Staying happy even when staying 6 ft apart: The relationship between extroversion and social adaptability[☆]

Esha S. Naidu [a,*], Elaine Paravati [b], Shira Gabriel [a]

[a] Department of Psychology, The University at Buffalo, State University of New York, Buffalo, NY, USA
[b] Department of Psychology, Hamilton College, Clinton, NY, USA

ABSTRACT

COVID-19-related social distancing guidelines pose challenges that may be particularly distressing for those high in extroversion, who tend to experience greater happiness when in social situations (Costa & McCrae, 1980; Emmons & Diener, 1985). Our research sought to examine if extroversion was related to greater use of COVID-19-compliant, nontraditional social strategies (e.g. collective effervescent experiences, social surrogate use, and video-chatting) when social options were limited. We examined residents of New York State before the start of the pandemic, during the peak of the pandemic, and one year after the peak of the pandemic. Using a variety of analytical strategies, we found that extroversion was associated with greater use of nontraditional social strategies during the pandemic, and that use of some of these strategies partly explained a relationship between extroversion and maintaining happiness during the pandemic. Furthermore, extroversion was associated with greater use of some of these strategies only when traditional social opportunities were limited. These findings suggest that extroverts are likely to seek out and utilize unorthodox forms of connection to maintain wellbeing, particularly when other social options are unavailable. This work makes novel contributions to our understanding of extroversion and the flexibility of the need to belong.

1. Introduction

In response to the spread of COVID-19 in the United States, the Centers for Disease Control and Prevention recommended in March of 2020 that individuals limit close contact with people outside of their homes to restrict the spread of the disease (i.e. socially distance; CDC, 2020). These recommendations led movie theaters, dine-in restaurants, bars, gyms, and coffee shops to be shut down, and many workplaces to move to remote work models, changing the ways that people socialize and maintain important connections (Sohrabi et al., 2020; Wang et al., 2021). Although all people were greatly affected by these enormous changes to daily life, the specific ways that people's social behavior changed, adapted, and reacted to this enormous disruption may have been highly dependent on differences in their levels of extroversion

(Volk et al., 2021). Because sociability and gregariousness are innate to extroversion (John et al., 2008), placing limitations on social interactions may be particularly concerning for people high in extroversion. To combat these impediments to socialization, people high in extroversion may be likely to use alternative social strategies (e.g. collective effervescence, social surrogates, and video-chatting) that comply with social distancing guidelines and allow one to maintain valuable social connections. Therefore, in the current study, we predict that one's level of extroversion will predict how individuals were affected by and responded to COVID-19 related challenges. Residents of New York State were studied before, during, and near the end of enforcement of strict social distancing rules (one year later)[1] to examine novel hypotheses about extroversion and the flexibility of the need to belong. Specifically, we examined if extroversion was related to greater use of nontraditional

social strategies that comply with safety guidelines when social options are limited.[2]

1.1. Extroversion during COVID-19

Extroverts find joy in socializing, talking to others, and simply being in the presence of other people (Ostendorf & Angleitner, 2004; Rammstedt & John, 2007; Woodcock et al., 2013). Because COVID-19 social distancing guidelines made it particularly difficult to engage in those kinds of activities, extroverts may have experienced worse outcomes than others during the pandemic. Accordingly, people higher in extroversion have reported having greater concerns about feeling lonely during social isolation (Aschwanden et al., 2021; Entringer & Gosling, 2021) and extroversion has been related to greater stress during the pandemic (Liu et al., 2021). Additionally, COVID-19 guidelines predicted worsened depression for extroverts, but not for introverts (Wijngaards et al., 2020). This suggests that extroverts may have felt a greater impact of social distancing guidelines and felt they had a lessened ability to socialize in ways they were accustomed to, which then led them to feeling more depressed than their introverted peers.

There is also evidence to suggest that, despite a general decline in wellbeing, social factors related to extroversion may have helped individuals to mitigate the felt disruption to their social lives. For example, the difference between introverts' and extroverts' drops in felt social connection disappeared when controlling for other factors such as relationship status (Gubler et al., 2020) and feelings of social connectedness prior to the pandemic (Folk et al., 2020). Relatedly, extroverts reported more anxiety and stress at the start of the pandemic compared to their introverted peers, but those differences went away as the pandemic continued (Gruda and Ojo, 2021; Zacher & Rudolph, 2021). These findings suggest that the creative ways that extroverts found to stay connected during COVID-19 could have helped buffer them against some of the negative effects of social distancing. In support, one study conducted during the pandemic demonstrated that highly extroverted police officers were more likely to socialize with colleagues outside of work compared with their less extroverted counterparts (Langvik et al., 2021). Thus, it might be the case that having effective social strategies to employ could prevent even the most social individuals from feeling lonely while social distancing.

In the current work, we are particularly interested in how extroverts were affected by the pandemic in terms of their felt happiness. A strong relationship between extroversion and happiness has been consistently replicated over numerous studies and has been shown to be both stable over time as well as generalizable to diverse populations (Costa & McCrae, 1980; Emmons & Diener, 1985; Francis, 1998; Heady & Wearing, 1992). One potential explanation for this robust relationship between extroversion and happiness may be that extroverts are more likely to have more frequent social interactions and, as a result of those interactions, experience more positive affect (Argyle & Lu, 1990; Emmons & Diener, 1985; Pavot et al., 1990). However, social distancing guidelines implemented during COVID-19 may have reduced extroverts' ability to have traditional social interactions, and therefore diminished the strong relationship between extroversion and happiness. By exploring how the relationship between extroversion and happiness has changed during the pandemic, was affected by limitations on traditional social strategies, and may have been bolstered by use of nontraditional social strategies, potential findings from the current study will

contribute to a better understanding of the relationship between extroversion and happiness.

1.2. Extroversion and social strategies

Requirements to socially distance made it nearly impossible for individuals to engage in the face-to-face activities that they normally used to fulfill their belongingness needs. However, because social needs can be flexibly fulfilled, people can use a variety of social strategies to maintain a sense of connectedness despite a new and strange social landscape (Paravati et al., 2021). In the current study, we predicted that extroversion would be associated with greater use of nontraditional, COVID-19 compliant, methods of social connection, such as experiencing collective effervescence (shared experiences of connectedness and transcendence; Gabriel et al., 2020), using social surrogates (symbolic social bonds; Gabriel & Young, 2011; Hartmann, 2016), and video-chatting during the pandemic. Although no one has yet examined these relationships, research suggests that extroverts may be more motivated to engage in these strategies, particularly when traditional options are limited, as compared to introverts.

