Research article

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Characteristics of popular climate policies: A replication study after more than ten years of climate activism

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Author statement

The authors made the following contributions. Gundula Thiele: Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Project administration, Software, Visualization, Writing – original draft. Ulrike Senftleben: Writing – review and editing. Stefan Scherbaum: Funding acquisition, Resources, Supervision, Writing – review and editing. Caroline Surrey: Conceptualization, Supervision, Writing – review and editing.

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Abstract

Climate policies guide behavioural adaptation towards climate protection and are therefore a key instrument in mitigating climate change. However, policy implementation is dependent on acceptability, making it important to identify factors that increase policy acceptability. We aim to replicate the findings of De Groot & Schuitema (2012) about attributes that increase or decrease acceptability and how they interact with social norms. In the experiment ($N = 193$), each participant read four policy scenarios combining different extents of coerciveness (push and pull measures) targeting behaviours with low or high behavioural costs (littering and mobility). Additionally, participants received information of either a strong or a weak social norm supporting the respective policy (between-subjects). We replicated the main effects showing that pull measures, lower behavioural costs and a strong supporting social norm were each associated with higher ratings of policy acceptability. We also replicated the interaction between coerciveness and behavioural costs, indicating that push measures are rated as even less acceptable if they target high-cost behaviours. We found no statistically significant interactions of social norm and coerciveness or a three-way interaction of all factors. These findings suggest that different policy attributes influence acceptability and that complementary combinations might alleviate resistance.

Keywords

climate policy, environmental policy, policy acceptability, replication

Impact statement

Our study shows that environmental policies are more likely to be accepted if they incentivize desirable behaviour, if the desired behaviour has low costs (e.g., effort or monetary expenses), and if they are supported by a strong social norm, i.e. a majority. This underscores the importance of thoughtful policy implementation and communication. Combining policies with complementary attributes might alleviate resistance to individual measures. For example, to ensure high acceptability, policies targeting high-cost behaviour should reward it rather than punish undesirable behaviour. Communication and discourse around policies is crucial to securing majority support. At the same time, policy effectiveness should not be neglected, so that implemented policies ultimately protect the climate effectively. Further research should focus on integrating the various identified factors that influence policy acceptability and how acceptability and effectiveness of policies can and should be balanced.

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1 Introduction

Climate change is a complex and urgent problem on itself (Incropera, 2015) and additionally entangled with other crises (Redclift & Sage, 1998). It calls for complex and global solutions (Parsons et al., 2024; Zahnow et al., 2025), such as policies that bundle the transformative potential of individuals in a society and that complement local and individual efforts with large-scale changes. Policies are, on the one hand, informed by science and experts to maximise the effect of policies (e.g., Hendzlik et al., 2023). On the other hand, political decision-making may also be oriented towards stabilizing the current situation of power, e.g. by implementing popular policies in order to appeal to voters (Caselli et al., 2014; Chiu, 2002). Indeed, one of the important predictors of policy implementation is the policy's acceptability[1] (Burstein, 2003; Page & Shapiro, 1983). Therefore, one research aim in environmental psychology is to discern how policy acceptability can be explained and possibly increased in the case of environmental policies.

Previous research has identified that individual characteristics such as political orientation, participation in society or climate change perception predict policy acceptability (Bumann, 2021; Drews & Van den Bergh, 2016). Aside from individual factors, the specific features of policies also influence their acceptability, such as fairness and effectiveness of climate change mitigation (Bergquist et al., 2022). In addition, de Groot and Schuitema (2012) showed that specific features of policies influence their acceptability. They observed that varying the costs of targeted behaviour, the coerciveness of the policy and the social norm favouring the policy resulted in different acceptability ratings. These findings have also received support from other research (Huber et al., 2018; Malhado et al., 2014; Wang et al., 2024). De Groot & Schuitema (2012) varied the behaviours the policies targeted with regard to the costs of behavioural adaptation, which includes monetary costs as well as effort. Policies either targeted mobility behaviours, which we considered high-cost with respect to changing them, or they targeted littering, which is considered low-cost (e.g., Rau et al., 2024; Wang et al., 2024). De Groot & Schuitema (2012) operationalized coerciveness as push vs. pull measures: push measures punish unfavourable behaviours (e.g., via costs or fines) while pull measures incentivize favourable behaviours (e.g., through lower prices or ease of use). The social norm was varied across participants by informing them that either a majority (strong norm) or minority (weak norm) of participants in a pilot study had supported the policy at hand. The authors found that acceptability rates were higher for policies that targeted low-cost behaviours, were less coercive (pull measures) and were supported by a strong social norm (de Groot & Schuitema, 2012).

