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Mobile Instant Messaging Uses and Technostress: A Qualitative Approach

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Abstract:	A growing number of people use mobile instant messaging (MIM) apps for a variety of purposes—most commonly related to social interaction, but also to coordinate work-related activities, fulfill informational needs, and discuss politics and public affairs. Despite its convenience for daily life, MIM may also act as an environmental antecedent of technostress due to users' inability to cope with the demands of the app in a healthy manner. We conducted two qualitative studies (N1 = 26; N2 = 147) to examine why people use MIM apps in their daily life and if diverse uses relate to MIM stress differently. This research 1) develops a general catalogue of MIM uses; 2) suggests a four-dimensional construct of MIM technostress consisting of overload, ambiguity, invasion, and urgency; 3) outlines several differences across age groups and between genders; and 4) describes possible relationships between MIM uses and stress.

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Professor Stephanidis
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Dear Prof. Stephanidis,

Thank you very much for the opportunity to revise our article, entitled, "Mobile Instant Messaging Uses and Technostress: A Qualitative Approach." The comments offered by the reviewers have been extremely interesting, useful, and enlightening.

In the revised version, we have strengthened the theoretical arguments, provided more details on our methodological approach and, also importantly, examined age- and gender-related differences that are associated with MIM uses and the different technostressors—at least in our samples. We are indebted to the Managing Editor and the three anonymous Reviewers as we strongly believe this manuscript is much improved.

We look forward to hearing from you. Best regards,

Alberto Ardèvol-Abreu
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Mobile Instant Messaging Uses and Technostress: A Qualitative Approach

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Mobile Instant Messaging Uses and Technostress: A Qualitative Approach

Abstract

A growing number of people use mobile instant messaging (MIM) apps for a variety of purposes—most commonly related to social interaction, but also to coordinate work-related activities, fulfill informational needs, and discuss politics and public affairs. Despite its convenience for daily life, MIM may also act as an environmental antecedent of technostress due to users' inability to cope with the demands of the app in a healthy manner. We conducted two qualitative studies (N_1 = 26; N_2 = 147) to examine why people use MIM apps in their daily life and if diverse uses relate to MIM stress differently. This research 1) develops a general catalogue of MIM uses; 2) suggests a four-dimensional construct of MIM technostress consisting of overload, ambiguity, invasion, and urgency; 3) outlines several differences across age groups and between genders; and 4) describes possible relationships between MIM uses and stress.

Keywords: Mobile Instant Messaging Uses, Technostress, Overload, Ambiguity, Invasion, Urgency.

Mobile Instant Messaging Uses and Technostress: A Qualitative Approach

Mobile instant messaging (MIM) apps are changing the way people communicate with family, friends, or coworkers (Valeriani & Vaccari, 2017). Similar to other social media, people seem to be using MIM for diverse purposes, primarily for *social interaction*, but also as a *source of news* and information, a platform for *political talk* (Gil de Zúñiga et al., 2014; Valeriani & Vaccari, 2017), or a tool for *work-related activities* (Thomas, 2018). Recent research on the consequences of MIM use show a somewhat mixed picture: While some studies suggest a variety of individual and social benefits arising from MIM-mediated interactions, such as improving subjective well-being and social connectedness (Bano et al., 2019; Chan, 2015); others point to MIM as an antecedent of stress (Blabst & Diefenbach, 2017; Shin, et al., 2018). Given the mid- and long-term consequences of stress on psychological health and well-being (Lazarus, 1991; Lazarus & Folkman, 1987), a better understanding of the link between MIM uses and stress is needed.

The permanent flow of incoming alerts, combined with on-screen prompts to interact ('last seen' and 'read receipts'), and social pressures to reply in a timely manner (Blabst & Diefenbach, 2017; Lee et al., 2016) may lead some users to feel they are not able to cope with the communicative demands of the app, what we argue as MIM stress (see Lazarus, 1990; Tarafdar et al., 2007, 2019). Based on a processual perspective of stress (Lazarus, 1990; Lazarus & Folkman, 1987), this article explores the role of MIM as a potential antecedent of technostress. To do so, we build on and extend previous research on technostress that identified five stressors associated with information and computer

technology (ICT) use in the organizational domain: overload, invasion, complexity, insecurity, and uncertainty (Tarafdar et al., 2007, 2019).

Using two different sources of data collected in Spain (focus group discussions with 26 adults and a qualitative survey of 147 undergraduates), we analyze people's interaction with MIM in their daily life and propose a comprehensive, specific, and updated taxonomy of uses. Moreover, we extend and systematize previous findings into a theory-driven, multi-dimensional construct of MIM technostress and explore its association with different uses of MIM. Finally, we also examine gender- and age-related differences in MIM uses and associated technostress. Hence, this study is intended to contribute to both the literature on uses of MIM and technostress.

MIM Uses

MIM apps allow people to communicate with virtually everyone, from anywhere, at any time, potentialities that have only become more important since the Covid-19 outbreak. Although they are primarily intended for text messaging, they also offer voice and video calls and file sharing. WhatsApp is the major player in the market: More than 2 billion active users in more than 180 countries exchange roughly 100 billion WhatsApp messages every day (Cathcart, 2020; WhatsApp, n.d.). In Spain, recent figures from the Reuters Institute indicate that 81% of those surveyed use WhatsApp, which makes it the top MIM app in the country (Newman et al., 2020). Other messaging services that are growing market share around the world in recent years are Telegram and Line. Although MIM apps seem to be used more and more by people of all ages, research suggests that their intensity and type of usage varies across age groups and between genders (see Costa-Sánchez & Guerrero-Pico, 2020; Kircaburun et al., 2018; Rosales & Fernández-Ardèvol, 2016), an observation that deserves further exploration.

A general orientation to study how audiences use the media is the uses and gratifications (U&G) framework. This paradigm posits that individuals use the media actively, and their selection of media channels or sources is an attempt to fulfill specific needs (Quan-Haase & Young, 2010; Rubin, 2009). Within this theoretical framework, a relatively small body of literature has approached the uses that people (or, more commonly, specific social or professional groups) make of MIM apps. An important precursor or this literature was an influential study on motives for chatting on the *desktop* instant messenger ICQ (Leung, 2001, revisited by Quan-Haase & Young, 2010). Leung's gratifications sought from ICQ included, among others, affection, inclusion, sociability, entertainment, and escape.

More recent studies on *mobile phone-based* IM apps suggest that people use them mainly for *social interaction*, that is, to keep in touch with friends and family and coordinate daily and leisure activities. This use of MIM apps may be driven by their ability to create a "heightened sense of presence" (Karapanos et al., 2016, p. 892) and connects with the social needs of affiliation and intimacy (see Reeve, 2009). In this vein, a recent study found that individuals' motivation to maintain existing relationships is positively related to WhatsApp use (Kircaburun et al., 2018). In another study that focused on affiliation motivation, Makki and colleagues (2017) found that undergraduate students use Snapchat for maintaining and developing relationships, expressing positivity, and telling their loved ones "how important they are to [them]" (p. 415). This motive seems to be relevant for both women and men, although there may be differences in its behavioral expression: Women may tend to use MIM—and other ICTs—for maintaining existing relationships and building bonding social capital, while men's use may be more associated with meeting new people and socializing (Kircaburun et al., 2018; Piwek & Joinson, 2016; see also Costa-Sánchez & Guerrero-Pico, 2020; Vidales-Bolaños &

Sádaba-Chalezquer, 2017). The few existing studies that involve samples with wide age ranges suggest that social interaction uses are common across age groups, even though exchanging personal affective information seems to be more frequent among late teens (e.g., Martínez-Comeche & Ruthven, 2021).

MIM is also increasingly adopted for *work-related* information exchange (Thomas, 2018). For example, a survey study among health professionals at five British hospitals found that 33.1% of doctors and 5.7% of nurses used MIM apps to share patient-related information (for example, to seek a colleague's opinion) (Mobasheri et al., 2016). Relatedly, Chou and Liu (2016) reported "application" motives for using LINE such as talking about business or executing commercial transactions.

Other apparently less common uses of MIM include *news* gathering and sharing and *discussing politics* in one-on-one or group chats—mainly in private groups with close ties, but increasingly more in large 'public' groups that may contain strangers— (Newman et al., 2019; see also Canavilhas et al., 2019; Pont-Sorribes et al., 2020; Valeriani & Vaccari, 2017). Thus, one of the motivations of elderly adults in Taiwan for using LINE is to acquire and update information (e.g., news or traffic information) (Chou & Liu, 2016). More recently, Gil de Zúñiga et al. (2021) adapted previous measures of social media U&G and found WhatsApp use for political discussion to be an important antecedent of conventional participation and protest. Previous studies also suggest gender differences in this type of use such that men may be more likely to exchange "messages about politics" (Martínez-Comeche & Ruthven, 2021, p. 6).

Building on these previous reports, our first step is to create a catalogue of MIM uses that is not focused on specific social or professional groups and may be

comprehensive, MIM-specific (but not tool-specific), updated, and adapted to the national context of our study. We therefore ask our first research question:

RQ1: What are the reasons why adults currently use MIM apps?

MIM Stress

Transactional-based models describe stress not as a single construct, but as a dynamic system in which specific environmental conditions create demands that the individual evaluates as damaging or taxing on their resources. This transactional account has provided a theoretical foundation for a large part of studies of technostress, especially at the organizational level (Ragu-Nathan et al., 2008; Tarafdar et al., 2019). But technostress may not be limited to the work setting: Tarafdar and colleagues have drawn attention to "the pervasiveness of IS [Information Systems] in the non-work context" (2019, p. 27), and encourage the examination of technostress in other environments—for example, the personal life.

In the current networked society, certain characteristics of "not primarily work-related" IS (e.g., social media) seem to be associated with feelings of overload and fatigue (Lee et al., 2016, p. 54). More germane to this work, a study conducted among young and 'stressed by MIM' South Korean participants found that these apps are sometimes perceived as being "too close and too crowded" (Shin et al., 2018, p. 1). For example, strangers or unwanted persons can use MIM to contact anyone without previous acceptance, creating pressure on recipients to respond (too close). The crowdedness alludes to perceptions of having too many contacts and getting an excessive number of notifications, which frequently result in fatigue, distractions, and stress (Shin et al., 2018). However, findings on this area are mixed and reveal many nuances in the effects of MIM. Some work suggests that WhatsApp-based interactions increase psychological well-being (Bano et al. 2019, in a study with Pakistani undergraduates) and social

connectedness (Chan, 2015), while other evidence indicates that this positive association with well-being occurs only with passive uses (reading MIM *without* engaging in direct exchanges; Beyens et al., 2020).

These previous findings make it seem likely that *specific* uses of MIM create stressful situations where individuals perceive some of the characteristics of the app (MIM stressors) as damaging. Some of the already defined techno-stressors may also be relevant for our understanding of the MIM stress process. This applies to *overload* and *invasion*, which have been negatively associated with job satisfaction, productivity, and psychological well-being (see Lee et al., 2016; Ragu-Nathan et al., 2008; Schieman & Young, 2013; Tarafdar et al., 2007).

Concerning *techno-overload*, MIM apps typically provide users with large amounts of information from their contacts, especially when they are part of groups or chat rooms. A recent report indicates that growing numbers of WhatsApp users are joining large 'public' chat groups with people they do not know, in which they discuss about "news and politics" and "local community" issues (Newman et al., 2019, p. 20). More generally, users' chat window may be filled up with text messages, links, and audio and video files about work shifts and pending work tasks, kids after-school activities, neighborhood association meetings, news, etc. All this information may accumulate in (some) users' chat interface and feed their perception of "being burdened" (Misra & Stokols, 2012, p. 739) or force them "to deal with excess of information" (Tarafdar et al., 2019, p. 9). *MIM overload* resembles Tarafdar et al.'s (2007) techno-overload dimension of technostress, described as "situations where ICTs force users to work faster and longer" (p. 315). This is what Blabst and Diefenbach (2017) found in an exploratory survey of university students: The number of one-on-one WhatsApp conversations in the previous days was positively associated with feelings of stress (single-item measure). They also found that

users who made an active use of 'last seen' and 'read receipts' (i.e., checking when their contacts were last online or if they read their messages) reported higher levels of stress than those who did not pay attention to this information.

Invasion may also be relevant to explain the MIM stress process. This dimension of technostress is commonly understood as the perception that the use of ICTs increases the permeation of work into the personal life (Bucher et al., 2013; Tarafdar et al., 2007, 2019). A similar argument may be applied to more personal uses of MIM apps: 'anytime anywhere' MIM conversations have potential to infiltrate every moment of users' lives, pushing them into permanent multitasking and reducing their attentional and cognitive resources to other tasks (Reinecke et al., 2017). MIM (over)use may therefore interrupt people's daily routines, making it difficult to fully focus on other personal, interpersonal, social, or professional activities. This suggests that some MIM users will be burdened with feelings of *MIM invasion*. Indeed, a survey study conducted among Spanish students found that almost 63% of them "definitely agree" with the assertion that using WhatsApp and BlackBerry Messenger can become a real nuisance, "especially when one is engaged in another activity" (Fondevila-Gascón et al., 2014, p. 9).

Besides these more classical dimensions of technostress, MIM users may evaluate other characteristics of MIM apps as harmful to their well-being. We aim to extend and systematize previous observations and studies under the theoretical framework of MIM technostress, which we theorize as a multi- rather than a single-dimensional construct. Moreover, we aim to examine how distinct patterns of MIM use contribute to the different dimensions of MIM-associated stress. More formally:

RQ2: What characteristics of MIM are evaluated as harmful (MIM stressors)?

RQ3: What specific uses of MIM apps are associated with the different dimensions of MIM stress?

Methods

Study 1

We conducted a first qualitative study based on focus group discussions. This approach helped us answer RQ1 and RQ2 (uses of MIM and MIM stressors). Because stressors—or distressors— "are stress creators *appraised* by the individual as threatening" (Tarafdar et al., 2019, p. 10, italics are ours), it is important to listen to MIM users' evaluations as to why they perceive certain conditions, associated with MIM use, as harmful. The Ethics Committee of ANONYMIZEDXXX (registration # 2020-0419) reviewed approved the study. The public opinion company ANONYMIZED used their panel of respondents and social media channels to recruit a sample of 26 Spanish adults who reported using MIM every day. In the light of the epidemiological situation at the time, we opted for videoconference meetings. Discussions were conducted between December 15, 2020, and January 19, 2021. Each discussant received €18 as compensation.

All participants used WhatsApp daily, six were Telegram users, and only one of them had Snapchat and used it occasionally. To facilitate the opening up and stimulate interaction, we formed homogeneous groups in terms of age (groups 1-4) or other personal characteristics (group 5, see below). The first group (G1) was comprised of five college-age adults (21 to 28 years old, M = 24.0; two females; three students and two unemployed); G2 included six young adults (33 to 44 years old, M = 38.8; three females; two unemployed and one furloughed due to the pandemic); G3 incorporated four middle-aged adults (48 to 53 years old, M = 50.7; three females; one unemployed); and G4 consisted of five old adults (69 to 85 years old, M = 73.6; three females; four retired and one never worked). We also created a high-demand group (G5),

whose six members potentially faced more and more varied stressors because they worked full-time, had children at home, and reported high levels of political interest—which may lead to increased use of MIM for news and political discussion—(38 to 54 years old, *M* = 47.3; three females; two private sector workers, one public sector worker, and three business owners or self-employed). Some discussants received help from their family in adjusting the video conference settings, but once the sessions started, participants were alone. Discussions lasted between 49 and 62 minutes and were moderated by the authors and transcribed by the company. The first part of the sessions focused on MIM uses (with no reference to stress) and the second part on participants' views of MIM as a stressor.

Study 2

This second study was also approved by the Ethics Committee of ANONYMIZEDXXX (registration # 2020-0450). We conducted an online survey to assess the applicability of the categories developed from Study 1 (MIM uses and technostressors, RQ1 and RQ2, respectively) to a different sample, as well as to examine the relationship between specific uses of MIM and technostressors (RQ3). Respondents were asked about "a recent experience with MIM that increased or decreased [their] feelings of stress." We included the option to narrate a stress-reducing experience in order not to force participants to appraise MIM as a source of stress.

Following Karapanos et al.'s procedure (2016), we asked respondents to take a few minutes to recall a single experience and describe its context and the reason why they believed the use of MIM increased or decreased their feelings of stress. This concrete approach to a single experience reduces respondents' recall and selection biases (Karapanos et al., 2016). It also relieves participants from the difficulty of considering a myriad of uses and experiences to provide a *general* view of MIM as a stressor (as in Study 1). We distributed the survey link

through email to a convenience sample of psychology and communication students at the University of ANONYMIZED (Spain) between March 1 and March 23, 2021. We obtained informed consent from all respondents, who voluntarily completed the survey and received course credits for their participation. In addition, respondents were assured of the anonymity of their responses. Out of 313 students who were sent the link, 147 (102 in psychology and 45 in communication studies) returned valid questionnaires. Respondents were predominantly female (76.9%) with ages ranging between 18 and 45 (M = 20.4, SD = 4.0). Some of them (13.6%) combined their studies with work. Only three students had children. Descriptions of their experiences ranged in length between 9 and 1,881 characters, including spaces (M = 282.6, SD = 231.9).

Data Analysis

We first created text files that reproduced the conversations in Study 1 and the open-ended responses in Study 2. We then submitted the resulting documents to a combination of deductive and inductive content analysis (Elo & Kyngäs, 2008). In a first, open approach to the data, we attended to the manifest content of the group discussions without imposing preconceived categories. According to guidelines in qualitative research, the first and the second authors generated a coding frame that captured possible MIM uses (RQ1) and possible dimensions of MIM stress (RQ2). The divergences of the coding frame were resolved through a team discussion involving all authors. In a second stage, we compared and—when possible—adapted our labels to those of prior relevant literature on media U&G and technostress. Thirdly, we applied the resulting categories to the different, less diverse sample of Study 2.

Results

MIM Uses

Data from Study 1 revealed five broad uses of MIM (Table 1). First, all five discussion groups indicated that the main MIM use was "to stay in touch [… and] know about the people [they] love" and deep in their relationships with family, friends, or coworkers. This dimension connects with the psychological needs for relatedness and intimacy (Reeve, 2009). It is similar to affection as one of the "intrinsic motives" for using the desktop chat software ICQ detected by Leung (2001), and to relational maintenance as a "social motivator of Snapchat use" among students (Makki et al., 2017, p. 413). We have labeled this set of uses as *relatedness, intimacy, and social interaction*, which includes two main subdimensions: a) *relatedness and intimacy* and b) *planning and coordination of social activity* (examples in Table 1). Most participants of both genders and from all groups referred to MIM as a tool to maintain emotional bonds with close ties: spouse, immediate family, and close friends (bonding networks). Nonetheless, two young male discussants in G1 indicated that they participate in large MIM groups where they interact with weak ties: people they "never met in person" (group #1, male, 26) or "they have only met in person once" (#1, male, 22) (bridging networks). More interestingly, three members of the senior group also referred to these weak tie interactions in large MIM groups: with Pilates and embroidery classmates (#4, female, 74), photography enthusiasts (#4, male, 70), or members of the fitness club (#4, female, 69).

