Comprehensive Results in Social Psychology

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/rrsp20

# Social value orientation, subjective effectiveness, perceived cost, and the use of protective measures during the COVID-19 pandemic in Germany

Johannes Leder , Alexander Pastukhov & Astrid Schütz

**To cite this article:** Johannes Leder , Alexander Pastukhov & Astrid Schütz (2020): Social value orientation, subjective effectiveness, perceived cost, and the use of protective measures during the COVID-19 pandemic in Germany, Comprehensive Results in Social Psychology, DOI: 10.1080/23743603.2020.1828850

**To link to this article:** https://doi.org/10.1080/23743603.2020.1828850

Published online: 05 Nov 2020.

COMPREHENSIVE RESULTS IN SOCIAL PSYCHOLOGY
https://doi.org/10.1080/23743603.2020.1828850

EASP European Association of Social Psychology
Routledge Taylor & Francis Group

ARTICLE



# Social value orientation, subjective effectiveness, perceived cost, and the use of protective measures during the COVID-19 pandemic in Germany

Johannes Leder, Alexander Pastukhov and Astrid Schütz

Department of Psychology, University of Bamberg, Bamberg, Germany

**ABSTRACT**

We investigated the influence of perceived protective value for the public, perceived self-protective value, and perceived cost of the behavior on the adoption of protective behavior during the COVID-19 pandemic. In a pilot study conducted when the lockdown was put in place in Germany, we investigated perceptions of the protective value and use of various protective behavioral measures against COVID-19. Although our sample (German general public, $N$ = 419; age = 38.07, $SD$ = 15.67; women = 71.1% [diverse = 0.5%]; students = 34.37%) consisted mostly of prosocially oriented individuals, we found that, above all, participants used protective measures that offered self-protection. In a second study conducted after the lock down in Germany had been lifted, which used a similar sample (German general public, $N$ = 253; age = 42.53, $SD$ = 16.03; women = 69.8% [diverse = 0.4%]; students = 24.10%), we observed the same results even after people had adapted to the threat. In addition, the second study showed a negative relationship between the perceived costs of a behavior and the frequency of its use. The two studies suggest that the use of protective measures during the COVID-19 pandemic is based on a cost-benefit perception. We conclude that health communication should focus on the perceived self-protective value of certain behaviors but should simultaneously emphasize their relatively low cost.

**ARTICLE HISTORY**
Received 24 April 2020
Accepted 23 September 2020

**Keywords**
Social-value orientation; COVID-19; protective behavior

Crises are times that challenge people to care for themselves and others. But as known from research in economics and psychology, individuals differ in their willingness to focus on the individual versus the public good (e.g. Fehr & Schmidt, 2005; Murphy & Ackermann, 2014; Ruch et al., 2017). The case of COVID-19 is especially tricky as people can infect others before they experience any symptoms themselves. Furthermore, the infection carries a risk that is much more serious to older people and people with existing medical conditions. Thus, it is often a burden for an individual to adopt preventive measures even when such measures will have positive consequences for the public.

Around the world, governments are attempting to curb the spread of the Coronavirus (COVID-19). However, democratic societies are relying on individuals to use protective

**CONTACT** Johannes Leder Johannes.leder@uni-bamberg.de Department of Psychology, University of Bamberg, Bamberg 96045, Germany

measures to slow the spread of COVID-19. Whether an individual uses a specific protective measure depends on whether the individual considers the protective behavior to be effective (Floyd et al., 2000; Peters et al., 2013; Sheeran et al., 2014).

In the current COVID-19 outbreak, protective measures can serve either the individual, which means that the measures taken by an individual will reduce the likelihood that the individual taking the action will become infected, or they can serve the public by reducing the likelihood that the individual will spread the infection to others. However, studies have yet to investigate the extent to which people base their decision to use a certain protective measure on the subjective protective value for themselves or the subjective protective value for the public.

Based on theorizing and empirical research in decision-making, prosocial behavior in general (e.g. Hilbig et al., 2014) and social risk-taking in particular (Leder & Betsch, 2016) are linked to personality traits. We investigated whether individual differences in the willingness to use protective measures depend on whether the measures protect primarily the self or the public and whether this difference can be linked to the individual's social value orientation (SVO; Van Lange, 1999).

SVO (Van Lange, 1999) reflects three social motives that guide decisions that have social and personal consequences: cooperation, competition, and individualism. SVO motives influence behavior because they modulate the weight individuals assign to the consequences that an interpersonal decision has for themselves and others (Van Lange, 1999). High SVO (i.e. a stronger prosocial orientation) is positively related to choices that maximize joint outcomes, whereas low SVO is associated with choices that maximize personal payoffs (Balliet et al., 2010; Baumert et al., 2014; Fung et al., 2012; Hilbig & Zettler, 2009; McClintock & Allison, 1989). SVO also seems to be linked to behaviors that impact public health as research on vaccination behavior has shown that SVO is associated with intention to vaccinate (Böhm et al., 2016).

We propose that the mechanism underlying the decision to use certain protective behaviors is guided by a cost-benefit perception akin to the process underlying risk-taking behaviors (Blais & Weber, 2006; Weber & Hsee, 1998). Thus, for the context of protective behavior, we propose that the use of behaviors depends on the perceived cost and perceived protective value associated with these behaviors. Furthermore, we speculate that the weighting of cost as well as the protective value for the self and the public will vary with the actor's SVO.

After experiencing negative events, people generally adjust quickly in order to avoid negative consequences (Biele et al., 2009; Denrell & March, 2001). This results in the behavior of initially avoiding contexts in which the threat may be encountered. However, even after very severe events, with increasing experience, people quickly return to the habits they fostered before the event as suggested by research comparing tourists and locals during the second intifada in Israel (Yechiam et al., 2005) or after the London bombings in 2005 (Burns et al., 2012). Importantly, research has not yet addressed the question of how individual differences in SVO affect behavior regarding risks to the self and the public. A pandemic is such a case because, even though some behaviors are useful overall, certain behaviors offer more benefit to the self, whereas other behaviors offer more benefit to the public. By conducting a pilot study (Study 1), which was conducted immediately after the restrictions were put in place by the government, and a second study (Study 2), conducted after the restrictions have been eased, we were able

to investigate the impact of SVO on public health protective behavior as a function of a cost-benefit perception during a pandemic.

### *Overview of studies*

The current pandemic has imposed important constraints on behavior. For example, social distancing was mandatory, and movement has been severely restricted. For these reasons, behavioral measures might not have been closely linked to the attitudes of individuals but were to some extent the result of external forces. In a pilot study, conducted at the beginning of "the lock down" in Bavaria, we assessed various health protective behaviors as well as their perceived protective value for the self and the public. Hypotheses were preregistered via OSF for Study 1 and preregistered with the Comprehensive Results in Social Psychology for Study 2. For clarity we refer to OSF-preregistered and CRSP-preregistered. We OSF-preregistered two hypotheses for Study 1: (a) With increasing SVO, protective measures will be seen as more effective for protecting the public, and (b) High SVO will result in more use of measures that are expected to protect the public, and low SVO will result in more reliance on measures that are expected to protect the self. We carried out a second CRSP-preregistered study, which build on the pilot study after the restrictions had been eased to examine how reported behaviors changed and whether the effect of SVO was stronger when external constraints were reduced. Furthermore, by measuring the perceived costs of protective behaviors, the second study allowed us to examine the motivational process underlying protection and whether this process is moderated by SVO. We propose that because SVO modulates the weight individuals assign to the consequences that an interpersonal decision has for themselves and others this should influence the importance of perceived cost, protective value to the public, and self-protective value for the various behaviors. Importantly, competing with this hypothesis and replicating the pilot study (Study 1), we hypothesized that there may not be an interaction between SVO and self-protection or public protection, but a main effect of self-protection, which would be stronger than the effect of public protection. Furthermore, in a pandemic most protective behaviors are of public value; thus, cost should be less important for high SVO individuals because high SVO individuals are more motivated to increase social welfare. Thus, we expected to find an interaction of SVO with cost in which cost influences the adoption of protective measures less for individuals with high SVO than for individuals with low SVO.

## Pilot study (Study 1)

We OSF-preregistered the pilot study (the preregistration, data, and analysis script can be found here: https://osf.io/8faeb), in which we sought to address the question of whether SVO is related to the use of protective measures against COVID-19 depending on the protective value of the behavior expected for oneself or the public. We OSF-preregistered two hypotheses: (a) With increasing SVO, protective measures will be seen as more effective for protecting the public, and (b) High SVO will result in more use of measures that are expected to protect the public, and low SVO will result in more reliance on measures that are expected to protect the self. To test these hypotheses, we conducted an online study with a convenience sample from the general population in Germany.

## Method

### Participants and design

We recruited participants from our local participant database (ORSEE; Greiner, 2015) and via posts on university Facebook groups. We collected data from a sample of $N = 419$ individuals, age = 38.07 ($SD = 15.67$), women = 71.1% (diverse = 0.5%), students = 34.37% (see the supplement Table S1 for a more detailed description). We excluded seven participants who used extreme values (1 or 101) for all responses in at least one category. Participants completed an online survey available from 3/20/2020 until 3/23/2020. As a thank you for participating, respondents were invited to enter their names in a lottery for six Amazon gift certificates of 20€ each.

### Materials

We measured social value orientation (SVO; Van Lange et al., 1997) with the slider measure (Murphy et al., 2011) and asked participants to rate 17 behaviors with respect to their protective value for themselves and the public. We then asked participants the extent to which they were currently engaging in these behaviors. As control variables, we assessed Honesty-Humility with the HEXACO-60 (Ashton & Lee, 2007) and trait anxiety (German version of the BFI-2; Danner et al., 2016).

***Personality measures.*** SVO was measured with the primary items from the SVO slider measure (Murphy et al., 2011). Honesty-Humility was measured with the HEXACO-60 subscale (Lee & Ashton, 2018). To assess trait anxiety, we used the four items that formed the anxiety subscale from the BFI-2 (Danner et al., 2016). The Cronbach's alpha values, means, and standard deviations of the scale scores are reported in Table 1.

