ways: first, individuals differ not only in their degree of dispositional trait mindfulness but also because they cultivate mindfulness through contemplative practices (Burzler & Tran, 2022). Thus, the moderating effects might be more pronounced for cultivated than for trait mindfulness. Second, the measure used in this study only captures a narrow, awareness-based aspect of mindfulness. Future research might benefit from using more comprehensive mindfulness measures to examine the potential moderating role of mindfulness.

Study 2 (S2)

Rationale and Overarching Aims

S2 aimed to causally test the effects of availability pressure on need experiences (RQ1/RQ2) by applying an experimental design,[4] replicate the findings concerning the relationships between need experiences and well-/ill-being (H1–H6), examine potential indirect effects (H7–H12), and investigate the moderating role of *cultivated* mindfulness (H13, H14–H19). The IM³UNE postulates that health-promoting personality traits not only affect the beneficial versus detrimental consequences (in terms of need experiences and well-/ill-being) of mobile media demands, but also—in a first appraisal—the perceived valence of these demands. This might especially hold for mindfulness, which should help individuals non-judgmentally observe their emotional reactions to incoming mobile media demands (i.e., non-judging of inner experience), as well as refrain from automatically reacting to them (i.e., nonreactivity to inner experience; Baer et al., 2006). Mindful individuals may therefore be less likely to interpret a high number of incoming calls or messages as a pressure-evoking availability expectation, as they can deal with them in a self-determined way. It can thus be hypothesized:

- **H20**: Messenger users' mindfulness moderates the association between messenger-related demands and perceived availability pressure in such a way that for more mindful users, being exposed to messenger-related demands leads to less perceived availability pressure compared to less mindful users.

Method

Design and Manipulation. We conducted a pre-registered (https://osf.io/258av) two-factorial online experiment. Availability pressure was manipulated as a between-subjects factor using vignettes (Lutz et al., 2020). More concretely, we used screenshots of a WhatsApp chat triggering either a low or high level of availability pressure by varying: (a) the number of missed calls (i.e., one vs. five); (b) the urgency of the callback request (i.e., "whenever you got a minute" vs. "as soon as possible"); and (c) the sender's online status ("last seen" vs. "online"; Figure 2). Mindfulness as a within-subjects factor was cultivated using the meditation app 7Mind. Over the course of 4 weeks, all participants received weekly emails instructing them to use specific app content (e.g., mindfulness meditation or body scan; see OSF file "intervention program"). On average, they spent 159 minutes ($SD = 65.58$) completing 18 sessions ($SD = 9.62$). As further described in the Results section, both manipulations were successful.

Procedure. In 2023, following an identical schedule, we collected data in spring and fall over 4 weeks: first, using a screening questionnaire, participants provided their informed consent, demographic information, and contact details. Afterward, a pre-intervention questionnaire was used to collect participants' trait mindfulness and their emotional responses to the randomly assigned vignettes. At the end of this stage, participants

