Tradeoffs between self and environment in environmental judgment and decision making

Hanna Andersson
To my family
Abstract

One of the greatest challenges of today is to change our behavior to act more pro-environmentally to reduce global warming. We need to make sacrifices for the environment, e.g., use a means of transportation that take a longer time but causes less CO₂ emission. The present thesis aims to study different factors (intrinsic, extrinsic motivational, and extrinsic motivational-neutral information) that influence us when making tradeoffs between self and environment. Paper I examined how an anchor (a reference price) and an eco-label influence price judgments. It was found that both a judgment of an objective fact (product price) and a subjective preference (willingness to pay for the product) were affected by an anchor. An eco-label resulted in higher judgments of objective facts. People with higher environmental concern were more affected by an anchor when stating their willingness to pay than their low concern counterparts. In Paper II and Paper III, an interaction between a high anchor and a normative message that put the emissions into context was found when making a tradeoff between CO₂ emissions and travel time for a flight (Paper II) or a car journey (Paper III). People with higher concern for the environment gave a longer travel time when they received a high anchor (Paper II and Paper III) or no anchor (Paper III). Paper IV investigated how a survey measuring environmental concern can be divided to different indices and how they predict answers in a tradeoff task. The result suggests that a two-factor structure divided into ecocentric and anthropocentric concern is a possible alternative and that people scoring higher on any of the environmental concern indices were willing to travel for a longer time. Taken together, the results show that normative messages, anchors, and concern for the environment are factors that can influence and interact when people make tradeoffs between self and environment in environmental judgment and decision making.

Keywords: tradeoff, environmental concern, anchoring effect, normative message, travel time
Sammanfattning


Nyckelord: avvägning, miljöoro, förankringseffekt, normativt budskap, restid
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My uncle David Hansson for showing me what a life in academia could entail.

Last, but not least, the love of my life Viktor Barsk for always being such a great listener.
List of Papers

This thesis is based on the following papers, which are referred to in the text by Roman numerals.

**Paper I**

**Paper II**

**Paper III**

**Paper IV**

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Introduction

Making tradeoffs between what might be preferable for ourselves and what is good for the environment is one of the key challenges if human activities are to become more sustainable. According to Gifford (2011), there are several psychological barriers that hinder us to take action to mitigate climate change, one of which includes conflicting values, goals, and aspirations. Everyone has multiple objectives that [s]he wants to achieve (e.g., flying abroad and reduce our impact on the environment). Our goals and values are not always compatible with each other (Lindenberg & Steg, 2007). People usually have conflicts between goals, and they need to make tradeoffs among the possible consequences of different alternatives in the decision making process. What are they willing to give up concerning one aspect on one hand to achieve something on the other hand? This thesis explores some factors that affect us when we make tradeoffs between what is good for the self and what is good for the environment.

Tradeoffs in environmental decisions

If human behavior is to become more sustainable, we need to be willing to abstain from doing or buying things that we might want to or buy for the sake of the environment. In several situations there might be an alternative option from our default option that has less impact on the environment, e.g., buying a vegetarian or insect burger instead of a meat burger (Kusch & Fiebelkorn, 2019), or taking the train instead of flying. In both cases, the goal of either traveling from one place to the other or avoid hunger will be fulfilled. However, the trip will probably take a longer time and the meal might not be the preferred one. But to reduce one’s carbon footprint is an important objective to achieve for some people.

An objective is, according to Keeney (1992), “a statement of something that one desires to achieve” (p. 34). When choosing among means of transportation, maximizing punctuality could be one objective, minimizing carbon dioxide (CO₂) might be another. Let us consider two means of transportation, train and bus, between two cities. The bus has a high punctuality and emits 32.6 kg CO₂ and the train has a moderate punctuality and emits 0.01 kg CO₂. Now the decision maker needs to decide if that increase in punctuality compensates for the increased carbon footprint. In a tradeoff task (sometimes called a matching task) the decision maker is presented with two alternatives (e.g., train and bus), one of which has values on all criteria (e.g., punctuality and CO₂ emissions) while the other alternative has one missing value for one of the criteria (Deparis et al., 2015). The decision maker is asked to provide the missing value for the criterion so that he/she is indifferent towards the two alternatives according to his/her preferences (Tversky et al., 1988).
Matching gives from a limited number of questions considerable information on tradeoffs (Carmon & Simonson, 1998) and is, therefore, a suitable tool for preference elicitation (Deparis et al., 2015).

Sometimes people need to sacrifice time to act in a more pro-environmental way, and sometimes they need to sacrifice money (Berger & Wyss, 2021). In a study by Berger and Wyss (2021), participants made several choices between lower carbon emissions and a money reward. When the prospective bonus payment was higher, fewer people chose the pro-environmental option, but when the environmental consequences were higher the pro-environmental behavior increased. Further, pro-environmental behavior was found to correlate with gender, belief in climate change, and environmental attitudes. Another study has investigated pro-environmental behavior in the context wherein participants made a tradeoff between time and CO₂ (Lange et al., 2018). In this lab-based experiment, participants’ choices had real-life consequences. Participants could either choose a faster option that would allow them to leave the laboratory earlier or they could choose a slower option – hence need to stay for a longer time in the laboratory. But if participants chose the faster option a series of extra lights would light up, which had a negative impact on the environment due to energy usage. It was found that self-reported pro-environmental behavior as well as environmental attitudes, identity, values, and concern correlated with participants’ choices. The proportion of pro-environmental decisions increased when the CO₂ emissions increased, but the amount of pro-environmental decisions decreased when the waiting time required in the laboratory increased.

