1  **Avoidance, Rationalization, and Denial: Defensive Self-Protection in the Face of Climate**

2  **Change Negatively Predicts Pro-Environmental Behavior**

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**Avoidance, Rationalization, and Denial: Defensive Self-Protection in the Face of Climate Change Negatively Predicts Pro-Environmental Behavior**

Despite urgent need for climate action, denial of climate change and resulting absence of appropriate pro-environmental behavior are widespread. Interpretive (recognition of climate change as a problem but re-interpretation of its severity) and implicatory denial of climate change (recognition of climate change as a problem but denial of psychological, political, and moral implications) can be interpreted as self-protective strategies people use to protect the self in the face of threat. However, research has usually considered individual self-protective strategies but has not integrated them into one comprehensive measure. The present research aimed at reviewing the existing literature and constructing the Climate Self-Protection Scale (CSPS) to assess climate-relevant defensive, self-protective strategies. In Study 1, $N=354$ Germans responded to a pool of items. Using exploratory main axis analysis, we identified a five-factorial structure of the measure, corresponding to the self-protective strategies rationalization, avoidance, denial of personal outcome severity, denial of global outcome severity, and denial of guilt. Study 2 ($N=453$ Germans) used confirmatory factor analysis to verify the five-factorial structure of the CSPS. Self-protective strategies were positively related with each other (except for avoidance and denial of guilt) and fit into a framework of interpretive (denial of global and personal outcome severity) and implicatory denial (rationalization, avoidance, denial of guilt). They related positively to male gender and right-wing political orientation, and negatively to various indicators of pro-environmentalism, even when controlling for covariates. This provides evidence of criterion and construct validity of the CSPS. In future research, the scale could be used as a tool to examine climate-relevant self-protective strategies further.

**Keywords:** climate change; denial; defensiveness; test construction; self-protection; pro-environmental behaviour

## 1. Introduction

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49      Climate change is one of the biggest crises humanity ever faced, taking into account

50 consequences for biodiversity, environmental justice, human rights, mass migration, and

51 health, to name only a few. The climate crisis is visible across the planet (Crippa et al., 2019;

52 IPCC, 2018), with devastating wildfires in the Arctic and Australia, droughts, melting

53 permafrost in Siberia, extreme weather, and the five hottest years on record all within the last

54 decade. The Global North, bearing the biggest historical responsibility for climate change, is

55 no exception.

56      Nevertheless, emissions continue to grow (Peters et al., 2020). In fact, many privileged

57 people in the Global North can be characterized by a paradox. For example, in Germany most

58 people report environmentally friendly attitudes and intentions (BMU & UBA 2019) but

59 simultaneously ignore climate change in everyday life. Their attitudes are often inconsistent

60 with appropriate environmentally friendly decisions such as local, organic, plant based diets,

61 fossil-free and reduced collective rather than individualized traffic, and a general reduction in

62 consumption (Moser & Kleinhückelkotten, 2018). At the individual level, this paradox may

63 be an indicator of inner conflicts, for example between opposing values or short- and long-

64 term goals, or indicate lack of psychological resources to deal with threat proactively.

65 Resulting defensive, self-protective strategies may lead to absence of appropriate pro-

66 environmental behavior (PEB, Stich & Wagner, 2012). Understanding self-protective

67 strategies, the psychological functions they serve, and the conditions under which they arise is

68 relevant to enable people to deal proactively with the threat of climate change, both to

69 maintain psychological health but also to work towards mitigating the crisis. In this paper, we

70 develop and validate a tool measuring common climate-relevant self-protective strategies –

71 the Climate Self-Protection Scale (CSPS).

## 2. Theoretical Background

**2.1 Self-Protection as a Reaction to Threat**

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73

74       Several theories and strands of research suggest that humans are motivated to protect

75 their sense of self in the face of threat (e.g., Self-Determination Theory, Deci & Ryan, 1985,

76 2000; Cognitive Dissonance Theory, Festinger, 1957; Transactional Theory of Coping,

77 Lazarus, 1991; Self-Affirmation Theory, Steele, 1988; psychoanalytic theory, e.g., Freud,

78 1936, and research, e.g., Lertzman, 2015; sociological research, e.g., Norgaard, 2011).

79 Acknowledgement of climate change and its consequences can lead to potentially traumatic

80 negative emotions and threaten individual and collective identities (Norgaard, 2006a; Stokols

81 et al., 2009; Woodbury, 2019). When psychological resources are insufficient to deal with

82 threat proactively, people use defensive strategies to protect the self from the threat and

83 corresponding negative or even painful emotions, to avoid identity conflicts, and to maintain

84 positive self-esteem. In the remainder of this paper we will therefore call these strategies *self-*

85 *protective strategies*. Various climate-relevant self-protective strategies have been described,

86 ranging from the literal denial of climate change (e.g., Jylhä et al., 2016) to emotion-focused

87 coping strategies, such as de-emphasizing the seriousness of climate change (e.g., Ojala,

88 2015). However, they have not yet been integrated into a comprehensive framework (but see

89 Norgaard, 2019 on the spectrum of denial). Further, the terminology used to describe these

90 self-protective strategies is inconsistent across but also within disciplines.

91       To summarize the existing literature on self-protection, we lean on Cohen's (2001)

92 work on denial in the context of human rights violations and will use his terminology in the

93 remainder of the paper. Cohen notes that "the term *denial* refers to the maintenance of social

94 worlds in which an undesirable situation (event, condition, phenomenon) is unrecognized,

95 ignored or made to seem normal" (p. 51). He distinguishes between three forms of denial –

96 literal, interpretive, and implicatory denial – that can be mapped onto the various self-

97 protective strategies.

98       **2.1.1 Literal denial.**

99       Literal denial refers to denial of facts and includes the claim that something did or

100 does not happen or is not true. Climate change denial is usually understood to be literal – the

101 denial that climate change is happening at all.

102       Most research investigating literal climate denial focused on ideological variables and

103 gender. Häkkinen and Akrami (2014) found social-dominance orientation – an individuals'

104 preference for social hierarchies and devaluation of low-status groups (Pratto et al., 1994) – to

105 be most predictive of climate denial. Ideological variables such as right-wing authoritarianism

106 and social dominance orientation consistently related to climate denial in cross-sectional data

107 (McCright & Dunlap, 2011; Milfont et al., 2013). However, only right-wing authoritarianism

108 predicted change in climate denial over time (Stanley et al., 2017). This indicates that climate

109 denial can be understood as a desire to conform to traditional values rather than through a

110 motivation to dominate over nature or other groups that are harmed by climate change. This

111 research describes climate deniers as people with a (far) right political identity who feel

112 threatened by acknowledging the reality of climate change. They want to defend and protect

113 the status quo because they benefit from it, either economically or psychologically (system

114 justification, Feygina et al., 2010). Further, literal climate denial is more common in men than

115 in women (Jylhä et al., 2016; Feygina et al., 2010; McCright & Dunlap, 2011; Ojala, 2015;

116 Poortinga et al., 2011). However, given that accounts of literal denial are relatively rare in

117 Germany (e.g., Steentjes et al., 2017; Stoll-Kleemann & O'Riordan, 2020) we did not include

118 literal climate denial in the present research.

119       **2.1.2 Interpretive denial.**

120       Interpretive denial means the absorption of traumatic events into the psyche through

121 distortion of facts or emotional distancing, to numb and distance the self from uncontrollable,

122 overwhelming situations (Ager, 2008). In fact, only few studies have exclusively examined

123 literal denial without confounding its measurement with interpretive denial (e.g., Jylhä et al.,

124    2016). Interpretive denial describes the re-interpretation of facts and, thus, does not include

125    denial of facts per se. Common examples are changing words to disguise the meaning of

126    events (e.g., euphemisms; non-comprehensive, distancing technical jargon). Regarding

127    climate change, this could be acknowledging that climate change is happening but claiming

128    that it is not as bad and that its consequences are exaggerated. Literature on emotion-focused

129    coping and sociological, psychoanalytic, and addiction and trauma research describe various

130    interpretive forms of denial, such as de-emphasizing the seriousness of climate change (Ojala,

131    2012, 2015; Ojala & Bengtsson, 2019), relativization (Homburg et al., 2007), denial of

132    outcome severity (Opotow & Weiss, 2000; Sparks et al., 2010), or normalization and

133    minimization (Ager, 2008; Lertzman, 2015; Norgaard, 2006a). Various variables predicted

134    interpretive climate denial among Swedish adolescents over a one-year period, for example,

135    environmental and hedonistic/egoistic values, knowledge about and feelings of powerlessness

136    in societal matters (distrust, disinterest in societal issues, low environmental efficacy, low

137    tolerance towards immigrants), and descriptive social norms such as social influence from

138    parents and peers (Ojala, 2015). Parents', especially fathers' dismissive and despondent

139    communication style also predicted interpretive climate denial (Ojala & Bengtsson, 2019).

140        **2.1.3 Implicatory denial.**

141        Lastly, implicatory denial means that awareness of a fact is not integrated in everyday

142    life or translated into social action. One acknowledges the information per se but denies its

143    psychological, political, or moral implications. Regarding climate change, this includes the

144    denial that knowing about anthropogenic climate change has moral implications, such as

145    having a responsibility or perhaps moral obligation to act in a way that does not further

146    promote climate change or that helps mitigate its consequences. Various researchers describe

147    implicatory denial as similar to a conscious cognitive awareness without the emotional

148    acknowledgement of the implications ("knowing but not knowing", e.g., Norgaard, 2006b).

149    Denial here is a matter of self-protection when environmental problems are simultaneously

150  deeply disturbing and *invisible* (Ager, 2008; Haseley, 2019; Lertzman, 2015; Norgaard,

151  2006a). For example, Swiss citizens found the prospect of changing their lifestyles to mitigate

152  climate change more threatening than the reality of climate change itself. They employed

153  various implicatory denial strategies, such as blaming others' inaction and doubting one's

154  own ability to significantly act against climate change (Stoll-Kleemann et al., 2001).

