Computers in Human Behavior Reports 4 (2021) 100133

Contents lists available at ScienceDirect

Computers in Human Behavior Reports

journal homepage: www.sciencedirect.com/journal/computers-in-human-behavior-reports

A week during COVID-19: Online social interactions are associated with greater connection and more stress

Maureen Tibbetts, Adam Epstein-Shuman, Matthew Leitao, Kostadin Kushlev *

Department of Psychology, Georgetown University, USA

ARTICLE INFO

Keywords:
Well-being
Computer-mediated communication
COVID-19
Social interaction
Stress

ABSTRACT

Who thrives while socially distancing? In this exploratory study, we polled over 500 participants from the United States on April 8, 2020—during the early stages of the COVID-19 pandemic when the practice of social distancing was at its peak. Above and beyond other social and nonsocial activities, living arrangements, employment circumstances, personality traits, and demographics, people who spent more time interacting with close others—in person or online—felt more socially connected. In contrast, people who spent more time interacting with weak ties, specifically online, experienced greater negative affect, more stress, and lower social connectedness. In sum, much like in-person interactions, online social interactions with strong ties are associated with higher well-being, but online interactions with weak ties are related to lower well-being.

Introduction

The onset of the COVID-19 pandemic changed our lives in many ways, but perhaps it most drastically altered our social lives. By early April 2020, 39 U.S. states and the District of Columbia had put in place some version of a "stay-at-home" order, spurred by public health guidelines urging people to avoid large gatherings and maintain social distancing (Centers for Disease Control and Prevention, 2020). The impacts of these regulations were quickly evident: By early April 2020, visits to restaurants, for example, had decreased by 81% in the United States compared to the same time the previous year (CueBiq, 2020). While visits to traditional social venues declined, however, people were spending more time online; broadband internet use, for instance, jumped by almost 50% in the first quarter of 2020 compared to the same period in 2019 (Bugel et al., 2020).

People possess an inherent need to interact with one another (Baumeister & Leary, 1995; Fiske, 2014; Kenrick et al., 2010; Maslow, 1943; Ryan & Deci, 2000; Ryff, 1989). As such, social relationships and interactions are some of the strongest predictors of well-being (e.g., Kahneman et al., 2004; Reis et al., 2000). During the early stages of the pandemic, opportunities for in-person interactions became increasingly scarce. However, face-to-face interactions across many settings—the workplace, the classroom—were rapidly replaced by computer-mediated social interactions. This is best illustrated by the growth of the video call platform Zoom. In December 2019, only 10 million people used Zoom each day, but by March 2020, its daily users had grown to over 200 million (Yuan, 2020). As its user base expanded, Zoom became a popular space for recreational social interactions. Between February 23 and April 12, 2020, Zoom saw a nearly 2,000% increase in the number of weekend calls made, along with a 700% increase in calls made between 5:00 p.m. and 9:00 p.m. on weekdays (Reilly, 2020). While it is clear that online communication skyrocketed during this time of social distancing, the question remains: Can digitally mediated interactions be associated with the same emotional benefits predicted by in-person interactions?

Digital communication and well-being

Research into the impacts of digital social interactions on well-being has shown both positive and negative effects (Lieberman & Schroeder, 2020; Waytz & Gray, 2018). For example, more frequent digital messaging, such as checking email or phone notifications, has been linked to experiencing greater stress and negative affect in both correlational and experimental research (Fitz et al., 2019; Kushlev & Dunn, 2015; Mark et al., 2012, 2016). In addition to increasing stress and negative emotions, digital communication has been shown to decrease positive emotion and social connectedness by interfering with the benefits of simultaneous face-to-face interactions (Dwyer et al., 2018; Kushlev & Leitao, 2020). Because digital communication has increased during the pandemic (Bugel et al., 2020), these negative aspects of

* Corresponding author. Department of Psychology, Georgetown University, 37th and O Streets, N.W., Washington, DC 20057, USA.
E-mail address: kk1199@georgetown.edu (K. Kushlev).

https://doi.org/10.1016/j.chbr.2021.100133
Received 15 March 2021; Received in revised form 19 July 2021; Accepted 8 August 2021
Available online 9 August 2021
2451-9588/© 2021 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

digital interactions may be magnified.

It is also possible, however, that online communication while social distancing might be particularly valuable in reducing negative emotions by providing a buffer against stressful events (e.g., Holtzman et al., 2017). After a stressful experience, participants in one study who received social support through a text message felt better than those who received no social support at all (Holtzman et al., 2017). Recent research has even suggested that simply having access to one's phone can act almost as an "adult pacifier" (Melumad & Pham, 2020), reducing negative emotions and stress (Hunter et al., 2018). When in-person social interactions are less frequent, digital communication may not only provide a buffer against stress and negative emotions, but also promote positive emotion and social connectedness by serving as a reservoir of social capital (Cheng et al., 2019). Indeed, online communication allows users to connect with loved ones and make new friends without geographical constraints (e.g., Desjarlais & Willoughby, 2010; Leong et al., 2016). Past research shows that in-person interactions with both strong ties (e.g., family and friends) and weak ties (acquaintances and strangers) are associated with more positive emotions and greater social connectedness (Epley & Schroeder, 2014; Reis et al., 2000; Sandstrom & Dunn, 2014a). While social distancing, could people reap similar benefits while interacting online with strong and weak ties?