Although all people have a need to feel that they belong, individuals differ in how they prefer to fulfill that need (Paravati et al., 2021; Cross et al., 2000; Derrick et al., 2019; Gabriel & Gardner, 1999; Gabriel et al., 2017). Extroverts have a particularly high desire for social interaction, regardless of who the target may be or what the particular social situation is (Leary et al., 2013; Lee et al., 2008). On the other hand, introverts typically enjoy social interactions less and participate less in social activities (Argyle & Lu, 1990; Lucas & Diener, 2001; Mehl et al., 2006; Paunonen, 2003). Therefore, we proposed that extroversion would be associated with greater use of nontraditional, COVID-19 compliant social strategies to fulfill social needs during a time when common social strategies are unavailable. These strategies included collective effervescence, use of social surrogates, and video-chatting (which has been associated with greater extroversion during the start of COVID-19; Pfund et al., 2021).

First, we expected that extroverts would be more likely to have more collective effervescent experiences during the pandemic. Collective effervescence is a sensation of sacredness and feeling of connectedness that accompanies some large- or small-scale group events (Durkheim, 1912; Gabriel et al., 2020; Páez et al., 2015) and can foster feelings of connection with people that one does not necessarily know. Importantly, collective effervescence can occur without the *physical* presence of other people, making it a potential mechanism by which people might feel socially connected during isolation. For example, collective effervescence can occur while in virtual lectures with others, playing communal online games, during virtual concerts, or in socially distanced gatherings (Gabriel et al., 2020). Prior to the start of the pandemic, extroversion was associated with more frequent experiences of collective effervescence in day-to-day life (Gabriel et al., 2020) and a greater tendency to feel collective effervescence in groups (Gabriel et al., 2017). Therefore, we expected that extroverts would use this strategy to maintain wellbeing during the pandemic, even when traditional means of feeling collective effervescence (e.g. live concerts, religious events, live sporting events) were not available.

Second, we expected that extroverts would be more likely to use social surrogates (narrative social worlds, reminders of others, and parasocial relationships) during the pandemic. Social surrogates are another way of providing a sense of social connection without the physical presence of other people, thus making them highly relevant to the social distancing guidelines set in place during the COVID-19 pandemic. Social surrogates can include connecting to the "social worlds" of fictional narratives, such as those found in television shows (Derrick et al., 2009; Greenwood & Long, 2009) or immersive books (Gabriel & Young, 2011). Social surrogates can also include using nonhuman objects, such as comfort foods, photographs, and letters, to remind us of others (Gardner et al., 2005; Troisi & Gabriel, 2011).

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[2] The data were collected as a part of a larger data collection project that aims to examine many different research questions related to social connections in times of limited social contact. A full list of all included measures and data for all relevant analyses are available at the following link: https://osf.io/8pe2j/?view_only=80a78ed8c2bf4970a2f1c6226af4927a. Due to the sudden nature of the crisis, we were unable to pre-register our research plans before beginning data collection.

Finally, social surrogates can include forming and maintaining "para-social relationships," which are one-sided relationships between media figures, such as celebrities, and their fans (Derrick et al., 2008). Despite being symbolic, these bonds feel psychologically real (Hartmann, 2016) and can fulfill social needs in ways similar to traditional relationships (Paravati et al., 2021; Gabriel et al., 2016; Greenwood & Long, 2009). Although prior work on the relationship between extroversion and social surrogates is mixed (Derrick et al., 2019; Weibel et al., 2010), we propose that specifically during COVID-19, when options to socialize are limited, extroverts would be likely to use these strategies to obtain social satisfaction.

In summary, in the current study, we expected that extroverts who were limited in their options to socialize in traditional ways would be more likely than their more introverted counterparts to seek out and utilize social options that are nontraditional yet effective and compliant with COVID-19 social distancing guidelines.

1.3. The present study

The goal of the current research was to examine how extroversion is related to use of nontraditional social strategies when common forms of social interaction are discouraged.

First, consistent with past research, we expected that those high in extroversion experienced greater drops in happiness from prior to the start of COVID-19 to during the peak of COVID-19 than introverts did, as extroverts may have been particularly impacted by being unable to maintain their regular social relationships (Aschwanden et al., 2021; Wijngaards et al., 2020).

H1. Extroversion will moderate a decrease in happiness from before the COVID-19 pandemic to during the COVID-19 pandemic, such that those higher in extroversion will have experienced greater drops in happiness.

Next, as extroverts may be more motivated to adapt to novel modes of socializing when necessitated (e.g. Bowden-Green et al., 2021), we expected that extroversion would predict greater use of nontraditional social strategies during COVID-19. These include collective effervescence, social surrogates (e.g. narrative social worlds, reminders of others, and parasocial relationships) and video-chatting.

H2. Extroversion will be positively related to use of nontraditional social strategies during COVID-19.

Third, we expected that use of nontraditional social strategies would be related to happiness during COVID-19 as use of these strategies has been shown to fulfill social needs (Paravati et al., 2021; Gabriel et al., 2016; Shaw & Gant, 2004) and buffer against stress (Cohen et al., 2000; Cohen & McKay, 1984; Cohen & Wills, 1985; Thoits, 1986).

H3. Greater use of nontraditional social strategies will be related to happiness during COVID-19 even when controlling for levels of happiness before COVID-19.

Fourth, we expected that use of safe and effective social strategies (i. e. those that are related to happiness during COVID-19) would explain a positive relationship between extroversion and happiness during COVID-19. In other words, extroverts may have been happier than more introverted individuals during COVID-19, in part, because they were more likely to use nontraditional social strategies.

H4. Use of safe and effective social strategies will mediate a relationship between extroversion and happiness during COVID-19.