[TABLE_1]

The second dimension comprises *work-, study-, and business-related* (non-social) *uses*, which includes scheduling working meetings, helping coworkers with problems, coordinating class assignments, distributing "documents, exams, cheat sheets," etc. This category is analogous

to that of social media use for work-related purposes in the literature on information systems (see, for example, Zhang et al., 2019). From a U&G perspective, this dimension can be interpreted as a response to the quasi-needs for job, money, and a career plan (Reeve, 2009). Based on life cycle, employment status, and other differences among participants, discussions in Study 1 revealed four subdimensions of this domain: c) *work*, d) *study*, e) *advertising and sale/purchase transactions*, and f) *job search*. As expected, this dimension was underrepresented in the older group (G4), while the study-related subdimension was more often reported by younger participants.

Third, participants in most focus groups recounted using MIM for *political and civic purposes* such as "shar[ing] a news story and [starting] some discussion," informing about demonstrations and protests, or organizing neighborhood-based volunteer activities. This is consistent with related findings alluding to parallel uses such as MIM for political discussion or social media for political participation (Gil de Zúñiga et al., 2021; Kim & Khang, 2014). Political and civic uses of MIM point to acquired social motivations such as affiliation, power (Reeve, 2009), or cognition (Cacioppo et al., 1996). Within this general domain, the analysis of focus group data revealed three more specific subcategories: g) *news and political talk*, h) *political participation*, and i) *civic engagement*.

The fourth dimension includes *domestic and other non-work commitments* such as scheduling the "pick up of [their] granddaughters", "ordering water bottles," preparing the grocery shopping list, or coordinating the purchase of family gifts. As with the *work, study, and business* dimension, this category of usages is also a response to "situational demands and pressures" (Reeve, 2009, p. 173) that are at the origin of quasi-needs. Domestic commitments may also be close to certain physiological and psychological needs (e.g., people go to the

supermarket partly based on their need for food, and they buy Christmas gifts in connection with their need for relatedness and intimacy). These uses were reported in all groups except G1 but were undermentioned in comparison with the previous ones.

Finally, some participants use MIM for *pastime and entertainment*: To fill the "many dead times" of the day, beat boredom, talk for the sake of it, sharing some content that one finds constructive, pleasant, fun, etc. This category of uses responds to the innate human curiosity and the intrinsic motivation to seek out (Reeves, 2009, p. 144), and is common in the literature of social media (see Leung, 2001; Quan-Haase & Young, 2010). It also resonates with MIM-related entertainment uses detected among teenagers, especially males, such as playing videogames and "coordinat[ing] the necessary movements during games" (Costa-Sánchez & Guerrero-Pico, 2020, p. 6).

As an initial test of the transferability of this category system, we tried to identify MIM uses on the different sample of Study 2. We content analyzed the 147 open-ended responses and identified some of the uses above in 122 of the reported experiences (i.e., almost 83% of the responses). The rest of the experiences did not provide enough information to assign a specific MIM use. Most of these 122 cases connected with relatedness, intimacy, and social interaction (80, 65.6%) or work-, study-, and business-related uses (32, 26.2%). In fact, as one would expect from the characteristics of the sample, work and business were a relative minority (10), and this category was clearly biased towards study uses such as "organizing [group] assignments from home," "clarifying [assignment-related] doubts very quickly," or "discussing with other classmates the syllabus and conditions of an exam." Two experiences (1.6%) alluded to political and civic uses; another two detailed domestic and other non-work commitments; and one more (0.8%) recounted a pastime- and entertainment-related use. Five cases alluded to a combination

of two uses (study and political, study and relatedness [2], study and domestic, relatedness and pastime) (see more examples in Table 1).

Dimensions of MIM Stress

Data from Study 1 also shed light on the reasons why individuals may evaluate the demands of MIM as taxing on their resources. While previous studies had suggested some of these MIM-specific stressors, the present article expands these perspectives and brings them together under the technostress framework. It should first be noted that the analysis of discussions does not suggest a simple linear association between MIM use and stress. Some participants described situations were using MIM helped them deal with stressful situations, as if it was part of coping responses to other difficulties of the 'offline world.' MIM use helped them *finding personally relevant information*—"It is quite reassuring when you forget something and someone mentions it [via WhatsApp], or when you have an urgent doubt, such as a question about the classes" (#1, female, 23)—; *escaping from real-life problems*—"It doesn't stress me out too much; on the contrary, it helps me escape. Sometimes I must deal with a lot of pressure at work, and I check WhatsApp to relax a bit and giggle at some nonsense" (#2, male, 37)—; or *seeking for social and interpersonal support*—"It really gives me peace of mind to know that I can contact my family anytime, at any time of the day or night" (#4, f, 69).

Senior participants in G4 were the ones who perceived their interaction with MIM more positively in affective terms. "Reassuring" and "relaxing" were the most repeated adjectives spoken by older participants to evaluate their use of MIM. They barely mentioned any situation where MIM use made them feel stress. This may partly be due to their pattern of use of MIM: mostly for relatedness, intimacy, and social interaction, and almost never for work or business. Furthermore, their reported frequency of usage was lower, and they seemed to experience less

pressure to be available online and reply immediately: "The people I contact with are aware that I am not constantly checking WhatsApp; therefore, I do not feel any pressure" (#4, f, 74).

Despite this positive, stress-reducing potential of MIM, the analysis of the focus group data yielded four major dimensions of MIM stress (Table 2). Male and female participants in all groups mentioned difficulties in dealing with the large flow of incoming messages, most of which require attention and action. Following previous studies on work-related technostress and information overload (Misra & Stokols, 2011; Tarafdar et al., 2007), we called this dimension *MIM overload*: "Suddenly you have three people talking to you at the same time" (#1, m, 21); "200, 300, 400 messages […] you cannot read" (#1, f, 23). This sometimes includes low quality information—e.g., "evident fake news about politics, society…" (#4, f, 74)—that users need to filter or refute, which may be particularly stressful in connection with health news in the pandemic context. Some key features of the MIM apps (notification sound, vibration, etc.) seem to increase the perception of overload: "If I'm always hearing [the notification sound] in the background, there comes a moment when I become overwhelmed" (#5, f, 39). Overload is more likely to arise when participants interact in large MIM groups, and common coping strategies were silencing group chats, ignoring messages or, more rarely, deleting entire conversations.

[TABLE_2]

The second dimension that emerged from our qualitative data is *MIM invasion*, which is similar to invasion in the literature on technostress at work (see, for example, Tarafdar et al., 2007). It mainly refers to the MIM-facilitated permeation of work, study-, or business-related issues into the personal domain: "I finish my workday and I keep receiving work-related instructions" (#1, f, 28). The lockdown and home confinement worsened the situation for some of our discussants because work schedules "are not the same as they used to be": "[Some

coworkers] connect at night and text you" (#3, f, 48), or schedule work shifts and define tasks without considering that "you are outside working hours" (#1, f, 28). More broadly, not work-related MIM can also invade interpersonal relationships: "Many times I am engaged in a conversation […] and though the conversation may be super interesting, they may shift their attention to the screen. That's an invasion of our contact […]" (#1, m, 26). Following previous literature on technostress (Barber & Santuzzi, 2015; Tarafdar et al., 2019), we also include in this dimension the feelings of pervasiveness, or the perception that MIM technology never gives one a break. It does not refer to the number of messages (as in overload), but to the potential of the technology to interrupt people's "daily routines" (#5, f, 39) and its power to divide one's attention: "And one has to constantly keep an eye on the phone and... These new technologies do help a lot, generally speaking. But they are also time-consuming and stress you out, I think" (#2, m, 44). This perceived invasive nature of MIM was associated with both one-on-one and group chat interactions and expressed in all group discussions except G4 (senior).

Thirdly, women and men in all groups except G4 raised concerns about the sense of *urgency of response* associated with MIM use. In the IS literature, expectations of immediate response to work-related demands are part of the techno-invasion stressor (Tarafdar et al., 2019). Some participants and respondents, however, made an implicit distinction between both dimensions, and we have therefore chosen to consider *invasion* and *urgency of response* as separate—but related—stressors. For example, this mother is unlikely to view her daughter's messages as an invasion of her personal life, but she admits feeling pressured by her impatience: "[My] 11-year-old daughter has now a mobile phone, she has WhatsApp on it and is very impatient […]: 'Answer me, now' […]; 'Mom, answer; mom, answer.' And I say: 'My God, I can't right now'" (#5, f, 39). In a similar line, a 37-year-old male participant in G2 points out that

"it is an instant messaging technology, but it does not mean that you have to read [the messages] instantly." Indeed, some discussants reported turning off the blue ticks (read receipts) in the app as a coping strategy to minimize stress: "[…] Because it is true that I had a certain self-pressure to respond as soon as I got the message. It seemed wrong to me that others knew I had read it and not replied" (#3, f, 48). As for the invasion stressor, feelings of urgency arise in both one-on-one and group conversations.

Finally, the last stressor that emerged during the analysis was *MIM ambiguity*. It refers to the lack of human presence and appropriate context (e.g., tone of voice and non-verbal cues that indicate the communicative style and define the intention) that frequently characterize MIM-mediated communication. This loss of intangible elements sometimes leads to misunderstandings and misinterpretations of one-on-one or group conversations: "[…] People writing behind a screen are very brave, or sometimes they say things that are misinterpreted, or etcetera etcetera, don't they?" (#5, m, 53); "[I have moments] of stress, of saying to myself: 'Why did they say this? Why did they say that? Why is he now replying in this way?' This kind of misunderstandings that […] create some sort of anxiety" (#3, m, 52). Interestingly, none of the participants in G4 expressed feelings of ambiguity related to MIM use.

As with RQ1, we assessed the applicability of these four stressors to a different sample in Study 2. We found that 59 respondents (40.1% of valid responses) recalled an experience with MIM that *reduced* their feelings of stress, which reinforces the idea of a dual relationship between MIM use and stress: "I was stressed out [because] I did not know the date of my exam, and I could ask my classmates via WhatsApp and my stress reduced" (f, 18); "I could talk to my friends and express how I was feeling" (f, 21). Some respondents also mentioned that their use of

MIM allowed them to *ask for advice*: "I talked to a close friend because I needed some advice and, in a matter of minutes, I could solve the issue" (f, 20).

On the opposite side, 88 students (59.9%; 52 psychology and 36 communication students) addressed a stress-provoking experience associated with MIM. Sixty-two of these open-ended responses involved at least one of the four MIM stressors above. In four cases, respondents described online harassment or bullying experiences, which we do not reproduce here to protect their privacy. Although harassment and bullying may relate to some of the MIM stressors in this study (e.g., invasion, overload), we think the issues are complex enough to deserve a separate study, and therefore did not code bullying and harassment as part of MIM stress.

Overload was dominant and evaluated as a stressor in 27 of 62 experiences (43.5%). In 24 experiences (38.7%), respondents pointed to *ambiguity* as a stressor. Feelings of *invasion* were described in 17 cases (27.4%). Finally, *urgency* was mentioned in other 17 experiences (see examples in Table 2). The more anonymous context of Study 2 allowed us to uncover the flip side of urgency (that of the sender perspective): some students confessed that they feel impatient if they do not receive a quick response to their messages: "It was a conversation with my partner that we talked about something important, I was stressed waiting to receive their messages" (f, 18); "I feel the need for the messages I send to be instantly responded to; I do not communicate it to the other person out of respect, but the reality is that when I send a message and they take too long to respond, I get stressed and irritated" (f, 18). Urgency therefore arises from both external pressures to respond quickly and expectations regarding others' quickness to reply.

Some of the reported experiences involved more than one stressor, especially those related to the urgency category. For example, an 18-year-old female student narrated the

following stressful event that includes elements of *overload* ("kept getting notifications," "constant stream of messages"), *invasion* ("I could not focus on my things,"), and *urgency* ("why I wasn't answering the phone"):

> I was doing my assignments and I kept getting notifications from family and friends, asking me what I was doing, why I wasn't answering the phone, etc. It was already night, and I was tired of being all day in front of the computer, and the constant stream of messages stressed me more because I could not focus on my things. I just wanted to finish my assignments and go to sleep.

Different from findings of Study 1, Study 2 suggests gender differences in some of the dimensions of MIM stress—notably urgency and invasion. None of the male students expressed feelings of urgency associated with their stress-producing experiences, whereas 28.8% of women's episodes (excluding those for which no MIM-related stressor could be assigned) did. In contrast, 38.5% of men's but only 20.3% of women's stressing events involved the invasion technostressor.

MIM Uses and Stress

To answer RQ3, we reanalyzed 88 of the open-ended responses in Study 2—those from respondents who recalled a stress-provoking experience, 52 psychology and 36 communication students. We sought to relate MIM uses in Table 1 to specific stressors in Table 2. Figure 1 shows a Sankey diagram of the connections between MIM uses and stressors as reported in Study 2. Work- and study-related uses seem to have the greatest impact in the MIM stress generative process. Work and study uses were placed at the origin of perceptions of overload (17 times), ambiguity (8 times), invasion (7 times), and urgency (3 times). For example, this 27-year-old woman associated study-related uses with feelings of invasion and urgency:

> A WhatsApp group for the master's students where people were discussing issues relating to a certain course while we were having an online class. The discussion [was taking place]

> simultaneously with the class, which completely distracted our attention, in addition [the participants] were making decisions about the course without waiting for the approval of all classmates.

More surprisingly, relatedness and interaction uses were connected with MIM stress almost as frequently as work- and study-related uses. Specifically, experiences uncovered a common association of relatedness and social interaction uses with ambiguity (14 experiences). For example:

> I was having an argument with my partner, and communication via WhatsApp is clearly more unsatisfactory than face-to-face communication. We had been talking about the same issue for about 30 minutes and we could not understand each other. We were misunderstanding things. This increased my stress, and I felt overwhelmed (f, 18).

Relatedness and interaction uses were also reported as a source of urgency-related stress (6 cases), invasion (4 experiences) and, more rarely, overload (two cases). Seen from the other side of the process (that of the MIM stressors), feelings of overload and invasion seem to be mainly associated with work and study uses of MIM, while feelings of ambiguity and urgency are more commonly triggered by relatedness and social interaction uses. The remaining uses of MIM (domestic commitments, political and civic uses, and pastime and entertainment) were rarely or never mentioned as stressors—in part because these uses were less common in this second sample.

We also found gender differences in Study 2 regarding the context of these stress-producing experiences. Thus, women tended to report stressing experiences in connection with relatedness, intimacy, and social interaction (52.2% of women's experiences, excluding those for which no use could be assigned), while men were more prone to remember experiences associated with work, study, and business uses (66.7%).

[FIGURE 1]

Discussion

This study theorized and explored a model describing how different uses of MIM—not restricted to the work domain—are linked to different technostressors. First, we considered an open approach to develop a wide catalogue of MIM uses that attempts to expand the focus beyond specific social groups (e.g., students, health-care workers, the elderly) and specific tools (e.g., Snapchat, WhatsApp, BlackBerry Messenger). Furthermore, instead of relying on previous social media U&G literature and assuming a correspondence of uses between social media and MIM, we categorized MIM as a distinctive medium, characterized by particular uses that may impact perceived stress differently. Our catalogue of uses also reflects the current state of instant messaging, which is largely a mobile phone- and not a desktop-based technology.

Focus group conversations confirmed the central role of relational maintenance and intimate communication in relationship with MIM use, but also revealed a richness of detail and practices that we categorized in five categories and nine subcategories: *relatedness, intimacy, and social interaction* (with two subcategories); *work-, study-, and business-related uses* (four subcategories); *political and civic uses* (three subcategories); *domestic and other non-work commitments*; and *pastime and entertainment*. With regard to the first category, most participants use MIM to maintain and strengthen close tie relationships (bonding networks). Nonetheless, the conversations also revealed the potential of MIM groups to promote weak tie interaction. Remarkably, it was not only young discussants who connected with weak ties through MIM, but also some of the oldest participants (G4). This suggest a positive role for MIM groups in connecting people with different backgrounds (bridging networks), which may be particularly

beneficial for the elderly. We successfully applied the MIM use categories to a different sample (Study 2), which speaks in favor of their transferability.

Second, we also address recent calls for the examination of the model of technostress outside the work environment (Tarafdar et al., 2019). In this regard, we identify and integrate (within the technostress framework) four MIM-specific dimensions of technostress: 1) *MIM overload* was already suggested by previous qualitative and quantitative work (Blabst & Diefenbach, 2017; Shin et al., 2018). It refers to difficulties in dealing with group and individual chats that become overcrowded with messages, most of which require feedback from the recipients but are nearly impossible to fully read. Furthermore, some messages contain low quality information that users frequently need to filter or refute. 2) *MIM ambiguity* connects with a lack of human presence and appropriate conversational context, which sometimes leads to misunderstandings, misinterpretations, and communication problems. 3) *Invasion* stems from constant (24/7) connectivity, which elicits the feeling that MIM never gives one a break and interrupts one's routines. It relates to the consideration of MIM as a real nuisance, "especially when one is engaged in another activity," as reported in Fondevila-Gascón and colleagues' (2014, p. 9) survey study. Some participants keep receiving work-related instructions after their workday and perceive that work- or study-related issues 'spill over' into the personal domain (see Schieman & Young, 2013). Likewise, MIM conversations with friends or family can invade other personal spaces, such as a face-to-face conversations where conversational partners may shift their attention to the screen. Finally, 4) *MIM urgency* covers feelings of pressure resulting from impatience or expectations for a quick response. This appraisal may emanate from either the sender or the receiver of the message, and connects with Blabst and Diefenbach's (2017) findings regarding the direct association between active use of 'last seen' and 'read receipts' and

levels of perceived stress. Our four-dimensional measure of MIM stress proved to be applicable to a different, less diverse sample (Study 2), and may guide the development of future quantitative instruments.

Our study also examined the link between MIM uses and dimensions of MIM stress. Consistent with the mixed picture described in the literature review (e.g., Bano et al. 2019; Beyens, et al., 2020; Chan, 2015; Shin et al., 2018), participants' comments in both studies suggest that users do not necessarily (or always) appraise MIM as a stressor. More specifically, MIM may also help users deal with stressful situations of daily life and mobilize coping resources: finding personally relevant information, escaping from real-life problems, seeking for social and interpersonal support, or asking for advice. Some of the stress-reducing potential of MIM may therefore be connected to the mobilization of social resources for emotional and problem-oriented support (Chan, 2018; Yeshua-Katz, 2021).

By contrast, other participants' comments suggest that some uses of MIM contribute to different dimensions of MIM stress. Expectedly, work- and study-related uses seem to be important sources of MIM stress, especially via feelings of overload, ambiguity, and invasion. This is consistent with previous research that has shown that work-related communication outside working hours predicts stress, work-to-family conflict, and even sleep problems (Schieman & Young, 2013). Considering these negative health-related consequences, organizational practices should evolve to avoid job pressures after hours and, complementarily, promote assertive communication to reject work-related MIM communications during non-working time.

The results of this study also suggest a less obvious connection between relatedness and social interaction uses of MIM with stress. These more personal uses seem to be appraised, at

least sometimes, as a source of (stressing) ambiguity, urgency-related issues, invasion of one's offline reality and, to a lesser extent, overload. These findings may relate to individual differences in cognitive processes and coping strategies that may be associated with positive or negative consequences of MIM use. For instance, according to attachment theory, insecurely attached individuals are more prone to experience an increased need for intimacy and fear of rejection (Mikulincer & Shaver, 2012), which seems to foster a more frequent (and, we venture to say, more ambiguous and urgent) MIM-mediated interaction with close ties (see Weisskirch, 2012). On the contrary, individuals with an avoidant attachment style tend to show higher levels of emotional detachment and self-sufficiency (Mikulincer & Shaver, 2012), which may be linked to stress when the number or intensity of MIM-mediated exchanges are perceived as excessive. Future research should better examine individual differences to provide a better understanding of risk and protective factors for healthy, stress-free use of MIM.

