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Content

1. Introduction	3
2. State of the Art	5
2.1 Social Norms	5
2.2 The Environment as a Public Good	7
2.3 Social Norms and Environmental Action	9
2.4 Theoretical Framework and Hypotheses	11
3. Experimental Design	13
3.1 Eliciting social norms	14
3.2 Social norms in the public good experiment	16
3.3 Sample	18
3.4 Operationalization	19
4. Results	19
4.1 Baseline Characteristics and Beliefs about Social Norms	20
4.2 Beliefs about Social Norms and Mitigative Action	23
5. Discussion and Conclusion	28
6. Abstract	31
7. Appendix	32
8. References	40

1. Introduction

Without further and comprehensive action, global warming will have grave and transformational impacts on society as we know it (IPCC, 2018). This is not to say there are no alternatives. However, mitigation of and adaption to the effects of a changing climate will require significant efforts by all levels of society. More specifically, action on an international level is as much needed as individual behavioral changes (Bernauer, 2013). The latter part, as are most corresponding policies, is not straightforward:

“Public acceptability can enable or inhibit the implementation of policies and measures to limit global warming to 1.5°C and to adapt to the consequences. Public acceptability depends on the individual’s evaluation of expected policy consequences, the perceived fairness of the distribution of these consequences, and perceived fairness of decision procedures [...]” (IPCC, 2018: 22; see also Huber et al. 2020).

This means, in order to succeed in drafting policies that effectively tackle the challenge of climate change, we need a better understanding of the mechanisms, which drive individual behavior in this decision setting. This thesis is dedicated to dig deeper into these mechanisms. Research on drivers of individual pro-environmental behavior is already expansive (Anderson et al., 2017; Bakaki & Bernauer, 2018; Bernauer et al., 2020; Huber et al., 2020). Among the factors evaluated, economic as well as social factors are identified. In this thesis I focus on the latter. To be more precise, I analyze the effect of social norms on individual environmental decision making. Social norms are considered to be among the more effective behavioral interventions (Farrow et al., 2017; Kinzig et al. 2013; Cialdini et al., 1991). Nevertheless, there might be a caveat in implementing such an intervention, also known as a boomerang effect (Richter et al., 2018; Schultz et al., 2007). That is, social norm interventions are dependent on the individuals’ original evaluation of others’ beliefs (Sparkman, 2021; Rinscheid et al., 2021). Disregarding this status quo might lead to a misconception about how individuals act in certain situations. To avoid this, it is important to shed light on the mechanisms at play when individuals make decisions about their behavior towards the environment and the role social norms play in this setting.

While this is not a new field of research, I argue that the set of choices individuals face in the field of environmental action is worth investigating when analyzing the effect of social norms. Imagine, for example, individuals in an apartment building, who face the decision of investing in an air conditioning system or to contribute to a shared effort dedicated to improving the building’s insulation capacity and/or energy efficiency. The former helps individuals to *adapt*

to an increasing number of days with above average temperatures. Simultaneously, the operation of an air conditioning system increases energy consumption. This exacerbates, on aggregate, emission intensity, the original cause for the investment decision (in addition to increasing individual energy costs). Investing in the energy efficiency of the whole apartment building, on the other hand, is infeasible and impracticable on an individual level. However, concentrated and collective action would help in *mitigating* the effects of above average temperatures without further contributing to the root cause of the temperature rise. Nevertheless, individual benefits of both actions might not be equal. This example highlights the differences between adaptive and mitigative pro-environmental action. In more detail, adaptive action yields higher payoffs in an individual context, while mitigative action benefits society to a greater extent (Tol, 2005). Considering the environment as a public good, Hasson et al. (2010) argue that this distinction affects individual decisions in a one-shot public good game.

However, assessments of the effects of social norms on individual choices concerning adaptive and mitigative behavior are scarce. Thus, combining the two strands of literature on social norms and individual climate action allows this thesis to tap into this gap guided by the following research question:

What is the effect of a social norm intervention on individuals' adaptive or mitigative environmental behavior?

Empirically, I address this question in an experimental setting with a belief correction treatment. This process follows three steps: first, individuals answer questions about their beliefs about social norms in the population. Thereby, a distinction between *injunctive* and *descriptive* norms guides the questions. The latter describes respondents' *beliefs about actual behavior*, while the former addresses *beliefs about what society considers to be appropriate* (Cialdini et al., 1991; Krupka & Weber, 2013). The questions about the respondents' beliefs are based on questions from the European Values Study (EVS, Kritzinger et al., 2017). In a second step, individuals are randomly confronted with information about beliefs about descriptive norms, injunctive norms, or a combination of these (in addition to a control group). This information intervention is based on data from the EVS (Kritzinger et al., 2017). After having experienced one of three possible treatments, participants are asked to allocate a fictitious budget in a public good game. Here, they face a scenario similar to the example presented above and are asked to allocate resources either to adaptive or mitigative action.

The experiment was conducted among students of political science at the University of Vienna attending classes dealing with quantitative methods in the social sciences. In total seven

experimental sessions have been conducted with participant numbers ranging from six to 21 individuals. This resulted in 78 participants who completed the experiment and the public good game. Respondents were randomly paired into groups of three. The experiment was programmed with the open-source software Otree (Chen et al., 2016). Data analysis was conducted in R.

The results suggest that the kind of environmental action does not affect the level of contribution in a public good setting. Individuals contributed on average 56.22 % of their endowment to mitigative action, which is in line with stylized facts of public good games (Ostrom, 2000). Belief corrections of individual original beliefs about descriptive and injunctive norms in the population are hypothesized to affect contribution levels. Specifically, given an underestimation (overestimation) of a descriptive norm, a corresponding norm intervention is assumed to lead to an increase (decrease) in individual contributions to mitigation. Moreover, given an underestimation of a norm, a correction of beliefs about both, injunctive and descriptive norms is assumed to have a higher impact on individual contributions than only a singular norm correction. I don't find support for these hypothesized relationships. However, it appears that a combination of treatments, that is, information about descriptive and injunctive social norms, affects individual contributions, regardless of original beliefs.

The remainder of this thesis is structured as follows: In the next part I discuss research on social norms, nature as a public good, (pro-)environmental behavior, and the interactions of these fields in more detail. The discussion boils down to a simple model to capture the mechanisms in place between social norms and pro-environmental behavior presented by Nyborg (2018), which then allows me to derive hypotheses for this project. Subsequently, I present my experimental approach to test these hypotheses. Finally, I present the results of my approach before discussing the findings and concluding with an outlook on opportunities for further research.

2. State of the Art

As Kinzig et al. (2013) point out, the dynamics between social norms, nature as a public good, and environmental policy design as a proxy for different environmental actions are rather complex. Therefore, it is appropriate to assess each of these fields theoretically and shed light on the interactions, which lie at the roots of the complexities.

2.1 Social Norms

Expectations about others' behavior as well as expectations about reactions to one's behavior are fundamental to making decisions in a social context. Social norms as subjectively perceived "individual constructs" (Legros & Cislighi, 2020; Bicchieri, 2017; Cialdini et al., 1991) and

their effects on decision making stand in contrast to the conventional economic definition of rational decision makers, carefully calculating expected payoffs before making decisions (Elster, 1989). In other words: “For norms to be *social*, they must be shared by other people and partly sustained by their approval and disapproval. They are also sustained by the feelings of embarrassment, anxiety, guilt, and shame that a person suffers at the prospect of violating them.” (Elster, 1989, 99f.). This reciprocity of expectations can be considered essential for the effects of social norms on individual decision making.

While the social aspect of norms is insightful with respect to its effects it addresses neither the longevity of social norms, nor their origins. Ostrom (2000) sheds light on the evolution of social norms in the context of a commonly shared resource and the self-organized distribution and utilization of the latter. The central argument is that social norms facilitate the use of a common pool resource efficiently only if it evolves organically. This ensures understanding of mutual benefits as well as the legitimacy of punishments for non-compliant individuals (Ostrom, 2000, 148 ff.). However, such norms are dependent on common knowledge shared by current and passed on to future members of society (see Ostrom, 2000, 154).

This transmission of knowledge does not happen in a vacuum. Conversely, norms appear to be subject to continuous social bargaining and development, even in heterogenous groups (Reuben & Riedl, 2013). Herz & Taubinsky (2018) provide evidence for the evolution of norms in a bargaining context and highlight that past experiences of individuals shape their present perception of fairness and acceptability. This suggests that perceptions of social norms are affected by short-term individual experiences and can trigger immediate behavioral effects. What is more, it suggests that such norms are an active part of the decision-making process of individuals (Herz & Taubinsky (2018).

Krupka & Weber (2013) address the latter aspect and thereby assess injunctive social norms and descriptive social norms. That is, Krupka & Weber (2013, 499, italics added by the author) “distinguish norms regarding what one ‘ought’ to do, or *injunctive norms*, from customs or actions that people regularly take, or *descriptive norms*.” They find that injunctive social norms serve as an effective predictor for individual behavior in a dictator game. In more detail, individuals are likely to give up individual benefits in order to comply to socially acceptable behavioral norms. Schultz et al. (2007) evaluate injunctive norms as well as descriptive norms. Their findings suggest that while descriptive social norms can affect individuals’ behavior substantially, it does not always lead to a beneficial outcome. People with perceptions of a social norm above or below the level in society adjust their behavior accordingly, even though this

might entail negative consequences. However, adding information about the expectations regarding this norm in society – an injunctive norm – reinforces beneficial behavioral changes and almost eliminates harmful ones (Schultz et al. 2007, 431 f.).

So far social norms are understood as reciprocally effective social guidelines for behavior, commonly agreed upon and shared by members of society. Moreover, the possibility of imposing sanctions on non-compliant individuals helps enforcing these norms. Additionally, social norms are subject to bargaining in society generally as well as in specific contexts. Given these characteristics, norms appear to affect individuals' decision making already in an early stage. As Ostrom (2000) points out, such effects on decision making have a substantial impact on the continued availability of a commonly shared resource. Nature or the environment can be considered to be among such resources.

