



The Influence of Educational Group Activities on Perceived Biospheric Group Values and Pro- Environmental Intentions

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Abstract

An important aspect of environmental psychological research is how to adequately design interventions that promote individual engagement in climate action. A recent approach is to address the issue that most people structurally underestimate the extent to which others endorse biospheric values, leading to climate inaction. The present study investigated whether participation in environmentally-related group activities encouraging dialogical exchange strengthens perceived group values (H1) and by that increases intentions to behave pro-environmentally (H2), especially if identification with the reference group is high (H3). Within a combination of laboratory and field study, a within-subjects design with three measurement waves (baseline, pre- and post-intervention) was implemented where $n = 44$ participants filled in the questionnaire for all waves. The central aim of the interventions was to encourage dialogical exchange on environmental topics. The data indicated a significant increase in perceived biospheric group values (supporting H1) but neither a significant relation between group values and behavioural intentions (not supporting H2) nor an interaction between perceived biospheric group values and identification (not supporting H3). This is in line with a recent study not finding a significant relation between perceived biospheric group values and pro-environmental behavioural intentions, despite earlier research indicating perceived group values to promote climate action. The present study thus emphasizes the need for empirical research investigating the inconsistent findings regarding the role of perceived group values in encouraging pro-environmental behaviour.

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The Influence of Educational Group Activities on Perceived Biospheric Group Values and Pro-Environmental Intentions

As a result of human activities, our climate is changing and so are the circumstances of our daily lives and global society. The consequences are impacting our natural environment, challenging our routines and familiar ways of life. The most recent report of the Intergovernmental Panel on Climate Change (IPCC; 2021) emphasizes the need for urgent, thorough and long overdue action to reduce emissions to zero. Otherwise, the global temperature will increase more than 1.5°C or even 2°C within the 21st century, continuously altering our climate system and causing major changes in land and ocean ecosystems (IPCC, 2018, 2021).

Although data from the European Social Survey (ESS; European Research Infrastructure Consortium [ERIC], 2018) indicate that most Europeans believe in climate change and acknowledge it to be a global problem, climate adaptation and mitigation actions of relevant stakeholders are still insufficiently taken (IPCC, 2018). A second analysis of the ESS data found that stronger biospheric values, which reflect a general personal goal to care about nature and the environment, are typically associated with stronger pro-environmental attitudes and intentions (Bouman, Verschoor et al., 2020). Accordingly, biospheric values are generally regarded a motivational basis for climate action and emphasizing, activating or appealing to positive biospheric values may encourage pro-environmental behaviour (PEB; Bouman, Steg, & Perlaviciute, 2021; Bouman, Steg, & Kiers, 2018; Steg et al., 2011; Steg, 2016).

Next to personal values, another motivational factor for PEB may be the values of fellow group members. Interestingly, recent studies show that individuals often underestimate the extent to which others endorse biospheric values, which is argued to demotivate climate action (Bouman & Steg, 2019; Bouman, Steg, & Zawadzki, 2020). Consequently, a more

positive and realistic recognition of others' values may revise the underestimation of biospheric group values and by that encourage PEB (Bouman & Steg, 2019).

The present study investigates whether dialogical exchange on climate-related topics will strengthen perceived biospheric group values and thereby promote intentions to behave pro-environmentally. More specifically, it investigates the effect of educational interventions in which participants are encouraged to discuss their positive or negative experiences with PEB, implicitly making their values visible to other participants. Insights into the underlying mechanisms and the efficacy of such interventions can further contribute to a more adequate design, conceptualisation and monitoring of subsequent interventions.

Biospheric Values and Identification

Biospheric Personal Values

Values, refer to desirable life goals that are relatively stable over time and context, and used as important guiding principles in individuals' lives (Bouman, Steg, & Zawadzki, 2020).

Values are trans-situational and universal, which means that all individuals share the same set of values that they act upon in various situations. However, individuals differ in the extent to which they endorse and prioritize each value. The stronger certain values are endorsed and prioritized, the greater they influence individuals' motivation and decision-making (Bouman, van der Werff et al., 2021; Wang et al., 2021). Research in environmental psychology typically focuses on personal rather than group values, showing that stronger personal endorsement of biospheric values (i.e., caring about nature and the environment) is associated with stronger engagement in PEB (Bouman & Steg, 2019). Accordingly, in order to consistently and effectively implement PEB and climate action, it is crucial that many people strongly endorse biospheric values.

Since personal values are considered relatively stable, they cannot be easily targeted through interventions (Wang et al., 2021). Further, people are generally influenced by others'

opinions and behaviours (Bouman & Steg, 2019). Therefore, recent research shifted more towards the investigation of values on the group level.

Biospheric Group Values

Across cultures, it is found that similar to personal values, the stronger one perceives fellow group members to endorse biospheric values, the more likely they are to engage in PEB (Wang et al., 2021). This appears to be in particular the case among those who relatively weakly endorse biospheric personal values themselves and strongly identify with their own reference group (Bouman, Steg, & Zawadzki, 2020). Considering that, it is especially remarkable that people seem to systematically underestimate the extent to which other people hold biospheric values, although it is indicated that biospheric values are strongly endorsed and prioritised (Bouman, Steg, & Zawadzki, 2020; Bouman, van der Werff et al., 2021; Hanel, Wolfradt et al., 2018).

Since the perception that others do not care as much as oneself inhibits people to display value-congruent behaviour and engage in climate action, interventions on the group level are needed. Additionally, changing individuals' perceptions of fellow group members' values may be more likely to achieve than changing personal values, as perceived group values are more easily affected by new information than personal values (Bouman & Steg, 2020; Wang et al., 2021).