Since the publication of this study in 2012, climate change and climate activism have moved more into the focus of the public discourse, albeit not uniformly across countries (Barkemeyer et al., 2017; Chen et al., 2023; Hase et al., 2021;

[1] In our study we use the wording acceptability to make the wording consistent. Other studies may use different terms, e.g. acceptance or support, which are conceptually related as they are all evaluative responses to policies, but not identical as described in Kyselá et al. (2019). Acceptability is there defined as a passive evaluative response to proposals of policies.

Environmental Psychology Open

Katzung et al., 2023). This activism and discourse might have changed the importance of some of the factors. For example, the globally higher concern for environmental protection in society (e.g. Franzen & Bahr, 2024) might lead to a reduced influence of experimental manipulations of social norms. It might also result in individuals prioritizing environmental protection over their own costs, leading to potentially higher acceptability of policies targeting high-cost behaviours. On the other hand, through a stronger normative support for environmental policies perceptions of coerciveness might be de-prioritized in favour of the importance of implementing policies that protect our climate. Hence, in this paper we aimed to replicate findings from de Groot & Schuitema (2012), testing the same hypotheses as the original study. This included testing the main effects for each factor separately and then looking at interactions. As De Groot & Schuitema (2012) argued, push measures enforce greater behavioural restrictions, making high-cost behaviours feel even more constraining and therefore less acceptable than low-cost behaviours (Steg et al., 2005). Pull measures, in contrast, are generally acceptable regardless of the behavioural cost. But pull measures are not always effective enough for climate change mitigation (Gärling, 2007). A strong social norm might signal the necessity of effective policies and might therefore mitigate the detrimental effect of push measures on acceptability, while a weak norm might amplify it. Additionally, we wanted to explore the three-way interaction between the factors to see whether social norms had an influence on the interaction between coerciveness and behavioural cost. We reasoned that if there is an interaction between coerciveness and behavioural costs, then policies might be much less favourable when they are "negative" on both factors—that is, when they rely on coercion through punishment and entail high behavioural costs. The resulting decline in acceptability could potentially be mitigated by a strong social norm. We therefore aimed to examine this interaction more closely and added it as exploratory to the replication hypotheses:

1. Pull measures are rated as more acceptable than push measures (replication).
2. Policies that target low-cost behaviour are rated as more acceptable than those targeting high-cost behaviour (replication).
3. A strong social norm favouring a policy results in a higher acceptability rating than a weak social norm (replication).
4. Push & high-cost: Push measures are rated as even less acceptable than pull measures when they target high-cost behaviours compared to low-cost behaviours. Pull measures are rated as more acceptable regardless of the behavioural cost (replication).
5. Push & weak norm: Push measures are rated as even less acceptable than pull measures when a weak social norm favours the policy instead of a strong social norm. Pull measures are rated as more acceptable regardless of the social norm (replication).
6. Push & high-cost & weak norm: Social norms moderate the interaction effect of behavioural costs and coerciveness so that a strong social norm attenuates the reduced acceptability for policies that are push measures and target high-cost behaviours. A weak social norm on the other hand may amplify these negative effects (exploratory).

Environmental Psychology Open

2 Methods

We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study (Simmons et al., 2012). This study was preregistered at https://osf.io/ungmj/ and all data, materials and analysis scripts can be found there. The study was approved by the local data protection bureau. For studies with low risk an ethics approval is not necessary according to German law, therefore we did not obtain approval from an ethics committee. The participants gave informed consent to participate and to the processing of their anonymized data.

