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The psychology of balancing gains and losses for self and the environment: Evidence from a carbon emission versus travel time tradeoff task

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ABSTRACT

If human behavior is to become more sustainable, people will have to be willing to sacrifice personal gains and benefits for the sake of sustainability. Decisions will have to involve making tradeoffs between what is good for the self and what is good for sustainability. In the present paper, we studied the psychology of such tradeoffs in the context of a carbon dioxide (CO_2) emission versus travel time tradeoff task. The experiment investigated how intrinsic motivational factors (environmental concern), extrinsic motivational information (a normative message) and extrinsic motivation-neutral information (anchors) influence these tradeoffs. The results revealed that extrinsic factors interact in their effects on tradeoffs such that participants were willing to travel for a longer time for the benefit of less CO_2 emissions when they were externally motivated by a normative message, but only when this motivational emphasis was combined with a high anchor. Furthermore, this interaction was particularly strong in participants with high environmental concern. We conclude that extrinsic and intrinsic motivational factors interact in their effect on making people willing to accept personal losses in exchange for sustainability gains and that these motivational factors may have to be combined with further extrinsic information to influence decisions.

1. Introduction

Climate change is "the defining issue of our time" (United Nations, 2020). The International panel on climate change (IPCC) has estimated that a 1.5 °C increase in global temperature will cause a range of severe effects, such as a rise in sea levels and increased frequencies and/or intensities of droughts as well as heavy precipitation (IPCC, 2018). The reduction of carbon dioxide (CO_2) and other greenhouse gas emissions is a vital step to fight global warming. The success of these reductions will partly depend on changes in human behavior patterns (Steg & Vlek, 2009). If human behavior is to become more sustainable, however, people will have to be willing to sacrifice personal gains and benefits for the sake of sustainability. In many everyday situations, consumers will have to make decisions that involve making tradeoffs between what is good for the self and what is good for the environment. In the present paper, we studied the psychology of such tradeoffs in the context of a CO_2 emission versus travel time tradeoff task.

Imagine that you are about to make a one-hour domestic flight between two Swedish cities, Stockholm and Umeå (650 km or approx. 400 miles apart), causing 99 kg of CO_2 emissions. You are then asked how long you would be willing to let the trip take in order to reduce the emission of CO_2 to 22 kg. In the current study this is the tradeoff we asked the participants to make. The task requires participants to make tradeoffs between what can be considered good for the environment (less emissions) and what can be considered good for themselves (less travel time). The task thus pinpoints a central, psychological tenet of the conflict between pro-environmental and pro-self-interests; a conflict that is arguably an important obstacle to climate change mitigation. The conflict can be characterized as a tragedy of the commons (Nordgren, 2016), whereby there is a conflict between what is best for the majority of people and what is best for the individual.

The task can be characterized as a matching task, wherein the two levels of CO_2 emission (99 kg CO_2 and 22 kg CO_2) and one level of travel time (1 hour) are given to the participants and the participants' task is to fill in the second level of travel time to make the preference differences match. We assume that people prefer journeys of shorter duration rather than longer duration (a personal gain) and that people prefer causing less CO_2 emission to more (an environmental gain). However, a person's

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attitude towards climate change, environmental issues and feeling of personal responsibility to take remediating actions may cause variation in how much they are willing to increase their travel time to decrease CO_2 emission.

Thus, in this paper we were interested in the psychology of decision-making concerning the tradeoff between pro-environmental and pro-self alternatives. In this context, we were also interested in how this tradeoff may be modulated by motivational factors. A distinction between intrinsic/endogenous and extrinsic/exogenous sources of motivation can be made (Ryan & Deci, 2020). While both extrinsic and intrinsic sources of motivation can motivate pro-environmental behaviors, extrinsic motivation can also for example have an inhibiting effect on self-driven motivations of "green" consumers (Ali, Ashfaq, Begum, & Ali, 2020). We briefly discuss intrinsic and extrinsic motivational factors below before proceeding to the details of the current study.