Group Identification

As mentioned above, the extent to which individuals' pro-environmental behavioural intentions are influenced by their perceived group values depends on how strongly they identify with their reference group (Bouman, Steg, & Zawadzki, 2020). This is reflected in group identification, namely individuals' positive social relation to a group and how important is to them (Postmes et al., 2013; Leach et al., 2008).

Intervention Characteristics

The present study examines the changes within the perceived group values that occur through specific experiences, namely the participation in educational group activities encouraging dialogue and addressing subjects such as sustainability and climate change. It thus differs from previous studies like Bouman, Steg, and Zawadzki (2020) or Wang et al. (2021), which explicitly and directly discuss group values, by following a more implicit approach to reinforce the perceived group values and make them visible and tangible. Interacting with other people within a climate-related context and exchanging personal experiences, struggles and ambitions regarding PEB contributes to the impression participants have of fellow group members. Accordingly, it might adjust the extent to which participants perceive others to endorse biospheric values, encourage PEB and decrease climate inaction (Bouman & Steg, 2019; Bouman, Steg, & Zawadzki, 2020; Bouman, van der Werff et al., 2021; Wang et al., 2021).

Hypotheses

Within the present study, two main attempts can be differentiated, aiming to contribute to the investigation of implicit situational and contextual factors affecting group values as well as the relation between group values and PEB: a) examining the changes of perceived biospheric group values through specific experiences, namely the participation in educational group activities and b) providing insight into the question, whether emphasizing group values indirectly motivates PEB. From these central aims, and the preliminary insights discussed earlier, the following hypotheses can be derived:

H1: The participation in environmentally-related educational group activities strengthens perceived biospheric group values.

H2: The stronger individuals perceive their reference group to endorse biospheric values, the stronger are their intentions to engage in pro-environmental behaviour.

H3: The effect of perceived group values on pro-environmental behavioural intentions is stronger for those who more strongly identify with their reference group.

Method

Participants and Procedure

To test the aforementioned hypotheses, a combination of field and laboratory intervention studies was conducted in an online setting. The intervention consisted of different educational programmes, such as moderated discussions and workshops, each addressing environmental topics, climate change and sustainability. These programmes were designed to allow interaction between the participants, discussing for example individual or societal means of engagement in climate mitigation, positive visions of a sustainable future and possible attempts to realize them. The interactive nature of the interventions, focusing on pro-environmental attitudes and concerns, is expected to raise participants' awareness for others' biospheric values and by that adjust their perceptions.

The initial sample was selected by contacting environmental educational NGOs and other educational organisations based in Germany, asking whether they would be willing to collaborate in the research by forwarding the questionnaire to the participants of their interventions. The participants were sampled by self-selection, as they voluntarily and autonomously signed up to the programmes. The enrolment was open to any person being of 18 years or older with access to internet.

Due to low response rates and thus difficulties in reaching an adequate sample size, participants from a German-speaking convenience sample (extended social environment of the researcher), as well as an English-speaking student sample (SONA system, mostly psychology bachelor students) were included. With this extended sample, a moderated discussion was implemented that involved the exchange of experiences regarding climate

action and sustainability (see Appendix A). The ethics committee reviewed and approved the research each before the first sampling and before the extension of the sample.

Study Design

The study had a repeated measures within-subjects design with three waves. The participants were asked to fill in a 10-to-15-minute online questionnaire (see Appendix B) a few days before the actual intervention (T1, to compare the random changes over time with the changes during the intervention), shortly before the actual activity (T2, pre-intervention) and finally shortly afterwards (T3, post-intervention). The questionnaire first asked for informed consent, a personal identification code and demographic variables (gender, age), followed by items quantifying the main predictive variables: biospheric personal values and perceived biospheric group values, as well as group identification for exploratory purposes. As for the part of the survey that was conducted in Germany, the reference group used to measure group values and group identification were Germans or the German society. As for the English-speaking student sample, the reference group were fellow students or the student community. The questionnaire then proceeded to the main outcome variable: pro-environmental behavioural intention.

The programmes had variable durations from one and a half to four hours, the moderated discussion within for the student sample took about one hour. The student sample received SONA credits for participation, the remaining sample did not receive compensation.

Sample Size and Participant Flow

In total, 140 people participated in at least one of the three waves. Of the 140 participants, 57 were recruited from workshops and educational programmes from German NGOs and educational organisations. From those, nine participants completed all three waves and 27 participants completed T2 and T3. The 21 participants who only completed one wave (either T2 or T3) were excluded from the later analyses. Additionally, 83 participants were

recruited from a student SONA participant pool, of which 46 completed all three waves. The 37 participants who only filled in one wave (T1) were excluded from the later analyses. Both samples were taken together, resulting in 55 participants that completed all three waves. Of those, 11 more participants were excluded due to incomplete responses or mismatching cases¹, yielding in a final sample of $n = 44$ for the analyses².

According to a power analysis for a within subjects repeated measures analysis of variance (RM-ANOVA) with one group, three waves of measurement and a moderately small effect size ($f = .20$), as well as a t-test with two dependent means (repeated measure) and a moderately small effect size ($d = .40$), a sample of $n = 42$ was required to test H1 ($\alpha = .05$, power = .80, $r = .50$). An additional power analysis for a linear multiple regression with a fixed model, a single regression coefficient on pro-environmental behavioural intentions and two predictors (group values, group identification), given a moderately small effect size ($d = .10$), a sample of $n = 64$ was required to test H2 and H3 ($\alpha = .05$, power = .80).³

The power analysis was performed with G*Power 3.1, the data preparation and analysis were performed with IBM SPSS Statistics Version 28.0 (2021).