2.2 The Environment as a Public Good

Nature or the environment are fundamentally connected to humanity and its economic organization of society. As Polanyi (1944, 243) puts it: “Traditionally, land and labor have never been separated; labor is part of life, land remains part of nature, life and nature form an intertwined entity.”¹ This implies that the way society manages the land at its disposal is essentially connected to the functioning of society itself. What is more, land, or nature, are typically understood as a public good, conventionally defined by non-excludability as well as non-rivalry. The choice between exploitation and conservation of this public good is thus up to every individual member of society.

Decisions in such a context have been subject to research for decades. Hardin (1971), for example, assesses this problem theoretically as an n-prisoners dilemma, with no incentive for a fully rational individual to contribute to the public good. This leads eventually to total exploitation of the good in question.² However, Ostrom (2000, 140 f.) discusses experimental evidence contradicting this theoretical assertion and establishes seven stylized facts for public good experiments, represented in Table 1.

¹ Translated by the author.

² As Ostrom (2000, 139) illustrates, an individual is given an endowment E , from which it can choose x_i to contribute to the provision of a public good. Individual utility U_i is then given by:

$$U_i = U_i[(E - x_i) + A * P(\sum x_i)]$$

Where $A = \frac{1}{N}$ and $0 < \frac{1}{N} < P < 1$. P is a factor determining benefits from contribution and as long as $P < 1$, it is never optimal for a rational decision maker to cooperate and contribute to a public good.

Table 1: Stylized facts about public good experiments

Stylized fact	Description
Contribution size	40 – 60 % in a one-shot game/first round
Declining contributions	After the first round in repeated games, no convergence to zero
Cooperation	Beliefs about cooperation induce cooperation
Learning effects	Subjects do not converge to the behavior of a rational individual, but learn to cooperate when the game is repeated
Communication	Even without enforceable guarantees, communication leads to increased cooperation
Punishment	Punishing non-contributing subjects is common, even though not rational
Contextual factors	Framing, competition, payoff mechanisms, etc. matter for contributions

Notes: Stylized facts are a summary of the information provided in Ostrom (2000, 140 f.).

Fehr & Gächter (2000), for example, assess the effects of punishment and find that the option for punishment significantly increases cooperation as well as payoffs in multiple settings (stranger vs. partner settings). Kocher et al. (2008) combine research on punishment with contextual factors and find that stake size (as contextual factor) does not affect cooperation or punishment.

Aside from general findings, a broad range of research investigates behavior in a public good game with a specific framing, i.e. a climate change framing. Heitzig et al. (2011) establish a model which automatically rewards individuals according to their past contributions to meet an emission target. Establishing such a mechanism for a public good game with multiple rounds leads to unprofitability of free riding in the long run. In other words, while free riding might be beneficial in one period, the prospect of additional cost due to a redistributive mechanism in future periods renders this strategy unattractive. Tavoni et al. (2011) address action against climate change in the context of inequality. Individuals start the game with endowments of different sizes in order to mimic inherited wealth. They find that communication and the possibility to express (unbinding) contribution pledges improve successful cooperation and thus outcomes of individuals substantially. Additionally, successful cooperation comes with a reduction of inequality. Lastly, Tavoni et al. (2011, 11826) conduct a survey among participants and find that perceptions of fairness significantly affect decisions of individuals.

The latter aspect is especially relevant for the present project. The research discussed so far appears to support the stylized facts presented by Ostrom (2000). Furthermore, it adds additional nuance to the contextual factors described above, which include “a wide diversity of rules that are used to change the structure of the situation” (Ostrom, 2000, 148). Here is where social norms come back into the picture. If, for example, fairness perceptions of individuals correlate positively with contributions in a public good experiment, one could ask the question if such perceptions are broadly represented in society and thus correspond to the definition of social norms above. Subsequently, I address the effects of social norms in the context of nature as a public good in more detail.

2.3 Social Norms and Environmental Action

Actions to tackle climate change and the challenges accompanying it are a societal challenge (Bernauer 2013), as, theoretically, no individual is willing to contribute to this cause on its own (Hardin, 1971). As such, policy proposals as environmental action on an aggregate level and preferences towards the very same are a first way of addressing the connection between social norms in the field of environmental action.

Huber et al. (2020), for example, assess preferences towards a set of environmental policies and find that the latter are affected by individuals' beliefs about the fairness, the intrusiveness as well as the effectiveness of said policies. Moreover, the framing of choices affects how individuals think of possible environmental actions. de Groot & Schuitema's (2012) investigate the effects of a social norm intervention in such a setting. More specifically, they confront individuals with majority or minority support of policy proposals. They find that individuals are more likely to support a policy if a majority supports it, even though it might be coercive, or otherwise unpopular. The effect is even more pronounced for less intrusive or less costly policies (Aasen & Vatn, 2018; Andor et al., 2020; Gevrek & Uyduranoglu, 2015). In this realm, Huber et al. (2018) show that combining norms with other messages, in this case implemented policies, has a positive effect on individual pro-environmental action.

Social norms and environmental behavior have been subject to research for a long time. Farrow et al. (2017) provide an overview of key findings from the literature and report mixed results, which oftentimes appear to be highly context dependent (see also Alló & Loueiro, 2014, Yamin et al., 2019). Nonetheless, social norms appear to be a consistently effective intervention to induce pro-environmental behavior (see Kinzig et al., 2013; Schultz et al., 2013). Andre et al. (2021) scrutinize the interaction between knowledge of social norms and pro-environmental behavior. Distinguishing between *descriptive* and *injunctive norms* they find that a correction of beliefs about social norms has significant effects on pro-environmental behavior of participants. In more detail, both treatments are highly effective for individuals who underestimate the prevalence of certain norms in the population. A corresponding correction of these beliefs leads to a significantly higher willingness to donate to a pro-environmental cause (Andre et al., 2021, 17 ff.).

However, environmental action is not a one-dimensional and straightforward choice to make. Interdependencies of actions, feasibility of implementation as well as acceptance by members of society all limit or multiply the choices available to individuals (Bernauer, 2013). One common distinction in the literature is made between adaptive and mitigative action (Tol, 2005).

While “there are a wide range of adaption options that can reduce the risks of climate change [...]”, “there are limits to adaption and adaptive capacity for some human and natural systems [...]” (IPCC, 2018, 10). In other words, adaptive action is the kind of action that tries to make the consequences of climate change more bearable for society. Mitigation on the other hand, is the kind of action required to limit climate change to an extent that is compatible with current forms of societal organization. Nevertheless, mitigation is the kind of action that requires significant transformation of key areas of society, which makes it harder to implement (see IPCC, 2018).

Tol (2005) scrutinizes this distinction and argues that adaption and mitigation substitute each other. Moreover, facilitative adaption, a more long-term oriented approach, and mitigation are directly competing for resources. This is to say, every resource dedicated to render the consequences of climate change more compatible with current ways of living takes away means from action tackling the root causes of the problem. However, given that local and regional adaptive actions become increasingly necessary, the choices as to where to allocate resources is overshadowed by a short-term – long-term trade-off.

Hasson et al. (2010) assess the willingness to contribute to the environment as a public good with respect to personal vulnerability and the probability of a disaster, thereby distinguishing between adaption and mitigation. Conceptually, adaption is seen as a private action while mitigation is seen as a contribution to a public good.³ Conversely to the stylized facts presented in Table 1 and by Ostrom (2000, 140 f.), mitigation was only the preferred choice for about 26.5 % of the participants, which is well below contributions in other public good experiments (Hasson et al., 2010). Subsequently, I discuss a simple model to understand the relationship between social norms and contributions to public goods. Based on this theoretical framework, I present my hypotheses before introducing the experimental approach designed to test the latter.

³ Hasson et al. (2010, 333) present the following model to address the differences between adaption and mitigation:

$$E(\pi_i) = p \left(e - Ve \left(1 - d \frac{(B - x_i)}{B} \right) \right) + (1 - p)e,$$

where $p = 1 - m \frac{\sum x_i}{nB}$ is the probability of a disaster, e is the initial endowment, $B = x_i + a_i$ is the budget to address climate change, n is the group size, $x_i \leq B$ is the investment in mitigation, $a_i = B - x_i$ is the investment in adaption, $m < 1$ is the return to mitigation, d is the return to adaption and V measures individual vulnerability. This results in the prediction that decision makers face a social dilemma if $\frac{m}{n} < d < m$ (ibid., 333).

2.4 Theoretical Framework and Hypotheses

The research discussed above sheds light on a possible interaction of social norms and pro-environmental behavior in a public good context. Even considering the complexity of the debate on social norms, the distinction between *descriptive norms* (*what individuals do*) and *injunctive norms* (*what individuals believe should be done*), as described in section 2.1, is a common denominator when designing corresponding experimental interventions (Bicchieri, 2017; Krupka & Weber, 2013; Cialdini et al. 1991). Such social norm interventions have shown to affect individual behavior and/or behavioral intentions.

With respect to the decisions individuals face, Hasson et al. (2010), for example, distinguish between adaptive and mitigative action, but *do not take the effects of social norms into account*. Research such as the one conducted by Andre et al. (2021) does consider the effects of social norms *but make no distinction about the choices individuals face* in the realm of environmental action. In other words, even though a vast range of research hints at the effects of social norms on different pro-environmental behavior, the details of this relationship with respect to adaptive and mitigative behavior need to be further investigated, which is the purpose of this thesis.

Nyborg (2018, 10 ff.) offers a model to explain the mechanism through which social norms affect pro-environmental behavior. She considers a society of $N > 1$ identical individuals with an income of Y , which is equal for everybody and exogenously given. Moreover, G is introduced as the supply of any given public good. Individual income is defined as

$$Y = x_i + g_i,$$

where x_i is private consumption and g_i is the individual contribution to a public good (Nyborg, 2018, 10). The supply of the public good is defined as

$$G = G^0 + \sum_{j=1}^N g_j$$

and contributions of others are exogenous (Nyborg, 2018, 10).