Of particular interest are some age and gender differences in the MIM-stress process, which would deserve further exploration beyond the scope of the present investigation. In Study 1, the older age group (G4) seemed to perceive MIM use more as a stress-reducing activity and be relative immune to MIM-related stressors—except for exceptional feelings of overload. In the second study, we detected that female students were more prone to remember stress-provoking experiences in a context of relatedness, intimacy, and social interaction, while males reported more experiences connected with work, study, and business. Also in Study 2, women seemed more affected by feelings of urgency than men, while male students felt invaded more often than females. These findings could be explained by traditional gendered socialization.

The findings of this study should be interpreted carefully in the light of its limitations. We deliberately used a qualitative approach with non-probability samples that are not

representative of the characteristics of the country's (Study 1) or the university students' (Study 2) population. We tried to minimize this limitation by selecting a fairly diverse sample for Study 1 and by evaluating the applicability of our category systems to the less diverse sample of Study 2—where most respondents were psychology students, belonged to a similar age bracket, were females, childless, and did not work. However, it should be recalled that our findings regarding the association between MIM uses and stress (RQ3) were not inferred from the Study 1 sample, but from the less diverse sample of Study 2. The literature indicates that female psychology students may be particularly open-minded in their attitudes toward mental health problems—such as the outcomes of technostress—, but psychology undergraduates may also have more difficulties in managing daily life stressors—such as those triggered by MIM use—than other students (see Franzen et al., 2021; Kotera, Green, & Sheffield, 2019).

All in all, our study suggests that MIM-associated technostress is a multidimensional construct, that not all uses of MIM are equally associated with stress, and that relatedness and social interaction—and not only work- and study-related—uses of MIM may be a source of technostress. More importantly, MIM characteristics are not systematically appraised as threatening, and some uses of MIM may facilitate coping strategies that help to alleviate stressful situations of daily life. The latter be especially true and relevant for (some) older users. Given the negative consequences of technostress on health and well-being (Lee et al., 2016; Misra & Stokols, 2012; Schieman & Young, 2013), research should call for quantitative designs and replication of these findings in other populations. In this sense, our typology of MIM uses and stress may provide a guide for future development of quantitative measures.

Declaration of Interest Statement

There is no actual or potential conflict of interest in relation to this article.

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Table 1. Categories and Subcategories of MIM App Uses

Main category	*Sub-categories*[i/a]	*Examples of comments* (with focus group or Study number, participant's sex, and age in parentheses)
1. Relatedness, intimacy, and social interaction	a. Relatedness and intimacy	(#5, f, 47): [I use WhatsApp] with friends […] to keep up to date, because each one has their own life and, sometimes, it is not easy to see each other. […] It is a way to stay in touch, to be permanently… To know about the people you love. (S2, f, 20): [One time] I was emotionally bad, and thanks to WhatsApp I could talk with my best friend, who calmed me down. We talked for an hour or more, and it helped a lot.
	b. Planning and coordination of social activity	(#4, m, 85): Rather, it is about personal conversations: "Listen, what are you doing?" "Where are you going?" "Listen, let's meet for a coffee." "Listen, let's do something. I will do such-and-such thing and I'll call you later." (S2, m, 20): Because I was talking with friends about taking a walk together.
2. Work-, study-, and business-related uses	c. Work uses	(#3, m, 52): [At my work] there is a high turnover rate. People join and leave the [WhatsApp] group. Sometimes they ask things at 11 pm […] in the group: "How is this done?" "What should I do about that?" (S2, f, 24): With regard to my job, there was this crisis moment because I hadn't addressed an issue—it was my day off—and, suddenly, I had several messages from different people that required my attention.
	d. Study-related uses	(#2, m, 37): Not too long ago I was doing a master's degree and we shared everything [via WhatsApp]: documents, exams, cheat sheets… (S2, f, 18): […] in the class WhatsApp group, they never stopped texting. Even though I had the group muted, I used to enter the conversation to check if they had shared something important about the exams. But there were so many messages that I got overloaded.
	e. Advertising and sale / purchase transactions	(#3, f, 53): As I speak with you, there are like 8 WhatsApp [messages] waiting […]. I know these are from people that are interested in products from my website. I'll make money with that. (#2, m, 37): [I use WhatsApp] for the sale and purchase of second-hand [goods]. Sometimes they give you their mobile number and then we switch to WhatsApp, which is like more immediate.
	f. Job search	(#3, f, 50): I'm a member of two Telegram groups of Spanish language teachers. It's kind of a chat where we talk to students of Spanish from all over the world. It is also a way to find students for online lessons. (#2, m, 43): [I'm in a group] where you can inscribe […] and they send you job vacancies […]. You can even share your own vacancies, of which you may be aware and have not been previously shared.

3. Political and civic uses	g. News and political talk	(#4, f, 70): We talk about politics in the [group] for former college classmates. In other groups it is best not to talk [politics]. It can lead to uncomfortable moments because everyone does not think alike and there is no respect, or people insult each other, and one should try to avoid these things. S2, f, 20): When the news [of the epidemiological alert] broke, my family and friends started to send me [text] messages. Many of them were contradictory […].
	h. Civic engagement	(#1, m, 26): Some of my relatives […] used WhatsApp to provide [community] services. Older neighbors could order food instead of going to the store themselves and risking exposure to the [Covid-19] virus. (#3, f, 53): [I'm in a WhatsApp group] of an animal welfare organization […]. We are always vigilant for abandoned or mistreated animals. In this [group] we chat every day because there are sadly lots of abandoned or mistreated animals.
	i. Political participation	(#3, f, 48): [In the neighborhood] they have protested, blocked the street, and things like that. For instance, public health-care advocacy groups contact you [via WhatsApp] and say: "A gathering will take place in front of the health center at such-and-such a time, on such-and-such a day." (#2, m, 44): I'm registered as a member of a political party and […] we use [the WhatsApp group] to share information, organize the meetings, attend [face-to-face or virtual] meetings […].
4. Domestic and other non-work commitments		(#4, f, 70): For me it is reassuring to be able to contact […]. If, for example, something arises and I have to go and pick up my granddaughters… These things bring me peace of mind. (S2, f, 19): I was packing my stuff because I was going to my town. My boyfriend was picking me up, but at the last minute he decided to reschedule for an hour earlier. He was [texting] to tell me that he was picking me up right at that moment […].
5. Pastime and entertainment		(#2, m, 37): I use [WhatsApp] mainly for leisure […]. To exchange trivialities, many memes and stuff, and videos. (S2, f, 18): I tried to keep my mobile phone away during exam time so that I could focus, but every time I took a break and picked up my phone, it somehow made me escape from and release the stress caused by the exams.

Notes. Hashtags indicate the focus group number in examples from Study 1. S2 indicates that the example is taken from Study 2. Superscript i/a: If applicable.

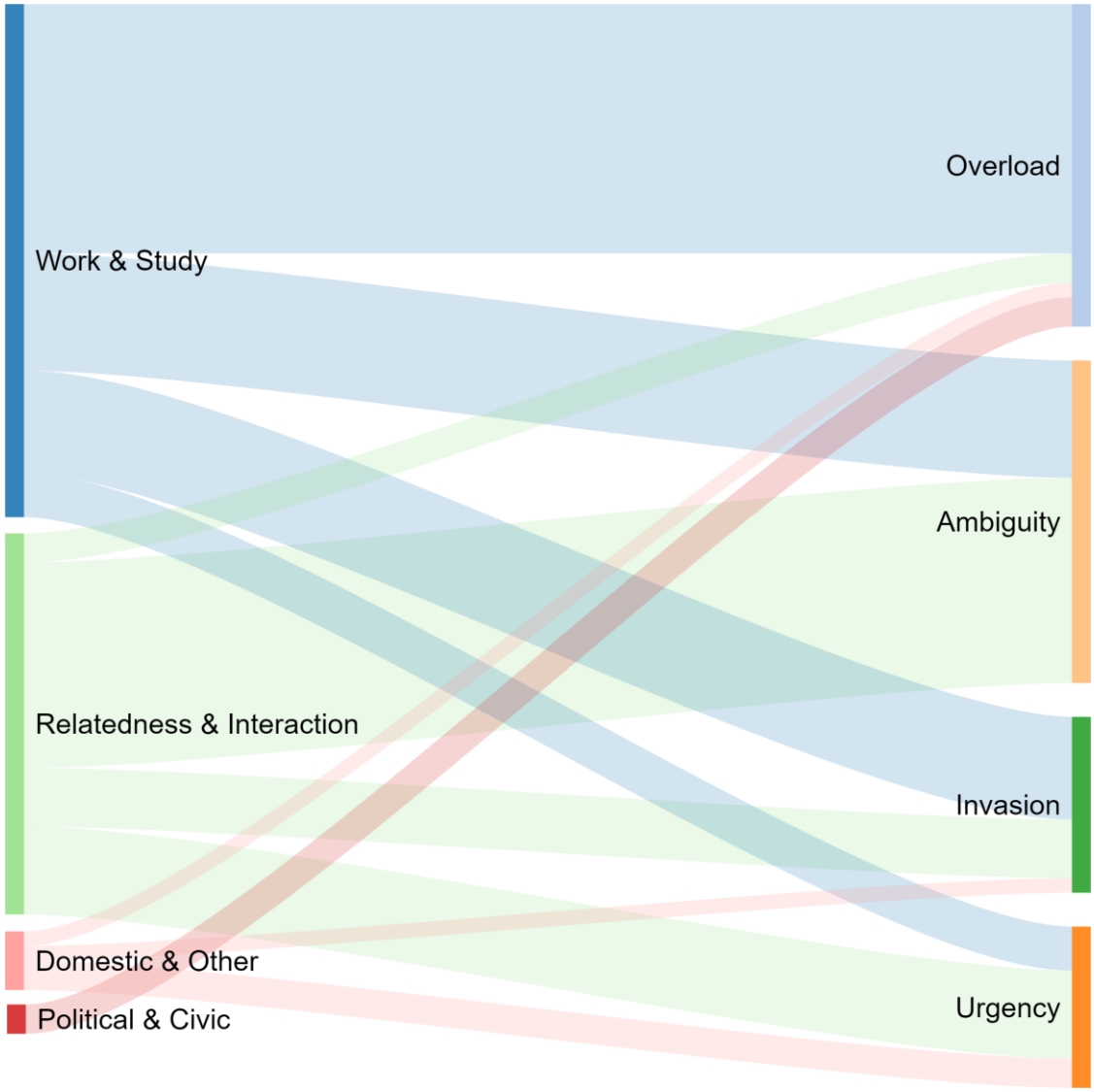
Table 2. Dimensions of MIM technostress

Dimension	*Examples of comments* (with focus group or Study number, participant's sex and age in parentheses)
1. MIM overload	(#2, m, 44): What stresses me out […] is to see a lot of red numbers [in the notification badge], you know? And I like to reply immediately and get rid of them. So, what stresses me out is that, seeing [those] red [numbers] […]. (S2, f, 19): […] many times I take my mobile phone after studying and I find thousands of messages that I am not able to read fully, so I remain uninformed.
2. MIM invasion	(#5, f, 47): […] We can receive a WhatsApp [message] at 2 am from our boss with instructions for the next day, you know? […]. No, no, maybe not at 2 am, but at 10 pm. I'm trying to control that. I mean, I think that's not OK […]. *Moderator*: But you read them. And […] maybe those messages are not always pleasant, some work-related messages may be unpleasant. Don't them cause […] some discomfort before going to bed, for example? *Participant*: Yes, it may stress me out when I think: "Damn it! Tomorrow morning, I have to do that". But I don't lose any sleep over it. *M*: And what about the weekends […]? *P*: I read them as well, yes. […] Depends on the content of the message, but I try, eh… If it's a Saturday, it's a Saturday and no, I am not working. Some weekends I do have to work, but come on, if I'm…. (#5, f, 39): Also [at home], if I have to cook for my kids or bathe them or, I don't know, if I'm busy. So, if I do not hear [the WhatsApp sound], I feel happier to continue doing my daily routines. Maybe if I'm continuously hearing it as a background noise, then I reach a point where I feel overwhelmed. If I don't hear it, I don't feel overwhelmed. I tend to silence [… WhatsApp] to ensure that it does not make me… I would not say anxious but nervous. I don't know how to explain it […]. In order not to hear it continuously, because it interrupts me. And when I get interrupted, I get nervous because I want to do things well. (#2, m, 44): […] They send you the message, and if it's 10:30 or 11 at night they send it to you anyway, and they don't care. And I like reading the messages and not leaving them unread, so I tend to read them at any time… Well, of course not at 2 am. But if they send me one at 11:30 or 12 at night, which is not that common, I use to read it. And one has to constantly keep an eye on the phone and... (S2, m, 26): I was the communication link […] and therefore I had to pass on every single message, wait for replies and reproduce them, and make decisions sequentially […]. This led to me not being able to focus on other activities such as studying or watching a film.
3. MIM urgency	(#3, f, 48): I think that [MIM apps] are a little stressful […]. [I] removed the popular blue ticks so that people cannot see if I read [the messages] or not. Because I felt a personal pressure to reply as soon as I read it; it seemed wrong to me to read them and not reply—with people noticing. I think [MIM] is a very good thing, because it helps you to have an immediate relationship and so, but it also has a side that makes you nervous. *M*: You mentioned a personal pressure. Is it explicit [from others] or is it only yours?

3. MIM urgency (cont.)	*P*: It's personal [self-imposed], but I think it's also social. Because sometimes, some people, not everyone, say: "You've read it and haven't replied", "It took you two hours to reply to me". Then I think it's a bit of both things […]. Therefore, in order to take pressure off yourself, you have to remove these [blue ticks]. (S2, f, 18): WhatsApp increased my stress because the messages I sent about the organization of upcoming university assignments were read or not, and for hours I did not get a response.
4. MIM ambiguity	(#1, m, 26): Since [MIM] lacks proper context, sometimes the message that is transmitted… There is a misinterpretation of the message. And some topics are intense and may stress individuals out. And then… *M*: Elaborate a bit more on this. When you talk about lack of context and stressing topics, what are you thinking about specifically? *P*: I'm thinking that when I send a message, I send it with a certain intention, don't I? But in fact, the other person misunderstands my intention. They start to mull it over. *M*: Maybe you say something in good faith, but they interpret that you want to aggravate them. *P*: Exactly. Or I may simply reply with 'OK,' and I am really paying attention. However, the other person may interpret it as me wanting to finish the conversation, it's this kind of things […]. (S2, f, 18): [...] when you chat [...] you cannot express everything you want to say without being interrupted. Furthermore, they cannot see, as they would in person, whether what they are saying is hurting you.

Notes. Hashtags indicate the focus group number in examples from Study 1. S2 indicates that the example is taken from Study 2.

Figure 1. Association between MIM uses (left) and MIM stressors (right)



Note. The width of the bands is proportional to the frequency of the association between a specific MIM app use (left) and dimension of MIM stress (right). The associations were coded from the open-ended responses in Study 2. The diagram was created using SankeyMATIC online diagram builder.

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Table of Responses to IJCHI Reviewers' Comments

Reviewer #	Reviewer Issue/Comment to Be Addressed	Response/Action Taken	Document Location
Managing Editor	Please consider referencing articles published in IJHCI on the topic of your paper	Thank you very much for this suggestion. The revised version includes two citations to *IJHCI* research articles (Chou & Liu, 2016; Makki et al., 2017).	pp. 5, 6, 13, and 22
1	The inclusion of quantitative studies and the major findings (motivations of using the apps and types of techno-distress, and antecedents of techno-distress) […] will be useful in giving the overall picture and provide the ground for a useful comparison with your qualitative findings. Such a comparison will be useful in highlighting your contributions in the discussion section […].	This is a very helpful suggestion. We have included and explained quantitative findings from Blabst and Diefenbach (2017); Canavilhas and colleagues (2017); Chou and Liu (2016); Fondevila-Gascón and colleagues, 2014; Leung (2001); Makki and colleagues (2017); Mobasheri and colleagues (2016); Kircaburun and colleagues (2018); Pont-Sorribes and colleagues (2020); and Vidales-Bolaños and Sádaba-Chalezquer (2017). In the revised discussion, we also explain in more detail what is similar and different to these previous contributions. In brief, we have: 1) developed a MIM-specific and updated catalogue of MIM uses that does not focus on a single social group or application; 2) integrated previously disperse observations under the MIM-technostress umbrella; 3) suggested a four-dimensional construct of MIM technostress; and 4) associated different patterns of MIM use with different dimensions of technostress.	Literature review and discussion sections
1	I am concerned about whether your findings in Study 1 is relevant to Study 2 given the composition of the respondents. Study 1 covers a broad age range. However, Study 2 is restricted and generally only covers G1 and G2 of Study 1. Hence, the relationship between those issues of interest in this study has to be examined with care. In addition, how representative is the respondents.	This is a very good observation. We used the more diverse sample of Study 1 to create our categories (MIM uses and associated stressors). We did not want to use the open-ended responses from Study 2 to create the categories because university students are a highly unrepresentative sample of the population (they are mostly below 20 years old, do not work, are single, do not have children, etc.). But Study 2 represents a great opportunity to test how our category systems (MIM uses and MIM technostressors) work in a different sample, which is an initial test of transferability. As we show in the revised paper, both category systems work fairly well in a different sample, and we see this as a strength of the study. We however agree with you that this idea of using sample 1 for developing the categories and using sample 2 to test their transferability was not properly explained in the first submitted manuscript. In the revised methods, results, and discussion sections we provide complete details of this strategy. For example: "We conducted an online survey to assess the applicability of the categories developed from Study 1 (MIM uses and technostressors, RQ1 and RQ2, respectively) to a different sample, as well as the association between specific uses of MIM and stressors (RQ3)" (p. 10). "As an initial test of the transferability of this category system, we tried to identify MIM uses on the different sample of Study 2" (p. 15). "As with RQ1, we assessed the applicability of these four stressors to a different sample in Study 2" (p. 19). "We successfully applied the MIM use categories to a different sample (Study 2), which speaks in favor of their transferability" (p. 23). "Our four-dimensional measure of MIM stress proved to be applicable to a different, less diverse sample (Study 2), and may guide the development of future quantitative instruments" (p. 24). As per your suggestion, we have also included verbatim examples of Study 2 in Tables 1 and 2. These examples show that our category system based on the first sample works well with the second sample. For example: "(S2, f, 24): With regard to my job, there was this crisis moment because I hadn't addressed an issue—it was my day off—and, suddenly, I had several messages from different people that required my attention" (p. 35). "(S2, f, 18): [...] when you chat [...] you cannot express everything you want to say without being interrupted. Furthermore, they cannot see, as they would in person, whether what they are saying is hurting you" (p. 38). Of course, participants in Study 1 and 2 are not representative of the Spanish population or the university students (102 respondents were psychology students),	Methods, results, and discussion sections

