Who has the future in mind? Gender, time perspectives, and pro-environmental behaviour

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Abstract
An individual’s relation to time may be an important driver of pro-environmental behaviour. We studied whether young individual’s gender and time-orientation are associated with pro-environmental behaviour. In a controlled laboratory environment with students in Germany, participants earned money by performing a real-effort task and were then offered the opportunity to invest their money into an environmental project that supports climate protection. Afterwards, we controlled for their time-orientation. In this consequential behavioural setting, we find that males who scored higher on future-negative orientation showed significantly more pro-environmental behaviour compared to females who scored higher on future-negative orientation and males who scored lower on future-negative orientation. Interestingly, our results are completely reversed when it comes to past-positive orientation. These findings have practical implications regarding the most appropriate way to address individuals in order to achieve more pro-environmental behaviour.

1. Introduction

Since 2019, large demonstrations and school strikes addressing the climate crisis and calling for climate protection have been taking place around the globe (Wallis and Loy 2021). These public protests give the impression of an increase in pro-environmental intention among the youth that seems predominantly motivated by fear of future developments caused by the climate crisis. Against this background, we are interested in the relationship between young individuals’ perspectives on time and their pro-environmental behaviour.

We address this research question in a controlled laboratory environment with students in Germany in which the participants perform a monetarily incentivized real-effort task and then enable them to donate their earned money to a tree-planting project. Additionally, we used the well-studied approach of time perspectives that Metric (1999) defines as ‘[…] the often non-conscious process whereby the continual flows of personal and social experiences are assigned to temporal categories, or time frames, that help to give order, coherence, and meaning to those events’ to measure individual time-orientation in a post-experiment questionnaire. These time perspectives can be seen as a process in which personal experiences flow into psychological time frames of the past, present, and future (Nuttin 1964, Metric 1999). To the best of our knowledge, this study is the first to relate individual time perspectives (Zimbardo and Boyd 1999, Kostal et al 2016) to monetarily incentivized and actual pro-environmental behaviour.

We find significant interaction effects of future-negative orientation and gender as well as past-positive orientation and gender on pro-environmental behaviour. More future-negative-oriented males tend to behave more pro-environmentally compared to less future-negative-oriented males and females score higher on future-negative orientation. In contrast, males scoring higher on past-positive orientation behave significantly less pro-environmentally compared to males scoring lower on past-positive orientation.
orientation and females scoring higher on past-positive orientation.

2. Methods

2.1. Study design
In our study, the participants performed a real-effort task in order to earn money. Thereby, we made use of the word encryption with double randomization (WEDR) task designed by Benndorf et al. (2019) since it is established in the literature and participants proved to get along very well with this task (e.g. Dorner 2019, von Bieberstein et al. 2020, Yanhui et al. 2021). In the WEDR task, the participants had to encrypt words. For each word encrypted correctly, they received a certain monetary reward. The words 1–5 were rewarded with 0.40 EUR, the words 6–10 with 0.30 EUR, the words 11–15 with 0.20 EUR, and the words 16 and up with 0.10 EUR for each word encrypted correctly. Each word consisted of three different letters and every letter contained a three-digit number. The participants were given a table which showed all 26 letters of the alphabet as well as the three-digit numbers for each of the letters. The participants had to choose the correct three-digit numbers for each of the three letters forming a word to encode a word correctly. Afterwards, the participants received a new word which consisted of new letters and the letters contained new three-digit numbers. Furthermore, the positions of the letters in the table changed at random. Figure 1 shows an example of the WEDR task. After having performed the WEDR task, the participants received the opportunity to donate a share of their earnings for a project which plants trees.

2.2. Procedure
We collected data in October 2020, at the Potsdam Laboratory for Economic Experiments (PLEx). The participants were students from the Universities in Potsdam and Berlin and were recruited at random by using Online Recruitment System for Economic Experiments (ORSEE) (Greiner 2015). During the experiment, the participants received instructions and first entered a trial stage to get familiar with the WEDR task without financial consequences. Afterwards, the incentivised WEDR task ran for 15 min. In a post-experimental questionnaire, we asked for the participants’ time perspectives (Zimbardo and Boyd 1999, Kostal et al. 2016) as well as for age, gender, nature relatedness, and the Big 5 personality traits since they proved to impact pro-environmental behaviour in the past (Zimmer et al. 1994, Obery and Bangert 2017, Poskus and Zukauskiene 2017, Vicente-Molina et al. 2018).