The present research

Our goal is to explore the pattern of associations of digital social interactions while social distancing with both positive and negative indicators of well-being. We assessed several indicators of well-being—namely, positive and negative affect, feelings of social connectedness, and stress levels over one week. Over the same time period, we also assessed the amount of time people spent interacting with weak and strong ties both in-person and online. We administered our survey to $N = 674$ adults residing in the United States on April 8, 2020, roughly one month after the World Health Organization had declared the COVID-19 outbreak a pandemic (WHO Director-General's opening remarks at the media briefing onCOVID-19, 20 20, March 11).

Preliminary analyses

Before tackling our main question, we wanted to establish the level of social distancing that was taking place in the United States during our survey. We used publicly available data from CueBiq (2020) to determine how many people were engaging in social distancing on April 8, 2020, as compared to other points in time during the pandemic.

As shown in Fig. 1, the objective mobility data indicates that the percentage of people staying at home reached its peak for 2020 on April 8, with 39% of Americans not leaving their homes. The Contact Index on April 8 was down by 75.6% compared to a year prior; this value is also close to its peak decline of 76.5%, observed on April 1, 2020. After April 8, these two indices show a slow decline in social distancing, but contact still remains below average as compared to the same period of 2019. As of December 31, 2020, neither of these measures of social distancing have reached those peak levels again. Therefore, April 8, 2020 should be understood as a time of peak social distancing, allowing us to examine the pattern of associations between digital communication and well-being when in-person interactions were at their most limited (c.f., Gollwitzer et al., 2020).

Methods

Participants

In total, N = 674 people consented to complete the survey. We recruited participants through Mechanical Turk (Mturk; $n = 499$), as well as CloudResearch Panels (n = 175), of whom $n = 100$ participants were specifically matched by CloudResearch to represent the United States population in age, gender, and race. All participants were compensated $1.00. Almost all of our sample (96.7%) reported practicing social distancing during the past 7 days.

Of those who consented, $N = 569$ participants finished the entire survey, completing the demographic questions at the end. This sample remained roughly representative of the U.S. population in sex, age, and income: Participants were 56.2% female with a mean age of $M = 46.05$ (SD = 17.49) and a median annual household income of $50,500. At the time of the survey, 6.9% of the sample reported being a college student, 44.8% of participants said that they were currently employed, and 26.1% reported living alone (see Tables S1 and S2 in Supplementary Online Material [SOM] for more information). Participants were located in 49 out of 50 U.S. states (New Hampshire was not represented), as well as the District of Columbia.

Power analyses. *A priori* power analyses indicated that, in order to detect an effect size of $r = 0.15$ with 90% power, we needed at least 459

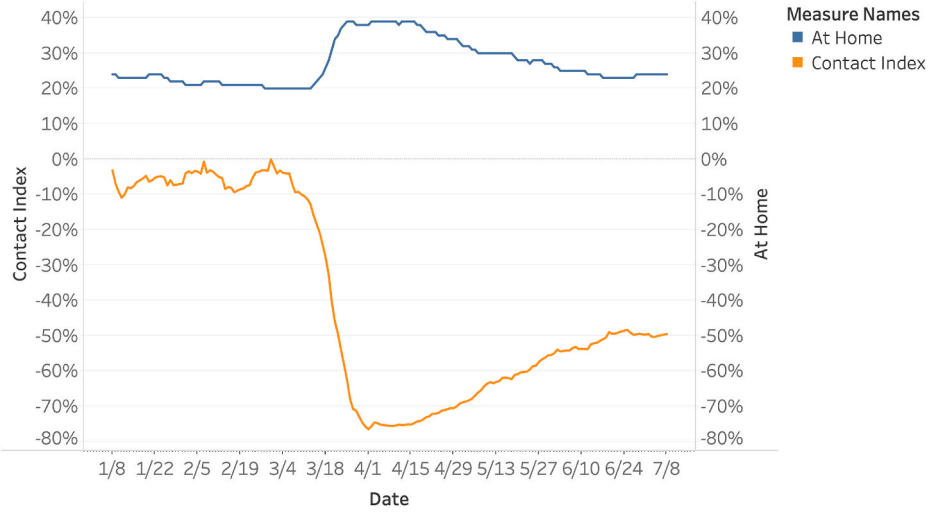


Fig. 1. Objective indicators of social distancing based on privacy-compliant first-party mobile device location data collected by CueBiq, showing an increase in people staying at home (blue) and a decrease in contact with others (orange). CueBiq collects first-party location data from over 25,000,000 daily active users across the continental U.S.; data are only collected from users who opt in on any of over 100 different mobile applications that have a "software development kit" (SDK). The At Home measure was calculated as the percentage of people across the United States who stayed within 330 feet of their home on a given day. Therefore, this value represents the raw percentage of people who stayed at home all day long (values were rounded to the nearest whole number). The Contact Index was created by measuring when two or more cellular devices came within 50 feet of one another for at least 5 min; this value was used to assess levels of human contact and interaction. The data for particular dates were compared with data collected on the same day of the previous year, yielding an index of social distancing. For both indices, we calculated the 7-day rolling average from January 8 (pre-pandemic) to July 8 (mid-pandemic)—that is, three months before and after our April 8 survey. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

participants (https://doi.org/10.17605/OSF.IO/NWG54). Thus, we set out to recruit 500 participants from MTurk. Additionally, we recruited a sample of 100 participants matched for key demographics from CloudResearch Panels (Litman et al., 2017). To achieve the representative sample, CloudResearch recruited an additional 75 participants; we included these participants in our sample. Because the MTurk sample was demographically similar to the matched sample, we combined participants into a single sample for our analyses. Sensitivity analyses indicated that the combined sample size of participants who completed the full survey, $N = 569$, gave us 67% power to detect small effect sizes, $r = 0.10$, 95% power to detect small-to-medium effect sizes, $r = 0.15$, and 99% power to detect medium effect sizes, $r = 0.20$.