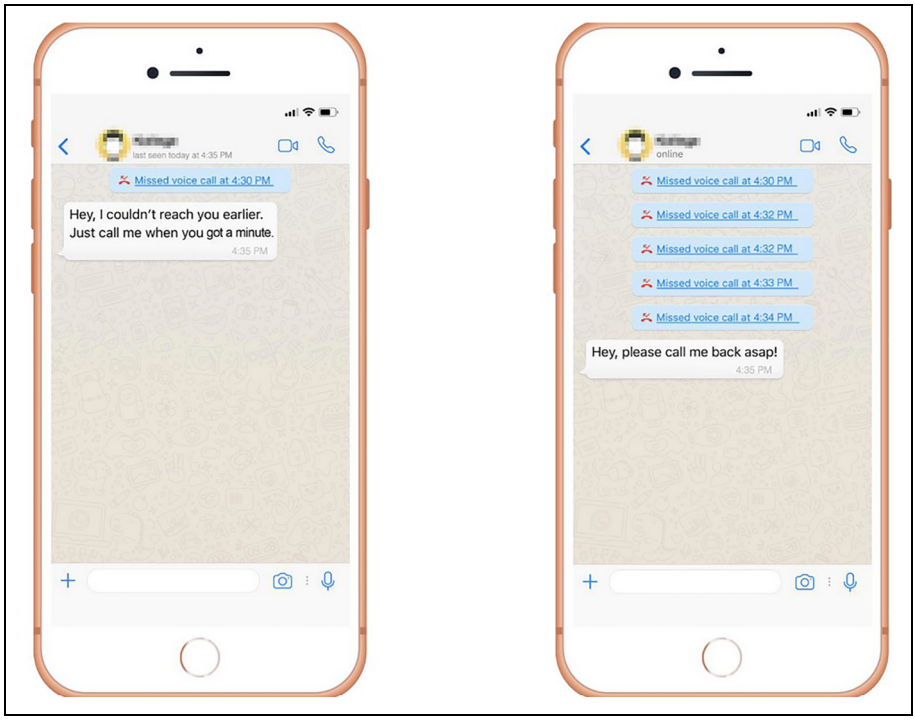

Figure 2. English Translation of the Vignettes Triggering Either a Low (Left) or High (Right) Level of Availability Pressure (Study 2).

received detailed instructions on how to install the 7Mind app. Then, the 4-week intervention period started. On each Monday, participants received emails instructing them to use specific content within the app. In the 5th week, they completed a post-intervention questionnaire assessing their trait mindfulness and emotional responses to the same vignettes as before the intervention.

Measures. All scales concerning the independent, mediating, and dependent variables were introduced to capture participants' appraisal of the demands displayed in the vignettes (i.e., "While looking at the WhatsApp screenshot, …"). We used the same instruments as in S1 to measure perceived availability pressure ($\omega_{t1} = .84$; $\omega_{t2} = .89$) and need experiences—with one modification: for competence satisfaction, we selected one item of the Intrinsic Need Satisfaction on Facebook Scale (Reinecke et al., 2014) that was most strongly associated with availability pressure in the context of smartphone use (Halfmann & Rieger, 2019).

Affect was measured using the Scale of Positive and Negative Experience (SPANE; Diener et al., 2010). On a 5-point agreement scale, participants indicated the extent to which they experienced six positive (e.g., happy; $\omega_{t1} = .95$; $\omega_{t2} = .96$) and six negative (e.g., sad; $\omega_{t1} = .88$; $\omega_{t2} = .90$) feelings. We created a balance score (SPANE-B) by

subtracting the negative from the positive sum score. Participants' vitality ($\omega_{t1} = .85$; $\omega_{t2} = .90$) and stress were measured using the same items as in S1.

The extent to which using 7Mind cultivated trait mindfulness (i.e., induction check) was assessed using the German short version of the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006; Burzler et al., 2019). The scale contains 23 items, covering the dimensions of observing (e.g., "I notice the smells and aromas of things," $\omega_{t1} = .69$; $\omega_{t2} = .77$), describing (e.g., "I'm good at finding the words to describe my feelings," $\omega_{t1} = .82$; $\omega_{t2} = .85$), non-reactivity to inner experience (e.g., "I perceive my feelings and emotions without having to react to them," $\omega_{t1} = .81$; $\omega_{t2} = .86$), acting with awareness (e.g., "When I do things, my mind wanders off and I'm easily distracted," $\omega_{t1} = .82$; $\omega_{t2} = .84$), and non-judging of experience (e.g., "Usually when I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about," $\omega_{t1} = .78$; $\omega_{t2} = .84$). These items were answered on a 5-point Likert scale ranging from 1 (*never applies*) to 5 (*applies very often*). This multidimensional operationalization fits our complex mindfulness intervention and was supported in a confirmatory factor analysis for both measurement times (see R Markdown section "CFA FFMQ").

We further assessed several control variables and both manipulation and attention-check items concerning the vignettes (see OSF file "S2_codebook"). Pearson correlations between all (in)dependent and mediating variables are reported in the R Markdown (section "descriptive and bivariate analyses," see OSF).