When choosing between a pro-environmental option or a less pro-environmental option, a person may have to abstain an egoistic benefit for the benefit of others (Stern et al., 1993). This can be seen as a social dilemma, whereby the choice is between acting with what is best for others in mind or what is best for the self (Nordlund & Garvill, 2003). If people always choose to act in one’s self-interest, the negative consequences for the environment will accumulate over time. At the same time, if people instead choose with others’ best interests in mind that will, usually, lead to short-term sacrifices for the individual.

**Normative messages – extrinsic motivational information**

We know from studies in psychology that how information is presented influences what people choose. In the Asian disease problem by Tversky and Kahneman (1981), two groups of participants receive the same choice: which of two programs that should be implemented to save 600 persons that are expected to die from an unusual Asian disease. In the first group, program A is presented to save 200 persons. In program B there is a 1/3 chance that all 600 will be saved but there is also a 2/3 chance that no one will be saved. In the second group, program C is presented to cause the death of 400 persons and in program D that there is a 1/3 chance that no one will die and a 2/3 chance that 600 persons will die. Both groups are in fact receiving the same problem (e.g., program A is the same as program C) but depending on how
the consequences are framed people choose differently. When the outcome of the action is being framed as saving 200 of the population (program A), people seem to think that option is good. However, if the outcome is framed as causing the death of 400 of the population (program C), more people tend to choose program D. This is one example of framing, but there are many other ways in which people can be influenced by how information is presented (Steiger & Kühberger, 2018), e.g., issue framing or emphasis framing (Druckman, 2004). The information highlights different aspects of the issue (e.g., in positive or negative terms), but does not hold logically equivalent information, as in the Asian disease problem. In this thesis, normative messages, which can be seen as a form of emphasis framing or issue framing, are used as extrinsic motivational information to study how normative messages influence people's tradeoffs between self and environment.

Cialdini et al. (1990) make a distinction between injunctive norms and descriptive norms. Injunctive norms inform about other people’s approval or disapproval. Descriptive norms inform about what others do. A common strategy used in campaigns to promote healthier or pro-environmental behavior is to inform people about others’ attitudes and behaviors (Miller & Prentice, 2016). But it is important to create the right type of normative messages (Cialdini, 2003). A descriptive-norm sign informing visitors in a National Park that many previous visitors have retained petrified wood from the park, together with a picture of several people stealing wood, increased the number of thefts (Cialdini et al., 2006). An injunctive-norm sign showing one visitor stealing a piece of wood with a red circle-and-bar over the visitor’s hand and with a statement plea to not remove petrified wood from the park, reduced the number of thefts in comparison to the descriptive norm. In a similar way, informing the public that many people are doing this thing for e.g., the environment, the message is at the same time saying that many people are doing this bad thing for the environment. However, descriptive norms can also be used to inform people about a prevalent behavior that is beneficial for the environment, e.g., a normative message that tells people that recycling is common (Cialdini, 2003). Previous research studying the interaction between injunctive and descriptive norm constructs has found that aligned social norms increase conformity (Schultz et al., 2007; Smith et al., 2012). Descriptive normative information can influence behaviors by either making use of what others do or avoiding what others do not do (Elliott, 1999; Bergqvist & Nilsson, 2019). According to Bergqvist and Nilsson (2019), seeing someone select something healthy over something unhealthy can indicate that choosing healthier options is more appropriate (a do-norm) while seeing someone reject something unhealthy in favor of something healthy may signal that choosing unhealthy is inappropriate (a don’t-norm). Using a don’t-norm has been shown to have a stronger influence on adjusting people’s behavior than a do-norm (Bergqvist & Nilsson, 2019).

In a study by Camilleri et al. (2019) people reduced the purchase of food that caused higher energy consumption when the greenhouse gases being emitted were visualized in light-bulb minutes. Bolderdijk et al. (2013) found that a movie containing both a normative message and factual information
interacted with pro-environmental values in influencing pro-environmental behavior. Watching the movie led to increased knowledge about global warming but the intention to act in a pro-environmental way was only observed for people that held strong biospheric values. Willingness to reduce emissions has been shown to increase when framed to affect the future national income (Hurlstone et al., 2014). In their study, Australians were prepared to reduce CO₂ emissions more when the national income was framed as a “forgone-gain” compared to a “loss” relative to the baseline expected future levels. Most people don’t know how much CO₂ their behavior causes to be emitted into the atmosphere (Luo & Zhao, 2021). One way to bridge this gap is to inform people about the impact of their actions on the environment by making information more accessible.

**Concern for the environment – intrinsic motivational factors**

Environmental attitudes have been defined as “a psychological tendency to evaluate the natural and built environments, and factors affecting their quality, with some degree of favor or disfavor” (McIntyre & Milfont, 2016, p.94). The terms environmental concern and environmental attitudes are sometimes used interchangeably (McIntyre & Milfont, 2016). But environmental concern has also been defined as one aspect of environmental attitudes (Bamberg, 2003). Pro-environmental behavior and environmental concern are complex and influenced by many factors (Gifford & Nilsson, 2014) such as education (Collado et al., 2020), personality (Markowitz et al., 2012), and biospheric, altruistic, and egoistic values (Milfont & Gouveia, 2006). To have a higher concern for the environment has also been shown to have an impact on stated willingness to give up something for the environment. In a Dutch study of teenagers, it was found that having a higher concern for the environment was associated with a willingness to make sacrifices with respect to money or time for the environment (Kuhlemeier et al., 1999). It has also been found that people with higher environmental concern are willing to pay more for eco-labelled products (Sörvqvist et al., 2013), and renewable energy (Lin & Syrgabayeva, 2016). Values and awareness of the problem can also influence willingness to lessen car usage (Nordlund & Garvill, 2003). In this thesis, environmental concern is interpreted as an intrinsic motivational factor that influences people when they make a judgment or decision of relevance for the environment.

