RUNNING HEAD: ENHANCING POSITIVE EMOTION DURING COVID-19

# Prosocial behavior promotes positive emotion during the COVID-19 pandemic

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This paper has not been peer-reviewed. Please send comments or feedback to the corresponding author.

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Abstract

The COVID-19 pandemic has raised concerns about humans' physical and mental wellbeing. In response, there has been an urgent "call to action" for psychological interventions that enhance positive emotion and psychological resilience. Prosocial behavior has been shown to effectively promote wellbeing, but is this strategy effective during a pandemic when ongoing apprehension for personal safety could acutely heighten self-focused concern? In two online pre-registered experiments ($N$ =1,623) conducted during the pandemic, we examined this question by randomly assigning participants to engage in other- or self-beneficial action. For the first time, we manipulated prosocial behavior's relatedness with the source of stress (COVID-19); participants purchased COVID-19-related or COVID-19-unrelated items for themselves or someone else. Consistent with pre-registered hypotheses, prosocial (vs. proself) behavior led to higher levels of self-reported positive affect, meaningfulness, empathy and social connection. Notably, prosocial behavior's emotional rewards emerged regardless of whether one's purchase was related to COVID-19 or not, and benefited participants who reported moderate-to-severe levels of anxiety/depression/distress during the pandemic. These findings suggest that generous action offers one strategy to bolster wellbeing during the pandemic.

Keywords:
COVID-19, Prosocial behavior, Positive emotion, Mental wellbeing, Pandemic

## Prosocial behavior promotes positive emotion during the COVID-19 pandemic

The COVID-19 pandemic poses significant threat to humans' physical health and mental health (Gruber et al., 2020; Pfefferbaum & North, 2020). People around the world have been inundated with COVID-19-related news and death-tolls, leading to anxiety about their own health and the health of their family, their children's education, and more. Furthermore, at the peak of COVID-19 isolation measures, more than 3.9 billion people in 90 countries (Sandford, 2020) have been affected by physical distancing or "stay at home" orders which help to contain the virus but may also short-circuit social connections that could alleviate distress (Tull et al., 2020). These adversities have led to sleep disturbance, substance abuse, anxiety, depression (e.g., Altena et al., 2020; Holmes et al., 2020; Huang & Zhao, 2020), and increased risks of domestic violence and suicidal behavior (e.g., Gunnell et al., 2020; Humphreys et al., 2020). Thus, it is of paramount importance to "*develop novel interventions to protect mental wellbeing, including those based on positive mechanistically based components"* (Holmes et al., 2020). Here, we examine the efficacy of one potential strategy: helping others.

Humans are an exceptionally prosocial species (Burkart et al., 2014). People frequently give their time, money, skill, blood and organs to help others (Aknin & Whillans, 2020). In the United States alone, Americans donated $427.71 billion to U.S. charities in 2018, according to Giving USA Annual Report on Philanthropy (2019). Impressively, prosocial tendencies have been shown to persist – and sometimes flourish – in emergency situations (e.g., Lowe & Fothergill, 2003; Zaki, 2020). For instance, data collected in Louisiana following Hurricane Katrina captured prosocial behavior from diverse groups, such as hotels, hospitals, and communities in response to the catastrophe (Rodriguez et al., 2006). Similarly, after the 8.0 magnitude earthquake in Wenchuan, Sichuan, Chinese people in the highest areas of destruction displayed more generosity than those in less affected areas (Rao

et al., 2011). This phenomenon, termed as "catastrophe compassion," has been observed during COVID-19; people have donated money, blood, and personal protection equipment to help others. Frontline health workers have volunteered to join the "dirty team" to take care of those infected with COVID-19, and people have been providing emotional support to strangers in online message forums (e.g., Butler, 2020).

Selfless acts such as these can provide immeasurable assistance to recipients, but do helpers benefit from their prosocial behavior? A mounting body of evidence suggests that engaging in various forms of prosocial behavior can promote emotional wellbeing (Aknin et al., 2013; Aknin et al., 2020; Curry et al., 2018; Dunn et al., 2008; Dunn et al., 2020; Hui et al., 2020). Notably, spending money on others – called *prosocial spending* – has been shown to lead to higher levels of happiness than spending money on oneself in rich and poor countries around the globe (Aknin et al., 2013; Aknin et al., 2015). In addition, prosocial behavior may also reduce negative emotions, such as distress and even anxiety or depressive symptoms (e.g., Cialdini & Kenrick, 1976; Doré et al., 2017; Raposa et al, 2016; Wang et al., 2020). Beyond self-report and lab-based evidence, prosocial behavior has been shown to predict lower mortality rates among aging community populations (Okun et al., 2013). Emotional and health benefits of prosocial behavior may stem from the positive experiences uniquely afforded by prosocial behavior, such as increased social connectedness, meaningfulness and perceived competence (e.g., Klein, 2017; Nelson et al., 2016; Poulin et al., 2013; Weinstein & Ryan, 2010).

Despite robust evidence for the emotional benefits of prosocial behavior, it is plausible that COVID-19 – the largest collective trauma that most living humans have experienced (Fancourt, Steptoe & Bu, 2020; Rosenfeld et al., 2020 preprint) – could undermine this relationship. Why? COVID-19's imminent threat, exceptional spread and ever-increasing death toll may lead to reduced empathy, compassion fatigue, and compassion

collapse, as well as greater ego-centric thinking (Cameron & Payne, 2011; Todd, et al, 2015; Todd & Simpson, 2016; Västfjäll et al., 2014). Indeed, past research on compassion collapse demonstrates that people exposed to greater numbers of disaster victims show lower levels of empathy toward others than those exposed to fewer victims (e.g., Cameron & Payne, 2011; Galak et al., 2011; Kogut & Rikov, 2005; Västfjäll et al., 2014). Other findings indicate that higher levels of uncertainty promote ego-centric thinking (Todd, et al, 2015; Todd & Simpson, 2016). These findings are important because past work also suggests that the emotional benefits of prosocial action may only be detectable among actors who have a high degree of care or concern for others (Hill & Howell, 2014). Therefore, it is plausible that the threats imposed by COVID-19 could lead to greater self-focus, which might then minimize or eliminate the emotional rewards of giving.

In addition to positive affect, we also examined whether prosocial behavior could alleviate negative psychological responses, such as COVID-19 intrusive thoughts or subjective worry/fear related to the pandemic. Intrusive thoughts and excessive worry are among the most common reactions to a traumatic event that could lead to anxiety and stress-related disorders (Bomyea & Lang, 2016; Hu et al., 2017; Zoellner et al. 2012). Given that the "altruism as hedonism" account suggests that helping can relieve one's own distress or sadness (Cialdini & Kenrick, 1976; Raposa et al., 2016), we hypothesized that prosocial behavior could reduce negative affect and intrusive thoughts (Marks et al., 2018). However, past research shows that prosocial behavior is more strongly linked with positive emotions than negative emotions (Curry et al., 2018; Hui et al., 2020; Jebb et al., 2020; Kushlev et al., 2020 preprint). Furthermore, realistic imminent threats imposed by the on-going pandemic may render negative psychological reactions particularly salient and resistant to change. Therefore, it is possible that prosocial behavior may only enhance positive affect and positive psychological outcomes.

Lastly, we explored whether the emotional benefits of prosocial behavior are detectable among individuals reporting higher levels of depression or anxiety symptoms. This question is important because findings from a national survey of Americans conducted in between April 23 - May 5 2020 indicate that 35.9% of respondents were experiencing either depression or anxiety symptoms during the pandemic (National Center for Health Statistics, NCHS, 2020). This value is significantly higher than the previous estimate of 11.0% from the pre-pandemic survey (January – June 2019; NCHS, 2020). Thus, if prosocial behavior provides short-term emotional benefits, even for individuals who report high anxiety or depressive symptoms, these results could be used to potentially support those who are experiencing higher levels of distress during the pandemic but should not replace clinical health care (Schacter & Margolin, 2019).

To address these questions, we conducted two well-powered and preregistered experiments online between April 16 to April 30, 2020, when the number of COVID-19 cases and fear of the virus rose dramatically worldwide. In both studies, participants were randomly assigned to a personal or prosocial condition, reporting the current affect and other psychological states before and after so that we could probe whether generous action promoted greater emotional and psychological well-being (see Figure 1). In Experiment 2, we also manipulated whether the personal or prosocial action was related to the current stressor – the COVID-19 pandemic – or not. This allowed us to examine whether prosocial behavior 1) enhances positive affect and positive psychological outcomes (e.g., meaningfulness, empathy), and 2) reduces negative affect and negative psychological reactions (intrusive thoughts, fear/worry related to COVID-19) during the COVID-19 pandemic. Moreover, Experiment 2 allowed us to examine whether the emotional rewards of prosocial action were moderated by the alignment between one's action and the current stressor (e.g., buying pandemic supplies vs. general supplies).

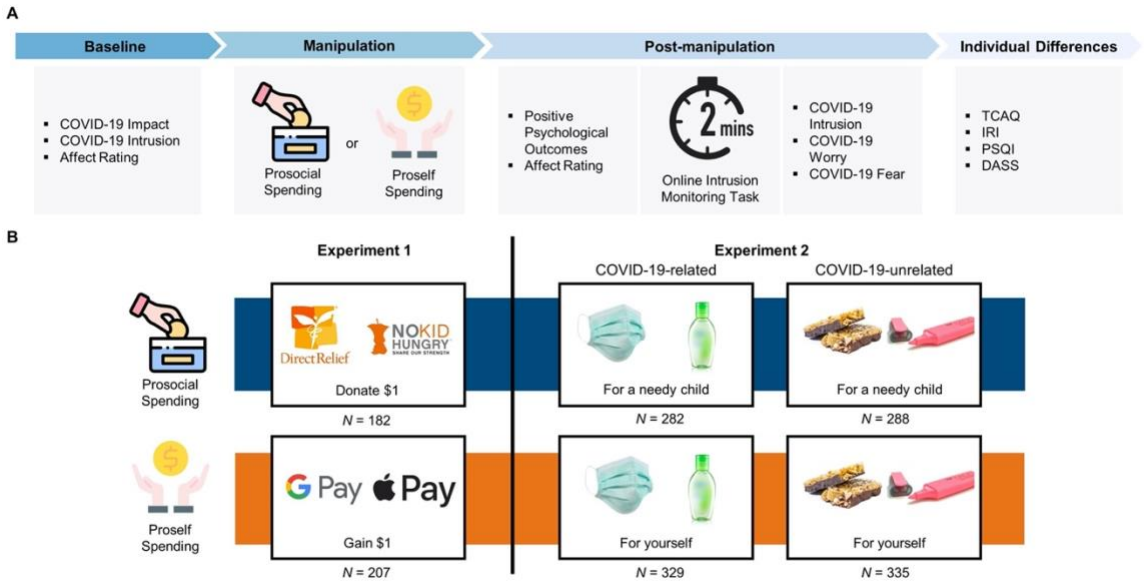


Fig. 1. An overview of experimental procedure with sample sizes in each condition. A) Experiments 1 and 2 task flow and B) Prosocial vs. proself manipulations in Experiments 1 and 2. In Experiment 2, COVID-relatedness was manipulated using both instructions and the purchased items: whether they were directly related to COVID-19 (e.g., masks and hand sanitizers, COVID-19-related) or not directly related to the COVID-19 (snacks and writing supplies, COVID-19-unrelated).