Our study design was approved by an ethics committee of the German Association for Experimental Economics Research e.V. and our data can be accessed in an Open Science Framework repository via this link: https://osf.io/8bmww/?view_only=97433821b7ec4f02b7c98ca5b41f4565.

2.3. Participants
In order to pre-calculate the sample size in our study, we made use of the results of Benndorf et al. (2019) on the productivity achieved on their real-effort task. In this context, we derived the number of observations necessary (≥100) to reach a sufficient statistical power (about 0.8). During our experimental sessions, a total of 106 participants took part. Thus, we ended up with a statistical power for our results between 0.771 and 0.966 (mean productivity: 60 tasks solved correctly (minimum: 41, maximum: 84), SD: 9.434, possible increase in the average number of tasks solved correctly: 5–7).

2.4. Dependent variables
We measured pro-environmental behaviour by the share of the total revenue they donated to a tree-planting project. The 24.5% of the participants did not donate at all (figure 2). Table 1 summarizes the characteristics of the dependent variable.

2.5. Independent variables
Our key variable for understanding individuals’ pro-environmental behaviour is their perspective of time. Thereby, we make use of the six time perspectives established by Zimbardo and Boyd (1999) and Kostal et al. (2016) who assign individuals to particular ‘types’ of time orientation. These time orientations can be divided into: future-positive, future-negative, present-hedonistic, present-fatalistic, past-positive, past-negative. These well-studied time perspectives are evolved from theoretical considerations, feedback from participants, and a series of exploratory studies using focus groups (Zimbardo and Gonzalez 1984, Gonzalez and Zimbardo 1985, Metrick 1999). Time perspectives may develop in early stages of life, influenced by family background, and culture and are also affected by e.g. learning processes supporting the individuals to develop a habitual focus on certain time perspectives (Nurmi 1991, Meter 1999, Zimbardo and Boyd 2008). Gupta et al. (2012)
Figure 1. Word encryption task. Source: own production.

![Figure 1](image1.png)

Figure 2. Distribution of the variable 'pro-environmental behaviour'. Source: own production.

![Figure 2](image2.png)

Table 1. Summary statistics for dependent variable. Source: own production.

|                         | Observation | Mean  | St. Dev. | Min  | Max  |
|-------------------------|-------------|-------|----------|------|------|
| Share of total revenue  | 106         | 10.960| 18.472   | 0    | 100  |
| Donated (1 = yes, 0 = no)| 106         | 0.755 | 0.432    | 0    | 0    |
Table 2. An overview of the time perspectives in this study.

| Time perspective      | Example of a statement to measure the time perspective | Internal consistency of the items of a time perspective (Cronbach's alpha) |
|-----------------------|------------------------------------------------------|--------------------------------------------------------------------------|
| Future-positive       | 'When I want to achieve something, I set goals and consider specific means for reaching those goals.' | $\alpha = 0.570$                                                        |
| Future-negative       | 'Usually, I do not know how I will be able to fulfil my goals in life.' | $\alpha = 0.546$                                                        |
| Present-hedonistic    | 'It is important to put excitement in my life.' | $\alpha = 0.570$                                                        |
| Present-fatalistic    | 'Since whatever will be will be, it does not really matter what I do.' | $\alpha = 0.501$                                                        |
| Past-positive         | 'Familiar childhood sights, sounds, smells often bring back a flood of wonderful memories.' | $\alpha = 0.492$                                                        |
| Past-negative         | 'I often think of what I should have done differently in my life.' | $\alpha = 0.677$                                                        |

Table 3. Summary statistics for explanatory variables. Source: own production.

|                          | Percentage | Min   | Max   | Mean   | Std. Dev. |
|--------------------------|------------|-------|-------|--------|-----------|
| Gender:                  |            |       |       |        |           |
| Female (1)               | 55.670     |       |       |        |           |
| Male (0)                 | 44.330     |       |       |        |           |
| Age                      |            | 19    | 36    | 23.619 | 3.898     |
| Income category          |            |       |       |        |           |
| 0: <500 Eur month$^{-1}$ | 26.804     |       |       |        |           |
| 1: 501–750 Eur month$^{-1}$ | 29.897   |       |       |        |           |
| 2: 751–1000 Eur month$^{-1}$ | 26.804   |       |       |        |           |
| 3: 1001–1250 Eur month$^{-1}$ | 8.247    |       |       |        |           |
| 4: 1251+ Eur month$^{-1}$ | 8.247      |       |       |        |           |

3. Results
3.1. Descriptive results
We find no statistically robust correlation between any of the six time orientations and pro-environmental behaviour (see table 4). Figure 3 plots the relationship between the six time orientations sorted by gender and pro-environmental behaviour graphically.

determine in their study that 71.6% of the individuals were predominantly deepened in one of the six time perspectives.