		and we acknowledge this as a limitation in the revised manuscript. We do not have reasons to believe that self-selection may have biased the results, because students were not previously aware that we were interested in stress. The main reason for them to complete the survey was to receive course credit. Furthermore, 47% is a quite reasonable response rate for this type of surveys. In the revised discussion, we explain that: "The findings of this study should be interpreted carefully in the light of its limitations. We deliberately used a qualitative approach with non-probability samples that are not representative of the characteristics of the country's (Study 1) or the university students' (Study 2) population. We tried to minimize this limitation by selecting a fairly diverse sample for Study 1 and by evaluating the applicability of our category systems to the less diverse sample of Study 2—where most respondents were psychology students, belonged to a similar age bracket, were females, childless, and did not work. However, it should be recalled that our findings regarding the association between MIM uses and stress (RQ3) were not inferred from the Study 1 sample, but from the less diverse sample of Study 2. The literature indicates that female psychology students may be particularly open-minded in their attitudes toward mental health problems—such as the outcomes of technostress—, but psychology undergraduates may also have more difficulties in managing daily life stressors—such as those triggered by MIM use—than other students (see Franzen et al., 2021; Kotera, Green, & Sheffield, 2019)" (p. 26).	
1	The mention of the progress of using 147 valid responses to 88 open-ended responses to finally 66 responses is really confusing. Again, the extent the profile of the 66 responses match those in Study 1 has to be considered and whether it is appropriate to adopt the earlier findings lock, stock, and barrel to the 66 responses.	We have reread our explanation of sample sizes and we agree that the original wording was not clear enough. In the revised manuscript, we explain that "147 students (102 in psychology and 45 in communication studies) returned valid questionnaires." In the section on 'Dimensions of MIM Stress,' we add that 88 students recalled "a stress-provoking experience," while 59 mentioned an experience that "*reduced* their feelings of stress." In the originally submitted manuscript, we used the 88 stress-provoking experiences to assess the validity of our catalogue of 'MIM uses,' and were able to match 66 of these 88 experiences with one or more uses. In the revised version, we conduct a more complete analysis and include the 59 stress-reducing experiences. We try to match these 88+59 experiences with specific MIM uses. In the results section on technostress, we use only the 88 stress-provoking experiences. We hope the explanation is more clear in the current version. Thus, in the revised article we explain that: "As an initial test of the transferability of this category system, we tried to identify MIM uses on the different sample of Study 2. We content analyzed the 147 open-ended responses and identified some of the uses above in 122 of the reported experiences (i.e., almost 83% of the responses). The rest of the experiences did not provide enough information to assign a specific MIM use" (p. 14). "As with RQ1, we assessed the applicability of these four stressors to a different sample in Study 2. We found that 59 respondents (40.1% of valid responses) recalled an experience with MIM that *reduced* their feelings of stress […]. On the opposite side, 88 students (59.9%; 52 psychology and 36 communication students) addressed a stress-provoking experience associated with MIM" (pp. 18-19).	p. 14 and pp. 18-19
2	-Abstract: Although the abstract is generally well-written, I think it may benefit from a final summary emphasizing the main contribution of the piece. So far, the paper presents insightful findings on the main antecedents of distress across age cohorts, so it may address this finding and its importance.	Thank you for your feedback. We have rewritten parts of the abstract, and now it emphasizes our four main contributions. The third contribution refers to the "differences in technostress creators across age groups": "This research 1) develops a general catalogue of MIM uses; 2) suggests a four-dimensional construct of MIM technostress consisting of overload, ambiguity, invasion, and urgency; 3) outlines several differences across age groups and between genders; and 4) describes possible relationships between MIM uses and stress" (p. 1).	p. 1
2	Introduction: Like the abstract, the introduction may need to include a "happy ending" wrapping up the main	We sincerely appreciate your observation. In the revised introduction and throughout the theory section, we explain that most previous research on MIM uses has frequently focused on specific population groups (e.g., students, the elderly, doctors) or assumed an equivalence of uses and gratifications between social media	p. 1 and literature review

	contribution of the piece to both the literature on techno-distress and U&G. What is new in the piece that both literatures should know and have thus far neglected?	and mobile instant messaging use (for example, by developing survey questions about WhatsApp uses based on previously identified Facebook uses). Regarding MIM distress, previous studies lack the integrative approach that we develop in this study. For example, some studies have already suggested that mobile instant messaging can produce feelings of overload, or interrupt users' concurrent tasks, but the four-dimensional model of stress we propose is a novel contribution to the literature. In the revised introduction, the final paragraph reads as follows: "Using two different sources of data collected in Spain (focus group discussions with 26 adults and a qualitative survey of 147 undergraduates), we analyze people's interaction with MIM in their daily life and propose a comprehensive, specific, and updated taxonomy of uses. Moreover, we extend and systematize previous findings into a theory-driven, multi-dimensional construct of MIM technostress and explore its association with different uses of MIM. Finally, we also examine gender- and age-related differences in MIM uses and associated technostress. Hence, this study is intended to contribute to both the literature on uses of MIM and technostress." (p. 3)	
2	-Theory: The paper does a good job in framing the study, but still more work is needed in explaining why understanding the uses of MIM are important (RQ1). Author(s) have reported some interesting trends of MIM use and address the need to provide an "inventory" of MIM uses but fail in explaining why and how (gap in the literature).	Thank you very much for your suggestion. In the revised theory section, we have included more literature on U&G (e.g., Costa-Sánchez & Guerrero-Pico, 2020; Kircaburun et al., 2020; Leung, 2001; Makki et al., 2017; Mobasheri et al., 2016; Pont-Sorribes et al., 2020). Throughout the introduction and literature review, we explain that: 1) The body of literature that addresses MIM-specific U&G is relatively small (some studies adapt social media U&G and assume they are equivalent to MIM U&G, but this is not necessarily the case). 2) Some other studies rely on the seminal work of Leung (2001) on motives for chatting on ICQ. This is somehow problematic because ICQ was a desktop (and not mobile-based) instant messenger software. 3) Other research has focused on specific population groups (e.g., students, health care professionals, the elderly…). Our category system was developed with a diverse group of participants and may therefore be more appropriate for more general populations. 4) Other studies have explored specific uses (e.g., MIM use for news or political discussion), but have not developed an inventory. 5) Finally, our catalogue is updated and adapted to the national context of our study. Below we have included some excerpts from the theory and discussion sections of the revised manuscript that illustrate these points: "An important precursor or this literature was an influential study on motives for chatting on the *desktop* instant messenger ICQ (Leung, 2001)" (p. 4). "Building on these previous reports, our first step is to create a catalogue of MIM uses that is not focused on specific social or professional groups and may be comprehensive, MIM-specific (but not tool-specific), updated, and adapted to the national context of our study" (pp. 5-6). "This study theorized and explored a model describing how different uses of MIM—not restricted to the work domain—are linked to different technostressors. First, we considered an open approach to develop a wide catalogue of MIM uses that attempts to expand the focus beyond specific social groups (e.g., students, health-care workers, the elderly) and specific tools (e.g., Snapchat, WhatsApp, BlackBerry Messenger). Furthermore, instead of relying on previous social media U&G literature and assuming a correspondence of uses between social media and MIM, we categorized MIM as a distinctive medium, characterized by particular uses that may impact perceived stress differently. Our catalogue of uses also reflects the current state of instant messaging, which is largely a mobile phone- and not a desktop-based technology" (p. 22).	pp. 4-6 and discussion section.
2	-Method: I applaud author(s)'s effort to reconciliate data from study 1 and study 2, although I found more interesting, compelling, and instructive focus	This is an important issue, and future readers may also have similar concerns. Due to the structure of the focus group discussions, participants did not explicitly connect their uses of MIM with particular stressors. This was because the questions in the first part of the sessions asked about MIM uses (with no reference to stress), while the second part focused on MIM stress (without explicitly asking participants	Methods and discussion sections (p.

	group interviews than written verbatims from a survey. Regarding the need of both sources of data collection, I was surprised on why focus groups were only used for answering RQ1 & RQ2 and not RQ3, since they may be fully applicable there too.	to connect MIM-associated stress with specific uses). We preferred to separate the 'uses' from the 'stress' discussions because we did not want to limit our catalogue of uses to those that participants identify as stressing. Following your comment, we revised the transcripts of the focus groups and found very few instances in which a specific use could be associated with a particular dimension of stress. This is why we do not consider it appropriate to use Study 1 to answer RQ3. In the revised version of the paper, we provide more information about this "compartmentalized" structure of the focus group discussions: "The first part of the sessions focused on MIM uses (with no reference to stress) and the second part on participants' views of MIM as a stressor" (p. 10). Furthermore, we now explain that our findings about the connection between MIM uses and stress dimensions (RQ3) need to be carefully considered because of the convenience, unrepresentative nature of our sample: "The findings of this study should be interpreted carefully in the light of its limitations. We deliberately used a qualitative approach with non-probability samples that are not representative of the characteristics of the country's (Study 1) or the university students' (Study 2) population. We tried to minimize this limitation by selecting a fairly diverse sample for Study 1 and by evaluating the applicability of our category systems to the less diverse sample of Study 2—where most respondents were psychology students, belonged to a similar age bracket, were females, childless, and did not work. However, it should be recalled that our findings regarding the association between MIM uses and stress (RQ3) were not inferred from the Study 1 sample, but from the less diverse sample of Study 2. The literature indicates that female psychology students may be particularly open-minded in their attitudes toward mental health problems—such as the outcomes of technostress—, but psychology undergraduates may also have more difficulties in managing daily life stressors—such as those triggered by MIM use—than other students (see Franzen et al., 2021; Kotera, Green, & Sheffield, 2019)" (p. 26).	10 and p. 26)
2	Germane to this, reporting percentages and descriptives on RQ3 seems underusing the richness of reported answers. I would like to see more empirical and theoretical elaboration on participants' responses on RQ3, perhaps reporting as verbatims written thoughts.	This is a very good point, and we thank you for raising it. We have now restructured Tables 1 (MIM uses) and 2 (MIM technostress) to include verbatim responses from Study 2. We have also added some theoretical reflections and verbatim examples from Study 2 directly in the text (results section), not only regarding RQ3, but also RQ1 and RQ2. For example: "Most of these 122 cases connected with relatedness, intimacy, and social interaction (80, 65.6%) or work-, study-, and business-related uses (32, 26.2%). In fact, as one would expect from the characteristics of the sample, work and business are a relative minority (10), and this category is clearly biased towards study-related uses such as 'organizing [group] assignments from home,' 'clarifying [assignment-related] doubts very quickly,' or 'discussing with other classmates the syllabus and conditions of an exam'" (p. 14). "The more anonymous context of Study 2 allowed us to uncover the flip side of urgency (that of the sender perspective): some students confessed that they feel impatient if they do not receive a quick response to their messages: 'It was a conversation with my partner that we talked about something important, I was stressed waiting to receive their messages' (f, 18); 'I feel the need for the messages I send to be instantly responded to; I do not communicate it to the other person out of respect, but the reality is that when I send a message and they take too long to respond, I get stressed and irritated' (f, 18)" (p. 19). "As with RQ1, we assessed the applicability of these four stressors to a different sample in Study 2. We found that 59 respondents (40.1% of valid responses) recalled an experience with MIM that *reduced* their feelings of stress, which reinforces the idea of a dual relationship between MIM use and stress: 'I was stressed out [because] I did not know the date of my exam, and I could ask my classmates via WhatsApp and my stress reduced' (f, 18); 'I could talk to my friends and express how I was feeling' (f, 21). Some respondents also mentioned that their use of MIM allowed them	Results section

		to *ask for advice*: 'I talked to a close friend because I needed some advice and, in a matter of minutes, I could solve the issue' (f, 20)" (pp. 18-19). "For example, this 27-year-old woman associated study-related uses with feelings of invasion and urgency: > A WhatsApp group for the master's students where people were discussing issues relating to a certain course while we were having an online class. The discussion [was taking place] simultaneously with the class, which completely distracted our attention, in addition [the participants] were making decisions about the course without waiting for the approval of all classmates. More surprisingly, relatedness and interaction uses were connected with MIM stress almost as frequently as work- and study-related uses. Specifically, experiences uncovered a common association of relatedness and social interaction uses with ambiguity (14 experiences). For example: > I was having an argument with my partner, and communication via WhatsApp is clearly more unsatisfactory than face-to-face communication. We had been talking about the same issue for about 30 minutes and we could not understand each other. We were misunderstanding things. This increased my stress, and I felt overwhelmed (f, 18)" (pp. 20-21).	
2	Regarding the procedure of focus groups meetings, I would also like to know more about the following issues: 1) why authors have decided to make focus groups on videocalls rather than face-to-face?	We first contacted an external public opinion company and asked them to help us conduct face-to-face focus group discussions on their premises. The company declined our proposition and argued that this kind of indoor group activity could pose a health risk to researchers and participants in the epidemiological context at the time (end of 2020). They offered us the alternative of using their panel of respondents and conducting videoconference meetings, which we found appropriate for our purposes and safer for everyone's health. In the revised version, we explain the reason for this choice (p. 9): "In the light of the epidemiological situation at the time, we opted for videoconference meetings. Discussions were conducted between December 15, 2020, and January 19, 2021. Each discussant received €18 as compensation."	Methods section (p. 9)
2	2) Do the videocalls may offer distinct findings than, for instance, personal interviews, that may bias the results (old age cohorts' difficulties in expressing & discussing online, see Harguittai)	In the present study, we did not perceive this kind of difficulties. Some participants had minor technical problems that could be handled without much disruption of the sessions, but these minor issues occurred across all groups. This does not mean, of course, that all age groups are equally equipped to deal with videocalls. But it should be noted that 1) during the Covid-19 pandemic, older adults became more "experienced and knowledgeable" users of computers and mobile phone technologies—they were probably forced to learn due to the confinement and restriction of their face-to-face activities (Nimrod, 2020, p. 6); 2) our focus group participants were recruited by an external company on a non-probability basis, which means that our older participants may be more "technology savvy" than the average older adult; 3) some participants received help from their family in adjusting the video conference settings. In the revised manuscript, we have included a sentence to explain this third point: "Some discussants received help from their family in adjusting the video conference settings, but once the sessions started, participants were alone. Discussions lasted between 49 and 62 minutes and were moderated by the authors and transcribed by the company" (p. 10).	p. 10
2	2) as group selection were fundamentally based on age cohorts, I would like also to see more information regarding work background, interest in technology, and news consumption.	Thank you very much for this suggestion. We collected information about participants' employment status according to the following categories: a) student or intern, b) housekeeper, c) unemployed for more than 6 months, d) unemployed for less than 6 months, e) temporary leave due to Covid-19 (Spanish ERTE schemes), f) private sector worker with a fixed-term contract, g) private sector worker with an open-ended contract, h) public sector worker with a fixed-term contract, i) public sector worker with a permanent or open-ended contract, j) business owner or self-employed without employees, k) business owner or self-employed with employees, l) retired who worked before. We also collected data about discussants' household type: a) couple without children, b) couple with children, c) single-parent family, d)	Methods section (pp. 9-10)

		large family: spouse, children, other relatives. Furthermore, we asked them about their degree of interest in politics, which is a proxy measure of news consumption (four-point Likert-type scale, from 'not at all interested' to 'extremely interested'). Although we do not have a direct measure of 'interest in technology,' a proxy measure can be developed based on participants' frequency of use of WhatsApp and Telegram (from 'never' to 'every day'): all discussants reporting using WhatsApp every day, while 6 of them were Telegram users with varying frequency of usage (see individual data in the Excel spreadsheet below). We have summarized most of this information in the revised methods section. In any case, if you or the Editor consider it necessary to provide future readers with the complete individual data, we can create an online appendix with the information below. Similarly, in case you think it is crucial to incorporate additional data from our 26 focus groups' participants, we can re-contact the public opinion company and ask them to collect that information for us.	

Group #	id	Gender	Age	Employment Status	Household type	Interest in politics	Freq. of WhatsApp use	Freq. of Telegram use
1	183	Female	28	Unemployed (less than 6 months)	Couple without children	Very	Every day	Never
	191	Male	22	Unemployed (less than 6 months)	Large family: spouse, children, other relatives	Extremely	Every day	Once or twice a week
	196	Male	21	Student or intern	Couple with children	Slightly	Every day	Never
	198	Female	23	Student or intern	Large family: spouse, children, other relatives	Slightly	Every day	Never
	215	Male	26	Student or intern	Large family: spouse, children, other relatives	Very	Every day	Never
2	152	Male	37	Private sector worker with an open-ended contract	Couple without children	Extremely	Every day	Never
	178	Female	33	Temporary leave due to Covid-19 (ERTE schemes)	Large family: spouse, children, other relatives	Not at all	Every day	Occasionally
	179	Female	35	Private sector worker with an open-ended contract	Couple without children	Slightly	Every day	Never
	180	Female	41	Private sector worker with an open-ended contract	Large family: spouse, children, other relatives	Slightly	Every day	Never
	202	Male	44	Unemployed (less than 6 months)	Couple without children	Very	Every day	Never
	203	Male	43	Unemployed (more than 6 months)	Couple with children	Extremely	Every day	Every day
3	47	Male	52	Public sector worker with a permanent or open-ended contract	Couple with children	Very	Every day	Occasionally
	153	Female	48	Private sector worker with a fixed-term contract	Couple with children	Very	Every day	Never
	236	Female	53	Private sector worker with an open-ended contract	Couple with children	Very	Every day	Never
	251	Female	50	Unemployed (more than 6 months)	Couple with children	Extremely	Every day	Once or twice a week
4	162	Female	70	Retired (worked before)	Couple without children	Extremely	Every day	Never
	163	Male	70	Retired (worked before)	Couple without children	Very	Every day	Every day
	164	Female	74	Retired (worked before)	Couple without children	Very	Every day	Never
	166	Male	85	Retired (worked before)	Large family: spouse, children, other relatives	Very	Every day	Never
	167	Female	69	Housekeeper	Couple without children	Slightly	Every day	Never
5	161	Male	54	Private sector worker with an open-ended contract	Couple with children	Extremely	Every day	Never
	169	Male	53	Business owner or self-employed without employees	Couple with children	Very	Every day	Never
	225	Female	43	Business owner or self-employed with employees	Couple with children	Very	Every day	Never
	235	Female	47	Public sector worker with a permanent or open-ended contract	Couple with children	Very	Every day	Never
	237	Male	49	Business owner or self-employed without employees	Single-parent family	Very	Every day	Never
	242	Female	38	Private sector worker with an open-ended contract	Couple with children	Extremely	Every day	Never