Subsequently, Nyborg (2018, 14 ff.) addresses the effect of social norms as a “warm glow” individuals receive from contributing to a public good. In doing so, they are observed as well as evaluated by other members of society. Here, each individual can either choose to contribute ($g_i = 1$) or not contribute ($g_i = 0$) from their income $Y > 1$ (Nyborg, 2018, 14). In this context, individual utility is defined as

$$U_i = u(x_i) + v(G) + s_i,$$

where “ u and v are concave and strictly increasing functions” (Nyborg, 2018, 11). $s_i = aKg_i$, is characterized by a which is the share of individuals contributing to a public good, and $K > 0$ which is a constant (Nyborg, 2018, 14). Moreover, only contributing individuals receive utility from the warm glow of social norms, whereas individuals who do not contribute are neither rewarded nor punished for their behavior (Nyborg, 2018, 14). According to Nyborg (2018, 14) rational individuals contribute to the public good, if

$$U(Y - 1) + s_i \geq U(Y),$$

which is the case if

$$ag_i \geq \frac{U(Y) - U(Y - 1)}{K}.$$

In this framework, Nyborg (2018, 15) identifies two stable equilibrium solutions. In the first case, nobody contributes ($a = 0, g_i = 0$), nobody receives any utility from social approval and thus there exists no incentive to change one’s behavior. In the second case, everybody contributes ($a = 1, g_i = 1$) (Nyborg, 2018, 15). Whenever

$$K \geq U(Y) - U(Y - 1)$$

it is beneficial for everybody to contribute (Nyborg, 2018, 15). In other words, if pro-environmental behavior is already established in a society, the second case may constitute a focal point (Nyborg, 2018, 15).

The latter aspect is especially important for this thesis. Individual behavior may be already affected by the social norms, which actors believe to be in place (see also Nimark & Sundaresan, 2019). Addressing and potentially correcting these beliefs may subsequently lead to a change in individual willingness to contribute to a public good even though such behavior entails personal cost (on these trade-offs see Lindenberg & Steg, 2007; Eom et al., 2018). However, as has been pointed out above, contributions may also be subject to the specific choices individuals face. In the present scenario the choice is between adaptive and mitigative environmental action. Lastly, a positive effect of a correction of beliefs about social norms can in no way be assumed as guaranteed (Sparkman et al., 2021; Schultz et al., 2007).

Based on the research and the model presented above, the following set of hypotheses seems plausible. The first hypothesis builds on the results presented by Hasson et al. (2010), which suggest that average contribution levels may be lower in a scenario where individuals have to choose between different kinds of environmental action. Therefore, a test of the contribution

levels across treatments seems appropriate. Here I assume that contribution levels do not differ from the stylized facts presented by Ostrom (2000) and are very likely.

H1: Individuals are more likely to contribute to mitigative as opposed to adaptive action.

The next set of hypotheses echoes the research on boomerang effects of social norm interventions (Richter et al., 2018; Schultz et al., 2007). The decision for adaptation or mitigation may depend on individuals' existing beliefs about social norms. More specifically, norms on actions (*descriptive norms*) might trigger corresponding behavioral shifts. Individuals underestimating (overestimating) such a norm might then increase (decrease) their contribution to mitigation in order to comply to existing levels of socially appropriate behavior (Schultz et al., 2007). Such an effect should be even more pronounced, if individual beliefs about, both, descriptive and injunctive norms are corrected (Schultz et al., 2017; Andre et al., 2021).

H2a: Individuals are more likely to contribute to mitigative action after a descriptive norm intervention compared to the control group, if they underestimate the prevalence of a social norm.

H2b: Individuals are less likely to contribute to mitigative action after a descriptive norm intervention compared to the control group, if they overestimate the prevalence of a social norm.

H3: Individuals are more likely to contribute to mitigative action after a descriptive and injunctive norm intervention compared to only a descriptive intervention, if they underestimate the prevalence of a social norm.

In light of Nyborg's (2018) model the mechanism behind these hypotheses might be simply driven by more social approval, that is, an even warmer glow of contributions to a public good. In other words, if individual beliefs are confronted with what is actually done in society the willingness to take mitigative action might increase. If, additionally, beliefs about what one ought to do based on current social norms are corrected, contributions for collective benefits should further increase. Subsequently, I describe the experimental design applied to elicit and correct beliefs about social norms as well as the public good game.

3. Experimental Design

To properly assess the effects of social norms on adaptive and mitigative behavior, the experimental design consists of two parts. The first part serves to elicit beliefs about social norms of individuals. Here I follow Andre et al.'s (2021) approach. I combine these results with the stylized facts about public good experiments and the findings from Hasson et al. (2010) of a one shot public good experiment and the theoretical insights from Nyborg (2018). The experiment is conducted in oTree (Chen et al. 2016), an open-source software. The data analysis is

conducted in R. This section is dedicated to discussing these approaches in more detail and describe the organization and execution of the experiment as well as the operationalization of variables.

3.1 Eliciting social norms

The potential differences of descriptive versus injunctive norms require a two-step process of eliciting and potentially correcting beliefs about social norms of individuals. Following Andre et al. (2021) I rely on survey data on environmental attitudes. The EVS (Kritzing et al., 2019) collects data on a number of questions related to the attitudes of individuals towards environmental behavior. The main advantage of using the data provided by Kritzing et al. (2019) is the representativeness of the sample of the Austrian population. This allows for conclusions about attitudes in the broader public as opposed to, for example, a smaller student sample. One disadvantage, however, is the survey design. The EVS (Kritzing et al., 2019) is not designed to specifically address social norms, which entails a trade-off in terms of accuracy for this project. Moreover, the survey has been conducted in 2017, which affects the timeliness of the values reported, especially given the attention climate change and the environment have been receiving recently. Nevertheless, this thesis' aim is to assess the effects of social norms represented in the population and not a smaller, potentially unevenly distributed sample. Therefore, I proceed using data from the EVS (Kritzing et al., 2019) for the process of eliciting and correcting individual beliefs about social norms.

More specifically, I choose two questions from the EVS (Kritzing et al., 2019) in order to create a basis for comparisons of beliefs about social norms. The first question asks about individual willingness to pay for the protection of the environment.⁴ This question serves to highlight the descriptive sphere of social norms as it assesses a costly action a person is prepared to take in order to behave in a pro-environmental way. The second question is part of an assessment of character traits. Among others, it raises the question about how similar the respondent is to a person, who cares about the environment, without the call for any specific action.⁵ This question is the basis for the injunctive norm intervention, the sphere of social norms in which beliefs about appropriate behavior are located.

⁴ The exact wording of the question is: "I would forgo parts of my income, if I could be sure that the money is used to prevent environmental pollution." (Kritzing et al. 2019, 26; translated by the author).

⁵ The exact wording is: "I now describe to you a fictitious person and want you to tell me [...] how similar this person is to you: 'To care about nature and the environment is important to her'." (Kritzing et al., 2019, 29 f.; translated by the author).

The question on willingness to pay is measured on a five-point scale ranging from “I totally agree” to “I don’t agree at all” (Kritzinger et al., 2018, 26). The question about similarity to a person caring greatly about nature and the environment is measured on a six-point scale ranging from “is very similar to me” to “is not at all similar to me” on a six-point scale (ibid., 30). In order to make the information more comprehensible, I summarize values indicating agreement or similarity (and the opposite) for these questions. The original distribution of results as well as the results from this data manipulation are presented in Table 2 and form the basis of the social norm intervention in the one shot public good experiment.

More specifically, regarding the question about willingness to pay, I summarize responses indicating agreement or total agreement as well as disagreement and strong disagreement into two categories. Indecisive respondents are excluded from this subsample. With regards to the question about similarity to a person caring greatly about nature and the environment, I summarize responses indicating high similarity, similarity, and some similarity as well as no similarity at all, no similarity, and hardly any similarity into two categories. This results in 51.35 % of the respondents indicating at least agreement to forgo some of their income in order to save nature and the environment (48.65 % opposing). Additionally, 85.9 % of respondents consider themselves at least somewhat similar to individuals who care greatly about nature and the environment (14.1 % do not).

Table 2: Detailed results for the descriptive and injunctive social norm intervention

	Willingness to Pay				Similarity				
	N	%	Sum	%	N	%	Sum	%	
Strongly agree	182	9.9			Very similar	388	21.2		
Agree	578	31.5	760	51.35	Similar	694	37.8		
Neither agree nor disagree	354	19.3			Somewhat similar	494	26.9	1,576	85.9
Disagree	405	22.1			Hardly similar	187	10.2	258	14.1
Strongly disagree	315	17.2	720	48.65	Not similar	60	3.27		
					Not similar at all	11	0.6		
Total	1,834	100	1,480	100		1,834	99.97	1,834	100

Note: Data from the EVS (Kritzinger et al. 2019); Willingness to pay summarizes the question “I would forgo parts of my income, if I could be sure that the money is used to prevent environmental pollution.” (Kritzinger et al. 2019, 26; translated by the author) measured on a scale from 1 – 5; indecisive responses have been excluded from the sum; Similarity summarizes the question “I now describe to you a fictitious person and want you to tell me [...] how similar this person is to you: ‘To care about nature and the environment is important to her’.” (Kritzinger et al., 2019, 29 f.; translated by the author) measured on a scale from 1-6; N/As have been removed from the data.

Again, following Andre et al. (2021), the questions extracted from the EVS (Kritzinger et al., 2018) are asked again in the experiment, however, this time in order to elicit the beliefs about social norms of individuals. Additionally, and in line with Andre et al. (2021, 7 f.) participants are asked the following questions:

- “Out of 100 people, how many stated that they are willing to do without some of their income in order to protect the environment?”
- “Out of 100 people, how many stated that they are very similar to a person, who cares greatly about nature and the environment?”

This serves to get an assessment of individual beliefs about the prevalence of social norms. Additionally, it allows for a comparison between their own attitudes and the ones represented in the sample provided by the EVS (Kritzing et al. 2019). This concludes the first part of the empirical approach, namely the elicitation of social norms and serves as a basis for the public good experiment described below.

