Value through cognitive effort: Working for an environmental organization increases subsequent donations

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Abstract

Cognitive effort is a characteristic but understudied feature of many pro-environmental behaviors, and traditionally, it is mostly discussed as a barrier that keeps people from behaving pro-environmentally. In contrast, contemporary frameworks of cognitive effort show that effort can also be beneficial, for example by increasing the subjective value of the outcome of an effortful action. From this new perspective, we conducted an exploratory secondary analysis of existing data from an online study (N = 1160) featuring the Work for Environmental Protection Task (WEPT), which allows participants to exert real cognitive effort in exchange for donations to a pre-selected pro-environmental organization. We found that after performing the WEPT, participants were more likely to donate additional bonus money to their assigned organization compared to an alternative organization, suggesting a higher subjective value of the former. To assess the robustness of this finding, we conducted a high-powered, preregistered confirmatory study (N = 801). We found that the differential pattern in the donation decisions replicated with a larger effect size and was also consistent with self-reported subjective value of the organizations. These findings indicate that spending effort for the benefit of a pro-environmental organization can increase the value assigned to that organization. This resonates with the idea that effort is more than just a barrier and can have a positive effect on pro-environmental behavior.

Keywords: Pro-environmental behaviour, Cognitive effort, Subjective value, Work for environmental protection task, Donation behaviour

1. Introduction

Addressing the climate crisis requires urgent transitions in all sectors of society. Psychological research can help enable these transitions by investigating barriers and facilitators of pro-environmental behavior (American Psychological Association, 2022; Nielsen, Clayton, et al., 2021). One factor that is often described as a barrier to pro-environmental behavior is the effort that is associated with many environmentally relevant decisions and activities. When participating in climate protest or environmental clean-up events or cycling to work, people often have to make substantial physical efforts to produce pro-environmental outcomes. Similarly, it can take much cognitive effort to compare the environmental impact of different consumer products or financial investment options, or to plan a multi-day train travel to a conference. These effort requirements likely prevent many people from engaging in pro-environmental behavior, that is, they act as behavioral costs (Kaiser, 2021; Schultz & Oskamp, 1996). As a result, many intervention approaches aim to reduce the effort required to behave pro-environmentally (Osbaldiston & Schott, 2012; Sunstein & Reisch, 2014). However, by drawing on insights from the cognitive psychology literature, we will argue that effort can also be beneficial for the promotion of pro-environmental behavior.

To study pro-environmental behavior as a function of its costs and benefits, behavioral scientists have developed different experimental paradigms (Lange, 2023). Several of these paradigms model behavioral costs through real-effort components: by working on effortful activities in laboratory or online studies, participants can produce positive environmental outcomes (Alt, 2024; Jankowski et al., 2024; Krebs et al., 2023; Lohmann et al., 2024). For example, in the Work for Environmental Protection Task (Lange & Dewitte, 2022), people can choose to work on a monotonous task and for every unit of effort they complete, a donation is made to a pro-environmental organization. Typically, people are less likely to exert such effort when larger efforts are required, indicating that effort functions as an effective barrier to pro-environmental behavior (Lange & Dewitte, 2022, 2023). This observation is in line with the finding that people tend to not engage in pro-environmental behaviors that they perceive to be too effortful (Dreijerink et al., 2022).

In the cognitive psychology literature, effort has traditionally been viewed as a cost that people try to avoid by choosing options that are less effortful (Kool et al.,

2010), even if that means forgoing a larger reward (Westbrook et al., 2013). This is also known as the law-of-least effort (Hull, 1943). However, a contemporary framework of cognitive effort suggests that it is not only associated with costs but can also be a source of value (Inzlicht et al., 2018). It has been shown that spending effort can increase the subjective value of a resulting outcome (Bogdanov et al., 2022; Ma et al., 2014; Wang et al., 2017) and can sometimes even be valued in itself (Clay et al., 2022; Eisenberger et al., 1989; but see also Lin et al., 2024). The view that effort can be both, a cost and a source of value, has been termed "effort paradox" (Inzlicht et al., 2018). Partly, this paradox can be explained by the temporal dimension of valuation (Bogdanov et al., 2022; Inzlicht et al., 2018; Yi et al., 2020): when effort is anticipated the associated reward is discounted (prospective discounting), while the reward valuation increases after effort has been spent (retrospective valuation). For instance, in the "Cognitive Effort Discounting Paradigm" participants can chose between doing an effortful task for $2 or an easier task for a variable lower reward (Westbrook et al., 2013). From this, a subjective value score of the effort levels can be calculated, which has been shown to decrease the higher the effort level is (Westbrook et al., 2013) and to be moderated by individuals' general willingness to spend cognitive effort, as measured by the Need for Cognition scale (NFC; Cacioppo et al., 1984; Zerna et al., 2023). On the other hand it has been shown that activity in brain regions implicated in reward processing increases after high effort compared to low effort trials (Bogdanov et al., 2022). Furthermore, the willingness to pay for the result of an action is higher after an effortful action compared to an easy action (Norton et al., 2012). Similarly, investing effort in a task can subsequently increase the task's perceived meaningfulness (Campbell et al., 2025). A related example from the pro-social behavior literature is that people were found to be more willing to donate to the same pro-social organization when the associated donation event was effortful (i.e., a charity run) rather than easy (i.e., a picnic; Olivola & Shafir, 2013).

Based on this new perspective on effort, we conducted an exploratory secondary analysis of data from an existing study that used the WEPT (Lange & Dewitte, 2023) to examine the effect of cognitive effort on outcome valuation in the context of pro-environmental behavior. The WEPT consists of multiple trials in which participants decide whether to screen a page of numbers for target numbers in exchange for donations to a pro-environmental organization. The effort levels and outcome values are manipulated across trials by varying the size

of the number page and the donation amount, respectively. The likelihood of completing a page decreases with increasing page size (Lange & Dewitte, 2022, 2023), which shows that the prospect of spending effort can be a barrier to pro-environmental behavior (i.e., prospective discounting). In the study by Lange and Dewitte (2023), participants completed the WEPT to generate donations for a randomly determined organization (WWF or OroVerde). Afterwards, participants had the option of keeping an additional 20 pence bonus or donating it to one of the two environmental organizations, either the organization they had worked for during the WEPT or the alternative one. In the present study, we analyzed this donation decision as a manifestation of the subjective value that participants assign to the organization they have been working for during the WEPT (i.e., retrospective valuation). Based on the results from the secondary analysis we formulated the following two hypotheses that we tested in a high-powered, preregistered confirmatory study.