How to measure concern for the environment has been a topic in psychology for a long time (Schultz, 2000). Some researchers have suggested that a distinction regarding concerns for the environment should be made between concern for non-self and self (Stern et al., 1995). Another distinction between different environmental concerns is the one between the anthropocentric concern (e.g., for humans including self) and ecocentric concern (e.g., for nature) (Thompson & Barton, 1994; Grendstad & Wollebaek, 1998). One of the scales to measure environmental concern was developed in Schultz (2001) where twelve items of environmental concern are divided into three
sub-indices. The first index is biospheric (concern for nature), the second index is altruistic (concern for other humans), and the third index is egoistic (concern for the self). The participants answer twelve questions on a seven-point scale indicating how concerned they are about environmental problems because of the consequences for each of the twelve items. Schultz’ Environmental concern (EC) has been widely used in research in environmental psychology to reflect an overall attitude towards the environment and has recently been recommended as a good option to measure environmental concern after an extensive review of several scales (Cruz & Manata, 2020).

**Anchors – extrinsic motivational-neutral information**

The anchoring effect has been shown to affect people’s judgment and decision making. This occurs when an initial value affects the final judgment (Furnham & Boo, 2011). In the classical experiment of Tversky and Kahneman (1974), the participants were first asked a comparative judgment question if they thought that the percentage of African countries in the United Nations was higher or lower than a value presented at a spinning wheel of fortune. Some of the participants received a high value (65% of the countries) and the others received a lower value (10% of the countries). After that, the participants got a question where they are asked to give their absolute judgment. The group that received a higher anchor (65%) tended to estimate a higher number on the absolute judgment question i.e., that there are more African countries as members in the United Nations, in comparison to the group that received the low anchor in the comparative judgment question. The anchoring effect has been found in many different domains, for example real estate evaluation (Northcraft & Neale, 1987), age estimation (Langeborg & Eriksson, 2016), general knowledge (Jacowitz & Kahneman, 1995) and willingness to pay (Green et al., 1998; Yoon et al., 2019). For a review on the anchoring effect, see Furhamn and Boo (2011) and for a Many Labs Replication Project see Klein et al. (2014). Anchoring is in this thesis used to study extrinsic motivation-neutral information on tradeoffs.

The finding that anchors influence our judgments seems to be robust. But why this effect occurs and what the underlying mechanisms are, have been debated in the literature for a long time. The anchoring and adjustment heuristic was one early explanation of the anchoring effect suggested by Tversky and Kahneman (1974). According to this paradigm, participants fall prey to the anchor because they make an insufficient adjustment from the starting value (anchor). Strack and Mussweiler (1997) have suggested the anchoring effect can be characterized as a special case of priming whereby the anchor given in the comparative judgment task activates information consistent with the anchor. This information is used when answering the absolute judgment question since the person will search for ways in which the target of the judgment is similar to the anchor and might test the hypothesis that the anchor value is the correct answer (Chapman & Johnson, 1999). Information that is consistent between the anchor and the target of the judgment will (ac-
cording to this explanation) be activated and, at the same time, reduce the activation of features that are not consistent, leading to the anchoring effect.

**Purpose**

The purpose of this thesis was to investigate how external factors such as normative messages (motivational information) and anchors (motivation-free information) influence people when making tradeoffs between self and environment. Further, the purpose was to study if these tradeoffs differ among participants depending on their concern towards the environment (internal motivational factor). Another point of interest was to see if anchors and an eco-label have a similar effect when people make a judgment of objective fact or stating their subjective preference. Finally, the purpose was also to investigate if one or several factors could be argued to represent environmental concern.
Summary of papers

Research aims

Paper I
The purpose of the first study was to study the anchoring effect in judgment of objective fact and subjective preference in the presence or absence of an eco-label. We also wanted to know if an anchor in the two different tasks would interact with an eco-label.

Paper II
In the second study, we investigated the psychology of CO₂ emission versus travel time tradeoff using a Swedish sample. The aim was to explore how these tradeoffs are influenced by extrinsic motivational information (a CO₂ normative message), extrinsic motivation-free information (anchors) and intrinsic motivational factors (environmental concern) in the context of air travel.

Paper III
The third paper aimed to study several different factors when people make tradeoffs, with a sample from another population (UK) and with a different vehicle (car) than in Paper II. The aim was to explore how these tradeoffs are influenced by the presence or absence of extrinsic motivational information (a normative message concerning CO₂, a normative message concerning health, or no normative message), extrinsic motivation-free information (high anchor, low anchor, or no anchor) and intrinsic motivational factor (environmental concern).

Paper IV
The fourth paper aimed to investigate if the environmental concern indices known as biospheric, altruistic, and egoistic are measuring the same underlying factor, environmental concern, or are measuring separable factors. The second aim of the fourth paper was to study if one or several of the environmental concerns predicts a tradeoff between self and environment.