## Experiment 1

Experimental materials, data, analytic codes, and pre-registrations can be found at https://osf.io/e3kdr/?view_only=6f73ca5683534d77994fb9ed6c042cb3. This research was approved by the Human Research Ethics Committee of the University of Hong Kong. Participants provided informed consent prior to participation, and were debriefed upon completing the study. Participants were paid $3 USD.

### Methods

**Participants.** An *a priori* power analysis indicated that we required 398 participants to detect a small effect size of Cohen's $d = 0.25$ with $\beta = 80\%$ and $\alpha = 5\%$ (one-tailed tests given our directional hypotheses). We estimated this effect size ($d = 0.25$) based on previous pre-registered studies that used a similar goody bag paradigm (Aknin et al., 2020; Hanniball et al., 2019, *d*s = 0.36, 0.15), and on recent meta-analyses examining prosocial behavior's

effect on well-being ($\delta$ = 0.28 in Curry et al., 2018; $d$ = 0.26 in Hui et al., 2020). Anticipating an exclusion rate of 20-25%, we pre-registered our intention to over-sample and collect data from 499 participants on Prolific Academic between April 16-17, 2020. Following our pre-registered exclusion criteria (75 participants excluded based on bot detection/attention check failures/outlier responses, and 35 additional participants excluded because they opt-outed in the prosocial condition, see Table S1), the final sample included 389 participants. Participants were randomly assigned to prosocial ($n$ = 182), and proself ($n$ = 207) condition.

**Materials and Procedure**. Participants first completed a COVID-19 impact questionnaire which measured 1) perceptions of COVID-19 infectiousness, death rates, and one's personal possibility of virus contraction; 2) positive/negative affect in past seven days, 3) how COVID-19 impacted one's physical and mental health, work and social life, and distress levels, and 4) intrusive thoughts related to COVID-19 in the past week. Participants also rated their alertness level on the Stanford Sleepiness Scale (SSS).

Participants then reported their positive and negative affect (i.e., baseline affect) in response to the question "please indicate how you CURRENTLY feel on the following scale" on a 7-point Likert scale (1: not at all to 7: extremely) for five positive items: Inspired, Relaxed, Enthusiastic, Happy, Content; and five negative items: Hopeless, Fearful, Anxious, Depressed, Sad. Cronbach's alphas for positive and negative affect measures were high: 0.85-0.92 at baseline and post-task assessments for both experiments.

Following baseline affect ratings, participants were told that they had received a 5¢ voucher and were randomly assigned to either a prosocial or a proself condition in an adapted version of Hanniball and colleagues (2019) online Goody Bag paradigm. In the *prosocial condition*, participants read about two US charities: *Direct Relief,* an organization that provides frontline health workers with medical resources (e.g., protective masks, exam gloves and isolation gowns) to protect them from COVID-19; and *No Kid Hungry,* an organization

that provides free meals to children when schools are closed due to COVID-19. Participants could use their 5¢ electronic voucher to donate $1 dollar to their preferred charity. Given autonomy is important for prosocial decisions (Weinstein & Ryan, 2010), participants could also opt-out from the donation opportunity and keep the cash value (5¢ US) for themselves (credited to their Prolific account). As in previous research (e.g., Aknin et al., 2013; Hanniball et al., 2019), we pre-registered our intention to exclude participants who opted out of making a donation in the prosocial condition.

In the *proself condition*, participants could choose to transfer the purchasing power ($1 dollar) of their electronic voucher to their personal digital wallet of *Google Pay* or *Apple Pay* for personal use. To equate the amount of information and choices presented in both conditions, participants in the proself condition were given brief descriptions about the digital wallets and an opportunity to opt-out of transferring their funds to a digital wallet, meaning that the $1 would be credited to their Prolific account. Consistent with past research (e.g., Aknin et al., 2013; Hanniball et al., 2019), opt-out participants in proself condition were included in analyses because these participants gained money for themselves. After making their financial decision, participants in both the prosocial and proself conditions were asked to explain their selection by typing at least 150 characters into a blank text box; we added this novel step to the goody bag paradigm to increase the salience of one's recent prosocial or proself behavior.

Afterward, participants were asked to complete a five-item questionnaire assessing several positive psychological outcomes. Statements included: 1) I feel my act is meaningful; 2) My action will have a positive impact, 3) My action makes me feel empathetic for others' needs, (4) My action makes me feel I am social connected with others, and (5) I feel happy. Ratings were made on a 7-point Likert scale (1: not at all to 7: extremely). Participants then

reported their post-task positive and negative affect using the same items and scale from the baseline affect measure.

At this point, participants completed a 2-minute online COVID-19 thought intrusion monitoring task (adapted from Takarangi et al., 2014). During this task, participants were instructed to click anywhere on the browser whenever they experienced a COVID-19-related intrusive thought. The total number of clicks provided an estimate of COVID-19 intrusive thoughts. To ensure participants did not leave their computer, we asked participants to count the number of times that the letter "A" appeared on the screen among three other letters (L, M, Z) and to report their count right after the intrusion monitoring task. This counting task also served as an attention check. With a correct response of 7, we pre-registered our intention to exclude participants who reported <5 or >9 from subsequent analyses.

Following the intrusion monitoring task, participants reported how frequently they thought about COVID-19 during the previous 2-minutes on a 4-item self-report questionnaire which was adapted from the Impact of Event Scale-revised intrusion subscale (Weiss & Marmar, 1997). A sample item stated, "Thoughts related to COVID-19 suddenly or unexpectedly popped up in my mind", with participants answering on a 7-point Likert scale (1: not at all to 7: extremely). Participants next reported their worry and fear related to COVID-19 (adapted from Ahorsu et al., 2020; Freeman et al., 2020).

Finally, participants provided their demographic information and completed the following questionnaires: Interpersonal Reactivity Index (IRI, Davis, 1980), Thought Control Ability Questionnaire (TCAQ, Luciano et al., 2005), Pittsburgh Sleep Quality Index (PSQI, Buysse et al., 1989) and Depression-Anxiety Stress Scale (DASS-21, Lovibond & Lovibond, 1995).

**Analysis Plan: Preregistered Analyses.** We pre-registered our intention to use parametric independent sample one-tailed *t*-tests or their non-parametric equivalent (one-

tailed Mann-Whitney *U* tests if data violated normality assumption in the Shapiro-Wilk normality test). When we measured both baseline and post-task scores, we pre-registered to use Analyses of Covariance (ANCOVAs) to compare between-group differences on post-task outcomes, with baseline scores as covariates.

***Positive Psychological Outcomes***. We examined each individual outcome rating and the sum scores by adding participants' ratings on the 5 positive psychological outcome items.

***Positive and Negative Affect Change*.** We calculated mean positive and negative affect scores from participant's baseline and post-task affect ratings.

***Intrusive thoughts***. We calculated 1) total number of COVID-19 related intrusive thoughts during the 2-minute monitoring task and 2) standardized average score of self-reported intrusion frequencies during the monitoring task.

***Subjective Worry/Fear about COVID-19***: We calculated average ratings of subjective worry and fear, separately.

***Individual Difference variables***: Questionnaires were computed following conventional scoring criterion. We conducted correlational and regression analyses using these variables on the aforementioned outcome measures (see Supplemental Materials and Tables S3-S6).

## Results

Statistical analyses were performed on *JAMOVI* 1.0.0.0, *R* 4.0.0, and *JASP* 0.12.2. Sample characteristics are reported in Supplemental Materials. Descriptive statistics and 95% CIs for each outcome measure are presented in Table 1. Cohen's *ds* are calculated based on means and the standard deviations (SD) of the prosocial vs. proself conditions. We reported Bayes Factors ($BF_{10}$), the likelihood that observed data favoured alternative over null hypothesis ($H_1$ vs. $H_0$). The following measures violated normality assumption: sum scores and individual

ratings from positive psychological outcomes (*ps* < .02), total number of intrusions (*p* < .001), subjective fear (*p* < .001) and worry (*p* = .005).

**Pre-registered Analyses:**

***Positive psychological outcomes***. Findings were consistent with the majority of our pre-registered hypotheses. Compared to participants in the proself condition, participants in prosocial condition reported higher positive psychological outcomes (sum-up scores across all five items, *d* = 1.16). On individual items, prosocial acts promoted meaningfulness (*d* = 0.73), positive impact (*d* = 0.90), empathy (*d* = 1.78), and social connection (*d* = 1.26; *p*s < .001, $BF_{10} > 3.00 \times 10^9$ Fig. 2A). However, in contrast to our pre-registered hypothesis, participants in prosocial condition did not report higher levels of happiness (*p* = .343, *d* = 0.06, $BF_{10} = 0.20$, see Table 1).

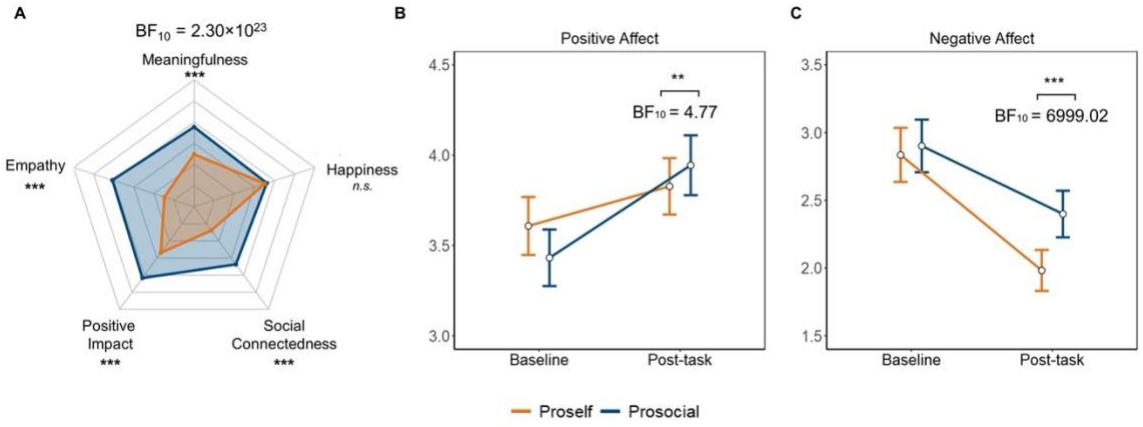


Fig. 2. Results of Experiment 1. A) positive psychological outcomes of individual ratings; B) baseline and post-task positive affect and C) baseline and post-task negative affect. ***: *p* < .001, **$p$<.01; *n.s.*: *p* > .05.

***Positive affect***. Consistent with our pre-registered hypothesis, an ANCOVA controlling for baseline positive affect revealed that participants in the prosocial condition reported significantly higher levels of positive affect than participants in the proself condition, $F(1,386) = 7.97$, $p = .005$, $d = 0.29$, $BF_{10} = 4.77$ (Table 1, Fig. 2B).

***Negative affect***. Counter to our pre-registered hypothesis, an ANCOVA controlling for baseline levels of negative affect showed that participants in the prosocial condition reported significantly *higher* levels of negative affect than participants in the proself condition, $F(1,386) = 23.37$, $p < .001$, $d = 0.49$, $BF_{10} = 6999.02$ (Table 1, Fig. 2C).