Measures of Predictor and Outcome Variables

Biospheric Personal Values

Personal values were measured with either the German or English version of the Environmental Portrait Value Questionnaire (E-PVQ) by Bouman, Steg, and Kiers (2018). Participants were instructed to rate 17 items reflecting the biospheric (four items), altruistic (five items), hedonic (three items) and egoistic (five items) values of a portrayed person on a

¹ For two participants, the cases were merged manually, being similar in age and gender and having coherent recording / intervention dates but differing in one digit / letter of the identifier code, assumably by accident.

² All of the analyses were performed with a sample requiring only T1 and T2 (baseline; $n = 45$) or T2 and T3 (intervention; $n = 64$) versus smaller sample requiring all three waves ($n = 44$). There was no relevant difference in significance and only marginal differences in the descriptive tendencies between the results of both samples, for which reason only the results of the smaller but more coherent sample are reported

³ Note that the results of the analyses did not differ between $n = 64$ or $n = 44$, as mentioned above. Due to later discussed sampling issues, it was not feasible to recruit a larger sample.

7-point scale (1 *totally not like me* to 7 *totally like me*) indicating the extent to which the person is like themselves. The present study research focuses on four items measuring biospheric personal values: It is important to this person to... prevent environmental pollution; ...protect the environment; ...respect nature; ...be in unity with nature. The respective items formed a reliable scale displaying biospheric personal values throughout all waves (T1: $\alpha = .82$, $M = 5.72$, $SD = 0.91$; T2: $\alpha = .84$, $M = 5.80$, $SD = 0.87$; T3: $\alpha = .82$, $M = 5.97$, $SD = 0.75$).

Biospheric Group Values

To measure group values, a variation of the E-PVQ was conducted (Bouman, Steg, & Zawadzki, 2020). The items and instructions were the same as for personal values, except that the participants were asked to indicate the extent to which the person is like an average member of the reference group (either a German or a student). The respective items formed a reliable scale displaying biospheric group values throughout all waves (T1: $\alpha = .83$, $M = 4.27$, $SD = 1.03$; T2: $\alpha = .91$, $M = 4.22$, $SD = 1.19$; T3: $\alpha = .95$, $M = 4.45$, $SD = 1.34$).

Group Identification

To measure group identification, four items from Bouman, Steg, and Zawadzki (2020) were adapted to fit the reference group: I feel committed to [the German society / my fellow students]; I am glad to be part of the [German society / student community]; Being [German / a student] is an important part of how I see myself; I identify with [the German society / my fellow students]. Participants were instructed to rate to what extent they agree with the statements on a 7-point scale (1 *not at all* to 7 *completely*). The respective items formed a reliable scale, displaying group identification throughout all waves (T1: $\alpha = .83$, $M = 4.26$, $SD = 1.29$; T2: $\alpha = .89$, $M = 4.11$, $SD = 1.36$; T3: $\alpha = .89$, $M = 4.09$, $SD = 1.4$).

Pro-Environmental Behavioural Intentions

To measure participants' intentions to behave pro-environmentally, a validated measure of PEB, mostly based on the Pro-Environmental Behaviour Scale (PEBS), was adjusted to display self-reported intentions rather than behaviour (Markle, 2013; Hanel, Litzellachner, & Maio, 2018). Intentions are a precedent and strong predictor of future behaviours, while self-reported behaviour are a retrospective measure and should ideally not be altered by the intervention. Participants were instructed to rate to what extent they intend to conduct 16 specific behaviours on a 7-point scale (1 *not at all* to 7 *completely*). The respective items form a reliable scale displaying pro-environmental behavioural intentions throughout all waves (T1: $\alpha = .74$, $M = 5.35$, $SD = 0.76$; T2: $\alpha = .81$, $M = 5.43$, $SD = 0.77$; T3: $\alpha = .84$, $M = 5.67$, $SD = 0.78$).

Results

Demographics

Within the final sample, 44 people participated at all three waves of which 12 identified as male, 30 as female and two as non-binary. The average age was 20 years within a range from 18 to 30 years ($Mdn = 20$, $M = 20.39$, $SD = 2.1$). Regarding the sampling, four participants took part in the German-speaking field study and 40 people in the English-speaking lab study.

Hypotheses Testing

To gain an overview of the relevant variables and analyse the significant differences during the baseline period (T1 to T2, no significant difference expected) and intervention (T2 to T3, significant difference expected; H1), an initial repeated measures analysis including all three waves was performed. For a visualization of the variables' development over the three waves see Figure 1. Further, pairwise bivariate correlations were performed to test whether perceived biospheric group values significantly predict pro-environmental behavioural

intentions (H2). Finally, a linear multiple regression analysis was performed to test whether there is an interaction between group identification and group values as predictors of behavioural intentions (H3).

H1: Repeated Measures Analysis with Pairwise Comparisons

To gain an overview of the variables and to compare the different conditions, a within subjects repeated measures analysis including all three waves was computed for each of the relevant variables. A graphic assessment of the value distribution indicated that normality could be assumed for each variable.

For perceived biospheric group values, the most relevant variable for H1, a Mauchly's test indicated that sphericity was given ($\chi^2(2) = 4.72, p = .094$). A test of the within-subjects effects indicated that the difference between the mean group values was significant ($F(2,86) = 7.15, p = .001$). A priori planned polynomial contrasts further indicated, that the effect was significantly linear ($F(1,43) = 10.75, p = .002$). Post hoc pairwise comparisons (sidak correction; see Table 1) indicated, that group values at T1 were not significantly different from T2 but significantly differed from T3.

