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Preferences for the Far Future

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Both research and anecdotal evidence suggest that people care about long-run environmental outcomes, but often fail to act sustainably, endangering environmental stability. For a large population sample, we show that people substantially value the environment intrinsically, i.e., even after their own and their kin's lifespan. Willingness-to-pay for very long-run environmental benefits not experienced by the respondent is similar to that of short-run benefits, experienced by the respondent. However, adding a cooperation problem through uncertainty about other people's preferences significantly decreases participants' willingness-to-pay for both time frames, with respondents being pessimistic about others' willingness to contribute.

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1. Introduction

Human activity over the past centuries has led to substantial changes in our natural environment: the climate is changing faster than expected; we see a severe loss of biodiversity; there is increasing pollution of oceans (IPCC 2014). At the same time, there is evidence that people care about, and are willing to pay for, long-run environmental stability: politicians spend time and money on negotiating international agreements on protecting the climate; consumers accept higher costs when buying ecologically produced food; travellers and organizations compensate their emissions from flying. Indeed, absent a clear preference for the very long-run stability of the environment, it is not clear that these activities are beneficial for today's consumers, compared to maximizing their own and their direct descendants' financial resources instead, to cope best with the expected changes (Purdy 2019). Despite this apparent willingness to protect the environment, long-term environmental stability is endangered, because of unsustainable decisions that lead to further deforestation, pollution, and emissions. Given the looming failure to preserve long-term stability, we ask whether poor environmental outcomes are caused (i) by a failure of decision-makers who in principle value the environment in the long-run to successfully cooperate on their jointly preferred outcome, or (ii) by a lack of sufficiently large and wide-spread willingness-to-pay (WTP) for environmental stability in the far future, where current consumers will not directly benefit from it. That is, does the anecdotal evidence on behaviour like emissions compensations or organic food consumption reflect a widespread and substantial preference for the long-run? To answer this question, our study takes two approaches: first, we elicit whether people value environmental stability only if they will enjoy the benefits of better environmental conditions themselves (in the next decades), or value it intrinsically and are willing to pay for its provision, even if benefits do not accrue until the far future, beyond their own and their family's lifespan (in the next centuries). Second, we want to find potential effects of an underlying cooperation problem in the provision of environmental goods, i.e. whether there is a difference in WTP for environmental goods in the presence of a cooperation problem, compared to a situation without the threat of cooperation failure.

Previous studies on environmental, non-market goods show that people have positive WTP for various goods, even if they do not directly benefit from them (e.g. through

usage of the respective good). In a meta-analysis, Loomis and White (1996) summarize the annual per household WTP for different endangered species, ranging from USD 6 for the striped shiner to USD 95 for the northern spotted owl and its habitats. Although some of the variation in WTP could be explained by whether the decision maker was a visitor of the respective area, the results show that people intrinsically value the existence of certain environmental goods, different species in this case, that do not generate any direct benefit to them. Estimates of the WTP for environmental goods such as a reduction of greenhouse gas emissions come to rather mixed results (see also Johnson and Nemet, 2010). While Brouwer et al. (2008) find a WTP of EUR 25 per ton of CO2, other studies find lower values, e.g., Löschel et al. (2013) reporting EUR 12. Diederich and Goeschl (2014) find even lower values, with an average WTP for one ton of CO2 of EUR 6.30, with the median participant willing to pay only EUR 0.30. One reason for the high discrepancy can be found in the different designs of the studies. For example, Diederich and Goeschl (2014) used the European Emissions Trading System to elicit participants' WTP for one certificate for one ton of CO2. If people do not believe that buying certificates reduces CO2 emissions in practice, they will indicate a very low WTP, irrespective of how much they value climate stability. On the other hand, people show very high WTP for other CO2-offsetting programs: two thirds of participants in a lab-in-the-field experiment conducted by Fornwagner and Hauser (2020) invested their entire endowment of EUR 69 in a CO2-offsetting program, spending the money on planting near-city trees. However, the relatively high WTP for CO2-offsetting in this study might stem from the design of the offsetting program, if people value for example the recreational value of more trees close to the city, rather than the mere CO2-offsetting function and its long-term effects per se.