Intrusive thoughts, subjective worry/fear were did not differ significantly between the two conditions ($p$s > .75, for statistical details, see Supplemental Materials).

***Exploratory analyses controlling individual differences***. Participants in the prosocial condition reported significantly higher scores on our measure of baseline alertness (SSS), depression-anxiety (DASS-21) and thought control (TCAQ) than participants in the proself condition (see Table S5). Given that these differences could influence changes in affect, we conducted linear regression analyses in which we predicted changes in positive and negative affect from 1) condition and 2) all individual difference variables. Results confirmed that condition remained a significant predictor for positive affect change ($p = .01$) and for negative affect change ($p < .001$, see Table S7).

Table 1. Experiment 1 means, 95% CI, and Cohen's *d* effect size estimates for pre-registered outcome comparisons. Positive and negative affect change scores are calculated as post-task minus baseline scores therefore a positive value indicates an increase and a negative value indicates a reduction. ** $p < .01$. *** $p < .001$.

| Outcome measurements | Prosocial | Proself | *d* |
|---|---|---|---|
| Positive Outcomes | 23.99 [23.19, 25.04] | 16.57 [15.68, 17.48] | 1.16*** |
| Happiness | 4.62 [4.41, 4.85] | 4.52 [4.29, 4.71] | 0.06 |
| Meaningfulness | 4.77 [4.54, 5.01] | 3.48 [3.22, 3.75] | 0.73*** |
| Positive Impact | 5.16 [4.97, 5.37] | 3.69 [3.41, 3.94] | 0.90*** |
| Empathy | 5.07 [4.89, 5.27] | 2.48 [2.27, 2.72] | 1.78*** |
| Social Connectedness | 4.37 [4.15, 4.63] | 2.39 [2.16, 2.59] | 1.26*** |
| Positive Affect Change | 0.51 [0.39, 0.65] | 0.22 [0.10, 0.33] | 0.33*** |
| Negative Affect Change | -0.50 [-0.64, -0.39] | -0.85 [-1.01, -0.72] | -0.37*** |
| Intrusion Frequency | 2.47 [2.06, 2.95] | 2.23 [1.88, 2.63] | -0.08 |
| Self-reported Intrusions | 2.43 [2.26, 2.60] | 2.29 [2.13, 2.45] | -0.12 |
| Subjective Worry | 1.68 [1.53, 1.82] | 1.56 [1.42, 1.71] | -0.12 |
| Subjective Fear | 0.87 [0.77, 0.99] | 0.81 [0.72, 0.91] | -0.09 |

Note: Cohen's *ds* was calculated using means and S.D.s from the two conditions. Intrusion frequency refers to number of COVID-19 thought intrusions during the 2-minute intrusion monitoring task; self-reported intrusions refer to post-task self-reported intrusions.

## Discussion

Experiment 1 offers some evidence to suggest that engaging in prosocial (vs. proself) action has psychological benefits during the COVID-19 pandemic. Consistent with our pre-registered hypotheses, making a $1 USD prosocial donation promoted positive affect and positive psychological outcomes than receiving personal gains. However, counter to our pre-registered hypotheses, prosocial donations did not reduce negative psychological reactions, such as intrusive thoughts, subjective worry or fear related to COVID-19. Moreover, although negative affect was reduced from baseline to post-task assessments, participants in the prosocial condition reported *higher* levels of negative affect than participants in the proself condition.

Higher levels of negative affect in the prosocial (vs. proself) condition may have resulted from our presentation of COVID-19-related information to participants in prosocial condition only. Indeed, this information may have reminded participants of the suffering incurred by the pandemic (e.g., frontline health workers who lack protection gears and children who do not have access to meals). While this explanation is post-hoc and speculative, it aligns with existing evidence documenting a robust association between COVID-19 information exposure and lower well-being and greater distress (e.g., Bu et al., 2020; Gao et al., 2020; Huckins et al., 2020).

The finding that COVID-19-related prosocial behavior enhanced both positive and negative affect raises intriguing questions. First, does prosocial behavior need to be directly related to the source of stress/anxiety (e.g., COVID-19) to have emotional benefits? Second, does reading COVID-19-related information increase negative affect in the context of an on-going global pandemic? To address these questions, we directly manipulated prosocial vs. proself behavior's relatedness with COVID-19 in a 2 (prosocial vs. proself) by 2 (COVID-19-related vs. COVID-19-unrelated) between-subject design (Figure 1B). In the COVID-19-

related conditions, participants could purchase either a face mask or hand sanitizer, two essential personal hygiene items that protect people against the COVID-19 virus. In the COVID-19-unrelated conditions, participants could purchase either healthy snacks or writing supplies, two items that are not directly related to the COVID-19 virus. We manipulated whether these items were available for purchase for oneself (in the proself condition) or for a needy child (in the prosocial condition). A 2 X 2 design allows us to not only examine our pre-registered hypothesis that prosocial behavior enhances positive affect during the pandemic, but also allows us to examine the effects of COVID-19-relateness on participants' emotional responses, as well as their interactions. To our knowledge, this is the first investigation of whether prosocial actions related to the source of stress (COVID-19 in the present context) may influence prosocial behavior's emotional benefits.

## Experiment 2

### Methods

**Participants.** An *a priori* power analysis ($\beta = 80\%$, $\alpha = 5\%$) revealed that we required 1,200 participants to detect a relatively small effect size (Cohen's $d = 0.23$) in a 2 (prosocial vs. proself) X 2 (COVID-19-related vs. COVID-19-unrelated) between-subject design. Anticipating an exclusion rate of approximately 20%, we recruited data from 1,421 participants who submitted responses on Prolific Academic between April 24 to April 30, 2020. We stopped data collection on April 30, 2020 when U.S. federal government's state-wide social distancing guidelines expired (LeBlanc et al., 2020). Among these 1,421 participants, we retained 1,234 of them after applying our pre-registered exclusion criteria (100 participants were excluded based on bot detection/attention check fails/outliers exclusion, with 50 and 37 additional participants excluded as they opt-outed in the COVID-related and COVID-unrelated prosocial conditions, respectively, see Table S2). Participants were randomly assigned to one of four conditions: prosocial COVID-19-related ($n = 282$) vs.

proself COVID-19-related ($n$ = 329); and prosocial COVID-19-unrelated ($n$ = 288) vs. proself COVID-19-unrelated ($n$ = 335).

**Materials and Procedure**. The procedure was same as Experiment 1, except 1) we added a self-report measure of perceived competence to the positive psychological outcomes; 2) we changed prosocial and proself tasks into a 2 by 2 design; and 3) we removed the 150-character writing task.

***Prosocial vs. Proself tasks in COVID-19-related vs. COVID-19-unrelated conditions***. After completing the baseline survey, participants received an additional payment of 5¢ US in the form of electronic voucher with a purchasing power of $1. Participants in the *prosocial conditions* could use the $1 to purchase an item for a needy child from a low-income American family through real, online donation campaigns on DonorsChoose.org. Meanwhile, participants in the *proself* conditions could use the $1 to purchase equivalent items for themselves. In the COVID-19-related conditions, items were directly related to COVID-19. For instance, participants could purchase personal protection equipment (PPE), such as a reusable face mask or hand sanitizer, two essential hygiene items during the pandemic. In the COVID-19-unrelated condition, items were not directly related to the COVID-19, e.g., healthy snacks or writing supplies for daily uses.

Participants then read information about the importance of the items. Specifically, in the prosocial/COVID-19-related condition, participants were told how PPEs were important in protecting the needy child's health during the pandemic. In the prosocial/COVID-19-unrelated condition, participants read how snacks/writing supplies were important for the needy child's nutrition/academic performance, and they did not read any COVID-19-related information. In the proself conditions, participants read similar information as in the prosocial condition, with the beneficiaries referred to themselves instead of a needy child (for verbatim instructions, see OSF).

Similar to Experiment 1, participants could opt-out from making a purchasing choice in all four conditions and keep the cash value (5¢ US) for themselves (credited to their Prolific account). To discourage opt-outs, participants were informed that funds would not be credited to their Prolific Academic account for approximately 3 months. Consistent with past research (Aknin et al., 2013; Hanniball et al., 2019), we pre-registered our intention to exclude participants who opted out of making a purchase in the prosocial condition because they did not engage in a prosocial action. Also consistent with past work (Aknin et al., 2013; Hanniball et al., 2019), we pre-registered our intention to include participants who opted out of the purchase in the proself condition because these individuals also gained money for themselves[1]. To avoid collecting personal data (e.g. mailing address), participants in the proself conditions received $1 or $0.05 (those who opted out) as bonus payments at the end of the study.

**Pre-registered Analyses.** Analyses were same as in Experiment 1, except that *t*-tests/Mann-Whitney *U* tests /ANCOVAs were run on prosocial vs. proself comparisons within COVID-19-related and COVID-19-unrelated conditions, separately.

We pre-registered our plan to explore whether COVID-relatedness moderates the emotional benefits of prosocial behavior with a series of 2 (COVID-19-related vs. COVID-19-unrelated) X 2 (prosocial vs. proself) ANOVAs on positive psychological outcomes, intrusive thoughts frequency from intrusion monitoring task, and on subjective worry/fear.

[1] We also pre-registered our intention to analyse the data excluding participants in the proself conditions who opted-out of making a purchase and chose to receive the cash for themselves. However, after data collection, we found that doing so left us with 956 participants, which failed to reach our pre-registered sample size ($N$=1,200) and dramatically reduced statistical power. Therefore, consistent with past theorizing and research (Aknin et al., 2020; Hanniball et al., 2019), we present analyses that include participants who opted out of making a purchase in the proself condition in text. However, readers can find detailed analyses when opt-out proself participants are excluded in the Supplementary Materials.

For positive/negative affect, and self-report COVID-19 intrusive thoughts, we conducted mixed 2 (baseline vs. post-task, within-subject) X 2 (COVID-19-related vs. COVID-19-unrelated, between-subject) X 2 (prosocial vs. proself, between-subject) ANOVAs

***Experiments 1 & 2 Exploratory Analyses***: In both experiments, we examined whether the emotional benefits of prosocial behavior are detectable among individuals who reported moderate-to-extremely severe depression/anxiety/stress. Following conventional cut-offs on the DASS-21 (Lovibond & Lovibond, 1995), we categorized participants into moderate-to-extremely severe category if they met one of the following criteria: depression>6, anxiety>5 or stress>9, with remaining participants assigned to the normal-to-mild category. To be consistent with other pre-registered analyses, we next conducted ANCOVAs with baseline positive affect as covariates to investigate whether participants from prosocial and proself conditions differ in their post-task positive affect.

**Results**

Descriptive statistics for each outcome measure and Cohen's *d*s are presented in Table 2. The following measures violated normality assumption: sum scores and individual ratings from positive psychological outcomes (*ps* < .001), total number of intrusions ($p < .001$), subjective fear ($p < .001$) and worry ($p < .004$).