Methods
The methods used in the papers in this thesis are experimental methods (Paper I, Paper III, and Paper III) and exploratory factor analysis (Paper IV). Questionnaires were used to obtain data in all papers.
Design and procedure

Paper I

Experiment 1
A within-subjects design with the anchor (high/low) and the eco-label (with/without) as independent variables and price (fact) as the dependent variable was used. In total, 137 participants were included in the analysis (56.9% women, mean age = 27.95 years, SD = 9.1) Participants answered an online questionnaire (randomly assigned to one of twenty-four questionnaires) on a laptop or tablet provided by the experimenter. After reading and signing the informed consent, they started to answer the questions. The participants answered four questions (olive oil, butter, coffee, and rice) e.g., “Do you think that the price for 500 g <eco-labeled> coffee is higher or lower than 19.95 [56.95] SEK?” If the participant answered lower, they received this absolute judgment question: “You answered that you don’t think that 500 g of <eco-labeled> coffee costs more than 19.95 [56.95] SEK. How much do you think that 500 g of <eco-labeled> coffee costs? Participants received a high anchor on two of the questions (see the square brackets) and a low anchor on the other two questions. Half of the questions concerned an eco-labeled product (see the angle brackets) and the other half a conventional product. Environmental concern was collected as an observational variable. The participants responded to “How concerned are you that today’s environmental problems will affect…?” on 12 consequences on a nine-point scale ranging from 1 (not concerned) to 9 (very concerned). The mean for the twelve items (All living creatures, Me, People in the community, Animals, My children, All people, My future, Marine life, My health, My lifestyle, Plants, and Future generations) were calculated and analyzed as one, global, index of environmental concern. The questionnaire took between 5 and 10 min to complete.

Experiment 2
The same design, and procedure as in Experiment 1 was used, and 155 participants were included in the analysis (54.3% women, mean age = 24.9 years, SD = 5.8). But instead of asking the participants for an objective estimate of a market price, they were asked to state their subjective preference e.g., “Would you be willing to pay more or less than 19.95 [56.95] SEK for 500 g <eco-labeled> coffee?” If the participant answered higher, they received this question: “You answered that you would be willing to pay more than 19.95 [56.95] SEK for 500 g <eco-labeled> coffee. How much at the most would you be willing to pay for 500 g of <eco-labeled> coffee?”

Paper II
A between-subjects 2 × 2 factorial design was used, with two levels of anchor (low or high anchor) and two levels of normative message (with or without CO2 normative message). The dependent variable was travel time. In total, 201 participants (55.7% women) were included in the analysis (mean age =
26.3 years, $SD = 6.9$). Participants answered an online questionnaire, randomly assigned to one of the four experimental conditions, on a tablet or laptop provided by the experimenter. The comparative judgment task asked for the willingness to make a longer-lasting trip 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 participants 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 information in curly brackets (normative message); the other half did not get this information (no normative message). In the following absolute judgment question, the participants received this information: “You answered yes [no] to the question above. How long would you at most be prepared to travel? (Answer in hours).” Environmental concern was collected as an observational variable and the mean score of all questions were used as described for Paper I.

**Paper III**

A between-subjects $3 \times 3$ factorial design was used, with three levels of anchor (no anchor, low anchor, and high anchor) and three levels of normative message (no normative message, CO$_2$ normative message, and health normative message). A sample of 1076 participants living in England was recruited through the online crowd-sourcing platform Prolific Academic (61.5% women, mean age = 36.5 years, $SD = 11.7$). Participants were randomly assigned to one of nine groups. The comparative judgment task asked for the willingness to make a longer-lasting trip to reduce the CO$_2$ emission: “Assume that you have rented a petrol car to journey from Brighton to Manchester. The drive is estimated to take 5 hours and emit 61 kg of carbon dioxide (CO$_2$). {CO$_2$ normative message /health normative message /no normative message} “If you got the opportunity to reduce the emissions to 20 kg CO$_2$ by renting an equivalent electric car at the same cost, would you be willing to let the journey take a longer time than 5 hours and 30 minutes [8 hours and 30 minutes] instead of 5 hours?” The CO$_2$ normative message was: “{According to the Committee on Climate Change, a reduction to 4 500 kg of CO$_2$ emission per average UK household and year is required by 2030 to keep on track to achieve the UK-wide goal of reduction in CO$_2$ emissions. This amounts to an average maximum of 36 kg of CO$_2$ per person and week.}” The health normative message was: “{According to the National Health Service, a reduction of 2.1g of salt a day is required to achieve the recommended daily consumption for adults to eat no more than 6g of salt a day, based on a recommendation from 2018. This amounts to a maximum of 42g per person and week.}” If the participant selected “Yes”, they received this follow up question: “(First, a repetition of the question you just answered). Assume that you have rented a petrol car to journey from Brighton to Manchester. The
drive is estimated to take 5 hours and emit 61 kg of carbon dioxide (CO₂).
If you got the opportunity to reduce the emissions to 20 kg CO₂ by renting an
equivalent electric car at the same cost, would you be willing to let the jour-
ney take longer time than 5 hours and 30 minutes [8 hours and 30 minutes] instead of 5 hours? (You answered "Yes" on the question above) “How much
time would you be willing to let the journey take, at most, to reduce the emis-
sions from 61 kg of CO₂ to 20 kg CO₂? Answer in hours and minutes.” Envi-
ronmental concern was collected as an observational variable and used as
described in Paper I and II.

**Paper IV**

The data used in Paper IV are from the previous data collection undertaken in
Paper III. The dataset consists of an English sample of 1171 participants (68% females) between 18 and 65 years (mean age = 36.3 years, SD = 11.6).
For the linear regression, a subset of 121 participants from the same dataset (70% females) living in England between 18 and 65 years (mean age = 35.8 years, SD = 11.4) was selected because they received the tradeoff question presented in Paper III without either anchor or normative message.