155  Similarly, a recent German study (Stoll-Kleemann & O'Riordan, 2020) showed that

156  implicatory denial, diffusion, and displacement of responsibility for climate action has

157  replaced literal and interpretive denial. Ojala (2013) identified distancing as means of not

158  needing to engage with the problem in Swedish youth. Norgaard (2006a), Ager (2008), and

159  Lertzman (2015) describe societies that live under the constant threat of the consequences of

160  climate change or environmental devastation but choose to ignore the risk and continue

161  everyday life as normal. In other words: When one avoids the problem, one does not need to

162  engage with it. Based on an extensive interview study in Norway, Norgaard (2006a) describes

163  an implicatory denial of climate change that serves to avoid unpleasant emotions in a culture

164  that acknowledges climate change as a problem. Specifically, her sample collectively engaged

165  in socio-cultural narratives of "perspectival selectivity" (i.e., taking a perspective that favors

166  oneself and blames others' bad actions) and "selective attention" (i.e., focusing attention away

167  from certain information and not thinking too far ahead). These strategies served the function

168  of protecting the self from threat, maintaining a sense of innocence for the deniers, and

169  creating positive self-representations (Norgaard, 2006a). Others describe strategies such as the

170  denial of guilt (and responsibility, Homburg et al., 2007), denial of stakeholder inclusion

171  (Sparks et al., 2010), and deflection of responsibility (Norgaard, 2006b; Ojala, 2013, 2015;

172  Stoll-Kleemann et al., 2001).

173       The two latter forms of denial (interpretive and implicatory denial) may offer an

174  explanation for the paradox of failing to act despite good intentions – people protect

175  themselves by *knowing but not knowing* at the same time, and thus they justify not acting.

176  **2.1.4 Self-protection and pro-environmentalism.**

177  Self-protective strategies should be represented in various forms of pro-

178  environmentalism, ranging from environmental awareness, over environmental motivation to

179  actual PEB. Environmental awareness can be understood as being conscious of environmental

180  issues and having positive attitudes toward the environment, while environmental motivation

181  is the quality of the motivation one has for performing PEB. PEB represents low-impact

182  environmentally-friendly behavior that reduces one's ecological footprint. Self-protective

183  strategies have been found to be negatively related with PEB (Homburg et al., 2007; Ojala,

184  2012, 2013) and environmental values predicted interpretive climate denial of Swedish

185  adolescents (Ojala, 2015). Given the relations between environmental motivation and PEB

186  (e.g., Pelletier et al., 1998), we expect that the pattern would be similar for relations between

187  environmental motivation and self-protective strategies.

188

189  **2.2 Aim and Overview of Studies**

190  Previous research employed a range of methods to assess climate-relevant self-

191  protective strategies, such as interviews (Lertzman, 2015; Norgaard, 2019; Stich & Wagner,

192  2012), open-ended questions (Ojala, 2012), and questionnaires (Homburg et al., 2007; Jylhä et

193  al., 2016; Jylhä & Akrami, 2015; Ojala, 2015; Sparks et al., 2010). But despite its relevance,

194  there is, to our knowledge, no comprehensive measure that assesses and summarizes the self-

195  protective strategies people *commonly* use to protect themselves from the threatening reality

196  of climate change. We therefore conducted two studies to (1) construct a questionnaire that

197  measures defensive, climate-relevant self-protective strategies and (2) to validate this

198  measure.

199  Based on Cohen's (2001) conceptual framework of denial, we classified and

200  interpreted different self-protective strategies and expected to replicate his findings regarding

201  interpretive and implicatory denial. Further, we assessed relations with pro-environmentalism,

202 gender, and political orientation as measures of construct validity (specifically convergent and

203 factorial validity) and criterion validity. We use definitions by Moosbrugger & Kelava (2012)

204 for construct validity as the extent to which the interpretation of a test result is in line with its

205 theoretical underpinnings (e.g., relation of self-protection with gender, political orientation,

206 and pro-environmentalism) and for criterion validity as the extent to which a test results

207 allows for extrapolation to practically relevant outcomes (e.g., relation of self-protection with

208 PEB).

209 　　　　We conducted both studies in Germany. Besides practical reasons for selection of the

210 samples, the German population is particularly informative. Germans tend to have strong

211 environmental and nature awareness (BMU & UBA 2019), which rarely translates into

212 impactful PEB (see Moser & Kleinhückelkotten, 2018). In global comparison, Germans are

213 highly privileged, for example in terms of education level (OECD, 2018) and GDP per capita

214 (World Bank, 2018), and have among the largest $CO_2$-impact per capita (11t consumption

215 based carbon emissions in 2016, Quéré et al., 2018). Thus, it is a societal context in which

216 individuals have relatively great power (money and knowledge) over their actions. Their

217 actions also have relatively great impact, both politically and in terms of (in)direct emissions.

218 Germany, thus, provides a societal context in which climate-relevant self-protective strategies

219 are particularly relevant. Conducting this research in a non-privileged, low-emissions sample,

220 i.e. with people not responsible for the climate crisis and whose actions may have relatively

221 little impact, would certainly yield different results. In those groups, the employment of self-

222 protective strategies may perhaps be the healthiest way to cope. In contrast, those who emit

223 most also need to change most (e.g., Sabbagh & Schmitt, 2016). Understanding a privileged,

224 high-impact group and the predictors for their behavior is most indicative when considering

225 individual reactions to climate change and PEB.

226

227 　　　　　　　　　　　　　　　　**3. Study 1**

**3.1 Aim and Hypotheses**

We designed Study 1 to develop a valid and reliable scale that assesses defensive, self-protective strategies people commonly use to protect the self when dealing (or failing to deal) with climate change. To this end, we constructed items both based on and taken from the reviewed literature. We then interpreted the emerging self-protective strategies with regard to Cohen's (2001) interpretive and implicatory denial. We describe the steps of item collection and selection, the internal consistency of the measure's subscales, and test their relations with each other and with measures of PEB. We tested the following hypotheses:

*H1*: The identified self-protective strategies are positively related with each other.

*H2*: The identified self-protective strategies can be mapped onto Cohen's categories of interpretive and implicatory denial.

*H3*: Right-wing political orientation correlates positively with the identified self-protective strategies.

*H4*: Men report more self-protective strategies than women.

*H5*: The identified self-protective strategies are negatively related with (a) PEB and (b) willingness to donate to environmental organizations.

**3.2 Method**

**3.2.1 Participants and procedure.**

A convenience sample of $N$=354 German individuals participated in an online study ($M_{age}$=27.74 years, $SD$=11.68, range:18-78) hosted on the platform SoSci-Survey (Leiner, 2014). The sample was predominantly female (80.29%) and had a rather high educational background (59.00% high school degree, 32.45% university degree).

Participants gave informed consent in line with the DGPS and Helsinki declarations and then responded to items about self-protective strategies, PEB, socio-demographic background (age, gender, education, income), and political orientation. To avoid sequence

254　effects, we presented items in randomized order within the sections on self-protection and

255　PEB, respectively. We also randomized the order in which we presented the sections on self-

256　protection and PEB but found order not to influence answers (see Supplemental Material).

257　Afterwards, participants could participate in a raffle for money as compensation for their

258　participation. We used this raffle as another indicator of PEB.

259　**3.2.2 Methods and materials.**

260　We display all items in the supplemental material.

261　*Climate Self-Protection Scale.* We based the construction of the CSPS on a literature

262　review of psychological and sociological studies on defensive, self-protective strategies and

263　coping in the environmental domain. We developed a pool of items based on qualitative

264　interviews by Stich and Wagner (2012), Norgaard (2011), and Klonek and Kauffeld (2015),

265　open-ended questions by Ojala (2012), and theoretical considerations by Opotow and Weiss

266　(2000). Moreover, we translated and adapted quantitative measures by Homburg et al. (2007),

267　Sparks et al. (2010), Lavergne & Pelletier (2015), and Zaalberg, Midden, Meijnders, and

268　McCalley (2009) into German. Based on own theoretical considerations, we created

269　additional items for potential strategies not considered in the work above, yielding 99 items in

270　total. Participants indicated (dis)agreement with the statements on a seven-point Likert scale

271　(1=*strongly disagree*, 7=*strongly agree*). After data collection but before analysis, we re-

272　examined items individually and deleted eighteen items due to ambiguous phrasing (e.g., "I

273　cannot act extremely environmentally friendly and perhaps there is no necessity for it"). See

274　Table 2 for the final scale and item statistics, and Supplemental material for information about

275　the origin of each item.

276　*PEB.* We used nineteen items to capture a broad range of impactful private- and

277　public-sphere PEB (cf. Stern, 2000; eight items by Cooke, Fielding, & Louis, 2016; eight

278　items from the General Ecological Behavior scale, Kaiser & Wilson, 2004, and three own

279　items; e.g., "I participate in environmental demonstrations"). Participants rated items on a

11

280    five-point Likert scale (1=*never*, 5=*always*). We dichotomized items (0=never, seldom,

281    occasionally; 1=often, always) for Rasch-modelling, following recommendations by Kaiser

282    and Wilson (2004). We excluded eight people with missing data. Person separation reliability

283    was satisfactory ($R_p$=.78). Item mean square infit values ranged from .55 to 1.08, well below

284    the recommended 1.30 for samples smaller than 500 (Bond & Fox, 2013).

285          Furthermore, as compensation for their participation, participants could take part in a

286    raffle (4x50€). They could choose to keep the money for themselves or donate all or part of it

287    to an environmental organization. We analyzed willingness to donate to obtain another

288    estimate of PEB.

289    **3.2.3 Data preparation and statistical analysis.**

290          We used the statistical program R, version 3.6.1 (R Core Team, 2019) for all statistical

291    analyses. Prior to analysis, we examined variables for accuracy of data entry, missing data,

292    and answering speed. We used bogus regression analysis to determine fit between data

293    distributions and assumptions of multivariate data analysis. These analyses revealed no

294    deviation with respect to multivariate normality. An inspection of bivariate scatter plots

295    revealed no evidence for heteroscedasticity or nonlinearity. We excluded two cases because

296    TIME_RSI, a speeding-index specifying relative speed (Leiner, 2019), was >2, suggesting

297    that those participants were much faster than typical participants in the data set. Based on

298    Mahalanobis distance, we removed three multivariate outliers ($p<.001$), leaving a total sample

299    of *N*=349 cases. Please refer to Supplemental Material for data analyses using the entire

300    dataset without exclusions, and analyses without covariates.