2	As for the written responses (RQ3): how did author(s) distribute the survey link? (University repositories, social media…etc). Reflect also upon the emergence of selection bias in case of social media distribution.	This is a very relevant question. We distributed the survey link through email to all students enrolled in the Psychology and Communication courses taught by the first and second authors. We think that, compared to social media distribution, our procedure minimizes self-selection bias. In the revised manuscript, we describe the channel we used to distribute the survey link for Study 2: "We distributed the survey link through email to a convenience sample of psychology and communication students at the University of ANONYMIZED (Spain) between March 1 and March 23, 2021. We obtained informed consent from all respondents, who voluntarily completed the survey and received course credits for their participation. In addition, respondents were assured of the anonymity of their responses. Out of 313 students who were sent the link, 147 (102 in psychology and 45 in communication studies) returned valid questionnaires" (pp. 10-11).	pp. 10-11
2	-Results & Discussion: As most respondents were female, please address this in the limitation and emphasize gender implications of MIM use throughout the document, in all cases you have such information.	It is true that most respondents in Study 2 were female (76.9%). This is not particularly problematic for the proposed categories of MIM uses (RQ1) or dimensions of MIM stress (RQ2), because they were developed from Study 1 focus group data. As we explain in the article, data from Study 2 were used to make an initial assessment of the applicability of our category systems to a different sample (i.e., their transferability to a sample of university students). But, as you correctly point out, the female-predominant sample for Study 2 is a limitation to our assessment of the association between MIM uses and techno-stressors (RQ3). We have addressed this limitation in the revised manuscript: "The findings of this study should be interpreted carefully in the light of its limitations. We deliberately used a qualitative approach with non-probability samples that are not representative of the characteristics of the country's (Study 1) or the university students' (Study 2) population. We tried to minimize this limitation by selecting a fairly diverse sample for Study 1 and by evaluating the applicability of our category systems to the less diverse	Literature review, results, and discussion sections

		sample of Study 2—where most respondents were psychology students, belonged to a similar age bracket, were females, childless, and did not work. However, it should be recalled that our findings regarding the association between MIM uses and stress (RQ3) were not inferred from the Study 1 sample, but from the less diverse sample of Study 2. The literature indicates that female psychology students may be particularly open-minded in their attitudes toward mental health problems—such as the outcomes of technostress—, but psychology undergraduates may also have more difficulties in managing daily life stressors—such as those triggered by MIM use—than other students (see Franzen et al., 2021; Kotera, Green, & Sheffield, 2019)" (pp. 25-26). Extant literature addressing gender differences in MIM use is quite scarce, and that which exists focuses on desktop-based instant messaging or employs student samples. As we discuss in our article, we think that desktop- (e.g., ICQ or Live Messenger) and mobile-based MIM apps are used quite differently, and one cannot assume that findings from the former are relevant to the latter. With these considerations in mind, in the revised article we explain that some studies have suggested that women may be more prone to use the affordances of MIM apps such as Snapchat to build bonding social capital (Piwek & Joinson, 2016). Although Piwek and Joinson did not directly test this assumption and call for "more research" on the issue (p. 364), one can assume that social capital in the context of MIM interactions emerges in connection with particular uses such 'relatedness, intimacy, and social interaction' (our first category). However, this does not mean that 'relatedness, intimacy, and social interaction' are not important motives for MIM among males. It may only be that the behavioral expression of this motive is different (for example, more connected to bridging social capital). In this vein, Kircaburin et al. (2018) found that men are more likely to use MIM and other social media for meeting new people and socializing. We have summarized these ideas in the revised literature review. In the paragraph referring to social interaction-related uses, we have now added that (pp. 4-5): "This motive seems to be relevant for both women and men, although there may be important differences in its behavioral expression: Women may tend to use MIM—and other ICTs—for maintaining existing relationships and building social capital, while men's use may be more associated with meeting new people and socializing (Kircaburun et al., 2018; Piwek & Joinson, 2016; see also Costa-Sánchez & Guerrero-Pico, 2020, Vidales-Bolaños & Sádaba-Chalezquer, 2017)." In the results section, we have also included the previous finding by Costa-Sánchez and Guerrero-Pico suggesting that certain entertainment-related-uses of WhatsApp are more common among males (p. 14): "It also resonates with MIM-related entertainment uses detected among teenagers, especially males, such as playing videogames and "coordinat[ing] the necessary movements during games" (Costa-Sánchez & Guerrero-Pico, 2020, p. 6)." As for the rest of MIM uses (work, political, domestic), we also included the following lines in the literature review. "Although MIM apps seem to be used more and more by people of all ages, research suggests that their intensity and type of usage varies across age groups and between genders (see Costa-Sánchez & Guerrero-Pico, 2020; Kircaburun et al., 2018; Rosales & Fernández-Ardèvol, 2016), an observation that deserves further exploration" (p. 4). "Previous studies also suggest gender differences in this type of use such that men may be more likely to exchange "messages about politics" (Martínez-Comeche & Ruthven, 2021, p. 6)" (p. 6).	
2	I would also like to see more elaboration on gender differences of MIM use and potential effects, if any. That would add more nuances to your findings and provide further implications.	Thank you very much for your feedback. The design of this study was not structured to find gender differences. This is why Study 2 uses a predominantly female sample. Nevertheless, as per your suggestion, we have re-examined both datasets for gender differences. Focus group data do not suggest relevant gender differences regarding MIM use. A woman in Group 3 expressed that she disliked being part of large MIM groups with people she did not know personally, but this	Results and discussion sections

		feeling was not prevalent among other women. Regarding our survey dataset (Study 2), we found that: "We also found gender differences in Study 2 regarding the context of these stress-producing experiences. Thus, women tended to report stressing experiences in connection with relatedness, intimacy, and social interaction (52.2% of women's experiences, excluding those for which no use could be assigned), while men were more prone to remember experiences associated with work, study, and business uses (66.7%)" (p. 21). Regarding gender differences in the component dimensions of MIM stress, we carefully reviewed the focus group dataset and concluded that women's and men's perceptions of the role of MIM as a technostressor were relatively similar—at least in this qualitative sample. In the revised version of the article, we emphasize in several paragraphs that: "Male and female participants in all groups mentioned difficulties in dealing with the large flow of incoming messages" (p. 16). "Thirdly, women and men in all groups except G4 raised concerns about the sense of *urgency of response* associated with MIM use" (p. 16). In the younger sample of Study 2, we did find some gender differences in perceived MIM stress that would deserve further study with more diverse participants. In the revised results section, we state that: "Different from findings of Study 1, Study 2 also suggests gender differences in some of the dimensions of MIM stress—notably urgency and invasion. None of the male students expressed feelings of urgency associated with their stress-producing experiences, whereas 28.8% of women's episodes (excluding those for which no MIM-related stressor could be assigned) did. In contrast, 38.5% of men's but only 20.3% of women's stressing events involved the invasion technostressor" (p. 20). In the revised discussion, we also add that: "Of particular interest are some age and gender differences in MIM stressors, which would deserve further exploration beyond the scope of the present investigation. In Study 1, the older age group (G4) seemed to perceive MIM use more as a stress-reducing activity and be relative immune to MIM-related stressors—except for exceptional feelings of overload. In the second study, we detected that female students were more prone to remember stress-provoking experiences in a context of relatedness, intimacy, and social interaction, while males reported more experiences connected with work, study, and business. Also in Study 2, women seemed more affected by feelings of urgency than men, while male students felt invaded more often than females. These findings could be explained by traditional gendered socialization" (p. 25).	
2	Age cohorts were fundamental to filter out focus groups. However, results fall short in discussing the role of age in both MIM use and MIM use and effects. In general, I think the paper would benefit from a better elaboration on age and gender meanings of distress	We thank you for your constructive feedback. The main reason to create relatively homogeneous groups in terms of age was to "facilitate the opening up and stimulate interaction" (p. 10). But your comment made us think about an important difference between MIM interactions with strong and weak ties, as well as their age-related implications. In the revised results section, we have added that: "Most participants of both genders and from all groups referred to MIM as a tool to maintain emotional bonds with close ties: spouse, immediate family, and close friends (bonding networks). Nonetheless, two young male discussants in G1 indicated that they participate in large MIM groups where they interact with weak ties: people they "never met in person" (group #1, male, 26) or "they have only met in person once" (#1, male, 22) (bridging networks). More interestingly, three members of the senior group also referred to these weak tie interactions that characterize large MIM groups: with Pilates and embroidery classmates (#4, female, 74), photography enthusiasts (#4, male, 70), or members of the fitness club (#4, female, 69)" (p. 12). We integrated this idea in the revised discussion:	Results and discussion sections

		"With regard to the first category, most participants use MIM to maintain and strengthen close tie relationships (bonding networks). Nonetheless, the conversations also revealed the potential of MIM groups to promote weak tie interaction. Remarkably, it was not only young discussants who connected with weak ties through MIM, but also some of the oldest participants (G4). This suggest a positive role for MIM groups in connecting people with different backgrounds (bridging networks), which may be particularly beneficial for the elderly" (pp. 22-23). Following your suggestion, we have also expanded on some age-related differences in MIM stress that may be of interest to future readers. In particular, focus group discussions suggest that our senior participants felt less taxed by their use of MIM. This may be connected, among other factors, with their relatively smaller social circles, their reduced time spent with the app, and the feeling of safety in knowing that they can contact their family in case they need help. In the revised discussion, we explain that: "Of particular interest are some age and gender differences in MIM stressors, which would deserve further exploration beyond the scope of the present investigation. In Study 1, the older age group (G4) seemed to perceive MIM use more as a stress-reducing activity and be relative immune to MIM-related stressors—except for exceptional feelings of overload. In the second study, we detected that female students were more prone to remember stress-provoking experiences in a context of relatedness, intimacy, and social interaction, while males reported more experiences connected with work, study, and business. Also in Study 2, women seemed more affected by feelings of urgency than men, while male students felt invaded more often than females. These findings could be explained by traditional gendered socialization" (p. 25).	
2	Also, some reflection in the discussion section on the challenges faced in the process of reconciliation of both sources of data collection may help.	This suggestion resonates with Reviewer 1's comments. It is true that the first version of the manuscript did not adequately detail the reasons to use two different datasets from two different samples and collected through different methods. We did not want to create our categories (MIM uses and dimensions of MIM stress) based on a convenience sample of students because they are highly unrepresentative of the population's characteristics (e.g., they are mostly below 20 years old, do not work, are single, do not have children, etc.). But Study 2 represents a great opportunity to test if (and how) our category systems work in a different sample, which is an initial test of their transferability. As we show in the revised paper, both category systems work fairly well in a different sample, and we see this as a strength of the study. This idea of using sample 1 for developing the categories and sample 2 to test their transferability was not properly explained in the initially submitted manuscript. In the revised methods, results, and discussion sections, we provide complete details of this strategy. For example: "We conducted an online survey to assess the applicability of the categories developed from Study 1 (MIM uses and technostressors, RQ1 and RQ2, respectively) to a different sample, as well as to examine the relationship between specific uses of MIM and technostressors (RQ3)" (p. 10). "As an initial test of the transferability of this category system, we tried to identify MIM uses on the different sample of Study 2" (p. 14). "As with RQ1, we assessed the applicability of these four stressors to a different sample in Study 2" (p. 18). The revised discussion also incorporates this idea: "We successfully applied the MIM use categories to a different sample (Study 2), which speaks in favor of their transferability" (p. 23). "Our four-dimensional measure of MIM stress proved to be applicable to a different, less diverse sample (Study 2), and may guide the development of future quantitative instruments" (p. 24).	Methods and results sections

		"We tried to minimize this limitation by selecting a fairly diverse sample for Study 1 and by evaluating the applicability of our category systems to the less diverse sample of Study 2—where most respondents were psychology students, belonged to a similar age bracket, were females, childless, and did not work. However, it should be recalled that our findings regarding the association between MIM uses and stress (RQ3) were not inferred from the Study 1 sample, but from the less diverse sample of Study 2.The literature indicates that female psychology students may be particularly open-minded in their attitudes toward mental health problems—such as the outcomes of technostress—, but psychology undergraduates may also have more difficulties in managing daily life stressors—such as those triggered by MIM use—than other students (see Franzen et al., 2021; Kotera, Green, & Sheffield, 2019)." (p. 26). As per your and Reviewer 1's suggestion, we have also included verbatim examples of Study 2 in Tables 1 and 2. These examples show that our category system based on the first sample works well with the second sample. Of course, participants in Study 1 and 2 are not representative of the Spanish population or the university students (102 of the respondents in Study 2 were psychology students), and we acknowledge this as a limitation in the revised manuscript: "The findings of this study should be interpreted carefully in the light of its limitations. We deliberately used an open, qualitative approach with non-probability samples that are not representative of the characteristics of the country's (Study 1) or the university students' (Study 2) population" (pp. 25-26). We hope these explanations are more clear in the revised version. Again, thanks a lot for your time and expertise. We sincerely believe the manuscript has been greatly fostered as a result of the improvements made over this round of reviews.	
3	First, the theoretical framework could be more complete. Recent studies in Spain have delved into the use of WhatsApp by teenagers, revealing a series of transversal digital skills that would contribute to their development (Costa-Sánchez & Guerrero, 2021). Furthermore, from the theoretical parameters of the Uses and Gratifications framework, there is a wide range of more recent analyzes that must be collected (those mentioned in the article are almost prior to the emergence of mobile instant apps).	Thank you very much for your feedback. We have carefully examined Costa-Sánchez and Guerrero-Pico's article and some other recent U&G studies on social media and mobile instant messaging. As per your suggestion, which resonates with the first comment made by Reviewer 1, we have incorporated the following studies to our literature review and discussion section: Canavilhas, Colussi, & Moura (2019); Costa-Sánchez & Guerrero-Pico (2020); Fondevila-Gascón, et al. (2014); Kircaburun et al. (2020); Makki et al., (2017); Martínez-Comeche & Ruthven, 2021; Mobasheri et al. (2015); Pont-Sorribes, Besalú, & Codina (2020); and Vidales-Bolaños & Sádaba-Chalezquer (2017). In the revised literature review we provide greater detail on recent findings regarding MIM U&G. For example: "This use of MIM apps may be driven by their ability to create a "heightened sense of presence" (Karapanos et al., 2016, p. 892) and connects with the social needs of affiliation and intimacy (see Reeve, 2009). In this vein, a recent study found that individuals' motivation to maintain existing relationships is positively related to WhatsApp use (Kircaburun et al., 2018). In another study that focused on affiliation motivation, Makki and colleagues (2017) found that undergraduate students use Snapchat for maintaining and developing relationships, expressing positivity, and telling their loved ones "how important they are to [them]" (p. 415). This motive seems to be relevant for both women and men, although there may be differences in its behavioral expression: Women may tend to use MIM—and other ICTs—for maintaining existing relationships and building bonding social capital, while men's use may be more associated with meeting new people and socializing (Kircaburun et al., 2018; Piwek & Joinson, 2016; see also Costa-Sánchez & Guerrero-Pico, 2020; Vidales-Bolaños & Sádaba-Chalezquer). The few existing studies that involve samples with wide age ranges suggest that social interaction uses are common across age groups, even though exchanging personal affective information seems to be more frequent among late teens (e.g., Martínez-Comeche & Ruthven, 2021)" (p. 5). "Other apparently less common uses of MIM include *news* gathering and sharing and *discussing politics* in one-on-one or group chats—mainly in private groups with close ties, but increasingly more in large 'public' groups that may contain strangers— (Newman et al., 2019; see also Canavilhas et al., 2019; Pont-Sorribes et al., 2020; Valeriani & Vaccari, 2017). Thus, one of the motivations of elderly adults in Taiwan for using LINE is to acquire	p. 5, results, and discussion sections.

		and update information (e.g., news or traffic information) (Chou & Liu, 2016). More recently, Gil de Zúñiga et al. (2021) adapted previous measures of social media U&G and found WhatsApp use for political discussion to be an important antecedent of conventional participation and protest. Previous studies also suggest gender differences in this type of use such that men may be more likely to exchange "messages about politics" (Martínez-Comeche & Ruthven, 2021, p. 6)." (p. 5). "MIM is also increasingly adopted for *work-related* information exchange (Thomas, 2018). For example, a survey study among health professionals at five British hospitals found that 33.1% of doctors and 5.7% of nurses used MIM apps to share patient-related information (for example, to seek a colleague's opinion) (Mobasheri et al., 2016). Relatedly, Chou and Liu (2016) reported 'application' motives for using LINE such as talking about business or executing commercial transactions" (p. 5). The revised results section also states: "Finally, some participants use MIM for *pastime and entertainment*: To fill the "many dead times" of the day, beat boredom, talk for the sake of it, sharing some content that one finds constructive, pleasant, fun, etc. This category of uses responds to the innate human curiosity and the intrinsic motivation to seek out (Reeves, 2009, p. 144), and is common in the literature of social media (see Leung, 2001; Quan-Haase & Young, 2010). It also resonates with MIM-related entertainment uses detected among teenagers, especially males, such as playing videogames and "coordinat[ing] the necessary movements during games" (Costa-Sánchez & Guerrero-Pico, 2020, p. 6)" (p. 14). Finally, in the revised discussion we have added that: "3) *Invasion* stems from constant (24/7) connectivity, which elicits the feeling that MIM never gives one a break and interrupts one's routines. It relates to the consideration of MIM as a real nuisance, "especially when one is engaged in another activity," as reported in Fondevila-Gascón and colleagues' (2014, p. 9) survey study" (p. 23).	
3	On the other hand, some research has detected different uses on the same platform (WhatsApp) depending on whether it is an interpersonal or a group channel. The work should specify if different uses and motivations can be differentiated.	Thank you very much for your constructive suggestion. It is true that Costa-Sánchez and Guerrero-Pico's (2020) influential study in *Social Media + Society* differentiates between interpersonal and group uses of WhatsApp. A careful examination of Table 2 of their article, however, shows substantial overlap between both categories. For example, "talk and meet up with friends and family," "send photos," "send videos," "send audios," and "humor" are present both in the interpersonal and group categories. Only "play videogames" and "second screen" are present in the latter category but not in the former. Similarly, all elements in our category of uses (e.g., relatedness, work, study, etc.) involve interpersonal and group interactions. But your comment made us consider that this distinction may have important implications for MIM-related stress. As per your suggestion, we re-examined both datasets and found that, for some of the dimensions of MIM stress, the interpersonal/group aspect is relevant. For example, overload is more likely to arise in group than in one-on-one chats. In the revised results section, we explain that: "Overload is more likely to arise when participants interact in large MIM groups, and common coping strategies were silencing group chats, ignoring messages or, more rarely, deleting entire conversations" (p. 16). "This perceived invasive nature of MIM was connected with both one-on-one and group chat interactions and expressed in all group discussions except G4 (senior)" (p. 17). "As for the invasion stressor, feelings of urgency arise in both one-on-one and group conversations (p. 18). "Finally, the last stressor that emerged during the data analysis was *MIM ambiguity*. […] This loss of intangible elements sometimes leads to misunderstandings and misinterpretations of one-on-one or group conversations" (p. 18).	pp. 16-18

3	Differences in gender use have also been identified and the work does not refer to it (Vidales-Bolaños & Sádaba-Chalezquer, 2017).	Thank you for this suggestion. We have read Vidales-Bolaños and Sádaba-Chalezquer's piece on mobile uses among teenagers and their effects of social capital. Even though the study is broad and covers mobile use in general and not MIM use in particular, it is true that it highlights a gender difference in identity construction that may connect with MIM use. In the revised literature review, we explain that MIM use for social interaction: "seems to be relevant for both women and men, although there may be differences in its behavioral expression: Women may tend to use MIM—and other ICTs—for maintaining existing relationships and building bonding social capital, while men's use may be more associated with meeting new people and socializing (Kircaburun et al., 2018; Piwek & Joinson, 2016; see also Costa-Sánchez & Guerrero-Pico, 2020; Vidales-Bolaños & Sábada-Chalezquer, 2017). The few existing studies that involve samples with wide age ranges suggest that social interaction uses are common across age groups, even though exchanging personal affective information seems to be more frequent among late teens (e.g., Martínez-Comeche & Ruthven, 2021)" (p. 5). In addition, we have also included gender and age differences in the results section. These are relevant for MIM uses but also for MIM stress. As we explain in the revised results and discussion sections: "Most participants of both genders and from all groups referred to MIM as a tool to maintain emotional bonds with close ties: spouse, immediate family, close friends, etc. (bonding networks). Nonetheless, two young male discussants in Group 1 indicated that they participate in large MIM groups where they interact with weak ties: people they "never met in person" (group #1, male, 26) or "they have only met in person once" (#1, male, 22) (bridging networks). More interestingly, three members of the senior group also referred to these weak tie interactions that characterize large MIM groups: with Pilates and embroidery classmates (#4, female, 74), photography enthusiasts (#4, male, 70), or members of the fitness club (#4, female, 69)" (p. 12). "We also found gender differences in Study 2 regarding the context of these stress-producing experiences. Thus, women tended to report stressing experiences in connection with relatedness, intimacy, and social interaction (52.2% of women's experiences, excluding those for which no use could be assigned), while men were more prone to remember experiences associated with work, study, and business uses (66.7%)" (p. 21). "Male and female participants in all groups mentioned difficulties in dealing with the large flow of incoming messages, most of which require attention and action" (p. 16). "Thirdly, women and men in all groups except G4 raised concerns about the sense of *urgency of response* associated with MIM use" (p. 17). "Interestingly, none of the participants in G4 expressed feelings of ambiguity related to MIM use (p. 18)". "Different from findings of Study 1, Study 2 also suggests gender differences in some of the dimensions of MIM stress—notably urgency and invasion. None of the male students expressed feelings of urgency associated with their stress-producing experiences, whereas 28.8% of women's episodes (excluding those for which no MIM-related stressor could be assigned) did. In contrast, 38.5% of men's but only 20.3% of women's stressing events involved the invasion stressor" (p. 20). "Remarkably, it was not only young discussants who connected with weak ties through MIM, but also some of the oldest participants (G4). This suggest a positive role for MIM groups in connecting people with different backgrounds (bridging networks), which may be particularly beneficial for the elderly" (p. 22).	Literature review, results, and discussion sections