3.2 Social norms in the public good experiment

In order to assess the effect of different kinds of social norms on individuals’ behavior in the public good game, participants in the experiment are randomly presented one of the following treatments:

- Descriptive norm treatment:** Information about the share of people who are willing to forgo some of their income in order to address environmental protection.
- Injunctive norm treatment:** Information about the share of people who think they are very similar to a person caring about nature and the environment.
- Descriptive and injunctive norm treatment:** Combination of i. and ii.
- Control group:** No information treatment.

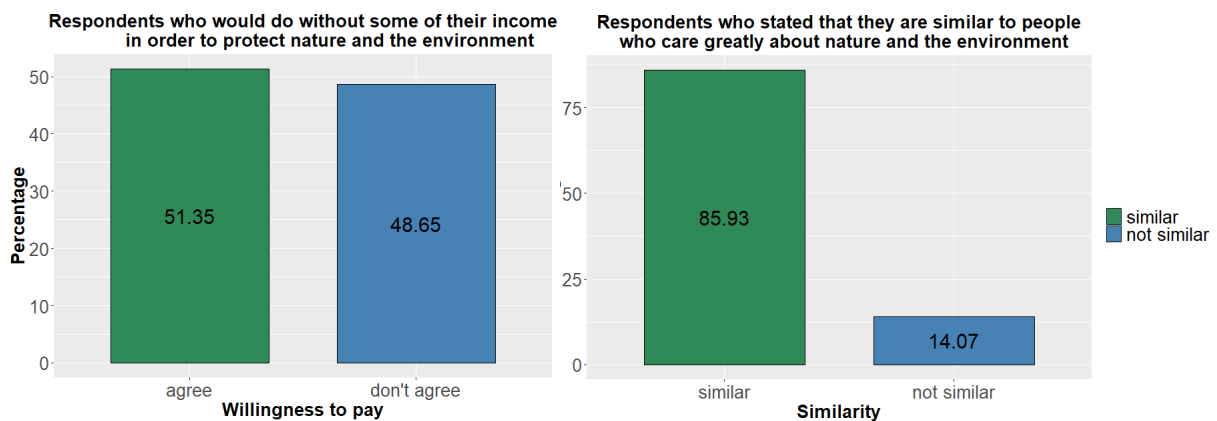


Figure 1 – Data from the EVS (Kritzing et al. 2019); Panel A (left) is based on a summary of the question “I would forgo parts of my income, if I could be sure that the money is used to prevent environmental pollution.” (Kritzing et al. 2019, 26; translated by the author) measured on a scale from 1 – 5; indecisive responses have been excluded from the sum; n=1,480. Panel B (right) is based on a summary of the question “I now describe to you a fictitious person and want you to tell me [...] how similar this person is to you: ‘To care about nature and the environment is important to her’.” (Kritzing et al., 2019, 29 f.; translated by the author) measured on a scale from 1-6; N/As have been removed from the data; n=1,834.

The treatments use the illustrations depicted in Figure 1. The left panel shows the binary support or opposition to costly action in order to protect nature and the environment. The right panel shows the %age of individuals, who consider themselves similar to someone who cares greatly about nature and the environment, also in a binary manner. The treatments include either one of the two panels or both illustrations. After each treatment respondents are confronted with their stated beliefs about the prevalence of social norms in order to highlight possible differences and corrections. The substantial differences between an almost 50:50 split with respect to the proxy of a descriptive norm and 85.9 % of respondents expressing support for the proxy of an injunctive norm might further strengthen differences between treatments. Generally, such differences might lead to an even more pronounced effect of a combined treatment (or an injunctive norm treatment alone).

After having received one of the four treatments discussed above, participants are asked to adaption or mitigation in a public good experiment. Several factors render the public good game an appropriate framework to test the hypotheses presented above. First, nature is essentially a public good and allocating scarce resources to either adaptive or mitigative action can be represented easily in this context. Thus, the direct trade-off between these two actions (Tol, 2005) is part of the choices individuals can make. Second, the “warm glow” described by Nyborg (2018) is representable in the payoff structure of the public good game. In other words, total payoffs are affected by individual contributions and knowing that others are affected by one’s choices could trigger the “warm glow” individuals receive from social approval. This stands in contrast to, for example, the dictator game, in which individuals conventionally face only one other player in a hierarchical setup (Achtziger et al., 2016; Güth & Kocher, 2014). Furthermore, the public good game is frequently utilized to assess the effects of norms on individual contributions in general settings (Catola et al., 2021) as well as in settings focusing on environmental action (Hasson et al., 2010).

Lastly, the public good game is by default affected by the decision makers’ expectations about the behavior of other members of society consisting of multiple players. In other words: “From evolutionary theory, we should expect individuals to have an initial propensity to follow a norm of reciprocity and to be willing to restrict their own use of a common-pool resource as long as almost everyone reciprocates.” (Ostrom, 2000, 149). Thus, information about social norms is a low-barrier intervention, which addresses this “norm of reciprocity” (ibid.). This has the potential to affect the extent to which an individual complies to such a norm when making decisions about the allocation of scarce resources in the public good game.

Respondents receive information with a description of adaptive and mitigative environmental action similar to the example given in the introduction of this thesis. At the end of this description individuals are asked a yes/no question about the definition of mitigative environmental action in order to refresh their attention. The framing of the experimental instructions is such that it is clear that a choice for adaption corresponds to a non-contribution, while a choice for mitigation corresponds to the opposite (see Appendix). Moreover, it is indicated that a decision to contribute might entail a lower personal benefit. Subsequently, participants are asked to allocate parts of their budget (100 fictitious points) to one of the two actions possible. Possible spillover-effects between the two actions are plausible for real world scenarios. Nevertheless, I follow Tol's (2005) argument of both actions essentially competing for resources for the sake of simplicity. These considerations yield the following expression for a fictitious individual payoff U_i

$$U_i = E - x_i + a * m \sum x_i,$$

where E is the initial endowment of each individual and x_i represents their contribution. In this setting $E = 100$. Following Ostrom (2000, 139) $a = \frac{1}{N}$, $m < 1$ and indicates the positive effects of a contribution, i.e., mitigative action. Following Hasson et al. (2010, 334) I assume that $m = 0.7$. As has been pointed out above, contributing (mitigation) is never rational if $m < 1$ (Ostrom, 2000). As no payoffs are distributed to the participants, the main focus of the analysis lies on the individual contribution x_i .

3.3 Sample

The sample for this experiment consists of students of political science at the University of Vienna. The recruitment process was facilitated by lecturers of classes on quantitative methods in the social sciences. Recruitment encompassed 7 classes, in which a total of 86 participants started the survey and the experiment. A total of 78 students completed the experiment including the contribution task and therefore represent the final sample. Otree (Chen et al., 2016) requires experimenters to indicate a number k determining the group size in the public good game, which is why the sessions have to be created for a multiple of this k . For this experiment $k = 3$ and participants were randomly assigned into groups of corresponding size. Due to this requirement, information on pay-offs (calculated per group) is only available for 45 participants, which have been allocated to complete groups. For incomplete groups, pay-offs could not be calculated. However, this is no big hurdle for the analysis in this paper, as the focus lies on individual contributions, for which data is available for the full sample of 78 participants.

Data collection took place in 7 sessions in two weeks in December 2022. The experimenter was present in all but two of the classes in order to provide details on the design after participants completed the survey/experiment. No incentives have been distributed to individuals for their participation. It is not possible for students of this course to attend multiple classes of the same kind, thus no participant had the possibility of participating more than once. Before fielding the experiment, a pilot session among students of economics and political science at the University of Vienna had been fielded in order to optimize the flow of the experiment and get rid of potentially unclear instructions and other bugs.

3.4 Operationalization

In order to test the hypotheses above some data manipulation is necessary. First, the dependent variable y_i for the estimation procedure is the contribution chosen by the participant. Second, in order to assess the effect of a social norm treatment contingent on the original beliefs of the participants, individual original beliefs have been subtracted from the treatment values drawn from the EVS (Kritzing et al. 2019) (see Table 2). Positive values of this variable indicate an underestimation of the beliefs in the population, which is hypothesized to have a positive impact on individuals' contributions. Negative values indicate an overestimation (with a negative effect on contributions). This results in the variables des_i (for a belief about a descriptive norm) and inj_i (for a belief about an injunctive norm). Moreover, in order to indicate over- or underestimation of any social norm a dummy variable und_i has been constructed where a value of 1 (if individual beliefs des_i or inj_i are strictly bigger than 0) indicates underestimation and a value of 0 overestimation. The three treatments t_i are assigned randomly and are coded as dummy variables. The control group serves as reference group. Age is simply numerical, and gender has been recoded to a dummy variable where 1 indicates an identification of the respondent as female.

4. Results

As the small sample size entails some problems for statistical inference, I rely on tests designed for rather small samples such as the Wilcoxon rank sum test to test for differences of distributions (Wilcoxon, 1945; see also Catola et al. 2021). But before I proceed to this part of the analysis, I subsequently present some descriptive results. In order to compare environmental attitudes in the present sample to the one drawn from the EVS (Kritzing et al., 2019) the variables regarding “willingness to pay to protect nature and the environment” and “similarity to a person caring greatly about nature and the environment” are recoded following the scheme

described for the design of the treatments and are reported in Table 3 in comparison to the population values.

Table 3: Environmental attitudes in the EVS population compared to the experimental sample

	Willingness to Pay				Similarity				
	EVS sample		Student sample		EVS sample		Student sample		
	N	%	N	%	N	%	N	%	
Strongly agree	182	9.92	38	48.72	Very similar	388	21.16	9	11.54
Agree	578	31.50	11	14.10	Similar	694	37.84	29	37.18
Neither agree nor disagree	354	19.30	17	21.79	Somewhat similar	494	26.94	35	44.87
Disagree	405	22.10	10	12.82	Hardly similar	187	10.20	2	2.56
Strongly disagree	315	17.20	2	2.56	Not similar	60	3.27	3	3.85
					Not similar at all	11	0.60	0	0
Total	1834	100	78	100		1834	100	78	100

Note: Data from the EVS (Kritzing et al. 2019) (n=1834) and from own data collection (n=78); Willingness to pay summarizes the question “I would forgo parts of my income, if I could be sure that the money is used to prevent environmental pollution.” (Kritzing et al. 2019, 26; translated by the author) measured on a scale from 1 – 5; indecisive responses have been excluded from the sum; Similarity summarizes the question “I now describe to you a fictitious person and want you to tell me [...] how similar this person is to you: ‘To care about nature and the environment is important to her’.” (Kritzing et al., 2019, 29 f.; translated by the author) measured on a scale from 1-6; N/As have been removed from the data

While the distribution is similar for the proxy of an injunctive norm (even though there is a stronger tendency to moderate attitudes), this is not the case for the distribution of the proxy for a descriptive norm. The willingness to pay in order to save nature and the environment is considerably higher in the experimental sample. As has been pointed out above, using data from a representative sample might come at the detriment of a lack of similarity to the student sample at hand. However, while this difference in attitudes across samples is striking, it might strengthen the effectiveness of the interventions, as possible corrections of beliefs might be stronger. Subsequently, I analyze baseline characteristics of the participants as well as individual beliefs about social norms before testing the effects of different treatments on individual contributions.