301          To reduce the amount of items in the scale, we conducted a factor analysis

302    (Thompson, 2004). Finally, we examined inter-relations of the resulting subscales using

303    Gaussian graphical modeling (Bhushan et al., 2019) and correlation analysis, and relations

304    with PEB and socio-demographic variables using *t*-tests and regression analysis.

305

306    **3.3 Results**

307        **3.3.1 Descriptives.**

308    Descriptive statistics for study variables are displayed in Table 1. On average, participants

309    scored rather high on PEB. Most people (*n*=292, 85.88%) wanted to participate in the raffle.

310    Of those, 162 people (55.48%) indicated they would be willing to donate some or all of the

311    money to an environmental organization, in case they would win (*M*=25.12€, *SD*=16.19€,

312    range:3-50€).

313        **3.3.2 Exploratory main axis analysis.**

314        Following recommendations by Tabachnick and Fidell (2013), we excluded four items

315    that had high inter-item correlations (*r*>.80). We then ran an exploratory main axis analysis

316    with oblique rotation to reduce the number of items of the CSPS further. According to the

317    Kaiser-Meyer-Olkin criterion, data were well suited for factor analysis (KMO=.93). Horn's

318    (1965) parallel analysis suggested a seven-factor solution (Eigenvalues=2.43–8.38). We

319    deleted 40 items with low communality indicating low item-total correlations ($h^2$<.50;

320    Tabachnick & Fidell, 2013), seven items with low factor loadings (<.45), and one cross-

321    loading item.

322        We then ran a second main axis analysis with the remaining 29 items. Data were well

323    suited for factor analysis (KMO=.93). Horn's (1965) parallel analysis suggested a five-factor

324    solution (Eigenvalues=2.14–5.77). We deleted one additional item because its factor loading

325    was <.45, one item because it was cross-loading, and one item that had low communality

326    ($h^2$=.40). Examination of internal consistency if single items were dropped revealed that no

327    further items needed to be excluded from the measure.

328        The final 26 items were well suited for factor analysis (KMO=.92) and distributed

329    over five factors (Eigenvalues=1.86–4.80; see Table 2). We suggest to interpret the factors as

330    follows: rationalization (e.g., "How I behave toward the environment has minimal impact on

Table 1

*Spearman correlations and descriptive statistics of study variables*

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | α [95%CI] | M (SD) | Skewness (Kurtosis) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Overall self-protection | — | [.84, .88] | [.54, .69] | [.59, .72] | [.65, .77] | [.42, .60] | [-.48, -.31] | [-.29, -.06] | [-.12, .12] | [-.18, .08] | [.25, .44] | .91 [.89, .92] | 2.70 (.80) | .39 (-.28) |
| 2. Rationalization | .85** | — | [.22, .42] | [.41, .59] | [.49, .66] | [.33, .55] | [-.44, -.27] | [-.27, -.03] | [-.13, .11] | [-.21, .05] | [.22, .43] | .91 [.89, .92] | 2.88 (1.25) | .62 (.07) |
| 3. Avoidance and suppression | .66** | .37** | — | [.07, .31] | [.14, .32] | [-.19, .01] | [-.37, -.18] | [-.21, .03] | [-.23, -.02] | [-.27, -.04] | [.05, .24] | .90 [.88, .92] | 2.64 (1.11) | .45 (-.50) |
| 4. Denial of personal outcome severity | .66** | .51** | .26** | — | [.39, .61] | [.17, .41] | [-.36, -.16] | [-.23, .05] | [-.13, .09] | [-.11, .14] | [.08, .31] | .86 [.84, .88] | 2.27 (1.12) | .96 (.85) |
| 5. Denial of global outcome severity | .69** | .55** | .32** | .53** | — | [.37, .56] | [-.43, -.26] | [-.28, -.09] | [-.09, .18] | [-.10, .18] | [.29, .48] | .87 [.85-.89] | 1.91 (1.05) | 1.37 (1.69) |
| 6. Denial of guilt | .47** | .35** | -.04 | .28** | .38** | — | [-.17, .02] | [-.25, .02] | [.14, .33] | [.08, .31] | [.07, .31] | .77 [.73, .81] | 3.52 (1.21) | .49 (-.06) |
| 7. Pro-environmental behavior | -.42** | -.38** | -.30** | -.30** | -.36** | -.08 | — | [.16, .42] | [.04, .25] | [-.06, .18] | [-.43, -.24] | .78[a] | -.05 (1.38) | .43 (.93) |
| 8. Donation to environmental organization | -.19* | -.17 | -.10 | -.11 | -.19* | -.16 | .30** | — | [-.10, .18] | [-.02, .28] | [-.28, -.07] | | 25.12 (16.19) | .51 (-1.17) |
| 9. Age | .03 | .01 | -.11 | .02 | .01 | .23** | .10 | -.03 | — | [.60, .78] | [.02, .28] | | 27.74 (11.68) | 2.01 (3.46) |
| 10. Income | -.08 | -.12 | -.14 | .01 | -.07 | .15 | .11 | .07 | .61** | — | [-.04, .22] | | 948.67 (898.43) | 2.13 (4.78) |
| 11. Political orientation | .29** | .28** | .13 | .15 | .31** | .15 | -.33** | -.19* | .08 | .05 | — | | 33.29 (17.70) | .44 (.01) |

*Note.* We display descriptive statistics of Rasch person parameter for pro-environmental behavior. *p*-values adjusted for multiple tests.

Above the diagonal are 95% confidence intervals.

[a]Person separation reliability

*p<.05, **p<.01.

337   climate change", α=.91), avoidance (e.g., "I try to avoid negative thoughts about climate change

338   in my everyday life", α=.90), denial of personal outcome severity (e.g., "I expect climate change

339   to affect other regions but not to burden me", α=.86), denial of global outcome severity (e.g., "I

340   believe that climate change won't be as severe as expected in the future", α=.87), and denial of

341   guilt (e.g., "I don't need to make climate change a matter of conscience", α=.77). The overall 26-

342   item scale had excellent internal consistency (α=.91). The resulting model explained 60% of

343   sample variance. All items loaded exclusively on their target factors and had factor loadings >.45.

344   Communalities were good with the lowest $h^2$=.48. Table 2 shows items statistics, factor loadings

345   after oblique rotation, communalities, and eigenvalues and explained variance of the factors. The

346   subscales denial of personal outcome severity and denial of global outcome severity displayed

347   skewness indicative of non-normal distribution (see Table 1). To remedy this, we used log

348   transformations and performed all relevant analyses with and without transformed data

349   (Tabachnick & Fidell, 2013).

350       **3.3.3 Short summary of the scale and its subscales.**

351   People indicated medium-low levels of self-protection. They reported denial of the outcome

352   severity of global climate change least, while denial of guilt was more common. As displayed in

353   Table 1, rationalization correlated strongly with denial of global outcome severity and denial of

354   personal outcome severity, meaning that those who rationalized the problem of climate change

355   also tended to deny that climate change is as severe as it is and that it has consequences for them

356   personally. Interestingly, avoidance correlated negatively with denial of guilt but had medium

357   positive correlations with all other self-protective strategies. Those who avoided the problem of

358   climate change in everyday life denied its severity both globally and for themselves, and

359   rationalized the problem, but did not deny feelings of guilt around climate change. The two

360   Table 2

361   *Factor loadings and communalities of main axis analysis (promax-rotation) for self-protective*

362   *strategies and descriptive statistics for individual items*

| Items | $F_1$ | $F_2$ | $F_3$ | $F_4$ | $F_5$ | $h^2$ | $M$ | $SD$ | Skew-ness | Kurto-sis |
|---|---|---|---|---|---|---|---|---|---|---|
| 34. It doesn't make a difference for climate change if I change my behavior or if I don't change my behavior. | .85 | | | | | .73 | 2.53 | 1.44 | .97 | .53 |
| 38. How I behave toward the environment has minimal impact on climate change. | .82 | | | | | .52 | 3.38 | 1.67 | .36 | -.71 |
| 10. My individual behavior probably doesn't have a measurable influence on the environment. | .82 | | | | | .54 | 3.23 | 1.74 | .30 | -1.02 |
| 41. No matter what I do, I cannot do anything against climate change ultimately. | .80 | | | | | .67 | 2.83 | 1.49 | .66 | -.11 |
| 37. In my lifetime, I cannot make an important contribution to the reduction of climate change. | .79 | | | | | .56 | 2.92 | 1.58 | .60 | -.38 |
| 36. My personal influence on climate change is negligible. | .75 | | | | | .68 | 3.01 | 1.55 | .56 | -.30 |
| 30. I myself cannot do anything against climate change. | .70 | | | | | .62 | 2.30 | 1.39 | 1.10 | .85 |
| 50. When I get worried about climate change, I try to think of something else. | | .84 | | | | .62 | 2.72 | 1.35 | .39 | -.55 |
| 53. I don't obsess over climate change because it would burden me psychologically. | | .77 | | | | .57 | 2.38 | 1.35 | .79 | -.17 |
| 61. I try to avoid negative thoughts about climate change in my everyday life. | | .76 | | | | .55 | 3.09 | 1.57 | .33 | -.73 |
| 56. I often suppress my thoughts about climate change because otherwise I would probably go crazy. | | .75 | | | | .53 | 2.64 | 1.63 | .81 | -.21 |
| 57. I try not to think about climate change. | | .74 | | | | .64 | 2.56 | 1.45 | .51 | -.84 |
| 55. I try to ignore climate change in everyday life to feel safe. | | .73 | | | | .61 | 2.19 | 1.32 | 1.00 | .17 |
| 63. I don't think much about my impact on the environment because I might not be able to handle knowing how negative my influence really is. | | .64 | | | | .52 | 2.57 | 1.46 | .61 | -.61 |
| 94. I tend to suppress thoughts about climate change in my everyday life. | | .59 | | | | .48 | 2.97 | 1.46 | .58 | -.04 |
| 27. Climate change will not affect me here in Germany. | | | .82 | | | .70 | 2.22 | 1.33 | 1.07 | .55 |
| 28. I expect climate change to affect other regions but not to burden me. | | | .82 | | | .69 | 2.34 | 1.39 | .88 | -.04 |
| 06. Nothing will happen to me as a consequence of climate change because Germany is a safe country. | | | .74 | | | .53 | 2.23 | 1.34 | 1.05 | .64 |
| 23. Climate change does not really affect people in Germany. | | | .65 | | | .49 | 2.28 | 1.30 | .96 | .24 |
| 25. I believe that climate change won't be as severe as expected in the future. | | | | .89 | | .76 | 2.03 | 1.19 | 1.23 | 1.16 |
| 14. The damage that climate change will bring about will not be as severe as being claimed. | | | | .87 | | .72 | 1.86 | 1.16 | 1.75 | 3.55 |
| 18. The influence of humans on climate change is being overstated. | | | | .70 | | .62 | 1.85 | 1.20 | 1.64 | 2.54 |
| 95.[i] I have a guilty conscience because I know that I should behave more sustainably. | | | | | .81 | .60 | 3.86 | 1.62 | .28 | -.63 |
| 49.[i] I feel guilty because I know about climate change but do not take a lot of action against it. | | | | | .78 | .61 | 4.24 | 1.59 | .05 | -.69 |
| 47. I don't need to make climate change a matter of conscience. | | | | | .46 | .62 | 3.01 | 1.59 | .59 | -.38 |
| 43. I have nothing to blame myself for when it comes to climate change. | | | | | .46 | .50 | 2.95 | 1.49 | .69 | .12 |
| Eigenvalues | 4.80 | 4.40 | 2.42 | 2.21 | 1.86 | | | | | |
| Percent of variance | .18 | .17 | .09 | .08 | .07 | | | | | |
| Cumulative percent of variance | .18 | .35 | .45 | .53 | .60 | | | | | |