1.1. Intrinsic motivational factors

McIntyre and Milfont (2016) have defined environmental attitudes as "a psychological tendency to evaluate the natural and built environments, and factors affecting their quality, with some degree of favor or disfavor". They note that the terms environmental attitudes and environmental concern are often used interchangeably, but that some see environmental concern as one of several aspects of environmental attitudes. Pro-environmental behavior and environmental concern are complex and influenced by many factors (Gifford & Nilsson, 2014), e.g., personality (Markowitz, Goldberg, Ashton, & Lee, 2012), education (Collado, Rosa, & Corraliza, 2020), as well as biospheric, egoistic and altruistic values (Milfont & Gouveia, 2006). In a Dutch study of teenagers' environmental knowledge and attitudes, environmental concern was associated to willingness to make sacrifices, e.g., spare time or money, for the environment (Kuhlemeier, Van Den Bergh, & Lagerweij, 1999). Further, there is a correlation between having a high concern for the environment and willingness to pay for green electricity (Hansla, Gamble, Juliusson, & Gärling, 2008a).

In the current study, interest centers on individual differences in environmental concern due to their potential co-variation with CO_2 emission versus travel time tradeoffs. People with strong pro-environmental values and attitudes should make larger tradeoffs, offering to give up more of their personal assets or comfort to reduce CO_2 emission by a specific amount than people with weaker pro-environmental values. In this context individual differences in environmental concern are viewed as an intrinsic motivational factor that influences willingness to accept larger tradeoffs between personal and environmental gain.

1.2. Extrinsic motivational information

In addition to intrinsic factors, extrinsic motivational factors may also influence the magnitude of these tradeoffs. Reducing private air travel is often proposed as a target to reduce one's carbon footprint. Therefore, we suppose that Swedish participants, and people in general, are willing to consider increasing their travel time to reduce the CO_2 emission. A complicating factor is that carbon literacy is low (Grinstein, Kodra, Chen, Sheldon, & Zik, 2018) and most people are arguably not aware of how much this reduction from 99 to 22 kg CO_2 is worth. According to the Swedish Environmental Protection Agency (2019), these CO_2 emissions are in the same order of magnitude as the maximum weekly emission (38 kg) of the long-term goal of 2 tons/year and inhabitant. Providing people with this information puts the CO_2 emissions in context and conveys a normative message which could influence CO_2 emission versus travel time tradeoffs.

However, information alone is often not enough to induce pro-environmental behavior (see, e.g., Kollmuss & Agyeman, 2002). Some additional extrinsic cue or intrinsic motivation might be needed. Bolderdijk, Gorsira, Keizer, and Steg (2013) found that an informational intervention in the form of a movie containing factual information and normative messages interacted with pro-environmental values in influencing pro-environmental behavior. Watching the movie led to increased knowledge about the environmental problem, but a strengthened intention for pro-environmental behavior was only observed for participants with strong biospheric values.

1.3. Extrinsic (motivation-neutral) reference information

Decision making, judgments, and valuation are influenced by various heuristics, sometimes leading to biases (Tversky & Kahneman, 1974). One such bias is the tendency to make judgments close to anchors, which was described by Tversky and Kahneman (1974). The anchoring effect is very robust and difficult to avoid, even when people have been made aware of the influence from anchors on decisions beforehand (Bahník, Englich, & Strack, 2017; Furnham & Boo, 2011; Strack, Bahník, & Mussweiler, 2016). In the domain of decision and risk analysis, anchoring could occur in many steps when modeling preferences, values, and choices (Montibeller & von Winterfeldt, 2015). Anchoring influences responses to general knowledge questions (Jacowitz & Kahneman, 1995; Tversky & Kahneman, 1974), quantitative estimates in general (Bahník & Strack, 2016; Langeborg & Eriksson, 2016) as well as quantitative estimates of personal preferences (Green, Jacowitz, Kahneman, & McFadden, 1998; Yoon, Fong, & Dimoka, 2019) and other's personal preferences (Krueger & Clement, 1994). For example, anchoring influences people's willingness to pay for and willingness to accept carbon taxes for flying (Brouwer, Brander, & Van Beukering, 2008; Sonnenschein & Smedby, 2019).

In the current study, anchoring is employed as a technique to study the influence from extrinsic (motivation-neutral) information on CO_2 versus travel time tradeoffs.

In the standard anchoring paradigm, the anchor is introduced in a comparative judgment question. According to the Selective Accessibility Model (Mussweiler & Strack, 1999) the comparison increases the accessibility of information consistent with the anchor. In a following absolute judgment question this anchor-consistent information biases the answer towards the anchor. Chapman and Johnson (1999, Experiment 5) suggest that anchoring effects may interact with domain-relevant information. They showed that anchors exert a greater influence over people's judgments when they have target features at their disposal, provided that they need to construct their answers to the question and not merely retrieve them from their expert knowledge.