Participants. Following Lakens (2022), we justified our sample size based on resource constraints: with a budget of €6,000 and plans to reward participants with €20, we were able to recruit a maximum of 300 participants. We are aware that our financial restraints may result in low power for some hypotheses. However, following the power analyses that were initially pre-registered, those paths of the IM³UNE involving direct effects can even be tested with ca. 100 participants. Hence, we aimed to recruit as many participants as our budget affords—but at least more than 100.

As the 7Mind app offers free access for students, participants were recruited in two mid-sized German universities. Overall, 375 messenger users who had not recently engaged in mindfulness training completed our screening questionnaire. The sample size decreased from t_1 ($N = 306$) to t_2 ($N = 183$). As pre-registered, we excluded participants who completed fewer than 10 meditations ($n = 11$) or had an overall Relative Speed Index > 2 (Leiner, 2019) in at least one of the 3 questionnaires ($n = 6$). This led to a final sample of 166 participants. On average, they were 21 years old ($SD = 2.26$) and predominantly female (84%). Most of them were bachelor students (84%) and WhatsApp users (99%).

Results

As in S1, we conducted multilevel regression analyses (Hox, 2010) using the R-package lme4. Our final models each include the availability pressure manipulation as a between-subjects predictor (–0.5 = low, 0.5 = high), the mindfulness intervention as a within-

subjects predictor (–0.5 = pre, 0.5 = post), and again standard demographic (i.e., age, gender) and theoretically relevant (i.e., availability preferences, perceived obligation to be available, intention to deal with demands differently) control variables. For further statistical information, see the Online Appendix (Table B1; Figures B1–B6) and R Markdown (OSF).

Perceived Availability Pressure and Cultivated Mindfulness. The availability pressure manipulation successfully positively affected perceived availability pressure ($b = 1.01$, $p < .001$). Indicating a successful mindfulness cultivation within participants, the 7Mind intervention positively predicted the dimensions of observing ($b = 0.22$, $p < .001$), describing ($b = 0.16$, $p = .002$), non-reactivity to inner experience ($b = 0.33$, $p < .001$), acting with awareness ($b = 0.26$, $p < .001$), and non-judging of experience ($b = 0.34$, $p < .001$). Furthermore, both experimental factors significantly interacted when predicting perceived availability pressure ($b = 0.59$, $p < .001$). In line with H20, being exposed to a screenshot of a WhatsApp chat after the mindfulness intervention led to less perceived availability pressure than before the intervention. However, this seems to apply primarily to the low-pressure and less to the high-pressure condition.

Availability Pressure–Need Experiences Relations. The availability pressure manipulation significantly reduced autonomy and relatedness satisfaction (RQ1a/c) and increased autonomy, competence, and relatedness frustration (RQ2a/b/c). There was no significant effect on competence satisfaction (RQ1b).

Need Experiences–Well-/Ill-Being Relations. Specific need experiences were, as hypothesized, significantly related to the investigated well-/ill-being indicators: affect was positively associated with autonomy (H1a) and relatedness (H1c) satisfaction, and negatively associated with autonomy frustration (H4a). For vitality, we identified a positive relationship with relatedness satisfaction (H2c) and a negative one with autonomy frustration (H5a). Stress was negatively linked to autonomy satisfaction (H3a) and positively linked to autonomy frustration (H6a). The remaining relationships were insignificant, thereby rejecting H1b, H2a/b, H3b/c, H4b/c, H5b/c, and H6b/c.

Availability Pressure–Need Experiences–Well-/Ill-Being Relations. Our mediation analyses reflect 2–1–1 models, meaning the independent variable (i.e., availability pressure) is at Level 2, whereas the mediating (i.e., need experiences) and dependent (i.e., well-/ill-being indicators) variables are at Level 1. Following Zhang et al. (2009), we group-mean centered the mediator and added the group mean of the mediator as Level-2 predictor. As hypothesized, there were negative indirect effects of the availability pressure manipulation on affect via autonomy satisfaction (H7a), relatedness satisfaction (H7c), and autonomy frustration (H10a). The remaining three need experiences did not mediate this association, thereby rejecting H7b and H10b/c. In line with our assumptions, there were negative indirect effects of the availability pressure manipulation on vitality via relatedness satisfaction (H8c) and autonomy frustration (H11a). Rejecting H8a/b and H11b/c, there were no indirect effects via the remaining four need experiences. Finally, as predicted, there were positive indirect

effects of the availability pressure manipulation on stress via autonomy satisfaction (H9a) and frustration (H12a), but not via the remaining four need experiences (rejecting H9b/c and H12b/c).

