

Leveraging Smartphones to Observe Couples Remotely and Illuminate How COVID-19 Stress Shaped Marital Communication

James K. McNulty¹, Lindsey L. Hicks², Jordan A. Turner¹, and Andrea L. Meltzer¹

¹ Department of Psychology, Florida State University

² Department of Psychology, Christopher Newport University

The height of the COVID-19 pandemic was an exceptionally stressful time for families that offered a unique opportunity to understand how stressful experiences occurring outside the relationship shape behavior occurring inside the relationship. Given the social distancing requirements of the pandemic, however, most research addressing this issue has relied on self-reports of behavior, which are susceptible to bias. In the summer of 2020, we asked a sample of married individuals living in the United States, Canada, Ireland, and the United Kingdom to complete online questionnaires assessing neuroticism and attachment insecurity, their levels of chronic stress, and their levels of acute stress due to the COVID-19 pandemic. We then asked participants to submit a 10-min video of themselves and their spouse attempting to solve an important marital problem that they recorded on their smartphone or other device and uploaded to a secure server. Coders were able to reliably code the behavior of both partners using an established coding system, and the distribution of codes was similar to prior research. Consistent with predictions, participants' COVID-19 stress interacted with their neuroticism and attachment avoidance to predict their levels of oppositional behavior, controlling for their levels of chronic stress and their partner's behavior; neuroticism and attachment avoidance were associated with behaving in a more oppositional manner among participants who reported high but not low COVID-19 stress. Attachment anxiety trended toward predicting more oppositional behavior regardless of stress. These results shed light on how stress affects behavior and introduce a novel way to observe family behavior remotely.

Keywords: COVID-19, marriage, communication, stress, VSA model

The height of the COVID-19 pandemic was a time of exceptional stress for families. Not only did people experience anxiety about becoming infected themselves (Salari et al., 2020; Taylor et al., 2020), they worried about loved ones becoming infected (Jean-Baptiste et al., 2020). Moreover, parents, particularly mothers, struggled with how to manage their children during mandatory lockdowns with no access to daycare (Waddell et al., 2021). And on top of all this, the pandemic led to considerable economic stress, as the economy slowed and people lost their jobs (Taylor et al., 2020). Prime et al. (2020) summarized a number of the negative implications these stressors had for families, noting that many of them emerged due to the negative implications that stress has for marital communication.

The vulnerability stress adaptation (VSA) model of marriage (Karney & Bradbury, 1995) is perhaps the most influential model

addressing how stress affects marital communication. The VSA model divides the various predictors of marital satisfaction and dissolution into three classes—enduring qualities, external circumstances, and adaptive processes. Enduring qualities are the stable qualities that characterize each member of the couple, ranging from personality characteristics (e.g., agreeableness, neuroticism) and other individual differences (e.g., attachment insecurity) to personal histories and accumulated experiences (e.g., family background, education). External circumstances are the ongoing events that occur *outside the relationship*, such as acute stressors and positive experiences that occur at work, with friends, etc. Adaptive processes are the couple members' cognitive and behavioral reactions to one another, including their communication behavior.

According to the VSA model, these three classes of variables combine to predict marital outcomes. Enduring qualities predict marital outcomes through their effects on adaptive processes like communication; whereas some individual characteristics lead people to engage in more adaptive behaviors on average, other individual characteristics lead people to engage in more maladaptive behaviors on average. Nevertheless, the strength and even manner of these associations is expected to depend on the external circumstances people face, such as their existing levels of stress. In particular, stress is posited to affect how couples behave during their interactions with one another in two ways. First, the VSA model posits that stress affects behavior directly, such that more (vs. less) stress is associated with engaging in more maladaptive behaviors, including communication behaviors. Second, the VSA model posits that stress accentuates the association between partners' enduring qualities and their behavior, such that more stress allows personal characteristics of each partner to more strongly

This article was published Online First October 10, 2022.

James K. McNulty  <https://orcid.org/0000-0002-5476-7472>

Lindsey L. Hicks  <https://orcid.org/0000-0001-7451-3982>

Jordan A. Turner  <https://orcid.org/0000-0001-7121-3714>

Andrea L. Meltzer  <https://orcid.org/0000-0002-4353-2889>

Data collection was funded by a "Collaborative Collision" grant from the Office of Research of Florida State University. None of the data from the study described here have been published elsewhere, and these ideas have not yet been disseminated. Predictions and analyses were not preregistered. Data, syntax, and materials are available at https://osf.io/udptc/?view_only=bb523126bc3343e39bc327aab6eb7b4b.

Correspondence concerning this article should be addressed to James K. McNulty, Department of Psychology, Florida State University, 1107 West Call Street, Tallahassee, FL 32306-4301, United States. Email: mcnulty@psy.fsu.edu

predict their behavior. Consistent with both possibilities, stress diminishes cognitive capacity (Shields et al., 2017) and thereby limits people's ability to inhibit oppositional behaviors (Buck & Neff, 2012).

Research conducted during the COVID-19 pandemic also offers evidence consistent with these possibilities (Hicks et al., 2022; Kroencke et al., 2020; Overall et al., 2021, 2022). In one study, for example, men who endorsed higher (vs. lower) hostile sexism before the pandemic were more likely to report heightened verbal aggression toward their partners and children during mandatory quarantine (Overall et al., 2021). In another study, married individuals with chronic concerns about infectious disease experienced less enjoyment of sex on days that they were more (vs. less) concerned about COVID-19 infection (Hicks et al., 2021).