Figure 1

Change in Relevant Variables Throughout all Waves of Measurement

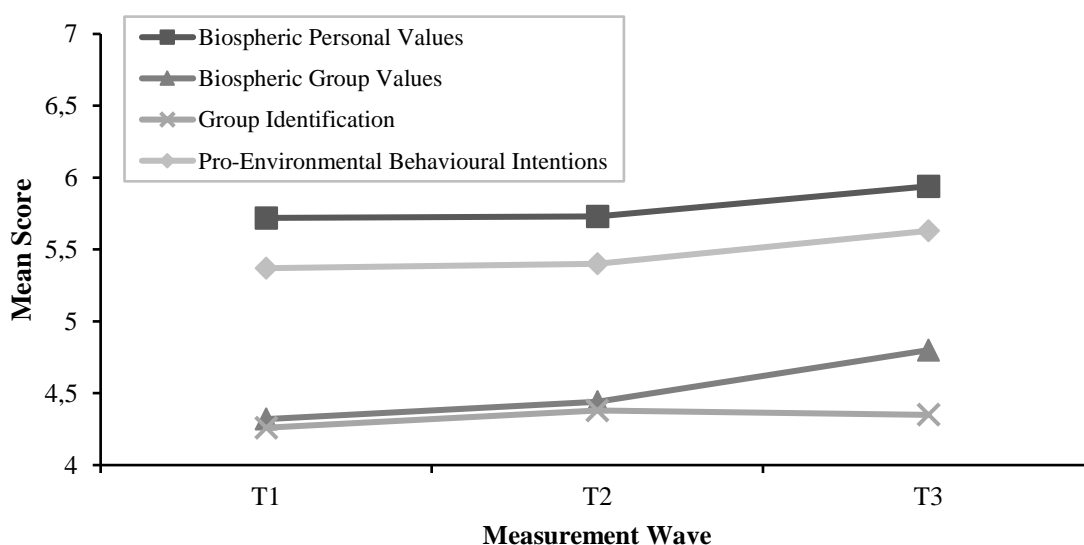


Table 1*Pairwise Comparisons of the Mean Scores for Biospheric Group Values*

| Compared Waves | | Mean Difference | Significance ^b | 95% Confidence Interval for Difference | |
|----------------|----|-----------------|---------------------------|--|-------------|
| | | | | Lower Bound | Upper Bound |
| T1 | T2 | -.131 | .717 | -.469 | .208 |
| T1 | T3 | -.480* | .006 | -.849 | -.117 |
| T2 | T3 | -.352* | .008 | -.625 | -.080 |

* The mean difference is significant at the .05 level.

^b Adjustment for multiple comparisons: Sidak.

Further, group values at T2 significantly differed from T3. Especially the last comparison of group values increasing from T2 to T3 is in accordance with and does support H1; the intervention strengthened perceived biospheric group values. The standardized effect size was estimated with Cohen's $d = .48$, thus indicating a rather moderate effect. A post hoc power analysis given $\alpha = .05$, $n = 44$ and $d = .48$ indicated an achieved power of .93.

For biospheric personal values, since a Mauchly's test indicated that sphericity was violated ($\chi^2(2) = 8.17$, $p = .017$), the Greenhouse-Geisser corrected values are reported. A test of the within-subjects effects indicated, that the difference between the mean personal values was significant ($F(1.7, 73.08) = 4.85$, $p = .014$). A priori planned polynomial contrasts further indicated that the effect was significantly linear ($F(1, 43) = 5.94$, $p = .019$). Post hoc pairwise comparisons (sidak correction; see Table 2) indicated that personal values at T1 were not significantly different from T2 nor T3. However, personal values at T2 significantly differed from T3, which is in line with preliminary findings on interventions emphasizing personal values. The estimated effect size for personal values ($d = .50$) was moderate and slightly higher than for group values.

Table 2*Pairwise Comparisons of the Mean Scores for Biospheric Personal Values*

| Compared Waves | | Mean Difference | Significance ^b | 95% Confidence Interval for Difference | |
|----------------|----|-----------------|---------------------------|--|-------------|
| | | | | Lower Bound | Upper Bound |
| T1 | T2 | -.017 | .996 | -.221 | .187 |
| T1 | T3 | -.222 | .056 | -.448 | .004 |
| T2 | T3 | -.205* | .005 | -.357 | -.052 |

* The mean difference is significant at the .05 level.

^b Adjustment for multiple comparisons: Sidak.

For group identification, since a Mauchly's test indicated that sphericity was violated ($\chi^2(2) = 26.85, p < .001$), the Greenhouse-Geisser corrected values are reported. A test of the within-subjects effects indicated that there is no significant difference between the mean identification ($F(1.36, 58.41) = .70, p = .447$). Hence, no pairwise comparisons are reported.

For pro-environmental behavioural intentions, a Mauchly's test indicated that sphericity was given ($\chi^2(2) = 3.25, p = .197$). A test of the within-subjects effects indicated that the difference between the mean intentions was significant ($F(2, 86) = 8.46, p < .001$). A priori planned polynomial contrasts further indicated that the effect was significantly linear ($F(1, 43) = 11.39, p = .002$). Post hoc pairwise comparisons (sidak correction; see Table 3) indicated that intentions at T1 were not significantly different from T2 but significantly differed from T3. Further, intentions at T2 significantly differed from T3. The estimated effect size for intentions ($d = .58$) was moderate and slightly higher than for group values.

Table 3*Pairwise Comparisons of the Mean Scores for Pro-Environmental Behavioural Intentions*

| Compared Waves | | Mean Difference | Significance ^b | 95% Confidence Interval for Difference | |
|----------------|----|-----------------|---------------------------|--|-------------|
| | | | | Lower Bound | Upper Bound |
| T1 | T2 | -.026 | .977 | -.199 | .148 |
| T1 | T3 | -.258* | .005 | -.447 | -.068 |
| T2 | T3 | -.232* | .001 | -.381 | -.083 |

* The mean difference is significant at the .05 level.