We hypothesized that participants would be more likely to donate to the organization they had worked for during the WEPT than to the alternative organization (Hypothesis 1). This finding would speak in favor of the idea that spending cognitive effort can increase the subjective value of the associated outcome also in the context of pro-environmental behavior. Furthermore, we hypothesized that we will find the same within-subject effects of the WEPT *page size* (Hypothesis 2.1) and *donation amount* (Hypothesis 2.2) on page completion decisions, as shown in previous studies using the WEPT (Lange & Dewitte, 2022, 2023): The larger the page size and the lower the donation amount, the lower the likelihood to complete a WEPT page. With this we aim to replicate those effects in a new sample and, in particular, to generate further evidence for the idea that prospective effort, indicated by the page size, can act as a barrier to pro-environmental behavior.

2. Exploratory secondary analysis

2.1 Methods

2.1.1 Existing dataset

The exploratory secondary analysis was conducted on the existing and openly available dataset from Lange and Dewitte (2023; https://osf.io/fhg3t/). Their aim was to validate the WEPT in different countries and investigate the effect of scope

sensitivity on WEPT choices (i.e., the decision whether to complete a WEPT page). They recruited participants via Prolific from three different countries (UK, US and South Africa) and assigned participants to one of two groups: a high or low "absolute impact condition" (see below). Data from all participants that completed the WEPT and the donation decision (n = 1160) from all three countries and both absolute impact conditions were included in the secondary analysis. The socio-demographic distribution is reported in Table 1. For details on the recruitment process see Lange and Dewitte (2023).

Table 1 Socio-demographics distribution of participants included in the secondary analysis and in the confirmatory study.

	Secondary analysis	**Confirmatory study**
n	1160	801
Mean age (±SD)	32.63 (±12.35)	39.40 (±13.49)
Gender (%)		
Female	68.4	58.4
Male	29.7	39.9
Prefer not to say	0.6	0.5
Prefer to self-describe	1.3	1.2
Profession (%)		
Student	22.0	8.0
Employed full-time	40.6	50.7
Employed part-time	16.3	19.3
Unemployed	10.8	11.9
Retired	3.3	4.5
Prefer not to say	1.6	1.5
Prefer to self-describe	5.5	4.1

2.1.2 Experimental procedure

Here we report only those aspects of the study design that are relevant for the conducted secondary analysis. For more details, we refer readers to the original publication (Lange & Dewitte, 2023).

During the WEPT, participants chose if they want to work on a number identification task in exchange for a donation or not. The task involved identifying numbers that have an even first and odd second digit (e.g., 81). Participants were truthfully told that money would be donated to a pro-environmental organization for each page they complete with an accuracy of 90%. For every page, participants were informed about the amount of numbers on the page (40, 80, 120, 160 or 200 numbers; *page size*) and the amount of money that would be donated to the organization (*donation amount*). The donation amount was manipulated within- and between-subjects. Participants were either in the "high absolute impact condition" where they could generate 10, 20 or 30 pence donations or they were in the "low absolute impact condition" and could generate 1, 2 or 3 pence donations. This yielded a total of 15 unique WEPT page combinations that were presented to each subject. The absolute impact manipulation was not of interest for our hypothesis and was therefore not added as a predictor in the secondary analysis.

Participants performed the WEPT for the benefit of one of two pro-environmental organizations: WWF or OroVerde (*WEPT organization*). They were randomly assigned to one of those organizations. In the instructions only the assigned organization was introduced while the alternative organization was not mentioned. This between-subject manipulation was added to "examine the generalizability across organizations" (Lange & Dewitte, 2023) but was not of further interest in the original publication. However, in our secondary analysis, the WEPT organization served as the main independent variable.

After the WEPT, participants were informed that they receive 20 pence as bonus money and could decide to keep the money, donate it to OroVerde, or donate to WWF, and that if they decided to donate, the amount would be increased by 50% (Lange & Dewitte, 2023). In our secondary analysis, the *donation decision* was the main dependent variable, which we assume to capture the retrospective valuation of the organizations.

2.1.3 Data analysis

To test the effect of performing the WEPT for a given organization on the valuation of that organization, we conducted a multinomial logistic regression in R (Version 4.3.3; R Core Team, 2024) using the package nnet (Venables & Ripley, 2002) and zero-sum contrast coding. We used the between-subject predictor *WEPT organization* (OroVerde and WWF) to explain the dependent variable *donation decision* (donate to OroVerde, donate to WWF, keep money). The reference category was set to "donate to OroVerde" to be able to compare the likelihoods of donating to OroVerde and WWF. P-values were calculated using the Wald z-statistic. The comparison between donating to OroVerde and keeping the money was not of interest but is reported in the Supplementary Materials (Table S1).

Additionally, we also tested the effect of the total number of completed WEPT pages per participant by adding this variable as a predictor to the multinomial model. We also examined the interaction between completed WEPT pages and *WEPT organization*, reasoning that the effect of *WEPT organization* on donation decisions might depend on the amount of effort and time spent on the WEPT. Model comparison was performed with Likelihood Ratio Tests. Following the analysis approach of Lange and Dewitte (2023), a page counted as completed when the time spent on a page was above 2 *SD* of the average duration of that page.