Finally, we expected to replicate the finding that extroversion would be related to greater use of nontraditional social strategies when social options are limited (H2) even one year after the peak of the pandemic. As social distancing guidelines had greatly loosened by Spring 2021 (CDC, 2021), we expected that a relationship between extroversion and use of nontraditional social strategies would only exist for those who

were experiencing social limitations (i.e. following social distancing guidelines). We expected that extroverts who were not following social distancing guidelines at that time might not have been using nontraditional social strategies as much because their preferred methods of socialization were available to them again (Derrick et al., 2019). Support for this hypothesis would suggest that extroverts are more flexible in meeting their social needs specifically when other options to interact with others are limited.

H5. Relationships between extroversion and greater use of nontraditional social strategies will be moderated by strictness of adherence to COVID-19 social distancing guidelines, such that extroverts who are social distancing will be more likely to use nontraditional social strategies than those who are not.

By examining these questions at three time points over two studies, the current work captures how levels of extroversion predict social behavior in response to COVID-19 restrictions prior to their introduction, at the peak of the pandemic, and one year after the start of the pandemic. As the level of adherence to these guidelines differed over each of these three timepoints, these analyses allowed us to examine social behavior when no limitations were in place, when heavy limitations were strongly enforced, and at a time when some individuals behaved under limitations while others did not. Overall, examination of these hypotheses will help to inform how those higher in extroversion may be more flexible in using various kinds of strategies to fulfill their desire for social interaction when limitations are placed on traditional modes of socially connecting.

2. Study 1

To examine Hypotheses 1–4, we collected data at two points: once in early January 2020 (before social distancing guidelines took effect in NYS), and again in April/May 2020 (while social distancing guidelines were enforced).

2.1. Method

2.1.1. Participants

This study involved undergraduate students at a large university in New York State who were enrolled in an introductory psychology course. The research was approved by the university's internal review board and was carried out in accordance with relevant ethical guidelines. The first timepoint of the study (January 2020) was part of a mass testing session for all introductory psychology students. Later in the semester (April/May 2020), these students were notified of the opportunity to participate in a follow-up study for partial fulfillment of a course requirement. After consenting, participants completed each survey on the external website Qualtrics. The final sample of participants included 353 (153 female) students who completed measures at both time points. The sample was diverse in ethnicity (41 African/African American, 96 Asian/Asian American, 2 American Indian/Alaska Native, 180 European/European American, and 35 Hispanic) with an average age of 19.27 years ($SD = 1.6$ years).

Although this was a sample of convenience, all participants, as students at a state university in New York State during the severe outbreak of COVID-19, experienced strict social distancing regulations and were therefore well suited to our research question. As we planned to conduct several analyses in order to test our hypotheses, to determine the necessary sample size, we conducted a priori power analyses for the analysis which would require the largest sample to detect a significant effect with 0.80 power and an alpha level of 0.05. This was the planned test of each social strategy predicting happiness during COVID-19 while controlling for happiness prior to COVID-19. Prior work has shown that the relationships between general use of social surrogates, collective effervescence and broad wellbeing during COVID-19 has a small to moderate effect sizes (Naidu et al., *unpublished data*), therefore we

anticipated small to moderate effect sizes for the analyses in the current study. The test estimated that a sample size between 68 and 485 would be necessary to detect a small to medium effect with 0.80 power and an alpha level of 0.05. Therefore, the final sample of 353 was adequate to address the research questions examined in the current study.

2.1.2. Materials

General demographics, including age, gender, and race, were collected at the end of each survey. All other materials were presented in random order within the indicated survey. Standardized scores are used in all analyses. The full scales are available in the Supplemental materials. All scales were standardized for use in analysis.

2.1.2.1. Time 1 measures

2.1.2.1.1. Extroversion. To assess extroversion, the two-item extroversion subscale from the short Big Five Inventory (Rammstedt & John, 2007) was used. Participants responded by selecting how well the descriptions "extraverted, enthusiastic" and "reserved, quiet" (reverse scored) describe themselves on a scale of 1 (*strongly* disagree) to 7 (*strongly* agree). These items showed good reliability ($\alpha = 0.71$).

2.1.2.1.2. Happiness. Participants reported their happiness by responding to one item: "In general I consider myself…" using a scale of 1 (*not a happy person*) to 7 (*a very happy person*).

2.1.2.2. Time 2 measures

2.1.2.2.1. Happiness. Participants reported their happiness by responding to one item: "Please indicate how often you feel the following emotion: Happy" using a scale of 1 (*not at all*) to 7 (*extremely*).

2.1.2.2.2. Disruption caused by COVID-19. To assess how much participants' daily lives were disrupted specifically due to issues related to COVID-19, they responded to 9 items. An example item includes, "How much of your daily routine is disrupted by the current COVID-19 guidelines?" Participants responded using a scale of 1 (*none at all*) to 7 (*about all of it*). Together these items showed good reliability, $\omega = 0.79$.

2.1.2.2.3. Video chatting. To assess how often participants used video chatting to stay in touch with others during COVID-19, they responded to two items by selecting how often in the past week they did the following activities, "Video chat with a group (using Webex, Zoom, Skype, Facetime, Facebook, etc.)" and "Video chat with one or two people at a time (using Webex, Zoom, Skype, Facetime, Facebook, etc.)". Participants responded to these items on a seven-point scale from 1 (*I never do that*) to 7 (*multiple times a day*), $\alpha = 0.82$.

2.1.2.2.4. Collective effervescence experiences. To assess how frequently participants were having collective effervescent experiences during COVID-19, participants were provided a description and several examples of collective effervescent events that could happen while following social distancing guidelines (e.g. feeling a sense of connection to a church group via a virtual service, or experiencing a sense of connection with a fitness group during a virtual workout class). They were then asked to recall and briefly describe any similar experiences that they may have recently had. Then, participants were asked "How frequently have you had this kind of group experience in the past few weeks?" and responded on a scale of 1 (*never*) to 5 (*daily*).

2.1.2.2.5. Narrative social worlds. To assess how often participants immersed themselves in fictional social worlds, they responded to four items by selecting how often in the past week they did the following activities, "Watch one of my favorite TV shows-an episode I've never seen," "Watch one of my favorite TV shows- a re-run," "Read one of my favorite books," and "Watch one of my favorite movies." Participants responded to these items on a seven-point scale from 1 (*I never do that*) to 7 (*multiple times a day*), $\omega = 0.60$.