Measures

We assessed our key variables of interest, including affect, stress, and social connectedness, as well as in-person and online interactions with strong and weak social ties over the past week (see Table 1). Broader measures of subjective well-being, such as life satisfaction, were also included in the survey but are beyond the focus of the present report, which focuses on the association between behavior and well-being measured over a single week. The full data and the full questionnaire are provided on the Open Science Framework, OSF: https://osf.io/kqsw7/?view_only=5d15ceaec8db476e897295179352e349.

Time interacting with strong and weak ties: in-person and online. Participants were asked to estimate the number of hours they spent interacting with *family and friends* (i.e., close others/strong ties) both in-person and online during an average day in the past week. For each of the two questions, they responded using a sliding scale from 0 to 8 h. Then, participants completed the same set of questions regarding the time they had spent interacting with *acquaintances and/or strangers* (i.e., weak ties) on an average day in the past week (see Table 1 for descriptives). See Table S3 for the correlations of these four variables with demographics and other dispositional predictors.

For descriptive purposes, we also asked participants to estimate the overall percentage (0%–100%) of their social interactions that took place online versus in-person during the past week. On average, participants estimated that roughly half (48.5%) of their social interactions happened online during the past week.

Well-being. We measured both positive and negative indicators of well-being over the past week, including positive affect, negative affect, stress, and social connectedness.

Positive and negative affect. Positive and negative affect over the past week were measured using the 12-item Scale of Positive and Negative Experience (SPANE; Diener et al., 2010). Participants rated how often they had experienced various emotions, such as "Positive," "Unpleasant," "Angry," and "Joyful," using a 1 to 5 scale (1 = *Very rarely or never*; 5 = *Very often or always*). We added two additional items to assess negative affect, especially relevant to the pandemic: "Lonely" (item-total $r = 0.62$) and "Stressed" (item-total $r = 0.75$). Thus, we calculated participants' mean positive affect ($M = 3.33$, SD = 0.92, $\alpha = 0.92$) using their responses from the 6 positive items and their mean negative affect ($M = 2.75$, SD = 0.95, $\alpha = 0.92$) using their responses for the 8 negative items.

Stress. We measured stress using the 10-item Perceived Stress Scale (PSS; Cohen & Williamson, 1988), $M = 1.80$, SD = 0.82, $\alpha = 0.88$. On a 0 to 4 scale (0 = *Never*; 4 = *Very often*) participants answered various questions regarding their experiences over the past week, such as "During the past week, how often have you felt that you were unable to control the important things in your life?"

Social connectedness. Each participant's feeling of social connectedness during the past week was measured using 11 items that we adapted from the Social Connectedness Scale (Lee et al., 2001), $M = 3.25$, SD = 0.86, $\alpha = 0.89$. Participants answered how often they had agreed with each statement using a 1 to 5 scale (1 = *Very rarely or never*; 5 = *Very often or always*). We included most of the items from the original scale (i.e., "I feel distant from people"), but because we wanted to capture participants' feelings of social connectedness specifically during the past week, the survey did not include dispositional items, such as "I fit in well in new situations." See Table S2 for the correlations of all four well-being indicators with demographics and other dispositional predictors.

Covariates and controls. We also assessed a wide range of related predictors, which we treated as covariates, including weekly online and offline behaviors, living and employment arrangements, and a wide range of personality and demographic factors (see Table 2). See Tables S2–S7 in SOM for descriptive information and correlations between variables.

Interaction partners. In addition to measuring time spent interacting with strong and weak ties in general, we also asked participants to report the types of people with whom they had interacted in the past week ("Check all that apply"). The list included the following options: no one, friends, dating partner/potential dating partner, spouse/partner/significant other, family/relatives, your children, roommate/housemate/living partner, coworkers/classmates, boss/supervisor, clients/customers/students/patients, acquaintances, strangers.

Other in-person and online activities. To capture the types of activities in which participants were engaging during the COVID-19 pandemic, we presented them with a list of activities and asked whether they had done any of them during the past week ("Which of the following activities have you done in the past week? Please check all that apply"). Participants could select from 10 activities, which included

Table 1
Pearson correlations between in-person and online interactions during the past week and measures of wellbeing.