2.2 Results

2.2.1 Donation decision depends on WEPT organization

Across both groups, participants donated more often to WWF (42.59%) than OroVerde (18.62%), while 38.79% decided to keep the money. Whether the *WEPT organization* was OroVerde or WWF significantly predicted whether the money was donated to WWF or OroVerde ($b = 0.702$, $Exp(b) = 2.019$, $p < 0.001$, 95% CI = [1.456, 2.80]). The odds ratio of 2.019 shows that the odds of a participant who did the WEPT for OroVerde deciding to donate to OroVerde (rather than to WWF) are around twice as high compared to the odds of a participant that did the WEPT for WWF. In short, participants were more likely to donate money to the assigned WEPT organization as compared to the alternative (see Figure 1A). This increase in likelihood is numerically similar between both organizations: Completing the WEPT for OroVerde (rather than WWF) increases the donation proportion to

OroVerde by an additional 9.03 percentage points and completing the WEPT for WWF (rather than OroVerde) increases the donation proportions for WWF by an additional 8.82 percentage points.

When repeating this analysis in the three different country subsamples, we found that the effect was strongest in the South African sample (*Exp(b)* = 2.736, 95% CI = [1.557, 4.807]) and somewhat weaker in the UK (*Exp(b)* = 1.820, 95% CI = [1.056, 3.137]) and US sample (*Exp(b)* = 1.754, 95% CI = [0.943, 3.263]). For the full regression table see the Supplementary Materials (Table S2).

We also added the total number of completed WEPT pages for each participant and the interaction with the WEPT organization as a predictor to the multinomial model. Likelihood Ratio Tests showed that adding this predictor was just not significant ($\chi^2(2) = 5.89$, $p = 0.053$, $b = -0.018$, *Exp(b)* = 0.982, 95% CI = [0.950, 1.016]), and neither was adding the interaction ($\chi^2(2) = 3.63$, $p = 0.163$, $b = 0.034$, *Exp(b)* =1.035, 95% CI = [0.968, 1.106]).

2.3 Discussion secondary analysis

With our secondary analysis of Lange and Dewitte (2023), we gathered initial evidence for our hypothesis that spending effort on a behavioral task for the benefit of a given pro-environmental organization can increase subsequent contributions to that organization. Moreover, we could derive an effect size estimate from the secondary analysis on which we based our preregistered sample size rationale for the confirmatory study (see below). Given that the study by Lange and Dewitte (2023) was not designed to test for this effect and given the exploratory nature of our analyses, some uncertainties remained about the robustness of the effect. We aimed to address these in the confirmatory study.

First, while participants were informed about the work and goals of the *assigned* organization during the instructions, they only encountered the alternative organization during the donation decision after the WEPT. This difference in exposure might have rendered the assigned organization to be more familiar, which could have led to the observed increased subjective preference due to mere exposure effects (Montoya et al., 2017; Zajonc, 2001) rather than due to cognitive effort. Although an unlikely alternative explanation in the present context, featuring only one brief exposure, we aimed to reduce exposure

differences in the confirmatory study. Therefore, we introduced both organizations equally at the beginning of the experiment and repeated the mission statement of both organizations on the donation decision page after the WEPT.

Second, we observed a general preference for WWF, as more than twice as many participants decided to donate to WWF than OroVerde, possibly because WWF is better known than OroVerde. Similar to mere exposure, general familiarity can result in increased subjective preference for the respective organization, which might overshadow more subtle differences in the donation decision that are driven by effort investment. In the confirmatory study, we therefore replaced WWF with Eden Projects, an organization that is less well known than WWF and hence more comparable to OroVerde, with the aim to ameliorate the strong differences in preference and hence increase overall power for the comparison of interest.

Third, to corroborate the notion that the donation decision can be interpreted as a reflection of subjective value, in the confirmatory study, we included a self-report question asking directly for the subjective value of the organizations.

We also included the Need For Cognition scale (NFC; Cacioppo et al., 1984) to assess the general willingness to spend cognitive effort and relate our findings to previous work on effort-based decision making. Furthermore, we changed the following design details to reduce the experiment duration and associated costs. We restricted the WEPT to 6 instead of 15 pages[1] and recruited participants from the US and UK but not from South Africa as the latter group spent notably longer on the experiment[2], which increased the costs with the recruitment platform Prolific. As the South African subsample showed the clearest hypothesized effect in the secondary analysis (see Supplementary Materials; Table S2), excluding this group would, if anything, rendered our replication approach more conservative. These changes were preregistered.

[1] When repeating the main secondary analysis, as reported above, restricted to participants that finished up to 6 pages, the results remain the same (see Supplementary Materials; Table S3).
[2] See the Supplementary Materials (Table S4) for the experiment durations and WEPT choices of the three different country samples of Lange and Dewitte (2023).

3. Confirmatory study

3.1 Methods

The design of the confirmatory study followed closely the relevant design aspects of the study by Lange and Dewitte (2023). The methods, sample size, hypotheses and data analysis plan were preregistered on Open Science Framework (OSF; https://osf.io/m59qw/?view_only=f68ddbbb9b3940ec89ebb78f8f104b4f).

3.1.1 Participants

Participants were recruited from Prolific with the following inclusion criteria: older than 18 years, fluent in English, currently living in the US or UK, and not having participated yet in a previous WEPT study, conducted by any of the authors. The prescreening questions provided by Prolific were used to determine eligibility. The reimbursement for participation was 1.63 Pounds. Additionally, participants could choose to keep or donate an offered 20 pence bonus following the WEPT. The study description on Prolific did not mention the donations for pro-environmental organizations to avoid selection bias.

Based on the multinomial logistic regression results from the secondary analysis, we conducted a simulation-based power analysis to estimate the required sample size for the confirmatory study. We simulated data (for n = 200, 300, 400, 500, 600, 700 and 800) of the two variables *WEPT organization* and *donation decision* based on the predicted probabilities from the multinomial logistic regression analysis. For each sample size, we ran 1000 iterations testing for significance with the same multinomial model that was used for the secondary analysis (α = 0.05). Based on the iterations we calculated the proportion of rejected null hypothesis which gave us the power estimates. We found that with a sample size of 800 we will reach a power of 94.8%. We preregistered this sample size rationale on OSF.