***Protective behaviors.*** The participants rated 17 behaviors (see Figures 2 and 3 for the complete list), 14 of which had been endorsed as protective measures against COVID-19 by the WHO (www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public). The three other behaviors consisted of (a) one behavior that was not protective (attending Coronavirus parties), (b) one behavior that had a high protective value for the public (shopping for members of high-risk groups), and (c) one behavior that had more protective value for the self than for the public (stockpiling food). All three behaviors were used as a check for the consistency of responses. These three behaviors were analyzed along with all the other items. Responses to the item "attending Coronavirus parties" were reversed, and the item was renamed "avoiding Coronavirus parties" so that all behaviors were protective and not hazardous. The order of the behaviors in Figures 2 and 3 was based on the reported frequency of use. However, their order was randomized in the survey.

**Table 1.** Internal consistencies, means, and standard deviations of the scales.

| Scale | Cronbach's alpha | *M* | *SD* |
|---|---|---|---|
| Honesty-Humility | 0.71 | 3.63 | 0.59 |
| Anxiety | 0.77 | 3.09 | 0.82 |

The perceived protective value of each behavior for the self and the public was measured with responses to the items "the behavior protects me ('Verhalten schützt mich')" and "the behavior protects the public ('Verhalten schützt die Allgemeinheit')," respectively. Each behavior was rated on a slider measure with the anchors *not at all* to *totally*, and no numeric values were presented. Both items were portrayed with sliders next to each other so that participants could quickly complete the questionnaire. Participants rated each of the 17 behaviors in a matrix.

We used a similar slider measure to assess the frequency with which the participants engaged in specific protective behaviors. The question "How often do you show this behavior these days?" ("Wie häufig zeigen Sie derzeit aufgrund von COVID-19 die folgenden Verhaltensweisen?") was used but with the anchors *never* to *very often*.

As stated in the OSF-preregistration and because the study is part of a larger project, we also assessed risk perception, attitudes toward measures for protecting against COVID-19, flexible goal adjustment, tenacious goal pursuit, and state anxiety.

### Procedure

Participants gave their consent and then responded to the survey, which had the following sequence: (a) SVO slider measure (Murphy et al., 2011), (b) HEXACO-60 items from the Honesty-Humility subscale (Ashton & Lee, 2007), (c) items assessing trait anxiety, (d) items from the FLEXTEN (Bak & Brandtstädter, 1998), (e) ratings of the protective value of behaviors for the self and the public, (f) risk perception with respect to COVID-19, (g) attitudes toward COVID-19 measures, (h) reports on the frequency of engaging in specific protective measures, and (i) short version of the state anxiety measure (Grimm, 2009). Finally, participants were able to register for a lottery for six Amazon gift certificates of 20€ each.

### Statistical methods

The analysis was performed in R version 3.6.3 (R Development Core Team, 2020) using *Tidyverse* packages (Wickham et al., 2019). We used the libraries *glmmTMB* (Brooks et al., 2017) for generalized linear mixed model (GLMM) analyses, *brms* (Bürkner, 2018) for Bayesian GLMM, *psych* (Revelle, 2019) for psychometric tools, and *performance* for the Bayes Factor, the likelihood ratio test, and the model weight analysis.

The slider ratings (i.e. responses regarding the self-protective value, the protective value for the public, and the frequency of use) had values of 1–101 and were transformed by subtracting 1 from the raw response and dividing it by 100 so that the final values ranged from 0 to 1.

## Results

First, as OSF preregistered, we checked the validity of the slider measure of social value orientation (SVO) in our sample. SVO was correlated with Honesty-Humility, $r$ =.29, $p < .001$, Bayes Factor > 1000 but not with trait anxiety, $r = .019$, $p = .6834$, Bayes Factor = 0.12. Inspecting the distribution of SVO in the sample depicted in Figure 1 showed that 92.2% of participants fell into the prosocial type.

Participants responded consistently to the questions regarding protective behaviors. *Attending Coronavirus parties* (reversed and renamed "avoiding Coronavirus parties" for the analysis) received low ratings for protective value and use. Participants were sensitive

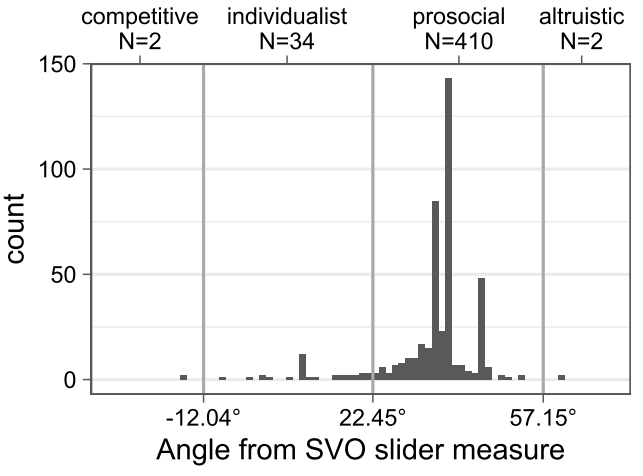



**Figure 1.** The distribution of SVO scores from the slider measure as represented by angles.

to the objective protective value of behavior and rated *shopping for members of high-risk groups* as being particularly valuable for the public, and they rated *stocking up on food* as particularly valuable for the self. In general, the density of the responses was concentrated at the extreme positive endpoints of perceived protective value for the self and the public with some behaviors (e.g. *not shaking hands, washing hands for 30 seconds*) exhibiting almost no variation (see Figure 2).

The frequency of the use of each behavior clearly depended on the perceived protective value for the public but depended more on the perceived self-protective value (see Figure 3). Behaviors fell into two clusters: behaviors that people engaged in frequently and behaviors that people engaged in less frequently with almost no middle ground between the two.

To test the effect of the self- and public protective values on the frequency of the behavior, we ran a generalized linear mixed model, beta family with self-protection, public protection, and their interactions with SVO as fixed factors and with behavior and participant ID as random factors. Behavior and participant ID were used as random factors (intercepts only). 95% credible intervals (CI) were computed from posterior distributions fitted by using Bayesian GLMM. The Bayes Factor (BF), likelihood ratio test (LRT and pLRT), and model weight (Weight) were computed by comparing a model without the corresponding predictor with the full model. A weight above 0.5 implies that removing a predictor improves the model by reducing its complexity without having a substantial effect on its predictive performance (see Table 2 for the results).

We found that it was the perceived self-protective value of a behavior that was most important for its use, whereas public protective value was only a secondary concern. Behaviors that were low on self-protective value (e.g. *wearing face masks, wearing gloves*) were reported less frequently despite having medium scores regarding their perceived protective value for the public.

## Discussion

With the pilot study, we sought to investigate the effect of social value orientation (SVO) on the perception and use of measures that protect against COVID-19. We found that

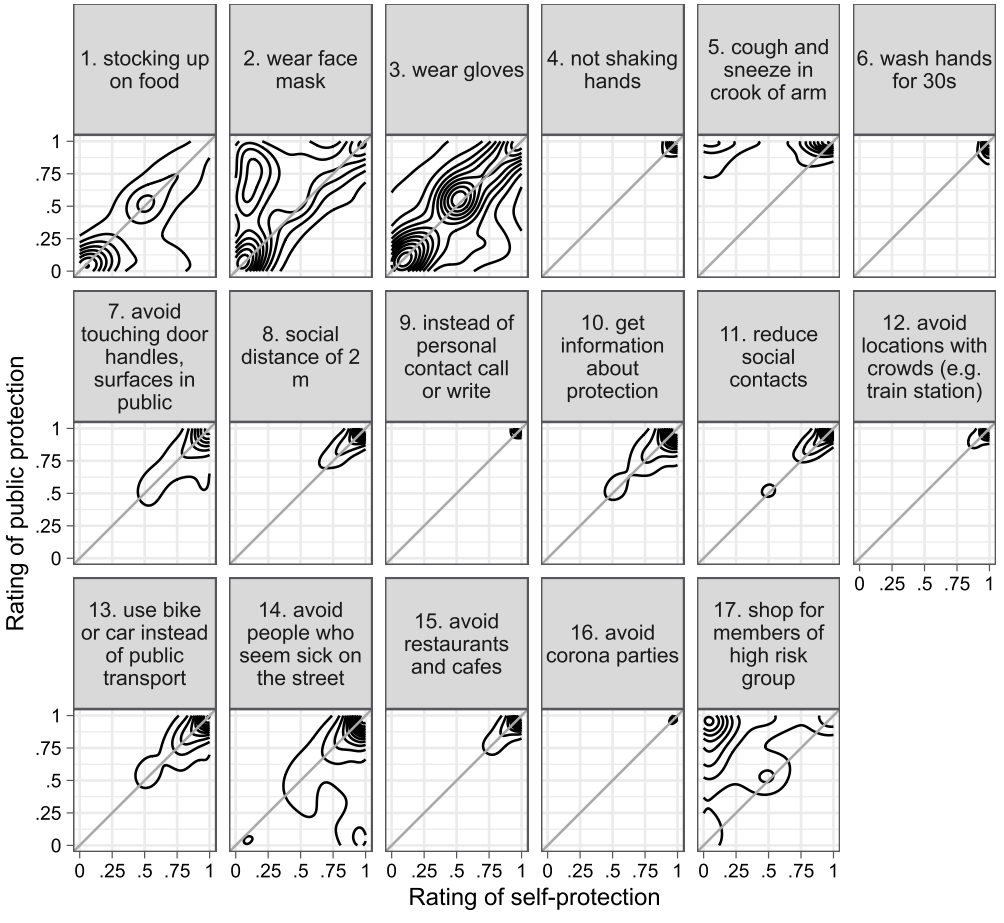
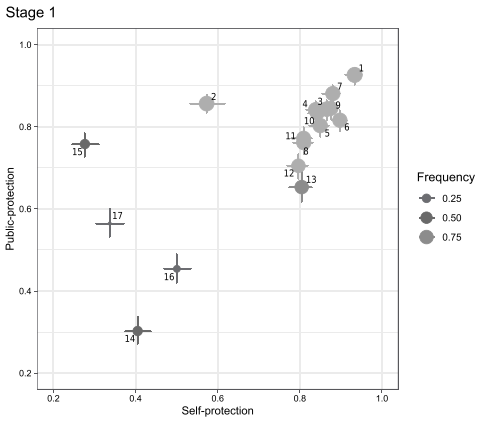



**Figure 2.** Distribution of behavior ratings for self-protection versus public protection. The geometric density depicts the perceived self-protective value on the x-axis against the perceived protective value for the public on the y-axis. See the supplementary information for the same data replotted for different SVO levels.

people used protective measures that were best for protecting themselves and that measures that offered protective value to the public were only a secondary concern. This was found despite the fact that most participants (92.2%) in the present sample could be classified as *prosocial* according to the SVO measure.