An overview of the independent and dependent variables used in the papers
in this thesis is presented in Table 1. The mean values of environmental con-
cern were used in Paper I-III as one global index.

<table>
<thead>
<tr>
<th>Dependent variables</th>
<th>Paper I</th>
<th>Paper II</th>
<th>Paper III</th>
<th>Paper IV</th>
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<td>Price (fact)</td>
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<td>Price (willingness to pay)</td>
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<td>Travel time</td>
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<td>Independent variables</td>
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<td>Anchor</td>
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<td>Eco-label</td>
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<td>CO₂ emissions</td>
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<td>Observational variable</td>
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<td>Environmental concern</td>
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<td>Design</td>
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<td>Between-participants</td>
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<td>Re-analysing data</td>
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Results

Paper I

Two $2 \times 2$ repeated measures ANOVA were performed, and the results showed clear effects of the anchor in both judgment of objective fact (Experiment 1) and judgment of subjective preference (Experiment 2), see Figure 1 and Figure 2. The eco-label also had an effect on judgment of objective fact but not on judgment of subjective preference. The eco-label interacted with the anchor when participants made a judgment of objective fact. When both a high anchor and an eco-label were present participants judged the price of the product to be higher in comparison to when participants only received the high anchor. There was no interaction between the participants’ environmental concern and the eco-label in either one of the two experiments. However, there was an interaction between participants’ environmental concern and the anchor when participants answered questions regarding their subjective preferences, see Figure 3.

Figure 1. Judgments of objective fact (price estimations) from Experiment 1 ($n = 137$). Mean values with standard errors.
Figure 2. Judgments of subjective preference (willingness to pay) from Experiment 2 (n = 155). Mean values with standard errors.
Figure 3. Judgments of subjective preference (willingness to pay) from Experiment 2 \((n = 155)\) with high and low anchor divided in three environmental concern groups. Mean values with standard errors.

**Paper II**

A robust ANOVA analysis revealed that extrinsic motivational-free information in the form of anchors and extrinsic motivational information in the form of a normative message interact when people make tradeoffs between travel time and CO\(_2\) emissions in the context of a flight journey. Participants were willing to travel for a longer time for the benefit of less CO\(_2\) emission when they received a normative message, but only when this message was combined with a high anchor, see Figure 4.
People with high environmental concern were more susceptible to the effect from normative message than their low concern counterparts, see Figure 5. A significant three-way interaction between anchor, normative message, and environmental concern was shown in a robust multiple regression of willingness to travel for a longer time, see Table 2. This indicates that the interaction between anchor and normative message might be larger among people with more concern for the environment.

Figure 4. Travel time answers of participants exposed to high or low anchors, with or without the additional information on recommended maximum weekly CO₂ emissions. 20% trimmed means and winsorized standard errors.
Figure 5. 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.

Table 2. Results of robust multiple regression.

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<td></td>
<td></td>
</tr>
<tr>
<td>Anchor</td>
<td>-2.36</td>
<td>&lt;.001 ***</td>
</tr>
<tr>
<td>Normative message</td>
<td>-1.04</td>
<td>.021 *</td>
</tr>
<tr>
<td>Environmental concern</td>
<td>0.65</td>
<td>&lt;.001 ***</td>
</tr>
<tr>
<td><strong>Two-way interactions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anchor × Normative message</td>
<td>1.26</td>
<td>.042 *</td>
</tr>
<tr>
<td>Anchor × Environmental concern</td>
<td>0.48</td>
<td>.061</td>
</tr>
<tr>
<td>Normative message × Environmental concern</td>
<td>-0.61</td>
<td>.024 *</td>
</tr>
<tr>
<td><strong>Three-way interaction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anchor × Normative message × Environmental concern</td>
<td>0.83</td>
<td>.028 *</td>
</tr>
</tbody>
</table>

**Paper III**

The results of a 3 × 3 × 3 ANOVA revealed that people who received both a normative message and a high anchor were willing to travel for a longer time, in the context of a car journey, than those that only received a high anchor, see Figure 6. People that received the CO2 normative message or the health normative message were willing to travel for a longer time than those that did not receive any information. People with higher concern for the environment were also willing to travel for a longer time than those that are less concerned for the environment. People that received a high anchor or no anchor were willing to travel for a longer time than those who received a low anchor, irrespectively of normative message. The results from Paper III also show
that people with high environmental concern are more susceptible to the effects from a high anchor than their low concern counterparts, see Figure 7.

![Figure 6](image1)  
**Figure 6.** Judgments of travel time for anchor (no, low, or high anchor) and information (no normative information, health normative information, or CO₂ normative information). Mean values with standard errors.

![Figure 7](image2)  
**Figure 7.** An illustration of the interaction between environmental concern (EC), divided into three groups (low EC, medium EC, and high EC) and the three levels of anchor (low, high, or no anchor). Mean values with standard errors.
**Paper IV**

The data analysis was divided into two parts. The first part was an exploratory factor analysis and the second part consisted of linear regressions with the constructed indices based on the environmental concern questionnaire to examine how good the indices predict willingness to travel for a longer time.

**Part 1 – Factor analysis**

For the number of factors, a multi-procedure method (Lüdecke et al., 2020), as well as a scree plot of eigenvalues, gave support for a two-factor structure rather than a three-factor or a one-factor structure. The results from an exploratory two-factor analysis using maximum likelihood as the extraction method and Oblimin with Kaiser normalization as the rotation method showed that two of the items, *All people* and *Future generations*, have absolute loadings over .3 on both factors and they were therefore excluded, and a new exploratory factor analysis was performed. The second analysis showed a much clearer factor structure, and the first factor contained the items *My future, My health, Me, My lifestyle, People in the community, and My children*. The second factor contained *Marine life, All living creatures, Animals, and Plants*. See Table 3 for the pattern matrix.