4.1 Baseline Characteristics and Beliefs about Social Norms

As the sample consists of bachelor students of political science at the University of Vienna, some baseline demographic characteristics of participants are similar, which is why questions on education were not part of the survey. The caveats of this approach are discussed further below. Table 4 gives an overview of key demographic variables (age and gender) of participants as well as baseline environmental attitudes following the questions of the EVS (Kritzing et al. 2019). Moreover, average beliefs about descriptive and injunctive norms are

reported. Applying Welch’s two sample t-test (Welch, 1947) shows that the treatment and control groups don’t show systematic differences when being compared to the full sample. Results do not differ when applying a Wilcoxon rank sum test (Wilcoxon, 1945).

Table 4: Means of key variables across treatment groups

Key Variables	Full Sample	Control	Descriptive	Injunctive	Combined
Age	22.73	23.14	23	22.05	22.57
Female	0.567	0.4286	0.4545	0.5789	0.6154
Willingness to pay	3.551	3.636	3.478	3.474	3.643
Similarity	4.59	4.409	4.783	4.737	4.357
Descriptive Beliefs	32.86	29.95	34.7	33.89	33
Injunctive Beliefs	57.05	54.64	63.35	55.16	53.07
n	78	22	23	19	14

Notes: Age is coded numerically; Female = 1 indicates a female respondent, three respondents did not identify as male or female and were excluded from this table; Willingness to pay summarizes the question “I would forgo parts of my income, if I could be sure that the money is used to prevent environmental pollution.” (Kritzing et al. 2019, 26; translated by the author) measured on a scale from 1 – 5, where 1 indicates no agreement and 5 indicates total agreement; Similarity summarizes the question “I now describe to you a fictitious person and want you to tell me [...] how similar this person is to you: ‘To care about nature and the environment is important to her’.” (Kritzing et al., 2019, 29 f.; translated by the author) measured on a scale from 1-6, where 1 indicates no similarity and 6 indicates strong similarity; Descriptive beliefs reports the mean of individuals’ beliefs about the prevalence of a descriptive norm; injunctive beliefs reports the mean of individuals’ beliefs about the prevalence of an injunctive norm.

As has been described further above, the population values for both norms drawn from the EVS (Kritzing et al., 2019) are as follows: 85.9 % of respondents claim that they are at least somewhat similar to a person caring greatly about nature and the environment; 51.35 % of individuals claim that to agree at least somewhat to the statement that they would do without some of their income to protect nature and the environment. Thus, with respect to participants’ original beliefs about the prevalence of social norms in the population Table 4 provides evidence of an underestimation of both a descriptive and an injunctive norm in the full sample as well as the treatment groups. Nevertheless, there are no systematic differences between the treatment groups and the full sample. Figure 2 illustrates these differences across groups for the perceptions of the descriptive as well as the injunctive norm.

The analysis above suggests that despite the small sample size, there are no systematic differences between the control and treatment groups as well as the full sample. Most importantly, original individual beliefs about social norms as well as environmental attitudes do not differ significantly across different groups when compared to the full sample. Following this analysis, I focus on individual contributions to mitigative as opposed to adaptive action and the effects of experimental treatments on these contributions. This allows to test the hypotheses developed further above.

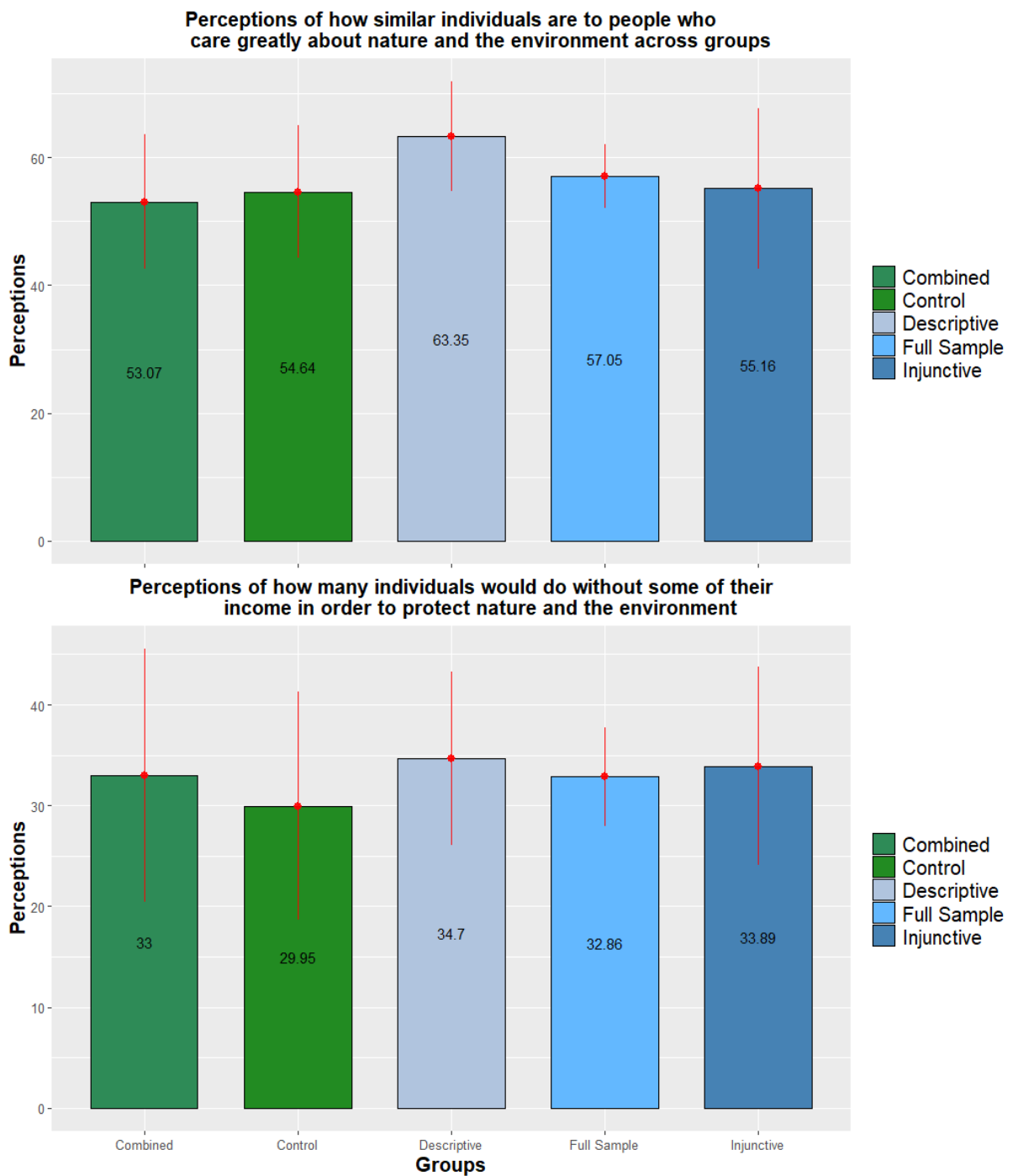


Figure 2 – Figures based on own data; the panel above reports the mean perceptions of individual beliefs about the prevalence of an injunctive norm based as reported by the participants; the panel below reports the mean perceptions of individual beliefs about the prevalence of a descriptive norm as reported by the participants; red lines indicate 95 % confidence intervals.

4.2 Beliefs about Social Norms and Mitigative Action

The hypotheses developed in section 2.4 address the general contribution level (H1), as well as contributions across treatments for individuals with different beliefs about social norms. Thereby, an underestimation of a social norm would require individual behavioral adjustment towards contribution to a mitigative action after learning new information in order to reap the benefits of social approval (H2a). This effect should be even stronger if different messages are combined (H3). Given potentially harmful effects of social norm interventions (Schultz et al. 2007), the opposite should be the case for individuals who overestimate the prevalence of a social norms (H2b), which might be mediated by providing additional information about injunctive norms.

Overall contribution levels are in line with the stylized facts presented by Ostrom (2000). 56.22 % of the original endowment are spent on mitigation in the public good game in the full sample. This finding provides evidence for H1, which states that contributions to mitigation are more likely than adaptive action. Contributions across treatment groups range from 52.91 % of the endowment in the control group to 61.79 % of the endowment for individuals in the combined treatment group (descriptive treatment group: 54 %; injunctive treatment group 58.63 %). To test the hypotheses reiterated above, Wilcoxon rank sum tests (Wilcoxon, 1945) (given the unequal sample sizes between control and treatment groups) are applied in order to compare distributions of individual contributions to mitigative action across treatment groups and the control group. The Wilcoxon rank sum test is a non-parametric alternative to the t-test (Conover, 1973) generally used for smaller samples (e.g., Catola et al. 2021). The graphical results of this comparison can be found in Figure 3. As indicated above, there are some marginal differences across treatment groups, however, none of these are statistically significant on any conventional level (already indicated by the overlapping confidence intervals in Figure 3, which are calculated separately).