To the extent that COVID-19 stress did accentuate the association between enduring qualities and relationship behavior, three enduring qualities reliably linked to more negative interpersonal outcomes would have been particularly likely to do so—neuroticism, attachment anxiety, and attachment avoidance (see Pietromonaco & Overall, 2021). *Neuroticism* is characterized by a tendency to experience negative affect (Costa & McCrae, 1992), and between-person differences in neuroticism have been reliably linked to numerous negative interpersonal outcomes (for review, see McNulty, 2013), at least in part because neuroticism is associated with behaving in a more oppositional manner during discussions with a partner (McNulty, 2008). Consistent with the idea that this tendency may be accentuated during times of stress, neuroticism was associated with heightened reactions to stress during the COVID-19 pandemic (Kroencke et al., 2020). *Attachment anxiety* is a form of attachment insecurity characterized by a tendency to show increased sensitivity and reaction to interpersonal threats, typically manifesting in excessive reassurance seeking (Mikulincer & Shaver, 2007); *attachment avoidance* is a form of attachment insecurity characterized by discomfort with interpersonal closeness, typically manifesting in steadfast independence (Mikulincer & Shaver, 2007). Both qualities are associated with behaving in a more oppositional manner during discussions with a partner (Simpson & Rholes, 2017). Consistent with the idea that stress may accentuate these tendencies, one study conducted during the COVID-19 pandemic demonstrated that higher (vs. lower) attachment anxiety was associated with reporting more relationship problems and lower relationship quality among people facing more COVID-19 stress (Overall et al., 2022). Although own attachment avoidance did not interact with stress to predict outcomes in this study, partner attachment avoidance was associated with lower problem-solving efficacy and family cohesion.

Nevertheless, there are critical limits to what we have learned so far about the effects of COVID-19 stress on interpersonal behavior. Many pandemic studies did not explicitly assess behavior, and the ones that did relied on self- and partner-reports (e.g., Hicks et al., 2021; Overall et al., 2021). Self- and partner-reports of behavior can be problematic (Jacobson & Moore, 1981) because processes of sentiment override can cause feelings like relationship satisfaction and stress to color intimates' perceptions of their behavior (Weiss, 1980), casting some doubt on the findings of these studies. Researchers studying marital communication frequently favor observational procedures that quantify the behaviors couples exhibit during interactions recorded in the lab or at people's

homes (for review, see Overall & McNulty, 2017). Unfortunately, social distancing requirements precluded such methods during the height of the pandemic.

Moreover, recent research utilizing observational data from 10 longitudinal studies of 1,104 newlywed couples to test the VSA model casts doubt on the idea that stress directly informs behavior or interacts with enduring qualities to do so (McNulty et al., 2021). All 10 studies included self-report measures of stress, neuroticism, and attachment security, as well as observational measures of behavior obtained from video recordings of couples involved in problem-solving discussions that occurred in a research laboratory. Analyses supported several predictions derived from the VSA model, including the idea that stress plays a critical role in determining how marriages change over time. Neither observed behavior, nor the three enduring qualities, nor the interactions between behavior and these qualities predicted changes in satisfaction over time when considered alone. When these variables were allowed to interact with changes in stress over time, however, every variable accounted for changes in marital satisfaction. Nevertheless, stress did not predict behavior or accentuate the association between enduring qualities and behavior in the studies; none of the interactions between stress and these three enduring qualities predicting behavior reached statistical significance.

Rather than completely cast aside the idea that stress shapes interpersonal behavior, however, the authors of that study suggested that the lack of support for these assertions of the VSA model may stem from the fact that their measure of stress was a measure of *chronic stress*—operationally defined as the average level of stress experienced over the past six months in numerous independent domains (e.g., finances, friends, family, in-laws). As noted earlier, existing research suggests that stress affects behavior because it minimizes the cognitive capacity required to inhibit more oppositional behavior (Buck & Neff, 2012), presumably because people focus their attention on the source of such stress (Brandstätter & Schüler, 2013), which minimizes the cognitive capacity available to cope with other issues (Schoofs et al., 2008). But, chronic stressors likely vary in the extent to which they are relevant from day to day, week to week, and even month to month. Consider a participant who reports that her relationship with her in-laws was stressful over the past six months because they visited several times. Or consider another participant who reports that his health is a source of chronic stress because he has gout, which randomly flares up from time to time. Although both sources of chronic stress may have compromised these individuals' self-regulatory capacity and thereby affected their behavior at specific times over the prior 6 months, both sources of chronic stress should be unrelated to self-regulatory capacity and behavior at times when they are less relevant, which may be most of the time, including when they were interacting with their partners in a lab. *Acute stressors*, in contrast, such as an argument with a close friend, having a difficult day at work, or experiencing a pandemic, demand immediate attention and thus likely affect self-regulatory capacity in the moments that immediately surround them. For this reason, McNulty et al. (2021) suggested that acute experiences of stress experienced around the time communication behavior is measured may better predict that behavior and accentuate the association between enduring qualities and that behavior as suggested by the VSA model.

The COVID-19 pandemic offers an opportunity to directly test this possibility. The height of the COVID-19 pandemic caused stress that was likely to be relevant to most people on a daily basis, making it likely to be relevant in the moments surrounding the dyadic interactions occurring during that time. Of course, studying the effects of stress on communication during the COVID-19 pandemic presented challenges. As noted, the height of the pandemic limited researchers' ability to bring couples into the lab or to visit their homes as they normally would.