The pilot study showed that health communication was effective in influencing people's perceptions. Protective measures such as *social distancing* and *washing hands*, which had been communicated as being effective ways to protect the self and the public, were perceived as such and adopted. Other measures that had been portrayed over and over again as important for the public but not for self-protection (e.g. *wearing face masks*) were used much less often. To increase the perceived self-protective value of protective behavior, future health communication could build on this finding and elaborate on how, in the long run, public prevention will also affect the individual and the people the people the individual is closest to.




| | | |
|---|---|---|
| 1 | avoid corona parties | .96 \| .97 \| .98 |
| 2 | cough and sneeze in crook of arm | .89 \| .92 \| .93 |
| 3 | not shaking hands | .88 \| .9 \| .92 |
| 4 | reduce social contacts | .87 \| .89 \| .91 |
| 5 | avoid restaurants and cafes | .85 \| .88 \| .9 |
| 6 | wash hands for 30s | .84 \| .86 \| .88 |
| 7 | instead of personal contact call or write | .84 \| .86 \| .88 |
| 8 | use bike or car instead of public transport | .83 \| .86 \| .88 |
| 9 | avoid locations with crowds (e.g. train station) | .82 \| .84 \| .86 |
| 10 | social distance of 2 m | .8 \| .82 \| .84 |
| 11 | get information about protection | .78 \| .81 \| .84 |
| 12 | avoid touching door handles, surfaces in public | .73 \| .76 \| .79 |
| 13 | avoid people who seem sick on the street | .71 \| .75 \| .77 |
| 14 | stocking up on food | .28 \| .31 \| .35 |
| 15 | shop for members of high risk group | .28 \| .31 \| .35 |
| 16 | wear gloves | .13 \| .15 \| .18 |
| 17 | wear face mask | .05 \| .06 \| .08 |

**Figure 3.** The reported frequency of behavior versus average self- and public protection ratings. The reported frequency of behavior (depicted by dot size and color, see also the table to the right of the figure) plotted against the average self- and public protection ratings. The dots' positions and the middle values in the table show mean values. Error bars and flanking values show 95%-bias-corrected accelerated confidence intervals.

**Table 2.** Results for generalized linear mixed models (GLMMs) beta family.

| Predictor | Estimate | 95% CI | *z* | *p* | BF | LRT | $p_{LRT}$ | Weight |
|---|---|---|---|---|---|---|---|---|
| SVO angle | 0 | [−0.01, 0.01] | 0.64 | 0.5218 | 65.84 | 0.41 | 0.521 | 0.57 |
| Self | 0.86 | [0.42, 1.32] | 3.76 | 0.0002 | 0.06 | 14.28 | 0.0002 | 0 |
| Public | 0.5 | [0.01, 0.97] | 2.12 | 0.0338 | 8.62 | 4.48 | 0.0343 | 0.43 |
| Self × Public | −0.25 | [−0.53, 0.03] | −1.84 | 0.0651 | 14.68 | 3.41 | 0.0647 | 0.71 |
| SVO × Self | 0 | [−0.01, 0.01] | 0.25 | 0.8063 | 78.5 | 0.06 | 0.8063 | 1 |
| SVO × Public | 0 | [−0.01, 0.02] | 0.48 | 0.6299 | 72.02 | 0.23 | 0.6297 | 0.57 |

Logit link for proportion, log link for precision.

We found no evidence that SVO influenced either the perception or the frequency of the use of protective measures. However, the majority of the present sample was categorized as prosocial, and thus, the finding that SVO did not influence the perception of protective measures or their use could not be generalized. But the homogeneity of the sample also increased the importance of the present study because it showed that even individuals who are prosocial and who are motivated by cooperation and fairness seek first to protect themselves in the case of a pandemic.

Participants in the pilot study were volunteers and, as the data on SVO indicated, they were very prosocial in general. Furthermore, the responses in the current study were based on self-reports and are therefore not objective indicators. For example, self-reports may have been affected by social desirability so that people wanted to present themselves as behaving in socially approved ways. Furthermore, the restrictions imposed by the government may have induced relatively homogenous behavior overall.

The pilot study yielded two findings: The sample showed a high level of prosociality, and SVO did not predict protective behavior or the perception of protective value. We are proposing a second study to investigate (a) whether the immediate threat by the pandemic induced a tendency to respond in a more prosocial way on the SVO slider measure than individuals would typically do and (b) after restrictions are alleviated and adjustment

has occurred, whether protective behavior is a function of cost-benefit perceptions and whether these perceptions are linked to SVO. The results of the pilot study can also be explained on the basis of the assumptions that the situation induced high uniformity of behavior and that therefore SVO had no influence. In a second study that was conducted after restrictions are eased, behavior should be less uniform because situational pressure will be reduced. On the other hand, if SVO is the cause of the high uniformity, then high uniformity may also be observed in the second study. Furthermore, if SVO itself was affected by the situation, then the second study conducted after restrictions had been eased should find an increase on the SVO slider measure of people who are not prosocial, indicating an overall reduction in prosociality.

## Study 2

Study 2 investigated the process underlying health protective behavior in a pandemic and the possible impact of SVO and whether measured SVO of the sample was higher at the onset of the restrictions than after time has passed and people had adjusted to the threat. In Study 2, which occurred after the restrictions were eased, we used some participants who took part in the Study 1 and sampled additional participants from a similar population. Therefore, Study 2 allowed us to investigate changes in perceptions and behavior and also whether reported prosociality was influenced by immediate threat, such as at the onset of the pandemic. Extending the pilot study, we assessed the perceived cost of behaviors to better understand the motivational process underlying health protective behavior on the basis of perceived costs and benefits. We propose that SVO will influence the weights associated with perceived cost, protective value to the public, and self-protective value and that these weights will in turn impact behavior. In the pilot study we assessed self- and public protection on two independent scales. For this reason, we did not know whether participants perceived a conflict between protecting the self or protecting the public or not. For example, it is a possible explanation of the findings in the pilot, that prosocial individuals view self-protective measures a way to protect the public. For this reason, we included perceived conflict between self- and public protection for each behavior and carried out an exploratory analysis employing a mediation analysis.

### *Method*

#### *Participants and design*

We aimed to collect data from the participants who participated in Study 1. We had a total of $N = 292$ email addresses from people who participated in the pilot study. We aimed to recruit them to participate in the second study. We planned that if responses are less than $N = 200$, we would post our survey in the population, which was invited in the pilot, and then would compare responses from new respondents and previous respondents.

We received $N = 123$ responses from the original sample, for this reason we recruited $N = 131$ additional participants. We collected a total sample of $N = 254$ individuals, age = 42.53 ($SD = 16.03$), women = 69.8% (diverse = 0.4%), students = 24.1% (see the supplement Table S2 for a more detailed description).

The procedure was identical to the Study 1 and participants completed an online survey available from 5/27/2020 until 6/20/2020. As a thank you for participating, respondents were invited to enter their names in a lottery for six Amazon gift certificates of 20€ each.

### Materials

We used the same materials as in the pilot study to measure SVO (Murphy et al., 2011) and Honesty-Humility (HEXACO; Ashton & Lee, 2007) as well as anxiety (BFI-2; Danner et al., 2016). The perceived protective value of each behavior and the frequency of use was assessed using the same measures as in Study 1. The Cronbach's alpha values, means, and standard deviations of the scale scores for Study 2 are reported in Table 3.

We used the behaviors listed in Table 4. Changes from the pilot or added items are noted in the comments.

We added an item for assessing the cost associated with each behavior. The item was measured with a slider for each behavior, and only the end points were labeled. The item read "How strongly do you agree with the following statement regarding each behavior: It requires a lot of effort for me to perform this behavior" with the end points *not at all* to *totally* (German: Wie sehr stimmen Sie dieser Aussage zu: Es erfordert sehr viel Aufwand dieses Verhalten umzusetzen. Anker: überhaupt nicht – völlig).

Because the pandemic had been going on for some time we assessed personal experience with the following items which had the response yes and no:

- Are you currently sick with COVID-19? ("Sind Sie derzeit an COVID-19 erkrankt?")
- Where you personally sick with COVID-19? ("Waren Sie persönlich an COVID-19 erkrankt?")
- Do you know somebody personally who is sick with COVID-19? ("Kennen Sie jemanden persönlich, der derzeit an COVID-19 erkrankt ist?")
- Do you know somebody personally who has died of COVID-19? ("Kennen Sie jemanden persönlich, der aufgrund von COVID-19 verstorben ist?")
- Do you know somebody personally who has recovered from COVID-19? ("Kennen Sie jemanden persönlich, der von COVID-19 genesen ist?")

## Results

### Exclusion criteria

We planned to exclude participants who gave extreme responses (1 or 101) for all responses in at least one category. No participants were excluded.

We used participants' personal experience as a quasi-experimental factor in a regression that predicted the use of protective measures only when $n = 15$. This applied

**Table 3.** Internal consistencies, means, and standard deviations of the scales.

| Scale | Cronbach's alpha | *M* | *SD* |
|---|---|---|---|
| Honesty-Humility | 0.59 | 3.73 | 0.61 |
| Anxiety | 0.56 | 3.01 | 0.88 |