**Table 3. Pattern matrix for two factor analysis of 10 items with 1171 participants (extraction method: Maximum likelihood, rotation method: Oblimin with Kaiser normalization).**

<table>
<thead>
<tr>
<th>item</th>
<th>Factor 1: Anthropocentric</th>
<th>Factor 2: Ecocentric</th>
</tr>
</thead>
<tbody>
<tr>
<td>My future</td>
<td>.888</td>
<td>.056</td>
</tr>
<tr>
<td>My health</td>
<td>.882</td>
<td>-.008</td>
</tr>
<tr>
<td>Me</td>
<td>.840</td>
<td>-.063</td>
</tr>
<tr>
<td>My lifestyle</td>
<td>.782</td>
<td>.102</td>
</tr>
<tr>
<td>People in the community</td>
<td>.651</td>
<td>-.197</td>
</tr>
<tr>
<td>My children</td>
<td>.492</td>
<td>-.043</td>
</tr>
<tr>
<td>Marine life</td>
<td>-.082</td>
<td>-.919</td>
</tr>
<tr>
<td>All living creatures</td>
<td>.007</td>
<td>-.901</td>
</tr>
<tr>
<td>Animals</td>
<td>.016</td>
<td>-.892</td>
</tr>
<tr>
<td>Plants</td>
<td>.162</td>
<td>-.737</td>
</tr>
</tbody>
</table>

**Part 2 – Linear regression**

The results from several linear regression analyses are shown in Table 4. Each row shows the result of a separate simple regression \((n = 121)\), with the travel time answer of a tradeoff task as dependent variable and a constructed environmental concern index as independent variable. All lines of Table 4 pertain to the same data, but the models are not nested. The first index, EC, is the grand mean of all twelve items and the second index, EC10, is the grand mean of the items *My future, My health, Me, My lifestyle, People in the community, My children, Marine life, All living creatures, Animals, and Plants*. Index 1 is the grand mean of the items *Me, My lifestyle, My health, My future,*
All people, People in the community and My children and index 2 consists of the items All living creatures, Plants, Animals, Marine life and Future generations. For items in the anthropocentric and ecocentric indices, see Table 3. Biospheric environmental concern index consists of Marine life, All living creatures, Animals, and Plants. Altruistic concern index: All people, People in the community, My children, and Future generations. Egoistic environmental concern index: My future, My health, Me, and My lifestyle.

Table 4. Results from linear regressions analysis of travel time and different environmental concern indices.

<table>
<thead>
<tr>
<th></th>
<th>$R^2$</th>
<th>$R^2_{adj}$</th>
<th>b</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC</td>
<td>0.1166</td>
<td>0.1091</td>
<td>0.338</td>
<td>3.96</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>EC10</td>
<td>0.1165</td>
<td>0.1091</td>
<td>0.336</td>
<td>3.96</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Index 1</td>
<td>0.0856</td>
<td>0.0779</td>
<td>0.254</td>
<td>3.34</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Index 2</td>
<td>0.1109</td>
<td>0.1034</td>
<td>0.311</td>
<td>3.85</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Anthropocentric</td>
<td>0.0862</td>
<td>0.0786</td>
<td>0.247</td>
<td>3.35</td>
<td>0.001</td>
</tr>
<tr>
<td>Ecocentric = Biospheric</td>
<td>0.0944</td>
<td>0.0867</td>
<td>0.275</td>
<td>3.52</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Altruistic</td>
<td>0.1024</td>
<td>0.0948</td>
<td>0.265</td>
<td>3.68</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Egoistic</td>
<td>0.0622</td>
<td>0.0543</td>
<td>0.203</td>
<td>2.81</td>
<td>0.006</td>
</tr>
<tr>
<td>Biospheric+Altruistic</td>
<td>0.1273</td>
<td>0.1199</td>
<td>0.349</td>
<td>4.17</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>
Discussion

Main findings
People with high environmental concern are more affected by anchors in subjective preference (Paper I, Experiment 2) as well as willing to travel for a longer time when they receive a high anchor (Paper II and Paper III) or no anchor (Paper III). When a low anchor was present, the differences in environmental concern did not have any effect (Paper I, Paper II, and Paper III). A two-factor structure divided into ecocentric and anthropocentric environmental concerns is a possible alternative to the traditional three-factor structure (Paper IV). People scoring higher on environmental concern indices are willing to travel for a longer time (Paper II, Paper III, and Paper IV). When making a tradeoff between CO₂ emission and travel time the results show that there is an interaction between a CO₂ normative message and a high anchor in both flight and car travel tasks (Paper II and Paper III).

Judgments about fact and subjective preference
The eco-label and the anchor were found to interact when participants made a judgment of objective fact so that a higher judgment was made when both the high anchor and the eco-label were present (Paper I, Experiment 1). The reason for this may be that there is a change in the accessible knowledge about the target when both the eco-label and the anchor value are compared with the target for the judgment (i.e., price). The high anchor and the eco-label together might make the information about higher prices more accessible since both a high anchor and an eco-label are consistent with higher prices.