In our experiment, half of the participants have access to external motivational information in the form of a normative message. This external information may cause the participants to reflect upon climate change and carbon dioxide emissions, generating a larger pool of anchor-consistent target features, which in turn, would result in a larger effect of the anchor.

1.4. Purpose

The purpose of the present study was to investigate the psychology of CO_2 emission versus travel time tradeoffs and to explore how these tradeoffs are influenced by extrinsic motivational information (a normative message), extrinsic motivation-free information (anchors) and intrinsic motivational factors (environmental concern).

The anchoring effect is generally strong, and we predicted that the anchors would influence people's answers to tradeoff tasks, with a willingness to give up more travel time among participants in a high anchor condition. Based on the SAM account of anchoring, we hypothesized that the anchoring effect would be larger among participants given the normative message.

We predicted that people with strong pro-environmental values and attitudes would make larger tradeoffs than people with weaker pro-environmental attitudes. Further, we predicted that people with stronger pro-environmental attitudes would be more affected by the

normative message when making tradeoffs.

A further aim was to study the interaction between the anchors and participants environmental attitudes. People with high concern for the environment are expected to be keener on reducing their carbon footprint. If this also makes them elaborate more before answering the questions, the SAM account of anchoring would predict that their responses should be more influenced by the anchor. However, people with more concern for the environment may also have stronger values and opinions, which may lead them to be less influenced by anchors. We are not aware of any previous investigations concerning how the anchoring effect in preference tradeoff judgments is influenced by the strength of people's values, but in a recent study (Andersson et al., 2021) we found that the anchor effect increased with peoples increasing concern for the environment.

2. Method

2.1. Participants

A total of 212 participants were recruited at a Swedish university. (We aimed for a minimum of 50 participants per each of four conditions, corresponding to power 1-$\beta = .8$, for $\alpha = .05$ and $f = 0.20$ in a two-way ANOVA analysis including an interaction (anchor: high/low, normative message: yes/no).) Eleven participants were excluded from the data analysis because they did not complete the experiment. In total, 201 participants were included in the analysis (mean age 26.3 years, $SD = 6.9$, min 19, median 23, max 63; 112 women, 87 men, 2 other or unsure). All participants were adults, they participated under written and oral informed consent and received a small honorarium. The study was conducted in accordance with the ethical guidelines of the American Psychological Association and the declaration of Helsinki.

2.2. Materials

2.2.1. Tasks, anchoring and normative messages

The effects of anchors and normative message were measured in an anchoring paradigm with a comparative judgment task and an absolute judgment task. The normative message was based on information from the Swedish Environmental Protection Agency (2019) which states that Swedes should cause no more than one to two tons of greenhouse gas (GHG) emission per capita and year, counted in CO_2-equivalents. This is a drastic reduction from the current level of approximately eight tons of consumption-based GHG emission per person and year (Swedish Environmental Protection Agency, 2020).

All participants received the same background information concerning a trip from Stockholm to Umeå, travel time, and the resulting CO_2 emission. There were four versions differing in anchor and normative message.

The comparative judgment task asked for the willingness to make a longer-lasting trip in order to reduce the CO_2 emission:

> Let us assume that you will fly from Stockholm to Umeå. This trip lasts 1 hour and will emit 99 kg of CO_2.
>
> {The Swedish Environmental Protection Agency recommends that each of us should not use more than two tons of greenhouse gases per person and year, which amounts to a maximum of 38 kg of CO_2 per week on average.}
>
> If you had the opportunity to reduce the CO_2 emission to 22 kg, would you be willing to travel for a longer time than 2 hours [6 hours] instead of 1 hour?

Half the participant received this question with a low anchor (2 hours) and half with a high anchor (6 hours). Half the participants in each anchor condition received the question with the information in curly brackets (normative message); the other half did not get this information (no message). The comparative question was answered with a yes or no response. The anchor values were selected because they represent reasonable compromises. Further, 6 hours is approximately the time it would take to travel between the two cities by train, although a train journey was not mentioned in the task description.