Most environmental goods show aspects of public goods: there is no exclusion from a stable climate and there is no rivalry about it. This implies a cooperation problem in the provision of environmental goods and, hence, adds complication to the elicitation of WTP. People may condition their stated WTP on their belief about others' WTP: they might expect free-riding of others and, hence, give less, or free-ride themselves. Liebe et al. (2011) showed that people are pessimistic about other's WTP for environmental goods and that there is a high discrepancy between average stated WTP and average belief about WTP. If WTP is elicited in the presence of a cooperation problem, the resulting numbers might be smaller than in the absence of a cooperation problem, as

people base their decision on their (potentially pessimistic) beliefs (Bardsley and Moffatt 2007). In the present study, we measure WTP both, in the presence and in the absence of a cooperation problem, i.e., with and without uncertainty about the amount others are going to pay when committing to own WTP (Bardsley et al. 2021). The latter case can be interpreted in terms of policies that secure contributions by all citizens. We will not elicit people's WTP for a single environmental good (e.g. a species) or a certain policy (e.g. planting trees). The focus of this study is on people's valuation and maximum WTP for environmental stability in general, including, e.g. climate stability and air quality. Beliefs about the effectiveness or any side-effects of a specific policy will not affect this general valuation, which is therefore of direct interest for judging environmental policy based on consumers' preferences. Because people's WTP can be affected by the time-horizon of the environmental outcomes (Layton and Levine 2003), we measure WTP both for benefits of the investment in the environmental good that will accrue within the consumer's life-span, and those that accrue only in the far future, after the decision maker's own lifespan, and even after the lifespan of all her friends and family.

Experiments on the provision of intergenerational public goods examine such situations, where decisions made by members of a current group affect members of future groups. When the costs of uncooperative behaviour (e.g. lower investments in an intergenerational public good) are passed on to future groups and do not affect the current group of decision makers, some experiments found cooperation to increase (Spiller and Bolle 2016, Grolleau et al. 2016), while others found the opposite behavior (Jacquet et al. 2013, Sherstyuk 2016, Ponte et al. 2017). These studies did not control for preferences for the well-being of future groups though, which directly affect the relevant outcomes in the coordination problem. Cooperation may be improved by the introduction of policy mechanisms such as voting (Hauser et al. 2014) or punishment (Lohse and Waichmann 2020): compared to groups without the respective mechanism, groups using the mechanism could overcome the cooperation problem more often and were more successful in reaching the sustainable outcome. In line with the above argument for preferences for the future, studies found that a personal link to future decision makers increased cooperation, compared to situations where there was no such link. This has been shown for both, the presence of a hypothetical representative of future generations in negotiations (Kamijo et al. 2017), and the presence of a real

representative of the next generation in the form of the decision maker's own child (Fornwagner and Hauser 2020). We test for the effect of this link and investigate differences in WTP for the far future between parents and non-parents. Following the argumentation in Fornwagner and Hauser (2020), we expect parents to have a higher WTP for long-term environmental goods, as there is a genetic link to the future generations that will benefit from such goods.

The paper proceeds as follows. The next section will present our survey design and the experimental measurement of WTP for environmental stability. The following section presents the results, and the last section discusses the findings.

2. Survey Design

We used an online survey experiment to elicit preferences for the stability of the environment in the general population. The experiment was programmed in oTree (Chen et al. 2016), and we recruited participants via the online platform Prolific. The study was preregistered on aspredicted.org (#51473 and #52857).

The main survey consisted of three or four parts, depending on the respective treatment (see below for details). The first part of the survey elicited participants' views on climate change. The second part elicited stated-preference indications of how strongly participants care for the environment over different time-horizons. These two parts were identical for all four treatments. Treatments differed for the third part, where we elicited WTP for environmental stability. The treatments differed according to two dimensions: (i) absence / presence of a cooperation problem, and (ii) short-run / long-run time-horizon. The two treatments with a cooperation problem included a fourth part, where we asked participants for their beliefs about others' WTP. The main survey was followed by a short questionnaire where participants indicated the number of children and grandchildren they have (if any). Details about each part follow hereafter.

In the first part of the survey, participants answered three questions about climate change: (i) whether they think that the climate is changing, (ii) if they believe that climate change is happening, whether it is caused by human activity or rather by natural processes, and (iii) whether they believe that technologies will evolve in the future, that

allow humans to regulate the climate. Note that questions (i) and (ii) were taken from the European Social Survey.

The second part of the survey asked participants how strongly they care about the state of the environment over different time horizons (short-term, long-term, and very long-term), using a verbal stated-preference format. In particular, on three separate screens they were asked how much they agree with the following statements *"I care about the state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans) in the next ten years"* (short-run), *"I care about the state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans) in the next decades, even after my own lifespan"* (long-run), and *"I care about the state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans) a few centuries from now, <u>after</u> my own lifespan and the lifespan of all my friends, family, and their descendants."* (very long-run). The possible answers ranged from 1 (*"Strongly disagree"*) to 5 (*"Strongly agree"*), so a higher number indicates a higher concern for the environment in the respective time-scale.