Data was collected from 843 participants of which 42 aborted the study before completion of the WEPT and were thus excluded. Of the remaining 801 participants, three ended the study after the donation decision and were, as per preregistration, still included in the main confirmatory analyses (Hypotheses 1 and 2), but data for the NFC scale are missing for them. Five participants did not respond to the demographic questions at the end of the experiment. While for

four of them we could use the demographic data they provided on Prolific instead, for one participant the demographic data are missing. The first 20 datasets were collected as part of a pilot experiment before the preregistration to estimate the average duration and generated donation amounts. This served to determine the expected total costs of the experiment and to enter a reasonable expected duration on Prolific. As preregistered, the analyses included the pilot data but were not carried out before collection of the full dataset. The data from the remaining 781 participants were collected after submission of the preregistration. For a comparison of the sociodemographic distribution of the samples from the secondary analysis and confirmatory study see Table 1.

3.1.2 Experimental Procedure

The study was run via Qualtrics and administered in English. The research was conducted according to the ethical rules presented in the General Ethics Protocol of (BLINDED FOR PEER-REVIEW).

After reading and agreeing to the informed consent form, participants were instructed on and practiced the WEPT. We used the same 15 unique WEPT trials as in the high-impact condition of Lange and Dewitte (2023). That is, participants had the option to complete pages of varying length (40, 80, 120, 160, 200 numbers) for varying amounts of donation (10, 20, 30 pence). However, in the confirmatory study, only six of these trials were drawn at random for each participant. The random selection was counterbalanced across subjects such that in total all pages were presented equally often and no page was presented twice to the same individual.

After successful completion of the WEPT practice round, consisting of 18 numbers without donations, participants were randomly assigned to either OroVerde or Eden Projects as the donation recipient (between-subject factor "*WEPT organization*"). For all participants, both organization names were mentioned in the instructions and described as: "Both are working on the preservation of tropical forests by investing, for example, in reforestation and environmental education in Latin America." This text was the same description as used in Lange and Dewitte (2023). We informed participants that: "One of the two environmental organizations will be randomly selected by the program as the donation recipient" and told them on the next page of the instructions which one

was selected. The organization's name was not mentioned again during the subsequent WEPT trials.

Following the WEPT, participants were presented with the same donation decision as in Lange and Dewitte (2023), along with the renewed description of the two organizations (see above). The only difference to Lange and Dewitte (2023) was that we replaced WWF with Eden Projects. Thus, the outcome *donation decision* had three levels: keep the bonus money, donate to OroVerde or donate to Eden Projects.

Afterwards, we asked participants explicitly about their valuation of the organization. For this, participants rated how much they value the work being done by the following six different pro-environmental organizations on a scale from 1 (= not at all) to 5 (= a lot): OroVerde, Eden Projects, Greenpeace, World Wildlife Fund (WWF), Rainforest Alliance (RA) and Forest Stewardship Council (FSC). The organizations were presented in a list, with the order randomized across subjects.

At the end of the study, participants filled in the NFC scale and provided details on their demographics (gender, age, native language, country of residence and profession; see Table 1). In total, 606.24 Euro were generated as donations (138.97 Euro from the donation decisions and 467.27 Euro through the WEPT). The amount was donated to the respective organization after the end of data collection.

3.1.3 Data analysis

The two preregistered hypotheses were analyzed in the following way. Hypothesis 1 (i.e., performing the WEPT for a given organization makes donating to that organization more likely as compared to donating to the alternative) was tested with a multinomial model in the same way as done in the secondary analysis.

Hypothesis 2 (i.e., with decreasing page size and increasing donation amounts, the likelihood to complete a WEPT page increases) was tested with a generalized linear mixed model (GLMM) with a binomial distribution family and logit link function. P-values were calculated using Likelihood Ratio Tests with the function mixed() from the package afex (Singmann et al., 2024). We followed the "maximal

model" approach (Barr et al., 2013) and started model selection with the maximal model that contained the continuous predictors *donation amount* and *page size* and their interaction as fixed effects, and by-participant random slopes for the fixed effects and their interaction. Both predictors were z-standardized to avoid convergence issues and make the interaction term interpretable. We added the optimizer "bobyqa" to deal with convergence issues. As in the secondary analysis, the same preregistered duration cutoff value was used to determine whether a page counted as completed.

We conducted three exploratory analyses which were not preregistered. First, we investigated whether the total number of completed WEPT pages modulates the effect of *WEPT organization* on donation decisions. For this we repeated the analysis for Hypothesis 1 but added the total number of completed WEPT pages as a fixed effect and the interaction with WEPT organization. If we observe such an interaction, it could indicate that the effect of WEPT organization is influenced by the effort and time spent on the WEPT.

Second, we further explored how the self-reported ratings of the subjective value assigned to the environmental organizations relate to the effect of WEPT organization on donation decisions (i.e., Hypothesis 1). Specifically, we tested for a corresponding increase in self-reported subjective value of the two WEPT organizations depending on (a) the assigned *WEPT organization*, and depending on (b) the donation decision. Finding such an increase in (a) would provide further evidence for our interpretation that performing the WEPT for a given organization increases the organization's subjective value. Finding the increase in (b) would confirm our interpretation of the donation decision as an indication of subjective value. To test this, we conducted two repeated measures ANOVAs (rmANOVA) including the within-subject factor *environmental organizations,* and either the between-subject factor *WEPT organization* (a) or *donation decision* (b). In case of a violation of the sphericity assumption, we applied a Greenhouse-Geisser correction.

Third, we assessed the relationship between the NFC scores and total number of completed WEPT pages with a Spearman correlation. This allowed us to test if participants that are generally more willing to spend cognitive effort also complete more WEPT pages.

3.2 Results

We first report the two pre-registered analyses which test the effect of *WEPT organization* on *donation decisions*, and the effect of *page size* and *donation amount* on WEPT choices. This is followed by the exploratory analyses that test (1) the influence of the number of completed WEPT pages on the main effect of *WEPT organization* on *donation decisions* (i.e., an interaction effect), (2) the relationship between the *donation decision* and self-reported subjective value, and (3) the relationship between NFC scores and WEPT choices.

