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Climate change assemblies as spaces for the potential mitigation of climate policy misperceptions: A survey experiment

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ABSTRACT

Climate action stands as one of the paramount challenges in contemporary society. A significant impediment lies in the prevalence of misperceptions, notably the dissemination of narratives that either endorse climate policy delay or outright climate denial, often perpetuated by vested interests. The World Economic Forum, recognising the gravity of this issue, has underscored" misinformation and disinformation" as the preeminent global risk in the coming biennium, while the UN IPCC has stated that rampant disinformation is delaying climate action. Significantly, misinformation has been linked to climate misperceptions, for example, the belief in technological utopianism, for example, that climate change policies are ineffective and technological solutions will fix the problem in the future, which normalises acceptance of the status quo despite the urgent need for transformative actions. Recent scholarly literature posits that deliberative forums, commonly referred to as mini-publics, can contribute to mitigating such misperceptions while ensuring democratic legitimacy (Muradova *et al.* 2023) by informing the public. This paper contributes to the special issue on how Climate Change Assemblies (CAs) can contribute to reflexive environmental governance and help societies address the climate emergency, by exploring how CAs perform for the mitigation of climate policy misperceptions. In particular, we focus on whether communication about the procedural, aspects of citizen assemblies to the broader public emerges as a critical component. We understand these mechanisms to be contingent upon complex institutional dynamics, including mechanisms integral to their functioning such as the roles of representation, competence, and voice within assemblies. This empirical inquiry is situated within the framework of a survey experiment conducted across five European countries with varying climate policy salience and emissions levels. We find for most people reading about a climate citizens' assembly makes little difference. We do find some minimal effects for the wider citizenry in general related to voice, although there are larger effects for some more sceptical cohorts, particularly for representation.

1. Introduction

Over the past decade, science communication regarding climate change and the need for action has shifted fundamentally. CAs have spread rapidly as a form of public engagement with climate governance and research has explored some aspects of the change they can create in climate governance. However, studies have not yet shed sufficient light on how CAs influence the wider public. As Elstub, Carrick, Andrews (this Special Issue) argue, this is an important gap as it has been suggested that CAs could have systemic effects if the public is made aware of them and supports them. In theoretical terms, the amalgamation of expert information endorsed within a mini-public framework holds the potential to comprehensively address democratic deficits through deploying dialogical communication and empowering citizens in the wider public. This approach, rather than functioning as a standalone remedy for misperceptions, offers additional legitimacy and has the capacity to persuade individuals toward expert correction more effectively (Muradova, Culloty, and Suiter, 2023). However, there is limited and mixed evidence of the efficacy of communicating the results of mini-publics to the wider public. Further, CAs do not automatically have positive effects on the wider public and can even have no or even negative backfire effects (Goldberg, 2023; van der does and Jacquet

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2023). Further, any effects hinge not only on awareness but importantly the contextualization of CAs. CAs might not be equally useful for all purposes. Such complex institutions present a challenge in discerning precisely which among the myriad normative mechanisms operating within them might exert the most persuasive influence on the broader public. This consideration is particularly significant concerning the communication of these institutions to these publics.

Scholars have posted various mechanisms through which mini-publics may be effective at influencing the wider public. We argue below that these mechanisms can be categorised into three: People like me (representation); scrutiny and accountability of experts (competence); and the potential for the wider public to contribute (voice). In much of the deliberative democracy literature, much has been made of the representation condition; however, little work has been done to disentangle the other elements of a mini-public systematically. In this paper, we experimentally manipulate three different kinds of causal mechanisms: the Representation Condition; the Competence Condition; and the Voice Condition in order to uncover which, if any, is the most efficacious in terms of communication in correcting climate action misperceptions.