This first impression is confirmed by Wilcoxon rank sum tests as there are no significant differences in distributions between treatment and control groups (p-values ranging from 0.35 when comparing control group to the combined treatment group to a p-value of 0.91 when comparing the control group to the descriptive treatment group). Moreover, this procedure does not yield any significant differences of distributions of contribution levels across different treatment groups only (p-values ranging from 0.55 when comparing the descriptive treatment group to the combined treatment group to a p-value of 0.83 when comparing the descriptive treatment

group to the injunctive treatment group). This trend continues when comparing contribution levels in the control group to contribution levels of any of the treatments (p-value 0.5036).

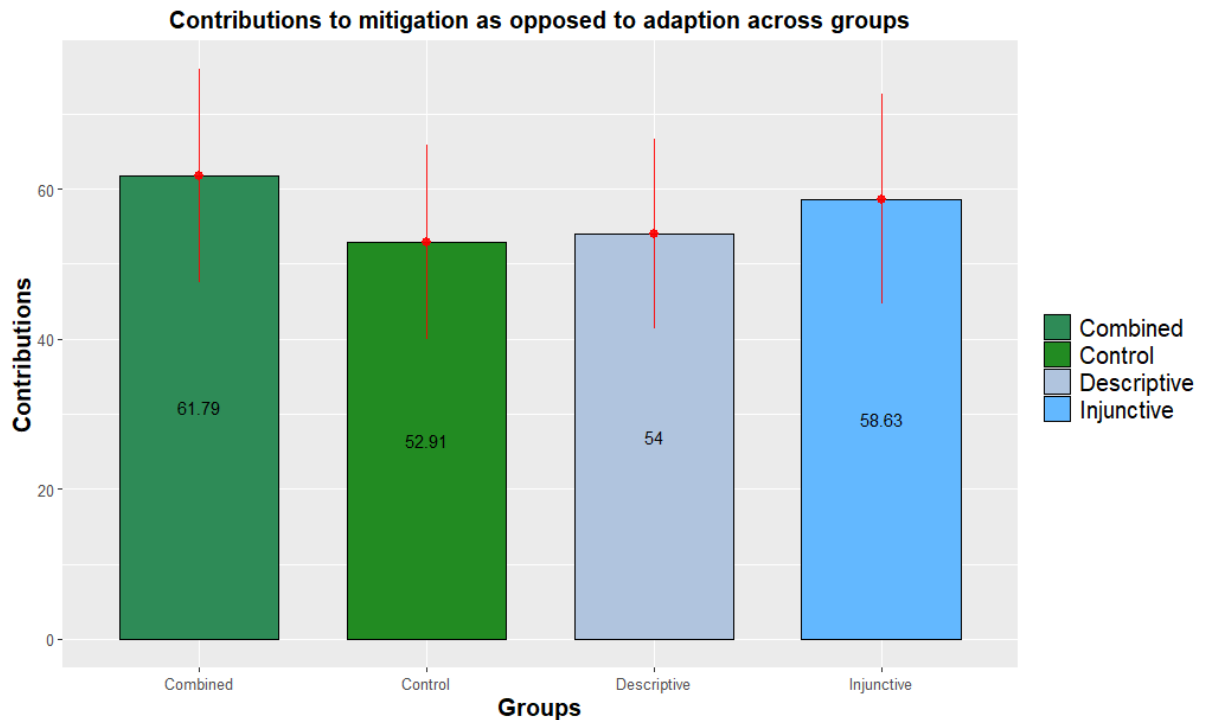


Figure 3 – Figures based on own data; mean contribution across treatment groups; red lines indicate 95 % confidence intervals.

To test the effects of the original beliefs about social norms on individuals’ contributions (basis for H2a, H2b, and H3) I conduct a similar testing procedure as the one described above. Table 5 indicates differences in contribution levels of individuals who over- and underestimate the prevalence of any social norm, both social norms, as well as those who underestimate either a descriptive or an injunctive social norm across treatment and control groups. However, the multiple conditions imposed on the data reduces within group variation drastically, which is why some of the columns/fields remain empty or show high values (i.e., 100). Generally, individuals in this sample tend to underestimate the prevalence of at least one social norm.⁶ Moreover, at least descriptively some differences between treatment and control groups in the hypothesized directions are observable. That is to say, individuals who underestimate the prevalence of a social norm tend to contribute more after any of the treatments. Given the few cases of individuals overestimating the prevalence of a social norm, no such trend is observable for this group. However, general contribution levels appear to be higher for individuals in this sub-sample,

⁶ About 96.15 % of all participants underestimate the prevalence of at least one social norm, 78.21 % underestimate the prevalence of both. Moreover, 93.59 % underestimate the prevalence of an injunctive norm and 80.77 % underestimate the prevalence of a descriptive norm in the population. These results are calculated comparing experimental data to population data, which stems from the EVS (Kritzing et al., 2019).

namely for individuals who tend to overestimate the prevalence of social norms in the population.

Table 5: Mean contributions contingent on distance of individual original beliefs to value in the population

	Full sample	Control	Descriptive	Injunctive	Combined	Treatment
Descriptive Norm						
Overestimation	59.73	55	60.2	55	100	62.1
Underestimation	55.38	52.23	52.28	59.6	58.85	56.52
Injunctive Norm						
Overestimation	74	N/A	56.67	100	100	74
Underestimation	55	52.91	53.6	56.33	58.85	55.9
Any Norm						
Overestimation	83.33	N/A	50	100	100	83.33
Underestimation	55.13	52.91	54.18	56.33	58.85	56.06
Both Norms						
Overestimation	59.76	55	60.14	55	N/A	61.75
Underestimation	55.23	52.29	51.31	59.6	58.85	56.36
N	78	22	23	19	14	56

Note: Underestimation (overestimation) is a dummy variable, which takes the value 1 (0) if the difference between individuals' original beliefs and the population value drawn from the EVS (Kritzing et al. 2019) is greater (smaller) than 0; the column "Treatment" summarizes individuals who received a treatment.

As before, Wilcoxon rank sum tests are applied to check for significant differences of distributions across treatment and control groups. With respect to individual contributions to mitigative environmental action, no significant differences across treatment and control groups are observable (p-values range from 0.36 when comparing the control group to the injunctive treatment group to a p-value of 0.89 when doing so for control and descriptive treatment group). Similarly, there are no significant differences in contribution levels across the different treatments. This is evidence against hypothesis 2a stating that individuals who underestimate a descriptive social norm will adjust their behavior after a corresponding social norm intervention. Furthermore, hypothesis 3 can also not be sustained as there are no significant differences between a descriptive norm intervention and a combined norm intervention (p-value of 0.40).

Given the small number of cases for an overestimation of a social norm, the analysis for these participants rests on comparatively few cases. Hypothesis 2b states that individuals who overestimate a descriptive norm will adjust their contributions downwards after a social norm intervention. A corresponding Wilcoxon rank sum test provides no evidence for this relationship (p-value 0.8). Moreover, no significant differences can be found, when comparing mean contributions across different treatment and control groups for individuals who overestimate the prevalence of a social norm. Figure 4 illustrates these findings visually by comparing individuals who underestimated either the descriptive or the injunctive norm across treatment groups.

Given multiple unavailable values for individuals overestimating a social norm, no such figure is produced for the group of overestimating individuals.

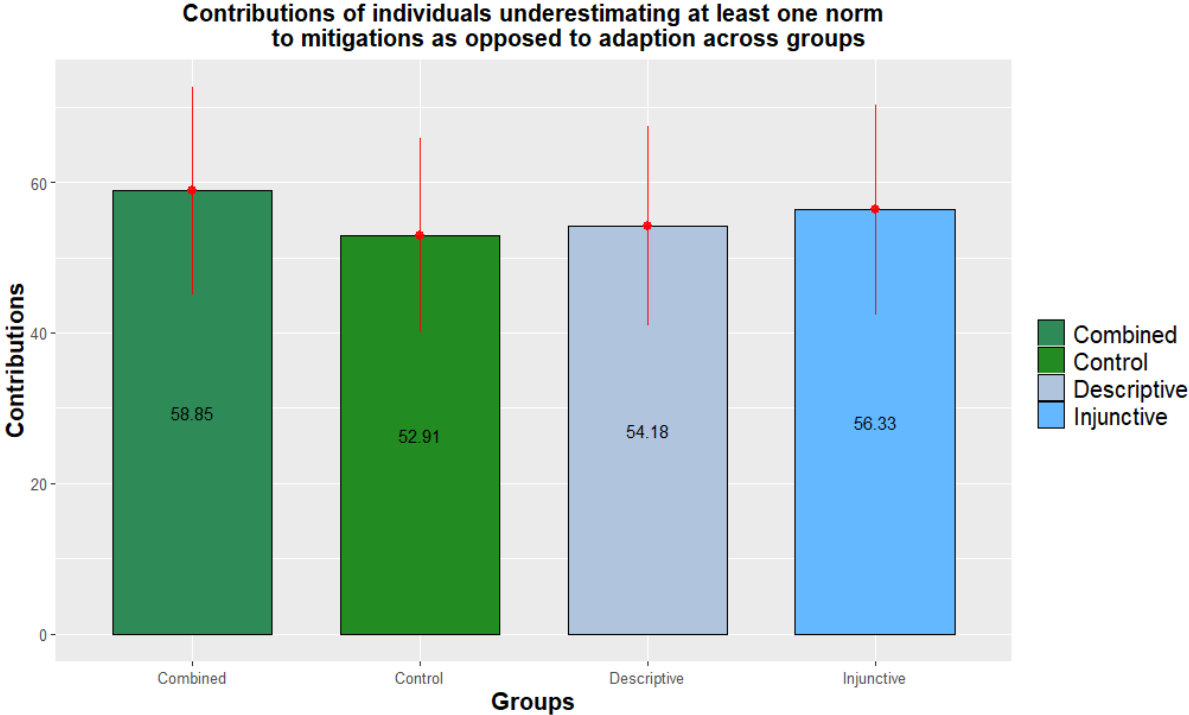


Figure 4 – Mean contributions to mitigative environmental action for individuals who underestimate the prevalence of at least one social norm across treatment groups; red lines indicate 95 % confidence intervals.