**Table 4.** List of protective behaviors.

| English | German | Comment |
|---|---|---|
| Stock up on food | Auf Vorrat einkaufen. | |
| Wear face mask in stores. | Gesichtsmaske in Geschäften tragen. | Added "store" |
| Wear gloves. | Handschuhe tragen. | |
| Don't shake hands. | Nicht die Hand geben. | |
| Sneeze or cough in the crook of the arm. | In die Armbeuge niesen oder husten. | |
| Wash hands with soap for 30 seconds. | Hände mit Seife für 30 Sekunden waschen. | |
| Do not touch doorknobs, grab handles or other objects in public. | Türklinken, Haltegriffe oder andere Gegenstände in der Öffentlichkeit nicht anzufassen. | |
| Keep a distance of 1.50 meters from other people. | Abstand von 1,50 Meter zu anderen Menschen einhalten. | Changed from 2 m to 1.50 m |
| Instead of talking to people in person, making phone calls, using video conferencing or writing. | Statt persönlich mit Leuten zu sprechen telefonieren, videokonferenzen nutzen oder schreiben. | Added Videoconferences |
| Find out about protective measures. | Sich über Schutzmaßnahmen informieren. | |
| Reduce social contact. | Soziale Kontakte reduzieren. | |
| Avoid places where there are many people (e.g., shopping center, train station). | Orte vermeiden an denen viele Menschen sind (wie z.B. Einkaufszentrum, Bahnhof). | |
| Use a car or bicycle instead of public transport. | PKW oder Fahrrad statt öffentlicher Verkehrsmittel nutzen. | |
| Go to corona parties. | Zu Coronaparties gehen. | |
| Avoid people who cough and look sick. | Personen die husten und krank wirken aus dem Weg gehen. | |
| Avoid visits to cafes and restaurants. | Café- und Restaurantbesuche meiden. | |
| Shop for people in the high-risk group. | Für Personen der Hochrisikogruppe einkaufen. | |
| Shop outside of peak hours. | Außerhalb der Stoßzeiten einkaufen. | New item |
| Sew face masks for others. | Gesichtsmasken für andere nähen. | New item |
| Use online instead of presence offers for shopping | Online statt Präsenzangebote zum Einkaufen nutzen. | New item |
| Allow older people to move ahead at the checkout in shops. | Ältere Personen an der Kasse vorlassen. | New item |
| Reduce private contacts to a maximum of one person outside the household. | Private Kontakte konsequent auf maximal eine Person außerhalb des Haushalts reduzieren. | New item |
| Address people who do not wear a face mask while shopping. | Menschen ansprechen die beim Einkaufen keine Gesichtsmaske tragen. | New item |
| Addressing people do not adhere to the distance rules. | Menschen ansprechen die Distanzregeln nicht einhalten. | New item |
| Visit grandparents/older relatives. | Großeltern/ältere Verwandte besuchen. | New item |
| Only shop where a security service monitors the number of people in the store. | Nur dort einkaufen, wo ein Sicherheitsdienst die Anzahl der Personen im Laden überwacht. | New item |
| Generally wear a face mask in public. | Generell in der Öffentlichkeit eine Gesichtsmaske tragen. | New item |

Changes from the pilot are noted in the comment column.

to the personal experiences knowing someone who is sick ($n$ = 16), knowing someone who died ($n$ = 93), and knowing someone who recovered ($n$ = 91).

### Transformations

The slider ratings (i.e. responses to self-protective value, protective value for the public, and frequency of use) had values of 1–101 and were transformed by subtracting 1 from the raw response and dividing it by 100 so that the final values ranged from 0 to 1.

### Statistical analysis

We used generalized linear mixed models (GLMMs) as in the pilot study (Study 1). The main difference from the pilot study was the inclusion of the (a) *behavioral cost* term and its interactions with SVO, self-protective value, and protective value for the public, (b) *public-self-protective-value conflict*, (c) variables capturing a respondent's personal experience (*knowing someone who is sick, knowing someone who died*, and *knowing someone who recovered*). For the Bayesian GLMM, we based the standard deviation of the priors on the results of the pilot study, but the priors themselves were centered at zero to ensure model neutrality. We tested the importance of the term by comparing the predictive performance of the reduced model (without the corresponding term) with the full model.

As an exploratory analysis, we examined whether self-protective value mediated the relationship between public protection and protective behavior.

For the between-study comparison, we had planned to fit the results of the second study to the same model as in the pilot study (i.e. without the *behavior cost* term), and we had planned to compare the posterior distributions for the individual terms via a permutation analysis. We did not implement this approach but instead explicitly modeled the difference between Study 1 and Study 2 for each behavior and measured variables. We used Bayesian hierarchical generalized linear models from the beta family with a logit link function, with the study as the only main factor and participant as a random factor for intercepts. We report the results in detail below.

### Preregistered comparison of studies 1 and 2

First, as CRSP-preregistered and as in Study 1, we checked the validity of the slider measure of social value orientation (SVO) in our sample. SVO was correlated with Honesty-Humility, $r$ = .29, $p$ < .001, Bayes Factor > 1000, but not with trait anxiety, $r$ = .04, $p$ = .49, Bayes Factor = 0.2. Both correlations were consistent with the correlations in Study 1 and with the literature (Baumert et al., 2014; Hilbig et al., 2013). Inspecting the distribution of SVO in the sample depicted in Figure 4 via both Kolmogorov-Smirnov and Wilcoxon rank sum tests showed that the distribution of participants across types and values was almost the same as in Study 1.

When comparing the perceived self-protective and public protective values and the frequencies of use for each behavior between the two studies, we found that, with the exception of wearing a mask, all these measures decreased. However, for most reported behaviors, the changes were not statistically significant (see Tables 5–7 and Figures S1–S3). The largest decreases were observed for specific types of social distancing, such as reducing social contact, avoiding cafés, writing or calling instead of meeting in person, and avoiding crowds. By contrast, although the perceptions of the self- and public

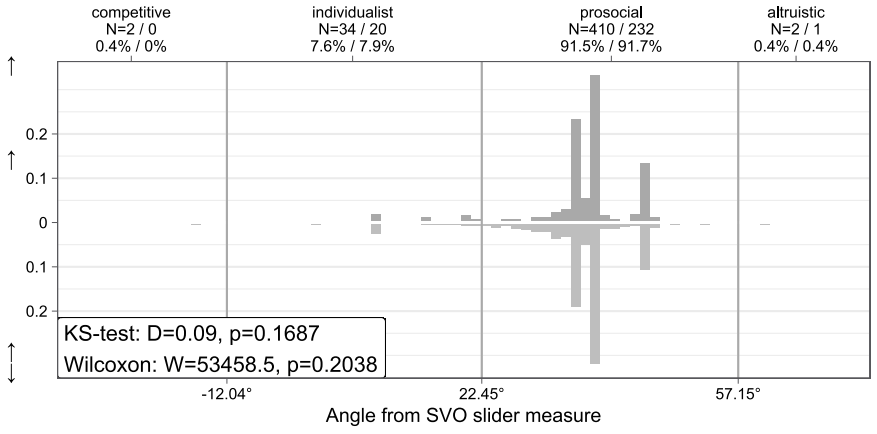



**Figure 4.** The distribution of SVO scores from the slider measure as represented by angles for studies 1 and 2. Study 2 is depicted in the upper plot and Study 1 in the plot mirrored below it. The absolute and relative frequencies for each discrete SVO type are given above the plots in the respective interval. The Study 1 values are given before the slash and the Study 2 values after the slash. The inset shows the results of Kolmogorov-Smirnov and Wilcoxon rank sum tests, which were used to compare the two samples.

**Table 5.** Results for bayesian generalized linear hierarchical models beta family logit link comparing perceived self-protective value in studies 1 and 2.

| Behavior | Log-odds | 95% CI | Odds | WAIC | BF | Weight |
|---|---|---|---|---|---|---|
| Stock up on food | −0.14 | [−0.35, 0.05] | 0.87 | −0.05 ± 1.42 | 1.4782 | 0.52 |
| Wear gloves | −0.68 | [−0.88, −0.47] | 0.51 | 19.69 ± 6.48 | <.001 | 0.06 |
| Not shake hands | −0.18 | [−0.35, 0] | 0.84 | 1.06 ± 1.48 | 0.7022 | 0.02 |
| Safe coughing | −0.27 | [−0.49, −0.05] | 0.76 | 2.01 ± 2.12 | 0.1797 | 0.05 |
| Wash hands | −0.17 | [−0.34, 0.01] | 0.84 | 1.3 ± 1.41 | 0.6974 | 0.00 |
| Avoid doorknobs | −0.31 | [−0.49, −0.12] | 0.73 | 4.51 ± 2.92 | 0.0161 | 0.00 |
| Social distancing | −0.13 | [−0.31, 0.04] | 0.88 | 0.43 ± 1.2 | 1.4598 | 0.20 |
| Write or call | −0.32 | [−0.49, −0.14] | 0.73 | 5.32 ± 2.61 | 0.008 | 0.00 |
| Find information | −0.25 | [−0.43, −0.07] | 0.78 | 2.8 ± 2.12 | 0.1328 | 0.00 |
| Reduce social contact | −0.35 | [−0.53, −0.15] | 0.70 | 5.64 ± 3.06 | 0.0052 | 0.00 |
| Avoid crowds | −0.25 | [−0.42, −0.08] | 0.78 | 3.2 ± 2.31 | 0.0853 | 0.00 |
| Use bike or car | −0.01 | [−0.18, 0.18] | 0.99 | −1 ± 0.1 | 4.3028 | 1.00 |
| Avoid sick people | −0.12 | [−0.3, 0.06] | 0.89 | −0.07 ± 1.03 | 1.9874 | 0.56 |
| Avoid cafes | −0.56 | [−0.76, −0.39] | 0.57 | 15.56 ± 5.05 | <.001 | 0.00 |
| Shop for high-risk | −0.18 | [−0.37, 0.02] | 0.84 | 0.65 ± 1.51 | 0.8289 | 0.22 |
| Reduce private contacts | −0.56 | [−0.76, −0.38] | 0.57 | 15.63 ± 5.08 | <.001 | 0.00 |
| Wear mask in public | 0.00 | [−0.19, 0.2] | 1.00 | −0.95 ± 0.09 | 3.8176 | 1.00 |

The reference level is the behavior at the time of Study 1.

protective values of wearing a mask did not change, the frequency of mask use significantly increased.