2.1.2.2.6. Reminders of others. To assess how often participants reminded themselves of their important social connections, they responded to three items by selecting how often in the past week they did the following activities, "Look at old pictures of friends and/or

family," "Look through my old stuff (e.g. souvenirs or mementos)," and "Read old letters, personal emails, old text messages, or saved conversations." Participants responded to these items on a seven-point scale from 1 (*I never do that*) to 7 (*multiple times a day*), $\omega = 0.82$.

2.1.2.2.7. Parasocial relationships. To assess how often participants used connections to parasocial relationship partners, they responded to three items by selecting how often in the past week they did the following activities, "Read a celebrity magazine," "Look up one of my favorite celebrities online," and "Watch a TV show/movie starring one of my favorite celebrities." Participants responded to these items on a seven-point scale from 1 (*I never do that*) to 7 (*multiple times a day*), $\omega = 0.76$.

2.2. Results[3]

2.2.1. Changes in well-being during COVID-19

2.2.1.1. Global well-being and life disruption during COVID. Before addressing our main hypotheses, we first conducted paired samples *t*-test assessing happiness from pre-COVID-19 (January 2020) to during the 2020 peak of COVID-19 (April/May 2020). As expected, these tests indicated that happiness pre-COVID-19 ($M = 5.16$, $SD = 1.27$) was greater than happiness measured during COVID-19 ($M = 4.11$, $SD = 1.38$); $t(228) = 10.26$, $p < .001$. Further, Cohen's effect size value ($d = 0.79$) suggested a moderate to high practical significance.

We also conducted correlational analysis to determine if extroversion was related to the level of overall disruption people experienced in their lives as a result of COVID-19 (see Table 1). We predicted that extroverts, given their high level of social needs, would feel the most disrupted by social distancing guidelines. Indeed, in line with our hypotheses, extroversion was associated with greater experiences of disruption to daily life due to COVID-19 ($r(225) = 0.205$, $p < .01$).

2.2.1.2. Extroversion and changes in wellbeing. We predicted that those higher in extroversion (+1 SD) would show a greater reduction in happiness from before the pandemic to during the pandemic, when social distancing guidelines were enforced compared to those lower in extroversion (−1 SD). To explore this, we conducted mixed model analyses of variance with happiness measured both before and during the pandemic as the within-subjects variable and extroversion as the between-subjects variable.

The analyses revealed that extroversion moderated the effects of time on happiness ($F(1, 220) = 9.39$, $p < .01$ $\eta p^2 = 0.04$). Happiness was found to significantly decrease between Time 1 and Time 2 for both

Table 1
Descriptive statistics and correlations for extroversion and wellbeing outcomes.

M	SD	Measure	1	2	3	4
4.1	1.56	1. Extroversion	1.00			
5.16	1.27	2. Happiness Before COVID-19	0.43***	1.00		
4.04	1.40	3. Happiness During COVID-19	0.18**	0.32***	1.00	
4.21	0.89	4. Disruption caused by COVID-19	0.21**	0.02*	−0.21***	1.00

*** $p < .001$.
** $p < .01$.
* $p < .05$; $N = 231$.

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those high in extroversion ($F(1, 220) = 96.42$, $p < .001$, $\eta p^2 = 0.31$)and those low in extroversion ($F(1, 220) = 27.30$, $p < .001$, $\eta p^2 = 0.11$), indicating that both experienced a decrease in happiness. However, the decrease was significantly steeper for those high in extroversion (Fig. 1). In other words, those high in extroversion experienced greater drops in happiness from before to during the pandemic.

2.2.2. Extroversion and social strategy use[4]

What social strategies are extroverts using during COVID-19? To answer this question, we examined correlations between extroversion and use of nontraditional social strategies during COVID-19. These correlations are presented in Table 2. In support of H2, extroversion was positively related to every assessed nontraditional social strategy, including collective effervescent experiences ($r(223) = 0.15$, $p < .05$), narrative social worlds ($r(225) = 0.15$, $p < .05$), reminders of others ($r(225) = 0.25$, $p < .001$), parasocial relationships ($r(225) = 0.14$, $p < .05$), and video-chatting ($r(211) = 0.26$, $p < .001$). In summary, as predicted, extroversion was associated with greater use of nontraditional social strategies during COVID-19.

2.2.3. Safe social strategies and happiness during COVID-19

We expected that use of safe social strategies would be associated with happiness during COVID-19. During social isolation, individuals had limited access to traditional relationships, so finding a nontraditional way to fill the need to belong should be associated with maintaining happiness specifically during COVID-19. To test this, we performed a series of regressions with each social strategy predicting happiness during COVID-19 while simultaneously controlling for happiness assessed before COVID-19 and the interaction of happiness before COVID-19 and the social strategy. The result of each of these regressions is presented in Table 3. In summary, collective effervescent events, parasocial relationships, and narrative social worlds predicted happiness during COVID-19, while reminders of others and video-chatting did not.

2.2.4. Extroversion and social strategies during COVID-19

To further explore if use of these effective and safe social strategies explained the positive relationship between extroversion and happiness during COVID-19, we created a new variable combining the three
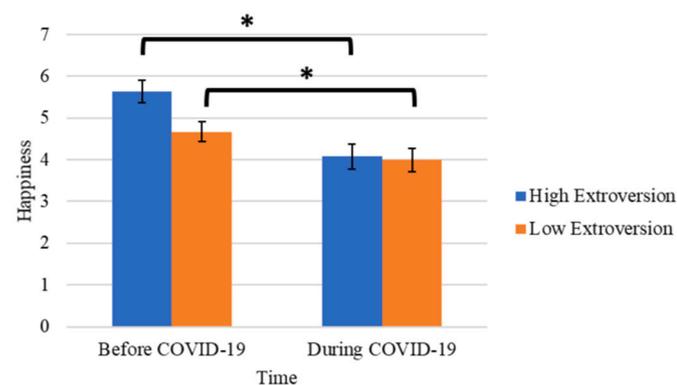

Fig. 1. Predicted means of low (−1 SD) and high (+1 SD) levels of extroversion predicting differences between changes in happiness from pre-COVID-19 to during COVID-19. Error bars represent one standard error above and below the mean. Asterisks indicate significant differences for tested comparisons ($p < .05$).

measures assessing use of parasocial relationships, narrative social worlds, and experiencing frequent CE events, which reflects total use of effective and safe social strategies, ranging from 1 to 15 (with higher numbers indicating more use of these nontraditional strategies).[5] We standardized and then used this composite variable to conduct a mediation analysis using bootstrapping with 5000 samples (as recommended by Preacher & Hayes, 2008).[6] Zero-order correlations between these variables are presented in Table 4. As Fig. 2 illustrates, the relationship between extroversion and use of effective and safe social strategies was statistically significant, as was the relationship between effective and safe social strategies and happiness during COVID-19. Bootstrapped 95% confidence intervals constructed around the indirect effect did not include 0, 95% CI [0.01, 0.12], suggesting that use of effective and safe social strategies partly accounts for a positive relationship between extroversion and happiness during COVID-19.