**Pre-registered Confirmatory Analyses:**

***Positive psychological outcomes***. Consistent with our pre-registered hypotheses, participants in the prosocial condition reported higher positive psychological outcomes in both COVID-19-related and COVID-19-unrelated conditions (*ps* < .001, $BF_{10} > 1\times10^{11}$) as compared to proself spending. Specifically, in the COVID-19-related conditions, prosocial behavior led to greater feelings of happiness ($d = 0.32$), meaning ($d = 0.52$), positive impact ($d = 0.62$), empathy ($d = 0.87$), and social connectedness ($d = 0.64$; *ps* < .001, $BF_{10} > 300$, Fig. 3A). In contrast to our pre-registered hypothesis, participants in the prosocial condition

did not report higher levels of competence than participants in the proself condition ($p$ = .377, $d$ = 0.03, $BF_{10}$ = 0.14). In the COVID-19-unrelated condition, prosocial (vs. proself) spending led to elevated reports on all positive outcomes ($ps$ < .001, $d$s: 0.38-1.91, $BF_{10}$ > $8\times10^6$, Fig. 3B, Table 2).

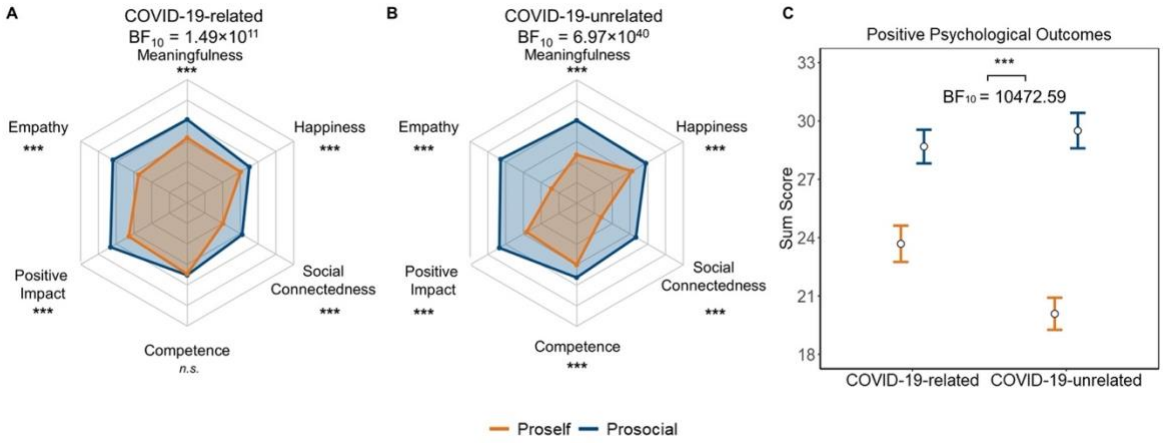


Fig. 3. Positive psychological outcome ratings from A) COVID-19-related and B) COVID-19-unrelated conditions; as well as the C) COVID-19-relatedness by prosocial vs. proself interaction. ***: $p$ < .001, Error bars indicate 95% confidential intervals.

***Positive affect***. Consistent with our pre-registered hypothesis, prosocial spending led to higher levels of post-spending positive affect in both the COVID-19-related and COVID-19-unrelated conditions than proself spending (Fig. 4A-4B). In the COVID-19-related conditions, the ANCOVA controlling for baseline positive affect revealed that prosocial participants reported higher positive affect compared to proself participants, $F(1,608) = 18.63$, $p$ < .001, $d$ = 0.35, $BF_{10}$ = 713.88. The same ANCOVA in the COVID-19-unrelated conditions similarly revealed significant condition effect: $F(1,620) = 34.29$, $p$ < .001, $d$ = 0.47, $BF_{10} = 1.05\times10^6$.

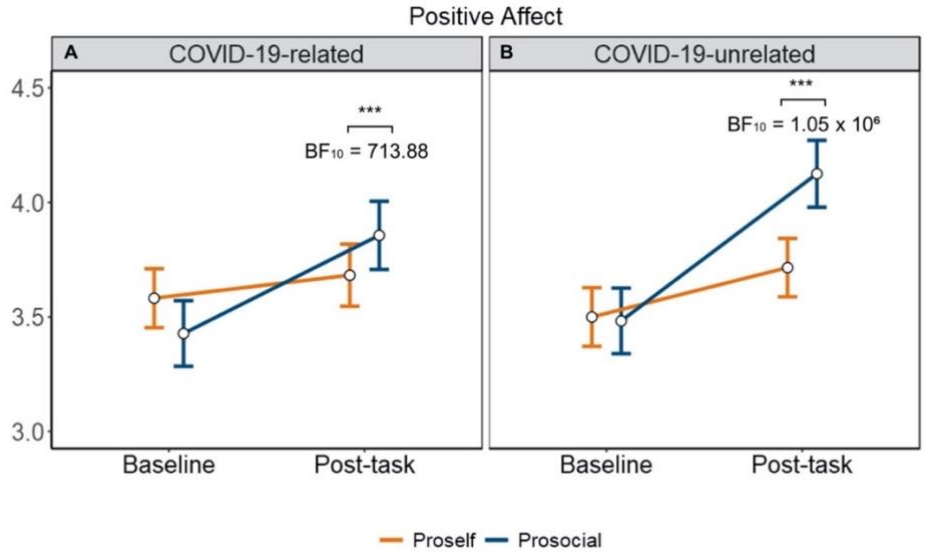


Fig. 4. Prosocial (vs. proself) behavior enhanced positive affect from baseline to post-task in both A) COVID-19-related and B) COVID-19-unrelated conditions. ***: $p < .001$. Error bars indicate 95% confidential intervals.

In contrast to our pre-registered hypothesis, negative affect (Fig. 5B-5C), intrusions, subjective worry/fear did not significantly differ between prosocial and proself conditions (*p*s>.13, see Table 2 and Supplemental Materials for details).

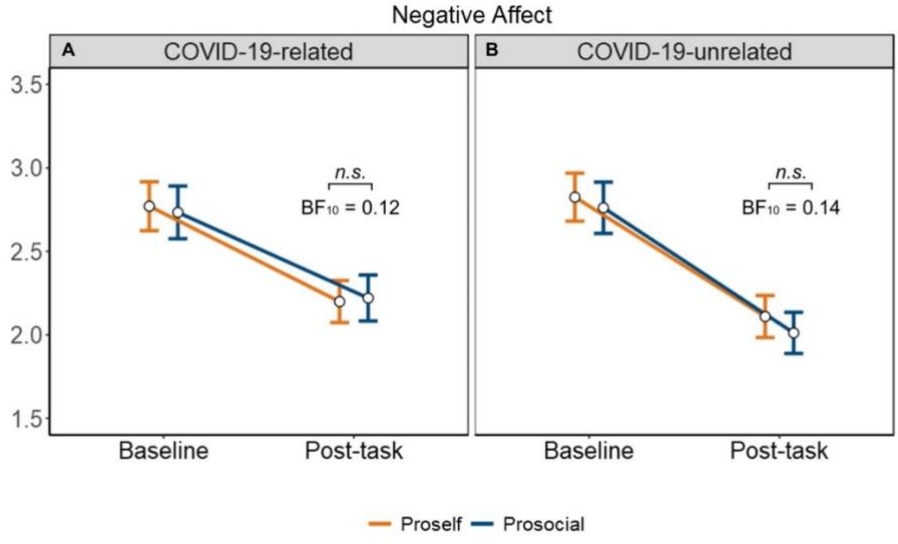


Fig. 5. Average negative affect reported by participants in the prosocial and proself conditions in A) COVID-19-related, and B) COVID-19-unrelated condition. *n.s.*: $p>.05$. Error bars indicate 95% confidential intervals.

**Preregistered Exploratory Analyses:**

***Positive psychological outcomes***. The ANOVA on sum scores of positive psychological outcomes revealed a significant Condition by COVID-19-relatedness interaction, $F(1,1230) = 23.90$, $p < .001$, $\eta_p^2 = 0.019$, $BF_{10} = 10472.59$ (see Figure 3C). Post-hoc Bonferroni-corrected comparisons showed that the prosocial vs. proself psychological benefits in the COVID-19-unrelated condition ($t(1230) = 14.81$, $p < .001$, $d = 1.21$) were nearly twice as large as those in the COVID-19-related condition ($t(1230) = 7.79$, $p < .001$, $d = 0.62$).

***Positive affect***. The mixed ANOVA revealed the three-way Time by COVID-19-relatedness by condition interaction was not significant with $BF_{10}$ supporting the null hypothesis, $F(1,1230) = 0.87$, $p = .351$, $\eta_p^2 < .001$, $BF_{10} = 0.38$. Thus, COVID-19-relatedness did not moderate prosocial behavior's enhancements of positive affect (Fig. 4A vs. 4B). However, we found a significant COVID-19-relatedness by Time interaction, $F(1,1230) = 9.67$, $p = .002$, $\eta_p^2 = 0.008$. To break down this interaction, we calculated positive affect changes scores (Time 2-Time 1 positive affect, with higher scores indicated elevated positive affect from baseline to post-task). We found that participants in the COVID-19-unrelated conditions reported higher positive affect enhancements than participants in the COVID-19-related conditions, $W = 173236$, $p = .006$, $d = 0.17$, $BF_{10} = 5.26$.

***Negative affect***. The same three-way interaction on negative affect was not significant with the $BF_{10}$ supporting the null hypothesis, $F(1,1230) = 0.872$, $p = .350$, $\eta_p^2 = .001$, $BF_{10} = 0.38$. Again, we found a significant COVID-19-relatedness by time interaction, $F(1,1230) = 14.68$, $p < .001$, $\eta_p^2 = 0.012$, $BF_{10} = 259.23$. To break down this interaction, we calculated negative affect changes scores (Time 2-Time 1 negative affect, with lower scores indicated reduced negative affect from baseline to post-task). We found that COVID-19-unrelated

participants showed larger negative affect reduction than COVID-19-related participants, $W$ = 210498, $p$ = .001, $d$ = 0.21, $BF_{10}$ = 69.59 (Fig. 5A vs. 5B).

COVID-19-relatedness did not moderate prosocial vs. proself's impacts on intrusive thoughts nor subjective worry/fear.

**Non-Preregistered Exploratory Analyses:**

***Depression/anxiety/stress levels and prosocial behavior's affective benefits***. Across two experiments, 750 out of 1623 participants (29%) reported moderate-to-extremely severe levels of depression, anxiety or stress, based on DASS-21 conventional cutoffs (Lovibond & Lovibond, 1995). Therefore, we conducted an ANCOVA to examine whether prosocial behavior enhanced positive affect among this more severely impacted sub-sample, with baseline positive affect as covariate. Analyses revealed that among these 750 participants, prosocial (vs. proself) behavior enhanced positive affect with a moderate effect size ($F$(1,747) = 19.70, $p$ < .001, $d$ = 0.33, $BF_{10}$ = 315.31, Figure 5A). The same ANCOVA on participants who reported normal-to-mild levels of depression/anxiety/stress ($n$=873) similarly showed that prosocial (vs. proself) behavior enhanced positive affect ($F$(1,870) = 41.38, $p$ < .001, $d$ = 0.44, $BF_{10}$ =1.35×$10^6$, Figure 6B). These findings suggest that the affective benefits of prosocial behavior are evident for individuals who were coping relatively well with the pandemic – as well as those individuals who reported greater distress.