To measure time perspectives, we used the short version of ‘Zimbardo’s Time Perspective Inventory’ (Zimbardo and Boyd 1999) introduced by Kostal et al (2016) which is more user-friendly than the initial version. All six time perspectives are measured by three items through a confirmatory factor analysis as proposed by Zimbardo and Boyd (1999). Kostal et al (2016) used a Likert-response format with five options ranging from very uncharacteristic (1) to very characteristic (5). Moreover, in preparation for the regression models, a confirmatory factor analysis and standardization of the data were executed. Table 2 provides an overview of the different time perspectives, examples of the items used to measure the time preferences as well as the internal consistency of the different items of one category. The summary statistic of all independent variables including the six time perspectives described above is presented in table 3.

7 Kostal et al (2016) reduced the Time Perspectives Inventory by of Zimbardo and Boyd (1999) from 56 to 18 items to make it easier to apply in research. This short version has been already applied in previous studies (e.g. Lukavska 2018, Linkov et al 2019) and proved to display individuals’ time perspectives as good as the long version (Kostal et al 2016).

8 See the correlation matrix for all independent variables in table 5.
### Table 4. Correlation matrix. *p < 0.1, **p < 0.05, ***p < 0.01. Source: own production.

|                      | PEB   | Female | FP    | FN    | PH   | PF   | PP   | PN   |
|----------------------|-------|--------|-------|-------|------|------|------|------|
| Pro-environmental behaviour (PEB) | 1.000 |        |       |       |      |      |      |      |
| Female               | −0.064| 1.000  |       |       |      |      |      |      |
| Future-positive (FP) | −0.091| 0.119  | 1.000 |       |      |      |      |      |
| Future-negative (FN) | 0.056 | 0.157  | −0.217**| 1.000 |      |      |      |      |
| Present-hedonistic (PH) | −0.060 | −0.043 | 0.031 | −0.257*** | 1.000 |      |      |      |
| Present-fatalistic (PF) | 0.056 | 0.044  | −0.236**| −0.245 **| 0.079 | 1.000 |      |      |
| Past-positive (PP)   | −0.124| −0.022 | −0.042 | −0.289*** | 0.155 | −0.041 | 1.000 |      |
| Past-negative (PN)   | 0.023 | −0.066 | −0.040 | 0.431*** | −0.255*** | 0.064 | −0.279*** | 1.000 |

### Figure 3. Distribution of the variable ‘pro-environmental behaviour’ across time perspectives. Source: own production.

### Table 5. Correlation matrix for all independent variables. *p < 0.1, **p < 0.05, ***p < 0.01. Source: own production.

|                      | Revenue from real-effort task | Share donated | Female | Age | Neuroticism | Extraversion | Agreeableness | Conscientiousness | Openness | NR | Income Category |
|----------------------|-------------------------------|---------------|--------|-----|-------------|--------------|---------------|-------------------|----------|----|-----------------|
| Revenue from real-effort task | 1                             |               |        |     |             |              |               |                   |          |    |                 |
| Share donated        | −0.133                        |               |        |     |             |              |               |                   |          |    |                 |
| Female               | 0.044                         | −0.032        | 1      |     |             |              |               |                   |          |    |                 |
| Age                  | 0.215**                       | −0.167        | −0.163 | 1   |             |              |               |                   |          |    |                 |
| Neuroticism          | −0.071                        | 0.098         | −0.187 | −0.190* | 1           |              |               |                   |          |    |                 |
| Extraversion         | −0.037                        | −0.077        | 0.054  | −0.186*| 0.176*      | 1             |               |                   |          |    |                 |
| Agreeableness        | 0.327***                      | 0.031         | −0.181 | 0.270***| −0.073      | −0.202**      | 1              |                   |          |    |                 |
| Conscientiousness    | 0.133                         | 0.096         | −0.317**| −0.076 | 0.037      | 0.094         | 0.167          | 1                 |          |    |                 |
| Openness             | 0.058                         | −0.150        | −0.174 | −0.148 | 0.019      | 0.026         | −0.026         | 0.252**           | 1         |    |                 |
| NR                   | −0.149                        | −0.146        | 0.139  | 0.128 | −0.049     | −0.019        | −0.061         | 0.066            | −0.218*      | 1   |                 |
| Income Category      | −0.047                        | 0.075         | −0.249**| −0.063 | −0.005     | −0.020        | 0.045          | 0.090            | 0.083      | −0.045 |                 |