The second part of the survey allows us to find differences in the concern of a stable environment that stem from different time-horizons and to investigate whether people care intrinsically, or only seek for stability if they (or at least their descendants or friends) benefit directly from it. As direct benefits to the respondent and their kin decrease with longer horizons, we expect the degree of concern for the environment to decrease with the time-horizon. A higher consideration of the environment during the own lifespan than after the own lifespan would be consistent with the results of Jacquet et el. (2013), who found lowest climate action if benefits were passed on to future generations. As making salient people's connection to future generations seems to have a positive effect on willingness to invest (Kaminjo et al. 2017, Fornwagner and Hauser 2020,), we expect the degree of concern to be higher in the long-run (with link to future generation) than in the very long-run (without link to beneficiaries). If a person cares strongly about environmental stability in the very long-run, we expect her also to care about the environment in the short-run and to state a high concern for all time-scales. However, someone who values the environment intrinsically but discounts the future in a way described above, would care strongly about environmental stability in the short-run, care substantially less for the environment after her own lifespan, and even less

after the lifespan of all her friends and family. This behaviour would lead to a high degree of agreement for the first statement (short-run), a lower agreement for the second (long-run), and the lowest agreement for the third statement (very long-tun). Hence, we formulate our first hypothesis:

> *Hypothesis I: People state a higher degree of concern of the environment for the short-run than for the long-run, and a higher degree of concern for the long-run than for the very long-run.*

The third part of the survey used a titration method to elicit participants' monetary valuations in terms of maximum WTP for securing a state of general environmental stability. WTP was measured as the maximum fraction of net income that participants would be willing to give up in order to save the environment, using a choice-based titration task. In a first step of the elicitation, participants were asked whether (under two assumptions described below) they would be willing to give up 10% of their net-income to keep the environment stable. If they answered "Yes", the fraction asked for increased in the next step of the elicitation and it decreased if participants indicated "No" (see Figure 1 for the steps of the titration). The titration included four steps and, hence, resulted into one out of 16 possible ranges. After the elicitation, participants were informed about the resulting range (e.g. *"between 3.5 and 5%"* of net-income) and could confirm the resulting range. If they did not confirm the result, they could reconsider their WTP by choosing from a choice-list the range that represents their WTP. The list included the 16 possible ranges that resulted from our titration method. In the subsequent data analysis, we use participants' final WTP, i.e., values indicated after confirmation or potential reconsideration.

In the WTP valuation task, participants were asked to make two key assumptions: one concerning the time-horizon and one about the behaviour of other people. For each of the two dimensions, there were two possible formulations of the assumption, according to the treatment participants were randomly exposed to. Concerning the time-horizon, participants should assume *"that the state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans)*" either could be *"kept stable only in the short-run, i.e., over the next few decades during your lifespan"* (decades condition), or could be *"kept stable in the long-run, i.e., over the next few centuries"* (centuries condition) if everyone gives up the share of their income asked for in the respective step of the titration.

Additionally, participants in the *decades* conditions were told that many of the benefits of giving up this share would accrue in the next few years, while participants with the *centuries* condition were told that many of the benefits of giving up this share would accrue at a later time, after their own lifespan. Thus, using the choice-based titration task, we assess which fractions of net income the participant is willing to give up, assuming that this will indeed allow for a stable environment (but see below for the role of the coordination problem).

The second assumption concerned uncertainty about others' willingness-to-pay. In the absence of a coordination problem, participants indicated their WTP assuming that *"everyone agreed on and committed to giving up this share"* (certainty assumption). That is, participants indicated a maximum willingness to pay with the understanding that this is conditional on everybody else also forgoing this share, thus basically dictating the societal decision. In the treatment with a coordination problem present, participants indicated their WTP assuming that *"When you make your commitment to give up this share, you do not know what share of their income others will give up"* (uncertainty assumption). That is, participants indicated a maximum willingness to pay with the understanding that other may give more, or less. Importantly, in both conditions, we asked participants to assume that the state of the environment could be kept stable (in the respective time-scale) if everybody gave up the fraction under consideration. However, only in the certainty condition was this latter requirement automatically fulfilled. Participants in the uncertainty condition faced a cooperation problem: the environment could be kept stable if everyone gave up the fraction under consideration, but one cannot be certain that everybody does. If not everybody contributes as stipulated, the benefits of contributing are uncertain.

Participants saw the task description with either the decades or the centuries assumption, and the certainty or the uncertainty assumption. Then they were asked, whether they would be willing to give up the displayed fraction (see Figure 1) under the stated assumptions.