3.2.1 Preregistered analyses

Donation decisions (Hypothesis 1)

Across both *WEPT organization* groups, 51.19% decided to keep the money, 30.96% decided to donate to Eden Projects and 17.85% to OroVerde. The multinomial regression analysis showed that the *WEPT organization* significantly predicted the *donation decisions* ($b = 1.461$, *Exp(b)* $= 4.312$, $p < 0.001$, 95% CI = [2.74, 6.78]). When the WEPT organization changed from OroVerde to Eden Projects, the odds of donating to Eden Projects instead of OroVerde increased more than four times (see Figure 1B). When comparing the odds ratios from the confirmatory study (*Exp(b)* $= 4.312$) and the secondary analysis (*Exp(b)* $= 2.019$) we can see that the effect is stronger in the confirmatory study. Together, this supports Hypothesis 1 and confirms the robustness of the main finding from the secondary analysis. For the full model output including the comparison with keep decisions, and an exploratory robustness check showing the non-significant interaction effects of gender, age and NFC scores, see the Supplementary Materials (Table S5 and S6).

Moreover, we found that the increase in donation proportion was numerically larger for donations to OroVerde (additional 17.09 percentage points) than to Eden Projects (additional 12.72 percentage points) when completing the WEPT for the respective organization compared to the other.

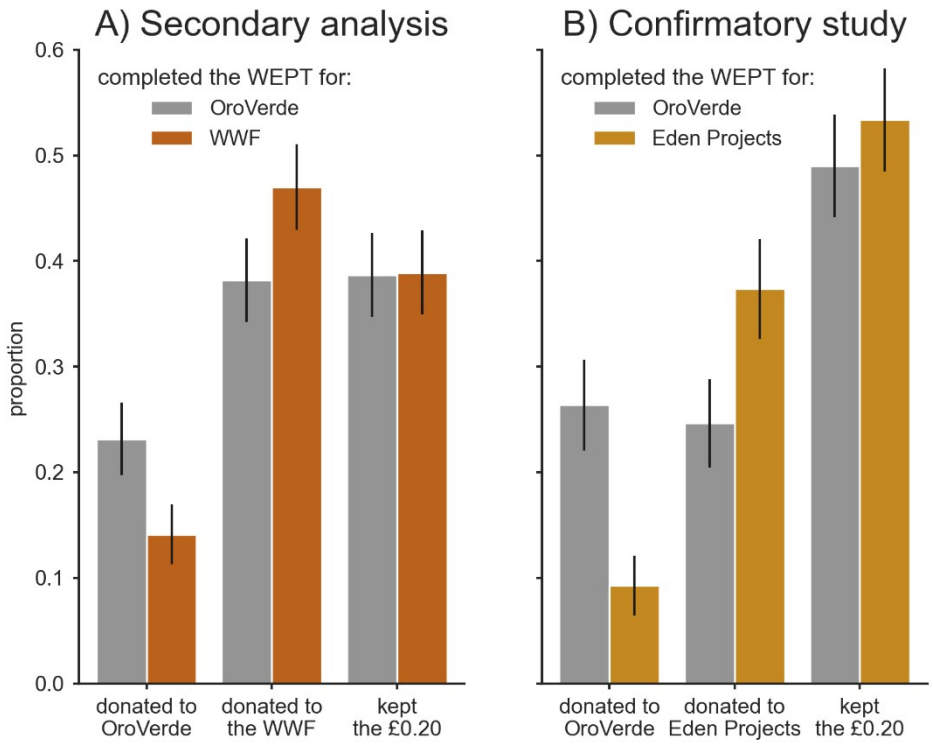

Figure 1 Donation decisions (Hypothesis 1). *The observed donation proportions per WEPT organization group. Every participant could only choose one of the three donation options. The bars from the same group, i.e., same color, add up to 1. A) shows the proportions from the secondary analysis; and B) shows the proportions from the confirmatory study. Vertical bars are 95% confidence intervals.*

WEPT choices (Hypothesis 2)

Participants completed on average 3.29 (*SD* = 2.15) out of 6 pages. There were 104 out of 801 participants that did not complete any page and 221 that completed all 6 pages. In total, 2639 pages were completed, and 12 additional pages were not counted as completed due to the preregistered duration cutoff.

The maximal GLMM that converged included by-participant random slope for *page size* and by-participant random intercepts. The Likelihood Ratio Tests showed that *page size* ($\chi^2(1) = 216.67$, $p < 0.001$) and *donation amount* ($\chi^2(1) = 23.67$, $p < 0.001$) but not their interaction ($\chi^2(1) = 0.93$, $p = 0.334$) significantly predicted the decisions whether to complete a WEPT page. The coefficient of *page size* ($b = -0.855$, *Exp(b)* = 0.425) shows that with every increase in *page size*, the odds of completing the page decreased by 57.5%. The coefficient of *donation amount* ($b = 0.212$, *Exp(b)* = 1.236) shows that with every increase in *donation*

amount, the odds of completing the page increased by 23.6%. These results support Hypothesis 2.

When visually inspecting the data (see Figure 2), the effects of the two predictors do not seem to be equally strong at each level of the other predictor (e.g., at page size 120). These visual differences may be due to measurement noise and the fact that in the confirmatory study the two predictors were not purely within-subject as every participant saw a different subset of the 15 possible page combinations.