	N reporting	M (SD)	1.	2.	3.	4.	5.	6.	7.
1.Positive Affect	651	3.33 (0.91)							
2.Negative Affect	651	2.75 (0.95)	-.54*** [-.59; −.49]						
3.Stress	644	1.80 (0.82)	-.57*** [-.62; −.52]	.79*** [.75; .81]					
4.Social Connectedness	637	3.25 (0.86)	.51*** [.45; .57]	-.64*** [-.69; −.59]	-.70*** [-.74; −.66]				
5.Strong Ties in Person (Hrs)	605	3.35 (2.80)	.19*** [.12; .27]	-.04 [-.12; .04]	-.02 [-.10; .06]	.10* [.02; .18]			
6.Strong Ties Online (Hrs)	602	3.09 (2.46)	.15*** [.07; .23]	.16*** [.08; .24]	.16*** [.08; .23]	-.04 [-.12; .04]	.14*** [.06; .22]		
7.Weak Ties in Person (Hrs)	603	1.52 (2.19)	.15*** [.07; .23]	.08 [-.00; .16]	.13** [.05; .21]	-.07 [-15; .01]	.39*** [.31; .45]	.39*** [.32; .46]	
8.Weak Ties Online (Hrs)	601	1.91 (2.36)	.09* [.01; .17]	.18*** [.11; .26]	.20*** [.13; .28]	-.16*** [-.24; −.08]	.22*** [.14; .29]	.61*** [.55; .66]	.62*** [.57; .67]

Note. ***$p < .001$. **$p < .01$. *$p < .05$. *Values in brackets represent the 95% confidence interval of the Pearson correlation coefficients.*

Table 2
Selected predictors in the final step of stepwise regressions with forward predictor selection for each well-being outcome.

	Positive Affect			Negative Affect			Stress			Social Connectedness		
R^2	.30			.35			.41			.44		
	b (se)	r	$r_{partial}$	b (se)	r	$r_{partial}$	b (se)	r	$r_{partial}$	b (se)	r	$r_{partial}$
1. Time Interacting in Person												
w/Strong Ties	.04 (.01)	.21	.14				-.02 (.01)	-.04	-.10	.04 (.01)	.11	.16
2. Time Interacting Online												
w/Strong Ties										.05 (.02)	-.04	.15
w/Weak Ties				.07 (.02)	.20	.20	.05 (.01)	.21	.16	-.08 (.02)	-.18	-.12
3. Interaction partners												
No one	-.31 (.13)	-.12	-.11									
Roommate	-.28 (.14)	-.04	-.08									
Family										.17 (.06)	.09	.13
Romantic Partner										.16 (.06)	.18	.12
Customers/Clients				.51 (.15)	.10	.15						
Coworkers/Classmates										.25 (.09)	.15	.11
4. Other Activities												
Exercise	.20 (.07)	.23	.12	-.19 (.07)	-.15	-.12						
Existing Hobbies							-.12 (.06)	-.02	-.09			
Making New Friends				-.40 (.13)	-.01	-.13						
Watching Shows/Movies				.20 (.08)	.00	.10						
5. Other Online Activities												
Meetings with Clubs	.21 (.09)	.18	.10									
Games with Strong Ties	.18 (.08)	.15	.09									
# Phone Notifications	.00 (.00)	.16	.15									
6. Living												
w/Children							.14 (.06)	.09	.10			
7. Personality												
Emotional Stability	.25 (.03)	.42	.38	-.34 (.03)	-.53	-.49	-.31 (.02)	-.59	-.55	.27 (.02)	.55	.45
Extraversion	.08 (.02)	.29	.14							.11 (.02)	.34	.23
8. Demographics												
Age				-.01 (.00)	-.28	-.10	-.01 (.00)	-.36	-.19	.01 (.00)	.31	.17
Currently Employed										-.15 (.06)	-.04	-.10
Can Work Remotely	-.16 (.08)	.06	-.09									

Note. The final step of the stepwise regressions shown above includes only the predictors that met the criterion for entry ($p < .05$) at each of the preceding steps. See Tables S8–S11 for details on predictor selection step-by-step. Empty cells indicate that the predictor was not selected in the final step for a given outcome. The list of variables initially provided for each stepwise regression with forward selection included time interacting with strong and weak ties online and in-person, as well as a wide range of related variables and established predictors of well-being as described next. The weekly predictors entered into the stepwise regression are as follows: *(1)* time interacting in person *(with strong ties and weak ties); (2)* time interacting online *(with strong ties and weak ties); (3)* interaction partners*: people with whom participants interacted during the past week,* each coded as 0–No, 1–Yes *(no one, friends, dating partner/potential dating partner, spouse/partner/significant other, family/relatives, one's children, roommate/housemate/living partner, coworkers/classmates, boss/supervisor, clients/customers/students/patients, acquaintances, strangers); (4)* other activities over the past week, each coded as 0–No, 1–Yes *(existing hobbies, new hobbies, cooking/baking, exercising, leisure activities, reading for pleasure, watching shows/movies, going for walks outside, catching up with friends/family, making new friends); (5)* other online activities and behaviors over the past week, each coded as 0–No, 1–Yes *(virtually co-watching shows/movies, group video chats with friends/family, remote dinners/drinking, online meetings with clubs, playing online games simultaneously with family/friends, virtual workout classes, catching up online with friends),* along with *% social interactions online vs. in person (0–100%), % active vs. passive social media use* (coded from 1 to 11, where 1 = *100% passive*, 6 = *equal parts passive and active*, and 11 = *100% active*), and *smartphone screen time* (0–12 h), *pickups* (0–400), and *notifications* (0–400). We also entered a range of stable and dispositional predictors, including: *(6)* living arrangements, each coded as 0–No, 1–Yes *(living alone, living with one's partner, one's children, parent(s), sibling(s), friend(s), grandparent(s), aunt(s)/uncle(s), cousin(s), niece(s)/nephew(s), roommate(s), and caring for children); (7)* personality traits *(extraversion, agreeableness, conscientiousness, emotional stability,* and *openness to experience,* measured on a scale from 1 to 7 (*TIPI;* Gosling et al., 2003*), and (8)* demographics *(age, gender, income, education, and race).* Finally, the following variables were also entered but are not shown in the final model, as they did not predict any of the outcomes*: (a)* COVID-19 diagnoses of self and others, coded as 0–No, 1–Yes*; (b)* employment arrangements, each coded as 0–No, 1–Yes *(currently employed, commuting to work, ability to work remotely); (c)* places where participants spent time in the past week, each coded as 0–No, 1–Yes *(at home, at work/school, on public transit, in a car, at a restaurant/café, at a bar/party, at the gym, out in public, out in nature).* See Supplementary Online Material for measure details, descriptive statistics, and correlations.