		"Of particular interest are some age and gender differences in MIM stressors, which would deserve further exploration beyond the scope of the present investigation. In Study 1, the older age group (G4) seemed to perceive MIM use more as a stress-reducing activity and be relative immune to MIM-related stressors—except for exceptional feelings of overload. In the second study, we detected that female students were more prone to remember stress-provoking experiences in a context of relatedness, intimacy, and social interaction, while males reported more experiences connected with work, study, and business. Also in Study 2, women seemed more affected by feelings of urgency than men, while male students felt invaded more often than females. These findings could be explained by traditional gendered socialization" (p. 25).	
3	The intensification of its use since the pandemic has also been suggested, so it would be of interest to know if users have reflected on it at any time.	This is a very good suggestion. After re-examining our data, we have found participants' comments on the influence of the Covid-19 pandemic and, more relevant to this study, its connection with some of the proposed dimensions of MIM stress. "[…] we called this dimension *MIM overload*: «Suddenly you have three people talking to you at the same time» (#1, m, 21); «200, 300, 400 messages […] you cannot read» (#1, f, 23). This sometimes includes low quality information—e.g., «evident fake news about politics, society…» (#4, f, 74)—that users need to filter or refute, which may be particularly stressful in connection with health news in the pandemic context" (p. 16). "The second dimension of technostress that emerged from our qualitative data is *MIM invasion*—which is similar to invasion in the literature on technostress at work (see, for example, Tarafdar et al., 2007). It mainly refers to the MIM-facilitated permeation of work, business, or study-related issues into the personal domain: 'I finish my workday and I keep receiving work-related instructions' (#1, f, 28). The lockdown and home confinement worsened the situation for some of our discussants because work schedules 'are not the same as they used to be': '[Some coworkers] connect at night and text you' (#3, f, 48), or schedule work shifts and define tasks without considering that 'you are outside working hours' (#1, f, 28)" (p. 17).	pp. 16-17
	In the Methodological section and in relation to the online questionnaire, it would be interesting to know the percentage of Psychology students, who could a priori be more sensitive to the issues they deal with in their University training, such as stress.	This is a very relevant point. In the revised methods section, we have added that: "We obtained informed consent from all respondents, who voluntarily completed the survey and received course credits for their participation. In addition, respondents were assured of the anonymity of their responses. Out of 313 students who were sent the link, 147 (102 in psychology and 45 in communication studies) returned valid questionnaires" (p. 11). We have also expanded on the limitations associated with our sample composition: "We deliberately used a qualitative approach with non-probability samples that are not representative of the characteristics of the country's (Study 1) or the university students' (Study 2) population. We tried to minimize this limitation by selecting a fairly diverse sample for Study 1 and by evaluating the applicability of our category systems to the less diverse sample of Study 2—where most respondents were psychology students, belonged to a similar age bracket, were females, childless, and did not work. However, it should be recalled that our findings regarding the association between MIM uses and stress (RQ3) were not inferred from the Study 1 sample, but from the less diverse sample of Study 2. The literature indicates that female psychology students may be particularly open-minded in their attitudes toward mental health problems—such as the outcomes of technostress—, but psychology undergraduates may also have more difficulties in managing daily life stressors—such as those triggered by MIM use—than other students (see Franzen et al., 2021; Kotera, Green, & Sheffield, 2019)." (p. 26).	p. 11 and discussion section
	References should be expanded as suggested.	Thanks a lot. We have included the following references: Canavilhas, Colussi, & Moura (2019); Costa-Sánchez & Guerrero-Pico (2020); Fondevila-Gascón, et al. (2014); Franzen et al., (2021); Kircaburun et al. (2020); Makki, et al. (2017); Martínez-Comeche & Ruthven, 2021; Mobasheri et al. (2015); Pont-Sorribes, Besalú, & Codina (2020); and Vidales-Bolaños & Sádaba-Chalezquer (2017).	Luterature review.

The comments offered by the reviewers have been extremely interesting, useful, and enlightening. In this revised version, we have strengthened the theoretical arguments, provided more details on our methodological approach and, also importantly, examined age- and gender-related differences that are associated with MIM uses and the different technostressors—at least in our samples. We are indebted to the Managing Editor and the three anonymous Reviewers as we strongly believe this manuscript is much improved. We look forward to hearing from you.
Best,

AUTHOR/S.

Mobile Instant Messaging Uses and Technostress: A Qualitative Approach

Abstract

A growing number of people use mobile instant messaging (MIM) apps for a variety of purposes—most commonly related to social interaction, but also to coordinate work-related activities, fulfill informational needs, and discuss politics and public affairs. Despite its convenience for daily life, MIM may also act as an environmental antecedent of technostress due to users' inability to cope with the demands of the app in a healthy manner. We conducted two qualitative studies (N_1 = 26; N_2 = 147) to examine why people use MIM apps in their daily life and if diverse uses relate to MIM stress differently. This research 1) develops a general catalogue of MIM uses; 2) suggests a four-dimensional construct of MIM technostress consisting of overload, ambiguity, invasion, and urgency; 3) outlines several differences across age groups and between genders; and 4) describes possible relationships between MIM uses and stress.

Keywords: Mobile Instant Messaging Uses, Technostress, Overload, Ambiguity, Invasion, Urgency.

Mobile Instant Messaging Uses and Technostress: A Qualitative Approach

Mobile instant messaging (MIM) apps are changing the way people communicate with family, friends, or coworkers (Valeriani & Vaccari, 2017). Similar to other social media, people seem to be using MIM for diverse purposes, primarily for *social interaction*, but also as a *source of news* and information, a platform for *political talk* (Gil de Zúñiga et al., 2014; Valeriani & Vaccari, 2017), or a tool for *work-related activities* (Thomas, 2018). Recent research on the consequences of MIM use show a somewhat mixed picture: While some studies suggest a variety of individual and social benefits arising from MIM-mediated interactions, such as improving subjective well-being and social connectedness (Bano et al., 2019; Chan, 2015); others point to MIM as an antecedent of stress (Blabst & Diefenbach, 2017; Shin, et al., 2018). Given the mid- and long-term consequences of stress on psychological health and well-being (Lazarus, 1991; Lazarus & Folkman, 1987), a better understanding of the link between MIM uses and stress is needed.

The permanent flow of incoming alerts, combined with on-screen prompts to interact ('last seen' and 'read receipts'), and social pressures to reply in a timely manner (Blabst & Diefenbach, 2017; Lee et al., 2016) may lead some users to feel they are not able to cope with the communicative demands of the app, what we argue as MIM stress (see Lazarus, 1990; Tarafdar et al., 2007, 2019). Based on a processual perspective of stress (Lazarus, 1990; Lazarus & Folkman, 1987), this article explores the role of MIM as a potential antecedent of technostress. To do so, we build on and extend previous research on technostress that identified five stressors associated with information and computer

technology (ICT) use in the organizational domain: overload, invasion, complexity, insecurity, and uncertainty (Tarafdar et al., 2007, 2019).

Using two different sources of data collected in Spain (focus group discussions with 26 adults and a qualitative survey of 147 undergraduates), we analyze people's interaction with MIM in their daily life and propose a comprehensive, specific, and updated taxonomy of uses. Moreover, we extend and systematize previous findings into a theory-driven, multi-dimensional construct of MIM technostress and explore its association with different uses of MIM. Finally, we also examine gender- and age-related differences in MIM uses and associated technostress. Hence, this study is intended to contribute to both the literature on uses of MIM and technostress.

MIM Uses

MIM apps allow people to communicate with virtually everyone, from anywhere, at any time, potentialities that have only become more important since the Covid-19 outbreak. Although they are primarily intended for text messaging, they also offer voice and video calls and file sharing. WhatsApp is the major player in the market: More than 2 billion active users in more than 180 countries exchange roughly 100 billion WhatsApp messages every day (Cathcart, 2020; WhatsApp, n.d.). In Spain, recent figures from the Reuters Institute indicate that 81% of those surveyed use WhatsApp, which makes it the top MIM app in the country (Newman et al., 2020). Other messaging services that are growing market share around the world in recent years are Telegram and Line. Although MIM apps seem to be used more and more by people of all ages, research suggests that their intensity and type of usage varies across age groups and between genders (see Costa-Sánchez & Guerrero-Pico, 2020; Kircaburun et al., 2018; Rosales & Fernández-Ardèvol, 2016), an observation that deserves further exploration.

A general orientation to study how audiences use the media is the uses and gratifications (U&G) framework. This paradigm posits that individuals use the media actively, and their selection of media channels or sources is an attempt to fulfill specific needs (Quan-Haase & Young, 2010; Rubin, 2009). Within this theoretical framework, a relatively small body of literature has approached the uses that people (or, more commonly, specific social or professional groups) make of MIM apps. An important precursor or this literature was an influential study on motives for chatting on the *desktop* instant messenger ICQ (Leung, 2001, revisited by Quan-Haase & Young, 2010). Leung's gratifications sought from ICQ included, among others, affection, inclusion, sociability, entertainment, and escape.

More recent studies on *mobile phone-based* IM apps suggest that people use them mainly for *social interaction*, that is, to keep in touch with friends and family and coordinate daily and leisure activities. This use of MIM apps may be driven by their ability to create a "heightened sense of presence" (Karapanos et al., 2016, p. 892) and connects with the social needs of affiliation and intimacy (see Reeve, 2009). In this vein, a recent study found that individuals' motivation to maintain existing relationships is positively related to WhatsApp use (Kircaburun et al., 2018). In another study that focused on affiliation motivation, Makki and colleagues (2017) found that undergraduate students use Snapchat for maintaining and developing relationships, expressing positivity, and telling their loved ones "how important they are to [them]" (p. 415). This motive seems to be relevant for both women and men, although there may be differences in its behavioral expression: Women may tend to use MIM—and other ICTs—for maintaining existing relationships and building bonding social capital, while men's use may be more associated with meeting new people and socializing (Kircaburun et al., 2018; Piwek & Joinson, 2016; see also Costa-Sánchez & Guerrero-Pico, 2020; Vidales-Bolaños &

Sádaba-Chalezquer, 2017). The few existing studies that involve samples with wide age ranges suggest that social interaction uses are common across age groups, even though exchanging personal affective information seems to be more frequent among late teens (e.g., Martínez-Comeche & Ruthven, 2021).

MIM is also increasingly adopted for *work-related* information exchange (Thomas, 2018). For example, a survey study among health professionals at five British hospitals found that 33.1% of doctors and 5.7% of nurses used MIM apps to share patient-related information (for example, to seek a colleague's opinion) (Mobasheri et al., 2016). Relatedly, Chou and Liu (2016) reported "application" motives for using LINE such as talking about business or executing commercial transactions.

Other apparently less common uses of MIM include *news* gathering and sharing and *discussing politics* in one-on-one or group chats—mainly in private groups with close ties, but increasingly more in large 'public' groups that may contain strangers— (Newman et al., 2019; see also Canavilhas et al., 2019; Pont-Sorribes et al., 2020; Valeriani & Vaccari, 2017). Thus, one of the motivations of elderly adults in Taiwan for using LINE is to acquire and update information (e.g., news or traffic information) (Chou & Liu, 2016). More recently, Gil de Zúñiga et al. (2021) adapted previous measures of social media U&G and found WhatsApp use for political discussion to be an important antecedent of conventional participation and protest. Previous studies also suggest gender differences in this type of use such that men may be more likely to exchange "messages about politics" (Martínez-Comeche & Ruthven, 2021, p. 6).

Building on these previous reports, our first step is to create a catalogue of MIM uses that is not focused on specific social or professional groups and may be

comprehensive, MIM-specific (but not tool-specific), updated, and adapted to the national context of our study. We therefore ask our first research question:

RQ1: What are the reasons why adults currently use MIM apps?

MIM Stress

Transactional-based models describe stress not as a single construct, but as a dynamic system in which specific environmental conditions create demands that the individual evaluates as damaging or taxing on their resources. This transactional account has provided a theoretical foundation for a large part of studies of technostress, especially at the organizational level (Ragu-Nathan et al., 2008; Tarafdar et al., 2019). But technostress may not be limited to the work setting: Tarafdar and colleagues have drawn attention to "the pervasiveness of IS [Information Systems] in the non-work context" (2019, p. 27), and encourage the examination of technostress in other environments—for example, the personal life.

In the current networked society, certain characteristics of "not primarily work-related" IS (e.g., social media) seem to be associated with feelings of overload and fatigue (Lee et al., 2016, p. 54). More germane to this work, a study conducted among young and 'stressed by MIM' South Korean participants found that these apps are sometimes perceived as being "too close and too crowded" (Shin et al., 2018, p. 1). For example, strangers or unwanted persons can use MIM to contact anyone without previous acceptance, creating pressure on recipients to respond (too close). The crowdedness alludes to perceptions of having too many contacts and getting an excessive number of notifications, which frequently result in fatigue, distractions, and stress (Shin et al., 2018). However, findings on this area are mixed and reveal many nuances in the effects of MIM. Some work suggests that WhatsApp-based interactions increase psychological well-being (Bano et al. 2019, in a study with Pakistani undergraduates) and social

connectedness (Chan, 2015), while other evidence indicates that this positive association with well-being occurs only with passive uses (reading MIM *without* engaging in direct exchanges; Beyens et al., 2020).

These previous findings make it seem likely that *specific* uses of MIM create stressful situations where individuals perceive some of the characteristics of the app (MIM stressors) as damaging. Some of the already defined techno-stressors may also be relevant for our understanding of the MIM stress process. This applies to *overload* and *invasion*, which have been negatively associated with job satisfaction, productivity, and psychological well-being (see Lee et al., 2016; Ragu-Nathan et al., 2008; Schieman & Young, 2013; Tarafdar et al., 2007).

Concerning *techno-overload*, MIM apps typically provide users with large amounts of information from their contacts, especially when they are part of groups or chat rooms. A recent report indicates that growing numbers of WhatsApp users are joining large 'public' chat groups with people they do not know, in which they discuss about "news and politics" and "local community" issues (Newman et al., 2019, p. 20). More generally, users' chat window may be filled up with text messages, links, and audio and video files about work shifts and pending work tasks, kids after-school activities, neighborhood association meetings, news, etc. All this information may accumulate in (some) users' chat interface and feed their perception of "being burdened" (Misra & Stokols, 2012, p. 739) or force them "to deal with excess of information" (Tarafdar et al., 2019, p. 9). *MIM overload* resembles Tarafdar et al.'s (2007) techno-overload dimension of technostress, described as "situations where ICTs force users to work faster and longer" (p. 315). This is what Blabst and Diefenbach (2017) found in an exploratory survey of university students: The number of one-on-one WhatsApp conversations in the previous days was positively associated with feelings of stress (single-item measure). They also found that

users who made an active use of 'last seen' and 'read receipts' (i.e., checking when their contacts were last online or if they read their messages) reported higher levels of stress than those who did not pay attention to this information.

Invasion may also be relevant to explain the MIM stress process. This dimension of technostress is commonly understood as the perception that the use of ICTs increases the permeation of work into the personal life (Bucher et al., 2013; Tarafdar et al., 2007, 2019). A similar argument may be applied to more personal uses of MIM apps: 'anytime anywhere' MIM conversations have potential to infiltrate every moment of users' lives, pushing them into permanent multitasking and reducing their attentional and cognitive resources to other tasks (Reinecke et al., 2017). MIM (over)use may therefore interrupt people's daily routines, making it difficult to fully focus on other personal, interpersonal, social, or professional activities. This suggests that some MIM users will be burdened with feelings of *MIM invasion*. Indeed, a survey study conducted among Spanish students found that almost 63% of them "definitely agree" with the assertion that using WhatsApp and BlackBerry Messenger can become a real nuisance, "especially when one is engaged in another activity" (Fondevila-Gascón et al., 2014, p. 9).

Besides these more classical dimensions of technostress, MIM users may evaluate other characteristics of MIM apps as harmful to their well-being. We aim to extend and systematize previous observations and studies under the theoretical framework of MIM technostress, which we theorize as a multi- rather than a single-dimensional construct. Moreover, we aim to examine how distinct patterns of MIM use contribute to the different dimensions of MIM-associated stress. More formally:

RQ2: What characteristics of MIM are evaluated as harmful (MIM stressors)?

RQ3: What specific uses of MIM apps are associated with the different dimensions of MIM stress?

Methods

Study 1

We conducted a first qualitative study based on focus group discussions. This approach helped us answer RQ1 and RQ2 (uses of MIM and MIM stressors). Because stressors—or distressors— "are stress creators *appraised* by the individual as threatening" (Tarafdar et al., 2019, p. 10, italics are ours), it is important to listen to MIM users' evaluations as to why they perceive certain conditions, associated with MIM use, as harmful. The Ethics Committee of ANONYMIZEDXXX (registration # 2020-0419) reviewed approved the study. The public opinion company ANONYMIZED used their panel of respondents and social media channels to recruit a sample of 26 Spanish adults who reported using MIM every day. In the light of the epidemiological situation at the time, we opted for videoconference meetings. Discussions were conducted between December 15, 2020, and January 19, 2021. Each discussant received €18 as compensation.

All participants used WhatsApp daily, six were Telegram users, and only one of them had Snapchat and used it occasionally. To facilitate the opening up and stimulate interaction, we formed homogeneous groups in terms of age (groups 1-4) or other personal characteristics (group 5, see below). The first group (G1) was comprised of five college-age adults (21 to 28 years old, M = 24.0; two females; three students and two unemployed); G2 included six young adults (33 to 44 years old, M = 38.8; three females; two unemployed and one furloughed due to the pandemic); G3 incorporated four middle-aged adults (48 to 53 years old, M = 50.7; three females; one unemployed); and G4 consisted of five old adults (69 to 85 years old, M = 73.6; three females; four retired and one never worked). We also created a high-demand group (G5),

whose six members potentially faced more and more varied stressors because they worked full-time, had children at home, and reported high levels of political interest—which may lead to increased use of MIM for news and political discussion—(38 to 54 years old, *M* = 47.3; three females; two private sector workers, one public sector worker, and three business owners or self-employed). Some discussants received help from their family in adjusting the video conference settings, but once the sessions started, participants were alone. Discussions lasted between 49 and 62 minutes and were moderated by the authors and transcribed by the company. The first part of the sessions focused on MIM uses (with no reference to stress) and the second part on participants' views of MIM as a stressor.