Fortunately, technology offers a simple and efficient way to assess behavior remotely (see, Perry et al., 2021). In the present study, we asked participants to record a problem-solving discussion on their smartphones and upload those recordings to a secure server. We then asked a team of trained observers to code the behaviors exhibited during those conversations. In the current article, we describe (a) the procedures we used, (b) the quality of the data obtained, and (c) analyses testing the possibility that the acute, COVID-related stress people experienced at the height of the pandemic predicted the quality of their problem-solving discussion behavior and accentuated the extent to which three enduring qualities—neuroticism, attachment anxiety, attachment avoidance—predicted such behavior.

Overview of the Present Study

The present study was conducted from June to August 2020, a time of considerable stress due to the COVID-19 pandemic during which most people faced considerable concern over infection from a highly contagious and lethal disease and some form of mandatory lockdown. Participants were married individuals living in the United States, Canada, Ireland, and the United Kingdom recruited from Prolific.co, an online participant recruitment facilitator. Participants reported their acute stress due to the COVID-19 pandemic, their chronic stress across numerous domains, and their levels of three enduring qualities robustly linked to interpersonal outcomes—neuroticism, attachment anxiety, and attachment avoidance. We then invited participants to submit a video recording of a marital problem-solving discussion with their spouse. Using data from the participants who submitted such a recording, we tested the prediction that acute stress would (a) predict more oppositional behavior and (b) accentuate the positive association typically observed between these three enduring qualities and oppositional behavior. Although these predictions were not preregistered, they mirrored those described elsewhere (McNulty et al., 2021).

Method

Participants

Participants were a subsample of married individuals participating in a broader study of 287 married individuals; this subsample included only the participants who provided a usable recording of a problem-solving discussion with their spouse and completed all other relevant measures. The sample was the largest we could attain based on our funding. Of the 287 participants in the full study, 144 provided a recording. One participant who provided a recording did not speak English during the conversation, and two participants spent almost all their time off-topic, leaving a total of 141 participants with a usable recording; 10 of these participants did not complete all self-report measures, leaving a final sample of 131 participants that yielded .80 power to detect an effect at small as $r = .24$.

Of these, 90 participants self-reported their sex was female, all of whom self-identified as women; 41 self-reported their sex was male, all of whom self-identified as men. Six participants (five women) reported being in a same-sex relationship; 77.1% of the sample identified as "White or Caucasian," 10.7% identified as Asian, 2.3% identified as "Black or African American," 6.1% identified as multiethnic/racial, 0.8% identified as "Hispanic or Latinx," and 0.8% identified as "other." Participants were 40.42 ($SD = 10.67$) years of age, had been married an average of 10.23 ($SD = 10.44$) years, and received 4.96 ($SD = 2.56$) years of postsecondary education. Overall, 60.2% of participants were employed. Of those not employed, 58.1% were seeking work, and eight participants (6.0%) reported having lost their job due to the pandemic. A total of 80.2% of participants reported that their spouses were employed. Of the participants with unemployed spouses, 60.0% reported their spouse was seeking work, and 11 (9.0%) reported that their spouse lost her or his job due to the pandemic. In total, 12.5% of couples experienced at least one lost job due to the pandemic. Regarding children, 62.6% of participants reported having at least one child and the average number of children reported was 2.13 ($SD = 1.41$).

Procedure

Before completing any measures or tasks associated with the study, participants and their partners were asked to provide informed consent. All procedures were approved by the institutional review board of Florida State University under the title "COVID-19-Related Stress and Families." Participants were paid \$0.15 (all payments were in U.S. dollars) for completing the consent form, asking their partners to complete a separate consent form, and testing their computer for compatibility with software to be used for implicit measures beyond the scope of the current analyses. Participants then uploaded photos of themselves and their partners for purposes beyond these analyses, for which they were paid \$0.85. Participants then completed self-report measures, including measures of chronic stress, acute COVID-related stress, neuroticism, attachment insecurity, a marital problem inventory to help them identify a discussion topic, and several variables beyond the scope of the current analyses. Participants were paid \$10 for this portion of the study.

After completing the self-report measures, participants were invited to engage in a 10-min problem-solving discussion with their spouse that they were to record, with both audio and video, using a smartphone or other device. We sent a message through the crowdsourcing application that contained instructions and a link to a secure server, where they uploaded the video file. Participants were paid \$5 for uploading a video. The instructions read as follows:

Thank you for completing the baseline survey! Here is the link where you can upload your 10-minute conflict discussion video: [link to secure server provided]. The link will expire at [date and time at which 24 hours would have passed], so you need to upload your video before that time! As a reminder, here again are the instructions you saw in the survey you just took for how to take the video: Now, we need you to take a video recording of yourself and your partner. It is very important that you take this video TODAY (the same day on which you completed this survey). You will receive a bonus payment of \$5 on top of this survey's allotted payment for completing and sending us this video. Here are the instructions for the video. Earlier you were given a list of issues that might be difficulties in your marriage. We now want you to