"Existing hobbies," "New hobbies," "Exercising," "Watching shows/movies," and "Catching up with friends/family" (see Table S5 for descriptives). We then asked a similar question pertaining specifically to seven virtual activities. Activities included "Virtually co-watching shows or movies with others (on Netflix, Hulu, etc.)," "Remote dinners/drinking (eating dinner or another meal while video chatting)," and "Playing online games simultaneously with friends or family members" (see Table S6 for descriptives).

Stable control variables. We assessed a wide range of stable and dispositional variables, including current living arrangements (e.g., alone, with partner, roommates), employment arrangements, and Big Five personality traits (TIPI; Gosling et al., 2003). We also assessed a wide range of demographic variables, including age, gender, race, income, education, and employment status. Further details on these measures can be found in Table 2 and SOM.

Results

To explore our main research question, we started by examining the Pearson correlations between social interactions, both in-person and online, and measures of well-being over the past week. As shown in Table 1, spending more time interacting with strong ties, or close others, in person was associated with increased positive affect, $r = 0.19$, $p < .001$, and increased social connectedness, $r = 0.10$, $p = .012$. Spending more time interacting with close others through one's digital devices was also related to increased positive affect, $r = 0.15$, $p < .001$, but not with feeling more socially connected, $r = -0.04$, $p > .250$. Unlike in-person interactions with close others, online interactions with close others were associated with increased negative affect, $r = 0.16$, $p < .001$, and more stress, $r = 0.16$, $p < .001$. (See Table S3 in SOM for demographic predictors of the time spent interacting online and in-

person.).

Spending more time interacting with weak social ties in person was related to increased positive affect, $r = 0.15$, $p < .001$, but it was also associated with increased stress, $r = 0.13$, $p = .001$ (see Table 1). Similarly, spending more time interacting with weak ties through one's digital devices was related to positive affect, $r = 0.09$, $p = .026$, and more stress, $r = 0.20$, $p < .001$. But unlike in-person interactions with weak ties, online interactions with weak ties were also associated with more negative affect, $r = 0.18$, $p < .001$, and decreased social connectedness, $r = -0.16$, $p < .001$.

Overall, consistent with past research, in-person interactions were related to higher well-being outcomes across both positive and negative indicators. But while digitally mediated interactions were associated with greater positive affect, they were simultaneously correlated with greater negative affect and stress.

Next, we employed stepwise regressions with Forward Selection method (using SPSS-v26) for each of the four well-being outcomes: positive affect, negative affect, stress, and social connectedness. After entering a wide range of predictors, the strongest individual predictor was automatically identified and entered first; predictors continued to be added in order of predictive strength until no additional predictors met the criterion for inclusion, $p < .05$. As predictors were added, previously included variables were excluded if $p > .10$. To ensure stability in the sample size across variables, we only used data from those participants who finished the entire survey for these analyses ($N = 569$). Additional missing data were replaced with means to keep the sample size the same without adding additional variability. This forward selection approach allowed us to see whether time interacting online and in-person with strong and weak social ties are selected as predictors at all, and, if so, how strongly these variables are associated with well-being outcomes compared to related variables and established predictors of well-being.

For each stepwise regression, we entered our main predictors of time spent interacting online and in-person with strong and weak ties along with a wide range of related predictors (e.g., phone and social media use) and other controls. Based on past research, we also included living arrangements (living with a partner, living with and caring for children, as well as roommates, parents, and siblings; Okabe-Miyamoto et al., 2020). Going beyond past research, we also entered a wide range of people with whom participants had interacted in the past week, including both strong ties (e.g., partner, parents, children, family, friends) and weak ties (e.g., classmates, co-workers, clients, boss, acquaintances). We also included a wide range of offline (e.g., engaging in exercise and hobbies) and online activities (e.g., video calls with family and friends) over the past week. In addition, we entered several pandemic-specific variables, including working from home and having been diagnosed with COVID-19 (see Table S7 for descriptives). Finally, a range of common controls, including personality traits (extraversion, agreeableness, conscientiousness, emotional stability, and openness to experience) and demographics were included. See Table 2 and its notes for a detailed list of predictors and information on coding; see Tables S8–S11 for step-by-step forward selection for each outcome.