### *Preregistered analysis of the effect of protective value, perceived cost, perceived conflict, and personal experience on reported frequency of use*

The bivariate correlations between the measured protective behavior variables were computed using multilevel correlation, which accounts for the repeated measurements. For the correlations of the protective behavior variables with social value orientation, Honesty-Humility, and anxiety, the mean score across all measured protective behavior

**Table 6.** Results for bayesian generalized linear hierarchical models beta family logit link comparing the perceived public-protective value of studies 1 and 2.

| Behavior | Log-odds | 95% CI | Odds | WAIC | BF | Weight |
|---|---|---|---|---|---|---|
| Stock up on food | −0.07 | [−0.27, 0.13] | 0.93 | −0.69 ± 0.63 | 3.0772 | 1.00 |
| Wear gloves | −0.51 | [−0.7, −0.29] | 0.60 | 10.86 ± 4.7 | 0 | 0.03 |
| Not shake hands | −0.11 | [−0.3, 0.08] | 0.90 | −0.15 ± 0.85 | 2.2635 | 0.71 |
| Safe coughing | −0.09 | [−0.26, 0.09] | 0.91 | −0.6 ± 0.83 | 2.7632 | 1.00 |
| Wash hands | −0.21 | [−0.41, −0.05] | 0.81 | 1.71 ± 1.91 | 0.3317 | 0.03 |
| Avoid doorknobs | −0.39 | [−0.58, −0.19] | 0.68 | 6.76 ± 3.69 | 0.002 | 0.02 |
| Social distancing | −0.12 | [−0.29, 0.05] | 0.89 | 0.15 ± 1.07 | 1.7931 | 0.37 |
| Write or call | −0.39 | [−0.57, −0.21] | 0.68 | 8.08 ± 3.12 | 0.0006 | 0.00 |
| Find information | −0.18 | [−0.37, 0.01] | 0.84 | 0.73 ± 1.57 | 0.7668 | 0.20 |
| Reduce social contact | −0.38 | [−0.57, −0.19] | 0.68 | 7.31 ± 3.32 | 0.0013 | 0.00 |
| Avoid crowds | −0.29 | [−0.47, −0.12] | 0.75 | 4.04 ± 2.62 | 0.0306 | 0.00 |
| Use bike or car | −0.07 | [−0.24, 0.12] | 0.93 | −0.49 ± 0.69 | 3.1004 | 1.00 |
| Avoid sick people | −0.14 | [−0.36, 0.05] | 0.87 | −0.05 ± 1.23 | 1.5647 | 0.53 |
| Avoid cafes | −0.59 | [−0.77, −0.39] | 0.55 | 15.86 ± 5.24 | <.001 | 0.00 |
| Shop for high-risk | −0.21 | [−0.41, −0.02] | 0.81 | 1.4 ± 1.9 | 0.4461 | 0.11 |
| Reduce private contacts | −0.61 | [−0.8, −0.41] | 0.54 | 18.25 ± 5.3 | <.001 | 0.00 |
| Wear mask in public | −0.03 | [−0.22, 0.18] | 0.97 | −0.98 ± 0.23 | 3.7024 | 1.00 |

The reference level is the behavior at the time of Study 1.

**Table 7.** Results for Bayesian generalized linear hierarchical models beta family logit link comparing the frequency of the reported use of protective behaviors in studies 1 and 2.

| Behavior | Log-odds | 95% CI | Odds | WAIC | BF | Weight |
|---|---|---|---|---|---|---|
| Stock up on food | −0.21 | [−0.4, −0.02] | 0.81 | 1.39 ± 2.14 | 0.4138 | 0.19 |
| Wear gloves | −0.28 | [−0.45, −0.09] | 0.76 | 3.85 ± 2.12 | 0.0416 | 0.00 |
| Not shake hands | −0.08 | [−0.25, 0.1] | 0.92 | −0.28 ± 0.5 | 3.0728 | 1.00 |
| Safe coughing | −0.12 | [−0.29, 0.05] | 0.89 | 0.32 ± 0.87 | 1.7689 | 0.09 |
| Wash hands | −0.14 | [−0.32, 0.03] | 0.87 | 0.53 ± 1.29 | 1.2519 | 0.18 |
| Avoid doorknobs | −0.30 | [−0.48, −0.11] | 0.74 | 4.11 ± 2.88 | 0.0289 | 0.01 |
| Social distancing | −0.06 | [−0.22, 0.12] | 0.94 | −0.66 ± 0.58 | 3.7021 | 1.00 |
| Write or call | −0.53 | [−0.71, −0.34] | 0.59 | 15.55 ± 5.06 | <.001 | 0.00 |
| Find information | −0.42 | [−0.61, −0.24] | 0.66 | 8.53 ± 3.8 | 0.0003 | 0.00 |
| Reduce social contact | −0.65 | [−0.83, −0.48] | 0.52 | 23.82 ± 6.34 | <.001 | 0.00 |
| Avoid crowds | −0.49 | [−0.66, −0.31] | 0.61 | 13.04 ± 4.74 | <.001 | 0.00 |
| Use bike or car | −0.24 | [−0.43, −0.06] | 0.79 | 2.37 ± 1.82 | 0.1799 | 0.00 |
| Avoid sick people | −0.11 | [−0.3, 0.09] | 0.90 | −0.36 ± 0.98 | 2.3597 | 0.88 |
| Avoid cafes | −0.54 | [−0.74, −0.36] | 0.58 | 14.44 ± 4.53 | <.001 | 0.00 |
| Shop for high-risk | −0.46 | [−0.65, −0.27] | 0.63 | 9.65 ± 4.03 | 0.0001 | 0.00 |
| Reduce private contacts | −1.31 | [−1.52, −1.13] | 0.27 | 73.99 ± 11.48 | <.001 | 0.05 |
| Wear mask in public | 0.79 | [0.61, 0.99] | 2.20 | 30.35 ± 6.71 | <.001 | 0.00 |

The reference level is the behavior at the time of Study 1.

variables was used for each respondent. As can be seen, the responses to the protective measures were all significantly correlated, but there was only one significant correlation out of 17 between the individual difference measures (SVO, Honesty-Humility, and Anxiety) and the responses to the protective measures (see Table 8).

As in Study 1, the participants responded consistently to the questions about protective behaviors. *Attending Coronavirus parties* (reversed and renamed "avoiding Coronavirus parties" for the analysis) received low ratings for protective value and use. Participants were sensitive to the protective value of behavior and rated *shopping for members of high-risk groups* as particularly valuable for the public, and they rated *stocking up on food* as particularly valuable for the self. In contrast to Study 1, the density of the responses was not as concentrated at the extreme positive endpoints of perceived

**Table 8.** Bivariate correlations for all measures.

| Parameter 1 | Parameter 2 | *r* | 95% CI | *T* | *df* | *p* | *Obs* |
|---|---|---|---|---|---|---|---|
| Self-prot. value | Public prot. value | 0.61 | [0.59, 0.62] | 62.67 | 6742 | <.001 | 6744 |
| Self-prot. value | Perceived cost | −0.19 | [−0.21, −0.17] | −15.92 | 6742 | <.001 | 6744 |
| Self-prot. value | Conflict publ.-self | −0.24 | [−0.26, −0.22] | −20.51 | 6742 | <.001 | 6744 |
| Self-prot. value | Rep. frequency | 0.57 | [0.55, 0.58] | 56.39 | 6742 | <.001 | 6744 |
| Public prot. value | Perceived cost | −0.15 | [−0.17, −0.12] | −12.21 | 6742 | <.001 | 6744 |
| Public prot. value | Conflict publ.-self | −0.20 | [−0.22, −0.18] | −16.73 | 6742 | <.001 | 6744 |
| Public prot. value | Rep. frequency | 0.47 | [0.45, 0.49] | 43.58 | 6742 | <.001 | 6744 |
| Perceived cost | Conflict publ.-self | 0.34 | [0.32, 0.36] | 29.95 | 6742 | <.001 | 6744 |
| Perceived cost | Rep. frequency | −0.34 | [−0.36, −0.32] | −29.44 | 6742 | <.001 | 6744 |
| Conflict publ.-self | Rep. frequency | −0.28 | [−0.30, −0.26] [,] | −23.84 | 6742 | <.001 | 6744 |
| Self-prot. value | Honesty-Humility | −0.03 | [−0.15, 0.10] | −0.40 | 250 | 1.00 | 252 |
| Self-prot. value | SVO-Angle | −0.03 | [−0.15, 0.10] | −0.41 | 250 | 1.00 | 252 |
| Self-prot. value | Anxiety | 0.12 | [−0.01, 0.24] | 1.84 | 250 | 1.00 | 252 |
| Public prot. value | Honesty-Humility | 0.01 | [−0.11, 0.13] | 0.17 | 251 | 1.00 | 253 |
| Public prot. value | SVO-Angle | −0.02 | [−0.14, 0.10] | −0.32 | 251 | 1.00 | 253 |
| Public prot. value | Anxiety | 0.08 | [−0.05, 0.20] | 1.21 | 251 | 1.00 | 253 |
| Perceived cost | Honesty-Humility | −0.16 | [−0.28, −0.04] | −2.55 | 251 | .20 | 253 |
| Perceived cost | SVO-Angle | −0.11 | [−0.23, 0.01] | −1.75 | 251 | 1.00 | 253 |
| Perceived cost | Anxiety | −0.02 | [−0.15, 0.10] | −0.38 | 251 | 1.00 | 253 |
| Conflict publ.-self | Honesty-Humility | −0.20 | [−0.32, −0.08] | −3.29 | 250 | .02 | 252 |
| Conflict publ.-self | SVO-Angle | −0.13 | [−0.25, −0.01] | −2.08 | 250 | .62 | 252 |
| Conflict publ.-self | Anxiety | −0.06 | [−0.18, 0.07] | −0.92 | 250 | 1.00 | 252 |
| Rep. frequency | Honesty-Humility | 0.03 | [−0.09, 0.16] | 0.53 | 251 | 1.00 | 253 |
| Rep. frequency | SVO-Angle | 0.03 | [−0.09, 0.15] | 0.51 | 251 | 1.00 | 253 |
| Rep. frequency | Anxiety | 0.17 | [0.04, 0.28] | 2.69 | 251 | .15 | 253 |
| Honesty-Humility | SVO-Angle | 0.29 | [0.18, 0.40] | 4.89 | 251 | <.001 | 253 |
| Honesty-Humility | Anxiety | −0.15 | [−0.26, −0.02] | −2.34 | 251 | .34 | 253 |
| SVO-Angle | Anxiety | 0.04 | [−0.08, 0.17] | 0.69 | 251 | 1.00 | 253 |

The bivariate correlations between the protective behavior variables were controlled for the multilevel structure of the repeated measure within each respondent. The bivariate correlations between the protective behavior variables and the individual difference measures were based on the mean protective behavior score for each respondent and their score on the individual difference measure.

protective value for the self and the public, and all measures showed more variation (see Figure 5).

The frequency of the use of each behavior clearly depended on the perceived protective value for the public but depended even more on the perceived self-protective value (see Figure 6). The frequency of the use of behaviors differed in a continuous fashion, and a dichotomy of behaviors (i.e. behaviors used and not used, as in Study 1) was not observed. Also, the use of behaviors showed higher variance than in Study 1.

To quantify the effect of the self- and public protective values, the effect of experience with COVID-19, the perceived cost, and the effect of perceived conflict on the frequency of the behavior, we ran a generalized linear mixed model. 95% credible intervals (CIs) were computed from posterior distributions that were fitted by using Bayesian GLMM. The Bayes Factor (BF), likelihood ratio test (LRT and pLRT), and model weight (Weight) were computed by comparing a model without the corresponding predictor with the full model. A weight above 0.5 implies that the prediction is not important as removing it improves the model by reducing its complexity without having a substantial effect on its predictive performance. First, we ran a model with the same predictors as in Study 1. The results were consistent between the studies, although the strength of the effect for self-protective value increased, and public protective value decreased slightly (see Table 9).