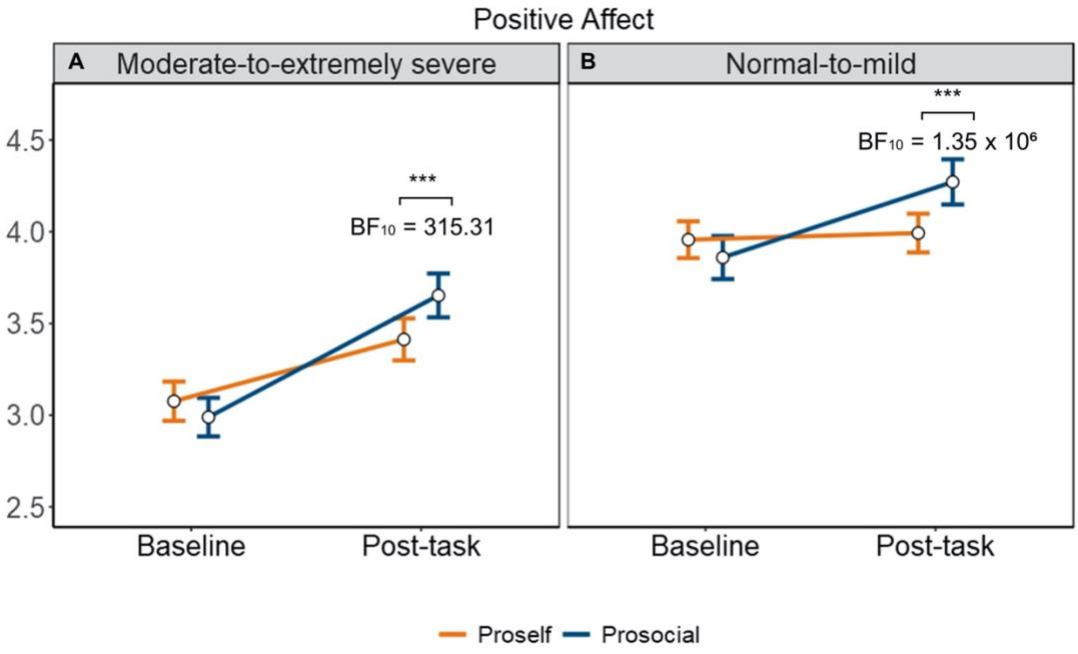


Fig. 6. Average positive affect reported by participants in A) moderate-to-extremely severe DASS levels and B) normal-to-mild DASS levels. Prosocial (vs. proself) behavior enhanced positive affect in both populations (*p*s < .001) ***: $p < .001$. Error bars indicate 95% confidential interval.

Table 2. Experiment 2 means, 95% CI, and Cohen's *d* effect size estimates for pre-registered outcome comparisons. Positive and negative affect change scores are calculated as post-task minus baseline scores therefore a positive value indicates an increase and a negative value indicates a reduction. ** $p < .01$. *** $p < .001$.

| | COVID-19-related | | | COVID-19-unrelated | | |
|---|---|---|---|---|---|---|
| Outcome measurements | Prosocial | Proself | *d* | Prosocial | Proself | *d* |
| Positive Outcomes | 28.69 [27.81,29.51] | 23.68 [22.80,24.64] | 0.62*** | 29.51 [28.44, 30.29] | 20.08 [19.30, 20.92] | 1.21*** |
| Happiness | 4.50 [4.31, 4.67] | 4.01 [3.83, 4.18] | 0.32*** | 4.89 [4.70, 5.06] | 4.12 [3.94, 4.28] | 0.49*** |
| Meaningfulness | 5.06 [4.89, 5.22] | 4.17 [3.98, 4.36] | 0.52*** | 5.03 [4.85, 5.20] | 3.36 [3.17, 3.53] | 1.01*** |
| Positive Impact | 5.32 [5.16, 5.48] | 4.29 [4.09, 4.48] | 0.62*** | 5.35 [5.19, 5.49] | 3.82 [3.64, 4.01] | 0.99*** |
| Empathy | 5.18 [5.02, 5.34] | 3.74 [3.52, 3.95] | 0.87*** | 5.28 [5.08, 5.43] | 2.41 [2.26, 2.58] | 1.91*** |
| Social Connectedness | 4.10 [3.91, 4.27] | 3.02 [2.84, 3.22] | 0.64*** | 4.33 [4.11, 4.52] | 2.38 [2.21, 2.55] | 1.18*** |
| Competence | 4.52 [4.33, 4.70] | 4.46 [4.29, 4.64] | 0.03 | 4.62 [4.41, 4.78] | 4.00 [3.82, 4.17] | 0.38*** |
| Positive Affect Change | 0.43 [0.34, 0.53] | 0.10 [0.01, 0.19] | 0.37*** | 0.64 [0.53, 0.75] | 0.22 [0.12, 0.32] | 0.44*** |
| Negative Affect Change | -0.51 [-0.60, -0.43] | -0.57 [-0.67, -0.49] | -0.07 | -0.75 [-0.86, -0.65] | -0.72 [-0.82, -0.62] | 0.04 |
| Intrusion Frequency | 2.41 [2.11, 2.76] | 2.64 [2.30, 2.99] | 0.08 | 2.47 [2.21, 2.78] | 2.12 [1.87, 2.42] | -0.13 |
| Self-reported Intrusions | 2.30 [2.17, 2.44] | 2.35 [2.23, 2.49] | 0.04 | 2.40 [2.27, 2.53] | 2.26 [2.15, 2.38] | -0.12 |
| Subjective Worry | 1.53 [1.41, 1.64] | 1.63 [1.53, 1.74] | 0.10 | 1.68 [1.56, 1.79] | 1.61 [1.50, 1.71] | -0.07 |
| Subjective Fear | 0.79 [0.70, 0.87] | 0.80 [0.72, 0.88] | 0.02 | 0.87 [0.78, 0.95] | 0.87 [0.79, 0.96] | 0.005 |

Note: Cohen's *d* was calculated using means and S.D.s from the two conditions. Intrusion frequency refers to counts of intrusions during the 2-minute intrusion monitoring task; self-reported intrusions refer to post-task self-reported intrusions.

## General Discussion

Safeguarding the public's mental health and emotional wellbeing is of paramount importance during the sweeping global pandemic when people are under chronic stress, heightened anxiety and depression (Holmes et al., 2020). Supporting our pre-registered hypotheses, we found that prosocial behavior led to greater positive affect and positive psychological outcomes, such as empathy and social connectedness, than self-directed behavior in two experiments. Moreover, prosocial behavior benefited those who reported high levels of depression/anxiety-related symptoms during the pandemic. Together, we provide novel evidence that small acts of kindness may benefit helpers by bolstering wellbeing and psychological resources when facing adversity and a global pandemic.

To our knowledge, this is the first study to probe whether the emotional benefits of prosocial action vary as a function of alignment with a source of concern or stressor. Notably, benefits of prosocial action emerged regardless of whether the prosocial behavior was related to a general, large-scale and potentially personal stressor (i.e. COVID-19) or not. These findings bear positive implications for safeguarding mental health during the pandemic (Holmes et al., 2020): with many common sources of well-being and stress reduction being minimized or discouraged to slow the spread of the virus (e.g., in-person communication), people require alternative methods to find happiness, connection, and meaning. The present findings offer one relatively low-cost prosocial behavior that could readily boost positive affect and psychological outcomes with moderate-to-large effect sizes.

Results from Experiment 2 revealed that simply reading COVID-19 related information lowered positive affect and increased negative affect regardless of beneficiaries. These findings are consistent with previous research showing that media/news consumption of COVID-19 related information had a negative impact on mental well-being (Bu et al., 2020; Gao et al., 2020; Huckins et al., 2020). Despite such undesirable impacts, engaging in prosocial (vs. proself) acts enhanced positive affect and positive psychological outcomes in both experiments. Given that people are

inundated with COVID-19 related information, our results suggested that prosocial acts could be a fruitful avenue for improving well-being during the on-going pandemic.

While prosocial spending's emotional rewards emerged in both conditions, psychological outcome enhancements were significantly larger in the COVID-19-unrelated condition than in the COVID-19-related condition. Thus, the magnitude of prosocial behavior's benefits may be influenced by prosocial vs. proself behavior's potential impacts: while participants were told that items in the COVID-19-related and unrelated conditions worth the same value ($1 USD), it is possible that the PPEs in the COVID-19-related conditions were perceived as more impactful than snacks/writing supplies in the COVID-19-unrelated conditions. Future studies can directly manipulate the impact of prosocial and proself behavior to further investigate this possibility.

Compared to positive affect, prosocial behavior seemed ineffective in reducing negative affect and negative psychological outcomes (e.g. intrusive thoughts, fear and worry related to COVID-19). It is unclear why prosocial behavior did not lead to lower levels of negative emotions in the present studies. This may stem from past research and theorizing which shows that positive affect and negative affect can be independent components of subjective well-being (Diener & Emmons, 1984; Diener, 2000) and exist on orthogonal dimensions (Watson & Tellegen, 1985). Therefore, an enhancement of positive affect does not always lead to reductions of negative affect. Supporting this possibility, past research shows that prosocial behavior is more strongly linked with positive emotions than negative emotions (e.g., Curry et al., 2018; Hui et al., 2020; Jebb et al., 2020; Kushlev et al., 2020 preprint). Indeed, past work on prosocial spending typically finds that spending money on others consistently leads to benefits in positive emotions, while declines in negative emotions are less constant, even mixed (e.g., Aknin et al., 2012; Aknin et al., 2018). It is possible that the current global context may also be a source of stability for negative emotions: fear and worry may be more resistant to change because of the chronic stress and imminent threat posed by the pandemic.

One limitation of this work is that we only recruited samples from United States (US), which may raise questions regarding generalizability. The US is a meaningful context for examination because it has the highest number of COVID-19 infections and deaths since March 26, 2020 (Johns Hopkins University, 2020). As a result, the heightened fear and anxiety surrounding the COVID-19 pandemic provides a theoretically rich backdrop for studying the potential benefits of prosocial behavior. While prosocial behavior brings emotional benefits even among the most impacted population and among those who reported high depressive/anxiety symptoms, whether these results could be generalized to other regions/populations remains an open question. However, there are good reasons to be optimistic: the emotional and wellbeing benefits of prosociality have been detected in a variety of different populations and cultural contexts around the world (Aknin et al., 2013). Furthermore, the present studies were preregistered with high statistical power and pre-determined analytical plans, which is likely to increase their replicability.

Another limitation of the study concerns the manipulations of prosociality and COVID-19-relatedness. Admittedly, the prosocial acts were at relatively low cost: participants spent 5¢ USD to donate $1 USD worth of goods. On the one hand, this low-cost donation provides a conservative test of our hypothesis (Prentice & Miller, 1992). On the other hand, however, our results may not be generalizable to high-cost prosocial behavior enacted during the pandemic. Regarding the manipulation of COVID-19-relatedness, while snacks/writing supplies were not directly related to COVID-19, participants may still have perceived these items to be related to COVID-19 given the lack of food, especially for low-income families, during this challenging time. Future research, ideally looking at large and real-world demonstrations of generosity, and prosocial behavior's perceived relatedness with COVID-19, will help to elucidate this relationship.