Consistent with past research (Costa & McCrae, 1980), emotional stability was associated with all four well-being outcomes, and extraversion was related to both positive affect and social connectedness (see Table 2). Older people felt less negative affect and stress while feeling more socially connected. Above and beyond all other predictors, however, time spent interacting with close others in person was still associated with increased positive affect, $\beta = 0.13$, $b = 0.04$, 95%CI[0.02; 0.07], and increased social connectedness, $\beta = 0.13$, $b = 0.04$, 95%CI [0.02; 0.06]. Interestingly, after controlling for other factors, time spent interacting with family and friends online also remained related to increased social connectedness, $\beta = 0.15$, $b = 0.05$, 95%CI [0.03; 0.08]. Time spent interacting with weak ties online continued to be associated with increased negative affect, $\beta = 0.18$, $b = 0.07$, 95%CI[0.04; 0.10], and more stress, $\beta = 0.13$, $b = 0.05$, 95%CI[0.02; 0.07]. After controlling for other variables, however, time spent interacting with weak ties in person no longer predicted any of the well-being outcomes (see Table 2).

Discussion

We explored the predictors of four key well-being outcomes over the past week—positive affect, negative affect, stress, and social connectedness—during the early stages of the COVID-19 pandemic when social distancing was at its peak in the United States. Above and beyond other activities, specific interaction partners, living arrangements, employment arrangements, personality, and demographics, people who spent more time interacting in person with close others felt more positive affect and social connectedness. People who interacted with close others online, however, also felt more socially connected after accounting for other factors. Thus, during the peak of social distancing in the United States, online social interactions with strong ties were predictive of at least some positive indicators of social well-being. In contrast, people who interacted with weak ties specifically online experienced greater negative affect, more stress, and less social connectedness. Looking at the uncontrolled bivariate relationships revealed a similar pattern: Both in-person and online interactions were associated with greater social connectedness, but only online interactions were simultaneously associated with more stress and negative affect.

Despite the limited opportunities for in-person interactions while social distancing, the pattern of relationships we observed is consistent with the broader pre-pandemic literature of the costs and benefits of digital social interactions (e.g., Holtzman et al., 2017; Kushlev & Leitao, 2020; Przybylski & Weinstein, 2017; Twenge & Campbell, 2019; Twenge et al., 2018). In particular, we see that online interactions specifically with close others were associated with feeling more socially connected. Furthermore, specific digital activities with close others, such as playing online games, were related to higher positive affect. Even at the peak of social distancing in the United States, however, online interactions with weak ties were associated with more negative affect and greater stress. These relationships with negative indicators of well-being could not be reduced to work-related digital communication: Indeed, the relationships remained even after controlling for employment, working from home, and specific interactions with a variety of work-related weak ties (e.g., one's boss, colleagues, clients, students).

A growing body of evidence suggests that in-person interactions even with weak ties—from colleagues to classmates to strangers—can be beneficial to well-being (Epley & Schroeder, 2014; Sandstrom & Dunn, 2014a). Research suggests that casual conversations with people, including one's coffee shop barista (Sandstrom & Dunn, 2014b) and even strangers on a commuter train (Epley & Schroeder, 2014), can boost positive emotion and social connection. We found that people who spent more time interacting with weak ties in person reported higher positive affect—though they also reported more stress. Interestingly, time spent interacting with weak ties in person was no longer associated with positive affect or stress after controlling for other factors. In contrast, interacting with weak ties online was associated with greater stress, more negative affect, and less social connectedness even after controlling for a wide range of additional variables. Of course, this pattern of findings might be due to the unprecedented measures of social distancing, which severely limited opportunities for casual conversations with others. The lack of such casual interactions in person during the pandemic might have led to low variability within this variable and weakened the strength of the relationship between interactions with weak ties and well-being. Additionally, it is worthwhile to acknowledge that we did not assess the amount of time that people interacted with different types of weak ties (e.g., work colleagues, baristas, strangers). Thus, our pattern of findings may be due to differences in the types of weak ties with whom people interacted online versus in person. Still, the overall pattern of our findings suggests that online interactions with weak ties are no replacement for in-person social interactions with weak

ties.

It is critical to note that this research neither attempts nor has the ability to examine causal relationships between variables. Thus, our research does not suggest that certain activities make people more or less happy during the COVID-19 pandemic. Even though we controlled for a wide range of factors, there could always be other factors for which we did not account. Furthermore, our correlational data cannot establish a direction of causality for any of our analyses. Indeed, a growing body of research is suggesting that feeling good is not only an outcome of a rich social life, but that happier people also have stronger relationships and more pleasant social interactions (e.g., Kansky & Diener, 2017). Thus, it is entirely possible that happier people had stronger interpersonal relationships and greater social resources before the pandemic even began. In addition, we did not differentiate between the types of online social interactions in which people took part; this may have further limited this research. For example, the impacts of video calls on well-being might be different from those of texting, and it is also likely that the type of online interaction might vary with the type of person with whom one is communicating: A person might be more likely to engage in video calls with his or her spouse or sibling, but he or she might be more apt to communicate with distant friends or colleagues via text or email. Regardless of the direction of causality or the ambiguity of online interactions, however, our research does establish a difference in the relationship of well-being with in-person versus online social interactions. It is this differential pattern of relationships—observed in a unique moment of human history while socially distancing during a once-in-a-lifetime pandemic—that is the main contribution of this research.