### 3.2. Regression results

We continue our data analysis by running Tobit regressions to account for the censoring of the dependent variable at 0. In this regard, we use a step-up approach and include in each model of table 6 session-day dummies as well as income-category
Table 6. Tobit regression, impact of time perspectives on pro-environmental behaviour. Standard errors are in parentheses. *p < 0.1,
**p < 0.05, ***p < 0.01. Source: own production.

| Pro-environmental behaviour (1) | (2) | (3) |
|---------------------------------|-----|-----|
| Future-positive                 | −1.517 (2.633) | −2.493 (3.291) |
| Future-negative                 | 2.534 (2.857)  | 9.893** (4.557) |
| Present-hedonistic              | −1.076 (2.483) | 3.462 (3.213)  |
| Present-fatalistic              | 1.724 (2.477)  | −4.615 (3.453) |
| Past-positive                   | −0.066 (2.641) | −7.214** (3.754) |
| Past-negative                   | −0.130 (2.695) | 4.871 (3.967)  |
| Female (1 = yes) x              | 0.381 (4.628)  |      |
| Future-positive                 | −11.306* (5.679) |      |
| Future-negative                 | −6.261 (4.409) |      |
| Present-hedonistic              | 8.446 (4.750)  |      |
| Present-fatalistic              | 11.466** (4.728) |      |
| Past-positive                   | −5.268 (5.405) |      |
| Female (1 = yes)                | −3.992 (5.469) | −5.014 (5.510) |
| Age                             | −0.341 (0.581) | −0.585 (0.616) |
| Big five                        | Yes | Yes | Yes |
| Income category                 | Yes | Yes | Yes |
| Nature relatedness              | Yes | Yes | Yes |
| Constant                        | 11.335 (17.425) | 17.174 (18.609) |
| N                               | 106 | 106 | 106 |
| Pseudo R²                        | 0.034 | 0.038 | 0.064 |

Figure 4. Linear prediction of the impact of future-negative time perspectives on pro-environmental behaviour by gender. Source: own production.

For a better interpretation of our findings, we plot the predictive margins in figures 4 and 5. If we focus on the future-negative orientation, we find that males who scored higher behaved more pro-environmentally compared to males who scored lower (p = 0.033) and females who scored higher (p = 0.051).

If we turn to past-positive orientation, our results show that males who were more past-positive-oriented behaved less pro-environmentally compared to males who were less past-positive-oriented...
(p = 0.059) and females who scored higher on past-positive orientation (p = 0.018). We find these effects even though future-negative and past-positive time orientations are not differently distributed by gender and no significant effect of gender on pro-environmental behaviour persists (two-sided t-tests, p > 0.100).

Furthermore, we find a small interaction effect of gender and present-fatalistic orientation on pro-environmental behaviour. However, this effect goes back to the sole fact that females scoring higher on present-fatalistic orientation behaved more pro-environmentally compared to males scoring higher on present-fatalistic orientation (p = 0.080).

4. Discussion and conclusion

Our findings contribute to the growing literature aiming to understand the determinants of individual pro-environmental behaviour. Reaching this aim becomes the more urgent the severe the climate crisis develops and the more obvious the importance of individual behaviour adoption becomes. For example, Bamberg and Moser (2007) has identified a concern–behaviour gap related to environmental issues that is partly driven by psychological barriers (Tam and Chan 2017). Additionally, Tam and Chan (2017) assume that these barriers reflect some ‘general psychological orientations that are culturally patterned’. In this context, individuals’ time perspectives contribute strongly to their general psychological orientations and play a crucial role in defining cultural patterns (Zimbardo and Gonzalez 1984, Zimbardo and Boyd 1999).