The absolute judgment task asked how long the participants would be willing to travel to achieve the reduction of CO_2 emission from 99 kg of CO_2 to 22 kg of CO_2. The text from the comparative question was repeated verbatim, and the participants were reminded of their previous answers (yes/no), followed by the question requiring an absolute judgment:

> You answered yes [no] to the question above.
>
> How long would you at most be prepared to travel? (Answer in hours)

2.2.2. Environmental concern

Environmental concern was measured with the 12 item Environmental Motives Scale (EMS) of Schultz (2000, 2001), translated into Swedish by Hansla, Gamble, Juliusson, and Gärling (2008b), on a nine-point scale from 1 (not concerned) to 9 (very concerned). The EMS is a measure of concern about the environmental problems caused by human behavior, and consists of three subscales for egoistic, altruistic and biospheric reasons for concern. The 12 items of the EMS were divided into three indexes, biospheric ($M = 7.43$, $SD = 1.70$, Cronbach's $\alpha = .91$), altruistic ($M = 7.26$, $SD = 1.75$, $\alpha = .85$), and egoistic ($M = 6.18$, $SD = 2.20$, $\alpha = .91$). The analysis and results involving environmental concern are based on 200 participants because one participant did not finish the EMS part of the survey.

The three subscales of the EMS were constructed by Schultz (2000, 2001) as separate components of environmental concern. However, we note that the correlations between the subscales are high (.72 for biospheric-altruistic, .51 biospheric-egoistic, and .75 altruistic-egoistic, all with $p < .001$), and a standardized Cronbach's alpha of a 'global' Environmental Motives Scale consisting of all 12 items is .93. This global scale ($M = 6.96$, $SD = 1.66$) is used in the data analysis, in line with previous research (Andersson et al., 2021; Hansla et al., 2008a).

The distributions of values for the three subscales of the EMS are highly skewed, with many participants giving answers at the very highest end of the possible range 1–9. The calculated environmental concern index has skewness −0.71, with 30% of the values being in the range 8–9. A similar observation has been reported by Bruni, Chance, and Schultz (2012), who found high percentages of scores 6-7 on a 7-point scale in an Environmental Motives Scale adapted for children.

2.3. Procedure and design

Data were collected in lobbies at a Swedish university during daytime. The participants used computers and tablets, partly screened off from the surroundings. A commercial survey tool (Survey Monkey) was used. The participants responded to a short survey in Swedish, starting with demographic questions (gender, age). The tradeoff task was approximately in the middle of the questionnaire and the environmental concern items were presented at the end. The questionnaire also contained a few other questions not reported here.

The experiment comprised a between-subjects 2 × 2 factorial design. The two experimental independent variables were anchor and normative message. The anchor factor had two levels, 'low anchor' (2 hours) and 'high anchor' (6 hours). The normative message factor also had two levels, with and without the motivational information. The dependent variable was travel time. Participants were randomly assigned to one of the four experimental conditions. Environmental concern was collected as an observational variable.

Table 1
Number of participants, number of affirmative answers to the anchoring question, trimmed mean and winsorized standard error in each experimental condition.

				Travel time	
Anchor	Normative message	*n*	Yes	$M_{0.2}$	$se_{0.2}$
High	No message	50	18	3.87	0.48
	Normative message	50	29	5.45	0.48
Low	No message	50	36	2.74	0.23
	Normative message	51	38	2.55	0.26

2.4. Data analysis

Data were analyzed with robust statistical methods (Wilcox, 2017) using the *WRS2* package (Mair & Wilcox, 2018) and the *robustbase* package (Maechler et al., 2019) in *R*. Robust methods were selected due to the large positive skew of the responses to the questions on travel time, with large deviations from normality of residuals and homoscedasticity (cf. Bahník & Strack, 2016). For two-way robust ANOVA the *t2way* function was used, which internally uses 20% trimmed means and 20% winsorized variances (Wilcox, 2017, p. 335). Trimming the means removes the extreme values in both tails, including a few implausibly small or large answers, but the winsorized contributions to the variances are still part of the analysis. For robust multiple regression, the *lmrob* function was used, which uses an iteratively re-weighted least squares estimation giving low or zero weights to outliers in the regression.

3. Results

3.1. Effects of extrinsic information on tradeoffs

The answers to the anchoring question (yes or no) and the main dependent variable (travel time in number of hours) are reported in Table 1 and Fig. 1. As expected, participants who received the high anchor answered with longer traveling times than participants who got the low anchor. In the high anchor condition, the addition of information on recommended maximum weekly CO_2 emission resulted in higher answers, i.e., people were willing to travel for a longer time. On the other hand, for the low anchor the mean answers are approximately the same with and without the normative message.