Mindfulness as a Moderator. Concerning the moderating role of mindfulness in the interplay between availability pressure and need experiences, only for autonomy frustration, we found a significant availability pressure manipulation × mindfulness intervention interaction. In line with H13d, after the intervention, participants reported lower levels of autonomy frustration in response to the respective vignette than before the intervention. This difference was only significant in the low ($p < .001$), but not in the high availability pressure condition ($p = .768$). There was no empirical support for H13a/b/c/e/f. Concerning the moderating role of mindfulness in the interplay between need experiences and well-/ill-being indicators, we identified only one significant interaction (i.e., mindfulness intervention × autonomy satisfaction predicting vitality). However, the relationship was not, as postulated, moderated at low levels of autonomy satisfaction. Instead, when autonomy satisfaction was high, participants reported more vitality after than before the intervention. Thus, H14a/b/c–19a/b/c were rejected.

Discussion

S2 again highlighted that availability pressure can lead to different need experiences, which in turn affect messenger users' well-/ill-being. Given its experimental design, the links between availability pressure and need experiences can now be explained causally. Concerning the moderating paths, the results are less supportive: cultivating mindfulness only moderated the effects of availability pressure on one out of six need experiences (i.e., autonomy frustration). However, it did not, as had been assumed, buffer the need-frustrating effect of the high-pressure condition; it rather reduced autonomy frustration in the low-pressure condition. Interestingly, the same patterns were found regarding the appraisal of messenger-related demands: if the vignette was intended to convey high pressure, mindfulness did not reduce the perceived level of availability pressure. In contrast, in the low-pressure condition, the mindfulness training had a mitigating effect. This could be because the vignette of the high-pressure condition obviously triggered such high availability pressure that a 4-week 7Mind training did not cultivate enough mindfulness to cope with it.

The non-significant interaction effects might also be attributed to the type of intervention. Descriptive analyses reveal that although participants' mindfulness increased from t_1 to t_2, the change was not very pronounced. This may be due to the use of an online training app, which is less effective than face-to-face training (Hefner & Freytag, 2024), the relatively short training time (i.e., 1 hour per week), and the content of the training, focusing on mindfulness in general without targeting the specific area of messenger use. Additionally, the increase in self-reported mindfulness might also reflect participants' inclination to respond consistently to the mindfulness training.

General Discussion

As mobile connectivity plays a crucial role in mental health (Vanden Abeele, 2021; Vanden Abeele & Nguyen, 2022), the present studies explored how and when availability pressure leads to different facets of mobile messenger users' well-being (i.e., affect and vitality) and ill-being (i.e., stress). Importantly, the *mobility* of smartphones—meaning their constant physical presence in our pockets or hands—may be a key driver of such pressure, as it facilitates a perceived obligation to be permanently available, regardless of time and place. To disentangle the heterogeneous field of research (see High et al., 2023; Meier & Reinecke, 2021), we examined those mediating and moderating mechanisms specified within the IM³UNE (Schneider et al., 2022). Below, we briefly summarize the findings common to both studies and highlight some selected inconclusive patterns.