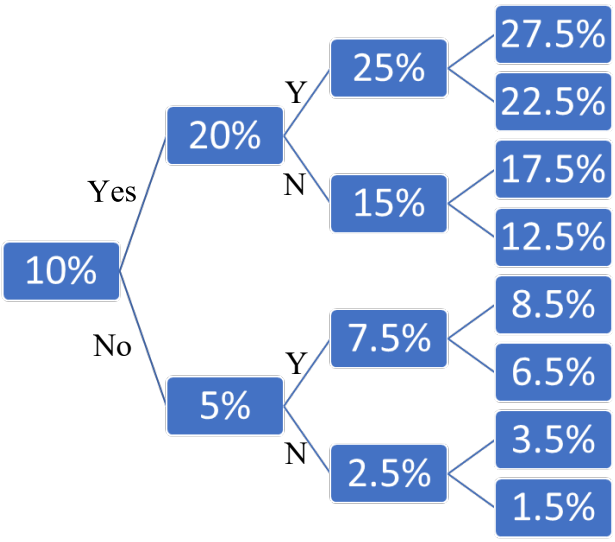


Figure 1: Titration method (not shown to participants)

The combination of the two dimensions (time-horizon and certainty) leads to four different treatments: *decades & certainty, decades & uncertainty, centuries & certainty,* and *centuries & uncertainty*. In a fourth part of the survey, participants of the two *uncertainty* treatments were asked about the fraction they believed others are willing to give up. They could directly indicate one range out of the 16 ranges resulting from the titration method, that describes best their belief about others' WTP. As argued above, with uncertainty about others' contributions, beliefs about those contributions become relevant for people's own willingness to contribute.

As it was explicitly mentioned that most of the benefits of the environmental stability that could be achieved would accrue after participants lifespan in the two *centuries* treatments, we expect them to be willing to give up less than participants in the *decades* treatments, who would directly benefit from their own investment. Following the results of Jacquet et al. (2013), we formulate our second hypothesis:

> *Hypothesis II: People in the two centuries conditions have a lower WTP than participants in the decades conditions.*

Hypothesis II is tested by comparing WTP for *centuries* and *decades* conditions. We also expect a difference between the *certainty* and the *uncertainty* conditions. While in the *certainty* conditions there is no cooperation problem between participants and no room for beliefs about other's WTP and strategic considerations, participants in the *uncertainty* conditions face a cooperation problem. According to previous studies on

cooperation, people often fail to cooperate. People may anticipate free-riding behaviour and have the possibility to free-ride themselves, which both imply a decreased WTP. Conditional cooperation with pessimistic beliefs also depresses WTP (Fischbacher and Gächter, 2010). This leads to our third hypothesis:

> *Hypothesis III: Participants in the uncertainty conditions state a lower WTP than participants in the certainty conditions.*

Anticipated free-riding of others could also lead to a higher WTP, as people might want to make up for lower contributions of others. However, as the survey is about global environmental stability, rather than about a small and restricted intervention, the contribution of a single individual is negligibly small and one higher investment cannot easily make up for lower investments of others. However, we can explicitly test the effect of anticipated free-riding using the data on beliefs that we collect in the fourth part of the survey (only in the two *uncertainty* conditions). Following the argument on conditional cooperation laid out above, and the finding that few people behave purely altruistically in cooperation contexts (Fischbacher et al. 2001), we formulate our fourth hypothesis:

> *Hypothesis IV: Participants' own WTP is lower than or equal to their belief about others' WTP.*

3. Results

We conducted the experiment in November 2020 and collected data for a total of 1201 participants, who earned GBP 1.35 for completing the survey. We had 291 participants in the *decades & certainty* treatment, 310 in *centuries & certainty,* 281 in *decades & uncertainty*, and 319 in *centuries & uncertainty* (differences are due to the computerized random assignment of participants to a treatment). Our youngest participant was 18 and the oldest 81 years old, and participants were on average 35 years old. The average (and median) participant had an annual income of between GBP 30,000 and GBP 39,999. 66.28% of our sample were female, and 42.71% had 1 or more children. 5.08% had one or more grandchildren.

Stated concern for the environment

The analysis of the data collected in the second part of the survey suggests that people care substantially for the environment for all three time-scales. The degree of concern was measured on a 5-point-scale, with 5 being the highest and 1 the lowest possible consideration of the environment in the respective time-scale. The mean stated concern was at 4.496, 4.415, and 4.163 for the short-, the long- and the very long-run, respectively. No participant indicated the lowest concern for the short-run statement. The median participant indicated a 5 for the short- and the long-run, and still a 4 for the very long-run, concerning the environmental situation in the far future, not only after the respondents own, but even after all her friends' and family's lifespan. This implies a significant intrinsic valuation of the environment, also if benefits of environmental stability will neither affect the respondent herself, nor her direct descendants. However, irrespective of the overall high concern for the environment at all time-scales, a comparison of the valuation in the short- and in the long-run shows that people are less concerned about the state of the environment in the latter case, where they are not affected themselves (Wilcoxon signed rank Test $p<0.001$). Compared to the long-run, stated concern further decreases in the very long-run, when there are few or no links to the generations who will be affected by the future state of the environment ($p<0.001$). Hence, although the degree of concern for the environment is high at all time-scales, it decreases for far-future consequences, in line with our Hypothesis I.