Using data from a pre-registered and approved study in five European countries (France, Germany, Italy, Ireland, Poland) which have high carbon emissions[1] but differ in terms of the salience of climate policies, we get behind the so-called "black box" /compound mechanisms of deliberation to identify the precise causal mechanism behind the role of mini-publics in the context of climate action policy making and in particular the mitigation of misperceptions. We test two common misperceptions; that climate change policies are counterproductive and even harmful to the economy, environment, and society more generally; and that climate policies are ineffective and technological solutions will fix it in the future. In doing so, we address three lacunas in much current research. 1. We focus on the wider public and not merely mini-public participants, 2. We start to disentangle the black box of causal mechanisms, 3. We engage in comparative research across five European countries.

We find that i) the role of voice is slightly more impactful than either representation or competence with respect to citizens in general and ii), however, for the more sceptical about climate change policies, arguably the more difficult cohort to shift, the representation condition matters more.

2. Literature

Tackling climate change and the crisis of climate misinformation represents a major global challenge (Cook, 2019; Holder et al., 2023; King, Janulewicz, and Arcostanzo, 2022; Painter et al., 2023). Rising climate misinformation is an important concern for public discourse about climate action because it confuses the public about the need for urgent action, increasing the potential for misperceptions and destabilising possibilities for democratic debate about the necessary responses. Biddlestone et al. (2022) found that belief in common climate misperceptions is linked to lower support for pro-climate policies. Other scholars have argued that climate misinformation undermines people's understanding of the relevance of climate change in the public sphere by reducing climate literacy (Ranney and Clark, 2016) as well as cancelling out accurate information (McCright et al., 2016).

Importantly, climate misinformation is now a partisan issue in parts of Europe, especially Germany. Studies have also documented the emergence and influence of the far right on climate policy discussions in Germany, Spain and Sweden (Forchtner, 2019; Forchtner and Lubarda, 2023; Kuppers, 2022; Moreno and Thornton, 2022). Within the German context, several studies have highlighted a link between ideology and climate change scepticism (Forchtner, Kroneder, and Wetzel, 2018; Kuppers, 2022) and that climate scepticism is a vehicle for performing populism (Kaiser, 2019) whereby climate policies are seen as furthering elite interests (including scientists) at the expense of the 'little guy'. Studies have also found that concerns over the natural environment are central to far-right politics in the European Parliament (Schaller and Carius, 2019). Kuppers' (2022) analysis of Alternative for Germany (AfD) climate sceptic frames in Germany found the most common policy frame is that climate mitigation policies will harm the economy.

Climate misinformation incorporates a range of arguments and claims aimed at denying or delaying consequential climate action policies. Coan et al. (2021) identified five basic misconceptions about climate change, namely: (1) it's not happening, (2) it's not us, (3) it's not bad, (4) solutions won't work, and (5) climate science/scientists are unreliable. These 'Super Claims' correspond to the five key climate change beliefs identified in survey research (Ding et al., 2011). Significantly, in their analysis, Coan et al. (2021) note a recent increase in Climate Change Countermovement (CCCM) attacks on climate policy and renewable energy. We focus on two claims in their typology which highlight the CCCM's focus on attacking climate policy making via claims that "Policies are harmful' and "Policies are ineffective" which includes arguments that markets are more efficient; it's better to adapt (rather than mitigate); the technofix argument that technology will save us. We do this in order to draw attention to the problematic 'techno-fix argument' which has received much criticism in the climate governance literature (Harvey, 2003; Huesemann and Huesemann, 2011; Jones et al., 2017). Broadly, this scholarship highlights that techno-optimistic discourses downplay the issues of safety, effectiveness, and ethics. In particular, these scholars point out that technological solutions address the symptoms but not the cause of the problem and therefore distracts from meaningful climate policies that require trans social and economic change (Morozov, 2013). Others have noted the speculative nature of such technologies, contending that they amount to seeking salvation through "technological miracles" (Spash, 2016, 930).