2.1 Participants

We calculated our sample size based on the smallest interaction effect ($\eta^2 = .03$, $\alpha = .05$, $\beta = .05$) in de Groot and Schuitema (2012) using g*Power (Faul et al., 2007), resulting in a target size of 190 participants. We had no estimates for our additional three-way interaction hypothesis and therefore used the most conservative calculation. We recruited through the central experimental server of psychology at Dresden University of Technology to participate in the questionnaire via LabVanced (Finger et al., 2017) between January and February 2024. Participants had to be at least 18 years old and proficient in German. 267 people participated in the study, of which 193 completed the full procedure, yielding complete datasets (66.3% female, 32.1% male, 1.6% neither; age range 18-82 years, $Md = 24$ years, $M = 31.98$ years, $SD = 15.16$ years). There were no further exclusions of datasets from analysis. Due to technical errors in the setup of the data collection in LabVanced, the groups were unbalanced, with 115 participants in the strong norm condition and 78 participants in the weak norm condition. Psychology students were eligible for receiving course credits for their participation.

2.2 Design and procedure

In the study, each participant rated the acceptability of four policy scenarios. We manipulated the cost (high- vs. low-cost behaviour) and the coerciveness (push vs. pull measure) of the policies within-participants. Participants were also assigned to either the weak norm or the strong norm group (between-subjects), resulting in a mixed 2×2×2 design. Participants either saw the two high-cost or the two low-cost policy scenarios first (counter-balanced). For each policy, either the push or the pull policy measure was presented first (randomized order). Each policy was accompanied by a statement that either a minority (weak social norm) or a majority (strong social norm) of pilot participants supported the policy, depending on the group each participant was assigned to. Participants therefore saw either the minority or the majority information for all four scenarios. After completing the four policy scenarios, participants could voluntarily enter demographic information. They were then debriefed and informed that the norm statements were there to induce a social norm and not the result of a real pilot study.

2.3 Materials

2.3.1 Policy Scenarios

We adapted the policy scenarios from de Groot and Schuitema (2012) to fit the German context of our sample (see table 1 for English translations). The resulting four policy scenarios consisted of a text describing a policy aimed at shaping the environmental behaviour of people. Each text combined one level of the coerciveness factor (pull/push) and one level of the behavioural cost factor (low/high cost). Low-cost behaviour policies targeted littering in public places, while high-cost behaviour policies targeted transport mode choice (taking the car vs. public transport). Push policies enforced behaviour adaptation through monetary punishment (taxes or fines), while pull policies incentivized behavioural adaptation through monetary or practical facilitation. In addition, we presented statements describing how many participants in a pilot study found the policy in question acceptable (weak norm condition: 10-20%; strong norm condition: 80-90%; see Table 1). As in the original study, the norm conditions were implemented as a between-subjects factor, meaning that one participant saw either the strong or weak norm information in all four policy scenarios.

2.3.2 Policy Acceptability

We assessed policy acceptability for each policy scenario using the item: "How acceptable do you find the new legislation above?". Participants responded on a 7-point Likert scale (ranging from "very unacceptable" to "very acceptable").

2.4 Data Analysis

All analyses were run in R (Version 4.4.2, R Core Team, 2019, for specific package information see Supplement B). We tested our hypotheses using a 2×2×2 mixed analysis of variance (ANOVA). However, the normality assumption was violated based on inspection of the Q-Q-plot and the Shapiro-Wilk test, $W = 0.92, p < .001$. Thus, we performed a parameter-free ANOVA using the MANOVA.RM-package by Friedrich et al. (2018) with a permutation approach (10,000 iterations). We used Holm-corrected Wilcoxon signed-rank tests as post-hoc tests. This deviates from the Tukey corrections we preregistered, but became necessary as our groups ended up being unbalanced.