choose one issue from this list that you consider to be the most significant problem or source of conflict in your marriage: Children; Religion; In-laws, parents, relatives; Recreation and leisure time; Communication; Household management; Showing affection; Making decisions; Friends; Unrealistic expectations; Money management; Sex; Jealousy; Solving problems; Trust; Independence; Drugs and alcohol; Career decisions; and Amount of time spent together. Once you have chosen one issue out of the above list, we want you to discuss this issue with your partner for 10 minutes. The goal of this discussion should be to work toward solving the problem. Please take a video of the entire discussion. You may use a phone, computer, iPad, etc. as long as it has a camera. Most importantly, we need to be able to hear both you and your partner clearly in the video, so position the device as close to you as possible. Position the recording device to the side of you and your partner so that we can see at least the head and shoulders of you both. You should sit directly facing your partner during the discussion and talk to your partner; do not talk to the camera. Make sure you have the discussion in a well-lit room; we need to be able to see you and your partner clearly in the video. Turn off any TV, music, or other sources of background noise. Take a short test video first to make sure sound and lighting are both clear. (Do not send us this video.) Make sure you have enough space on your recording device to store a 10-minute video before beginning your discussion. We recommend making sure you have 1.5 gb (1500 mb) of space left on your device before beginning the video. You can check this in your device's Settings. If you are familiar with changing video resolution on your device, please make sure the resolution is set to 1080p 30 fps or less. If you are unfamiliar with this, no need to change this setting, as your device is likely set to the right resolution by default. Once you have finished your video, please save it to your device and send it to us in the link provided in this message.

Regardless of whether they completed the video, all participants were invited to participate in the diary portion of the study during which they completed one survey per night for 12 subsequent nights. Each diary was estimated to take approximately 12 min, with the exception of the fourth and eighth day, which were estimated to take an extra 5 min, and the final day, which was estimated to take approximately 30 min. Participants were paid \$4.50 for day 12, \$2.50 for each of days four and eight, and \$1.50 for each remaining day. These diary data were not considered in the current analyses. Participants who completed all tasks received a \$1.00 bonus and were entered into a lottery to win one of two \$100 bonuses. Participants who completed all but one study component were entered into a lottery to win one of two \$50 bonuses. Predictions and analyses were not preregistered. Data, syntax, and materials are available at https://osf.io/udptc/?view_only=bb523126bc3343e39bc327aab6eb7b4b.

Measures

Chronic Stress

As in other studies (McNulty et al., 2021; Neff et al., 2021), we measured chronic stress by asking participants to report the extent to which they had experienced stress over the past 6 months in the following domains: relationship with their spouse, parenthood (if they had children), living conditions, financial status, work experience (if working), school experience (if in school), being a homemaker (if not working or in school), being unemployed (if unemployed and desiring work), own health, spouse's health, relationship with own family, relationship with in-laws, and relationship with friends. Participants used a scale from 1 = *not at all stressful* to

9 = *extremely stressful*. As in other research (e.g., McNulty et al., 2021; Neff et al., 2021), we averaged across all items except relationship with spouse (because the VSA model focuses on stress external to the relationship). Coefficient α is not reported because experiencing stress in one domain does not imply experiencing stress in other domains (see Diamantopoulos et al., 2008).

COVID-19 Stress

In contrast to the items assessing chronic stress, all items assessing COVID-19 stress inquired about thoughts and experiences likely to be relevant in the moments surrounding study participation. Specifically, we assessed COVID-related stress with the following six items: "To what extent are you worried about contracting COVID-19?," "To what extent are you worried about a loved one contracting COVID-19?," "To what extent has the uncertainty/ambiguity of the COVID-19 pandemic caused you stress or discomfort?," "How much income have you lost due to the COVID-19 pandemic?," "To what extent has the COVID-19 pandemic interfered with your ability to work or make a living?," and "To what extent has the COVID-19 pandemic caused you financial difficulties?" Participants used a scale from 1 = *not at all* to 7 = *a lot/very much*. We averaged items to form a scale with adequate internal consistency ($\alpha = .77$).

Communication Behavior

We coded participants' problem-solving videos using the same coding scheme as McNulty et al. (2021), which was a version of the verbal coding tactics scheme (VTCS; Sillars et al., 1982). The coding team comprised four individuals who had been trained by the first and second authors over the course of one academic year to code similar conversations from another study. They began coding in that study when they reached adequate reliability on "test conversations." While they coded the data from that study, they continued to meet as a group to discuss any "difficult codes" in order to minimize coder drift. The coders involved in coding the data from the present study coded these conversations immediately after completing the codes for the other study. Just over 20% of the conversations were double-coded to test reliability, which is detailed in the Results section.

Each speaking turn from each spouse was first coded as on-topic or off-topic, and all on-topic speaking turns were then coded as either integrative or distributive. Distributive codes, the focal variable, capture oppositional behaviors (i.e., those that challenge the other person's goals or points of view; see Overall & McNulty, 2017), and they can be direct or indirect. Direct distributive codes include oppositional statements that directly (a) blame and criticize the partner, (b) command the partner to change in some way, or (c) insult or undermine the partner. Indirect distributive codes include oppositional statements that blame, command, or reject the partner indirectly through presumptive attributions/mind-reading, hostile/trapping questions, avoiding/denying responsibility, and sarcasm. We combined across both direct and indirect distributive behavior to form an index of total number of speaking turns containing oppositional statements. Given the VTCS does not assign oppositional codes to off-topic speaking turns, we excluded two participants who spent the great majority of their speaking turns (92% and 73%) off-topic. One additional couple did

not speak English during their discussion; their data were also excluded. Reliability and descriptive statistics are provided in the Results section.