Willingness to pay for environmental stability

Participants' answers to the statements in the second part of the survey indicate that they care about environmental stability in the near future, long term and also the very long term, the far future. We next study how these preferences translate into willingness-to-pay valuations for the preservation of a stable environment. Table 1 shows average WTP as a share of disposable net income. WTP for environmental stability is substantial in all four conditions, in the range of 10% of income. We observe no statistically significant differences between WTP for the *decades* and the *centuries* condition in either of the *(un)certainty* conditions. Thus, we reject Hypothesis II. Consistent with the above-discussed high degree of concern for the very long-run, we observe substantial willingness to financially contribute to stability over centuries, beyond the own family's life span.

Table 1*:* WTP in the four treatments as fraction of net-income

	Decades	Centuries	
Certainty	10%	9.927%	p=0.745
Uncertainty	8.212%	8.382%	p=0.911
	p<0.001	p=0.003	

Notes: WTP was measured as a range. For the analysis shown in Table 1 and presented in this section we took a conservative approach and used the lower bound of each range (and 1 for the lowest possible WTP) to not overestimate people's WTP.

However, we find significantly smaller WTP in the presence of a cooperation problem, for both time horizons. Not only is the average WTP lower, but also the fraction of respondents indicating a WTP lower than 1.5% of their income (our lowest possible category) is substantially larger. In the conditions with no uncertainty about others' contributions, 11.7% (*decades*) and 15.2% (*centuries*) of participants had a WTP below 1.5% of their income. This fraction was at 20.3% (*decades*) and 24.5% (*centuries*) of participants in the conditions where others' contributions were uncertain.

The results are confirmed in a multivariate analysis. Table 2 shows the outcome of four regression models including different sets of covariates, and two dummy-variables for the *decades* and *uncertainty* conditions, respectively. *Decades* conditions are not significantly different from the *centuries* conditions, while the presence of uncertainty about others' contribution decreases respondents' WTP by roughly 1.5 percentage-points of income. This supports Hypothesis III, WTP is larger when there is no uncertainty about others' behaviour and, hence, no cooperation problem.

The multivariate analyses also indicate that WTP measures map positively on the stated consideration for the environment as indicated in Part I. They are also higher for those respondents who believe in climate change, and lower for those who think climate change is not human-made or that future technologies will emerge that will allow engineering the environment. Regarding demographics, we find that WTP decreases with age: older people are willing to give up less than younger people. Interestingly, respondents with children have lower WTP than non-parents. The effect is smaller if we include environmental attitudes (model 4), but a direct raw comparison of parents to non-parents shows significant differences as well (Mann-Whitney-U test p<0.001).

Table 2: Multivariate Analysis of WTP for Environmental Stability

	(1) WTP	(2) WTP	(3) WTP	(4) WTP
Decades condition	0.054 (0.12)	-0.296 (-0.70)	-0.361 (-0.86)	-0.296 (-0.72)
Uncertainty	-1.454*** (-3.31)	-1.731*** (-4.08)	-1.668*** (-3.96)	-1.551*** (-3.76)
Belief that climate changes			3.101*** (5.76)	1.915*** (3.54)
Belief that climate change is natural			-1.402*** (-3.83)	-1.165** (-3.25)
Belief that technology will solve problem			-1.041*** (-3.84)	-0.478 (-1.72)
Stated concern for short-run		1.778*** (3.32)		1.196* (2.28)
Stated concern for long-run		0.717 (1.39)		0.475 (0.94)
Stated concern for very long-run		1.247*** (3.43)		0.919** (2.58)
Children (Binary)	-1.841*** (-3.55)			-1.056* (-2.14)
Age	-0.067** (-3.26)			-0.07*** (-3.59)
Income	-0.06 (-0.75)			-0.062 (-0.82)
Female	-0.687 (-1.53)			-1.148** (-2.70)
Constant	13.71*** (15.25)	-6.215*** (-3.72)	4.625 (1.75)	-0.087 (-0.03)
N	1198	1201	1201	1198

Notes: t-statistics in parenthesis. ***p<0.01, **p<0.05, *p<0.1

This result is not in line with our expectations. Fornwagner and Hauser (2020) show substantial WTP for parents, and we expected parents to have a higher WTP for long-term environmental goods due to their genetic link to future beneficiaries. A potential explanation for this result may be that parents want to maximize their financial resources for their own family, to be inherited by their children. Benefits of investments

into environmental stability are distributed over many different people without the genetic link (see also Jacquet et al. 2013; Purdy 2019).