3 Results

We found a mean acceptability rating of $M = 5.51$ ($Md = 6, SD = 1.81$) across all experimental conditions, suggesting that the presented policies were generally perceived as somewhat acceptable (see Figure 1 and Table A1). Means and confidence intervals for acceptability ratings in each condition are listed in supplement A. For hypotheses 1 to 3, we found significant main effects for the factors coerciveness, $ATS(1,448.69) = 70.63$, $p < .001$, behavioural cost, $ATS(1,\infty) = 49.87$, $p < .001$, and social norm, $ATS(1,\infty) = 13.15$, $p < .001$, confirming our hypotheses. Hence, policies were rated as more acceptable when they were less coercive, targeted a low-cost behaviour and were favoured by a strong social norm, compared to their counterparts.

Environmental Psychology Open

Table 1

Overview of the four policy scenarios (English translation)

	High-cost behaviour	Low-cost behaviour
Pull	In order to reduce car traffic due to CO_2 emissions, the government is planning to promote public transport with vouchers. This means that vouchers will be distributed to all households; for example, vouchers for travelling to work could be issued at a greatly reduced cost, and children could receive free bus vouchers for travelling to school. In a pilot survey with a sample representative of the German population, around 10% [minority]/90% [majority] of respondents stated that this measure would be acceptable to reduce car use.	To reduce littering in public areas, the government plans to improve the number of litter bins in heavily littered public areas (by around 250% more). This concerns places such as shopping centres, parks, streets in residential areas and large cities. These bins will also have an area for the disposal of cigarette butts. In a pilot survey with a sample representative of the German population, around 14% [minority]/86% [majority] of respondents said that this measure was acceptable to reduce littering in their area.
Push	In order to reduce car traffic due to CO_2 emissions, the government is planning to increase taxes for those who use cars. Currently the tax is approximately between 80 euros and 400 euros a year, but an increase of 14% has been proposed, (ranging from 91 euros to 456 euros) on top of the existing cost. In a pilot survey with a sample representative of the German population, around 20% [minority]/80% [majority] of respondents said that this measure would be acceptable to reduce car use.	In order to reduce littering in public areas, the government is planning to increase the current fine for the improper disposal of rubbish. Currently, for example, throwing away a cigarette butt could result in a fine of 50 euros. This will be increased by 15% (65 Euros) and will also be applied to other forms of littering such as throwing away rubbish and packaging. The public order office will be given the additional task of monitoring people who litter and will be authorized to stop and immediately fine people. In a pilot survey with a sample representative of the German population, around 19% [minority]/81% [majority] of respondents said that this measure was acceptable to reduce littering in their region.