The present research has possible implications for our digital lives after the pandemic is over. In the early stages of the pandemic, three out of four chief financial officers (CFOs) in the United States said that they plan to permanently shift some or all of their workforce to remote work (Gartner, Inc., 2020). This includes major U.S. employers, such as Amazon, Facebook, Microsoft, Zillow, and Capital One. Thus, for many highly skilled employees, work-life will not be 'returning to normal' post-COVID-19. Social distancing is set to become an enduring fixture of work-life for many. Despite some documented benefits of working from home, such as no commute, employees might miss out on the well-being benefits of casual social interactions with colleagues and others in their community. Our research suggests that the benefits of such in-person interactions with weak ties cannot be easily replaced with online social interactions.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chbr.2021.100133.

References

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin, 117*(3), 497–529. https://doi.org/10.1037/0033-2909.117.3.497.

Bugel, J., John, S., Schwartz, S., & AT&T. (2020, November). *Ericsson mobility report*. Ericsson. https://www.ericsson.com/4adc87/assets/local/mobility-report/documents/2020/november-2020-ericsson-mobility-report.pdf.

Cheng, C., Wang, H., Sigerson, L., & Chau, C. (2019). Do socially rich get richer? A nuanced perspective on social network site use and online social capital accrual. *Psychological Bulletin, 145*(7), 734–764. https://doi.org/10.1037/bul0000198.

Cohen, S., & Williamson, G. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan, & S. Oskamp (Eds.), *The social psychology of health: Claremont symposium on applied social psychology* (pp. 31–67). Newbury Park, CA: Sage.

Coronavirus Disease 2019 (COVID-19). (2020, July 15). Centers for Disease control and prevention. https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html.

Costa, P. T., & McCrae, R. R. (1980). Influence of extraversion and neuroticism on subjective well-being: Happy and unhappy people. *Journal of Personality and Social Psychology, 38*(4), 668–678. https://doi.org/10.1037/0022-3514.38.4.668.

CueBiq. (2020). CueBiq mobility insights. https://www.cuebiq.com/visitation-insights-covid19/?utm_source=nyt&utm_medium=article&utm_campaign=organic.

Desjarlais, M., & Willoughby, T. (2010). A longitudinal study of the relation between adolescent boys and girls' computer use with friends and friendship quality: Support for the social compensation or the rich-get-richer hypothesis? *Computers in Human Behavior, 26*(5), 896–905. https://doi.org/10.1016/j.chb.2010.02.004.

Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D., Oishi, S., & Biswas-Diener, R. (2010). New well-being measures: Short scales to assess flourishing and positive and negative feelings. *Social Indicators Research, 97*, 143–156. https://doi.org/10.1007/s11205-009-9493-y.

Dwyer, R. J., Kushlev, K., & Dunn, E. W. (2018). Smartphone use undermines enjoyment of face-to-face social interactions. *Journal of Experimental Social Psychology, 78*, 233–239. https://doi.org/10.1016/j.jesp.2017.10.007.

Epley, N., & Schroeder, J. (2014). Mistakenly seeking solitude. *Journal of Experimental Psychology: General, 143*(5), 1980–1999. https://doi.org/10.1037/a0037323.

Fiske, S. (2014). *Social beings: Core motives in social psychology*. Wiley.

Fitz, N., Kushlev, K., Jagannathan, R., Lewis, T., Paliwal, D., & Ariely, D. (2019). Batching smartphone notifications can improve well-being. *Computers in Human Behavior, 101*, 84–94. https://doi.org/10.1016/j.chb.2019.07.016.

Gartner. (2020, April 3). Gartner CFO survey reveals 74% intend to shift some employees to remote work permanently. Gartner. https://www.gartner.com/en/newsroom/press-releases/2020-04-03-gartner-cfo-surey-reveals-74-percent-of-organizations-to-shift-some-employees-to-remote-work-permanently2.

Gollwitzer, A., Martel, C., Brady, W. J., Pärnamets, P., Freedman, I. G., Knowles, E. D., & Van Bavel, J. J. (2020). Partisan differences in physical distancing are linked to health outcomes during the COVID-19 pandemic. *Nature Human Behaviour, 4*(11), 1186–1197. https://doi.org/10.1038/s41562-020-00977-7.

Gosling, S. D., Rentfrow, P. J., & Swann, W. B. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality, 37*(6), 504–528. https://doi.org/10.1016/S0092-6566(03)00046-1.

Holtzman, S., Declerck, D., Turcotte, K., Lisi, D., & Woodworth, M. (2017). Emotional support during times of stress: Can text messaging compete with in-person interactions? *Computers in Human Behavior, 71*, 130–139. https://doi.org/10.1016/j.chb.2017.01.043.

Hunter, J. F., Hooker, E. D., Rohleder, N., & Pressman, S. D. (2018). The use of smartphones as a digital security blanket: The influence of phone use and availability on psychological and physiological responses to social exclusion. *Psychosomatic Medicine, 80*(4), 345–352. https://doi.org/10.1097/PSY.0000000000000568.

Kahneman, D., Krueger, A. B., Schkade, D. A., Schwarz, N., & Stone, A. A. (2004). A survey method for characterizing daily life experience: The day reconstruction method. *Science, 306*(5702), 1776–1780. https://doi.org/10.1126/science.1103572.

Kansky, J., & Diener, E. (2017). Benefits of well-being: Health, social relationships, work, and resilience. *Journal of Positive School Psychology, 1*(2), 129–169. https://journalppw.com/index.php/JPPW/article/view/20.