Study 2

This second study was also approved by the Ethics Committee of ANONYMIZEDXXX (registration # 2020-0450). We conducted an online survey to assess the applicability of the categories developed from Study 1 (MIM uses and technostressors, RQ1 and RQ2, respectively) to a different sample, as well as to examine the relationship between specific uses of MIM and technostressors (RQ3). Respondents were asked about "a recent experience with MIM that increased or decreased [their] feelings of stress." We included the option to narrate a stress-reducing experience in order not to force participants to appraise MIM as a source of stress.

Following Karapanos et al.'s procedure (2016), we asked respondents to take a few minutes to recall a single experience and describe its context and the reason why they believed the use of MIM increased or decreased their feelings of stress. This concrete approach to a single experience reduces respondents' recall and selection biases (Karapanos et al., 2016). It also relieves participants from the difficulty of considering a myriad of uses and experiences to provide a *general* view of MIM as a stressor (as in Study 1). We distributed the survey link

through email to a convenience sample of psychology and communication students at the University of ANONYMIZED (Spain) between March 1 and March 23, 2021. We obtained informed consent from all respondents, who voluntarily completed the survey and received course credits for their participation. In addition, respondents were assured of the anonymity of their responses. Out of 313 students who were sent the link, 147 (102 in psychology and 45 in communication studies) returned valid questionnaires. Respondents were predominantly female (76.9%) with ages ranging between 18 and 45 (M = 20.4, SD = 4.0). Some of them (13.6%) combined their studies with work. Only three students had children. Descriptions of their experiences ranged in length between 9 and 1,881 characters, including spaces (M = 282.6, SD = 231.9).

Data Analysis

We first created text files that reproduced the conversations in Study 1 and the open-ended responses in Study 2. We then submitted the resulting documents to a combination of deductive and inductive content analysis (Elo & Kyngäs, 2008). In a first, open approach to the data, we attended to the manifest content of the group discussions without imposing preconceived categories. According to guidelines in qualitative research, the first and the second authors generated a coding frame that captured possible MIM uses (RQ1) and possible dimensions of MIM stress (RQ2). The divergences of the coding frame were resolved through a team discussion involving all authors. In a second stage, we compared and—when possible—adapted our labels to those of prior relevant literature on media U&G and technostress. Thirdly, we applied the resulting categories to the different, less diverse sample of Study 2.

Results

MIM Uses

Data from Study 1 revealed five broad uses of MIM (Table 1). First, all five discussion groups indicated that the main MIM use was "to stay in touch [… and] know about the people [they] love" and deep in their relationships with family, friends, or coworkers. This dimension connects with the psychological needs for relatedness and intimacy (Reeve, 2009). It is similar to affection as one of the "intrinsic motives" for using the desktop chat software ICQ detected by Leung (2001), and to relational maintenance as a "social motivator of Snapchat use" among students (Makki et al., 2017, p. 413). We have labeled this set of uses as *relatedness, intimacy, and social interaction*, which includes two main subdimensions: a) *relatedness and intimacy* and b) *planning and coordination of social activity* (examples in Table 1). Most participants of both genders and from all groups referred to MIM as a tool to maintain emotional bonds with close ties: spouse, immediate family, and close friends (bonding networks). Nonetheless, two young male discussants in G1 indicated that they participate in large MIM groups where they interact with weak ties: people they "never met in person" (group #1, male, 26) or "they have only met in person once" (#1, male, 22) (bridging networks). More interestingly, three members of the senior group also referred to these weak tie interactions in large MIM groups: with Pilates and embroidery classmates (#4, female, 74), photography enthusiasts (#4, male, 70), or members of the fitness club (#4, female, 69).

[TABLE_1]

The second dimension comprises *work-, study-, and business-related* (non-social) *uses*, which includes scheduling working meetings, helping coworkers with problems, coordinating class assignments, distributing "documents, exams, cheat sheets," etc. This category is analogous

to that of social media use for work-related purposes in the literature on information systems (see, for example, Zhang et al., 2019). From a U&G perspective, this dimension can be interpreted as a response to the quasi-needs for job, money, and a career plan (Reeve, 2009). Based on life cycle, employment status, and other differences among participants, discussions in Study 1 revealed four subdimensions of this domain: c) *work*, d) *study*, e) *advertising and sale/purchase transactions*, and f) *job search*. As expected, this dimension was underrepresented in the older group (G4), while the study-related subdimension was more often reported by younger participants.

Third, participants in most focus groups recounted using MIM for *political and civic purposes* such as "shar[ing] a news story and [starting] some discussion," informing about demonstrations and protests, or organizing neighborhood-based volunteer activities. This is consistent with related findings alluding to parallel uses such as MIM for political discussion or social media for political participation (Gil de Zúñiga et al., 2021; Kim & Khang, 2014). Political and civic uses of MIM point to acquired social motivations such as affiliation, power (Reeve, 2009), or cognition (Cacioppo et al., 1996). Within this general domain, the analysis of focus group data revealed three more specific subcategories: g) *news and political talk*, h) *political participation*, and i) *civic engagement*.

The fourth dimension includes *domestic and other non-work commitments* such as scheduling the "pick up of [their] granddaughters", "ordering water bottles," preparing the grocery shopping list, or coordinating the purchase of family gifts. As with the *work, study, and business* dimension, this category of usages is also a response to "situational demands and pressures" (Reeve, 2009, p. 173) that are at the origin of quasi-needs. Domestic commitments may also be close to certain physiological and psychological needs (e.g., people go to the

supermarket partly based on their need for food, and they buy Christmas gifts in connection with their need for relatedness and intimacy). These uses were reported in all groups except G1 but were undermentioned in comparison with the previous ones.

Finally, some participants use MIM for *pastime and entertainment*: To fill the "many dead times" of the day, beat boredom, talk for the sake of it, sharing some content that one finds constructive, pleasant, fun, etc. This category of uses responds to the innate human curiosity and the intrinsic motivation to seek out (Reeves, 2009, p. 144), and is common in the literature of social media (see Leung, 2001; Quan-Haase & Young, 2010). It also resonates with MIM-related entertainment uses detected among teenagers, especially males, such as playing videogames and "coordinat[ing] the necessary movements during games" (Costa-Sánchez & Guerrero-Pico, 2020, p. 6).

As an initial test of the transferability of this category system, we tried to identify MIM uses on the different sample of Study 2. We content analyzed the 147 open-ended responses and identified some of the uses above in 122 of the reported experiences (i.e., almost 83% of the responses). The rest of the experiences did not provide enough information to assign a specific MIM use. Most of these 122 cases connected with relatedness, intimacy, and social interaction (80, 65.6%) or work-, study-, and business-related uses (32, 26.2%). In fact, as one would expect from the characteristics of the sample, work and business were a relative minority (10), and this category was clearly biased towards study uses such as "organizing [group] assignments from home," "clarifying [assignment-related] doubts very quickly," or "discussing with other classmates the syllabus and conditions of an exam." Two experiences (1.6%) alluded to political and civic uses; another two detailed domestic and other non-work commitments; and one more (0.8%) recounted a pastime- and entertainment-related use. Five cases alluded to a combination

of two uses (study and political, study and relatedness [2], study and domestic, relatedness and pastime) (see more examples in Table 1).

Dimensions of MIM Stress

Data from Study 1 also shed light on the reasons why individuals may evaluate the demands of MIM as taxing on their resources. While previous studies had suggested some of these MIM-specific stressors, the present article expands these perspectives and brings them together under the technostress framework. It should first be noted that the analysis of discussions does not suggest a simple linear association between MIM use and stress. Some participants described situations were using MIM helped them deal with stressful situations, as if it was part of coping responses to other difficulties of the 'offline world.' MIM use helped them *finding personally relevant information*—"It is quite reassuring when you forget something and someone mentions it [via WhatsApp], or when you have an urgent doubt, such as a question about the classes" (#1, female, 23)—; *escaping from real-life problems*—"It doesn't stress me out too much; on the contrary, it helps me escape. Sometimes I must deal with a lot of pressure at work, and I check WhatsApp to relax a bit and giggle at some nonsense" (#2, male, 37)—; or *seeking for social and interpersonal support*—"It really gives me peace of mind to know that I can contact my family anytime, at any time of the day or night" (#4, f, 69).

Senior participants in G4 were the ones who perceived their interaction with MIM more positively in affective terms. "Reassuring" and "relaxing" were the most repeated adjectives spoken by older participants to evaluate their use of MIM. They barely mentioned any situation where MIM use made them feel stress. This may partly be due to their pattern of use of MIM: mostly for relatedness, intimacy, and social interaction, and almost never for work or business. Furthermore, their reported frequency of usage was lower, and they seemed to experience less

pressure to be available online and reply immediately: "The people I contact with are aware that I am not constantly checking WhatsApp; therefore, I do not feel any pressure" (#4, f, 74).

Despite this positive, stress-reducing potential of MIM, the analysis of the focus group data yielded four major dimensions of MIM stress (Table 2). Male and female participants in all groups mentioned difficulties in dealing with the large flow of incoming messages, most of which require attention and action. Following previous studies on work-related technostress and information overload (Misra & Stokols, 2011; Tarafdar et al., 2007), we called this dimension *MIM overload*: "Suddenly you have three people talking to you at the same time" (#1, m, 21); "200, 300, 400 messages […] you cannot read" (#1, f, 23). This sometimes includes low quality information—e.g., "evident fake news about politics, society…" (#4, f, 74)—that users need to filter or refute, which may be particularly stressful in connection with health news in the pandemic context. Some key features of the MIM apps (notification sound, vibration, etc.) seem to increase the perception of overload: "If I'm always hearing [the notification sound] in the background, there comes a moment when I become overwhelmed" (#5, f, 39). Overload is more likely to arise when participants interact in large MIM groups, and common coping strategies were silencing group chats, ignoring messages or, more rarely, deleting entire conversations.

[TABLE_2]

The second dimension that emerged from our qualitative data is *MIM invasion*, which is similar to invasion in the literature on technostress at work (see, for example, Tarafdar et al., 2007). It mainly refers to the MIM-facilitated permeation of work, study-, or business-related issues into the personal domain: "I finish my workday and I keep receiving work-related instructions" (#1, f, 28). The lockdown and home confinement worsened the situation for some of our discussants because work schedules "are not the same as they used to be": "[Some

coworkers] connect at night and text you" (#3, f, 48), or schedule work shifts and define tasks without considering that "you are outside working hours" (#1, f, 28). More broadly, not work-related MIM can also invade interpersonal relationships: "Many times I am engaged in a conversation […] and though the conversation may be super interesting, they may shift their attention to the screen. That's an invasion of our contact […]" (#1, m, 26). Following previous literature on technostress (Barber & Santuzzi, 2015; Tarafdar et al., 2019), we also include in this dimension the feelings of pervasiveness, or the perception that MIM technology never gives one a break. It does not refer to the number of messages (as in overload), but to the potential of the technology to interrupt people's "daily routines" (#5, f, 39) and its power to divide one's attention: "And one has to constantly keep an eye on the phone and... These new technologies do help a lot, generally speaking. But they are also time-consuming and stress you out, I think" (#2, m, 44). This perceived invasive nature of MIM was associated with both one-on-one and group chat interactions and expressed in all group discussions except G4 (senior).

Thirdly, women and men in all groups except G4 raised concerns about the sense of *urgency of response* associated with MIM use. In the IS literature, expectations of immediate response to work-related demands are part of the techno-invasion stressor (Tarafdar et al., 2019). Some participants and respondents, however, made an implicit distinction between both dimensions, and we have therefore chosen to consider *invasion* and *urgency of response* as separate—but related—stressors. For example, this mother is unlikely to view her daughter's messages as an invasion of her personal life, but she admits feeling pressured by her impatience: "[My] 11-year-old daughter has now a mobile phone, she has WhatsApp on it and is very impatient […]: 'Answer me, now' […]; 'Mom, answer; mom, answer.' And I say: 'My God, I can't right now'" (#5, f, 39). In a similar line, a 37-year-old male participant in G2 points out that

"it is an instant messaging technology, but it does not mean that you have to read [the messages] instantly." Indeed, some discussants reported turning off the blue ticks (read receipts) in the app as a coping strategy to minimize stress: "[…] Because it is true that I had a certain self-pressure to respond as soon as I got the message. It seemed wrong to me that others knew I had read it and not replied" (#3, f, 48). As for the invasion stressor, feelings of urgency arise in both one-on-one and group conversations.

Finally, the last stressor that emerged during the analysis was *MIM ambiguity*. It refers to the lack of human presence and appropriate context (e.g., tone of voice and non-verbal cues that indicate the communicative style and define the intention) that frequently characterize MIM-mediated communication. This loss of intangible elements sometimes leads to misunderstandings and misinterpretations of one-on-one or group conversations: "[…] People writing behind a screen are very brave, or sometimes they say things that are misinterpreted, or etcetera etcetera, don't they?" (#5, m, 53); "[I have moments] of stress, of saying to myself: 'Why did they say this? Why did they say that? Why is he now replying in this way?' This kind of misunderstandings that […] create some sort of anxiety" (#3, m, 52). Interestingly, none of the participants in G4 expressed feelings of ambiguity related to MIM use.

As with RQ1, we assessed the applicability of these four stressors to a different sample in Study 2. We found that 59 respondents (40.1% of valid responses) recalled an experience with MIM that *reduced* their feelings of stress, which reinforces the idea of a dual relationship between MIM use and stress: "I was stressed out [because] I did not know the date of my exam, and I could ask my classmates via WhatsApp and my stress reduced" (f, 18); "I could talk to my friends and express how I was feeling" (f, 21). Some respondents also mentioned that their use of

MIM allowed them to *ask for advice*: "I talked to a close friend because I needed some advice and, in a matter of minutes, I could solve the issue" (f, 20).

On the opposite side, 88 students (59.9%; 52 psychology and 36 communication students) addressed a stress-provoking experience associated with MIM. Sixty-two of these open-ended responses involved at least one of the four MIM stressors above. In four cases, respondents described online harassment or bullying experiences, which we do not reproduce here to protect their privacy. Although harassment and bullying may relate to some of the MIM stressors in this study (e.g., invasion, overload), we think the issues are complex enough to deserve a separate study, and therefore did not code bullying and harassment as part of MIM stress.

Overload was dominant and evaluated as a stressor in 27 of 62 experiences (43.5%). In 24 experiences (38.7%), respondents pointed to *ambiguity* as a stressor. Feelings of *invasion* were described in 17 cases (27.4%). Finally, *urgency* was mentioned in other 17 experiences (see examples in Table 2). The more anonymous context of Study 2 allowed us to uncover the flip side of urgency (that of the sender perspective): some students confessed that they feel impatient if they do not receive a quick response to their messages: "It was a conversation with my partner that we talked about something important, I was stressed waiting to receive their messages" (f, 18); "I feel the need for the messages I send to be instantly responded to; I do not communicate it to the other person out of respect, but the reality is that when I send a message and they take too long to respond, I get stressed and irritated" (f, 18). Urgency therefore arises from both external pressures to respond quickly and expectations regarding others' quickness to reply.

Some of the reported experiences involved more than one stressor, especially those related to the urgency category. For example, an 18-year-old female student narrated the

following stressful event that includes elements of *overload* ("kept getting notifications," "constant stream of messages"), *invasion* ("I could not focus on my things,"), and *urgency* ("why I wasn't answering the phone"):

> I was doing my assignments and I kept getting notifications from family and friends, asking me what I was doing, why I wasn't answering the phone, etc. It was already night, and I was tired of being all day in front of the computer, and the constant stream of messages stressed me more because I could not focus on my things. I just wanted to finish my assignments and go to sleep.

Different from findings of Study 1, Study 2 suggests gender differences in some of the dimensions of MIM stress—notably urgency and invasion. None of the male students expressed feelings of urgency associated with their stress-producing experiences, whereas 28.8% of women's episodes (excluding those for which no MIM-related stressor could be assigned) did. In contrast, 38.5% of men's but only 20.3% of women's stressing events involved the invasion technostressor.

MIM Uses and Stress

To answer RQ3, we reanalyzed 88 of the open-ended responses in Study 2—those from respondents who recalled a stress-provoking experience, 52 psychology and 36 communication students. We sought to relate MIM uses in Table 1 to specific stressors in Table 2. Figure 1 shows a Sankey diagram of the connections between MIM uses and stressors as reported in Study 2. Work- and study-related uses seem to have the greatest impact in the MIM stress generative process. Work and study uses were placed at the origin of perceptions of overload (17 times), ambiguity (8 times), invasion (7 times), and urgency (3 times). For example, this 27-year-old woman associated study-related uses with feelings of invasion and urgency:

> A WhatsApp group for the master's students where people were discussing issues relating to a certain course while we were having an online class. The discussion [was taking place]

> simultaneously with the class, which completely distracted our attention, in addition [the participants] were making decisions about the course without waiting for the approval of all classmates.

More surprisingly, relatedness and interaction uses were connected with MIM stress almost as frequently as work- and study-related uses. Specifically, experiences uncovered a common association of relatedness and social interaction uses with ambiguity (14 experiences). For example:

> I was having an argument with my partner, and communication via WhatsApp is clearly more unsatisfactory than face-to-face communication. We had been talking about the same issue for about 30 minutes and we could not understand each other. We were misunderstanding things. This increased my stress, and I felt overwhelmed (f, 18).

Relatedness and interaction uses were also reported as a source of urgency-related stress (6 cases), invasion (4 experiences) and, more rarely, overload (two cases). Seen from the other side of the process (that of the MIM stressors), feelings of overload and invasion seem to be mainly associated with work and study uses of MIM, while feelings of ambiguity and urgency are more commonly triggered by relatedness and social interaction uses. The remaining uses of MIM (domestic commitments, political and civic uses, and pastime and entertainment) were rarely or never mentioned as stressors—in part because these uses were less common in this second sample.

We also found gender differences in Study 2 regarding the context of these stress-producing experiences. Thus, women tended to report stressing experiences in connection with relatedness, intimacy, and social interaction (52.2% of women's experiences, excluding those for which no use could be assigned), while men were more prone to remember experiences associated with work, study, and business uses (66.7%).

[FIGURE 1]

Discussion

This study theorized and explored a model describing how different uses of MIM—not restricted to the work domain—are linked to different technostressors. First, we considered an open approach to develop a wide catalogue of MIM uses that attempts to expand the focus beyond specific social groups (e.g., students, health-care workers, the elderly) and specific tools (e.g., Snapchat, WhatsApp, BlackBerry Messenger). Furthermore, instead of relying on previous social media U&G literature and assuming a correspondence of uses between social media and MIM, we categorized MIM as a distinctive medium, characterized by particular uses that may impact perceived stress differently. Our catalogue of uses also reflects the current state of instant messaging, which is largely a mobile phone- and not a desktop-based technology.