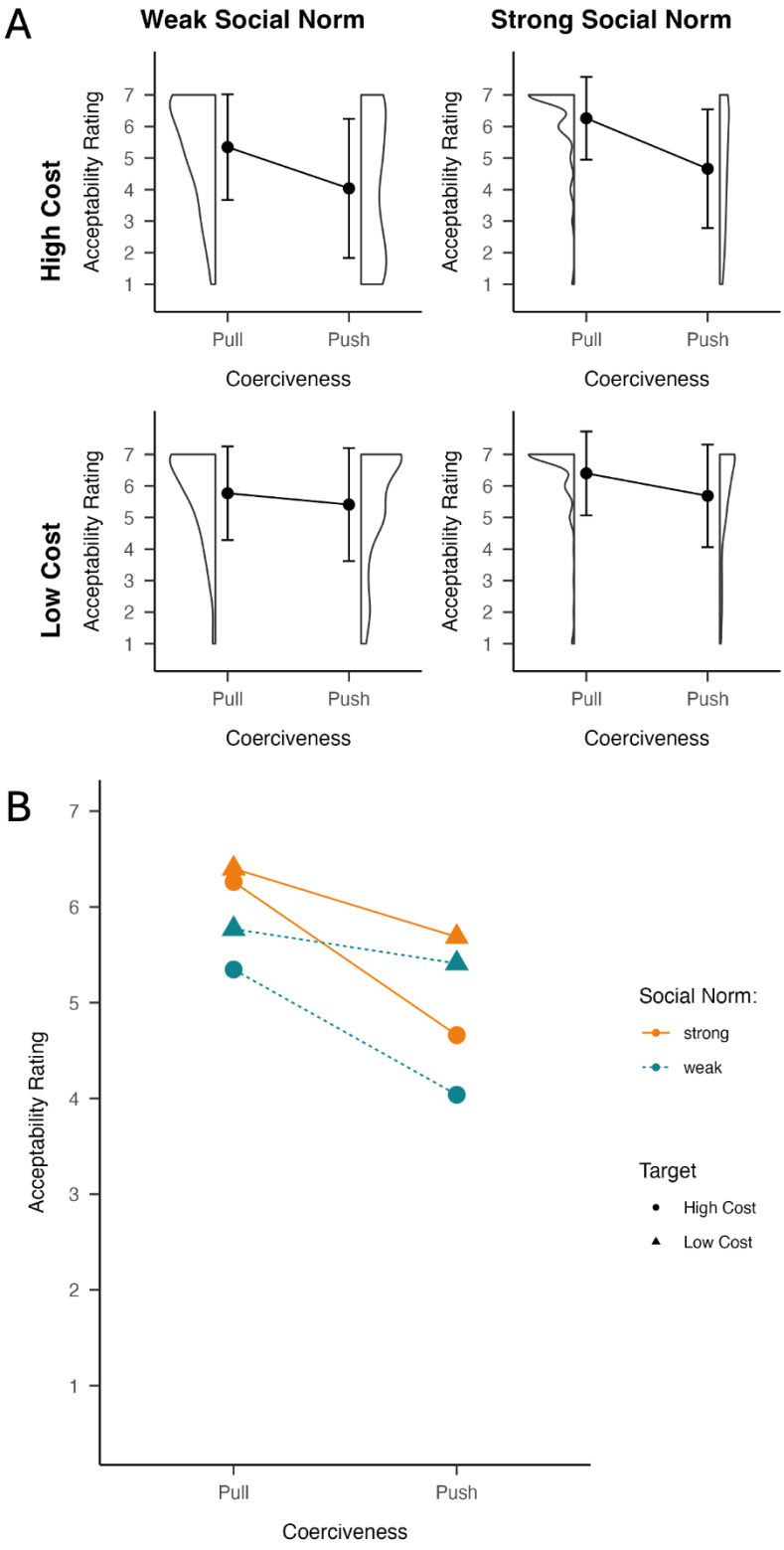
Note. The norm information was presented as a between-subjects condition, therefore participants read either the majority information in each scenario or the minority information in each scenario.

We found a significant interaction between coerciveness and behavioural cost (H4), $ATS(1,\infty) = 22.06$, $p < .001$, indicating that the difference in acceptability between push and pull measures was increased when a high-cost behaviour was targeted compared to a low-cost behaviour (see Figure 1A). Post-hoc testing showed significant differences in acceptability in all pairwise comparisons, that is in pull vs. push measures separately for high- and low-cost behaviours, and in high- vs. low-cost behaviours separately for pull and push policies (all $p < .05$, see Table A3 in the supplement). This suggests a consistent interaction effect driven by both coerciveness and behavioural cost. Pull measures were generally rated as more acceptable, but were not independent of the behavioural cost. We can therefore partially accept H4, as push measures were rated especially unacceptable when targeting high-cost behaviours, but since pull measures were also influenced by behavioural costs, we have to reject this part of H4.

Environmental Psychology Open

Figure 1

Acceptability rating distributions across the four policy scenarios and the between-subjects condition social norm



Note. Points display mean acceptability ratings, error bars display standard deviations.

Environmental Psychology Open

We found no significant interaction of coerciveness and social norm (H5), $ATS(1,\infty) = 1.86$, $p = .17$, hence contradicting our hypothesis that the effect of push vs. pull measures is greater when there is a weak compared to a strong social norm. On the other hand, pull measures were rated acceptable regardless of the strength of the social norm, as we expected.