For instance, Gu et al (2020) showed that only in future-oriented cultures can exposure to ecological resource scarcity translate into pro-environmental behaviour. Therefore, understanding the relationship between an individual’s time perspective and pro-environmental behaviour plays a crucial role in understanding how these psychological barriers at work in the concern–behaviour gap may be resolved.

In addition to the important impact of time perspectives, the literature also shows that negative feelings like guilt or shame mediate pro-environmental behaviour (Keeling and McGoldrick 2010, Rees et al 2015, Adams et al 2020). From this perspective, our results support recent findings on important determinants of pro-environmental behaviour and stress the importance of understanding the impact of individuals’ psychological barriers on their pro-environmental behaviour.

Finally, our results add to the discussion on appropriate communication strategies to increase pro-environmental behaviour (e.g. Ojala and Bengtsson 2019). Intrinsically motivated pro-environmental behaviour is a preliminary for both, the success of climate political interventions as well as for behavioural changes to combat climate change (Diederich and Goeschl 2017, Dorner 2019). Thus, our results emphasize the potential of diligent and careful communication to support political intervention for climate protection in democratic processes. Based on our findings, it seems useful to highlight more positive feelings about the past and more negative feelings about the future in communication to foster more pro-environmental behaviour among men. This is especially important since men proved
to behave significantly less pro-environmentally compared to females in previous studies (e.g. Lee 2009, Vicente-Molina et al 2018, Lopez-Bonilla et al 2020).

Lab experiments as other research methods might be associated with biases. In our study we tried to mitigate such concerns. For instance, we ensured that the decision-making of a participant as well as his payment could not be detected by others as each participant was sitting in single cabin and the payment process took part after the experiment outside of the lab and individually. Furthermore, the participants were informed in advance that their decisions in the lab could not be matched with their identity by the experimenter. By doing so, we mitigated potential social desirability bias. In addition, the participants did not know—while signing in for a session—about the content of the experiment. We also asked for their individual time perspectives after the participants had made their decisions to avoid a potential priming bias. Finally, we controlled not only for time perspectives but also for the Big 5, nature relatedness and socio-demographic characteristics in the questionnaire. With this procedure, we ensured that the time perspectives had no special weight in the questionnaire and avoided a potential experimenter demand effect. Additionally, the in detail described procedure, as well as the available data, allow for an easy replication of our study, also with other groups of participants. We leave this potential improvement of the validity of our results and its generalizability across contexts for future research.

Data availability statement

The data that support the findings of this study are openly available at the following URL/DOI: https://osf.io/8bmvw/?view_only=97433821b7ec4f02b7c98ca5b41f565.

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Instructions for the participants

Welcome to the experiment. We ask you to stay seated and quit communication with the other participants as of now. Please turn off your mobile and electrical devices. It is of the utmost importance to adhere to the rules. Otherwise, we reserve the right to exclude you from the experiment and, with that, from the payment. Every participant has received identical instructions. Please read these instructions very carefully.

Raise a hand in case you have any questions. We will answer questions personally.

By participating in this experiment, you can earn money. You already collected 5 EUR by arriving on time. This experiment involves a word encryption task. It takes exactly 15 min. In the course of this exercise, you will be shown words to encrypt. Every word consists of three letters. Each letter has a matching numerical code, which you have to find in the chart below. You are supposed to enter this code in the empty space underneath the letters. If you execute this task correctly for all three letters, you will have successfully encrypted a word, earning an additional amount of money. After that, you will see a new chart and a new word to decode. For each encrypted word from 1 to 5, you receive 40 cents. For the decoded words 6–10, you receive 30 cents. For the encrypted words 11–15, you receive 20 cents, and from the 16th word on, you receive 10 cents per word encrypted correctly.

Following the word encryption task, you will take part in a time estimation task. The time will be counted down invisibly from a certain moment. Afterward, we will ask you to estimate how much time has passed. You can also earn money with your estimation: If your estimation is accurate, your payment will be increased by 2 EUR. For every second your estimation differs from the actual time, you lose 10 cents. Hence you will not receive an additional payment in this task if you deviate more than 20 s from the actual time. Overall, your profit consists of the 5 EUR for showing up on time, the earned amount from the word decoding task, and the bonus from your accuracy on the time estimation task. At the end of the experiment, you can decide whether and how much of your earned money you would like to donate to a tree-planting project. After that, we will ask you to complete a questionnaire. Finally, we will ask you separately to go to the payment counter.

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9 English translation of the original German instructions for the participants at PLEX.