^b Adjustment for multiple comparisons: Sidak.

Summing up, perceived biospheric group values, biospheric personal values and pro-environmental behavioural intentions all significantly increased during the intervention in contrast to the baseline before the intervention, where no significant changes occurred. However, the present analysis did not indicate any correlations or causalities between the variables yet, which was therefore investigated by testing H2 and H3.

H2: Correlation between perceived group values and behavioural intentions

A bivariate correlation table was consulted to obtain an overview of significant correlations between the relevant variables. There was no significant correlation between perceived biospheric group values and behavioural intentions at any wave (T1: $r = .18$, $p = .128$; T2: $r = .12$, $p = .219$; T3: $r = -.01$, $p = .469$; one-tailed). Consequently, as there is no evidence for group values and behavioural intentions to correlate, the data does not support H2, namely that increased perceived biospheric group values strengthen or increase participants' pro-environmental behavioural intentions. A post hoc power analysis revealed that, given $n = 44$, $\alpha = .05$ and $|r| = .18$ to $.01$, the achieved power was $.06$ to $.31$, indicating a severely underpowered analysis.

Further, in accordance with preliminary insights, the results replicated a significant and moderate to strong correlation between biospheric personal values and pro-environmental behavioural intentions throughout all waves (T1: $r = .43, p = .002$; T2: $r = .69, p < .001$; T3: $r = .56, p < .001$; one-tailed). A post hoc power analysis given $n = 44, \alpha = .05$ and $|r| = .43$ to $.69$ indicated an achieved power of $.93$ to $.99$.

H3: Interaction of group identification and group values

To test whether there is an interaction effect of perceived biospheric group values and group identification as predictors of pro-environmental behavioural intention, a multiple linear regression analysis was performed for exploratory purposes, with group values, group identification and the interaction between the two variables as predictors of behavioural intentions. The assumptions of no multicollinearity ($VIF < 10, tolerance > .01$), homoscedasticity (scatterplot of residual variance) and normality (distribution of standardised residuals) were met. The model does not explain a significant amount of variance in behavioural intentions ($F(2,41) = .68, p = .514$). Hence, the data does not support H3, the assumption that the effect of perceived group values on pro-environmental behavioural intentions is partially moderated by group identification. However, a post hoc power analysis revealed that, given two predictors, $n = 44, \alpha = .05$ and $|R^2| = .03$ respectively $f^2 = .03$, the achieved power was $.31$, indicating a severely underpowered analysis. For H3 similar to H2, due to the small sample size and low power, no evidence-based assumptions can be derived from the data regarding the hypotheses.

Discussion

The present study examined whether participation in specific interventions can strengthen perceived biospheric group values and, thereby, increase pro-environmental behavioural intentions. In line with H1, participants perceived fellow group members, namely, other German citizens or students, to endorse biospheric values more strongly after

compared to before the intervention. Furthermore, participants reported higher pro-environmental behavioural intentions and personal biospheric values after the intervention. However, since these intentions were not significantly related to perceived biospheric group values, the data does neither support H2 nor H3: Group values and pro-environmental intentions do not significantly correlate (not supporting H2), and this relationship did not depend on the level of identification (not supporting H3).

Theoretical Implications

As mentioned above, the data indicated that certain interventions encouraging dialogical exchange may successfully change perceptions of others' values (H1). Hence, it can be assumed that biospheric (group) values do not have to be addressed explicitly within interventions to emphasize and strengthen them, which is an approach used in earlier research (Bouman & Steg, 2019; Bouman, Steg, & Perlaviciute, 2021; Bouman, van der Werff et al., 2021). Instead, simple dialogue and interaction, implicitly touching upon participants' biospheric values and making them visible to each other, efficiently increase the extent to which individuals perceive fellow group members to endorse biospheric values. Interestingly, personal biospheric values significantly increased as well, although they are argued to be difficult to change due to being relatively stable especially after adolescence (Bouman, Steg, & Zawadzki, 2020; Steg, 2016). These findings are in line with earlier research indicating that even later in their lifetime individuals may be encouraged to re-evaluate their value priorities, especially when the respective values are addressed repeatedly (Steg, 2016). This may be the case for the present study, as climate change and action are a pervasive and frequent societal concern (IPCC, 2018, 2021). In sum, the present findings indicate that interventions implicitly addressing biospheric personal and group values might not only effectively increase the extent to which individuals perceive others to endorse biospheric values, but also contribute to the re-evaluation of one's personal value priorities.

Furthermore, the present study supports findings of personal values being a predictor of PEB or, in this case, behavioural intentions. This is in line with and partially replicates earlier research, where targeting personal biospheric values was found to effectively promote PEB, assumably by making biospheric values salient in decision-making or emphasizing the benefits of value-congruent actions (Bouman & Steg, 2020; Bouman, van der Werff et al., 2021; Bouman, Verschoor et al., 2020). Therefore, interventions might effectively promote PEB by strengthening personal biospheric values through implicitly touching upon them instead of explicitly addressing them, for example within dialogical interaction. Although earlier findings indicate a similar relation for perceived group values and PEB (Bouman, Steg, & Zawadzki, 2020; Bouman, van der Werff et al., 2021; Wang et al., 2021), the present study did not find group values to be a significant predictor for pro-environmental behavioural intentions.