2.3. Discussion

Participants showed dips in happiness from prior to the pandemic (January 2020) to during the peak of the pandemic in March 2020. Extroversion was related to greater felt disruption to one's daily life during the pandemic and extroverts experienced greater drops in happiness from prior to during the pandemic competed to introverts. Higher extroversion was related to greater use of nontraditional social strategies, including having more frequent collective effervescent experiences using narrative social worlds, parasocial relationships, reminders of others, and video-chatting during the pandemic. Some of these strategies (collective effervescent experiences, narrative social worlds, and parasocial relationships) were related to greater maintenance of happiness during COVID-19. Mediational analyses suggested that use of these strategies helps to explain why extroversion was still related to happiness during COVID-19, despite the additional struggles that extroverts were experiencing. In other words, although extroverts experienced greater drops in happiness than introverts did during COVID-19, their propensity to use unconventional strategies helped them maintain greater levels of happiness compared to their more introverted counterparts. Notably, video-chatting and reminders of others were not related to greater happiness during COVID-19. Potential reasons for this finding will be considered in the general discussion.

3. Study 2

To explore our fifth hypothesis, that the limitation of other social options is a key factor in extroverts' use of nontraditional social strategies, we collected data again in Spring of 2021. In Spring 2020, when COVID-19 was at its peak, almost all residents of New York State were following social distancing guidelines to the best of their abilities. Therefore, in Study 1, we assumed that all participants were limiting their in-person social interactions during COVID-19 (the second time point of data collection). However, in Spring 2021, the social landscape had once again changed. Although some social distancing restrictions still remained, many were being lessened or lifted. This change was likely due to the availability of the COVID-19 vaccine, which made social gatherings safer than before immunization was available. Therefore, in Spring of 2021, some individuals were still following social distancing guidelines strictly, while others were socializing with others normally again (CDC, 2021). This situation provided a unique opportunity to

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[4] All participants did not complete every measure at both timepoints. Therefore, pairwise deletion was used for correlations, and the degrees of freedom may differ between specific reported correlations.

[5] Video-chatting and reminders of others were not included in this composite variable as although they are considered to be "safe" social strategies while complying with COVID-19 guidelines, they were not shown to be effective at maintaining happiness (Table 3), and therefore are not considered to be "effective" social strategies during COVID-19 for the purposes of the current study.

[6] The total observed sample size for this analysis was 224 participants.

Table 2
Correlations between extroversion and social strategies used during COVID-19.

M	SD	Measure	1	2	3	4	5	6
4.1	1.56	1. Extroversion	1.00					
2.33	1.33	2. Collective effervescent events	0.15*	1.00				
2.74	1.13	3. Narrative social worlds	0.16*	0.00**	1.00			
2.68	1.43	5. Reminders of others	0.25***	0.08	0.48***	1.00		
2.09	1.23	4. Parasocial relationships	0.14*	0.06	0.69***	0.51***	1.00	
3.53	1.79	6. Video-chatting	0.26***	0.11	0.25***	0.23***	0.25***	1.00

*** $p < .001$.
** $p < .01$.
* $p < .05$; $N = 231$.

Table 3
Regression coefficients for models of social strategy use predicting happiness during COVID-19 controlling for happiness before COVID-19 and the interaction term.

Predictors	B	t	p
Video-chatting	0.06	0.64	0.52
Happiness pre-COVID	0.46	4.84	0.000***
Interaction term: Video-chatting * Happiness	0.14	1.40	0.16**
Frequency of CE events	0.18	2.14	0.03*
Happiness pre-COVID	0.47	5.18	0.000***
Interaction term: CE events * Happiness	−0.20	−2.30	0.02*
Narrative Social Worlds	0.19	2.06	0.04*
Happiness pre-COVID	0.46	4.90	0.000***
Interaction term: Social Worlds * Happiness	−0.01	−0.11	0.91
Reminders of others	0.05	0.60	0.55
Happiness pre-COVID	0.46	4.97	0.000***
Interaction term: Reminders of others * Happiness	−0.07	−0.75	0.45
Parasocial relationships	0.21	2.29	0.02*
Happiness pre-COVID	0.47	5.07	0.000***
Interaction term: Parasocial relationships * Happiness	−0.09	−1.00	0.32

*** $p < .001$.
** $p < .01$.
* $p < .05$.

Table 4
Descriptives and correlations for extroversion and COVID-19 related outcomes.

M	SD	Measure	1	2	3	4
4.03	1.52	1. Extroversion	1.00			
7.14	2.58	2. Use of effective and safe social strategies	0.21**	1.00		
4.95	1.35	3. Happiness before COVID-19	0.37***	0.06*	1.00	
4.04	1.40	4. Happiness during COVID-19	0.18**	0.24***	0.32***	1.00

*** $p < .001$.
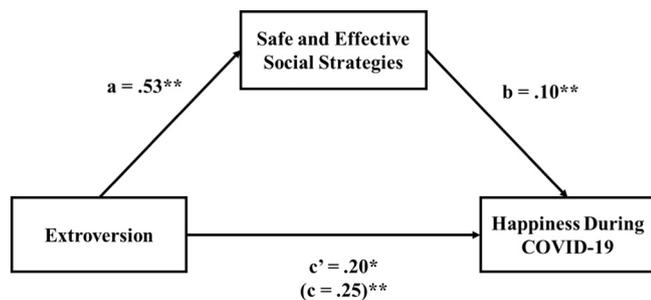** $p < .01$.
* $p < .05$.

Fig. 2. Mediation model of use of effective and safe social strategies mediating the relationship between extroversion and happiness during COVID-19.

study the behavior of individuals who were limiting their social options compared to those who were not. By including a variable assessing to what degree individuals were still following COVID-19 social distancing guidelines, we were able to replicate and build upon the findings from Study 1. Specifically, we were able to expand upon the findings by exploring whether extroversion was associated with flexibility in fulfilling social needs in nontraditional ways under normal social circumstances, or if this finding was only applicable under circumstances when their options for socialization were limited. We expected that, at this third time point, extroverts would be more likely to use nontraditional social strategies only when they were strictly following social distancing guidelines. Study 2 also allowed us to replicate our basic findings from Study 1 using a more extensive measure of extroversion (IPIP; Goldberg, 1992).