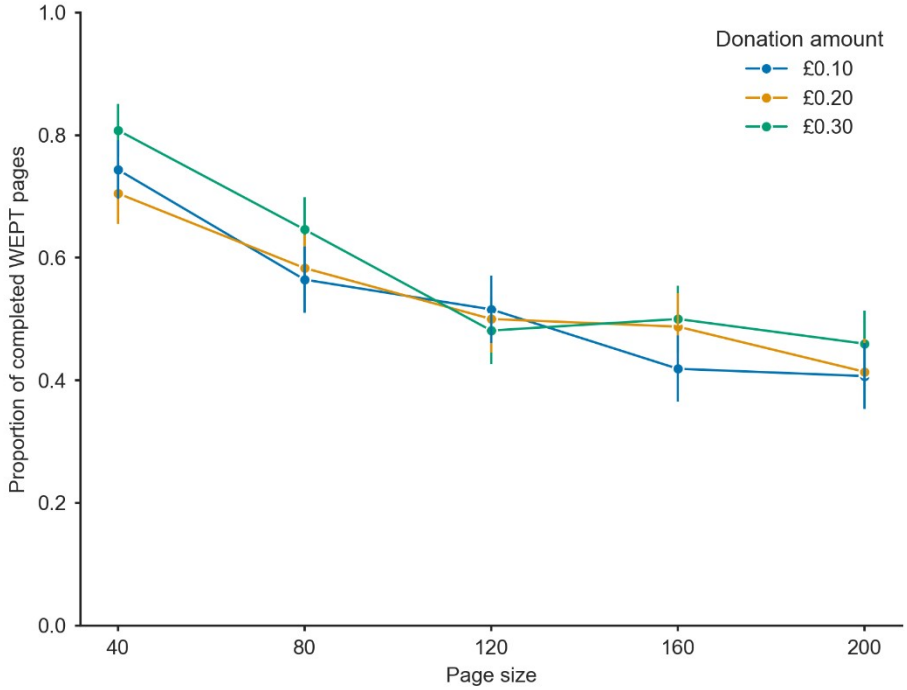

Figure 2 WEPT choices (Hypothesis 2). *The larger the page size is and the smaller the donation amount is, the lower is the average proportion of participants completing the page. The observed proportions are plotted. Vertical bars are 95% confidence intervals.*

3.2.2 Exploratory analyses

Effect of total number of completed WEPT pages on donation decisions

In addition to the preregistered analysis, we also conducted an exploratory analysis testing the effect of the total number of completed WEPT pages on the effect of *WEPT organization* on the donation decisions (i.e., interaction). The coefficients of the main effect of completed WEPT pages show a very small effect on donation decisions (b = 0.077, *Exp(b)* = 1.080, 95% CI = [0.965, 1.209]). The

coefficient of the interaction indicates that the main effect of *WEPT organization* gets smaller with an increase in completed pages (b = -0.312, *Exp(b)* = 0.732, 95% CI = [0.585, 0.917]). This indicates that people who chose to complete more pages tended to donate somewhat less often to the assigned organization. For the full regression table see Supplementary Materials (Table S7).

Self-reported valuation of organizations

We tested the effect of *WEPT organization* on participants' ratings of how much they value the work being done by six different pro-environmental organizations. For this, we conducted a rmANOVA that revealed a medium-sized variation in *environmental organizations* (F(4.39, 3506.24) = 79.40, η_p^2 = 0.090, 90% CI = [0.075, 0.105][3]), almost no difference in *WEPT organization* (F(1, 799) = 1.29, η_p^2 = 0.002, 90% CI = [0.000, 0.010]), and a small interaction (F(4.39, 3506.24) = 6.32, η_p^2 = 0.008, 90% CI = [0.003, 0.012]). To follow up on the interaction, we compared the values assigned to the two WEPT organizations. The valuation of OroVerde showed a difference between the two groups (see Figure 3A): The group that performed the WEPT for the benefit of OroVerde assigned higher values to OroVerde (M = 3.70, SD = 1.08) compared to the Eden Projects group (M = 3.45, SD = 1.08). The mean value assigned to Eden Projects did not differ by group (OroVerde group: M = 3.74, SD = 1.05; Eden Projects group: M = 3.77, SD = 1.00).

Additionally, we also investigated how the donation decision relates to the self-reported subjective value of the respective organization. For this we grouped participants by their donation decision and compared the values they assigned to the six organizations. The rmANOVA showed variation in *donation decision* (F(2, 798) = 41.05, η_p^2 = 0.093, 90% CI = [0.063, 0.125]), and in *environmental organizations* (F(4.38, 3496.63) = 59.73, η_p^2 = 0.070, 90% CI = [0.056, 0.083]) as well as a small interaction (F(8.76, 3496.63) = 5.29, η_p^2 = 0.013, 90% CI = [0.006, 0.018]). When comparing the mean values of the two organizations of interest, Eden Projects and OroVerde, we can see that those participants that decided to keep the money assigned a lower value to both organizations (M_{Eden} = 3.43, SD = 1.03; M_{OroVerde} = 3.31, SD = 1.08) than those that donated the money (see Figure 3B). Participants that decided to donate money to OroVerde assigned a higher value to OroVerde (M_{OroVerde} = 4.00, SD = 0.86) than those that donated to Eden

[3] A two-sided confidence interval around η_p^2 is 90%, rather than 95%, with alpha = 0.05 because the corresponding F-test is one-sided and the effect size always positive.

Projects (M_{OroVerde} = 3.78, SD = 1.09). Similarly, participants that donated to Eden Projects assigned a higher value to Eden Projects (M_{Eden} = 4.18, SD = 0.91) than those that donated to OroVerde (M_{Eden} = 3.93, SD = 0.89). For the full comparison including the other four organizations, see the Supplementary Materials (Figure S1 and S2).