Participants in Experiment 2 stated their willingness to pay (subjective preference) for the same products with the same anchors and eco-label as participants in Experiment 1, but there was no significant effect on willingness to pay of the eco-label in Experiment 2. Perhaps differences in the two types of judgment concerning the eco-label are due to that the participants might make a tradeoff when asked about their subjective preference but are unlikely to do so when asked to estimate an objective fact. However, the anchor has a similar effect in both judgments.

In research about judgment and decision making, a distinction between preferences and inferences can be made (Weber & Johnson, 2009). Preferences involve value judgments and are subjective, while inferences have been explained to be more about beliefs and usually have an objectively verifiable answer. Weber and Johnson (2009) suggest that even though this distinction usually is made, inferences and preferences might draw on the same cognitive processes. The result that an anchor has a similar effect on both judgment
of objective fact and subjective preference might support this suggestion. Perhaps previous findings in the anchoring paradigm concerning questions about facts might be of relevance for interpretations of similar studies about preferences. How information is provided, the decisionmaker’s beliefs, as well as decision environment are important to understand when studying judgment and decision making.

**Anchoring and normative messages**

Extrinsic information in the form of normative information and anchors interact in their effect when people state their preferences by making CO₂ versus travel time tradeoffs. Participants are willing to travel for a longer time for the benefit of less CO₂ emissions when they are externally motivated by a CO₂ normative message, but only when this motivational emphasis is combined with a high anchor. This result was found both when Swedish participants received a flight-travel task (Paper II) and when English participants received a car-travel task (Paper III). The tasks can be seen as a matching task, wherein the participants are presented with two levels of CO₂ emissions (e.g., 99 kg CO₂ and 22 kg CO₂ in Paper II) and one level of travel time (1 hour in Paper II). The task is to give the second level of travel time to make the preferences match. Matching gives information of tradeoffs (Carmon & Simonson, 1998) and is useful for preference elicitation (Deparis et al., 2015). It seems that tradeoffs between what is good for the self and what is good for the environment are sensitive and can be influenced by external cues such as anchoring information and normative messages. Furthermore, these external factors interact synergistically in the way they influence people’s willingness to make large time tradeoffs to reduce CO₂ emission. In previous research, Wu and Cheng (2011) found an interaction between attribute framing and anchoring. They suggest that a combination of a positive attribute description together with a high anchor induces higher willingness to pay as a form of congruence, in comparison to other combinations (e.g., negative terms, with low or high anchors present). The normative messages used in Paper II and Paper III send a don’t message when the participants are informed that they e.g., should not exceed a maximum of a certain amount of CO₂ emissions or salt intake. In previous research, don’t-norms have been shown to influence on people’s behavior change more in comparison to a do-norm (Bergqvist & Nilsson, 2019). The normative messages also focus on a potentially relevant consideration (rather than withholding equivalent information) and can be argued to be a type of issue frame. A difference between equivalence framing and issue framing is, according to Druckman (2004), that issue framing does not challenge preference invariance because something is described negatively or positively. Instead, people’s preferences or opinions might change when a different perspective on the problem is defined or emphasized (Druckman, 2001).

Further, it has been found that participants that elaborated on something of relevance to the judgment are more affected by the anchor (Chapman & Johnson, 1999). Participants that received a normative message had more
information at hand when they were thinking about the tradeoff. Perhaps participants generated more 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. Since both English participants in a car-travel task and Swedish participants in a flight-travel task were found to be willing to travel for a longer time when they received a high anchor and CO₂ normative message this suggests that these types of external cues interact when people make a tradeoff between travel time and CO₂ emissions. In Paper III, the participants that received a health normative message and those that received a CO₂ normative message were both willing to travel for a longer time than those that did not receive any normative message. This finding could be due to the fact that many environmental issues are related to aspects of health. Choosing eco-labeled groceries over conventional alternatives could be undertaken with the intention to reduce climate change or to avoid eating food that is sprayed with pesticides. Chevance et al. (2021) suggest that there are bi-directional associations between health-related behaviors and climate change. Reading a normative message about health seems to have made people more willing to make travel judgments in a pro-environmental way. In the presence of a low anchor neither one of the normative messages used in Paper II or Paper III had an influence on participants judgment. In both experiments, the low anchor drags the travel time down. Perhaps the low anchor made the participants think that it is acceptable to just make a small sacrifice. People are sometimes unwilling to change their lifestyle if they have a comfortable one (Gifford, 2011). Instead, they will justify and defend the societal status quo (Feygina et al., 2010). The low anchor could possibly justify not sacrificing so much of one’s comfort for the environment.

From an applied perspective, it was interesting to find in Paper III that, compared to the condition with no anchor, the low anchor appears to have the effect of pushing judgments lower rather than the high anchor pushing the judgments up. This indicates that people are willing to travel for a longer time to reduce the CO₂ emissions even if no anchor is present. This is positive since reducing car usage or living car-free is one of the largest causes of actions we can do to reduce our personal impact on global warming (Wynes & Nicholas, 2017).

**Environmental concern and tradeoffs**

In Paper I, participants with more concern for the environment answered with a higher price when they received a high anchor in comparison to the low environmental concern group when the participants made judgments about their subjective preferences. No difference was, however, found in how people were affected by the anchor depending on their environmental concern among those that answered the question of objective fact. One benefit of using a within-participants design is that it gives higher power than a between-participants design. However, in both experiment 1 and 2, it is possible that a larger sample size might have been beneficial to study interactions.
Especially, the three-way interaction analysis would have benefited from a larger sample size. The results should, therefore, be interpreted with some caution.

It was found in both Paper II and Paper III that participants with higher environmental concern tended to be more influenced by a high anchor than their lower concern counterparts. If a low anchor was present, there was no difference between participants stated willingness to travel for a longer time depending on their environmental concern.