A robust ANOVA showed a significant main effect of the anchor ($p <$ .001), but not of the normative message, see Table 2. There was also a significant interaction between the anchor and the normative message, $p = .023$. The explanatory measures of effect sizes according to Wilcox (2017) were large ($\widehat{\xi} = 0.47$) for the anchor, small for the normative message ($\widehat{\xi} = 0.16$), and medium ($\widehat{\xi} = 0.30$) for the interaction between anchor and normative message. (According to Mair & Wilcox (2019), values of $\widehat{\xi} = 0.10$, 0.30, and 0.50 correspond to small, medium, and large effect sizes, respectively).

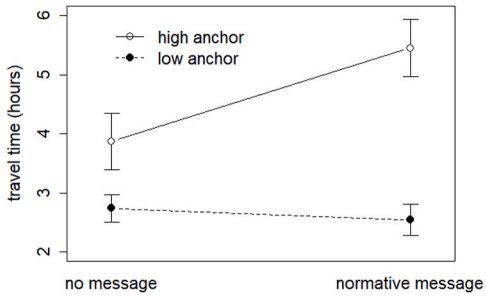

Fig. 1. Travel time answers for participants given high or low anchors, with and without the additional information on recommended maximum weekly CO_2 emission. (20% trimmed means and winsorized standard errors.)

Table 2
Results of robust two-way ANOVA.[a]

	Test statistic *Q*	*p*	Explanatory measure of effect size
Anchor	27.71	<.001	0.47
Normative message	3.30	.073	0.16
Anchor × Normative message	5.39	.023	0.30

[a] Test statistics *Q* and *p*-values from *t2way* (Wilcox, 2017, p. 337) with 20% trimmed means and 20% winsorized variances. Explanatory measures of effect sizes from *ESmainMCP* and *esImcp* (Wilcox, 2017, p. 370). Since the robust ANOVA uses adjusted critical values, the *t2way* routine does not report degrees of freedom (Mair & Wilcox, 2019; Wilcox, 2017). (A traditional two-way ANOVA analyses gives similar results and is reported in the Supplementary material, Part A.)

The interaction was further analyzed by means of the simple effects of the normative message at each anchor level. For the high anchor condition, the effect of the normative message was significant according to Yuen's test for trimmed means (mean difference 1.58, 95% *C.I.* [0.23, 2.94], $t_{0.2} = 2.33$, $df = 58$, $p = .023$), with a medium effect size (robust

Table 3
Results of robust multiple regression.[a]

	b	*t*	*p*	*95% C.I.*
Intercept	5.09	16.00	<.001 ***	[4.46, 5.71]
Main effects				
Anchor	−2.36	−5.38	<.001 ***	[−3.22, −1.49]
Normative message	−1.04	−2.34	.021 *	[−1.91, −0.16]
Environmental concern	0.65	3.42	<.001 ***	[0.27, 1.02]
Two-way interactions				
Anchor × Normative message	1.26	2.04	.042 *	[0.04, 2.48]
Anchor × Environmental concern	−0.48	−1.88	.061	[−0.98, 0.02]
Normative message × Environmental concern	−0.61	−2.28	.024 *	[−1.14, −0.08]
Three-way interaction				
Anchor × Normative message × Environmental concern	0.83	2.21	.028 *	[0.09, 1.57]

[a] Estimated unstandardized coefficients *b*, *t*-values, and *p*-values from *lmrob*. 95% confidence intervals from *confint*. The robust regression converged in 11 iterations ($R^2 = .238$, $R^2_{adj} = .210$). The algorithm classified one observation as an outlier (weight < .0005), 150 weights were approximately 1, with the remaining 49 weights distributed between .086 and .995. Anchoring was coded with 0 for high anchor and 1 for low anchor. Normative messages were coded with 0 for the condition with the message with additional information and 1 for the condition without it. For environmental concern, the centered mean of all twelve items of the Environmental Motives Scale was used. (A traditional multiple regression gives similar results, reported in the Supplementary material, Part A. Three separate analyses for the three EMS scales also give similar results, see Supplementary material, Part B.)

Cohen's $\widehat{\delta} = 0.50$) and a medium explanatory measure of effect size ($\widehat{\xi} = 0.31$). For the low anchor condition, the normative message had no effect ($t_{0.2} = 0.55$, $df = 58.53$, $p = .59$). The anchoring effect was significant both without the normative message (mean difference 1.12, 95% *C.I.* [0.05, 2.20], $t_{0.2} = 2.11$, $df = 42.34$, $p = .041$, $\widehat{\delta} = 0.45$, $\widehat{\xi} = 0.34$) and with the normative message (mean difference 2.90, 95% *C.I.* [1.80, 4.01], $t_{0.2} = 5.29$, $df = 45.02$, $p < .001$, $\widehat{\delta} = 1.14$, $\widehat{\xi} = 0.65$).