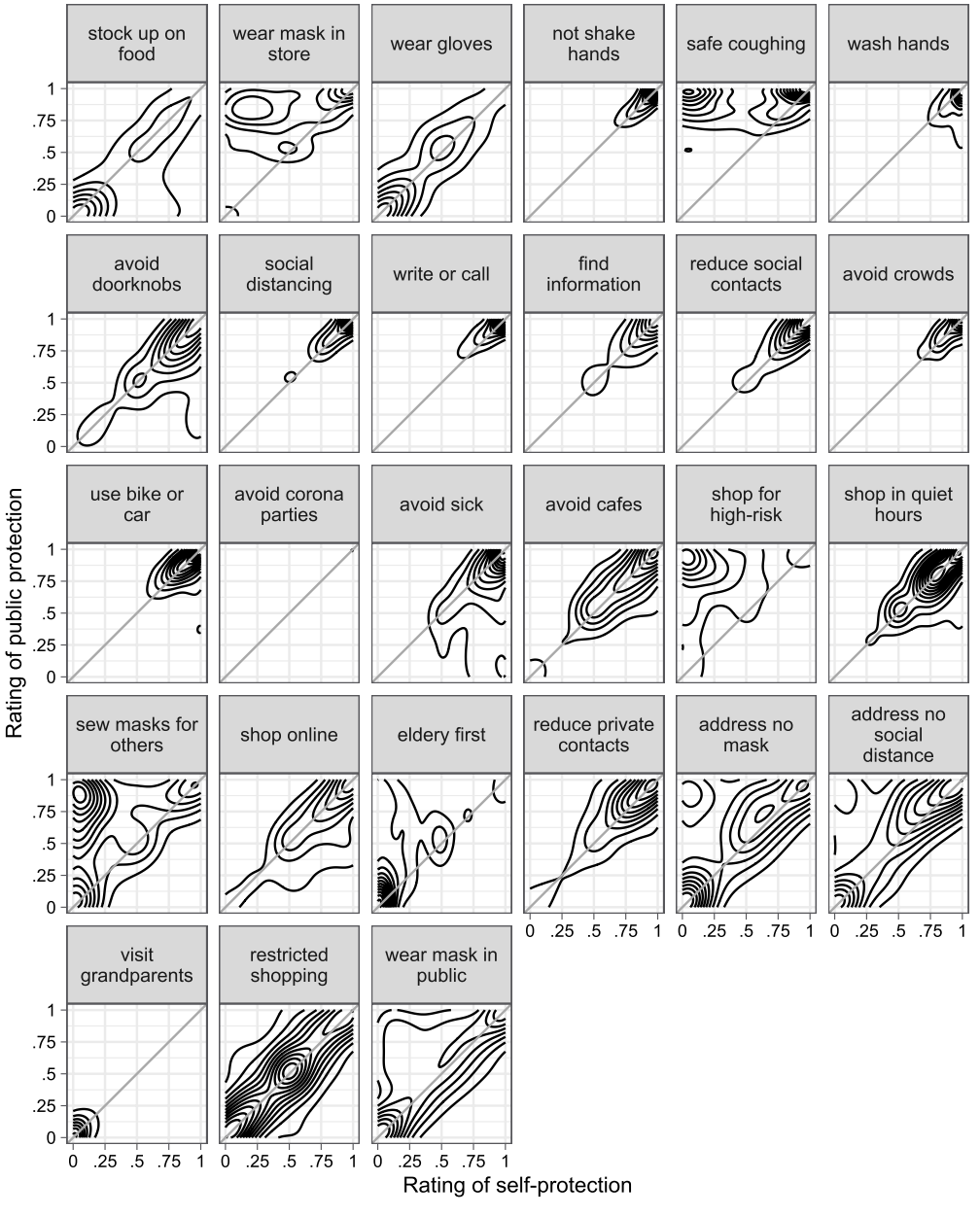
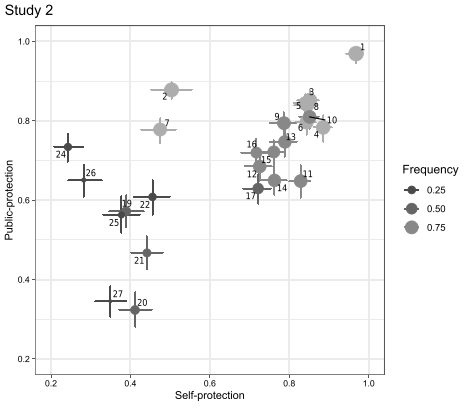



**Figure 5.** Distribution of behavior ratings for self-protection versus public protection. The geometric density depicts the perceived self-protective value on the x-axis against the perceived protective value for the public on the y-axis. See the supplementary information for the same data replotted for different SVO levels.

Then, we ran the model again, but we added the additional predictors, such as the perceived cost (and its interactions with self- and public protective values, and SVO), perceived conflict, and personal experience variables (see the results in Table 10). We found that the reported use of a protective behavior positively depended on its perceived




| | | |
|---|---|---|
| 1 | avoid corona parties | .98 \| .99 \| .99 |
| 2 | safe coughing | .87 \| .91 \| .93 |
| 3 | not shake hands | .86 \| .9 \| .92 |
| 4 | wash hands | .82 \| .85 \| .87 |
| 5 | social distancing | .81 \| .84 \| .86 |
| 6 | use bike or car | .76 \| .8 \| .83 |
| 7 | wear mask in store | .73 \| .76 \| .79 |
| 8 | write or call | .72 \| .76 \| .79 |
| 9 | reduce social contacts | .72 \| .75 \| .78 |
| 10 | avoid crowds | .71 \| .75 \| .78 |
| 11 | avoid sick | .7 \| .74 \| .77 |
| 12 | avoid cafes | .69 \| .73 \| .77 |
| 13 | find information | .69 \| .72 \| .76 |
| 14 | avoid doorknobs | .67 \| .71 \| .74 |
| 15 | shop in quiet hours | .6 \| .64 \| .68 |
| 16 | reduce private contacts | .48 \| .52 \| .57 |
| 17 | shop online | .44 \| .48 \| .53 |
| 18 | eldery first | .36 \| .4 \| .44 |
| 19 | wear mask in public | .3 \| .34 \| .38 |
| 20 | stock up on food | .28 \| .32 \| .36 |
| 21 | restricted shopping | .24 \| .27 \| .31 |
| 22 | address no social distance | .2 \| .24 \| .28 |
| 23 | visit grandparents | .21 \| .24 \| .27 |
| 24 | shop for high-risk | .2 \| .23 \| .27 |
| 25 | address no mask | .15 \| .17 \| .21 |
| 26 | sew masks for others | .08 \| .11 \| .15 |
| 27 | wear gloves | .08 \| .1 \| .13 |

**Figure 6.** The reported frequency of behavior versus the average self- and public protection ratings. The reported frequency of behavior (depicted by dot size and color, see also the table to the right of the figure) plotted against the average self- and public protection ratings. The dots' positions and the middle values in the table show mean values. Error bars and flanking values show 95%-bias-corrected accelerated confidence intervals.

**Table 9.** Results for generalized linear mixed models (GLMMs) beta family.

| Predictor | Estimate | 95% CI | *z* | *p* | BF | LRT | pLRT | Weight |
|---|---|---|---|---|---|---|---|---|
| SVO angle | 0.00 | [−0.01, 0.01] | −0.30 | .7670 | 78.75 | 0.09 | 0.7670 | 0.71 |
| Self | 1.15 | [0.74, 1.56] | 5.33 | .0000 | 0.00 | 28.60 | 0.0000 | 0.14 |
| Public | 0.34 | [−0.11, 0.79] | 1.47 | .1423 | 28.14 | 2.15 | 0.1430 | 0.43 |
| Self × Public | −0.22 | [−0.46, 0.03] | −1.69 | .0917 | 19.81 | 2.85 | 0.0915 | 0.71 |
| SVO × Self | 0.00 | [−0.01, 0.01] | −0.53 | .5967 | 71.50 | 0.28 | 0.5962 | 0.86 |
| SVO × Public | 0.01 | [0, 0.02] | 1.55 | .1221 | 24.87 | 2.39 | 0.1219 | 0.71 |

Model 1 in Study 2 with the same predictors as in Study 1.

**Table 10.** Results for generalized linear mixed models (GLMMs) beta family.

| Predictor | Estimate | 95% CI | z | p | BF | LRT | pLRT | Weight |
|---|---|---|---|---|---|---|---|---|
| SVO angle | 0.00 | [−0.02, 0.01] | −0.73 | .467 | 63.04 | 0.53 | 0.4671 | 0.57 |
| Self | 0.98 | [0.52, 1.42] | 4.23 | <.001 | 0.01 | 17.93 | 0.0000 | 0.14 |
| Public | 0.42 | [−0.07, 0.9] | 1.69 | .091 | 19.71 | 2.85 | 0.0911 | 0.29 |
| Public-self conflict | −0.27 | [−0.38, −0.16] | −4.88 | <.001 | 0.00 | 23.87 | 0.0000 | 0.29 |
| Cost | −0.60 | [−1, −0.23] | −3.07 | .002 | 0.73 | 9.45 | 0.0021 | 0.00 |
| Know sick | 0.14 | [−0.07, 0.37] | 1.27 | .206 | 36.99 | 1.60 | 0.2066 | 0.57 |
| Know recovered | −0.45 | [−0.7, −0.17] | −3.35 | <.001 | 0.34 | 10.99 | 0.0009 | 0.29 |
| Know fatal | 0.45 | [0.16, 0.7] | 3.27 | .001 | 0.43 | 10.53 | 0.0012 | 0.29 |
| Self × Public | −0.22 | [−0.49, 0.04] | −1.69 | .091 | 19.71 | 2.85 | 0.0912 | 0.71 |
| SVO × Self | 0.00 | [−0.01, 0.01] | 0.02 | .985 | 82.11 | 0.00 | 0.9849 | 0.57 |
| SVO × Public | 0.01 | [0, 0.02] | 1.36 | .173 | 32.40 | 1.86 | 0.1726 | 0.86 |
| SVO × Cost | 0.00 | [−0.01, 0.01] | 0.54 | .588 | 70.93 | 0.29 | 0.5883 | 0.57 |
| Self × Cost | −0.01 | [−0.3, 0.27] | −0.09 | .929 | 81.80 | 0.01 | 0.9295 | 1.00 |
| Public × Cost | −0.20 | [−0.49, 0.09] | −1.34 | .180 | 33.40 | 1.80 | 0.1798 | 0.43 |

Model 2 in Study 2 with the added predictors Cost, Conflict, and Personal Experience.

cost, public protective value, and self-protective value. The strongest positive effect for the use of protective measures was when behaviors were perceived as having a high self-protective value. Based on the point estimates, the effect of self-protective value was almost twice as strong as the effect of public-protective value. Comparing the sizes of the two effects on the basis of their 95% CIs also showed that the estimates were significantly

different. Behaviors that were low on self-protective value (e.g. *wearing a face mask in public, shopping for members of a high risk group*) were reported less frequently despite having medium-sized scores for their perceived protective value.