2.1. The deliberative environment

Deliberative democrats concerned about the erosion of democratic norms often spearheaded by the far-right posit the importance of citizens at the centre of political decision-making (Bachtiger et al., 2018) and within specific institutions such as mini-publics. Thus, mini-publics can be an important instrument to obtain a social mandate for radical transformations while engaging dissensus. These mini-publics, a randomly selected group of citizens who hear and dialogue with experts, discuss with one another and make recommendations on matters of public concern, are increasingly deployed in order to underpin climate action within CAs. They engage citizens as co-designers of climate action rather than having solutions imposed (Howarth et al., 2020; Willis, Curato, and Smith, 2022). Mark Warren posits that "deliberative mini-publics are one of the most promising ways of reducing the widening gulf between democracy and expertise" (2021, 494). It is now almost incontrovertible that taking part in mini-publics has normative benefits for participating citizens in terms of capabilities, knowledge, and attitudes. But there is at best mixed evidence that the benefits translate to the wider public and in some cases null or even backfire effects (van der Does and Jacquet, 2023; Goldberg, 2023). Although the overall support is relatively high (Bedock and Pilet, 2021; Goldberg and Bächtiger, 2023; Pilet et al., 2022) most evidence is based on very few cases and studies (van der Does and Jacquet, 2023).

In addition, the mechanisms at work in the translation to the wider public are complex and varied and, to date, are largely theoretically derived rather than empirically tested. As Elstub et al. (2024, this issue) argue, less emphasis is placed on how and to what extent CAs influence the wider public. This is an important gap as it has been suggested that CAs could have systemic effects if the public is aware of them and

[1] France, Germany, Italy and Poland are the four most polluting countries in the EU (Schwerdtle et al., 2023) and Ireland, has the second highest per capita emissions in the EU27 in 2021 (EPA 2023).

supports them. Yet Goldberg (2023) finds that more than 40 % of German citizens have never heard about CAs, and only a third of those who have heard of them have any expectations.

The most common justification for a minipublic effect is representation, where legitimacy is derived from the fact that members represent the microcosm of wider society (Fishkin, 2018), have been randomly chosen, and represent a diversity of viewpoints. For example, Pow argues that it is "people like me" with similarity being perceived along both socio-democratic lines as well as by sharing similar life experiences (Pow, Van Dijk, and Marien, 2020, 45).

Other scholars have argued for a justification for competence where mini-publics democratize expertise by enabling citizens to accrue competence by learning from experts and each other through deliberation (Warren and Gastil, 2015). Kuntze and Fesenfeld (2021) found that, in Germany, a citizen assembly can increase public support for climate policies and highlighted the competence condition as an important feature of CAs as they found that 'a combination of a citizen assembly and an expert panel, that in tandem make proposals to the federal government, promises to boost public support for climate policy'. This aligns with many of the trust-based approaches to mini-publics, which, it is argued, can act as trusted information proxies for citizens in the wider public (MacKenzie and Warren, 2012; Warren and Gastil, 2015) capable of making evidence-based assessments of policy proposals without concealed interest constraints.

Further, there is an argument for what we call the voice justification. The argument is that mini-publics should empower the inclusion of those potentially affected (Beauvais and Warren 2019) and can be directly participatory for example, by facilitating the inclusion of suggestions and questions and ensuring that these reach the empowered space thus directly involving citizen voices in an inclusive and discursive way (Curato et al., 2021). Thus, for this paper, we argue the theorised mechanisms at work can be simplified into three: representation, competence, and voice. Of these three justifications, it is representation which is perhaps the most normatively contested (Goldberg et al., 2021; Goldberg and Bächtiger, 2023; Lafont, 2015).

Given the mixed evidence on the effect of climate assemblies on the maxi public, and the yet untested mechanisms at play, we test two competing hypotheses.

H1a. : Exposure to procedural elements of a climate assembly will lead to moderation of misperceptions on climate policy (mitigation).

H1b. : Exposure to procedural elements of a climate assembly will lead to entrenching of misperceptions on climate policy (backfire).