Neuroticism

We assessed neuroticism with the Neuroticism subscale of the Ten Item Personality Inventory (Gosling et al., 2003), which uses two items to assess each of the Big Five traits. Participants used a scale from 1 = *strongly disagree* to 7 = *strongly agree* to indicate the extent to which pairs of personality traits (e.g., anxious, easily upset) apply to them. Reliability was adequate ($\alpha = .80$).

Attachment Insecurity

We assessed attachment insecurity with the Adult Attachment Questionnaire (Simpson et al., 1996). This measure assesses attachment anxiety with nine items and attachment avoidance with eight items. Participants indicated the extent to which they agreed with each statement using a scale from 1 = *strongly disagree* to 7 = *strongly agree*. Higher scores indicate higher attachment anxiety/avoidance. Reliability was adequate (for anxiety, $\alpha = .83$; for avoidance, $\alpha = .82$).

Data Analyses

All variables except the outcome variable were standardized prior to analyses so that the mean of each was zero and associations were interpretable in terms of *SD* units of the predictor. We ran three sets of analyses. First, we regressed oppositional behavior onto COVID-19 stress. Next, we regressed oppositional behavior onto COVID-19 stress and chronic stress simultaneously. Finally, we regressed oppositional behavior onto COVID-19 stress, chronic stress, the three enduring qualities, and interactions between each type of stress and each enduring quality. Given that oppositional behavior was number of speaking turns judged to be oppositional, which was a count variable that was skewed, we specified a negative binomial distribution and controlled the number of speaking turns in all analyses. We specified a negative binomial distribution because an attempt to model a Poisson distribution indicated substantial overdispersion, $\chi^2/df = 5.95$, whereas the negative binomial model indicated significantly lower dispersion, $\chi^2/df = 1.77$. We used robust standard errors to additionally guard against

Type 1 errors. Given the high correlation between own behavior and partner behavior, we tested our predictions controlling and not controlling partner behavior, which allowed us to examine whether all effects were indeed intrapersonal—that is, that own stress was associated with own behavior independent of how the partner behaved; we additionally tested all hypotheses without controlling partner behavior out of concern that such a strong covariate may minimize meaningful variance. Results were highly similar across both sets of analyses.

Results

Reliability and Validity of the Novel Observational Method and Preliminary Analyses

Descriptive statistics and correlations are provided in Table 1. The 144 people who did submit a video did not differ from the 143 people who did not submit a video recording on any of the variables examined here (all $ps > .10$). The fact that these subsamples did not differ suggests assessing behavior in this way may not compromise generalizability more than online research that relies solely on self-reports. Further, the reliability estimates of the double-coded recordings indicated that reliability was quite high. For primary participants, interclass correlation coefficient (ICC) = .92 for oppositional statements, and ICC = .94 for off-topic statements. For participants' partners, ICC = .83 for oppositional behavior. These results suggest self-shot videos can offer data that can be reliably coded. Further still, as can be seen in Table 1, approximately 8% of the statements from each member of the couple were oppositional, and there was substantial variance around this mean, which is quite similar to what has been obtained in behavioral research conducted in the lab (e.g., McNulty & Russell, 2010). Finally, as can also be seen in Table 1, only 6.64% of the speaking turns were judged to be off-topic, suggesting participants took the task seriously.

Several other descriptive statistics and correlations from Table 1 are worth highlighting. First, acute COVID-19 stress was only moderately correlated with chronic stress, suggesting these two measures captured different constructs. Second, acute COVID-19 stress, but not chronic stress, was positively correlated with oppositional behavior. Third, chronic stress, but not acute COVID-19 stress, was positively associated with neuroticism and both forms of attachment insecurity. Finally, own and partner oppositional behavior was strongly positively correlated.

Table 1
Descriptive Statistics and Correlations Among Study Variables

Variable/parameter	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Acute COVID-19 stress (1)	—	—	—	—	—	—	—	—
Chronic stress (2)	.23**	—	—	—	—	—	—	—
Neuroticism (3)	.00	.39**	—	—	—	—	—	—
Attachment anxiety (4)	.05	.30**	.17	—	—	—	—	—
Attachment avoidance (5)	.08	.20*	.02	.37**	—	—	—	—
Own oppositional behavior (6)	.24**	.17	.00	-.05	.15	—	—	—
Partner oppositional behavior (7)	-.08	.01	.02	.07	.07	.37**	—	—
Own off-topic behavior (8)	-.20*	.05	.03	.03	-.02	-.07	.23**	—
<i>M</i>	3.94	3.47	3.63	3.12	2.67	0.08	0.08	0.07
<i>SD</i>	1.20	1.51	1.44	1.28	1.14	0.12	0.11	0.13

Note. Behaviors are proportions of speaking turns receiving the relevant code.
* $p < .05$. ** $p < .01$.

Primary Analyses

In the first set of models, we examined the direct associations between acute COVID-19 stress and own behavior by regressing oppositional behavior onto COVID-19 stress and number of speaking turns. As noted, we specified a negative binomial distribution. Results appear in the top of Table 2. As can be seen, consistent with predictions, COVID-19 stress was associated with exhibiting more oppositional behavior, both controlling and not controlling for partner behavior.