3.1. Method

3.1.1. Participants

This study involved undergraduate students at a large university in New York State who were enrolled in an introductory psychology course. The research was approved by the university's internal review board and was carried out in accordance with relevant ethical guidelines. After consenting, participants completed the survey on the external website Qualtrics. The final sample of participants included 285 (92 female) students who completed measures at both time points. The sample was diverse in ethnicity (29 African/African American, 82 Asian/Asian American, 2 American Indian/Alaska Native, 1 Pacific Islander, 155 European/European American, 26 Hispanic, and 15 other) with an average age of 19.20 years ($SD = 1.5$ years).

In order to determine the necessary sample size to detect potential interactive effects, an a priori power analysis was conducted. As no prior research has examined the interaction between extroversion and adhering to COVID-19 guidelines on use of safe social strategies, we conservatively estimated the effect size to be small to medium. The test estimated that a sample size between 68 and 485 would be necessary to detect a small to medium effect with 0.80 power and an alpha level of 0.05. Therefore, the final sample of 285 was adequate to address this research question.

3.1.2. Materials

General demographics, including age, gender, and race, were collected at the end of the survey. All other materials were presented in random order. The full scales are available in the Supplemental materials. The measures for video-chatting ($\alpha = 0.78$), collective effervescence experiences, narrative social worlds ($\omega = 0.67$), reminders of others ($\omega = 0.89$), and parasocial relationships ($\omega = 0.87$), were identical to those used in Study 1.

3.1.2.1. Extroversion. To assess extroversion, participants completed the 10-item extroversion – introversion subscale of the international personality item pool (IPIP; Goldberg, 1992). Participants used a seven-point scale from 1 (*strongly disagree*) to 7 (*strongly agree*) to indicate to what degree each statement describes them. An example item from this

scale is "I feel comfortable around people." Higher scores on this scale indicate greater extroversion, whereas lower scores indicate greater introversion ($\omega = 0.85$).

3.1.2.2. Following COVID 19 guidelines. Following COVID-19 regulations was measured by responses to the following question: "In response to the COVID-19 outbreak in the United States, the CDC has recommended that people follow social distancing practices (restricting outings only for essentials, not meeting friends in person, maintaining at least 6 ft distance with people you come into contact with, etc.). How strictly or leniently are you personally following social distancing practices?" Participants responded to this question using a scale from 1 (*very leniently*) to 7 (*very strictly*).

3.2. Results

We expected that how strictly individuals were following COVID-19 guidelines would moderate the relationship between extroversion and use of safe social strategies. Specifically, we expected that the tendency for those higher in extroversion to use safe social strategies would be greater for those who were following COVID-19 social distancing guidelines more strictly. To test this, we performed a series of multiple regression analyses predicting use of each of the assessed safe social strategies with extroversion and following COVID-19 regulations entered in the first step of the regression analysis. In the second step, the interaction term of extroversion and following COVID-19 regulations was entered. The result of each of these analyses is presented in Table 5.

Strictness of following COVID-19 guidelines moderated the effect of extroversion on use of narrative social worlds (Fig. 3) and parasocial relationships (Fig. 4). Examination of the slopes revealed that for those who followed COVID-19 guidelines more strictly (+1 SD), the relationships between extroversion and use of narrative social worlds ($b = 0.10$, $p = .24$) and extroversion and parasocial relationships ($b = 0.13$, $p = .12$) were more positive compared to those who followed COVID-19

Table 5
Regression coefficients for models of following COVID-19 regulations, extroversion, and the interaction term predicting use of social strategies.

Predictors	B	t	p
Outcome: video-chatting			
Extroversion	0.12	1.87	0.06
Following COVID-19 regulations	0.08	1.31	0.19
Interaction term: Extroversion * Following regulations	0.08	1.50	0.14
Outcome: CE event frequency			
Extroversion	0.21	3.49	0.001*
Following COVID-19 regulations	−0.10	−1.68	0.09
Interaction term: Extroversion * Following regulations	−0.03	−0.8	0.42
Outcome: narrative social worlds			
Extroversion	−0.05	−0.89	0.37
Following COVID-19 regulations	0.06	1.01	0.31
Interaction term: Extroversion * Following regulations	0.15	2.79	0.006**
Outcome: reminders of others			
Extroversion	0.06	1.00	0.32
Following COVID-19 regulations	0.01	0.23	0.82
Interaction term: Extroversion * Following regulations	0.07	1.58	0.12
Outcome: parasocial relationships			
Extroversion	−0.04	−0.72	0.48
Following COVID-19 regulations	0.04***	0.70	0.49
Interaction term: Extroversion * Following regulations	0.17	3.19	0.002**

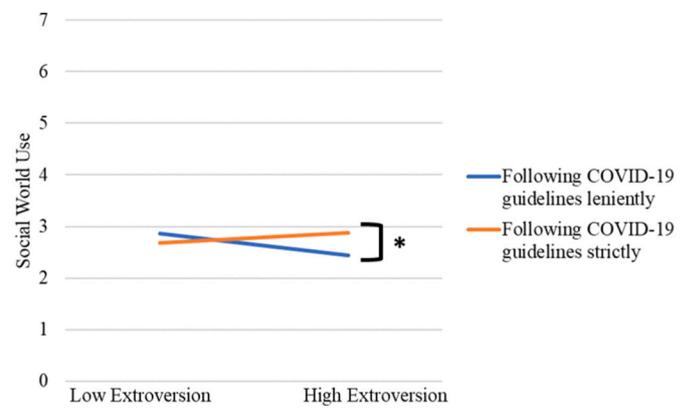*** $p < .001$.
** $p < .01$.
* $p < .05$.