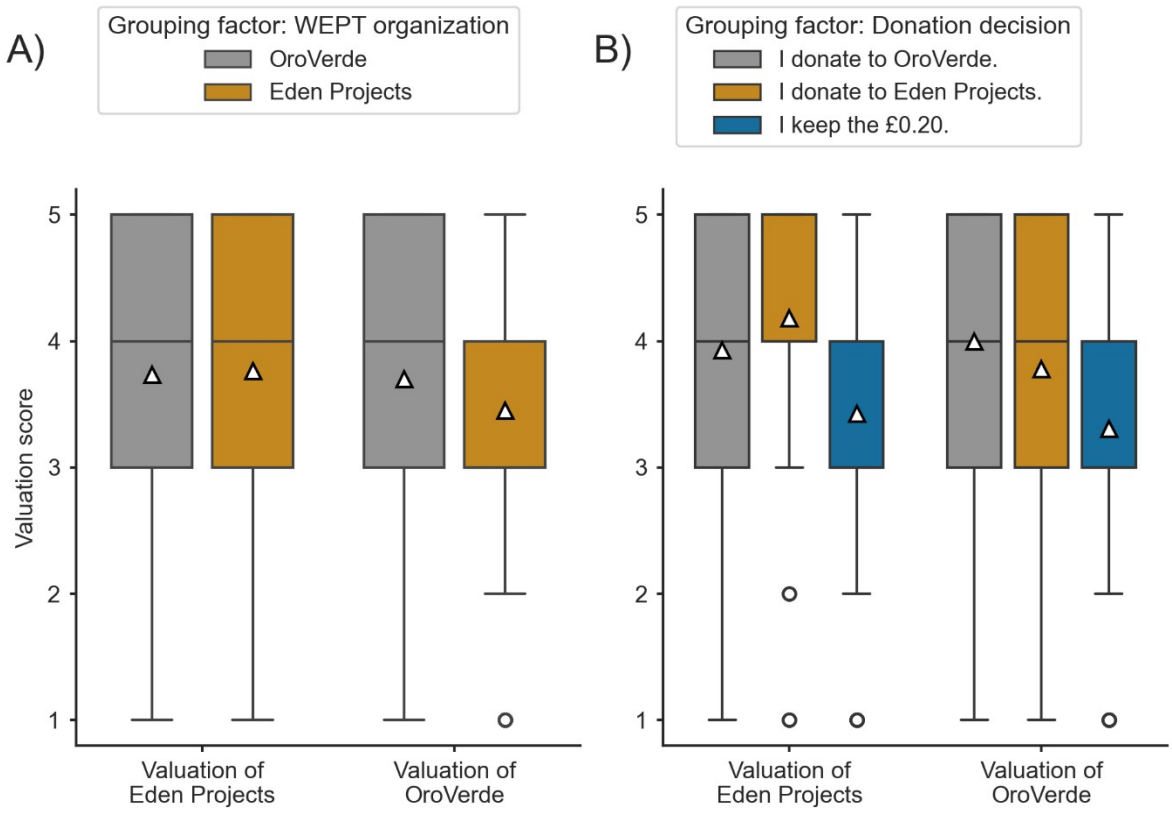

Figure 3 Self-reported valuation of organizations in the confirmatory study. *Participants indicated how much they value the work being done by six pro-environmental organizations on a scale from 1 (= not at all) to 5 (= a lot). Only the two WEPT organizations are plotted here. For the full comparison between all environmental organizations see the Supplementary Materials (Figure S1 and S2). A) groups the responses by assigned WEPT organization (experimentally manipulated). B) groups the responses by donation decision (self-selected by participants). The white triangles indicate the mean.*

Need for cognition and WEPT choices

There was a small positive correlation between the mean NFC scores and the total number of completed WEPT pages (r_S = 0.11, 95% CI = [0.043, 0.180]). The higher participants scored on the NFC, the more pages they tended to complete.

4. Discussion

In the current study, we investigated the effect of performing the WEPT for the benefit of a given pro-environmental organization on the valuation of that organization. In our secondary analysis of the existing dataset from Lange and Dewitte (2023), we found that after performing the WEPT to generate donations for a pro-environmental organization, participants were more likely to donate an additional bonus of 20 pence to that same organization than to an alternative organization. We interpret this as assigning a higher subjective value to the organization one has exerted effort for during the WEPT compared to the alternative organization. In a preregistered, high-powered confirmatory study we replicated the differential pattern in donation decisions with a stronger effect size. Moreover, the results from an exploratory analysis indicated that the effect of effort expenditure extended to self-reports of participants' valuation of the pro-environmental organizations.

In the confirmatory study, the observed effect of WEPT organization on the donation decision was stronger than in the secondary analysis. One difference between the studies is that the time between the donation decision and the initial information on the WEPT organization is shorter in our confirmatory study, than in Lange and Dewitte (2023), as here we used a version of the WEPT with 6 instead of 15 pages. This could have led participants to better remember the WEPT organization in our confirmatory study. To address this possibility, we reanalyzed a subsample of the dataset from Lange and Dewitte (2023) only including participants that completed up to 6 pages (see Supplementary Materials Table S3). The effect on donations was still present in the subsample and thus the difference in study procedure length seems to be an unlikely explanation. The stronger effect size might instead be due to the reduction in overall preference for one of the two organizations. In the secondary analysis, more than twice as many people decided to donate to WWF rather than OroVerde, indicating a general preference for WWF that may limit the effect the assignment of WEPT organization can have on the donation decisions. In the confirmatory study, we addressed this by replacing WWF with Eden Project as the donation recipient because we expected that Eden Projects would be less well known than WWF, and hence more comparable to OroVerde. Indeed, this change reduced the general preference for one of the two organizations but, contrary to our expectation, participants overall still preferred Eden Projects over OroVerde. It

could be that if general organization preferences are more balanced, the effect of the WEPT organization on subsequent donation decisions might be even stronger. Future studies might benefit from more knowledge about preexisting preferences or familiarity of the organizations to account for such effects. Furthermore, they could include different WEPT organizations and combinations to investigate if the effect generalizes. This could further inform strategies of pro-environmental organizations to increase donations to better understand when and for what kind of organizations the investment of effort is most effective.

One of our exploratory findings was that the increase in subjective value might be larger for the organization that is less well known, i.e., OroVerde. The self-reported subjective value of OroVerde in the confirmatory study is higher for the group that performed the WEPT for the benefit of OroVerde rather than Eden Projects, while both groups valued Eden Projects equally. In line with this is the exploratory finding in the confirmatory study that the probability of donating to OroVerde after completing the WEPT for OroVerde is numerically larger than for Eden Projects when completing the WEPT for Eden Projects (see Figure 1B). However, as this difference was not found in the secondary analysis, the robustness of this effect would need to be tested in future studies.