More broadly, our results join recent research in underscoring the importance of prosocial motivations during the COVID-19 pandemic (e.g., Brooks et al., 2020; Van Bavel et al., 2020). Recent work has shown that people are more willing to comply with physical distancing and isolation

rules when reminded how their behavior could benefit others and the community (e.g., Jordan et al., 2020 preprint). Enhanced empathy and social connections could also motivate people to engage in protective behavior for those vulnerable people (e.g., Pfattheicher et al., 2020 preprint; Zaki, 2020). Thus, emphasizing prosocial information during this global pandemic is likely to have broader social implications in combatting COVID-19 beyond promoting positive affect at an individual level.

One practical way to implement the present findings is to encourage greater prosocial behavior at a systemic level during the current pandemic such as governments funding social service programs (e.g. job training, food banks etc.) which enable people to help and improve the well-being of individuals in our society. Our experimental findings converge with recent evidence from a daily diary study conducted during the COVID-19 pandemic wherein daily helping behavior was associated with higher levels of positive affect (Sin et al., 2020; see also Bu et al., 2020). These findings underscore the notion that prosociality can take many forms (during the pandemic and beyond) to include informal helping, online donations, or lending emotional support to others, which may offer psychological benefits to the actor (Aknin & Whillans, 2020). Importantly, however, generous action should not come at the expense of personal safety. Prior evidence suggests that risky or excessive generosity can have negative consequences, such as making people feel exhausted and leading to deteriorated mental health (e.g., Cameron & Payne, 2011; Falk & Graeber, 2020; Tei et al., 2014). Impressively, the affective benefits documented here were achieved at relatively little cost: doing others a favour, at a cost as small as one dollar, could readily boost positive affect and psychological experiences without feeling financially or psychologically depleted.

Prosocial behavior and altruism have been advocated to be an effective intervention to protect mental wellbeing during the unprecedented global pandemic (Holmes et al., 2020). Our research provides the first causal evidence that generous actions does have a meaningful benefit on helpers' positive affect, whether they provide COVID-19 related help or otherwise. At a societal level, promoting prosocial behavior not only brings emotional benefits to individuals, but could also

increase social connections and cohesiveness. Future studies shall provide deeper insight into how humans may experience positive emotion during a global pandemic via social solidarity– and possibly emerge kinder than they were before.

**Data and code availability:** https://osf.io/e3kdr/?view_only=6f73ca5683534d77994fb9ed6c042cb3

**Acknowledgments**

We thank Yiwen Zhong for help on the project. This research was supported by the National Natural Science Foundation of China (No. 31922089, No. 31700953), Early Career Schema (No. 27610617), and General Research Fund (No. 17601318) of Hong Kong Research Grants Council to X.H.

**Conflict of Interests**

The authors declare no conflict of interests.

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Supplement of

Prosocial behaviour promotes positive emotion during the COVID-19 Pandemic

## Table of Content

## Supplement Results

*Sample characteristics*

Information on sample demographics, COVID-19's psychological impact (e.g., perceived existential threats of COVID-19, concerns of physical/mental health due to COVID-19), sleep quality, and anxiety/depression/stress levels from Experiments 1 and 2 are provided in Tables S3 and S4, respectively. On average, participants reported moderate levels of anxiety, depression and stress levels based on conventional cutoffs of the DASS-21 scale (Lovibond & Lovibond, 1995), with 29% of the sample reporting moderate-to-extremely severe depression or anxiety levels. This is largely consistent with the recent nation-level Household Pulse Survey conducted by the National Center for Health Statistics, which showed that 35.9% of the sample developed either depression or anxiety symptoms between April 23 and May 5 2020 (NCHS, 2020). As a pre-pandemic benchmark, the same survey conducted in January – June 2019 showed that 11.0% of the sample showed either depression or anxiety symptoms (NCHS, 2020). Thus, participants in our sample reported similar levels of anxiety and depression to that observed nation-wide during approximately the same time, and significantly higher levels than observed before the COVID-19 pandemic.

*Experiment 1 Preregistered Analyses*:

*Intrusion monitoring*. Counter to pre-registered hypothesis, a one-tailed Mann-Whitney *U* test revealed no significant difference between the two conditions on COVID-19 related intrusion frequencies during the 2-minute intrusion monitoring task, $W = 17903$, $p = .807$, $d = 0.08$, $BF_{10} = 0.07$.

*Self-reported intrusive thoughts*. Counter to pre-registered hypothesis, an ANCOVA using baseline intrusion scores as covariates showed that post-task self-reported intrusions did not differ between the two conditions, $F_{1,386} = 0.10$, $p = .755$, $\eta_p^2 < 0.001$, $BF_{10} = 0.12$.

*Subjective worry and fear related to COVID-19*. Counter to pre-registered hypothesis, a one-tailed Mann-Whitney *U* tests revealed no significant difference on subjective worry, $W = 17520$, $p = .884$, $d = 0.12$, $BF_{10} = 0.05$, nor subjective fear, $W = 17656$, $p = .859$, $d = 0.09$, $BF_{10} = 0.07$, across conditions.

*Experiment 2*

*Preregistered Confirmatory Analyses*:

*Negative affect*. Counter to pre-registered hypothesis, reports of negative affect did not differ after the spending task among participants in proself and prosocial spending conditions in either COVID+ conditions, $F_{1,608} = 0.71$, $p = 0.401$, $\eta_p^2 = 0.001$, $BF_{10} = 0.12$; nor COVID- conditions, $F_{1,620} = 0.91$, $p = 0.341$, $\eta_p^2 = 0.001$, $BF_{10} = 0.14$, when controlling for baseline negative affect as a covariate in an ANCOVA.

*Intrusion monitoring*. Counter to pre-registered hypothesis, intrusion monitoring did not differ among participants in proself and prosocial spending conditions in either COVID+ ($W = 47654$, $p = .277$, $d = 0.08$, $BF_{10} = 0.24$) or COVID- ($W = 44472$, $p = .957$, $d = 0.03$, $BF_{10} = 0.04$) conditions.

*Self-reported intrusive thoughts*. Counter to pre-registered hypothesis, self-reported intrusive thoughts did not differ among prosocial and proself participants in either the COVID+ ($F_{1,608} = 0.56$, $p = .454$, $\eta_p^2 < 0.001$, $BF_{10} = 0.12$) or the COVID- ($F_{1,620} = 2.28$, $p = .131$, $\eta_p^2 = 0.004$, $BF_{10} = 0.27$) conditions in the ANCOVA models using baseline intrusions as covariates.

*Preregistered Exploratory Analyses*:

*Subjective worry and fear related to COVID-19*. In the COVID+ conditions, prosocial and proself participants did not differ in their subjective worry ($W = 49250$, $p = .188$, $d = 0.10$, $BF_{10} = 0.20$), nor fear ($W = 46681$, $p = .893$, $d = 0.02$, $BF_{10} = 0.09$). Similarly, in the COVID- condition, there were no significant differences between the proself and prosocial conditions on subjective worry ($W = 46577$, $p = .457$, $d = 0.07$, $BF_{10} = 0.13$) and fear ($W = 47781$, $p = .837$, $d = 0.004$, $BF_{10} = 0.09$).

*Does COVID-19-relatedness moderate outcome measures?*

*Self-reported intrusive thoughts*. The same 2 x 2 x 2 mixed ANOVA as above on self-reported intrusive thoughts revealed no significant Time by Condition interaction ($p$ = .866), or Time by COVID-19-relatedness ($p$ = .894) nor a three-way interaction ($p$ = .200).

*Intrusion monitoring*. A 2 (Condition, Prosocial vs. Proself) X 2 (COVID-19-relatedness, COVID+ vs. COVID-) ANOVA on intrusion frequency revealed no significant main effects ($ps$ > 0.146) nor an interaction ($p$ = .070).

*Subjective COVID-19 related worry and fear.* The same 2 X 2 ANOVA revealed no main effects ($ps$ > .053) nor an interaction ($ps$ > .129) for COVID-19-related subjective worry/fear.

*Experiments 1 and 2 Regression analyses with individual difference variables*

In Experiment 1, we unexpectedly found participants in the Prosocial condition had significantly higher score on their baseline sleepiness, DASS-21 and TCAQ scores than the participants from the Proself condition (Table S5). In Experiment 2, none of the individual difference variables differed significantly between the two conditions within the COVID-19-related and COVID-19-unrelated conditions (Table S6). Given that individual differences could contribute to observed effects in affect changes, we conducted non-preregistered linear regression analyses using 1) condition and 2) all individual difference variables as predictors on positive/negative affect change scores, self-reported intrusions change, intrusion frequency, subjective worry and fear for Experiments 1 and 2. Results of these regression analyses confirmed results from pre-registered ANCOVAs: after controlling individual difference variables in the regression model, condition remained to be a significant predictor for positive ($p$ = .01) and negative affect change scores ($p$ < .001) in Experiment 1 (Table S7). For Experiment 2, condition remained as a significant predictor for positive affect change scores in both COVID-19-related ($p$ < .001) and COVID-19-unrelated ($p$ < .001) conditions (Table S8).

Condition became as a significant predictor for subjective worry in COVID-19-related ($p$ = .01) condition, but not in COVID-19-unrelated ($p$ = .45) condition. For Experiment 2, condition remained an unsignificant predictor for negative affect change scores in both COVID-19-related ($p$ = .18) and COVID-19-unrelated ($p$ = .70). For both Experiment 1 and Experiment 2, after controlling all individual difference variables, the condition remained an unsignificant predictor for self-reported intrusions change, intrusion frequency and fear ($p$s > .05). Correlational coeffiencies between individual difference questionnaire scores and outcomes measures are provided in Tables S9-11.

*Experiment 2: Analyses when excluding opt-out participants in proself conditions*

Excluding participants who chose opt-out in the proself conditions left us with 956 participants, who were randomly assigned to one of four conditions: prosocial COVID-19-related ($n$ = 282) vs. proself COVID-19-related ($n$ = 201); and prosocial COVID-19-unrelated ($n$ = 288) vs. proself COVID-19-unrelated ($n$ = 185). Note that this sample size failed to meet our pre-registered sample size ($N$=1,200), and resulted in highly uneven sample sizes across different conditions.

*Pre-registered Analyses:*

*Positive psychological outcomes.* In COVID-19-related conditions, compared to proself condition, participants in prosocial condition reported significantly higher sum scores aggregating all individual items, as well as higher scores on empathy and social connection ($p$s < .001, $d$s > 0.16), but not on happiness ($p$ = .078, $d$ = 0.10, $BF_{10}$ = .18), meaningfulness ($p$ = .100, $d$ = 0.09, $BF_{10}$ = .16), positive impact ($p$ = .185, $d$ = 0.06, $BF_{10}$ = .13), and competence ($p$ = .999, $d$ = -0.31, $BF_{10}$ = 20.08). In COVID-19-unrelated conditions, compared to proself conditions, participants in prosocial condition reported significantly higher sum scores, as well as higher scores on all six individual items (happiness, meaningfulness, positive impact, empathy, social connectedness and competence, $p$s < .001, $d$s > 0.30, $BF_{10}$ > 15.42).