Next, we examined whether this association remained significant controlling for the other ongoing stressors people faced in their lives by adding chronic stress as a covariate. As can be seen in the middle of Table 2, the association between COVID-19 stress and oppositional behavior continued to emerge as significant when controlling for partner behavior but trended toward significance when partner behavior was not controlled. Although chronic stress trended toward being positively associated with oppositional behavior when partner behavior was not controlled, chronic stress was not significantly associated with oppositional behavior in either model. Notably, an exploratory analysis revealed that COVID-19 stress did not interact with chronic stress to predict oppositional behavior, $b = -0.07, SE = 0.15, p = .630, 95\% CI = [-0.37, 0.23]$, suggesting COVID-19 stress was no more or less strongly associated with oppositional behavior for people who were already experiencing more chronic stress.

It is important to keep in mind that these main effects ignore the potential moderating role of enduring qualities, which the VSA

suggests are critical to understanding how stress is related to behavior. Thus, we tested the role of enduring qualities in moderating these associations in the final set of analyses. Specifically, we added the three individual difference variables and their interactions with both COVID-19 stress and chronic stress. Results appear in the bottom of Table 2. As can be seen, neuroticism and attachment avoidance moderated the association between COVID-19 stress, both controlling and not controlling for partner behavior. Replicating prior work (e.g., McNulty et al., 2021), none of the interactions involving chronic stress were significant. We estimated the simple effects of each significant interaction obtained in the final model that did not control partner behavior by estimating the simple effects of each quality at high (+1 SD) and low (-1 SD) levels of COVID-19 stress. The results were highly similar for both interactions; whereas COVID-19 stress was positively associated with oppositional behavior for people high in neuroticism, $b = 0.50, SE = 0.16, p = .002, 95\% CI = [0.19, 0.81]$, and people high attachment avoidance, $b = 0.49, SE = 0.15, p < .001, 95\% CI = [0.20, 0.78]$, COVID-19 stress was unrelated to such behavior among people low in these qualities (for neuroticism: $b = -0.01, SE = 0.15, p = .965, 95\% CI = [-0.31, 0.29]$; for attachment avoidance, $b = 0.00, SE = 0.15, p = .978, 95\% CI = [-0.30, 0.31]$). The consistency of interactive effects is particularly striking when viewed in Figure 1. As can be seen, both qualities were unrelated to oppositional behavior among people experiencing low COVID-19 stress but strongly positively associated with oppositional behavior among people experiencing high COVID-19 stress.

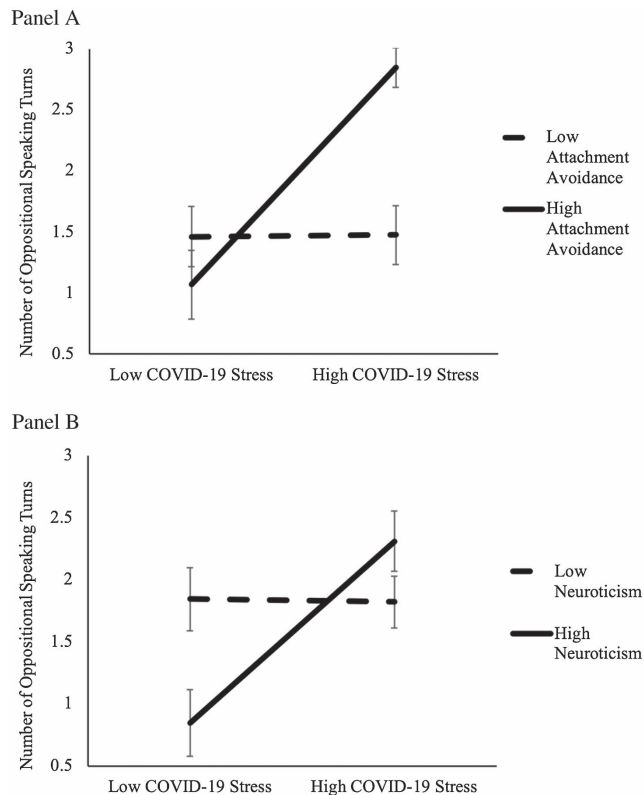
Table 2
Tests of Primary Predictions

Predict	Not controlling for partner behavior				Controlling for partner behavior			
	<i>b</i>	<i>SE</i>	<i>p</i>	95% CI	<i>b</i>	<i>SE</i>	<i>p</i>	95% CI
Model 1								
Intercept	.59	.13	<.001	.339, .844	.54	.12	<.001	.294, .779
Speaking turns	.68	.12	<.001	.445, .915	.51	.13	<.001	.251, .763
Partner behavior	—	—	—	—	.39	.14	.005	.118, .651
Acute COVID-19 stress	.30	.14	.028	.033, .576	.30	.13	.028	.032, .560
Model 2								
Intercept	.57	.13	<.001	.325, .820	.53	.12	<.001	.285, .773
Speaking turns	.65	.12	<.001	.420, .875	.50	.13	<.001	.244, .762
Partner behavior	—	—	—	—	.36	.13	.007	.097, .620
Chronic stress	.21	.13	.096	-.038, .458	.14	.11	.237	-.089, .360
Acute COVID-19 stress	.27	.14	.055	-.006, .543	.27	.14	.044	.007, .539
Model 3								
Intercept	.47	.13	<.001	.205, .734	.43	.13	.001	.178, .676
Speaking turns	.70	.11	<.001	.484, .914	.56	.13	<.001	.315, .807
Partner behavior	—	—	—	—	.38	.14	.007	.106, .659
Chronic stress	.32	.16	.050	.000, .633	.27	.15	.071	-.024, .571
Acute COVID-19 stress	.25	.11	.029	.025, .470	.25	.11	.022	.036, .470
Neuroticism	-.14	.13	.297	-.392, .120	-.17	.14	.212	-.441, .098
Attachment anxiety	-.19	.13	.147	-.453, .068	-.25	.14	.064	-.529, .015
Attachment avoidance	.09	.12	.484	-.154, .326	.09	.12	.448	-.144, .325
Chronic Stress × Neuroticism	-.02	.12	.853	-.262, .217	-.00	.12	1.000	-.243, .243
Chronic Stress × Attachment Anxiety	.09	.13	.469	-.161, .349	.01	.14	.920	-.269, .298
Chronic Stress × Attachment Avoidance	-.11	.13	.401	-.367, .147	-.04	.12	.740	-.277, .197
Acute COVID-19 Stress × Neuroticism	.25	.11	.017	.046, .463	.23	.12	.046	.004, .456
Acute COVID-19 Stress × Attachment Anxiety	-.17	.13	.206	-.431, .093	-.14	.13	.289	-.385, .115
Acute COVID-19 Stress × Attachment Avoidance	.24	.10	.014	.049, .438	.21	.10	.031	.019, .406