363   *Note.* $F_1$=Rationalization, $F_2$=Avoidance, $F_3$=Denial of personal outcome severity, $F_4$=Denial of global

364   outcome severity, $F_5$=Denial of guilt. [i]Reverse-coded.

365 factors capturing interpretive forms of denial, namely denial of global outcome severity and

366 denial of personal outcome severity, correlated strongly with each other and with rationalization

367 (see above). Denial of guilt was mainly associated with rationalization, avoidance, and denial of

368 global outcome severity. These results mainly support H1.

369      Complementing the inferential analysis, we visualized partial correlations between the

370 self-protective strategies using Gaussian graphical modelling with the glasso algorithm and

371 extended Bayesian information criterion for an optimal setting of the tuning parameter (Figure 1).

372 Gaussian graphical modelling is a Bayesian technique that displays partial correlations between

373 variables, controlling for all other variables in the dataset (Bhushan et al., 2019). This analysis

374 revealed only weak clustering of self-protective strategies, contradicting H2.

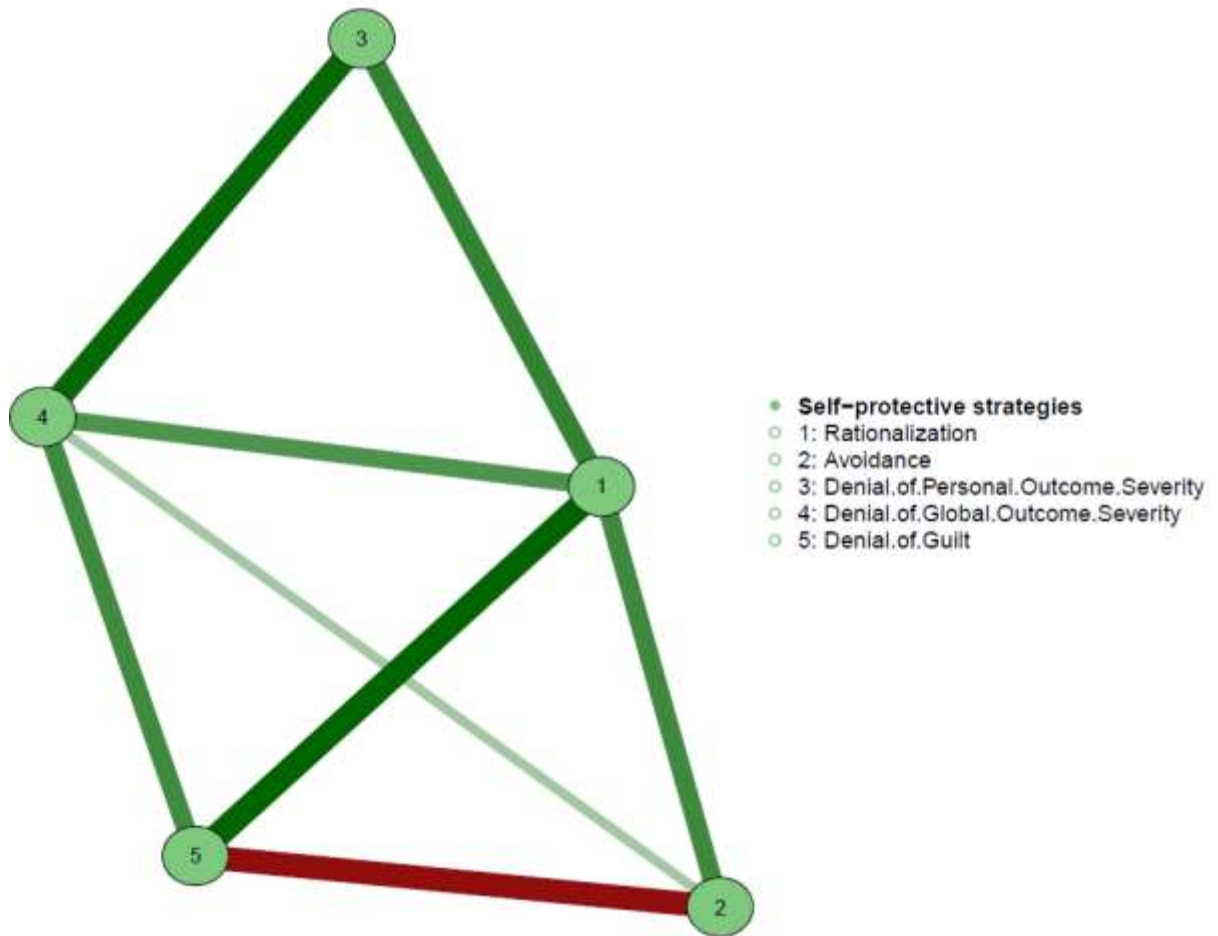375      **3.3.4 Self-protective strategies and socio-demographics.**

376      Regarding socio-demographic variables, the use of self-protective strategies was unrelated

377 to age (except for a positive correlation between age and denial of guilt) and income, but

378 positively related with political orientation. Those who reported right-wing political orientation

379 also reported higher use of self-protective strategies, especially denial of global outcome severity

380 and rationalization (see Table 1). This supports H3.

381 A series of Welch two sample $t$-tests revealed differences between the genders[1]. Women reported

382 significantly more avoidance than men ($t[120.40]=-4.21$, $p<.001$, $d=.50$, 95%CI of group

383 difference [-.80, -.29], $M[SD]_{female}=2.73[1.14]$, $M[SD]_{male}=2.19[.88]$), and less denial of personal

384 outcome severity ($t[86.43]=2.05$, $p=.043$, $d=.32$, 95%CI[.01, .69], $M[SD]_{female}=2.18[1.07]$,

385 $M[SD]_{male}=2.53[1.29]$), denial of global outcome severity ($t[78.39]=2.63$, $p=.010$, $d=.46$,

386 95%CI[.11, .84], $M[SD]_{female}=1.80[.93]$, $M[SD]_{male}=2.28[1.39]$), and denial of guilt

---

[1] We excluded people who reported being non-binary from this analysis because with a sample size of $n=2$, we deemed any analyses to lack sufficient power.

387  (*t*[93.86]=4.43, *p*<.001, *d*=.63, 95%CI[.40, 1.06], *M[SD]*female=3.34[1.15],

388  *M[SD]*male=4.08[1.21]). We found no difference between the genders in terms of rationalization.

389  Taken as a whole, these findings partially confirm H4.

390      A series of ANOVAs and subsequent pairwise *t*-tests with Bonferroni correction revealed

391  no differences between levels of education.



392

393  *Figure 1*. Gaussian graphical model displaying interrelations of the subscales of the CSPS. Green

394  lines indicate positive partial correlations and red lines indicate negative partial correlations.

395  Thickness of lines indicates strength of relationships. For sake of clarity, only partial correlations

396  above .1 are shown.

397

398    **3.3.5 Self-protective strategies and PEB.**

399    All self-protective strategies correlated negatively with PEB and willingness to donate

400    (see Table 1). We performed a hierarchical multiple regression analysis, predicting PEB from

401    self-protective strategies and covariates (see Table 3 for coefficients and model summaries).

402

403    Table 3

404    *Hierarchical regression predicting PEB*

| | Step 1 | | | | Step 2 | | | |
|---|---|---|---|---|---|---|---|---|
| | *B* | β | [95%CI] | *SE* | *B* | β | [95%CI] | *SE* |
| Intercept | .00 | | | .28 | .87* | | | .37 |
| | | | | | (.71[†]) | | | (.37) |
| Gender (1=female) | .31[†] | .09 | [-.26, .44] | .18 | .36* | .10 | [-.25, .45] | .18 |
| | | | | | (.35[†]) | (.10) | ([-.25, .45]) | (.18) |
| Age | .03*** | .25 | [.23, .27] | .01 | .03*** | .23 | [.22, .25] | .01 |
| | | | | | (.03***) | (.23) | ([.21, .25]) | (.01) |
| Income | .00 | -.07 | [-.07, -.07] | .00 | .00 | -.11 | [-.11, -.11] | .00 |
| | | | | | (.00) | (-.11) | ([-.11, -.11]) | (.00) |
| Political orientation | -.03*** | -.38 | [-.39, -.37] | .00 | -.02*** | -.27 | [-.28, -.26] | .00 |
| | | | | | (-.02***) | (-.27) | ([-.28, -.26]) | (.00) |
| Self-protective strategies | | | | | | | | |
| Rationalization | | | | | -.14[†] | -.12 | [-.27, .03] | .08 |
| | | | | | (-.12) | (-.11) | ([-.26, .04]) | (.08) |
| Avoidance | | | | | -.20** | -.16 | [-.30, -.03] | .07 |
| | | | | | (-.19**) | (-.15) | ([-.29, -.02]) | (.07) |
| Denial of personal outcome severity | | | | | -.06 | -.05 | [-.20, .09] | .07 |
| | | | | | (-.23) | (-.08) | ([-.41, .25]) | (.17) |
| Denial of global outcome severity | | | | | -.15 | -.11 | [-.30, .07] | .09 |
| | | | | | (-.34[†]) | (-.12) | ([-.50, .26]) | (.19) |
| Denial of guilt | | | | | .07 | .06 | [-.08, .20] | .07 |
| | | | | | (.07) | (.06) | ([-.08, .20]) | (.07) |
| $R^2$ | | | | .18 | | | | .27(.33) |
| Adjusted $R^2$ | | | | .17 | | | | .25(.30) |
| $\Delta R^2$ | | | | | | | | .09(.12) |

405    *Note*. In parentheses are results after log-transformation of denial of personal and global outcome

406    severity, *n*=321.