In a last step I conduct a simple OLS estimation procedure in order to assess the effect of any treatment on the contribution to mitigative action made by individuals contingent on their original beliefs about social norms in the population. To estimate the effect of a treatment given an underestimation of a social norm, the model expressed below is estimated:

$$y_i = t_i + des_i + inj_i + t_i * des_i + inj_i + e_i$$

where e_i describes the error term (the other variables are operationalized as described above). Standard errors are estimated as robust standard errors clustered on the individual level. Treatment assignment is random, thus exogeneity of the main regressor is ensured. Multiple models building up to the one described above are estimated and reported in Table 6 below. The baseline Model 1 includes only treatments and confirms the findings articulated above. Even though the directions of the effects indicate a positive effect, none of the treatments have a significant effect on individual contribution levels to mitigative action when compared to the control group. Controlling for beliefs (Model 2), does not alter these results. When including individuals’ original beliefs about a descriptive social norm and interaction terms with treatments into the model (Model 3), no significant effects of either beliefs or interaction coefficients are found. These results confirm the lack of support for hypotheses 2a, 2b, and 3, as an underestimation of a

descriptive norm does not trigger a strong effect of a correction of individual beliefs about social norms.

However, adding original beliefs about an injunctive social norm and interaction coefficients to the equation leads to a significant positive effect of the combined treatment on individual contributions to mitigative action. This provides some support for the corrective effects of a combined social norm treatment (H3). Somewhat counterintuitively the interaction term between the latter treatment and individual beliefs about injunctive norms yields a negative, but significant effect on individual contribution levels. This is evidence against Hypothesis 3 stating that a combined treatment will increase contributions to mitigation compared to other treatments if individuals underestimate the prevalence of a social norm. However, this is probably driven by the higher baseline contribution levels of individuals who overestimate the prevalence of a social norm (Table 5). Both effects are robust to the inclusion of individual beliefs about the prevalence of a descriptive social norm and interaction terms with the treatment dummies in the fully specified Model 5. This indicates that a combined message does indeed have a positive effect on individual contributions to mitigative environmental action.⁷

Summing up, the results presented in this section report essentially no significant differences between contribution levels to mitigative action across different information treatments aiming at correcting individual beliefs about social norms. Thus, I cannot report any evidence supporting hypotheses 2a, 2b, and 3. While the sample size might be partially responsible for these results, some theoretical drivers of these effects are also possible and discussed in the next section.

⁷ Results are robust to different specifications and clustering of standard errors.

Table 6: OLS estimation of contribution to mitigative action controlling for treatments and original beliefs

	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	52.91*** (6.215)	57.90*** (8.615)	53.22*** (8.832)	52.08*** (11.010)	52.39*** (12.209)
Control (ref.)	-	-	-	-	-
Descriptive	1.09 (8.729)	-0.29 (9.281)	4.00 (12.147)	9.62 (12.743)	10.89 (14.716)
Injunctive	5.72 (9.096)	5.60 (9.367)	-0.19 (14.693)	6.10 (15.554)	6.39 (17.373)
Combined	8.88 (8.985)	9.08 (8.931)	16.85 (10.569)	34.45** (13.284)	33.56** (14.478)
Beliefs descriptive	-	-0.01 (0.177)	-0.01 (0.271)	-	-0.02 (0.278)
Beliefs injunctive	-	-0.15 (0.170)	-	0.03 (0.246)	0.03 (0.256)
Control*Beliefs descriptive (ref.)	-	-	-	-	-
Descriptive*Beliefs descriptive	-	-	-0.18 (0.417)	-	-0.12 (0.429)
Injunctive*Beliefs descriptive	-	-	0.34 (0.527)	-	0.74 (0.620)
Combined*Beliefs descriptive	-	-	-0.44 (0.381)	-	-0.12 (0.428)
Control*Beliefs injunctive (ref.)	-	-	-	-	-
Descriptive*Beliefs injunctive	-	-	-	-0.37 (0.453)	-0.34 (0.480)
Injunctive*Beliefs injunctive	-	-	-	-0.01 (0.396)	-0.44 (0.447)
Combined*Beliefs injunctive	-	-	-	-0.78** (0.324)	-0.69* (0.392)
N	78	78	78	78	78
R2	0.0148	0.0296	0.05379	0.0719	0.103
AIC	749.08	751.91	753.94	752.43	757.77
BIC	760.87	768.41	775.15	773.64	788.41

Notes: * indicate significance codes: *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1; OLS estimation with heteroskedasticity robust standard errors clustered at the individual level; Control group serves as reference category in all models and for all interaction coefficients; variables descriptive, injunctive, and combined are dummy variables for the treatment group; belief descriptive/injunctive is a variable constructed from the difference between social norms in the population and individuals beliefs prior an information treatment, with negative values indicating an overestimation of a social norm and positive values indicating an underestimation.

5. Discussion and Conclusion

Environmental action is not straightforward. Distinguishing between adaption and mitigation (Tol, 2005) as possible dimensions of such behavior has the potential to shed additional light on drivers of individual (pro-)environmental behavior. Adaption provides short-term solutions to deal with the consequences of climate change and environmental degradation. Mitigation is a more long-term oriented action, aiming at reducing the root causes of climate change (IPCC,

2018). Thus, depending on the kind of environmental action, its benefits are either present in the short run individually or in the long run collectively (Hasson et al., 2010). Therefore, individuals may decide on their actions with respect to the potential, material benefits they may reap. However, this line of reasoning neglects the potential value of social approval, if any of the above actions, such as mitigation for the collective benefit, is conceived as socially expected, appropriate, and approved behavior (Nyborg, 2018; Bicchieri, 2017). The results presented in this thesis scrutinize the interaction between this material self-interest and the value of social approval in the context of individual pro-environmental decision making.

Central to the analysis are individual original beliefs about social norms and their effects on pro-environmental behavior (Sparkman et al., 2021; Schultz et al., 2007). The hypotheses put forward to address this relationship in this thesis are as follows: given an underestimation (overestimation) of a social norm, individuals are more (less) likely to contribute to a mitigative action benefitting society collectively, after a corresponding norm intervention. Moreover, a combination of multiple social norm interventions should trigger a stronger need for social approval (compared to other treatments). Ultimately, this should be expressed in higher levels of contributions to mitigative action, especially if individuals underestimate the prevalence of a social norm.

The experiment conducted to assess this relationship comprises 78 participants, all students of political science at the University of Vienna, recruited in seven sessions over two weeks in December 2022. The results obtained from this experiment, however, provide no support in favor of the hypotheses above. Even though contribution levels for mitigative action fit into the stylized facts of public good games (Ostrom 2000), no significant effect of original beliefs and a correction thereof is present. However, a combined treatment appears to significantly increase the contribution levels of individuals when controlling for original beliefs.

This lack of effects, especially of an underestimation of social norms in the population is surprising, given previous results obtained in similar studies. Andre et al. (2021), for example, find that such an underestimation significantly increases respondents' willingness to pay (albeit for only one possible decision). Similarly, Schultz et al. (2007) find that information about social norms for individuals underestimating the prevalence of such norms affects energy saving behavior significantly, even in the long run. However, lasting social norm change requires several evolutionary steps starting at an adjustment of empirical expectations about behavior followed by an adjustment of normative expectations and approval of this behavior (Bicchieri, 2017). Thus, observing an actual shift of beliefs and subsequently behavior, even though achievable

by correcting beliefs about social norms, might only be feasible in a non-laboratory setting (see also Bicchieri, 2017).

A first reason for these differences in results presented in this thesis may lie in the neglect of socio-economic aspects in the design of the empirical approach. Socio-economic status is a non-negligible factor when assessing individual pro-environmental action. Individual resource constraints may affect how much of the disposable income individuals are able to give up on for actions not yielding a direct, short-term pay-off. This translates to less utility gained from social approval for these individuals compared to purely material considerations (Eom et al., 2018). This conflict of individual goals when deciding on (pro-)environmental action are a promising sphere of future research.

The focus of the present thesis lies on the combination of different normative messages solely for the sake of additional social approval. Nevertheless, looking closer at which goals are activated by different messages in the field of environmental action might be worthwhile. As Lindenberg & Steg (2007) argue, individuals may follow normative, hedonic, or gain-oriented goals when deciding on individual environmental action. Depending on the signals individuals receive, this goal framing might be decisive for their subsequent action. Jacobson et al. (2011) provide some evidence that different norm messages trigger different goals, however, not in the field of environmental action. Smith et al. (2012), provide evidence that such a potential conflict of goals may be triggered by conflicting social norm messages. Assessing the activation of different goals contingent on individuals' socio-economic status in the field of environmental action appears to be a promising avenue for further research.

A second shortcoming of this thesis is the procedure applied to elicit beliefs about social norms. While there exist promising aspects of belief elicitation (e.g., Krupka & Weber, 2013), testing these beliefs against a population wide benchmark is a challenge. Bicchieri (2017) provides a framework for incentivized survey questions designed to assess beliefs about social norms on a larger scale. A database built on such questions would provide an adequate benchmark for the assessment of the evolution and effects of social norm on individual behavior without the need to rely on proxies.

Lastly, the rather small sample size as well as the lack of incentives for individual participation in the experiment and the public good game weaken the power of the results. Moreover, as is the case with any experiment in a controlled environment with a student sample, external validity is a concern, which could be countered with a field experiment (Nielsen et al., 2017; Levitt & List, 2007). Nonetheless, the results in this thesis add to an emerging literature

scrutinizing different kinds of environmental action and the conflicting goals individuals may face when making decisions in such a setting.

6. Abstract

Climate change poses an unprecedented challenge for societies and economies globally. Focusing on individual decision makers, this thesis addresses the dynamics of environmental action. Adaptive (dealing with consequences) and mitigative (dealing with root causes) environmental action are introduced as substitutive choices guided by the question of how social norms affect different kinds of environmental behavior. A norm elicitation task combined with a public good game, sheds light on this interaction ($n = 78$). The findings suggest that combining different social norm messages enhances individual contributions to mitigative action. However, an underestimation of social norms does not increase contributions after treatments.