Note. Bolded effects are significant at least at $p < .05$. *SE* = standard error; *CI* = confidence interval.

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Figure 1
Acute COVID-19 Stress Accentuates the Association Between Enduring Qualities and Communication Behavior



Discussion

The COVID-19 pandemic was a challenging time for couples and families (Pietromonaco & Overall, 2022; Prime et al., 2020), highlighting the need to better understand the mechanisms by which stress affects families. The VSA model suggests stress predicts interpersonal behavior and accentuates the extent to which enduring qualities predict such behavior. Nevertheless, prior research has failed to document such effects using self-report measures of chronic stress experienced in the past 6 months (McNulty et al., 2021). The present study leveraged participant-made recordings of marital problem-solving discussions to demonstrate that acute stress related to the COVID-19 pandemic (a) predicted relationship communication behavior during the height of the pandemic and (b) strengthened the association between two enduring qualities and such behavior. Specifically, neuroticism and attachment avoidance were associated with exhibiting more oppositional behavior in the context of higher but not lower acute COVID-19 stress.

These findings have several important implications. First, they join others in highlighting important differences between chronic and acute stress (Karney et al., 2005). Although acute stress was directly related to behavior and accentuated the effects of neuroticism and attachment avoidance, chronic stress did not play a similar role, either in this research or the studies analyzed by McNulty et al. (2021). Avoiding oppositional behaviors often requires self-regulation, and the relevance of acute stressful experiences can lower the ability to self-regulate as people cope with and

recover from those experiences (Hofmann et al., 2012; Shields et al., 2017). As demonstrated by Buck and Neff (2012), married spouses were more likely to self-report negative behaviors on days that they experienced more stress specifically because they reported having less self-regulatory capacity on those days. But, there is a limit to how long deficits in self-regulatory capacity will last. Eventually, due to sleep, food, exercise, etc., people gain back their cognitive energy. It may be for this reason that chronic stress appears to be less reliably linked to behavior—chronic stressors are only likely to be related to self-regulation and behavior in the moments they are relevant, and they are not always relevant. More acute stress experienced in the moments surrounding a conversation, in contrast, may be more relevant to the behaviors exhibited during that conversation, including one recorded in the lab or at home. In other words, we speculate that the acute COVID-19 stress experienced at the height of the pandemic was more likely to be relevant and disruptive to self-regulation and behavior on a daily basis than any chronic stress experienced over the past 6 months.

That said, we do not want readers to conclude from this research that chronic stress is *not* important for relationships. Although the current findings and the findings described by McNulty et al. (2021) failed to offer evidence that chronic stress predicted behavior or accentuated the link between other enduring qualities and behavior as observed in that research, chronic stress is still critical to explaining change in relationship satisfaction. In fact, analytically considering change in chronic stress was the *only* way to predict change in relationship satisfaction in McNulty et al. (2021) research, which may help explain why research that does not consider the role of chronic stress has had trouble accounting for change in satisfaction (see Joel et al., 2020). We argue that chronic stressors have repercussions for relationship behaviors, decisions, and judgments when they are relevant, and that these repercussions accumulate over the course of a relationship. In other words, though people who report that their relationships with their in-laws are stressful may not always feel stress regarding their in-laws, they likely have worse interactions with their partners when problems surrounding their in-laws are acutely relevant, and the evaluative implications of those interactions may have long-term effects (see Hicks et al., 2021; McNulty et al., 2013; Murray et al., 2010; Scinta & Gable, 2007).

To some extent, this is an issue related to the timing of measurements. Given their more long-term nature, chronic stressors are typically measured over a considerable timeframe. That relatively lengthy timeframe adds uncertainty regarding when that stress is relevant. If a researcher measures chronic stress experienced over the past 6 months and behavior exhibited right now, as we did here and others have done (McNulty et al., 2021; Neff & Karney, 2007), chronic stress may appear to be unrelated to behavior. That said, if a researcher happens to capture behavior at a time when the chronic stressor is relevant, such as when in-laws are visiting, or when a particular medical condition is flaring up, then there may be little difference between how such chronic stress is related to behavior and how acute stress is related to behavior. Considered this way, chronic and acute stress may not be all that different conceptually when both are relevant. In fact, chronic stressors that are relevant every day may minimize cognitive capacity and affect relationship behavior every day.