*Positive Affect.* In COVID-19-related conditions, the ANCOVA controlling for baseline positive affect did not find significant difference between prosocial and proself spending ($F$ (1, 480) = 1.77, $p$ = .185, $d$ = 0.14, $BF_{10}$ = 0.23). In contrary, the same ANCOVA in COVID-19-unrelated conditions revealed that prosocial participants reported higher positive affect compared to proself participants ($F$ (1, 470) = 10.92, $p$ = .001, $d$ = 0.30, $BF_{10}$ = 19.95).

*Negative Affect.* Compared to proself spending, prosocial spending did not significantly change negative affect in the COVID-19-related conditions, $F$ (1, 480) = 0.82, $p$ = .355, $d$ = 0.08, $BF_{10}$ = 0.16 nor in the COVID-19-unrelated conditions: $F$ (1, 470) = 1.31, $d$ = .13, $p$ = .253, $d$ = 0.11, $BF_{10}$ = 0.19.

No effect of prosocial vs. proself spending was found on the following measures: self-reported intrusion, COVID-19-related: $F$ (1, 480) = .46, $p$ = .498, $d$ = 0.06, $BF_{10}$ = 0.13; COVID-19-unrelated: $F$ (1, 470) = 1.70, $p$ = .193, $d$ = 0.12, $BF_{10}$ = 0.23. For intrusion frequency in intrusion monitoring task, COVID-19-related: $W$ = 29879, $p$ = .150, $d$ = 0.11, $BF_{10}$ = 0.20; COVID-19-unrelated: $W$ = 25342, $p$ = .820, $d$ = 0.10, $BF_{10}$ = 0.19. For subjective worry, COVID-19-related: $W$ = 31165, $p$ = .061, $d$ = 0.17, $BF_{10}$ = 0.56; COVID-19-unrelated: $W$ = 27710, $p$ = .460, $d$ = 0.05, $BF_{10}$ = 0.12. For fear, COVID-19-related: $W$ = 29607, $p$ = .399, $d$ = 0.11, $BF_{10}$ = 0.19; COVID-19-unrelated: $W$ = 27843, $p$ = .405, $d$ = 0.09, $BF_{10}$ = 0.17.

*Pre-registered Exploratory Analyses:*

*Positive psychological outcomes.* The ANOVA on sum scores of positive psychological outcomes revealed a significant condition by COVID-19-relatedness interaction ($F$ (1, 952) = 46.03, $p$ < .001, $\eta_p^2$ = .046, $BF_{10} = 3.26\times10^{8}$). Post-hoc Bonferroni-corrected comparisons showed that: participants in prosocial COVID- condition reported significantly higher positive psychological outcomes than participants in proself COVID-19-unrelated condition ($t$ (952) = 11.15, $p$ < .001, $d$ = 1.01, $BF_{10} = 1.17\times10^{21}$). In contrary, in the COVID-19-related conditions, participants in prosocial condition were

not significantly different from participants in the proself condition ($t$ (952) = 1.69, $p$ = .548, $d$ = 0.16, $BF_{10}$ = 0.46).

*Positive affect*. The time by COVID-19-relatedness by condition three-way interaction on positive affect was not significant with the $BF_{10}$ supporting null findings, $F$ (1, 952) = 1.58, $p$ = .209, $\eta_p^2$ = .002, $BF_{10}$ = 0.24. In line with main findings, we found a significant COVID-19-relatedness by time interaction, $F$ (1, 952) = 4.57, $p$ = .033, $\eta_p^2$ = .005, $BF_{10}$ = 1.51. To break down this interaction, we calculated positive affect changes scores (Time 2-Time 1 positive affect, with higher scores indicated higher positive affect from baseline to post-task). We found that participants in the COVID-19-unrelated conditions reported higher positive affect enhancements than participants in the COVID-19-related conditions, $W$ = 104511, $p$ = .023, $d$ = 0.16, $BF_{10}$ = 1.54.

*Negative affect*. The time by COVID-19-relatedness by condition three-way interaction on positive affect was not significant with the $BF_{10}$ supporting null findings, $F$ (1, 952) = 1.29, $p$ = .257, $\eta_p^2$ = .001, $BF_{10}$ = 0.20. Again, we found a significant COVID-19-relatedness by time interaction, $F$ (1, 952) = 9.00, $p$ = .003, $\eta_p^2$ = .009, $BF_{10}$ = 13.69. To break down this interaction, we calculated negative affect changes scores (Time 2-Time 1 negative affect, with lower scores indicated lower negative affect from baseline to post-task). We found that COVID-19-unrelated participants showed larger negative affect reduction than COVID-19-related participants, $W$ = 125480, $p$ = .008, $d$ = 0.21, $BF_{10}$ = 13.83.

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Table S1. Exclusion details of Experiment 1.

| **Items** | **Exclusion number (Prosocial)** | **Exclusion number (Proself)** |
|---|---|---|
| None | 254 | 245 |
| Bot Detection | 40 | |
| Attention Check | 1 | |
| Intrusion > 9 or < 5 | 17 | |
| Opt-out in Prosocial Condition | 35 | 0 |
| Outlier in Response time | 1 | 6 |
| Outlier in Intrusion Monitoring Task | 3 | |
| Outlier in measurements | 7 | |
| Final | 182 | 207 |

Table S2. Exclusion details of Experiment 2.

| **Items** | **COVID+** | | **COVID-** | |
|---|---|---|---|---|
| | Prosocial | Proself | Prosocial | Proself |
| None | 354 | 352 | 355 | 360 |
| Bot Detection & Duplicates | | | 12 | |
| Attention Check | | | 3 | |
| Intrusion > 9 or < 5 | | | 33 | |
| Opt-out in Prosocial Condition | 50 | 0 | 37 | 0 |
| Outlier in Response time | 6 | 6 | 1 | 1 |
| Outlier in Intrusion Monitoring Task | | | 7 | |
| Outlier in measurements | | | 31 | |
| Final | 282 | 329 | 288 | 335 |

Table S3. Experiment 1's sample demographic information and average baseline ratings of COVID-19's psychological impact, as well as participants' depression, anxiety, stress levels, and sleep quality ([+]based on *n*=384).

| | Prosocial (*n*=182) | Proself (*n*=207) |
|---|---|---|
| Age (S.D.) in years | 26.12 (5.71) | 27.22 (6.29) |
| Gender (Female %) | 42.86% | 46.38% |
| COVID-19 Infectiousness | 5.91 ± .09 | 5.74 ± .11 |
| COVID-19 Death Rate | 3.38 ± .11 | 3.70 ± .11 |
| COVID-19 Possibility of Contraction | 4.34 ± .11 | 4.31 ± .11 |
| Positive Mood (Past 7 Days) | 3.47 ± .09 | 3.55 ± .10 |
| Negative Mood (Past 7 Days) | 3.59 ± .10 | 3.44 ± .10 |
| Physical Health Concerns | 3.90 ± .11 | 3.73 ± .11 |
| Negative Impact on Work/Social Life | 5.65 ± .10 | 5.71 ± .11 |
| Negative Impact on Mental Health | 3.77 ± .11 | 3.69 ± .11 |
| Current Distress Level | 3.60 ± .11 | 3.48 ± .11 |
| Intrusive Thoughts (Past 7 Days) | 3.54 ± .09 | 3.30 ± .10 |
| Depression (DASS-21) | 6.68 ± .35 | 5.56 ± .36 |
| Anxiety (DASS-21) | 3.18 ± .25 | 2.56 ± .23 |
| Stress (DASS-21) | 6.51 ± .33 | 5.63 ± .31 |
| Sleep Quality (PSQI)[+] | 5.79 ± .24 | 6.33 ± .25 |

Note: DASS-21: Depression, Anxiety Stress Scale-21 item version. PSQI: Pittsburgh Sleep Quality Index.

Table S4. Experiment 2's sample demographic information and average baseline ratings of COVID-19's psychological impact, as well as participants' depression, anxiety, stress levels, and sleep quality ($^{+}$based on $n$=1223).

| | COVID+ | | COVID- | |
|---|---|---|---|---|
| | Prosocial ($n$=282) | Proself ($n$=329) | Prosocial ($n$=288) | Proself ($n$=335) |
| Age (S.D.) | 25.74 (6.37) | 26.20 (6.33) | 26.99 (6.27) | 26.00 (6.16) |
| Gender (Female %) | 48.58% | 44.38% | 53.13% | 48.36% |
| COVID-19 Infectiousness | 5.92 ± .08 | 5.87 ± .07 | 6.01 ± .07 | 5.82 ± .08 |
| COVID-19 Death Rate | 3.68 ± .09 | 3.53 ± .09 | 3.78 ± .09 | 3.69 ± .08 |
| COVID-19 Possibility of Contraction | 4.25 ± .09 | 4.33 ± .08 | 4.32 ± .09 | 4.27 ± .09 |
| Positive Mood (Past 7 Days) | 1.76 ± .06 | 1.92 ± .07 | 1.76 ± .07 | 1.93 ± .07 |
| Negative Mood (Past 7 Days) | 3.69 ± .08 | 3.60 ± .07 | 3.79 ± .08 | 3.70 ± .07 |
| Physical Health Concerns | 3.46 ± .09 | 3.53 ± .08 | 3.58 ± .09 | 3.67 ± .08 |
| Negative Impact on Work/Social Life | 5.85 ± .09 | 5.71 ± .08 | 5.74 ± .08 | 5.73 ± .08 |
| Negative Impact on Mental Health | 3.72 ± .10 | 3.67 ± .09 | 3.58 ± .09 | 3.65 ± .09 |
| Current Distress Level | 3.49 ± .09 | 3.47 ± .08 | 3.53 ± .07 | 3.53 ± .07 |
| Intrusive Thoughts (Past 7 Days) | 3.47 ± .07 | 3.44 ± .06 | 3.47 ± .07 | 3.42 ± .07 |
| Depression (DASS-21) | 6.07 ± .31 | 5.65 ± .28 | 6.02 ± .30 | 6.03 ± .27 |
| Anxiety (DASS-21) | 2.87 ± .21 | 2.76 ± .17 | 3.06 ± .20 | 3.13 ± .19 |
| Stress (DASS-21) | 5.94 ± .27 | 5.79 ± .23 | 6.29 ± .26 | 6.07 ± .24 |
| Sleep Quality (PSQI$^{+}$) | 5.92 ± .18 | 6.08 ± .17 | 5.92 ± .18 | 6.27 ± .18 |

Note: DASS-21: Depression, Anxiety Stress Scale-21 item version. PSQI: Pittsburgh Sleep Quality Index.

Table S5. Experiment 1 individual difference scores across the two conditions (Mean ± S.E.) and *p* values based on prosocial vs. proself comparisons.

| Individual difference measurements | Prosocial | Proself | *p* |
|---|---|---|---|
| TCAQ | 77.41 ± 1.16 | 82.30 ± 1.22 | .003 |
| IRI: | | | |
| Empathetic Concern | 25.43 ± .34 | 26.19 ± .36 | .06 |
| Perspective Taking | 25.49 ± .38 | 25.32 ± .35 | .74 |
| Personal Distress | 18.88 ± .34 | 18.39 ± .36 | .46 |
| SSS (Baseline) | 2.87 ± .09 | 2.60 ± .09 | .01 |
| SSS (Post-Experiment) | 2.74 ± .08 | 2.58 ± .08 | .10 |

Note: TCAQ: Thought control ability questionnaire; IRI: Interpersonal Reactivity Index; SSS: Stanford Sleepiness Scale.