Der Klimawandel stellt eine globale Herausforderung für Gesellschaften und Volkswirtschaften dar. In dieser Arbeit liegt der Fokus auf individuellen Entscheidungsträger:innen und deren Entscheidungsfindungsprozessen. Geleitet von der Frage wie soziale normen diese Prozesse beeinflussen, werden Adaption (Umgang mit Konsequenzen) und Mitigation (Umgang mit Ursachen) als Entscheidungsmöglichkeiten im Bereich des Klimawandels präsentiert. Ein Normerhebungsverfahren und ein „Public Good“-Spiel mit unterschiedlichen Informationen über soziale Normen als Interventionen beleuchtet diese Interaktion empirisch ($n = 78$). Die Ergebnisse zeigen, dass eine Botschaft, die Individuen über mehrere Normen informiert, Beiträge zu Mitigation erhöht. Das Unterschätzen einer sozialen Norm hat keinen positiven Einfluss auf die Beitragsleistung nach einer Informationsintervention.

7. Appendix

Welcome page of the experiment:

Information on the survey and data usage.

In this survey you will be asked questions about attitudes towards the environment as well as actions to protect the environment. The aim is to better understand what makes environmental protection popular.

In addition to those questions, some information about your person (gender and age) are part of the survey.

In any case, participation in this survey is completely anonymous. Moreover, no registration of any kind is required.

The collected information is used only for the purpose of a master's thesis.

If you agree to these conditions, please continue to the next page.

Next

Survey:

Welcome to this small survey!

Please enter the following information:

How old are you?

What is your gender?

- male
- female
- other
- prefer not to say

Would you spend some of your income in order to prevent environmental pollution?

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly Disagree

How similar are you to a person who cares greatly about nature and the environment?

- Very similar
- Similar
- Somewhat similar
- Hardly similar
- Not similar
- Not similar at all

Next

Elicitation of beliefs about social norms:

Your attitudes towards nature and the environment.

Please enter the following information:

Out of 100 people in Austria, how many do you think will do without some of their income in order to save nature and the environment?

Out of 100 people in Austria, how many stated that they are similar to a person, who cares greatly about nature and the environment?

Next

Control group page design

To be sure:

Before, you estimated that 23 out of 100 people in Austria would do without some of their income in order to prevent environmental pollution and that 43 out of 100 people in Austria stated that they are similar to people who care greatly about nature and the environment.

Is that correct?

- Yes
 No

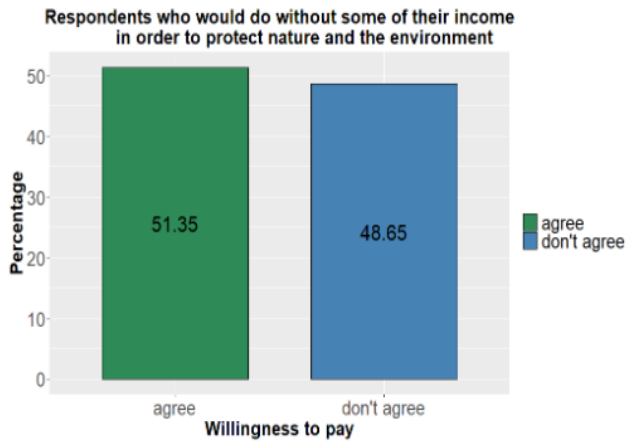
Next

Descriptive treatment page design

Attitudes towards the environment in the Austrian population

In a recent survey, people living in Austria have been asked about their attitudes towards nature and the environment.

These are the results for people, who would do without some of their income in order to prevent environmental pollution.



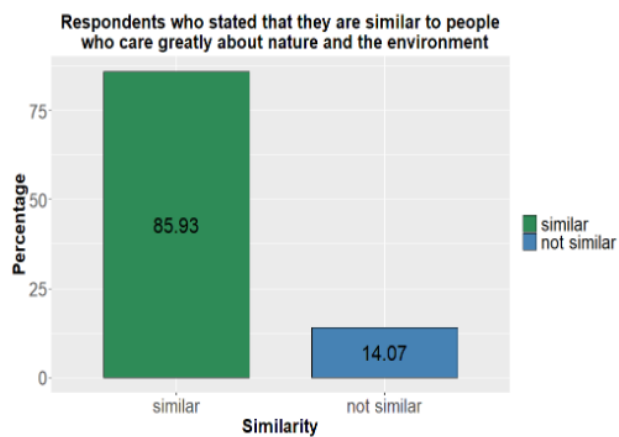
Before, you estimated that 35 out of 100 people in Austria would do without some of their income in order to prevent environmental pollution.

Injunctive treatment page design:

Attitudes towards the environment in the Austrian population

In a recent survey, people living in Austria have been asked about their attitudes towards nature and the environment.

These are the results for people, who stated that they are similar to people who care greatly about nature and the environment.



Before, you estimated that 32 out of 100 people in Austria stated that they are similar to people who care greatly about nature and the environment.

Is that correct?

- Yes
 No

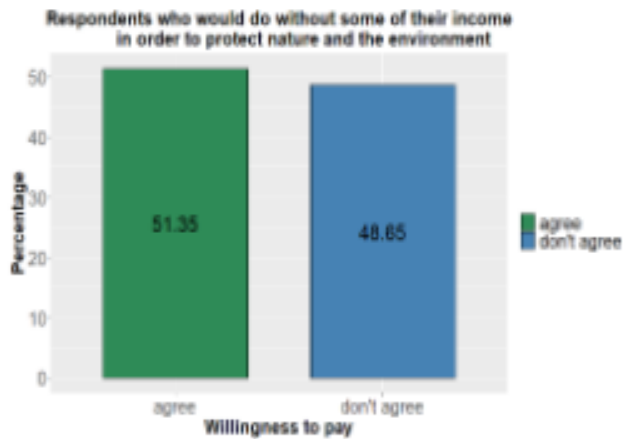
Next

Combined treatment page design:

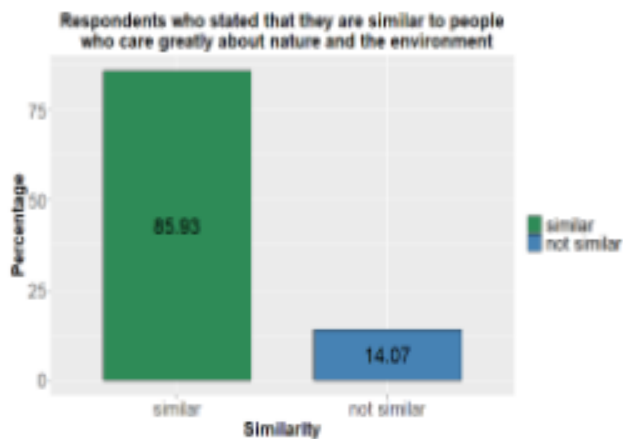
Attitudes towards the environment in the Austrian population

In a recent survey, people living in Austria have been asked about their attitudes towards nature and the environment.

These are the results for people, who would do without some of their income in order to prevent environmental pollution.



These are the results for people, who stated that they are similar to people who care greatly about nature and the environment.



Before, you estimated that 52 out of 100 people in Austria would do without some of their income in order to prevent environmental pollution and that 52 out of 100 people in Austria stated that they are similar to people who care greatly about nature and the environment.

Is that correct?

- Yes
- No

Next

Description of mitigative and adaptive environmental action (text only):

Climate action is not always straightforward.

The effects of climate change are becoming more visible in our everyday lives. Dealing with, for example, ever hotter summers will be among the challenges for us as a society. But what can we do?

First:

We can choose to make the consequences of a changing climate less harmful for us as a society. This is commonly referred to as adaptation.

Second:

We can choose to address the root causes of a changing climate and try to avoid the negative consequences in the first place.

This is commonly referred to as mitigation.

But there is a trade-off:

Tackling the root causes of a changing climate might be beneficial in the long run. But we still have to deal with the consequences that are already visible in our daily lives. Typically, we don't have the resources to do both and have to decide.

An example:

Imagine you live in an apartment building in a city like Vienna. Summers are getting hotter every year and living and perhaps working in your apartment is increasingly difficult due to the heat. You could, of course, invest in an air conditioning system, which cools your apartment down to bearable temperatures. However, this will increase your energy consumption, resulting not only in larger bills, but also in additional emissions. Even so, this might be the only way to improve your situation for you individually.

Now, you are not alone in this situation. Every other resident in the apartment building faces the same choice. However, this shared dilemma opens up a new path. Improving the energy efficiency of an apartment building is not possible for any individual resident. But if everybody were to contribute to a common pool of resources, an upgrade for the whole building could be not only feasible, but also beneficial for everybody. Among those benefits might be a reduced energy demand (heating and/or cooling), eventually reducing individual costs. Moreover, better insulation makes the consequences of hot summers more bearable for everybody.

It is obvious that the choice here is not straightforward. There are good reasons for choosing the short-term solution. It provides an immediate improvement of the situation. At the same time, contributing to the common pool of resources might reduce individual costs. This improves living conditions in a

changing climate. However, this effort might take a little longer to take effect. Additionally, you might not benefit equally from a collective effort.

Is addressing the root causes of climate change (e.g., by improving the energy efficiency of a building) referred to as mitigation?

Contribution page design:

What is your preferred action?

You find yourself in a similar situation as the one described before. Two other people in your class face the same dilemma. You receive an endowment of **100 points**. You don't have any information about how the others behave. If they share some of their points or not is unknown.

You can use your endowment in two ways:

First:

You can keep whatever amount you choose in order to individually adapt to the changing living conditions in a changing climate.

Second:

You can contribute whatever amount you choose in order to address the root causes of a changing climate collectively.

With the above dilemma in mind, how much would you be willing to contribute?

points

Next

Pay-off page design (fictitious example):

Collective or individual action.

You started with an endowment of **100 points**,
of which you contributed **34 points**.

Your group consisted of three randomly grouped individuals.

Together you contributed **109 points**.

This contribution to mitigate the root causes of climate change would benefit all players involved. Therefore, everybody would receive an individual share of **25 points**.

Your benefits are calculated from your endowment, your contribution, and the collective action of the group. Taken together, your fictitious pay-off in this scenario would be **91 points**.

Thank you very much for participating!

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