Nevertheless, other differences between chronic and acute stress may make them conceptually different in ways that make chronic

stressors weaker predictors of behavior even when relevant. Acute stressors are likely novel, forcing people to use self-regulatory capacity to find novel coping strategies. This may have been particularly true for COVID-19 stress. Chronic stressors, in contrast, are familiar and thus people may have automatized strategies for coping with them in ways that preserve self-regulatory capacity (see Gollwitzer, 1999). Consistent with this idea, there is some evidence that married individuals who faced moderate levels of stress early in the marriage were more resilient to future stress than individuals who faced less stress, as long as they demonstrated effective resources for managing that stress (Neff & Broady, 2011). Future research may benefit from directly examining whether repeated experiences with the same stressor are more strongly or weakly associated with relationship behavior.

The current research also helps explain the complex relationship between stress and relationship outcomes. Prior studies of natural disasters and the COVID-19 pandemic suggest that such acute stressors can (a) decrease satisfaction (Schmid et al., 2021), (b) increase satisfaction (Murray et al., 2021; Williamson et al., 2021), (c) leave satisfaction unchanged (Williamson, 2020), (d) increase the probability of marriage (Cohan & Cole, 2002; Xu & Feng, 2016), and (e) increase the probability of divorce (Cohan & Cole, 2002; Xu & Feng, 2016). The current research helps explain part of why such effects are so varied; the manner in which acute stress affects behavior depends on interpersonal qualities. Helping to explain how acute stressors can simultaneously appear to be associated with lower satisfaction and a higher probability of dissolution in some studies but unrelated to satisfaction in other studies, COVID-19 stress was associated with more oppositional behavior among people high in attachment avoidance and neuroticism but unassociated with such behavior among people low in these qualities. Helping to explain why acute stressors can be associated with increased probability of marriage (Cohan & Cole, 2002; Xu & Feng, 2016) and increased satisfaction (Williamson et al., 2021), other research suggests there may be hidden benefits to stress, perhaps because it forces people to rely on their automatic tendencies, which can be positive (see Hicks et al., 2021; Righetti et al., 2013). Taken together, these findings offer further evidence of the highly contextualized nature of close relationships (see McNulty, 2016).

Finally, the current research suggests a reliable and simple way to observe behavior that does not require couples to attend an in-person lab session or researchers to visit couples' homes (see, Perry et al., 2021). Behavior in the current research was observed and coded from participants' own recordings of themselves on a smartphone or other device. Not only were judges able to reliably code the data, the data appeared similar to data obtained from lab-based interactions (McNulty & Russell, 2010), and the infrequency of off-topic speaking turns provides evidence that couples took the task seriously. Moreover, the fact that the data replicated what was observed in prior research (McNulty et al., 2021) and offered support for our predictions offers evidence of their validity. Researchers may benefit from exploiting this opportunity to obtain behavioral data in a research environment that is increasingly moving toward online samples.

Although collecting data from both couple members is the gold standard in relationship science, we were unable to collect self-report data from participants' partners because there were not

enough eligible couples in which both members used the crowdsourcing site from which we recruited. But, there are likely other options for using this smartphone video option in couples or family research. For example, couples and families could be recruited via other means that include self-report measures from all members of the family, or such videos could be submitted as part of longitudinal studies involving couples and families who do attend lab sessions. We chose smartphones because they offered the anonymity required by Prolific.co, but participants recruited in other ways could participate via video-conferencing software. In sum, we see remote recording of families as an exciting opportunity for future research, and the data collected here suggest such data can be highly reliable and valid.

These findings should be considered in light of the strengths and limitations of this research. Regarding its strengths, the research offered a snapshot of real couples facing an extreme challenge together—coping with the early stages of the COVID-19 pandemic. Further, the research capitalized on technology in a way that offered a visual glimpse into a critical aspect of couples' relationships—their communication behavior. In their seminal piece, *Analyzing Close Relationships*, Kelley et al. (1983) argued that behavior is the interface of the relationship—the only way that spouses' qualities and experiences affect one another. Here, we directly observed such behavior and linked it to the stress people were feeling due to the COVID-19 pandemic. Finally, the couples observed here were sampled from several countries, enhancing the extent to which findings may generalize more broadly than studies sampling from only one country or region. All this said, the findings are correlational and thus causal conclusions should be drawn with caution. Although we considered three individual differences here to show stress had independent effects, other individual differences not assessed may explain some of our associations. Further, numerous participants in the broader study did not submit videos, yielding a rather modest sample size. Given the numerous parameters estimated by our final model, those findings should be interpreted with some caution until results can be replicated. Finally, the final sample was predominately White; although we are not aware of any reason to expect the magnitude of the association between stress and behavior to differ across such groups, the fact that some racial and ethnic groups may experience more stress makes these results particularly applicable to such groups. Future research may benefit from addressing this possibility.

Conclusion

The COVID-19 pandemic has been a stressful time for almost everyone, and stress can have critical implications for relationships. Prior theory and research offer conflicting suggestions regarding how stress affects communication behavior; the VSA model suggests that stress directly affects such behavior and accentuates the link between enduring qualities and behavior, but a direct test of these predictions failed to offer support by showing that chronic stress did not operate this way (McNulty et al., 2021). The current findings reconcile this perplexing inconsistency by showing that it is acute stress (e.g., stress related to the recent global pandemic), not chronic stress, that predicts communication behavior and accentuates the association between enduring qualities and behavior.

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Received December 8, 2021

Revision received August 12, 2022

Accepted September 1, 2022 ■