Fig. 3. Interaction of extroversion and following COVID-19 guidelines on use of narrative social worlds. Asterisks indicate significant slopes ($p < .05$).
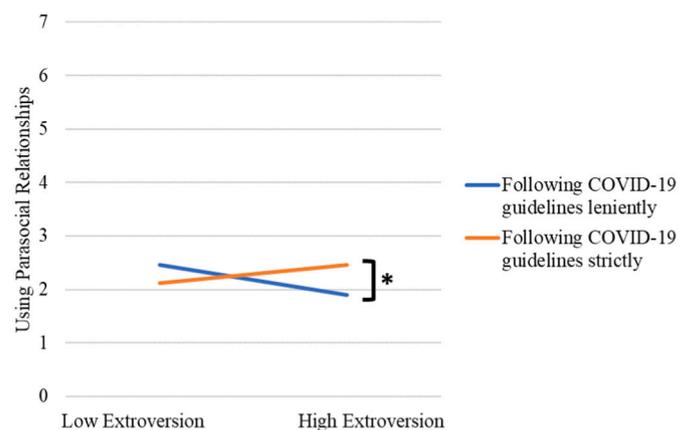

Fig. 4. Interaction of extroversion and following COVID-19 guidelines on use of parasocial relationships. Asterisks indicate significant slopes ($p < .05$).

guidelines more leniently (−1 SD), for whom the relationships between extroversion and use of narrative social worlds ($b = -0.21$, $p < .05$) and extroversion and parasocial relationships ($b = -0.21$, $p < .01$) were negative. Furthermore, at high levels of extroversion (+1 SD), the relationships between following COVID-19 guidelines and use of narrative social worlds ($b = 0.21$, $p < .01$) and parasocial relationships ($b = 0.21$, $p < .01$) were positive, while for those who were low in extroversion (−1 SD), the relationships between following COVID-19 guidelines and use of narrative social worlds ($b = -0.09$, $p = .29$) and parasocial relationships ($b = -0.13$, $p = .13$) were comparatively more negative.

The relationship between extroversion and CE event frequency was significant ($r = 0.21$) even when controlling for strictness of following COVID-19 guidelines, although the moderating effect was not significant. Reminders of others and video-chatting were not related to extroversion, following COVID-19 guidelines, or the interaction term.

3.3. Discussion

Individuals higher in extroversion were more likely to use narrative social worlds and parasocial relationships when their social options were limited due to following COVD-19 social distancing guidelines strictly. Comparatively, when they were following social distancing guidelines more leniently, and their social options were not limited, they were less likely to use narrative social worlds and parasocial relationships. This suggests that when options to socialize are limited, those higher in extroversion are better able to adapt and utilize nontraditional social strategies to achieve a highly desired feeling of connectedness.

However, when individuals have many social options available to them, including traditional options such as meeting loved ones face-to-face, greater extroversion is not related to a greater tendency to use alternative strategies. Interestingly, extroversion was associated with greater frequency of collective effervescent experiences even when controlling for adherence to COVID-19 guidelines. This is consistent with previous work demonstrating that even when no limitations of social options exist, extroversion is related to a greater tendency to experience CE and greater frequency of experiencing CE (Gabriel et al., 2019; Gabriel et al., 2017). Extroversion was not related to greater video-chatting or greater use of reminders of others. This finding will be further considered in the general discussion.

4. General discussion

The goal of the current study was to examine how extroversion may be related to a propensity to engage in a variety of social strategies when traditional options for socialization are limited. Our examination of people's experiences when living under involuntary limited social interaction, before the pandemic, at the start of the pandemic, and over one year later, provided novel insights into extroversion and the flexibility of the need to belong. The dramatic physical distancing measures necessitated by the outbreak of COVID-19 led to a sharp reduction in the traditional social activities (i.e. face to face social interactions between both individuals and groups) available to people. Therefore, in order to fulfill essential social needs and maintain happiness, individuals had to be creative and flexible in the ways that they approached socializing. The current study demonstrates how extroverts were particularly likely to utilize nontraditional social strategies, specifically when other options were not available. These findings help deepen our understandings of how extroversion is related to fulfillment of the need to belong, as well as what social strategies can effectively help maintain happiness when traditional options to socially interact are limited.

Overall, we found support for our hypotheses. First, our research found that people high in extroversion experienced greater drops in happiness from prior to the start of the pandemic to the peak of the pandemic compared to those lower in extroversion. However, extroversion was still associated with greater happiness even during COVID-19. Despite extroversion being related to greater life disruption due to the pandemic, higher levels of extroversion still seemed to have helped individuals to maintain a sense of wellbeing during the pandemic, likely in part due to their greater likelihood to utilize alternate methods of social connection during this time.

Next, we found support for our hypothesis that extroversion would be related to greater use of nontraditional social strategies during the COVID-19 pandemic. Indeed, extroversion was related to all of our assessed nontraditional social strategies, including more frequent collective effervescent experiences and greater use of narrative social worlds, parasocial relationships, reminders of others, and video-chatting during the pandemic. This suggests that the extroverts' enjoyment of social activities could extend to the pursuit of a variety of social strategies. The strategies investigated here may have allowed extroverts to feel socially fulfilled even when social distancing guidelines prevented them from pursuing more traditional social strategies such as going to a friend's house or meeting up with a group at a restaurant.

Indeed, use of these nontraditional social strategies was preferred by extroverts for good reason; some of these strategies predicted increases in happiness during COVID-19 even when controlling for prior levels of happiness. Specifically, frequency of collective effervescent experiences, use of narrative social worlds, and use of parasocial relationships were related to greater maintenance of happiness during COVID-19, replicating and expanding upon findings from previous work (Naidu et al., *unpublished data*; Gabriel et al., 2017). This finding supports the idea that seemingly nonsocial activities can provide important social benefits, particularly for individuals with limited options and/or undergoing chronic stress. Use of social surrogates may be especially notable, as

these are widely available- for example, individuals may just need to visit their local library or turn on their television to a favorite TV show in order to access the benefits of immersing themselves into the social world of a narrative and therefore maintain their happiness during times of stress. Collective effervescent experiences are also more readily available than previously theorized and can be experienced even during seemingly mundane events (see Gabriel et al., 2020) - making these experiences well within reach. Overall, these findings have important implications for how individuals can use social strategies to maintain happiness even during difficult times.