Common Patterns Across Both Studies

Availability pressure was negatively related to autonomy satisfaction and positively to autonomy and competence frustration. This is noteworthy, as it indicates that the mutual expectations of availability, which are particularly prominent in the context of *mobile* messenger services, may contribute to a lack of self-determined communication. However, availability pressure was not significantly related to competence satisfaction. For the relationships between need experiences and well-/ill-being, complex patterns emerged depending on the indicators: for affect and vitality, only relatedness satisfaction was positively correlated across both studies; for stress, autonomy frustration was negatively associated across studies, and neither competence and relatedness satisfaction nor relatedness frustration showed significant relationships. Furthermore, only a few results regarding (non)mediators were consistent: for none of the indicators, competence satisfaction and relatedness frustration played a mediating role. Only relatedness satisfaction mediated the link between availability pressure and affect and vitality, but not stress. Consistently across both studies, we found no significant moderating role of mindfulness in most associations (15 out of 24). However, we exploratorily found some direct significant relationships between mindfulness and competence satisfaction, competence frustration, and vitality across both studies. This suggests that—notwithstanding the unexpectedly rare and small interaction effects—being mindful and training mindfulness might have an overall positive effect on messenger users. In sum, both studies share more null findings than results that support hypotheses (23 vs. 6, respectively, out of 29 results consistent across both studies). Although due to potential power issues, we cannot conclude from null associations that they do not exist, specific assumptions derived from the IM³UNE, particularly those regarding the mediating and moderating relationships, were not consistently empirically supported.

Selected Inconclusive Patterns Across Both Studies

Although availability pressure was significantly associated with relatedness satisfaction in both studies, in S1, the relationship was positive, whereas the effect was negative in

S2. This also led to different mediations, showing that availability pressure—consistent with its conceptualization within the IM³UNE as mobile media *demand,* not stressor—did not have detrimental consequences per se: for instance, in S1, mediated via relatedness satisfaction, it was associated with increased affect and vitality. One reason for the discrepancy might be that participants in S1 thought about close relationships when answering items about perceived availability pressure. This may have led to positive associations with relatedness satisfaction (e.g., Taylor & Bazarova, 2021). In contrast, the manipulation in S2 referred to unknown others. In such a case, perceived availability pressure might be fully detrimental to need experiences. Moreover, S1 and S2 showed largely different patterns for the relationships between need experiences and well-/ill-being indicators, with some significant associations pointing in opposite directions. Although, for affect and competence satisfaction, this could be partially explained by the fact that we changed the measures, it is surprising that these heterogeneous and inconclusive patterns can be found even within two studies with comparable operationalizations. Finally, out of 24 possible relationships, mindfulness significantly moderated 8 in S1, but only 2 in S2. Interestingly, the significant moderating effects specified in the B1 paths of the model concerned the need for autonomy—the "perhaps most debated and studied need in SDT research" (Vansteenkiste & Ryan, 2013, p. 264)—in three out of four cases: whereas the influence of availability pressure on autonomy satisfaction and frustration was attenuated by (trait) mindfulness in S1, the relationship between availability pressure and autonomy frustration was strengthened by trained mindfulness in S2. This highlights that cultivated mindfulness has different features and benefits, and thus different effects than dispositional mindfulness (Rau & Williams, 2016): whereas dispositional mindfulness may make individuals more resistant to potential threats to their autonomy, cultivated mindfulness might (at least initially) foster greater awareness of such threats. The moderating effects specified in the B2 path of the model are few and very inconsistent. It is noticeable that there are more significant moderating effects in the first study than in the second. This may be related to different mindfulness types (S1: trait; S2: cultivated) or operationalizations (S1: MAAS; S2: pre-post-condition as successfully indicated by changed FFMQ scores), which might have affected the results (Burzler & Tran, 2022). Concerning both moderating paths (i.e., B1 and B2), it could be that mindfulness more strongly affects the perception of real-life experiences (S1) than those of artificial vignettes (S2). Finally, given the high number of young, highly educated, and female participants within both studies' samples, it might be interesting to replicate these studies in an older population that differs in messenger use intensity, internalized availability norms, and susceptibility to the effects of mobile media demands (Reinecke et al., 2017).

Conclusion, Limitations, and Outlook

In light of the assumptions derived from the IM³UNE (Schneider et al., 2022), our results have shown that satisfying versus frustrating fundamental needs for autonomy, competence, and relatedness do indeed represent qualitatively different experiences (Vansteenkiste & Ryan, 2013) and do not always go hand in hand. Moreover, although only partially consistent with our hypotheses, these need experiences in turn differentially