3.2. Effects of intrinsic motivation (environmental concern) on tradeoffs

As can be seen in Table 3, intrinsic motivation (environmental concern) interacted with the effects of extrinsic information on CO_2 versus travel time tradeoffs. A robust multiple regression of anchor, normative message, and environmental concern on travel time answers, including interaction terms, shows a significant three-way interaction between environmental concern, anchor, and normative message ($b = 0.83$, $t = 2.21$, $p = .028$), see Table 3. Due to the presence of this three-way interaction, the two-way interaction term between anchor and normative message ($b = 1.26$, $t = 2.04$, $p = .042$) is a conditional effect at the mean of the environmental concern scale, but the size of this interaction term will be different at other values of the environmental concern scale. Similarly, the regression coefficient for environmental concern ($b = 0.65$, $t = 3.42$, $p < .001$) corresponds to a simple effect of environmental concern on travel time answers for the condition with high anchor and the information of the normative message and is not a main effect of environmental concern irrespective of the anchor and normative message conditions.

To further probe the three-way interaction, we follow a 'pick-a-point' approach (Hayes and Matthes, 2009; Jaccard & Turrisi, 2003). When the quantitative variable environmental concern is viewed as moderating the two-way interaction between the two qualitative variables anchor and normative message, the positive three-way term means that the interaction between anchor and normative message is, on average, larger among people with higher environmental concern. To demonstrate this, the two-way interaction between anchor and normative message was computed at low, medium, and high levels of the environmental concern (EC) scale, viz. at the mean of EC and at one *SD* below and above the mean. The two-way interaction term is −0.11 ($p = .90$) and 2.63 ($p = .003$, *C.I.* = [0.8, 4.38]) at low (5.30) and high (8.62) values of EC, respectively. Results for mean EC (6.96) are shown in Table 3. Fig. 2 is an illustration of how the interaction between anchor and normative message depends on participants' environmental concerns, based on a three-way split of the participants. (Note that in the data analysis, environmental concern was a continuous variable, not a factor.)

Another suggestion of Jaccard and Turrisi (2003) is to probe the conditional or simple effect of environmental concern on travel time answers. In the multiple regression model, there was a significant increase of participants' travel time answers with increasing environmental concern only for participants in the condition of a high anchor together with the normative message ($b = 0.65$ in Table 3). For the other three combinations of anchor and normative message, the simple effects of environmental concern were not significant.

4. Discussion

The experiment reported here revealed two main findings: first, extrinsic information in the form of anchors and motivational information interact in their effect on the way people treat CO_2 versus travel time tradeoffs, such that participants are willing to travel longer for the benefit of less CO_2 emissions when they are externally motivated by a normative message, but only when this motivational emphasis is combined with a high anchor; and second, people with high environmental concern are more susceptible to the effects from extrinsic information than their low concern counterparts.

The results suggest that tradeoffs between self and environmental gain are sensitive and can be easily influenced by external cues such as reference/anchoring information and motivational messages. Furthermore, these external factors interact synergistically in the way they influence people's willingness to make large time tradeoffs to reduce CO_2 emission. Similarly, Wu and Cheng (2011) found an interaction between anchoring and attribute framing which they explained as a form of congruence, whereby a positive product attribute together with a high anchor induces higher willingness to pay responses than other combinations. The frames of Wu and Cheng conveyed equivalent information, framed in positive or negative terms, which is different from the current study, wherein the normative message contained different information, but there are similarities in the observed effects. A positive attribute description or a normative message both seem to increase the influence of a high anchor. We note that providing the normative message with information on CO_2 emissions to participants may be seen as a form of 'issue framing' or 'emphasis framing' (Druckman, 2004; see Steiger & Kühberger, 2018, for a review of the framing effect), whereby the issue of personal responsibility for reducing greenhouse gases is emphasized.