407    [†]*p*<.10, *p*<.05, **p*<.01, ***p*<.001.

408

409    Sample size was sufficiently large (minimum required sample size to detect a medium effect of

410    $f^2$=.15 with α=.05 and β=.95 was *N*=156, G*Power 3, Faul et al., 2007). We ran the analysis using

411    original and log-transformed data, as described above. However, as results of those analyses did

412    not significantly differ and to ease interpretation, we only report results using original data in

413    writing (Table 3 includes analyses with transformed data). We checked data for multicollinearity

414    and singularity and they were appropriate for regression analysis (VIF<10). In a first step, we

415    entered age, gender, income, and political orientation, which explained 17% of the variance in

416    PEB (*F*[4, 316]=17.56, *p*<.001, $R^2$=.18, $R^2_{adjusted}$=.17). Older age and left-wing political

417    orientation significantly predicted PEB. Adding self-protective strategies in a second step

418    explained another 8% of variance (*F*[9, 311]=12.69, *p*<.001, $R^2$=.27, $R^2_{adjusted}$=.25). In the final

419    model, those who reported less avoidance, women, older and left-wing participants reported more

420    PEB. We interpret this as evidence for H5a.

421        To predict willingness to donate to an environmental organization, we performed a

422    sequential logistic regression analysis. We did not analyze the amount people were willing to

423    donate but rather willingness per se, as a continuous variable would have been severely skewed

424    and undermined use of parametric statistics. A model using age, gender, income, and political

425    orientation as predictors was statistically significant against an intercept-only model ($\chi^2$[4,

426    *n*=277]=20.36, *p*<.001; see Table 4 for regression coefficients and odds ratios including 95%CIs).

427    Right-wing political orientation and male gender significantly predicted willingness to donate.

428    Overall predictive value of the model was small, with McFadden's $R^2$-index=.054. A model also

429    including self-protective strategies was significant against the null-model ($\chi^2$[9, *n*=277]=28.40,

430    *p*<.001), but did not significantly improve model fit of the first model ($\chi^2$[5, *n*=277]=8.04, *p*=.15).

431    Only male gender was a significant predictor of willingness to donate (McFadden's $R^2$-

432    index=.075). Based on these results we cannot confirm H5b.

433 Table 4

434 *Sequential logistic regression predicting observed PEB*

| | Step 1 | | | Step 2 | | |
|---|---|---|---|---|---|---|
| | *B* | SE | Odds Ratio [95%CI] | *B* | SE | Odds Ratio [95%CI] |
| Intercept | -.32 | .53 | .73 [.25, 2.05] | -1.07 | .72 | .34 [.08, 1.39] |
| Gender (1=female) | -.97** | .33 | .38 [.20, .71] | -.96** | .35 | .38 [.19, .75] |
| Age | .01 | .02 | 1.01 [.98, 1.05] | .01 | .02 | 1.01 [.97, 1.05] |
| Income | -.00 | .00 | 1.00 [1.00, 1.00] | -.00 | .00 | 1.00 [1.00, 1.00] |
| Political orientation | .02** | .01 | 1.02 [1.01, 1.04] | .01† | .01 | 1.01 [1.00, 1.03] |
| Self-protective strategies | | | | | | |
| Rationalization | | | | -.08 | .15 | 1.08 [.81, 1.45] |
| Avoidance | | | | .12 | .14 | 1.12 [.86, 1.47] |
| Denial of personal outcome severity | | | | -.23 | .15 | .80 [.59, 1.06] |
| Denial of global outcome severity | | | | .24 | .18 | 1.28 [.90, 1.84] |
| Denial of guilt | | | | .15 | .14 | 1.17 [.89, 1.54] |
| $\chi^2$(df) | | | 20.36***(4) | | | 28.40***(9) |

435 *Note*. n=277.

436 †*p*<.10, ***p*<.01, ****p*<.001.

437

438 **3.4 Discussion**

439 Using an exploratory main axis analysis, we identified a five-factorial structure of the CSPS,

440 corresponding to the self-protective strategies rationalization, avoidance, denial of personal

441 outcome severity, denial of global outcome severity, and denial of guilt. As expected in H1, the

442 identified self-protective strategies mostly related positively to each other with the exception of a

443 negative correlation between avoidance and denial of guilt. Contrary to H2, inspection of partial

444 correlations of the self-protective strategies (compare Figure 1) did not suggest strongly that they

445 may be placed in Cohen's framework of denial (2001).

446  Overall, the self-protective strategies were unrelated to age, income, and education but

447  were related to gender and political orientation. Women and left-wing individuals reported less

448  self-protective strategies, providing evidence for H3 and H4.

449  **3.4.1 Reliability and validity.**

450  This study revealed high internal consistency of the CSPS across all subscales.

451  Furthermore, we found evidence for criterion and construct validity, as the self-protective

452  strategies predicted PEB. The less people reported using self-protective strategies, the more they

453  also reported acting in environmentally friendly ways, and vice versa. This relation did not appear

454  regarding willingness to donate. However, donation behavior may give a very limited account of

455  actual PEB. It is based on the premise that climate change can be reduced through donating

456  money to certain actors rather than reducing material consumption and production of emissions.

457  Two explanations are possible: those who use less self-protective strategies also donate because

458  they acknowledge the importance of supporting those who fight against climate change. On the

459  other hand, donating can also be understood as a way of 'buying one's way out' of taking

460  responsibility, understanding donations as monetary compensation for other behaviors and thus,

461  legitimizing anti-environmental behavior. The negative correlation between PEB and willingness

462  to donate may reflect this. Willingness to donate, thus, could correlate positively or negatively

463  with self-protection and relations within potential sub-groups should be disentangled.

464

465  **4. Study 2**

466  **4.1 Aim and Hypotheses**

467  Study 2 aimed at verifying the factorial structure of the CSPS (factorial validity). Further,

468  it aimed at investigating criterion and construct validity of the subscales of the measure by

469  investigating their relations with various indicators of pro-environmentalism and exploring

470 relations with socio-demographic variables and political orientation. We expected to find the

471 following:

472     H1: The five-factorial structure of the CSPS can be replicated.

473     H2: The five factors can be represented by two secondary factors representing implicatory

474     and interpretive denial.

475     H3: Right-wing political orientation correlates positively with self-protective strategies.

476     H4: Men report more self-protective strategies than women.

477     H5: Self-protective strategies are negatively related to indicators of pro-environmentalism

478     (PEB, environmental awareness, environmental motivation, willingness to donate).

479

480 **4.2 Method**

481     **4.2.1 Participants and procedure.**

482     We recruited *N*=453 German individuals from a different participant pool using the SoSci-

483 Survey panel for an online study hosted on SoSci-Survey (Leiner, 2014). We followed the same

484 procedure as in Study 1, with the exception that we presented participants with the final CSPS

485 and assessed environmental awareness and environmental motivation[2]. The sample averaged

486 37.68 years (*SD*=15.69, range:18-87), was more balanced in terms of gender (62.59% female),

487 and had a rather high educational background (34.95% high school degree, 49.54% university

488 degree).

489     **4.2.2 Materials.**

490     We measured self-protective strategies with the 26 items of the CSPS constructed in

491 Study 1.

---

[2] We also measured basic need satisfaction and frustration, both globally and in the environmental domain but did not analyze the data as part of this study because they were not relevant to the current study and would have made this paper unnecessarily complex.

492    ***PEB.*** We assessed PEB and willingness to donate as in Study 1. However, participants

493    answered items about private-sphere PEB (14 items, e.g., "I limit the amount of meat I eat") on a

494    five-point Likert scale (1=*never*, 5=*always*) and items about public-sphere PEB (4 items, e.g., "I

495    participate in environmental demonstrations") on a four-point Likert scale (1=*never*, 4=*often*).

496    We dichotomized items (0=never, seldom, occasionally; 1=often, always) for Rasch modelling

497    (Kaiser & Wilson, 2004) and no cases had missing data. Person separation reliability was

498    satisfactory ($R_p$=.72). Item mean square infit values ranged from .80 to 1.05, well below the

499    recommended 1.30 for samples smaller than 500 (Bond & Fox, 2013).

500    ***Environmental awareness.*** We took four items (e.g., "We can only solve our

501    environmental problems through fundamentally transforming our economic system and way of

502    life") from the 2016 German Environmental Awareness Study (BMU & UBA, 2017) to measure

503    environmental awareness. Participants indicated agreement with the statements using a slider bar

504    (1=*strongly disagree*, 101=*strongly agree*).