Additionally, the indicated moderate to strong relation between personal values and behavioural intentions in contrast to the insignificant relation between group values and intentions is in line with and contributes to recent unresolved issues in research. Earlier studies found rather weak⁴ but mostly significant associations between perceived biospheric group values and PEB (compared to personal values), denoting it to be a promising approach in research and intervention design, especially due to the relative flexibility of perceived group values ((Bouman, Steg, & Zawadzki, 2020; Wang et al., 2021). Contradictorily, a more recent study aiming to replicate these findings cross-culturally did not find a significant relation between behavioural intentions and perceived biospheric group values but a positive relation between behavioural intentions and personal biospheric values (Huang et al., 2022), similar to the present study. Here, the inconsistent findings are explained through different

⁴ In the present study the regression coefficient for group values and identification within the multiple linear regression model (testing H3) was comparable to Bouman, Steg, and Zawadzki (2020) but not significant. A possible explanation is the difference in sample size ($n = 44$ compared to $n = 1711$) and thus power.

measures for environmental engagement, which might as well apply to the present study. However, this contradiction strongly indicates an urgent need for subsequent empirical research on the role of perceived group values in promoting climate action.

Practical Implications

The most important practical contribution of the present study might be its indication that interventions addressing climate-related subjects and encouraging dialogical exchange successfully increase biospheric (group) values as well as pro-environmental behavioural intentions. Each of these variables significantly increased during the intervention in comparison with a baseline time period. Consequently, any intervention being designed to encourage interpersonal exchange and implement interactive methods might strengthen participants' group values.

By emphasizing the importance of dialogue and interaction, the present study stresses the relevance of these methods next to communicating knowledge within the context of educational interventions. However, the applicability of interactive methods depends on the interventions used. While workshops, seminars or discussions can likely implement dialogical elements, this is hardly possible within presentations or informational campaigns. Subsequent studies could contribute to that by investigating to what extent (frequency, intensity) and which types of interaction (verbal, written, online post, possibly even artistic) effectively strengthen perceived group values and by that possibly encourage PEB.

Limitations

The main limitation of the present study was the small sample size and thus the low power. This is in particular problematic for H2 and H3, for which based on previous research a moderately small effect was assumed, especially since earlier research indicated the effect of increased perceived group values on pro-environmental behavioural intentions to be very small (Wang et al., 2021). One of the main sampling issues was the initial in-field design of

the study in the context of the Covid-19 pandemic and respective lockdown and social distancing measures beginning in March 2020, negatively impacting the data collection. The interventions took place between July and November 2021, when most people were either tired of, already fully engaged in or oversupplied with online programmes and content, resulting in a low response rate. Additionally, since the interventions were completely online, it was not possible to directly address the participants nor to encourage them to fill in all three waves of measurement. Generally, the commitment was rather low and the dropout high, as visible in the total number of only four of the initial participants being included in the analysis. Ultimately, the study was adjusted to be implemented as a laboratory study, sampling student participants. However, for this phase of data collection, the time was limited and thus aiming for a large sample size was still not feasible.

Another sampling issue might be that the sample was not only small but also very homogeneous (mostly students) and probably biased (self-selection). Assumably, participants chose to take part in the study partially by interest, yielding in a self-selected sample with a high chance to be biased towards pro-environmental attitudes and climate engagement. Since the mean score for biospheric personal values was relatively high, this would be in line with earlier research that found participants who strongly endorsed biospheric values themselves to be less influenced by perceived biospheric group values (Bouman, Steg, & Zawadzki, 2020).

Subsequent studies should attempt to replicate the present study design with a larger and more generalizable sample, aiming for a higher probability of finding significant correlations between increased perceived biospheric group values and pro-environmental behavioural intentions as a result of specific interventions. Moreover, research is needed to investigate whether targeting different groups might result in different findings as well, since the present sample did mostly consist of students from a SONA participant pool.

Apart from the sampling, the present study had some theoretical and methodological flaws. Firstly, especially the self-reported measures of pro-environmental behavioural intentions as well as biospheric personal values are prone to social desirability. However, this not necessarily influenced the hypotheses testing, since the general level of value endorsement or intentions was not of interest. Assuming that the self-reported measures were biased by social desirability, this could have either been the case for each wave equally, hence unlikely affect the relevant changes, or it could have increased with the intervention, as the necessity and desirability of pro-environmental values and intentions was stressed. Consequently, subsequent studies should control for confounding factors such as social desirability to investigate which elements of the intervention induced the observed changes. Secondly, it is questionable whether the increase in biospheric personal and group values is actually a consistent change or due to an increased salience of biospheric values. To investigate this, a follow-up study measuring the relevant variables a few days or weeks after the intervention would be needed.

Finally, the present study has some limitations when it comes to implementing the findings within the development of real-life interventions. Firstly, although the field sample consisted of various different interventions, the student sample used a default method for moderated discussions. This was necessary to adequately investigate the effect of implicitly addressing biospheric group values. However, it can hardly be translated into praxis, where interventions need to be developed and adjusted to account for their respective goals and target group. Secondly, intentions were measured instead of actual behaviour, since the self-reported behaviour can and should not change during the intervention. However, intentions do not necessarily yield in the corresponding behaviour (Grimmer & Miles, 2017). Individual implementation intentions are strongly influenced by contextual as well as personal factors, such as accessibility, convenience, costs and benefits or expectations (Abrahamse &

Matthies, 2018; Steg & Vlek, 2009). Additionally, self-reported intentions, compared to observed actual behaviour, are likely affected by social desirability. Thus, measuring intentions is useful to test the immediate effects of an intervention, but in order to draw conclusions about long-term effects, actual behaviour should be measured before (pre) and a few days or even weeks after the intervention (follow-up).