In the confirmatory study, we also found that the effect of WEPT organization on the donation decision was smaller in participants who completed more WEPT pages. In the secondary analysis, this interaction effect was not significant and numerically in the opposite direction. Thus, this finding should be interpreted with caution. This pattern might be taken to suggest that the amount of effort spent on the WEPT, as indicated by the number of completed pages, is not what drives the observed effect of the WEPT organization on donation decisions. However, the number of completed WEPT pages was not experimentally manipulated: participants could choose themselves how many pages to complete. Thus, there may be various factors that influenced those choices, resulting in groups that differ systematically in other factors besides the amount of effort spent on the WEPT. For example, in our exploratory analysis we found a small positive correlation between NFC scores and number of completed pages. This might indicate that those participants who completed more pages are less sensitive to effort costs and enjoy spending effort more as compared to those who did fewer pages, resulting in comparable *perceived* effort despite differences in completed pages. In line with this, it has been shown that participants scoring

high on the NFC scale perceived higher effort levels in a working memory task to be less effortful and less aversive than participants with lower NFC scores (Zerna et al., 2023). This also relates to the observation that participants who reported to engage in a certain pro-environmental behavior perceived it as less effortful than those that reported not to engage in it Dreijerink et al. (2022). In the present study, this might imply that participants who completed many pages perceived the number checking task as less effortful, rendering the completion of the WEPT less valuable overall, than those who did only a few pages. Future studies might include indices of perceived subjective effort (c.f., Halperin & Vigotsky, 2024) to gather further evidence for this hypothesis.

Our experimental approach can also be viewed in terms of testing the influence of a first pro-environmental behavior ("PEB1"; i.e., the WEPT) on a second pro-environmental behavior ("PEB2"; i.e., the donation decision) which relates to the concept of spillover (Nilsson et al., 2017; Truelove et al., 2014). PEB1 can make engagement in PEB2 more ("positive" spillover) or less ("negative" spillover) likely. Generally, however, there is very limited evidence for spillovers on other behaviors and if it occurs it seems to be moderated by various factors (Geiger et al., 2021; Maki et al., 2019). There is mixed evidence on whether the difficulty or effortfulness of PEB1 moderates spillover with some empirical evidence from the pro-social literature (Gneezy et al., 2012) and theoretical frameworks predicting positive spillover (Truelove et al., 2014), but empirical evidence showing no spillover (León et al., 2024; Maki et al., 2019). A difference in our approach to typical spillover studies is that we investigated the effects of engaging in PEB1 for a specific environmental outcome (e.g., generating donations for OroVerde) and how it impacts engagement in PEB2 with that same outcome, even though with a different kind of behavioral cost. Negative spillover would predict that generating donations for OroVerde through PEB1 decreases engagement in PEB2 for the benefit of OroVerde perhaps because participants think they have already done enough for OroVerde (i.e., moral licensing; Blanken et al., 2015). However, we rather found the opposite effect speaking in favor of positive spillover. One proposed mechanism underlying positive spillover is that engaging in PEB1 can induce positive affect or "warm glow" which can then lead to increased engagement in PEB2 (Chatelain et al., 2018; Prinzing, 2024; Zhou et al., 2024). Thus, in our study it could be that engaging in PEB1 led to positive affect which was then associated with the particular outcome of PEB1 resulting in increased PEB2 for that same outcome.

To investigate if positive affect influences the observed increase in donations would require further studies directly measuring or intervening on affect.

We replicated the effects of *donation amount* and *page size* on the choices whether to complete a WEPT page or not (Lange & Dewitte, 2022, 2023). With increasing donation amounts participants were more likely to complete a page, while with increasing page sizes participants were less likely. This confirms previous WEPT studies in a shortened version of the task with only 6 instead of 15 pages. Furthermore, the impeding influence of page size can be seen as evidence for the aversiveness of prospective effort where it acts as a cost during the WEPT. This is in contrast to the value-adding effect of having spent effort in the WEPT on the subsequent valuation of the WEPT organization. This contrast is in line with the effort paradox in which effort is considered to be both, a cost and a source of value, presumably depending on whether effort is anticipated or has already been spent (Inzlicht et al., 2018; Yi et al., 2020).

There is emerging evidence that participants who are recruited via Prolific are heavily influenced by their financial need when they participate in experiments involving financial decision making (Carlson & Crockett, 2024). Thus, in our study, decisions to keep the bonus money in the donation decision should not be interpreted in terms of selfishness or morality. Decisions to donate have multiple psychological and non-psychological determinants of which we studied one, namely cognitive effort. Also, we tested Prolific participants from the US and UK which allowed us to closely replicate Lange and Dewitte (2023) but limits the generalizability of the findings. To further test for generalizability, one needs to study the effect in other populations, specifically focusing on those that have the means to donate in real life (Carlson & Crockett, 2024).This would also be in line with the call for more research in pro-environmental behavior that focuses on people with a high-socio economic status (Nielsen, Nicholas, et al., 2021).

Our findings suggest that if potential donators spend effort in support of a pro-environmental organization, this can be a way to bind the donators to that organization by increasing its subjective value. In our study, the environmental goals of the two organizations were described in exactly the same terms, only the assigned organization was different. Thus, the observed increase in donations for the assigned organization speaks for an increase in value of the organization rather than of the environmental outcome in general. These results may inform the work of charitable pro-environmental organizations. For example, organizing

fundraising events in a way that involves effortful activities while emphasizing the specific organization as well as the environmental outcome could be a way to increase subsequent donations (see also Olivola & Shafir, 2013). Also, since we did not find evidence for a negative spillover of effort on donations, initial investment of effort should not be seen as barrier to further support the organization.

5. Conclusion

In this study, we investigated how the prospect of spending cognitive effort affects WEPT choices, and how having spent effort on the WEPT affects subsequent subjective valuation of the associated outcome. We showed that the overall effect of the donation amount and page size on WEPT choices replicated in a shortened version with only 6 pages. The impeding effect of larger page sizes on the completion of a page, to generate donations for an environmental organization, indicates that prospective effort acts as a cost and prevents pro-environmental behavior. We also showed that after having spent effort on the WEPT, donations to the assigned WEPT organization, rather than an alternative organization, become more likely. We interpret this as evidence for our hypothesis that spending effort for the benefit of a pro-environmental organization can increase the value assigned to that organization. This finding contributes to the understanding of the relation between cognitive effort and pro-environmental behavior, and can potentially inform strategies of pro-environmental organizations to raise donations by making use of the idea that effort can be more than just a barrier.

Data and Code Availability

We have shared all data, code, and materials on OSF (https://osf.io/ftruc/?view_only=f27bd7eaf662479d85569a117b11bfd7).

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