Beliefs and willingness to contribute

In the last part of our survey (after the elicitation of WTP), participants in the *uncertainty* conditions were asked how much they expect other people to be willing to give up. The belief data allow us to test whether there is a difference between people's belief about others' and their own WTP, and if so, whether people expect others to give more or less than themselves. We can also test if there is an association between their own WTP and their belief about others' WTP.

Participants in both *uncertainty* conditions on average (and at the median) believe that others are willing to give up 4.68% of their income. Compared with an average stated own WTP of 8.3% in the *uncertainty* conditions, beliefs are significantly smaller than stated WTP and we have to reject our Hypothesis IV ($p<0.001$ t-Test). There is no difference in beliefs for the *decades* and the *centuries* condition. In both treatments, more than one quarter of the participants believe that others have a WTP smaller than 1.5% of their income. Using the results concerning individual WTP and belief, we can calculate the gap between a participant's WTP and belief, defined as *WTP-Belief*. The results for this gap are shown in Figure 2. A negative gap implies a belief that is larger than the participant's own WTP, and vice versa for a positive gap. Only 14.5% of participants (pooled over both uncertainty treatments) state a WTP below their belief about others' WTP (i.e. free-ride). Further 27.3% indicate a WTP equal to their belief and the remaining 58.2% of participants are willing to give up more than what they believe others would be willing to give up.

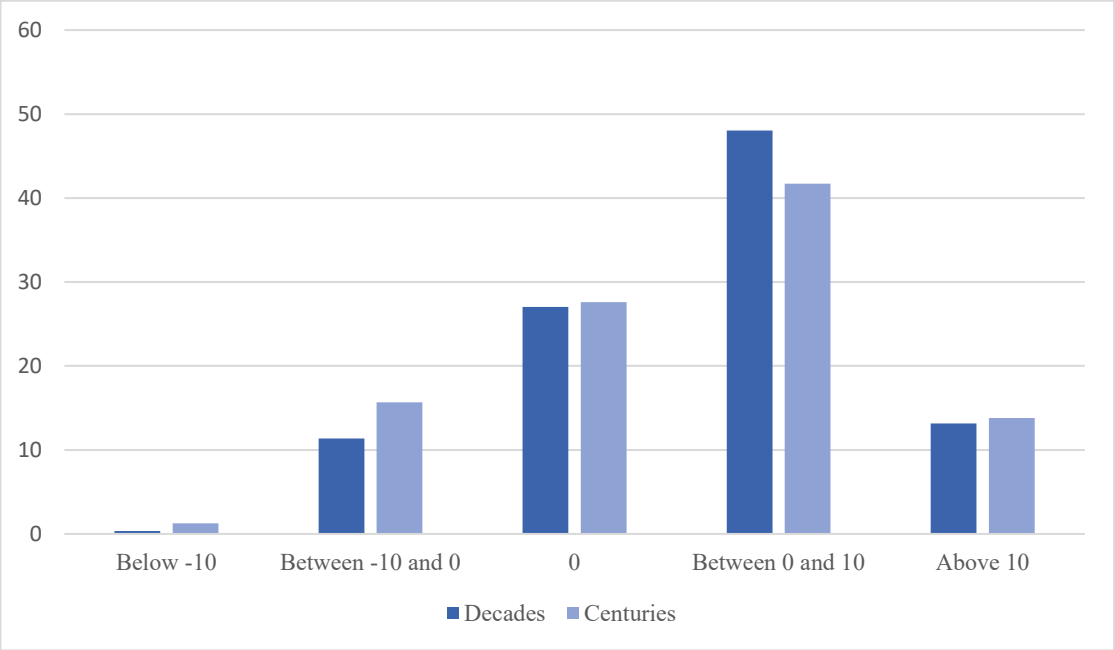
Table 3 replicates Table 2 for the *uncertainty* conditions, including individual-level belief data. We observe that the pattern of associations found in Table 2 remains robust after inclusion of beliefs. Moreover, a respondent's belief is strongly associated with her own WTP: a 1 percentage-point change in the WTP-belief is associated with an increase in WTP of roughly 0.85 percentage-points. We interpret this result such that the lower WTP in the *uncertainty* conditions can be explained partly by the rather pessimistic beliefs that participants have about others' WTP, assuming respondents base their own decision on their (pessimistic) beliefs.