We found no significant three-way interaction effect (H6), $ATS(1,\infty) = 0.02$, $p = .87$, thus having to reject our hypothesis that push measures that target high-cost (vs. low-cost) and are favoured by a weak (vs. strong) social norm are rated as least acceptable compared to pull measures (see Figure 1B).

4 Discussion

In this study, we aimed to replicate the findings of de Groot and Schuitema (2012) regarding which attributes make environmental policies more acceptable in a German sample and more than ten years after the original study. Participants had to rate the acceptability of four different policy scenarios where we manipulated coerciveness (push vs. pull measures) and behavioural costs (high- vs low-cost behaviours). In addition, participants received information about a strong or a weak social norm supporting the policy. We found that pull measures were rated as more acceptable than push measures, policies targeting low-cost behaviours were more acceptable than those targeting high-cost behaviours and acceptability was increased when policies were supported by a strong compared to a weak social norm. This directly replicates the main effects found in the original study (H1-H3). We also replicated the interaction effect for the behavioural cost and the policy's coerciveness, indicating that push measures are rated as even less acceptable if they target high-cost behaviours (H4), although pull measures were not independent of behavioural costs. However, we could not replicate the interaction between coerciveness and social norm from the original study and could not observe the expected three-way interaction.

Our findings are in line with previous research showing that low coerciveness, low behavioural costs and strong supporting norms increase acceptability (e.g., Huber et al., 2018; Malhado et al., 2014; Wang et al., 2024). Since acceptability is a key factor for policy implementation (Burstein, 2003; Page & Shapiro, 1983), this could suggest that policies with these attributes are more likely to be implemented. However, policy implementation is not just driven by acceptability, but also by effectiveness in achieving the desired outcomes (i.e., climate protection). Effectiveness and acceptability are not always aligned; for example, pull measures are not always effective enough (Gärling, 2007), and climate-friendly behaviours can be perceived as costlier, depending on the individual (Dreijerink et al., 2022; Moore & Boldero, 2017). This conflict between acceptability and effectiveness could be mitigated by combining different attributes of policies, as our interaction effect suggests. For example, we found that high-cost behaviours were rated more acceptable when targeted with pull in comparison to push measures. This suggests that acceptability for adaptation to high-cost behaviours might be higher if we create incentive structures and make the pro-environmental behaviour easier than its alternatives. Combining different features into one single policy might not always be feasible, but similar results were found for policy packaging, where combining different policy features might raise acceptability (Givoni, 2014; Wang et al.,

2020). Simultaneously, policy packages allow for more comprehensive strategies in tackling the complex problem of climate change (Geels, 2012), hence also increasing effectiveness. Note that the interaction effect in our data might have been amplified by the generally higher acceptability of low-cost behaviours; however, post-hoc tests still revealed a significant difference between push and pull measures for low-cost behaviours. Contradicting the original study, we did not find an interaction between the social norm and coerciveness. We propose that this might be due to increased societal discourse and activism around climate change in recent years (Barkemeyer et al., 2017; Chen et al., 2023; Hase et al., 2021; Katzung et al., 2023). As the high acceptability ratings for three out of four policy scenarios in our study show, participants generally accepted environmental policies regardless of their attributes and social norms supporting them. This could indicate that the general social norm might be more supportive of environmental policies in general, masking the effects from the manipulation in our study. Another explanation could be the between-subjects design, which we chose in accordance with the original study. However, between-subjects effects need more power to be detected (Bellemare et al., 2014; Heo & Leon, 2010), for example because of high inter-individual variability (Tankard & Paluck, 2016). Hence, future studies could either design a stronger manipulation or implement social norm as a within-participants factor (while making sure that this manipulation is not too obvious for participants).