The preference judgments asked of the participants in the current study relates to a widespread discussion in Sweden. Many participants have likely heard that the reduction of air travel is an important step in combatting climate change. Some may even have taken a personal decision to decrease their flying to reduce their carbon footprint. However, it is unlikely that they have thought about the particular tradeoff given in the scenario of the experiment reported. Thus their preferences are probably formed on-line, when answering the questions, but based upon personal values (including environmental attitudes) and societal norms. Participants in the normative message condition had more information

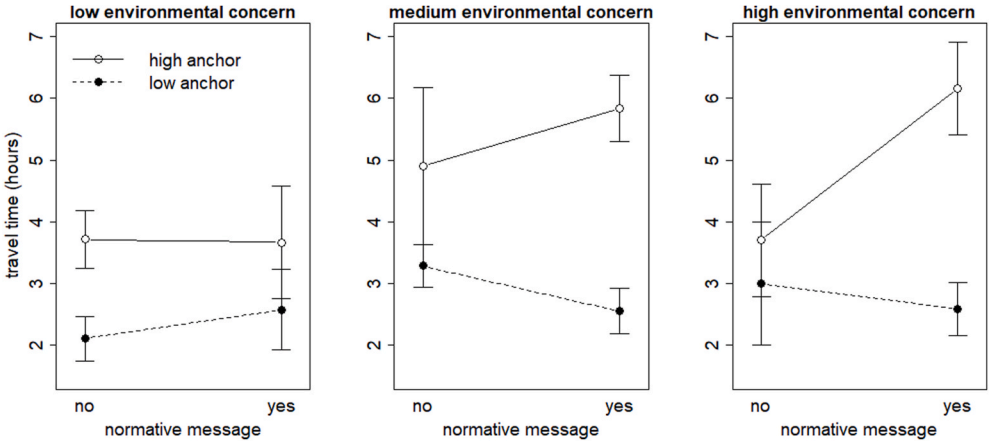

Fig. 2. Illustration of how the interaction between anchor and normative message varies with participants' environmental concern (trimmed mean values with standard errors). Participants were split in three groups based on their environmental concern (EC) values, in such a way that the groups had approximately equal numbers of participants, with the restriction that participants with the same EC were placed in the same group. (Low EC: min 2.0, max 6.5, median 5.3, $n = 72$. Medium EC: min 6.6, max 7.9, median 7.3, $n = 65$. High EC: min 8.0, max 9.0, median 8.8, $n = 63$.)

to contemplate and their thinking about the problem domain possibly generated a larger pool of anchor-consistent target features, which according to Anchoring as Activation (Chapman & Johnson, 1999) and the Selective Accessibility Model (Mussweiler & Strack, 1999) would result in a larger effect of the anchor. Thus, the results of the present study are in line with the idea that the effect of an anchor interacts with available information of relevance for the given setting (Chapman & Johnson, 1999).

The results reported here also show that intrinsic motivational factors (in the form of individual differences in environmental concern) influence the degree to which people are willing to give up more of their time in order to reduce CO_2 emissions. However, the effects of environmental concern on tradeoffs were only realized when the participants received a normative, motivational message and an external cue that further pushed their estimates upwards. It is quite a common finding that individual differences, in cognitive or other personality attributes, influence behavior and responses only in conditions that give the participants an experimental push in some direction (e.g., Bolderdijk et al., 2013; Sörqvist, Stenfelt, & Rönnberg, 2012). Therefore, it is not surprising that the effects of environmental concern on travel time estimates became manifest when the participants were pushed by a motivational message. It was more surprising to find that the interaction between environmental concern and a motivational message needed yet another push from further external cues (i.e., the high anchors) to manifest. On the other hand, interactions between environmental attitudes and situational prompts to promote pro-environmental behavior are not always easily observed (Moussaoui, Desrichard, & Milfont, 2020). The longer travel time answers among participants with higher environmental concern are in line with previous research showing that a biospheric value orientation contributes to the explanation of personal norms concerning moral obligations to reduce household energy consumption (Steg, Dreijerink, & Abrahamse, 2005) and that willingness to pay (higher taxes, higher prices on products and services) increases with positive attitudes toward nature and the environment (Joireman, Truelove, & Duell, 2010).