explain various states of well-/ill-being (Martela & Sheldon, 2019). Importantly, this paper is—together with Meier (2018) and van de Casteele et al. (2024)—among the first that study the mediating roles of both need satisfaction *and* frustration simultaneously. Future research is needed to further investigate why some associations (e.g., availability pressure and competence satisfaction) could not be supported across both studies and to replicate those that were inconsistent. One explanation for these inconsistencies might be that the constructs of need satisfaction and frustration encompass a wide range of subjective experiences, which can make it difficult to capture them reliably and comparably. However, as we aimed to economically measure the mediating need experiences in the diary study and keep it comparable in the experiment, we only used single items. Addressing this limitation, future research could incorporate more comprehensive and fine-grained measures that better reflect the complexity of these constructs (e.g., the BPNSFS as used by van de Casteele et al., 2024). Another avenue could delineate those variables serving as our set of statistical controls and thus as robust boundary conditions against which we tested our hypotheses. For instance, availability preferences or norms (e.g., 20–23; Hall & Baym, 2012) can be seen as internalized mobile media demands, and manipulating their salience may give additional insight into their causal link to perceived availability pressure and its consequences. Besides these suggested attempts to improve our operationalizations within the chosen methodological paradigm, future approaches could focus on the actual use of mobile devices in relation to encountering demands and experiencing need satisfaction and frustration using in-situ measurements such as experience-sampling methods (e.g., Dogruel & Schnauber-Stockmann, 2020; Gilbert et al., 2023) or tracking data (e.g., Van Gaeveren et al., 2024).

Although the moderating role of mindfulness was only partially supported, across both studies, mindfulness was directly positively related to need satisfaction and well-being and directly negatively related to need frustration and ill-being. In S1, trait mindfulness was significantly positively associated with competence satisfaction and vitality and negatively associated with autonomy and competence frustration. In S2, after the 7mind intervention, regardless of the type of vignette they saw, participants reported significantly more need satisfaction, less need frustration, more positive affect and vitality, as well as less stress than before the intervention. As this aligns with previous mobile media research investigating direct links between mindfulness and well-/ill-being (e.g., Bauer et al., 2017; Hefner & Freytag, 2024), we recommend refining the IM³UNE to also account for direct effects of health-promoting traits. As mobile media demands are embedded within broader structural contexts (Büchi, 2024), structural solutions beyond the individual level—which were the focus of the present research (i.e., mindfulness)—also warrant attention. On a meso level, organizations could establish health-promoting availability norms by clearly defining when employees are expected to be reachable and when they can disconnect from work-related communication. Similarly, norms concerning availability and disconnection are also relevant within family and friend groups (Geber et al., 2024). On a macro level, platform developers could foster more need-supportive environments: for instance, by providing users more autonomy over their notification preferences. Furthermore, political measures (e.g., banning private mobile phones in school settings) should be thoroughly evaluated with regard to their potential need-supportive or need-thwarting consequences. In this spirit,

mindfulness may help better tackle specific mobile media demands, such as availability pressure elicited by mobile messengers, as well as demands and stressors arising from our everyday life.

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Data Availability Statement

All data and material referred to in the article are publicly available in the OSF (see https://osf.io/92jw6/).

Supplemental Material

Supplemental material for this article is available online.

Notes

1. Due to space limitations, this article only summarizes the main argument concerning each model path. For a comprehensive theoretical derivation, please refer to Schneider et al. (2022)—the theoretical paper introducing the IM³UNE in detail. Please note that we follow the original hypothesis structure introduced by Schneider et al. (2022), as using group labels instead would neither reduce the number of model paths to be tested nor allow for a clear assignment of each path to its corresponding hypothesis.
2. The first study was part of a bigger research project testing all proposed paths of the IM³UNE. Thus, to reduce participant burden, our constructs were operationalized using short scales or single items. As already outlined in the introductory paragraph, this paper focuses on availability pressure as a mobile media demand and mindfulness as a health-promoting trait.

3. To test the robustness of our results, we additionally calculated models: (a) excluding these control variables, and (b) controlling for time variables (i.e., day of the week and time of the day). As summarized in the OSF file "S1_Model Comparison," these models yielded similar patterns regarding the significance and direction of effects.
4. We formulated open research questions as the IM³UNE implies a directional effect of availability pressure on need experiences, but does not specify whether this effect would be positive versus negative.

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