Focus group conversations confirmed the central role of relational maintenance and intimate communication in relationship with MIM use, but also revealed a richness of detail and practices that we categorized in five categories and nine subcategories: *relatedness, intimacy, and social interaction* (with two subcategories); *work-, study-, and business-related uses* (four subcategories); *political and civic uses* (three subcategories); *domestic and other non-work commitments*; and *pastime and entertainment*. With regard to the first category, most participants use MIM to maintain and strengthen close tie relationships (bonding networks). Nonetheless, the conversations also revealed the potential of MIM groups to promote weak tie interaction. Remarkably, it was not only young discussants who connected with weak ties through MIM, but also some of the oldest participants (G4). This suggest a positive role for MIM groups in connecting people with different backgrounds (bridging networks), which may be particularly

beneficial for the elderly. We successfully applied the MIM use categories to a different sample (Study 2), which speaks in favor of their transferability.

Second, we also address recent calls for the examination of the model of technostress outside the work environment (Tarafdar et al., 2019). In this regard, we identify and integrate (within the technostress framework) four MIM-specific dimensions of technostress: 1) *MIM overload* was already suggested by previous qualitative and quantitative work (Blabst & Diefenbach, 2017; Shin et al., 2018). It refers to difficulties in dealing with group and individual chats that become overcrowded with messages, most of which require feedback from the recipients but are nearly impossible to fully read. Furthermore, some messages contain low quality information that users frequently need to filter or refute. 2) *MIM ambiguity* connects with a lack of human presence and appropriate conversational context, which sometimes leads to misunderstandings, misinterpretations, and communication problems. 3) *Invasion* stems from constant (24/7) connectivity, which elicits the feeling that MIM never gives one a break and interrupts one's routines. It relates to the consideration of MIM as a real nuisance, "especially when one is engaged in another activity," as reported in Fondevila-Gascón and colleagues' (2014, p. 9) survey study. Some participants keep receiving work-related instructions after their workday and perceive that work- or study-related issues 'spill over' into the personal domain (see Schieman & Young, 2013). Likewise, MIM conversations with friends or family can invade other personal spaces, such as a face-to-face conversations where conversational partners may shift their attention to the screen. Finally, 4) *MIM urgency* covers feelings of pressure resulting from impatience or expectations for a quick response. This appraisal may emanate from either the sender or the receiver of the message, and connects with Blabst and Diefenbach's (2017) findings regarding the direct association between active use of 'last seen' and 'read receipts' and

levels of perceived stress. Our four-dimensional measure of MIM stress proved to be applicable to a different, less diverse sample (Study 2), and may guide the development of future quantitative instruments.

Our study also examined the link between MIM uses and dimensions of MIM stress. Consistent with the mixed picture described in the literature review (e.g., Bano et al. 2019; Beyens, et al., 2020; Chan, 2015; Shin et al., 2018), participants' comments in both studies suggest that users do not necessarily (or always) appraise MIM as a stressor. More specifically, MIM may also help users deal with stressful situations of daily life and mobilize coping resources: finding personally relevant information, escaping from real-life problems, seeking for social and interpersonal support, or asking for advice. Some of the stress-reducing potential of MIM may therefore be connected to the mobilization of social resources for emotional and problem-oriented support (Chan, 2018; Yeshua-Katz, 2021).

By contrast, other participants' comments suggest that some uses of MIM contribute to different dimensions of MIM stress. Expectedly, work- and study-related uses seem to be important sources of MIM stress, especially via feelings of overload, ambiguity, and invasion. This is consistent with previous research that has shown that work-related communication outside working hours predicts stress, work-to-family conflict, and even sleep problems (Schieman & Young, 2013). Considering these negative health-related consequences, organizational practices should evolve to avoid job pressures after hours and, complementarily, promote assertive communication to reject work-related MIM communications during non-working time.

The results of this study also suggest a less obvious connection between relatedness and social interaction uses of MIM with stress. These more personal uses seem to be appraised, at

least sometimes, as a source of (stressing) ambiguity, urgency-related issues, invasion of one's offline reality and, to a lesser extent, overload. These findings may relate to individual differences in cognitive processes and coping strategies that may be associated with positive or negative consequences of MIM use. For instance, according to attachment theory, insecurely attached individuals are more prone to experience an increased need for intimacy and fear of rejection (Mikulincer & Shaver, 2012), which seems to foster a more frequent (and, we venture to say, more ambiguous and urgent) MIM-mediated interaction with close ties (see Weisskirch, 2012). On the contrary, individuals with an avoidant attachment style tend to show higher levels of emotional detachment and self-sufficiency (Mikulincer & Shaver, 2012), which may be linked to stress when the number or intensity of MIM-mediated exchanges are perceived as excessive. Future research should better examine individual differences to provide a better understanding of risk and protective factors for healthy, stress-free use of MIM.

Of particular interest are some age and gender differences in the MIM-stress process, which would deserve further exploration beyond the scope of the present investigation. In Study 1, the older age group (G4) seemed to perceive MIM use more as a stress-reducing activity and be relative immune to MIM-related stressors—except for exceptional feelings of overload. In the second study, we detected that female students were more prone to remember stress-provoking experiences in a context of relatedness, intimacy, and social interaction, while males reported more experiences connected with work, study, and business. Also in Study 2, women seemed more affected by feelings of urgency than men, while male students felt invaded more often than females. These findings could be explained by traditional gendered socialization.

The findings of this study should be interpreted carefully in the light of its limitations. We deliberately used a qualitative approach with non-probability samples that are not

representative of the characteristics of the country's (Study 1) or the university students' (Study 2) population. We tried to minimize this limitation by selecting a fairly diverse sample for Study 1 and by evaluating the applicability of our category systems to the less diverse sample of Study 2—where most respondents were psychology students, belonged to a similar age bracket, were females, childless, and did not work. However, it should be recalled that our findings regarding the association between MIM uses and stress (RQ3) were not inferred from the Study 1 sample, but from the less diverse sample of Study 2. The literature indicates that female psychology students may be particularly open-minded in their attitudes toward mental health problems—such as the outcomes of technostress—, but psychology undergraduates may also have more difficulties in managing daily life stressors—such as those triggered by MIM use—than other students (see Franzen et al., 2021; Kotera, Green, & Sheffield, 2019).

All in all, our study suggests that MIM-associated technostress is a multidimensional construct, that not all uses of MIM are equally associated with stress, and that relatedness and social interaction—and not only work- and study-related—uses of MIM may be a source of technostress. More importantly, MIM characteristics are not systematically appraised as threatening, and some uses of MIM may facilitate coping strategies that help to alleviate stressful situations of daily life. The latter be especially true and relevant for (some) older users. Given the negative consequences of technostress on health and well-being (Lee et al., 2016; Misra & Stokols, 2012; Schieman & Young, 2013), research should call for quantitative designs and replication of these findings in other populations. In this sense, our typology of MIM uses and stress may provide a guide for future development of quantitative measures.

Declaration of Interest Statement

There is no actual or potential conflict of interest in relation to this article.

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Table 1. Categories and Subcategories of MIM App Uses

Main category	*Sub-categories*[i/a]	*Examples of comments* (with focus group or Study number, participant's sex, and age in parentheses)
1. Relatedness, intimacy, and social interaction	a. Relatedness and intimacy	(#5, f, 47): [I use WhatsApp] with friends […] to keep up to date, because each one has their own life and, sometimes, it is not easy to see each other. […] It is a way to stay in touch, to be permanently… To know about the people you love. (S2, f, 20): [One time] I was emotionally bad, and thanks to WhatsApp I could talk with my best friend, who calmed me down. We talked for an hour or more, and it helped a lot.
	b. Planning and coordination of social activity	(#4, m, 85): Rather, it is about personal conversations: "Listen, what are you doing?" "Where are you going?" "Listen, let's meet for a coffee." "Listen, let's do something. I will do such-and-such thing and I'll call you later." (S2, m, 20): Because I was talking with friends about taking a walk together.
2. Work-, study-, and business-related uses	c. Work uses	(#3, m, 52): [At my work] there is a high turnover rate. People join and leave the [WhatsApp] group. Sometimes they ask things at 11 pm […] in the group: "How is this done?" "What should I do about that?" (S2, f, 24): With regard to my job, there was this crisis moment because I hadn't addressed an issue—it was my day off—and, suddenly, I had several messages from different people that required my attention.
	d. Study-related uses	(#2, m, 37): Not too long ago I was doing a master's degree and we shared everything [via WhatsApp]: documents, exams, cheat sheets… (S2, f, 18): […] in the class WhatsApp group, they never stopped texting. Even though I had the group muted, I used to enter the conversation to check if they had shared something important about the exams. But there were so many messages that I got overloaded.
	e. Advertising and sale / purchase transactions	(#3, f, 53): As I speak with you, there are like 8 WhatsApp [messages] waiting […]. I know these are from people that are interested in products from my website. I'll make money with that. (#2, m, 37): [I use WhatsApp] for the sale and purchase of second-hand [goods]. Sometimes they give you their mobile number and then we switch to WhatsApp, which is like more immediate.
	f. Job search	(#3, f, 50): I'm a member of two Telegram groups of Spanish language teachers. It's kind of a chat where we talk to students of Spanish from all over the world. It is also a way to find students for online lessons. (#2, m, 43): [I'm in a group] where you can inscribe […] and they send you job vacancies […]. You can even share your own vacancies, of which you may be aware and have not been previously shared.

3. Political and civic uses	g. News and political talk	(#4, f, 70): We talk about politics in the [group] for former college classmates. In other groups it is best not to talk [politics]. It can lead to uncomfortable moments because everyone does not think alike and there is no respect, or people insult each other, and one should try to avoid these things. S2, f, 20): When the news [of the epidemiological alert] broke, my family and friends started to send me [text] messages. Many of them were contradictory […].
	h. Civic engagement	(#1, m, 26): Some of my relatives […] used WhatsApp to provide [community] services. Older neighbors could order food instead of going to the store themselves and risking exposure to the [Covid-19] virus. (#3, f, 53): [I'm in a WhatsApp group] of an animal welfare organization […]. We are always vigilant for abandoned or mistreated animals. In this [group] we chat every day because there are sadly lots of abandoned or mistreated animals.
	i. Political participation	(#3, f, 48): [In the neighborhood] they have protested, blocked the street, and things like that. For instance, public health-care advocacy groups contact you [via WhatsApp] and say: "A gathering will take place in front of the health center at such-and-such a time, on such-and-such a day." (#2, m, 44): I'm registered as a member of a political party and […] we use [the WhatsApp group] to share information, organize the meetings, attend [face-to-face or virtual] meetings […].
4. Domestic and other non-work commitments		(#4, f, 70): For me it is reassuring to be able to contact […]. If, for example, something arises and I have to go and pick up my granddaughters… These things bring me peace of mind. (S2, f, 19): I was packing my stuff because I was going to my town. My boyfriend was picking me up, but at the last minute he decided to reschedule for an hour earlier. He was [texting] to tell me that he was picking me up right at that moment […].
5. Pastime and entertainment		(#2, m, 37): I use [WhatsApp] mainly for leisure […]. To exchange trivialities, many memes and stuff, and videos. (S2, f, 18): I tried to keep my mobile phone away during exam time so that I could focus, but every time I took a break and picked up my phone, it somehow made me escape from and release the stress caused by the exams.

Notes. Hashtags indicate the focus group number in examples from Study 1. S2 indicates that the example is taken from Study 2. Superscript i/a: If applicable.

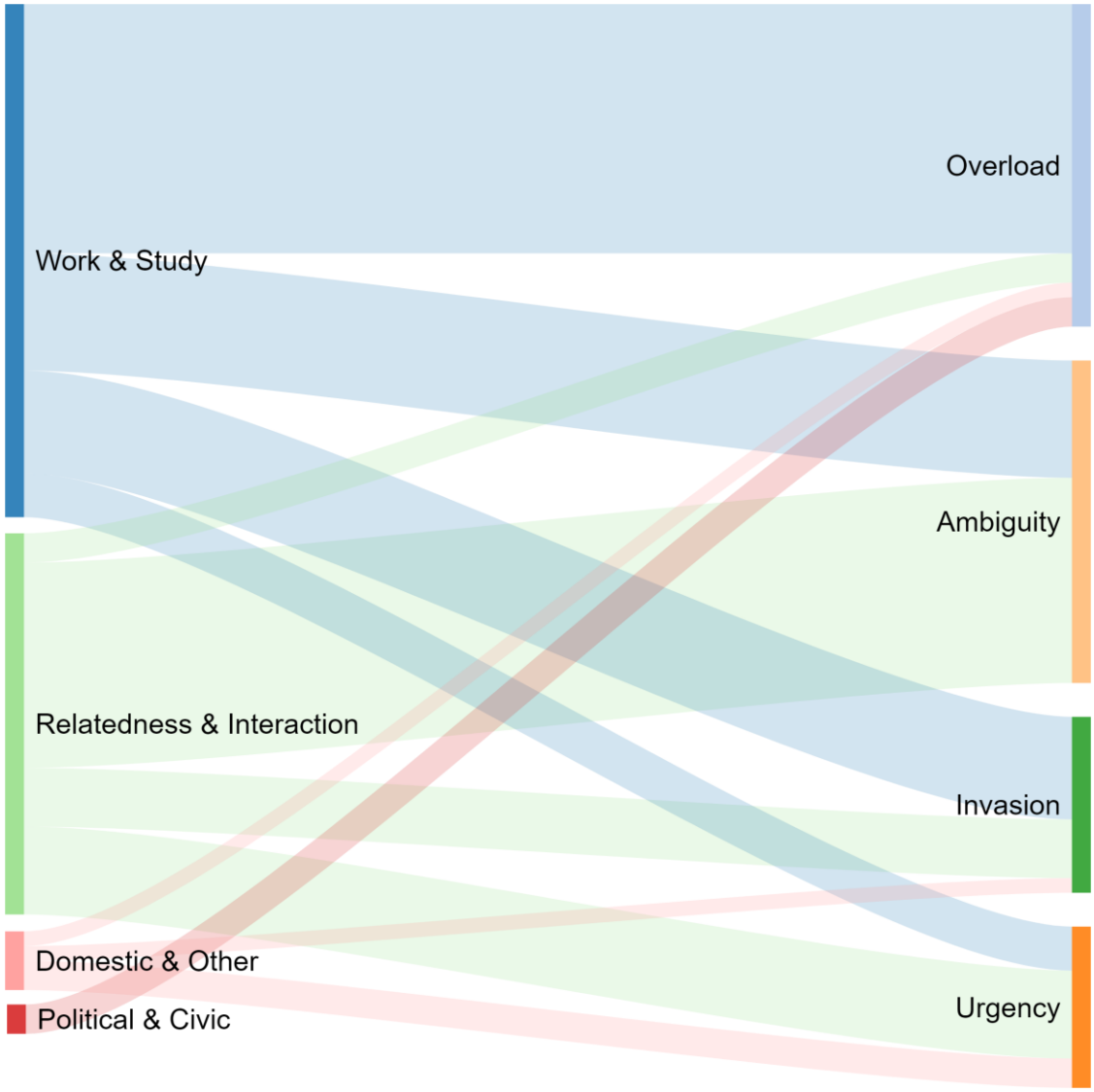
Table 2. Dimensions of MIM technostress

Dimension	*Examples of comments* (with focus group or Study number, participant's sex and age in parentheses)
1. MIM overload	(#2, m, 44): What stresses me out […] is to see a lot of red numbers [in the notification badge], you know? And I like to reply immediately and get rid of them. So, what stresses me out is that, seeing [those] red [numbers] […]. (S2, f, 19): […] many times I take my mobile phone after studying and I find thousands of messages that I am not able to read fully, so I remain uninformed.
2. MIM invasion	(#5, f, 47): […] We can receive a WhatsApp [message] at 2 am from our boss with instructions for the next day, you know? […]. No, no, maybe not at 2 am, but at 10 pm. I'm trying to control that. I mean, I think that's not OK […]. *Moderator*: But you read them. And […] maybe those messages are not always pleasant, some work-related messages may be unpleasant. Don't them cause […] some discomfort before going to bed, for example? *Participant*: Yes, it may stress me out when I think: "Damn it! Tomorrow morning, I have to do that". But I don't lose any sleep over it. *M*: And what about the weekends […]? *P*: I read them as well, yes. […] Depends on the content of the message, but I try, eh… If it's a Saturday, it's a Saturday and no, I am not working. Some weekends I do have to work, but come on, if I'm…. (#5, f, 39): Also [at home], if I have to cook for my kids or bathe them or, I don't know, if I'm busy. So, if I do not hear [the WhatsApp sound], I feel happier to continue doing my daily routines. Maybe if I'm continuously hearing it as a background noise, then I reach a point where I feel overwhelmed. If I don't hear it, I don't feel overwhelmed. I tend to silence [… WhatsApp] to ensure that it does not make me… I would not say anxious but nervous. I don't know how to explain it […]. In order not to hear it continuously, because it interrupts me. And when I get interrupted, I get nervous because I want to do things well. (#2, m, 44): […] They send you the message, and if it's 10:30 or 11 at night they send it to you anyway, and they don't care. And I like reading the messages and not leaving them unread, so I tend to read them at any time… Well, of course not at 2 am. But if they send me one at 11:30 or 12 at night, which is not that common, I use to read it. And one has to constantly keep an eye on the phone and... (S2, m, 26): I was the communication link […] and therefore I had to pass on every single message, wait for replies and reproduce them, and make decisions sequentially […]. This led to me not being able to focus on other activities such as studying or watching a film.
3. MIM urgency	(#3, f, 48): I think that [MIM apps] are a little stressful […]. [I] removed the popular blue ticks so that people cannot see if I read [the messages] or not. Because I felt a personal pressure to reply as soon as I read it; it seemed wrong to me to read them and not reply—with people noticing. I think [MIM] is a very good thing, because it helps you to have an immediate relationship and so, but it also has a side that makes you nervous. *M*: You mentioned a personal pressure. Is it explicit [from others] or is it only yours?

3. MIM urgency (cont.)	*P*: It's personal [self-imposed], but I think it's also social. Because sometimes, some people, not everyone, say: "You've read it and haven't replied", "It took you two hours to reply to me". Then I think it's a bit of both things […]. Therefore, in order to take pressure off yourself, you have to remove these [blue ticks]. (S2, f, 18): WhatsApp increased my stress because the messages I sent about the organization of upcoming university assignments were read or not, and for hours I did not get a response.
4. MIM ambiguity	(#1, m, 26): Since [MIM] lacks proper context, sometimes the message that is transmitted… There is a misinterpretation of the message. And some topics are intense and may stress individuals out. And then… *M*: Elaborate a bit more on this. When you talk about lack of context and stressing topics, what are you thinking about specifically? *P*: I'm thinking that when I send a message, I send it with a certain intention, don't I? But in fact, the other person misunderstands my intention. They start to mull it over. *M*: Maybe you say something in good faith, but they interpret that you want to aggravate them. *P*: Exactly. Or I may simply reply with 'OK,' and I am really paying attention. However, the other person may interpret it as me wanting to finish the conversation, it's this kind of things […]. (S2, f, 18): [...] when you chat [...] you cannot express everything you want to say without being interrupted. Furthermore, they cannot see, as they would in person, whether what they are saying is hurting you.

Notes. Hashtags indicate the focus group number in examples from Study 1. S2 indicates that the example is taken from Study 2.

Figure 1. Association between MIM uses (left) and MIM stressors (right)



Note. The width of the bands is proportional to the frequency of the association between a specific MIM app use (left) and dimension of MIM stress (right). The associations were coded from the open-ended responses in Study 2. The diagram was created using SankeyMATIC online diagram builder.