Many individuals feel a personal responsibility for CO_2 emission from flying, and people with a higher feeling of personal responsibility tend to be willing to pay higher carbon taxes (Brouwer et al., 2008; Sonnenschein & Smedby, 2019). Because of this, the normative message of the present study might have increased the pressure from a social norm, i.e., as a form of manipulation of the participants' feeling of personal responsibility. Thus, we suggest that one way of interpreting the results is that the normative message serves to increase a feeling of urgency and personal responsibility, making the participants more susceptible to a high anchor. In the present study, however, the action people were asked to take is non-monetary (longer travel times) and the result of this would be a direct decrease of their carbon footprints from 99 to 22 kg CO_2. There are interesting differences between this and past studies (Brouwer et al., 2008; Sonnenschein & Smedby, 2019), which we think are worth further investigation. Obviously, the decrease in CO_2 emission mentioned in our tradeoff tasks is a more direct result than a carbon tax, which does not necessarily decrease the emitted amount of CO_2. Direct pro-environmental behaviors have been measured as tradeoffs between travel time and CO_2 emission in a laboratory setting (Lange, Steinke, & Dewitte, 2018), using real time delays and CO_2 emissions.

A limitation of the study is that the anchors were introduced in the comparison question without a clear origin. We did not tell the participants that the anchor value had been randomly generated, nor that it had been given as a recommendation by an authoritative source. Both these situations are known to give rise to sizable anchoring effects (see, e.g., Furnham & Boo, 2011). In this study we did not investigate how the participants interpreted the anchor values, and we cannot exclude the possibility that some participants may have taken them as conveying relevant information.

We emphasize that the three-way interaction reported here needs to be interpreted with some caution. Post-hoc power was calculated as 0.66 for the three-way interaction term of the multiple regression analysis (Table 3), and previous studies have shown that significant interaction effects are more difficult to reproduce than main or simple effects (Open Science Collaboration, 2015). Further studies are needed to corroborate the results reported here.

In the current study, all twelve items of the Environmental Motives Scale (Schulz, 2000) were aggregated to a single measure of environmental concern (as, e.g., in Andersson et al., 2021; Hansla et al., 2008a). It could be argued that large pro-self versus pro-environment tradeoffs concerning climate change should be more strongly related to concern for others (altruistic), or concern for nature (biospheric), rather than concern for self (egoistic). Bolderdijk et al. (2013) found that biospheric values interacted with a normative message to strengthen intentions for pro-environmental behavior, while altruistic, egoistic, or hedonic values did not. However, separate analyses for the three EMS indexes give results that are very similar to those we have reported in Table 3 with the global environmental concern measure. As the name Environmental Motives Scale suggests, all the three indexes of the EMS relate to the environment. Even people who are "concerned about environmental problems because of the consequences for me" (an egoistic item) could be expected to be willing to trade off some comfort to protect the environment. In future studies it would be worth exploring other measures of environmental attitudes and values, together with measures of values and personality traits that are not explicitly connected to the environment.

The generalizability of the results to people in countries other than Sweden may be limited because the extent to which climate change, or global warming, is seen as a major problem varies between persons and between nations. We have assumed that almost every adult person in Sweden is aware of society's aspiration to reduce CO_2 emission. According to a Special Eurobarometer on Climate Change (European Union, 2017), 81% of Sweden's population considered climate change to be a 'very serious' problem (74% in the EU). Survey data was collected in March 2017, and there had been a 10 percentage-point increase since a similar survey in 2015. Interestingly, there are some pronounced differences between the EU member states' populations regarding who is seen as responsible for taking action. In Sweden, 59% saw action against climate change as a personal responsibility, much higher than the 22% average over the EU.

According to recent investigations (Kamb & Larsson, 2018; Larsson, Kamb, Nässén, & Åkerman, 2018), the air travel of the Swedish population gives rise to approximately 1.1 ton CO_2-equivalents GHG emissions, per Swedish inhabitant and year. Although emissions from air travel have not increased in recent years, the pressure upon society to reduce GHG emissions has led to an intense debate on air travel, both domestic and abroad, and both for tourism and business travel. For example, *flygskam* (flight shame) was included in the list of new words in the Swedish language for 2018 (Institutet för språk och folkminnen, 2018). Because of this, the effect sizes reported in the present study are expected to be larger than among populations with less concern for the environment generally and less concern with flights specifically. In future studies, it would be interesting to expand the domain to other populations and other GHG-reducing actions.

CRediT authorship contribution statement

Fredrik Bökman: Conceptualization, Methodology, Formal analysis, Data curation, Writing - original draft, Writing - review & editing, Visualization, Supervision.

Hanna Andersson: Conceptualization, Methodology, Investigation, Data curation, Writing - review & editing.

Patrik Sörqvist: Conceptualization, Writing - review & editing, Supervision.

Ulla Ahonen-Jonnarth: Conceptualization, Methodology, Writing - review & editing, Supervision.

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Declaration of competing interest

None.

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Appendix A. Supplementary data

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