Greater use of these safe and effective social strategies (frequency of collective effervescent experiences, narrative social worlds, and parasocial relationships) helped explain why extroversion was still related to happiness during COVID-19. Despite the additional struggles that extroverts were experiencing their propensity to use nontraditional social strategies was partly why they were able to nonetheless maintain greater levels of happiness compared to their more introverted counterparts. This may help to explain some discrepancies of past work suggesting that extroverts experienced increased feelings of loneliness but also had greater resilience and greater use of coping strategies during COVID-19 (Aschwanden et al., 2021; Folk et al., 2020; Gruda and Ojo, 2021; Gubler et al., 2020; Liu et al., 2021; Wijngaards et al., 2020; Zacher & Rudolph, 2021).

Finally, findings from Study 1 were replicated in Study 2, over one year after the start of the pandemic and utilizing a different measure of extroversion. Even when controlling for how much participants were adhering to social distancing guidelines, extroversion was positively related to greater frequency of CE events. Furthermore, the relationships between extroversion and the social strategies of using narrative social worlds and using parasocial relationships were moderated by how strictly individuals were following COVID-19 social distancing regulations. This implies that for some nontraditional social strategies, extroverts may only be likely to use them when other, perhaps more preferable, options are limited (Derrick et al., 2019).

Interestingly, in Study 1, video-chatting and using reminders of others were not related to greater happiness during COVID-19 and in Study 2, these two strategies were not related to greater extroversion. Although it was initially proposed that these strategies would help individuals to feel socially connected, this did not seem to be the case. It is worth considering the unique nature of these specific time points - individuals who used video chatting and reminders of others (such as looking at old pictures of friends and family) were doing so during a time where they were discouraged by the CDC to see these individuals in person. Perhaps during the pandemic, these activities may have only served to remind people of the forced distance between themselves and their loved ones. Because the other measured social strategies are not necessarily related to one's existing traditional relationships, they may have been better able to contribute to one's happiness.

4.1. Limitations

Although these findings hold important implications for wellbeing and the fulfillment of social needs under difficult circumstances, this specific sample and this specific time point are undoubtedly unique. Replications amid differing conditions would help to affirm our results. Similarly, although we believe our results would hold true to extroverts across the lifespan, it is worth noting that our sample was comprised of undergraduate university students. These individuals in particular may have greater practice in using nontraditional social strategies than others, given that they had become well-practiced in using video-chatting services for their university classes throughout the time that COVID-19 guidelines impacted their schooling. Similarly, they may have been more familiar with social surrogates, as the use of technology makes narratives readily available on streaming services and eBook readers; and options for collective effervescent opportunities more widespread than ever, given the plethora of online events and Internet

communities one can attend. With this in mind, these findings should be replicated among other populations to ensure the results are true of extroverts more generally and not just those in a technologically advanced university environment.

It should also be noted that due to the correlational deign of this work, the directionality of the relationships reported here cannot be objectively confirmed. Replications of the main findings of the current study should be replicated in laboratory settings, manipulating variables of interest, to confirm the hypothesized causality of these relationships. Additionally, it was assumed that during the peak of the pandemic (March/April 2020), participants were limiting their in-person interactions more than they were prior to the pandemic (January 2020), but this assumption was not directly assessed Study 1. However, in Study 2, by assessing the degree to which participants were following COVID-19 regulations, it is clear that following COVID-19 guidelines, including limiting in person interactions, was an important factor in predicting when extroverts were likely to use nontraditional social strategies. Therefore, it is very likely that this was also an important factor in the differences from before to during the pandemic observed in Study 1. Future work may seek to assess or control the degree to which individuals limit in-person interactions to confirm those relationships described in Study 1.

4.2. Conclusion

Overall, this work provides insight into how extroverts may differ from introverts in their inclination to seek out social opportunities even when traditional options are unavailable. Extroversion was related to greater use of available alternate social strategies including videochatting, narrative social worlds, reminders of others, parasocial relationships, and socially distanced collective effervescence. Extroverts' tendency to seek out these strategies was adaptive for them; some of these strategies were shown to be effective in helping extroverts maintain happiness during COVID-19, despite encountering greater disruption to their daily lives and experiencing greater dips in wellbeing. Importantly, use of some of these strategies was greater for extroverts who were following social distancing guidelines and therefore limited in their social options. This suggests that extroverts are more socially flexible in times of need, but may not seek these strategies out any more or less than introverts when traditional social opportunities are available. In this sense, then, extroverts seem to be able to adapt well to social challenges in order to maintain their social fulfillment and subsequent happiness. Though we all require some level of social need fulfillment in order to maintain wellbeing (Baumeister & Leary, 1995; Gabriel et al., 2017), individuals vary in how much fulfillment they need (John et al., 2008), as well as how we obtain that fulfillment (Paravati et al., 2021). This work helps broaden our understanding of how extroversion relates to both of these aspects during times of societal distress and gives us important clues into how individuals can maintain happiness even when their social lives have been disrupted in an unprecedented way. Although we hope our global community does not endure future pandemics that require this level of societal disruption, we do have hope that the findings from this work can help individuals to maintain happiness even amid challenging circumstances that impact their regular social routines. And so, for the extroverts who may be particularly impacted by such circumstances, we say: attend that online concert, read up on your celebrity idol, or re-watch that favorite movie- it might give you the social boost you are missing during difficult times.

Data statement

The data used in the research are publicly posted. The data can be obtained at: https://osf.io/8pe2j or by emailing eshanaid@buffalo.edu.

CRediT authorship contribution statement

Esha S. Naidu: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft. **Elaine Paravati:** Conceptualization, Methodology, Writing – review & editing. **Shira Gabriel:** Conceptualization, Methodology, Formal analysis, Writing – review & editing, Supervision.

Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2022.111549.

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