In addition, the conflict between public and self-protection reduced the use of a behavior, and so did perceived cost. Specifically, the behaviors that were associated with higher cost (e.g. reducing social contacts, wearing a mask in public) were reported less frequently. Similarly, the behaviors that were perceived as more costly on average (e.g. addressing a lack of social distancing in others or addressing people who are not wearing masks) generally had low frequencies. It was also apparent from the correlation in Table 8 that for these behaviors, the perceived conflict between self-protection and public protection was higher.

Furthermore, we found that personal experience altered the frequency of use of protective measures. Knowing someone who is currently sick had no effect. However, knowing someone who had recovered from COVID-19 reduced the reported frequency of the use of protective measures, whereas knowing someone with a fatal outcome increased it.

### *Exploratory analysis*

We examined whether the perceived conflict between self versus public protection and the perceived cost of using a specific protective measure were related to SVO, but we did not find evidence for this assumption as was apparent from the near-zero correlations (see Table 5) and the near-vertical distribution of responses regarding the perceived conflict between public and self-protection (see Fig SX) or perceived cost (see Fig SX) on SVO. To investigate the possibility that respondents view behaviors with high self-protective value as a way to protect the public, we also ran an exploratory mediation analysis. We carried out the mediation in a Bayesian statistical framework by estimating the indirect effect on the basis of the proportion of betas for the indirect effect (a * b path) that were significantly different from zero (i.e. 95% of the betas > 0). We found only a small nonsignificant indirect effect (87.4% of the betas > 0).

## General discussion

The two studies investigated the motivation underlying the use of protective measures against COVID-19. Study 1 was conducted immediately after the restrictions were put in place by the government, whereas Study 2 was conducted when the government had eased up on the restrictions. We measured participants' trait Honesty-Humility (Ashton & Lee, 2007), social value orientation (Murphy & Ackermann, 2014), and trait anxiety (Danner et al., 2016). The samples in Studies 1 and 2 were nearly identical with regard to personality and demographic variables. Respondents' perceived self-protective value, public protective value, and use of various protective measures were assessed. Study 2 also examined perceived cost and perceived conflict between public and self-protective value.

Both Studies 1 and 2 found that the self-protective value and the public-protective value of protective behaviors increased their use, but self-protective value was the primary concern, whereas the protective value to the public was only secondary.

However, we did not find an association between social value orientation and the perception of protective measures as well as their use in either study. Study 2 showed that besides the protective value of a behavior, the specific costs that are perceived to be associated with a behavior also influenced how often people engaged in it. This provided evidence that the mechanism underlying the decision to use certain protective behaviors against COVID-19 is guided by a cost-benefit perception akin to the process that underlies risk-taking behaviors (Blais & Weber, 2006; Weber & Hsee, 1998) and health behaviors as suggested by protection motivation theory (Maddux & Rogers, 1983; Rogers, 1975).

We also observed that the extent of perceived conflict between the self-protective value and the public protective value of a specific behavior negatively influenced their use. Behaviors that were associated with a higher level of perceived conflict were used less frequently. Conversely, this means that frequently used behaviors were perceived as most likely not entailing a tradeoff between personal and public safety.

Finally, in Study 2, we found that personal experiences, particularly knowing someone who had recovered from COVID-19, led to less use of protective measures, whereas knowing someone who had died from the disease had the opposite effect. Such a dramatic weighting of single-case anecdotal evidence is a well-known effect of altered risk perception (Betsch et al., 2011; Slovic et al., 2005; De Wit et al., 2008). Thus, when communicating about COVID-19, it could be beneficial to focus on narratives rather on statistical information as suggested by Hinyard and Kreuter (2007).

The sample's responses to SVO were identical in Studies 1 and 2, suggesting that the immediate threat posed by the pandemic did not induce a tendency to respond in a more prosocial way on the SVO slider measure than individuals would typically do. On the basis of the similarity of the samples, the changes in the responses to the measured variables in Study 2 are particularly important when comparing responses to protective value and use between Studies 1 and 2, and two observations were especially salient. First, wearing masks became more frequent in Study 2 even though masks were not viewed as having a different protective value from the viewpoint expressed in Study 1. This may partly be due to the fact that masks are compulsory in shops and public buildings. By contrast, the ratings of behaviors that are specific examples of the more general tendency to engage in social distancing decreased. Whereas the decrease in using these behaviors was partly due to the end of the lockdown in Germany and therefore to greater freedom (e.g. being able to meet others in small groups), this does not explain the decrease in the perceived protective value. It is possible that wearing a mask subjectively led to an increased feeling of safety and thus led people to reduce their use of other preventative measures.

The reduction of social distancing behaviors may also be the result of adaptation and the experience of decreasing numbers and the successful flattening of the curve. The environment of the initial success of lowering the number of cases in Germany renders the situation a wicked learning environment (Hogarth et al., 2015). Such an environment is characterized by misleading cause-effect relationships. In the present case of the pandemic, respondents experienced an outcome that was not as negative as anticipated. An inference regarding the cause of that outcome (i.e. a strict enforcement of social distancing) was not drawn in many cases. Instead, many respondents apparently changed their perception of risk in concluding that the risk of being infected was not as high as previously thought and consequently lowered their perception of the protective value of

certain behaviors. By contrast, public communication, which suggests counterfactual thinking (e.g. by comparing the numbers for Germany vs. England) may have helped to point to the success of social distancing because England's decision to use social distancing measures came late, and their numbers of deaths per capita were the highest in Europe. In fact, in late July, when people came back from vacation, Germany experienced a second increase.

The situation after the first wave indeed presented a near-miss situation, which describes a situation in which an expected fatal incident did not occur, even though its likelihood of occurrence was high. Such an incident typically results in erroneously concluding that the risk is lower than had been previously assumed (Dillon & Tinsley, 2008). As a result, populations that have experienced near-misses are less prepared for future disasters (Dillon et al., 2014; Huang et al., 2016). As a consequence, in the current context of COVID-19, it seems extremely important to clearly communicate how the use of social distancing measures has reduced the spread of COVID-19.

In general, the current study shows that expectancy-value processes underlie protective behavior in the face of COVID-19. We found that, first and foremost, even prosocial individuals are motivated to protect themselves and weigh the cost of a given behavior when considering its use. Future health communication could build on this finding and elaborate on how public prevention will also affect the individual and the individual's close relations in the long run – and thus increase the perceived self-protective value of protective behavior.

### *Limitations*

The samples used in Studies 1 and 2 were predominantly prosocially oriented. Thus, responses might not reflect the perceptions and behaviors of the general public. Previous research has shown that people who voluntarily participate in research typically have higher values on openness to experience and agreeableness (Marcus & Schütz, 2005). However, it is also possible that this prosocial orientation reflects the context of a crisis. The second study ruled out this second possibility and suggests that the sample was prosocial due to self-selection. Thus, the general public is probably less prosocially motivated and thus even less inclined to adopt behaviors that protect others.

As the studies were advertised as studies "about perceptions of the Coronavirus," personal interest and relevance may have had an additional impact on participation because interest in a topic is another factor that motivates people to participate in research (Marcus et al., 2007).

Third, the responses in the current study were based on self-reports and were therefore not objective indicators. Self-reports may have been affected by social desirability, and respondents may thereby have presented themselves as behaving in a way that the public would approve of. Thus, actual behavioral data may be even more extreme, that is, self-protective value may be even more important. Finally, and most importantly, the present studies were cross-sectional, and therefore, causal inferences cannot be drawn.

## Conclusions

We reported that even prosocially oriented individuals first and foremost seek self-protective measures and that public protection is only a secondary motive. Whereas the use of a behavior increased as the protective value of the behavior increased, the opposite was true for perceived cost and perceived conflict between self- and public protection. Thus, in order to increase adoption of protective behaviors, when communicating the importance of a public protective behavior, the emphasis should be on how, in the long run, public prevention will positively affect the individuals themselves and their close relations and does not come at a high cost.

## Acknowledgments

We thank Jane Zagorski for language editing.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## ORCID

Johannes Leder http://orcid.org/0000-0002-6413-4513
Alexander Pastukhov http://orcid.org/0000-0002-8738-8591
Astrid Schütz http://orcid.org/0000-0002-6358-167X

## References

Ashton, M. C., & Lee, K. (2007). Empirical, theoretical, and practical advantages of the HEXACO model of personality structure. *Personality and Social Psychology Review*, *11*(2), 150–166. https://doi.org/10.1177/1088868306294907

Bak, P. M., & Brandtstädter, J. (1998). Flexible goal adjustment and tenacious goal pursuit as coping resources: Hints to a regulatory dilemma. *Zeitschrift fur Psychologie*, *206*, 235–249. doi: 10.1037//0882-7974.5.1.58

Balliet, D., Parks, C., & Joireman, J. A. (2010). Social value orientation and cooperation in social dilemmas : A meta-analysis. *Group Processes and Intergroup Relations*, *12*(4), 533–547. https://doi.org/10.1177/1368430209105040

Baumert, A., Schlösser, T., & Schmitt, M. (2014). Economic games: A performance-based assessment of fairness and altruism. *European Journal of Psychological Assessment*, *30*(3), 178–192. https://doi.org/10.1027/1015-5759/a000183

Betsch, C., Ulshöfer, C., Renkewitz, F., & Betsch, T. (2011). The influence of narrative v. statistical information on perceiving vaccination risks. *Medical Decision Making*, *31*(5), 742–753. https://doi.org/10.1177/0272989X11400419