Table 3: Multivariate Analysis of WTP for Environmental Stability Including Belief

	(1) WTP	(2) WTP	(3) WTP	(4) WTP
Belief about WTP	0.876*** (14.82)	0.837*** (14.82)	0.864*** (15.18)	0.814*** (14.53)
Decades condition	0.307 (0.57)	-0.051 (-0.10)	-0.029 (-0.06)	-0.144 (-0.29)
Belief that climate changes			2.642*** (4.12)	1.801** (2.81)
Belief that climate change is natural			-1.037* (-2.31)	-0.613 (-1.38)
Belief that technology will solve problem			-1.037** (-3.24)	-0.489 (-1.51)
Stated concern for short-run		1.691** (2.68)		1.257* (1.99)
Stated concern for long-run		0.519 (0.89)		0.217 (0.38)
Stated concern for very long-run		1.381*** (3.36)		1.225** (3.01)
Children (Binary)	-1.004 (-1.60)			-0.379 (-0.64)
Age	-0.053* (-2.28)			-0.061** (-2.81)
Income	0.039 (0.40)			0.082 (0.88)
Female	-0.340 (-0.63)			-0.732 (-1.44)
Constant	6.430*** (5.76)	-11.26*** (-5.54)	-0.663 (-0.21)	-8.824* (-2.33)
N	599	600	600	599

Notes: t-statistics in parenthesis. ***p<0.01, **p<0.05, *p<0.1

Figure 2: Gap between own WTP and Belief about Others



Notes: A positive gap indicates a WTP that is larger than the player's belief. Figure indicates fraction of players with respective gap.

4. Discussion

In this paper, we present an online survey experiment with a total of 1201 participants. We find that people care about the environment in the short-, the long-, and the very long-run, even after their own and their friends' and descendants' lifespan. Although the stated concern for the environment decreases with the respective time-scale, the overall high degree of valuation for all time-horizons shows that people value the environment to a large degree intrinsically, irrespective of any usage value. This result is confirmed by our WTP elicitation, where we found a willingness to give up a rather high fraction of disposable income to save the environment.

On first sight, the reported WTP (more than 8% of income in all treatments) in our hypothetical measurements looks very high, especially in comparison to other, incentivized studies (e.g. Diederich and Goeschl 2014). Clearly, the nature of our inquiry with a focus on the very long-run, and comparing situations with and without a cooperation problem (to obtain non-strategic estimates of these valuations), does not lend itself to incentivized methods. However, note that we asked participants whether they would be willing to give up a certain fraction of income under the assumption, that

the environment in general, including very different aspects, could be kept stable, not just a certain aspect of it. That is, the current value is an all-inclusive maximum willingness to contribute, quite different form the measurement of WTP to retire for example a ton of CO2. Moreover, the findings are also in line with findings of substantial willingness to contribute in recent incentivized experimental studies (Fornwagner and Hauser, 2020). That is, while our study uses hypothetical scenarios, we believe it is informative on people's valuation of the environment.

The main insight from our study concerns the relevance of the very long-run stability of the environment for the general population. Many environmental policies involve benefits that will not accrue to currently living generations. It is thus not clear whether they are "beneficial" from the perspective of current generations, who need to politically support these policies. If people did not care about the long-run, efforts to internationally coordinate climate agreements and those to protect oceans and species would potentially make little sense from the electorate's perspective. Our data show that people do inherently care about the very long-run consequences of the current generations' economic activity. Cooperation and coordination of efforts in the presence of pessimistic views of other people's behaviour is a key aspect towards achieving the desired environmental stability.

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Appendix

Instructions

General Questions

You may have heard the idea that the world's climate is changing due to increases in temperature over the past 100 years. What is your personal opinion on this? Do you think that world's climate is changing?

[Definitely changing]

[Probably changing]

[Probably not changing]

[Definitely not changing]

Do you think that climate change is caused by natural processes, human activity, or both?

[Entirely by natural processes]

[Mainly by natural processes]

[About equally by natural processes and human activity]

[Mainly by human activity]

[Entirely by human activity]

[I don't think climate change is happening]

How much do you agree with the following statement?

New technologies to influence the climate will likely evolve in the future. Thus, there is no need to change our current life style and reduce our emission of CO2.

[Strongly agree]

[Agree]

[Neither agree nor disagree]

[Disagree]

[Strongly disagree]

Statement 1

Please indicate your degree of agreement on the following statement.

I care about the state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans) in the next few years.

[Strongly agree]

[Agree]

[Neither agree nor disagree]

[Disagree]

[Strongly disagree]

Statement 2

Please indicate your degree of agreement on the following statement.