Conclusion

Summing up, the present study indicated that interventions implicitly addressing biospheric group values by making them visible or encouraging dialogical exchange on climate-related topics can successfully increase the extent to which one perceives others to endorse these values. Although the data does not allow to make assumptions about a relation between increased group values and behavioural intentions, the present study adds to a relevant unsolved contradiction in research. While earlier studies indicated a high potential of the group approach in promoting PEB, a recent study did not find a significant relation between perceived biospheric group values and pro-environmental behavioural intentions. Hence, there are various starting points for subsequent research investigating the role of perceived group values in encouraging climate action within interventions.

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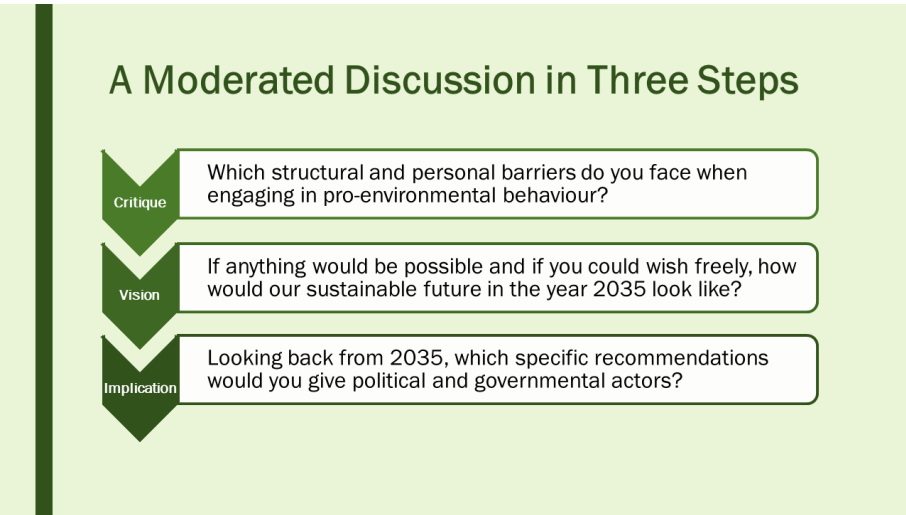
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Appendix A – Online SONA Study Intervention



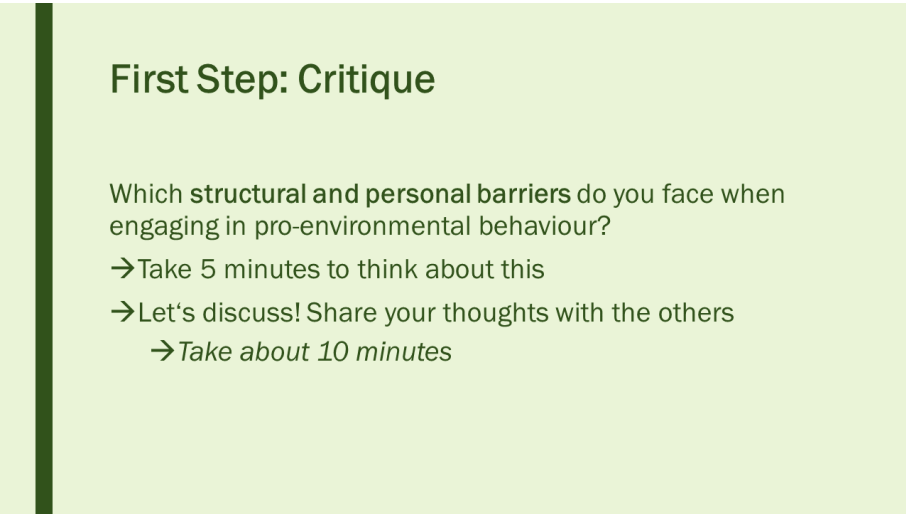
DISCUSSING CLIMATE

A moderated discussion of individual and structural aspects of engagement



A Moderated Discussion in Three Steps

- Critique** Which structural and personal barriers do you face when engaging in pro-environmental behaviour?
- Vision** If anything would be possible and if you could wish freely, how would our sustainable future in the year 2035 look like?
- Implication** Looking back from 2035, which specific recommendations would you give political and governmental actors?



First Step: Critique

Which **structural and personal barriers** do you face when engaging in pro-environmental behaviour?

- Take 5 minutes to think about this
- Let's discuss! Share your thoughts with the others
 - *Take about 10 minutes*

Second Step: Vision

If anything would be possible and if you could wish freely, how would our **sustainable future in the year 2035** look like?

- It doesn't have to be realistic yet, what would you wish for?
- Let's dream! Share your vision with the others
 - *Take about 15 minutes*
 - *Start with brainstorming*

Third Step: Implication

Looking back from 2035, which **specific recommendations** would you give political and governmental actors?

- Take about 5 minutes to think about this
 - *What is the most important to you?*
- Let's act! Share and discuss your suggestions and ideas
 - *Take about 10 minutes*
 - *Try to phrase three to five recommendations*

Appendix B – Questionnaire

Informed consent

Why do I receive this information?

As a participant of our programmes, you are invited to participate in research on the effects of educational group activities. This research is conducted by Sarah Kleinelsen (master's student) and supervised by Thijs Bouman (Assistant Professor, University of Groningen).

Do I have to participate in this research?

Participation in the research is voluntary. However, your consent is needed. Therefore, please read this information carefully. Only afterwards you decide if you want to participate. If you decide not to participate, you do not need to explain why, and there will be no negative consequences for you. You have this right at all times, including after you have consented to participate in the research.

What do we ask of you during the research?

First, you will be asked to consent to the collection and analysis of your data. Afterwards, you are generating a personal code to link the different measurement time points: at enrolment, right before the session and after the session. The code makes sure that we cannot link any data to you personally. The first questions are about your age and gender, the following are about what is important to you (values) and how you perceive yourself and others in relation to the environment. In total, the questionnaire will take you about 10 – 15 minutes.