Our study faces some more general limitations. First, while our sample has a broad age range, about two thirds of participants were younger than 30 years. Additionally, two thirds of participants identified as female. Previous research indicates that women* and older individuals generally show higher acceptability of environmental policies (Lehrer et al., 2025). This might have influenced the outcomes for acceptability in our sample in both directions, limiting the attribution of outcomes to a general societal trend. Future studies should therefore focus on collecting data from representative samples or aggregating diverse samples from multiple studies. Additionally, future studies should collect data both on existing behaviours like transportation habits or littering, and on control variables that have previously been shown to predict policy acceptance (e.g. environmental concern or values, see Ejelöv & Nilsson, 2020). This would give a more holistic picture of the reasons for (un)acceptability ratings for specific policies, both on the side of the policy as well on the side of the individual giving the rating.

Second, we assessed policy acceptability by using a single item. This reduces complexity and effort for participants but potentially forgoes information by operationalising acceptability as unidimensional. Additionally, ratings of acceptability are "passive evaluative response[s] to proposals" (Kyselá et al., 2019, p. 886) which do not include a behavioural component (e.g. a readiness to act in favour of such a policy). This means that the ratings on this item express a tendency to passively accept such policies, if they were implemented, but do not allow for inferences about actual acceptance or active support of environmental policies. Future studies could implement more complex measures that not only include acceptability, but acceptance and support of policies, to see which attributes also influence policy evaluations that include a behavioural component.

Further, our study as well as the original study operationalized very broad categories with four scenarios that target very specific behaviours. This makes the study more concise but leaves room for artifacts and conceptual ambiguity. With our design we cannot distinguish effects of the intended theoretical categorisations, such as coerciveness, from effects specific to the particular stimuli employed, such as comparing bins to taxes, which limits the validity of our study. Future studies should therefore employ multiple instantiations per category and treat stimuli as a random factor to deal with stimulus variation (Judd et al., 2012). Additionally, participants might see through the logic of comparisons and react to the design by intentionally behaving conforming or contrary to our hypotheses, confounding the effects in question. This could either be countered by using a larger stimulus set or controlled by asking participants afterwards about whether they used a specific strategy to answer the questions or what they think the hypotheses are. Using only one scenario per combination of conditions also limits generalisability. Environmental policies are not limited to mobility and littering, for example the German Environmental Agency recommended reducing subsidies for meat pricing (German Environmental Agency, 2025), which would combine a high-cost behaviour with a pull approach on behavioural adaptation. Using more than one scenario per combination of conditions would therefore improve methodological limitations as well as generalizability. While we expect the effects found in our study and in De Groot to be generalizable, it would be interesting to see if their strengths differ between domains of environmental policies (e.g., transportation, food, littering, etc.) and whether a greater variability of stimuli would be a more robust test.

Determining the reasons behind the (un)acceptability of climate policies is a large task as the underlying attitudes and motives are multi-faceted and climate policies touch on various aspects of our daily lives. We showed that coerciveness, behavioural costs and social norms influence policy acceptability and interact with each other. Combining different features within one policy or combining policies with different features might therefore alleviate some resistance towards environmental policy making. This could mean implementing a pull policy that targets a high-cost behaviour or lowering the behavioural costs for a push policy, according to our findings. Furthermore, as previous research has shown, effectiveness and acceptability are interlinked and should therefore be taken into account together when designing climate policies.

5 Open science statement



We have reported how we determined our sample size, all data exclusions (if any), all manipulations and conditions, and all measures in the study. This study, including hypotheses, analyses and sample size rationale, was preregistered on OSF and is available via https://osf.io/zhdnu. We deviated from this preregistration in conducting a parameter-free analysis of variance and Holm-corrected Wilcoxon signed-rank tests as post-hoc tests (instead of Tukey corrections) due to the violated normality assumption and to unbalanced groups. All study materials, data and analysis scripts (including readme and codebook) can be found in the OSF project under https://osf.io/ungmj/. Materials and analysis scripts are also publicly available via GitLab via https://gitlab.mn.tu-dresden.de/s9148817/re-popular-policy-open. For information on the project and computational reproducibility refer to the readme file in the project folder. Information on the data is provided in the codebook.

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