505    ***Environmental motivation.*** The *Motivation Toward the Environment scale* (MTES,

506    Pelletier et al., 1998) measured environmental motivation. Participants indicated agreement with

507    24 statements about reasons to act environmentally friendly, on a seven-point Likert scale

508    (1=*strongly disagree*, 7=*strongly agree*). The scale assesses three forms of environmental

509    motivation on six subscales, ranging from intrinsic (e.g., "for the pleasure I experience when I

510    find new ways to improve the quality of the environment") to extrinsic motivation (i.e., integrated

511    [e.g., "because being environmentally conscious has become a fundamental part of who I am"],

512    identified [e.g., "because I think it's a good idea to do something about the environment"],

513    introjected [e.g., "because I would feel bad if I didn't do anything"], and external regulation [e.g.,

514    "to avoid being criticized"]) to amotivation (e.g., "I truly have the impression I'm wasting my

515    time doing things for the environment"). We calculated overall environmental motivation using

516 mean scores in the following formula (Sheldon et al., 2017): Environmental motivation=intrinsic

517 motivation+integrated regulation+identified regulation–introjected regulation–external

518 regulation–amotivation.

519 **4.2.3 Data preparation and statistical analysis.**

520 Prior to analysis, we followed the same procedures as described in Study 1. We excluded

521 ten cases because TIME_RSI (Leiner, 2019) was >2, leaving a total sample of $N$=443 cases.

522 Using Mahalanobis distance, we identified another ten cases as multivariate outliers with $p$<.001,

523 which we excluded from multivariate analyses (final $N$=433). Please refer to Supplemental

524 Material for a full data analysis using the entire dataset, and analyses without covariates.

525 To validate the factor structure of the CSPS we performed a confirmatory factor analysis.

526 We examined inter-relations of its subscales using Gaussian graphical modelling and correlation

527 analysis, and relations with indicators of pro-environmentalism (PEB, environmental awareness,

528 environmental motivation, willingness to donate), and socio-demographic variables using $t$-tests

529 and path analysis.

530

531 **4.3 Results**

532 **4.3.1 Descriptives.**

533 Tables 5 and 6 display descriptive statistics of study variables. Participants scored rather

534 high on PEB, high on environmental motivation, and medium-low on self-protection. Most

535 people (80.83%) wanted to participate in the raffle. Of those, 196 people (54.44%) indicated they

536 would be willing to donate some or all of the money to an environmental organization, in case

537 they would win ($M$=31.08€, $SD$=16.79€, range:1-50€).

538 **4.3.2 Confirmatory factor analysis.**

539    ***Hypothesized model and assumptions.*** We performed a confirmatory factor analysis to

540    analyze the structure of the 26 items of the CSPS, using the R-package lavaan version 0.6-3

541    (Rosseel, 2012). There were no missing data. The Doornik-Hansen test revealed multivariate non-

542    normality (*E*(52)=459.26, *p*<.001) and inspection of histograms, Q-Q-plots, skewness, and

543    kurtosis of all individual items revealed positive skewness of most items. However, square-root-

544    transformation of items with skewness >.6, log-transformation of items with skewness >1, and

545    exclusion of seventeen multivariate outliers based on Mahalanobis distance with *p*<.001 did not

546    remedy this problem. Instead, we used the complete data set (*N*=443) and dealt with non-

547    normality using robust maximum likelihood estimation with Satorra-Bentler correction (MLM,

548    Finney & DiStefano, 2013).

549    As suggested in Study 1, we hypothesized a five-factor model and all factors to co-vary

550    with each other. To test whether the respective factors can be understood in terms of Cohen's

551    framework in this more balanced sample, we also included two secondary factors, namely,

552    interpretive denial (denial of personal outcome severity and denial of global severity) and

553    implicatory denial (rationalization, avoidance, and denial of guilt). We constrained latent factors

554    to have a mean of 0 and a variance of 1. With between 58 and 66 parameters to be estimated, the

555    ratio of cases to estimated parameters was approximately 7:1. The model was identified.

556    Graphical representations of all models including (un)standardized parameter estimates,

557    standardized residuals, squared multiple correlation coefficients, and empirical and model-

558    implicated variance-covariance-matrices are in the Supplemental Material.

559    ***Model Estimation.*** The hypothesized model had acceptable fit (Hu & Bentler, 1999),

560    Satorra-Bentler $\chi^2$(293, *N*=443)=814.24, *p*<.001, Robust Comparative Fit Index (CFI)=.91,

561    Akaike information criterion (AIC)=36262.22, Robust Root Mean Square Error of

562    Approximation (RMSEA)=.069, 90%CI[.063, .074]. Based on modification indices and

26

563    theoretical feasibility, we estimated three residual covariances of three items loading onto the

564    factor *avoidance* and one additional covariance between two items loading onto the factor *denial*

565    *of guilt* (see Figure 2). This improved model fit significantly, Satorra-Bentler $\chi^2$(289,

566    *N*=443)=618.51, *p*<.001, Robust CFI=.94, AIC=36036.50, Robust RMSEA=.055, 90%CI[.049,

567    .061], $\chi^2_{\text{diff}}$(4, *N*=443)=154.54, *p*<.001. Internal consistency of the replicated self-protective

568    strategies was acceptable to excellent (α=.73–.91).

569          Inspection of standardized parameter estimates of the secondary factors revealed that the

570    factor avoidance did not load highly on the secondary factor implicatory denial (β=.39). Since

571    there is theory to suggest that avoidance may be a separate process than implicatory denial (e.g.,

572    Salander & Windahl, 1999), we decided to include avoidance as its own secondary factor. The

573    resulting model did not significantly differ from the previous model, Satorra-Bentler $\chi^2$(288,

574    *N*=443)=618.19, *p*<.001, Robust CFI=.94, AIC=36037.33, Robust RMSEA=.055, 90%CI[.049,

575    .061], $\chi^2_{\text{diff}}$(1, *N*=443)=.75, *p*=.385.

576          We also analyzed a model without any secondary factors, Satorra-Bentler $\chi^2$(285,

577    *N*=443)=593.06, *p*<.001, Robust CFI=.94, AIC=36011.40, Robust RMSEA=.053, 90%CI[.047,

578    .059]. Even though the resulting model had slightly better model fit than models including

579    secondary factors ($\chi^2_{\text{diff}}$[3, *N*=443]=20.43, *p*<.001 and $\chi^2_{\text{diff}}$[4, *N*=443]=21.24, *p*<.001), the

580    difference was very small and its real-life significance may be questionable, especially given

581    theoretical support of a higher-order structure. We therefore interpret the findings as support for

582    H1 and H2.

583          **4.3.3 Relations of subscales.**

584          Replicating findings from Study 1, people indicated overall medium-low levels of self-

585    protection. Participants reported denial of the global outcome severity of climate change least,

586    while denial of guilt was more common. The pattern of correlations between the subscales was
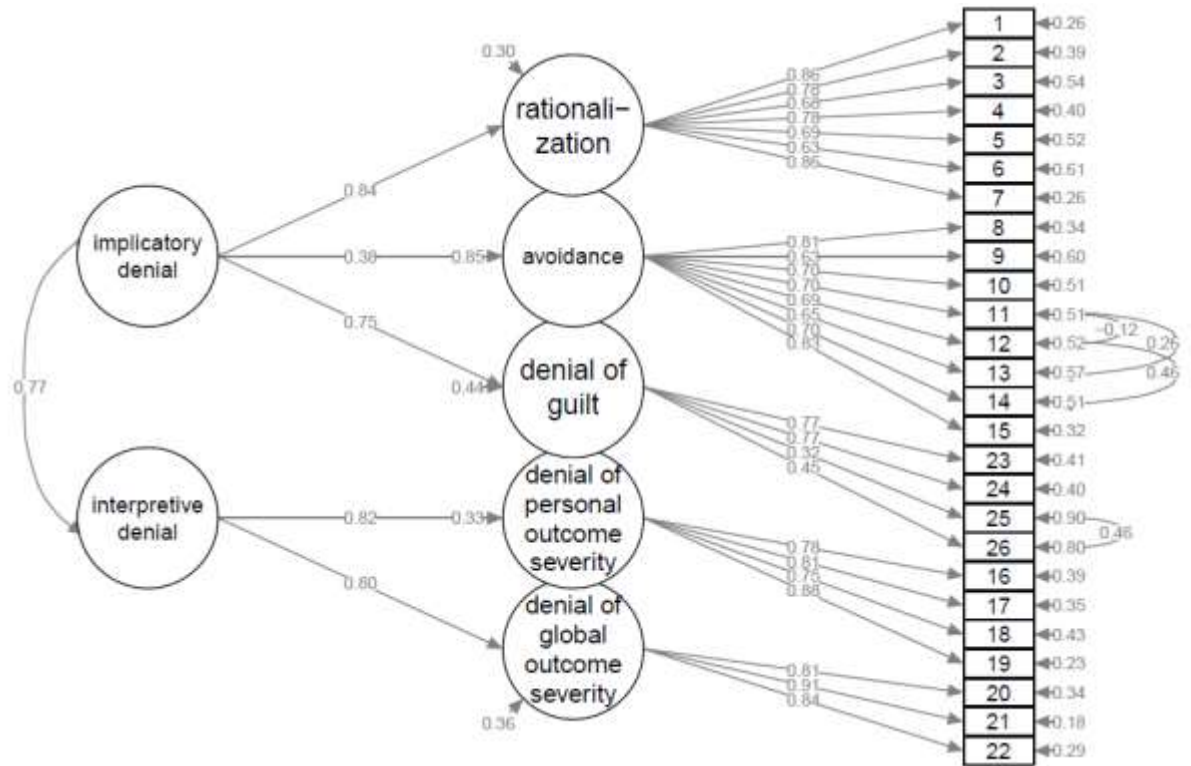
587

*Figure 2.* Final model showing the five factors of the Climate Self-Protection Scale and two

secondary factors corresponding to interpretive and implicatory denial. Displayed are

standardized parameter estimates. Latent variables (factors) are drawn as circles and measured

items are drawn as rectangles.

592

similar to that in Study 1 (Table 5). As in Study 1, we log-transformed the subscales denial of

personal and global outcome severity because their distributions were skewed.