How will we treat your data?

Your data will be processed within the context of a master's thesis and the evaluation of the educational programmes. During the data preparation, analysis and evaluation, it will not be possible for the researchers to link the data to you personally but only to the code. Only fully anonymized data without the identifier code will be shared by the researchers and only the overall results will be shared publicly.

What else do you need to know?

You may always ask questions about the research: now, during the research, and after the end of the research. You can do so by emailing s.kleinelsen@student.rug.nl.

Do you have questions/concerns about your rights as a research participant or about the conduct of the research? You may also contact the Ethics Committee of the Faculty of Behavioural and Social Sciences of the University of Groningen: ec-bss@rug.nl.

As a research participant, you have the right to a copy of this research information and consent form. Please save or print this screen before pushing the ‘next’ button if you would like a copy. You will not be able to go back once you have left this screen.

By consenting you indicate that you have read the information about the research and had enough opportunity to ask questions about it, that you understand what the research is about, what is being asked of you, how your data will be handled, and what your rights as a participant are.

You confirm that you yourself choose to participate and you can stop participating at any moment without having to explain why.

I consent to participate in this research

Personalized Identification Code

Below, please compose your identification code in the following order:

1. First letter of your first name
2. Day of birth (two digits)
3. Year of birth (last two digits)
4. First letter of your middle name (if none, use X)
5. First letter of city/town you were born in

For me this would be S (from Sarah) 08 98 (08th of may 1998) L (from Leonie) N (from Neustadt): S 08 05 L N

Personal Identification Code [_ _ _ _]

Demographics

- Gender (female/male/nonbinary/other)
- Age

Personal Biospheric Values (E-PVQ) (Bouman et al., 2018)

Please indicate how much the described person is similar to yourself.

1 = not like me at all, 7 = very much like me

- It is important to this person to prevent environmental pollution.
- It is important to this person to protect the environment.
- It is important to this person to respect nature.
- It is important to this person to be in unity with nature.
- It is important to this person that every person has equal opportunities.

- It is important to this person to take care of those who are worse off.
- It is important to this person that every person is treated justly.
- It is important to this person that there is no war or conflict.
- It is important to this person to be helpful to others.
- It is important to this person to have fun.
- It is important to this person to enjoy the life's pleasures.
- It is important to this person to do things they enjoy.
- It is important to this person to have control over others' actions.
- It is important to this person to have authority over others.
- It is important to this person to be influential.
- It is important to this person to have money and possessions.
- It is important to this person to work hard and be ambitious.

Group Values (E-PVQ) (Bouman et al., 2020)

Please indicate how much the described person is similar to a typical [group member].

1 = not like them at all, 7 = very much like them

- It is important to this person to prevent environmental pollution.
- It is important to this person to protect the environment.
- It is important to this person to respect nature.
- It is important to this person to be in unity with nature.
- It is important to this person that every person has equal opportunities.
- It is important to this person to take care of those who are worse off.
- It is important to this person that every person is treated justly.
- It is important to this person that there is no war or conflict.
- It is important to this person to be helpful to others.
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- It is important to this person to have authority over others.
- It is important to this person to be influential.
- It is important to this person to have money and possessions.
- It is important to this person to work hard and be ambitious.

Group Identification (Postmes et al., 2013)

Please indicate to what extent the following statements apply to you.

1 = not at all, 7 = completely

- Being [group member] is an important part of how I see myself.
- I identify with the [group] society.
- I feel committed to the [group] society.
- I am glad to be part of the [group] society.

Environmental Self-Identity (Van der Werff et al., 2013)

Please indicate to what extent the following statements apply to you.

1 = not at all, 7 = completely

- I am the type of person who acts environmentally friendly.
- Acting environmentally friendly is an important part of who I am.
- I see myself as an environmentally friendly person.

Environmental Group Identity (Wang et al., 2021)

Please indicate to what extent the following statements apply to [group member].

1 = not at all, 7 = completely

- [Group members] are the type of person who act environmentally friendly.
- Acting environmentally friendly is an important part of who [group members] are.
- I see [group members] as environmentally friendly.

Personal Norm (Steg et al., 2011)

Please indicate to what extent the following statements apply to you.

1 = not at all, 7 = completely

- I feel morally obligated to act in an environmentally-friendly manner.
- I would feel guilty if I did not act in an environmentally-friendly manner.
- I would be a better person if I would act in an environmentally-friendly manner.

Pro-Environmental Behavioural Intentions (adapted from PEBS; Markle, 2013)

Please indicate to what extent you intend to perform or already engage in the following behaviours.

1 = not at all, 7 = completely

- Use lights and electronic devices energy efficiently.
- Cut down on heating or air conditioning to limit energy use.
- Limit my time in the shower in order to conserve water.
- Wait until I have a full load to use the washing machine or dishwasher.
- Contribute to an environmental, conservation, or wildlife protection group.
- Educate myself about environmental issues.
- Talk to others about their environmental behaviour.
- Increase the amount of organically grown fruits and vegetables I consume.

- Increase the amount of local products I consume.
- Use a fuel efficient or electric vehicle.
- Decrease the amount of meat I consume.
- Decrease the amount of fish I consume.
- Decrease the amount of dairy I consume.
- Use car-pooling and/or car-sharing.
- Use public transportation whenever possible.
- Walk or cycle instead of driving whenever possible.

Perceived Efficacy

Scale from 0 = not at all likely to 10 = extremely likely

- Now imagine that large numbers of people changed their behaviour. How likely do you think it is that this would reduce climate change?
- How likely do you think it is that large numbers of people will actually change their behaviour to try to reduce climate change?
- How likely do you think it is that the government will take enough action that reduces climate change?