Biele, G., Erev, I., & Ert, E. (2009). Learning, risk attitude and hot stoves in restless bandit problems. *Journal of Mathematical Psychology*, *53*(3), 155–167. https://doi.org/10.1016/j.jmp.2008.05.006

Blais, A.-R., & Weber, E. U. (2006). A domain-specific risk-taking (DOSPERT) scale for adult populations. *Judgment and Decision Making*, *1*(1), 33–47. http://journal.sjdm.org/06005/jdm06005.htm

Böhm, R., Betsch, C., & Korn, L. (2016). Selfish-rational non-vaccination: Experimental evidence from an interactive vaccination game. *Journal of Economic Behavior & Organization*, *131*, 183–195. https://doi.org/10.1016/j.jebo.2015.11.008

Brooks, M. E., Kristensen, K., van Benthem, K. J., Magnusson, A., Berg, C. W., Nielsen, A., Skaug, H. J., Mächler, M., & Bolker, B. M. (2017). glmmTMB balances speed and flexibility among packages for zero-inflated generalized linear mixed modeling. *R Journal*, *9*(2), 378–400. https://doi.org/10.32614/rj-2017-066

Bürkner, P. C. (2018). Advanced Bayesian multilevel modeling with the R package brms. *R Journal*, *10*(1), 395–411. https://doi.org/10.32614/rj-2018-017

Burns, W. J., Peters, E., & Slovic, P. (2012). Risk perception and the economic crisis: A longitudinal study of the trajectory of perceived risk. *Risk Analysis*, *32*(4), 659–677. https://doi.org/10.1111/j.1539-6924.2011.01733.x

Danner, D., Rammstedt, B., Bluemke, M., Treiber, L., Berres, S., Soto, C., & John, O. (2016). Die deutsche Version des Big Five Inventory 2 (BFI-2). *Zusammenstellung Sozialwissenschaftlicher Items Und Skalen*, *72*(2010), 13421. https://doi.org/10.6102/zis247

De Wit, J. B. F., Das, E., & Vet, R. (2008). What works best: Objective statistics or a personal testimonial? An assessment of the persuasive effects of different types of message evidence on risk perception. *Health Psychology*, *27*(1), 110–115. https://doi.org/http://10.0.4.13/0278-6133.27.1.110

Denrell, J., & March, J. G. (2001). Adaptation as information restriction: The hot stove effect. *Organization Science*, *12*(5), 523–538. https://doi.org/10.1287/orsc.12.5.523.10092

Dillon, R. L., & Tinsley, C. H. (2008). How near-misses influence decision making under risk: A missed opportunity for learning. *Management Science*, *54*(8), 1425–1440. https://doi.org/10.1287/mnsc.1080.0869

Dillon, R. L., Tinsley, C. H., & Burns, W. J. (2014). Near-misses and future disaster preparedness. *Risk Analysis*, *34*(10), 1907–1922. https://doi.org/10.1111/risa.12209

Fehr, E., & Schmidt, K. M. (2005). The economics of fairness, reciprocity and altruism - Experimental evidence and new theories. In S. Kolm & J. M. Ythier (Eds.), *Handbook on the economics of giving, reciprocity and altruism* (pp. 615–691). Elsevier.

Floyd, D. L., Prentice-Dunn, S., & Rogers, R. W. (2000). A meta-analysis of research on protection motivation theory. *Journal of Applied Social Psychology*, *30*(2), 407–429. https://doi.org/10.1111/j.1559-1816.2000.tb02323.x

Fung, J. M. Y., Au, W. T., Hu, W., & Shi, K. (2012). Effect of risk orientation on cooperation and decision process in public goods dilemma. *Group Processes & Intergroup Relations*, *15*(6), 791–803. https://doi.org/10.1177/1368430212448443

Greiner, B. (2015). Subject pool recruitment procedures: Organizing experiments with ORSEE. *Journal of the Economic Science Association*, *1*(1), 114–125. https://doi.org/10.1007/s40881-015-0004-4

Grimm, J. (2009). *State-Trait-Anxiety Inventory nach Spielberger. Deutsche Lang- und Kurzversion*. Methodenforum Der Universität Wien.

Hilbig, B. E., Glöckner, A., & Zettler, I. (2014). Personality and prosocial behavior: Linking basic traits and social value orientations. *Journal of Personality and Social Psychology*, *107*(3), 529–539. https://doi.org/10.1037/a0036074

Hilbig, B. E., & Zettler, I. (2009). Pillars of cooperation: Honesty-humility, social value orientations, and economic behavior. *Journal of Research in Personality*, *43*(3), 516–519. https://doi.org/10.1016/j.jrp.2009.01.003

Hilbig, B. E., Zettler, I., Moshagen, M., & Heydasch, T. (2013). Tracing the path from personality - via cooperativeness - to conservation. *European Journal of Personality*, *27*(4), 319–327. https://doi.org/10.1002/per.1856

Hinyard, L. J., & Kreuter, M. W. (2007). Using narrative communication as a tool for health behavior change: A conceptual, theoretical, and empirical overview. *Health Education and Behavior*, *34*(5), 777–792. https://doi.org/10.1177/1090198106291963

Hogarth, R. M., Lejarraga, T., & Soyer, E. (2015). The two settings of kind and wicked learning environments. *Psychological Science*, *24*(5), 379–385. https://doi.org/10.1177/0963721415591878

Huang, S. K., Lindell, M. K., & Prater, C. S. (2016). Who leaves and who stays? A review and statistical meta-analysis of hurricane evacuation studies. *Environment and Behavior*, *48*(8), 991–1029. https://doi.org/10.1177/0013916515578485

Leder, J., & Betsch, T. (2016). Risky choice in interpersonal context: Do people dare because they care? *Journal Of Economic Psychology*, *52*, 1–23. https://doi.org/10.1016/j.joep.2015.11.003

Lee, K., & Ashton, M. C. (2018). Psychometric Properties of the HEXACO-100. *Assessment*, *25*(5), 543–556. https://doi.org/10.1177/1073191116659134

Maddux, J. E., & Rogers, R. W. (1983). Protection motivation and self-efficacy: A revised theory of fear appeals and attitude change. *Journal of Experimental Social Psychology*, *19*(5), 469–479. https://doi.org/10.1016/0022-1031(83)90023-9

Marcus, B., Bosnjak, M., Lindner, S., Pilischenko, S., & Schütz, A. (2007). Compensating for low topic interest and long surveys: A field experiment on nonresponse in web surveys. *Social Science Computer Review*, *25*(3), 372–383. https://doi.org/10.1177/0894439307297606

Marcus, B., & Schütz, A. (2005). Who are the people reluctant to participate in research? Personality correlates of four different types of noniesponse as inferred from self- And observer ratings. *Journal of Personality*, *73*(4), 959–984. https://doi.org/10.1111/j.1467-6494.2005.00335.x

McClintock, C. G., & Allison, S. T. (1989). Social value orientation and helping behavior. *Journal of Applied Social Psychology*, *19*, 353–362. https://doi.org/10.1111/j.1559-1816.1989.tb00060.x

Murphy, R. O., & Ackermann, K. A. (2014). Social Value Orientation: Theoretical and measurement issues in the study of social preferences. *Personality and Social Psychology Review*, *18*(1), 13–41. https://doi.org/10.1177/1088868313501745

Murphy, R. O., Ackermann, K. A., & Handgraaf, M. J. J. (2011). Measuring social value orientation. *Judgment and Decision Making*, *6*(8), 771–781. http://journal.sjdm.org/11/m25/m25.html

Peters, G. J. Y., Ruiter, R. A. C., & Kok, G. (2013). Threatening communication: A critical re-analysis and a revised meta-analytic test of fear appeal theory. *Health Psychology Review*, *7*(SUPPL1), 8–31. https://doi.org/10.1080/17437199.2012.703527

R Development Core Team. (2020). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing. R Foundation for Statistical Computing. https://doi.org/R Foundation for Statistical Computing. http://www.R-project.org

Revelle, W. (2019). *psych: Procedures for personality and psychological research*. R package published through CRAN (R package version 1. 9.12). NorthwesternUniversity. https://cran.r-project.org/package=psych

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *The Journal of Psychology*, *91*(1), 93–114. https://doi.org/10.1080/00223980.1975.9915803

Ruch, W., Bruntsch, R., & Wagner, L. (2017). The role of character traits in economic games. *Personality and Individual Differences*, *108*, 186–190. https://doi.org/10.1016/j.paid.2016.12.007

Sheeran, P., Harris, P. R., & Epton, T. (2014). Does heightening risk appraisals change people's intentions and behavior? A meta-analysis of experimental studies. *Psychological Bulletin*, *140*(2), 511–543. https://doi.org/10.1037/a0033065

Slovic, P., Peters, E., Finucane, M. L., & MacGregor, D. G. (2005). Affect, risk and decision making. *Health Psychology*, *24*, 35–40. https://doi.org/10.1037/0278-6133.24.4.S35

Van Lange, P. A. M. (1999). The pursuit of joint outcomes and equality in outcomes: An integrative model of social value orientation. *Journal of Personality and Social Psychology*, *77*(2), 337–349. https://doi.org/10.1037/0022-3514.77.2.337

Van Lange, P. A. M., Otten, W., De Bruin, E. M. N., & Joireman, J. A. (1997). Development of prosocial, individualistic, and competitive orientations: Theory and preliminary evidence. *Journal of Personality and Social Psychology*, *73*(4), 733–746. https://doi.org/10.1037/0022-3514.73.4.733

Weber, E. U., & Hsee, C. K. (1998). Cross-cultural differences in risk perception, but cross-cultural similarities in attitudes towards perceived risk. *Management Science*, *44*(9), 1205–1217. https://doi.org/10.1287/mnsc.44.9.1205

Wickham, H., Averick, M., Bryan, J., Chang, W., McGowan, L., François, R., Grolemund, G., Hayes, A., Henry, L., Hester, J., Kuhn, M., Pedersen, T., Miller, E., Bache, S., Müller, K., Ooms, J., Robinson, D., Seidel, D., Spinu, V., Vaughan, D., … Yutani, H. (2019). Welcome to the Tidyverse. *Journal of Open Source Software*, *4*(43), 1686. https://doi.org/10.21105/joss.01686

Yechiam, E., Barron, G., & Erev, I. (2005). The role of personal experience in contributing to different patterns of response to rare terrorist attacks. *Journal of Conflict Resolution*, *49*(3), 430–439. https://doi.org/10.1177/0022002704270847