Table S6. Experiment 2 individual difference scores across the four conditions (Mean ± S.E.) and *p* values based on prosocial vs. proself comparisons.

| | COVID-19-related | | | COVID-19-unrelated | | |
|---|---|---|---|---|---|---|
| Individual difference measurements | Prosocial | Proself | *p* | Prosocial | Proself | *p* |
| TCAQ | 79.57 ± 1.05 | 81.64 ± .96 | .09 | 78.26 ± 1.05 | 79.56 ± .95 | .36 |
| IRI | | | | | | |
| Empathetic Concern | 25.95 ± .31 | 25.49 ± .28 | .19 | 26.03 ± .31 | 25.79 ± .27 | .40 |
| Perspective Taking | 24.95 ± .28 | 25.65 ± .26 | .16 | 26.11 ± .29 | 25.41 ± .27 | .07 |
| Personal Distress | 18.30 ± .29 | 18.11 ± .29 | .71 | 18.83 ± .31 | 18.34 ± .28 | .20 |
| Sleepiness (Baseline) | 2.78 ± .07 | 2.67 ± .07 | .33 | 2.71 ± .07 | 2.88 ± .07 | .07 |
| Sleepiness (Post-Experiment) | 2.73 ± .07 | 2.61 ± .06 | .25 | 2.62 ± .07 | 2.74 ± .06 | .14 |

Note: TCAQ: Thought control ability questionnaire; IRI: Interpersonal Reactivity Index; SSS: Stanford Sleepiness Scale.

Table S7. Experiment 1 Statistics from the regression analyses for positive and negative affect change scores.

| | **Positive Affect Change** | | | | **Negative Affect Change** | | | |
|---|---|---|---|---|---|---|---|---|
| Predictors | Estimate | S.E. | *t* | *p* | Estimate | S.E. | *t* | *p* |
| Intercept | -.13 | .61 | -.22 | .83 | -1.06 | .62 | -1.72 | .09 |
| TCAQ | -1.70e-03 | 4.19e-03 | -.41 | .69 | .01 | 4.27e-03 | 2.60 | .01 |
| IRI | | | | | | | | |
| Empathetic Concern | -4.16e-03 | .01 | -.40 | .69 | -.01 | .01 | -1.33 | .18 |
| Perspective Taking | 1.68e-03 | .01 | .16 | .87 | -9.11e-04 | .01 | -.09 | .93 |
| Personal Distress | 8.91e-03 | .01 | .75 | .45 | 5.61e-03 | .01 | .47 | .64 |
| PSQI | 4.28e-05 | 3.96e-05 | 1.08 | .28 | 5.59e-07 | 4.03e-05 | .01 | .99 |
| DASS | | | | | | | | |
| Depression | .03 | .01 | 2.16 | .03 | -9.54e-05 | .01 | -.006 | 1.00 |
| Anxiety | -.02 | .02 | -1.25 | .25 | -9.28e-03 | .02 | -.48 | .63 |
| Stress | 4.18e-03 | .02 | .25 | .80 | .03 | .02 | -1.63 | .10 |
| Baseline SSS | .09 | .04 | 2.25 | .03 | -.09 | .04 | -2.16 | .03 |
| Condition | .23 | .09 | 2.56 | .01 | .45 | .09 | 4.74 | <.001 |

Note: TCAQ: Thought control ability questionnaire; IRI: Interpersonal Reactivity Index; PSQI: Pittsburgh Sleep Quality Index; DASS: Depression, Anxiety Stress Scale; SSS: Stanford Sleepiness Scale.

Table S8. Experiment 2 Statistics from the regression analyses for positive affect change scores within the COVID-19-related and COVID-19-unrelated conditions.

| Predictors | COVID-19-related | | | | COVID-19-unrelated | | | |
|---|---|---|---|---|---|---|---|---|
| | Estimate | S.E. | *t* | *p* | Estimate | S.E. | *t* | *p* |
| Intercept | -.56 | .43 | -1.29 | .20 | -.58 | .52 | -1.13 | .26 |
| TCAQ | 1.04e-03 | 2.92e-03 | .36 | .72 | -4.25e-03 | 3.50e-03 | -1.22 | .22 |
| IRI | | | | | | | | |
| Empathetic Concern | -1.22e-03 | 8.11e-03 | -.15 | .88 | .02 | 8.76e-03 | 1.89 | .06 |
| Perspective Taking | 7.20e-03 | 8,89e-03 | .81 | .42 | 5.30e-03 | 8.93e-03 | .59 | .55 |
| Personal Distress | -3.63e-05 | 8.59e-03 | -.004 | 1.00 | .02 | 9.55e-03 | 1.62 | .11 |
| PSQI | 3.92e-06 | 3.55e-05 | .11 | .91 | 6.74e-06 | 4.76e-05 | .14 | .89 |
| DASS | | | | | | | | |
| Depression | .01 | .01 | 1.23 | .22 | .01 | .01 | .89 | .38 |
| Anxiety | -5.87e-03 | .01 | -.40 | .69 | 4.49e-03 | .02 | .29 | .77 |
| Stress | 2.79e-02 | .01 | 2.27 | .02 | -6.33e-03 | .01 | -.46 | .65 |
| Baseline SSS | .07 | .03 | 2.26 | .02 | .09 | .03 | 2.52 | .01 |
| Condition | .32 | .07 | 4.51 | <.001 | .42 | .08 | 5.51 | <.001 |

Note: TCAQ: Thought control ability questionnaire; IRI: Interpersonal Reactivity Index; PSQI: Pittsburgh Sleep Quality Index; DASS: Depression, Anxiety Stress Scale; SSS: Stanford Sleepiness Scale.

Table S9. Experiment 1 correlational coefficients matrix among individual difference variables and outcome measures.

| | **PSQI** | **TCAQ** | **Depression (DASS-21)** | **Anxiety (DASS-21)** | **Stress (DASS-21)** | **PD (IRI)** | **PT (IRI)** | **EC (IRI)** | **Positive Affect Change** | **Negative Affect Change** | **Intrusion Change** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PSQI** | 1 | | | | | | | | | | |
| **TCAQ** | 0.02 | 1 | | | | | | | | | |
| **Depression (DASS-21)** | 0.01 | -0.65*** | 1 | | | | | | | | |
| **Anxiety (DASS-21)** | 0.07 | -0.42*** | 0.61*** | 1 | | | | | | | |
| **Stress (DASS-21)** | 0.06 | -0.61*** | 0.72*** | 0.69*** | 1 | | | | | | |
| **PD (IRI)** | -0.02 | -0.62*** | 0.42*** | 0.35*** | 0.41*** | 1 | | | | | |
| **PT (IRI)** | -0.02 | 0.04 | 0.05 | 0.04 | 0.03 | -0.17*** | 1 | | | | |
| **EC (IRI)** | 0.04 | -0.06 | 0.04 | 0.09 | 0.1 | 0.08 | 0.46*** | 1 | | | |
| **Positive Affect Change** | -0.01 | -0.23*** | 0.26*** | 0.13** | 0.19*** | 0.16*** | -0.01 | -0.02 | 1 | | |
| **Negative Affect Change** | -0.13** | 0.29*** | -0.27*** | -0.23*** | -0.29*** | -0.19*** | -0.02 | -0.12* | -0.35*** | 1 | |
| **Intrusion Change** | -0.12* | 0.17*** | -0.22*** | -0.2*** | -0.26*** | -0.16*** | -0.04 | -0.09 | -0.09 | 0.16*** | 1 |

Note: TCAQ: Thought control ability questionnaire; IRI: Interpersonal Reactivity Index; PD: Personal Distress; PT: Perspective Taking; EC: Empathic Concern.

Table S10. Experiment 2 correlational coefficients matrix among individual difference variables and outcome measures in COVID-19-related conditions.

| | PSQI | TCAQ | Depression (DASS- 21) | Anxiety (DASS-21) | Stress (DASS-21) | PD (IRI) | PT (IRI) | EC (IRI) | Positive Affect Change | Negative Affect Change | Intrusion Change |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PSQI** | | | | | | | | | | | |
| **TCAQ** | 0.02 | | | | | | | | | | |
| **Depression (DASS-21)** | 0.00 | -0.60*** | | | | | | | | | |
| **Anxiety (DASS-21)** | -0.07 | -0.46*** | 0.60*** | | | | | | | | |
| **Stress (DASS-21)** | -0.03 | -0.59*** | 0.68*** | 0.64*** | | | | | | | |
| **PD (IRI)** | -0.01 | -0.58*** | 0.4*** | 0.39*** | 0.4*** | | | | | | |
| **PT (IRI)** | -0.04 | 0.06 | -0.05 | -0.07 | 0.00 | -0.11** | | | | | |
| **EC (IRI)** | -0.04 | -0.07 | -0.01 | -0.02 | 0.07 | 0.08 | 0.53*** | | | | |
| **Positive Affect Change** | 0.00 | -0.14*** | 0.19*** | 0.13*** | 0.2*** | 0.09* | 0.01 | 0.03 | | | |
| **Negative Affect Change** | 0.00 | 0.22*** | -0.26*** | -0.15*** | -0.31*** | -0.16*** | -0.05 | -0.11*** | -0.37*** | | |
| **Intrusion Change** | -0.01 | 0.10* | -0.11** | -0.07 | -0.14*** | -0.12*** | -0.04 | -0.14*** | -0.07 | 0.14*** | |

Table S11. Experiment 2 correlational coefficients matrix among individual difference variables and outcome measures in COVID-19-unrelated conditions.

| | PSQI | TCAQ | Depression (DASS- 21) | Anxiety (DASS-21) | Stress (DASS-21) | PD (IRI) | PT (IRI) | EC (IRI) | Positive Affect Change | Negative Affect Change | Intrusion Change |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **PSQI** | 1 | | | | | | | | | | |
| **TCAQ** | -0.02 | 1 | | | | | | | | | |
| **Depression (DASS-21)** | 0 | -0.63*** | 1 | | | | | | | | |
| **Anxiety (DASS-21)** | -0.01 | -0.49*** | 0.61*** | 1 | | | | | | | |
| **Stress (DASS-21)** | 0.01 | -0.64*** | 0.64*** | 0.67*** | 1 | | | | | | |
| **PD (IRI)** | 0.08* | -0.61*** | 0.32*** | 0.34*** | 0.45*** | 1 | | | | | |
| **PT (IRI)** | 0 | 0.06 | -0.06 | -0.05 | -0.08* | -0.12 | 1 | | | | |
| **EC (IRI)** | 0.05 | -0.16*** | 0.01 | 0.01 | 0.1** | 0.13*** | 0.47*** | 1 | | | |
| **Positive Affect Change** | -0.01 | -0.21*** | 0.16*** | 0.12*** | 0.15*** | 0.19*** | 0.06 | 0.12*** | 1 | | |
| **Negative Affect Change** | -0.03 | 0.29*** | -0.27*** | -0.23*** | -0.25*** | -0.18*** | -0.06 | -0.16*** | -0.36*** | 1 | |
| **Intrusion Change** | 0 | 0.18*** | -0.15*** | -0.14*** | -0.19*** | -0.14*** | -0.02 | -0.14*** | -0.06 | 0.19*** | 1 |