Further, we visualized partial correlations between the subscales of the CSPS using

Gaussian graphical modelling (Bhushan et al., 2019, Figure 3). We observed two clusters

consisting of denial of personal and global outcome severity, and rationalization, avoidance, and

28

598    Table 5

599    *Spearman correlations and descriptive statistics of self-protective strategies*

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | α [95%CI] | M (SD) | Skewness (Kurtosis) |
|---|---|---|---|---|---|---|---|---|---|
| 1. Overall self-protection | — | [.80-.85] | [.61, .73] | [.64, .75] | [.59, .70] | [.40, .55] | .9 [.89, .92] | 2.75 (.82) | .38 (-.11) |
| 2. Rationalization | .83** | — | [.29, .46] | [.39, .56] | [.34, .49] | [.25, .44] | .89 [.88, .91] | 3.00 (1.27) | .42 (-.35) |
| 3. Avoidance | .69** | .39** | — | [.18, .39] | [.09, .32] | [-.16, .05] | .9 [.88, .91] | 2.68 (1.15) | .48 (-.43) |
| 4. Denial of personal outcome severity | .70** | .49** | .36** | — | [.48, .65] | [.20, .41] | .88 [.86, .9] | 2.05 (1.11) | 1.30 (1.48) |
| 5. Denial of global outcome severity | .64** | .44** | .31** | .58** | — | [.34, .50] | .88 [.86, .9] | 1.94 (1.17) | 1.50 (1.94) |
| 6. Denial of guilt | .43** | .30** | -.04 | .28** | .36** | — | .71 [.67, .76] | 3.75 (1.18) | .36 (-.22) |

606    *Note.* p-values adjusted for multiple tests. Above the diagonal are 95% confidence intervals.

607    **p<.01.

608    Table 6

609    *Spearman correlations of self-protective strategies with study variables and descriptive statistics of study variables*

| Variable | 1 [95%CI] | 2 [95%CI] | 3 [95%CI] | 4 [95%CI] | 5 [95%CI] | 6 [95%CI] | α [95%CI] | *M (SD)* | Skewness (Kurtosis) |
|---|---|---|---|---|---|---|---|---|---|
| 8. Pro-environmental behavior | -.36** [-.46, -.30] | -.31** [-.40, -.23] | -.28** [-.39, -.21] | -.24** [-.35, -.17] | -.31** [-.38, -.24] | -.03 [-.14, .03] | .72 | .47 (1.21) | .62 (1.27) |
| 9. Donation to environmental organization | -.04 [-.18, .10] | .03 [-.10, .18] | -.13 [-.28, .00] | -.02 [-.13, .14] | -.12 [-.23, .09] | .09 [-.03, .25] | - | 31.08 (16.79) | -.07 (-1.50) |
| 10. Environmental awareness | -.44** [-.55, -.38] | -.33** [-.43, -.25] | -.28** [-.10, -.08] | -.39** [-.53, -.34] | -.50** [-.62, -.45] | -.18* [-.34, -.16] | .80 [.77, .83] | 81.27 (17.12) | -1.02 (.74) |
| 11. Environmental motivation | -.44** [-.54, -.38] | -.38** [-.49, -.32] | -.40** [-.49, -.31] | -.35** [-.44, -.24] | -.32** [-.39, -.22] | .04 [-.07, .10] | .87 [.86, .89] | 140.75 (49.44) | -.22 (-.31) |
| 12. Age | .02 [-.06, .13] | .02 [-.05, .13] | -.10 [-.19, -.01] | .00 [-.10, .10] | .03 [-.07, .13] | .26** [.18, .35] | - | 37.68 (15.69) | .69 (-.61) |
| 13. Income | -.02 [-.20, .01] | -.02 [-.19, .02] | -.09 [-.22, -.07] | .06 [-.10, .07] | -.01 [-.13, .04] | .10 [-.06, .15] | - | 1833.50 (2519.33) | 9.83 (141.96) |
| 14. Political orientation | .23** [.16, .36] | .19** [.10, .29] | .13 [.04, .21] | .14 [.09, .30] | .25** [.21, .40] | .13 [.05, .26] | - | 35.80 (19.29) | .33 (-.28) |

616    *Note.* 1=Overall self-protection, 2=Rationalization, 3=Avoidance, 4=Denial of personal outcome severity, 5=Denial of global outcome

617    severity, 6=Denial of guilt. We display descriptive statistics of Rasch person parameter for pro-environmental behavior. *p*-values adjusted

618    for multiple tests.

619    [a]Person separation reliability

620    [†]*p*<.10, *\*p*<.05, *\*\*p*<.01.

30

621    denial of guilt, respectively. We interpret this as interpretive and implicatory denial strategies

622    clustering together, providing further evidence for H2.

623    **4.3.4 Self-protective strategies and socio-demographics.**

624    Replicating findings from Study 1, self-protective strategies were mostly unrelated to

625    age and income, except for a medium positive relation between denial of guilt and age and a

626    small negative correlation between age and avoidance. There was also a small positive

627    correlation between income and denial of guilt. All self-protective strategies were positively

628    related to right-wing political orientation, especially denial of global outcome severity,

629    confirming H3. See Table 6 for a full overview of correlations. A series of Welch two sample

630    *t*-tests revealed differences between the genders[3]. Women reported significantly less use of

631    rationalization ($t[305.55]=2.55$, $p=.011$, $d=.26$, 95%CI of group difference [.08, .59],

632    $M[SD]_{female}=2.87[1.22]$, $M[SD]_{male}=3.21[1.34]$), denial of global outcome severity

633    ($t[279.41]=2.46$, $p=.015$, $d=.26$, 95%CI[.06, .54], $M[SD]_{female}=1.84[1.07]$,

634    $M[SD]_{male}=2.14[1.31]$), and denial of guilt ($t[326.09]=4.27$, $p<.001$, $d=.43$, 95%CI[.27, .73],

635    $M[SD]_{female}=3.56[1.16]$, $M[SD]_{male}=4.06[1.17]$) than men, supporting H4.

636    A series of ANOVAs and subsequent pairwise *t*-tests with Bonferroni correction

637    revealed no differences between levels of education.

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[3] Due to power concerns, we excluded one person from this analysis because they reported being non-binary.
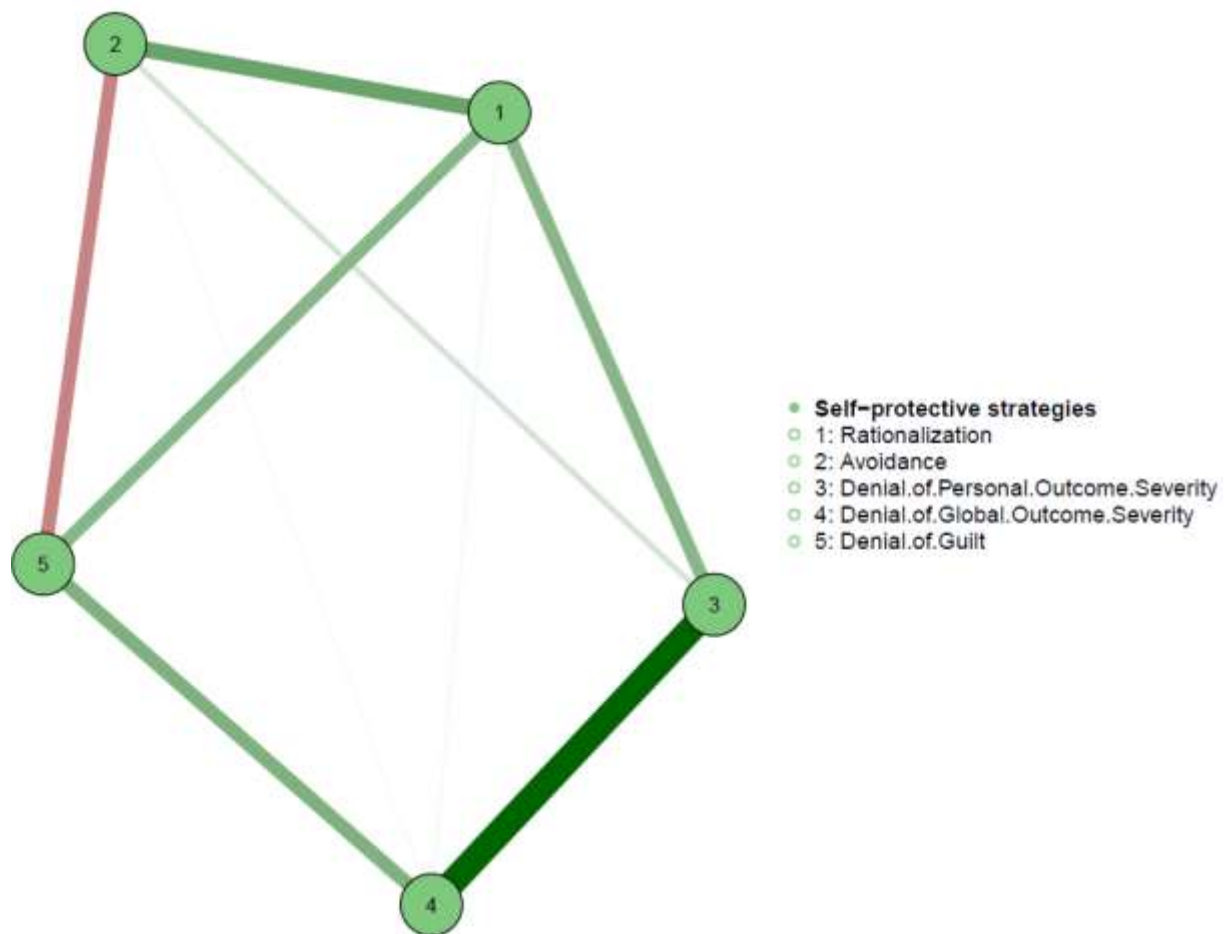
638

*Figure 3.* Gaussian graphical model displaying interrelations of the subscales of the CSPS.

Green lines indicate positive partial correlations and red lines indicate negative partial

correlations. Thickness of lines indicates strength of relationships. For sake of clarity, only

partial correlations above .1 are shown.

**4.3.5 Self-protective strategies and indicators of pro-environmentalism.**

All self-protective strategies correlated negatively with all indicators of pro-environmentalism

(see Table 6), except for willingness to donate, which appeared unrelated to self-protective

strategies. To investigate relations between self-protective strategies and different indicators

of pro-environmentalism, we ran a path model with self-protective strategies predicting

different environmental indicators, environmental awareness predicting environmental

660  *Figure 4.* Path model displaying relations between self-protective strategies and pro-environmentalism. Displayed are standardized

661  parameter estimates. Significant results are bold. 1=Rationalization, 2=Avoidance, 3=Denial of personal outcome severity, 4=Denial of

662  global outcome severity, 5=Denial of guilt.