Kenrick, D. T., Griskevicius, V., Neuberg, S. L., & Schaller, M. (2010). Renovating the pyramid of needs: Contemporary extensions built upon ancient foundations. *Perspectives on Psychological Science, 5*(3), 292–314. https://doi.org/10.1177/1745691610369469.

Kushlev, K., & Dunn, E. W. (2015). Checking email less frequently reduces stress. *Computers in Human Behavior, 43*, 220–228. https://doi.org/10.1016/j.chb.2014.11.005.

Kushlev, K., & Leitao, M. R. (2020). The effects of smartphones on well-being: Theoretical integration and research agenda. *Current Opinion in Psychology, 36*, 77–82. https://doi.org/10.1016/j.copsyc.2020.05.001.

Lee, R. M., Draper, M., & Lee, S. (2001). Social connectedness, dysfunctional interpersonal behaviors, and psychological distress: Testing a mediator model. *Journal of Counseling Psychology, 48*(3), 310–318. https://doi.org/10.1037/0022-0167.48.3.310.

Leong, W. E., Campbell, M., Kimpton, M., Wozencroft, K., & Orel, A. (2016). Social capital on Facebook: The impact of personality and online communication behaviors. *Journal of Educational Computing Research, 54*(6), 747–786. https://doi.org/10.1177/0735633116631886.

Lieberman, A., & Schroeder, J. (2020). Two social lives: How differences between online and offline interaction influence social outcomes. *Current Opinion in Psychology, 31*, 16–21. https://doi.org/10.1016/j.copsyc.2019.06.022.

Litman, L., Robinson, J., & Abberbock, T. (2017). TurkPrime.com: A versatile crowdsourcing data acquisition platform for the behavioral sciences. *Behavior Research Methods, 49*(2), 433–442. https://doi.org/10.3758/s13428-016-0727-z.

Mark, G. J., Iqbal, S. T., Czerwinski, M., Johns, P., Sano, A., & Lutchyn, Y. (2016). Email duration, batching and self-interruption: Patterns of email use on productivity and stress. In *CHI '16: Proceedings of the 2016 CHI conference on human factors in computing systems* (pp. 1717–1728). https://doi.org/10.1145/2858036.2858262.

Mark, G. J., Voida, S., & Cardello, A. (2012). A pace not dictated by electrons: An empirical study of work without email. In *CHI '12: Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 555–564). https://doi.org/10.1145/2207676.2207754.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review, 50*(4), 370–396. https://doi.org/10.1037/h0054346.

Melumad, S., & Pham, M. T. (2020). The smartphone as a pacifying technology. *Journal of Consumer Research, 47*(2), 237–255. https://doi.org/10.1093/jcr/ucaa005.

Okabe-Miyamoto, K., Folk, D. P., Lyubomirsky, S., & Dunn, E. W. (2020). Changes in social connection during COVID-19 social distancing: It's not (household) size that matters, it's who you're with. *PsyArXiv*. https://doi.org/10.31234/osf.io/zdq6y.

Przybylski, A. K., & Weinstein, N. (2017). A large-scale test of the goldilocks hypothesis: Quantifying the relations between digital-screen use and the mental well-being of adolescents. *Psychological Science, 28*(2), 204–215. https://doi.org/10.1177/0956797616678438.

Reilly, C. (2020, April 23). Zoom calls on weekends are up almost 2,000%. CNET.). https://www.cnet.com/news/zoom-calls-on-weekends-are-up-almost-2000-percent/ .

Reis, H. T., Sheldon, K. M., Gable, S. L., Roscoe, J., & Ryan, R. M. (2000). Daily well-being: The role of autonomy, competence, and relatedness. *Personality and Social Psychology Bulletin, 26*(4), 419–435. https://doi.org/10.1177/0146167200266002.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and wellbeing. *American Psychologist, 55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68.

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology, 57*(6), 1069–1081. https://doi.org/10.1037/0022-3514.57.6.1069.

Sandstrom, G. M., & Dunn, E. W. (2014a). Social interactions and well-being: The surprising power of weak ties. *Personality and Social Psychology Bulletin, 40*(7), 910–922. https://doi.org/10.1177/0146167214529799.

Sandstrom, G. M., & Dunn, E. W. (2014b). Is efficiency overrated? Minimal social interactions lead to belonging and positive affect. *Social Psychological and Personality Science, 5*, 437–442. https://doi.org/10.1177/1948550613502990.

Twenge, J. M., & Campbell, W. K. (2019). Media use is linked to lower psychological well-being: Evidence from three datasets. *Psychiatric Quarterly, 90*, 311–331. https://doi.org/10.1007/s11126-019-09630-7.

Twenge, J. M., Martin, G. N., & Campbell, W. K. (2018). Decreases in psychological well-being among American adolescents after 2012 and links to screen time during the rise of smartphone technology. *Emotion, 18*(6), 765–780. https://doi.org/10.1037/emo0000403.

Waytz, A., & Gray, K. (2018). Does online technology make us more or less sociable? A preliminary review and call for research. *Perspectives on Psychological Science, 13*(4), 473–491. https://doi.org/10.1177/1745691617746509.

WHO Director-General's opening remarks at the media briefing on COVID-19. (2020, March 11). World health organization. https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—11-march-2020.

Yuan, E. S. (2020, April 1). A message to our users. Zoom blog. https://blog.zoom.us/a-message-to-our-users/.