I care about the state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans) in the next decades and century, even after my own lifespan.

[Strongly agree]

[Agree]

[Neither agree nor disagree]

[Disagree]

[Strongly disagree]

Statement 3

Please indicate your degree of agreement on the following statement.

I care about the state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans) in a few centuries from now, after my own lifespan, and the lifespan of all my friends, family, and their descendants.

[Strongly agree]

[Agree]

[Neither agree nor disagree]

[Disagree]

[Strongly disagree]

How much would you give up?

Condition long-run & no uncertainty

Please take a minute to think about the following situation. Imagine that you give up a share of your disposable net-income to save the environment. Make the following two assumptions:

The state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans) could be kept stable in the long-run, i.e., over the next few centuries, if everyone gives up this share of their income.

Everyone agreed on and committed to giving up this share.

Note that many of the benefits of giving up this share would accrue at a later time, after your own lifespan.

Condition short-run & no uncertainty

Please take a minute to think about the following situation. Imagine that you give up a share of your disposable net-income to save the environment. Make the following two assumptions:

The state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans) could be kept stable only in the short-run, i.e., over the next few decades during your lifespan, if everyone gives up this share of their income.

Everyone agreed on and committed to giving up this share.

Note that many of the benefits of giving up this share would accrue in the next few years.

Condition long-run & uncertainty

Please take a minute to think about the following situation. Imagine that you give up a share of your disposable net-income to save the environment. Make the following two assumptions:

The state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans) could be kept stable in the long-run, i.e., over the next few centuries, if everyone gives up this share of their income.

When you make your commitment to give up this share, you do not know what share of their income others will give up.

Note that many of the benefits of giving up this share would accrue at a later time, after your own lifespan.

Condition long-run & uncertainty

Please take a minute to think about the following situation. Imagine that you give up a share of your disposable net-income to save the environment. Make the following two assumptions:

The state of the environment (e.g. climate, biodiversity, air pollution, or clean oceans) could be kept stable only in the short-run, i.e., over the next few decades during your lifespan, if everyone gives up this share of their income.

When you make your commitment to give up this share, you do not know what share of their income others will give up.

Note that many of the benefits of giving up this share would accrue in the next few years.

All conditions

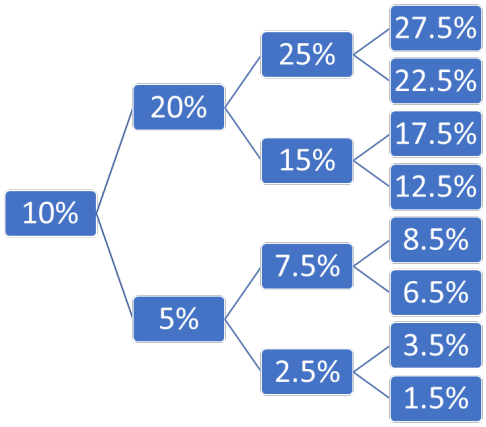
Under these assumptions, would you be willing to give up 10% of your net-income?

[Yes][No]

If yes: *You indicated that you would give up 10% of your income. Under the assumptions above, would you also give up 20% of your net-income?*

If no: *You indicated that you would not give up 10% of your income. Under the assumptions above, would you give up 5%?*

Participants went through the titration method below. Upper branches always indicate "Yes", lower "No". (Figure not shown to participants).



You indicated that you would be willing to give up between x and y% of your net-income, under the assumptions above. Hence, you would give up between x*10 and y*10 EURO of each 1000 EURO of net-income you earn.

If this represents your willingness to contribute for the short-term (long-term) stability of the environment, please indicate Confirm. If you feel it does not correctly represent your willingness to contribute, please click Reconsider to change your answers.

[Confirm][Reconsider]

If Reconsider:

You indicated that you would be willing to give up between x and y% of your net-income, under the assumptions above. Hence, you would give up between x*10 and y*10 EURO of each 1000 EURO of net-income you earn. However, you wanted to reconsider this contribution range.

Please indicate the range of net-income you would be willing to give up to save the environment, under the assumptions described on the previous pages.

[Participants could choose from a list with the ranges]

If confirm: next page displayed

Other people's willingness to give up (Only in the conditions with uncertainty)

How much do you think people are typically willing to give up for a stable environment in the long-run, i.e. over the next few centuries (short-run, i.e. over the next few decades), under the assumptions above? Please indicate the average share of net income that you think people are willing to give up.

[Participants could choose from a list with the ranges]

Family

On this page we would like to ask you about how many children and grandchildren you have (if any).

Number of children: [ ]

Number of grandchildren: [ ]

Thank you for taking part in our study.