663   motivation, and environmental motivation predicting environmental behavior, controlling for

664   age, gender, political orientation, and income (see Figure 4 for a simplified visualization of

665   the model with path coefficients and Supplemental Material for standardized residuals and

666   empirical and model-implicated variance-covariance-matrices). The Doornik-Hansen test

667   revealed multivariate non-normality ($E(26)=16549.01$, $p<.001$). We therefore used MLM

668   (Finney & DiStefano, 2013) and log-transformed data for denial of personal and global

669   outcome severity. With a sample size of $N=397$ and 44 parameters to be estimated, the ratio of

670   cases to estimated parameters was approximately 9:1. The model was identified. The

671   hypothesized model fit the data well (Hu & Bentler, 1999), with Satorra-Bentler $\chi^2(2,$

672   $N=397)=15.68$, $p<.001$, Robust CFI=.997, AIC=11831.75, Robust RMSEA=.125,

673   90%CI[.072, .186]. In sum, interpretive denial predicted environmental awareness,

674   implicatory denial and environmental awareness predicted environmental motivation,

675   rationalization, denial of global outcome severity, and environmental motivation predicted

676   PEB, and denial of guilt and environmental motivation predicted donations. We interpret this

677   as evidence for H5.

678

679   **4.4 Discussion**

680        This study provides further evidence for the criterion, construct, and factorial validity

681   of the CSPS, replicating and strengthening findings from Study 1. Using confirmatory factor

682   analysis, we replicated its five-factorial structure and found evidence for Cohen's framework,

683   providing evidence for factorial validity of the CSPS. Gaussian graphical modelling revealed

684   self-protective strategies to be predominantly positively related to each other and to cluster

685   into interpretive (denial of personal and global outcome severity) and implicatory denial

686    (rationalization, avoidance, and denial of guilt), referring to Cohen's (2001) framework.

687    Avoidance did not cluster as closely to the other implicatory strategies and negatively related to

688    denial of guilt.

689    Study 2 further aimed at investigating relations of self-protective strategies with various

690    indicators of pro-environmentalism, gender, and political orientation. As expected and replicating

691    findings from Study 1, male gender and right-wing political orientation related positively to self-

692    protective strategies. Self-protective strategies were also negatively related to various indicators

693    of pro-environmentalism, even when controlling for covariates, providing evidence for criterion

694    and construct validity of the CSPS.

695

696    **5. General Discussion**

697    The present research aimed at constructing and validating an instrument that could be

698    used to assess self-protective strategies people commonly use to deal with the threat of climate

699    change. Two studies found evidence for the CSPS to be an internally consistent and valid

700    measure of climate self-protective strategies. Across studies, the CSPS was negatively related to

701    various indicators of pro-environmentalism, and positively related to male gender and right-wing

702    political orientation.

703    **5.1 Interpretation of Results**

704    Regarding criterion and construct validity, we mainly found results in line with our

705    hypotheses. Self-protective strategies were negatively related to various indicators of pro-

706    environmentalism. More specifically, interpretive denial predicted environmental awareness,

707    while implicatory denial predicted environmental motivation. A mix of both predicted actual

708    behavior. This replicates findings by Ojala (2015) that de-emphasizing the seriousness of climate

709    change, a strategy corresponding to interpretive denial, was associated with less PEB. Similarly,

710  Homburg et al. (2007) found negative relations between denial of guilt (implicatory denial) and

711  PEB. We expected to find such a relation because self-protective strategies are used to disengage

712  from the climate crisis – and thus legitimize avoiding the necessity to change one's own behavior.

713         Unexpected findings emerged regarding willingness to donate, which correlated positively

714  with denial of guilt. One possible explanation could be that those who denied their guilt and were

715  confronted with this through answering the questionnaire may have developed a sense of

716  obligation and therefore indicated to donate money as a way to calm their consciousness.

717  However, one may also speculate that those who deny guilt do so because they already do all they

718  can for the environment. In this case, an absence of feelings of guilt would not be a self-

719  protective strategy. While this may be true for a subset of the participants, we found no overall

720  strong relations between denial of guilt and PEB.

721         Interestingly, avoidance and denial of guilt correlated negatively in both samples. Perhaps

722  those who felt guilty and were not able to deny those feelings needed to take a larger effort to

723  avoid the reality of climate change to enable themselves to cope with the demands of everyday

724  life. Salander & Windahl (1999) recommend to split what people commonly refer to as denial

725  into denial, disavowal, and avoidance, with avoidance being a conscious process, and the least

726  clinically relevant strategy of the three. This suggests avoidance may be separate from the other

727  implicatory strategies of denial that may be described as disavowal – the preconscious process of

728  simultaneous *knowing but not knowing*. In fact, the results of the confirmatory factor analysis in

729  Study 2 show models fit the data equally well, which include and exclude avoidance as an

730  implicatory strategy, respectively. Further, the negative relation between avoidance and denial of

731  guilt may indicate different subgroups in our samples that employ differing self-protective

732  strategies. This may even indicate a process people go through before they arrive at more

733  constructive strategies. Future research could disentangle these findings further.

734         Across studies, women used less self-protective strategies than men. Other researchers

735     consistently found that men engage in more literal and interpretive ("conservative male effect",

736     Jylhä et al., 2016; Feygina et al., 2010; McCright & Dunlap, 2011; Ojala, 2015; Poortinga et al.,

737     2011), and in implicatory climate denial (Norgaard, 2006a). Men may be more motivated to deny

738     to preserve the contemporary system because they benefit from it, relative to women, for example

739     in terms of relatively higher positions of power (Jylhä et al., 2016).

740         Further, right-wing political orientation and self-protective strategies were related. We

741     expected this finding, given the literature on relations between climate denial, right-wing

742     authoritarianism, and conservatism (Jylhä & Akrami, 2015; Milfont et al., 2013). In both studies,

743     these relations were stronger for interpretive denial than implicatory denial. Norgaard (2019)

744     found that climate denial exists on a spectrum of responses that entail both the political left and

745     right. Typically, the center-left employs implicatory forms of denial (Norgaard names public

746     apathy and trust in neoliberal market solutions that do not solve the root of the crisis, such as

747     green technology), while the political right employs interpretive and literal denial. While the

748     manifest shape of the denial is different, the function it serves is similar across the continuum.

749     Ultimately, it is a reaction to (psychological) threat and entails a reinforcement of social

750     structures and solidification of power relations (Norgaard, 2019). The present research is partly in

751     line with these findings.

752

753    **5.2 Limitations and Future Directions**

754         Some limitations of the current studies deserve comment. First, we used a non-probable

755     purposive sampling approach to recruit participants for the first study and relied on a panel

756     provider to recruit participants for the second study. While this led to non-representative samples

757     we argue that our relatively young privileged participants are particularly relevant as they will

758    live with climate change the longest, are very informed, and have influential behavior. However,

759    a follow-up study should further validate the CSPS in a representative sample.

760        Furthermore, when researching defensive, self-protective strategies, it is important to

761    remember that these processes are often unconscious and that social desirability may bias

762    answers. It is thus challenging to research them using methods that rely on conscious recollection.

763    Future research should complement our approach with implicit methods (e.g., Implicit

764    Association Test, Greenwald et al., 1998).

765        In our studies, we used a general measure of political left-right orientation as a predictor

766    of self-protective strategies. As prior research revealed the predictive role of more specific

767    ideological variables on literal climate denial, especially social dominance orientation (Jylhä &

768    Akrami, 2015; McCright & Dunlap, 2011) and system justification (Feygina et al., 2010), future

769    studies should include such specific predictors and examine their relations with the self-protective

770    strategies identified in our research. Further, as all levels of denial seem to be related to

771    protection of the self from threat, the CSPS could be used to investigate the relations between

772    self-protection and fundamental indicators of human well-being and functioning, regardless of

773    ideological outlook (e.g., basic psychological needs). For example, limited psychological

774    resources to face the threat of climate change due to thwarted basic psychological need

775    satisfaction (Deci & Ryan, 2000), may be one antecedent of self-protective strategies.

776        Lastly, the approach employed in this paper may be criticized for oversimplification of a

777    highly complex phenomenon (e.g., Poortinga et al., 2011) that can and should be examined using

778    a multitude of scientific perspectives. Not only are self-protective strategies relevant regarding

779    the psychological functions they serve and resulting absence of action, but also regarding

780    ideology and (global) power relations, economic and political interests, and implications for

781    environmental justice, self-determination, democracy, human rights, and environmental collapse.

38

782     It is important to note that denialism is also actively constructed by conservative think tanks

783     (Norgaard, 2019). Thus, psychological factors cannot fully explain denialism but rather explain

784     predisposition for agreement with it (Jylhä et al., 2016; Norgaard, 2011). At the same time, we

785     acknowledge that the complexity of the human condition and embeddedness of individuals in

786     pervasive economic-political contexts demand and require transdisciplinary and mixed-methods

787     approaches. Qualitative approaches that are able to capture and analyze the inherent

788     inconsistencies and ambiguities in the human experience may be particularly informative.

789     Nevertheless, we believe that our new measure may be a valuable contribution to the

790     understanding of psychological functions and antecendents of denial, to overcome it and enable

791     action.

792

793     **5.3 Conclusion**

794         Self-protective strategies are dangerous because they prevent the action needed to avert

795     and buffer the most dire consequences of the climate crisis. They serve the psychological function

796     of protecting and enabling the self to go about its everyday life without panicking. However,

797     people may need guidance on how to deal with uncomfortable, negative, and potentially

798     traumatic feelings associated with the threat of climate change, to overcome denial and start

799     action, while maintaining mental health. The present study fills in one piece of the puzzle by

800     providing a tool to measure climate-relevant self-protective strategies. Pursuing this research

801     further may at some point allow recommendations for a society that is resilient in the face of

802     crisis and able to deal with threat proactively and constructively, both on individual and collective

803     levels.

804

805

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