The results from a linear regression, in Paper IV, showed that people with higher concern for the environment are willing to travel for a longer time independently of which of several indices constructed from Schultz’ (2001) twelve items that is used to measure peoples environmental concern. All linear regressions were found to be significant. However, some of the indices had a higher $R^2$ value, which indicates that those indices slightly better predict tradeoffs between CO$_2$ emissions and travel time. In Paper I, Paper II, and Paper III a global EC index was used as a measure of environmental concern and the results from Paper IV seem to support this approach, although it is important to point out that there might be benefits of using more specialized indices, e.g., anthropocentric, ecocentric/biospheric or the sum of biospheric+altruistic in some situations to test specific hypotheses. It is also important to note that there are many other personal traits and situational factors that may influence people’s tradeoffs. The longer travel time answers among participants with higher environmental concern are in line with previous research. In a study by Steg et al (2005), it was found that a biospheric value orientation was related to the sense of moral obligation to reduce energy consumption in households. It has also been shown that a positive attitude towards nature and the environment increased willingness to pay e.g., a higher tax or price on products and services (Joireman et al., 2010).

Further, the results from Paper II showed that the effects of environmental concern on tradeoffs were observed when the participants received both the extrinsic motivational and extrinsic motivational-free information, so when presented together, participants were willing to travel for a longer time.

In previous research it has been shown that individual differences, such as personal values or cognitive abilities, influence responses and behavior more strongly if the participants receive an experimental push (e.g., Bolderdijk et al., 2013; Sörqvist et al., 2012). For this reason, it is not unexpected to find that the effects of environmental concern on willingness to travel for a longer time became manifest when the participants were pushed by the extrinsic motivational information (normative message). On the other hand, it was more unexpected to find that the interaction between environmental concern and a normative message needed another push from further external cues (i.e., a high anchor) to manifest. It is, however, important to note that an interaction between situational prompts and environmental attitudes to promote pro-environmental behavior is not always observed (Moussaoui et al., 2020).

The three-way interaction between anchor, normative message, and environmental concern found in Paper II suggests that the interaction between
normative message and anchor was stronger for those with higher concern for the environment. These results should be interpreted with some caution since previous research has shown that three-way interactions are less likely to be replicated (Open Science Collaboration, 2015). Future research should consider using a larger sample size to increase power.

In conclusion, people stating their willingness to pay and willingness to travel for a longer time (both in the context of a flight and a car journey) seem to be more affected by the high anchor if they also score high on the environmental concern questionnaire. People with higher concern for the environment state that they are willing to travel for a longer time to reduce CO₂ emissions (even when no anchor or normative message is present).

Environmental concern constructs
In the first three papers (Paper I, Paper II, and Paper III) a global index of environmental concern was used. In the fourth paper the first aim was to investigate if the structure of environmental concern consists of several factors or can be argued to be one factor for environmental concern. A somewhat different factor structure was found in comparison with Schultz (2001). The first factor analysis with twelve items showed that the first factor consisted of the four items from the egoistic index (My future, My health, Me, and My lifestyle) and three of the items from the altruistic index (People in the community, All people, and My children). The second factor consisted of the four items from the biospheric index (Marine life, All living creatures, Animals, and Plants) and the remaining item from the altruistic index (Future generations). But since two of the items (Future generations and All people) also had a high loading on the other factor, these two items were excluded. A new factor analysis with ten items was performed and was shown to have a clearer factor structure. In previous research, Cruz and Manata (2020) showed, using a confirmatory analysis, that their model was improved by removing three items from the original questionnaire by Schultz’s (2001). Snellgar (2006) showed that when three items were added to the questionnaire (concern for whales, trees, and my prosperity) a four-factor model fitted data better than the three-factor model originally proposed by Schultz (2001). In Paper IV, the first new factor (anthropocentric) constructed based on the factor analysis using ten items consists of two altruistic items and four egoistic items. These items have to do with humans (self or others), while the other new factor (ecocentric) consists of the four items from the biospheric index and has to do with nature. This idea of separating attitudes towards the environment into either concern for humans or for the nature has, among others, been suggested by Thompson and Barton (1994).

Future directions
While the tradeoffs between self and environment in this thesis have been studied in experimental settings, future research should consider using actual real-life decision situations. This could be done in a car-rental setting (as in
Paper III) as well as, e.g., when buying groceries or choosing between meals in an online meal delivery service or restaurant.

The results from Paper II and Paper III show that both a CO₂ normative message and a health normative message had an impact on people’s tradeoffs. Other types of normative messages and how these affect people’s willingness to give up something for the environment could be a subject of future research.

Conclusion

This thesis has shown that extrinsic motivational factors and extrinsic motivation-free factors such as normative messages and anchors as well as intrinsic motivational factors for instance concern for the environment are factors that influence people when they make tradeoffs between self and environment. When some of the factors are combined, they can increase people’s willingness to sacrifice something for the self to do good for the environment. The high anchor and the normative message may have made people more aware of the environmental problems and might therefore have made them willing to make a larger sacrifice. Judgment of objective fact and subjective preference are both affected by an anchor. People that are more concerned for the environment seem to be willing to sacrifice more when they received an experimental push. A push by some extrinsic factor might be one way to help humans to make judgments or decisions in a more pro-environmental way.
References


Papers
Associated papers have been removed in the electronic version of this thesis.
For more details about the papers see:
http://urn.kb.se/resolve?urn=urn:nbn:se:hig:diva-36620