We also ask whether there are differences amongst different climate sceptic cohorts. There is some evidence that correcting misperceptions about prevalent climate norms and behaviours can increase support for climate policies and the effects are strongest for individuals who are sceptical about the existence and threat of global warming (Andre et al., 2024). In a related vein, survey analysis exploring who supports deliberative assemblies and why across 15 Western European countries (drawn from the European Social Survey), Pilet et al. (2023) find that the most supportive are those who are less educated and have a low sense of political competence and an anti-elite sentiment. We thus ask whether this translates to the exposure to procedural elements of a climate assembly and if so through which mechanism.

H2a. Exposure to procedural elements of a climate assembly will lead to moderation of misperceptions on climate policy among climate sceptics (mitigation).

H2b. Exposure to procedural elements of a climate assembly will lead to entrenching of misperceptions on climate policy among climate sceptics (backfire).

3. Study design

To disentangle the causal mechanisms by which communication of the outcome of a CA leads to the correction of climate misperceptions, we fielded an online survey experiment in five European countries (France, Germany, Ireland, Italy and Poland), using an opt-in non-probability sample collected online between April 13, and June 6, 2023 (data collected by TPKS Teleperformance Services). A nationally representative sample was achieved in each country by selecting participants based on NUTS1 region, gender, age, and level of education. The final sample size was n = 5556: France (n = 1076), Germany (n = 1101), Ireland[2] (n = 1250), Italy (n = 1074), and Poland (n = 1055).

Our survey experiment was included in a larger study where participants were first assigned to our experiment and then assigned to one of the conditions using a simple random procedure each time. All five countries were included in the H2020 XXXXXX project and represented a variety of Eastern and Western European countries as well as countries from the south. Each has different experiences with climate assemblies. Ireland held the first national-level climate assembly in 2016. Germany has experienced a variety of climate assemblies, with a national assembly having been held in 2022, two more localized deliberative processes in the cities of Berlin (2022) and Bonn (2021), as well as two lesser-known local processes previous to these. Two Polish cities held less widely renowned processes in Gdansk (2016) and Kraków (2021). Milan's Permanent Citizens' Assembly on Climate (2022-ongoing) in Italy is the longest of these processes, institutionalised to accompany the implementation of its Air and Climate Plan until its end date in 2030. Other Italian cities have also experimented with climate governance and deliberation, the most recent of which was Bologna in 2023. Regarding France, the 2019 Citizens' Convention for Climate generated much media attention with mostly sceptical undertones (Giraudet et al. 2022). Yet, France is a highly polarised country at the voter-level on environmental issue preferences and ranked as one of the most pessimistic countries regarding the perceived effectiveness of environmental policies, while others reported that French people favour technology change. These countries also feature a range of opinions on climate change and vary in terms of the salience of the environmental issue at both the party system and individual levels. According to Eurobarometer data, Ireland has high levels of climate policy salience, a country noted for its climate laggard status (EB 2023), whereas Germany, often regarded as a climate pioneer with its Energiewende, has much lower levels of climate policy salience (European Commission, 2023; Leiserowitz et al. 2020).

Our factorial experiment is based on vignettes (see Fig. 1) that each respondent assigned to a treatment condition was invited to read at the end of a survey that took on average 22 minutes to fill. These vignettes convey several pieces of information such as the outcome of a fictitious climate assembly: "money and profit motives were behind many of the bad faith narratives to delay taking climate action". The second information is a core component of a Citizen Assembly and emphasises under the heading "who participated" that participants reflect the "make-up and diverse viewpoints of society". The third piece of information manipulates the procedural elements of a Citizen Assembly within three experimental conditions: Representation, Competence, and Voice. In the Representation condition, participants were informed that members "discussed the issue in small groups" which together with the invariant heading "who participated" signals the representation function of a deliberative event. The Competence condition builds on the former and adds that the assembly heard from "a broad range of scientific experts". The Voice condition introduces an additional layer of procedural transparency by stating that any member of society can "watch the

[2] Due to an error in a question wording involving 200 cases, a booster sample of 200 respondents was added. This does not affect the results of this analysis.

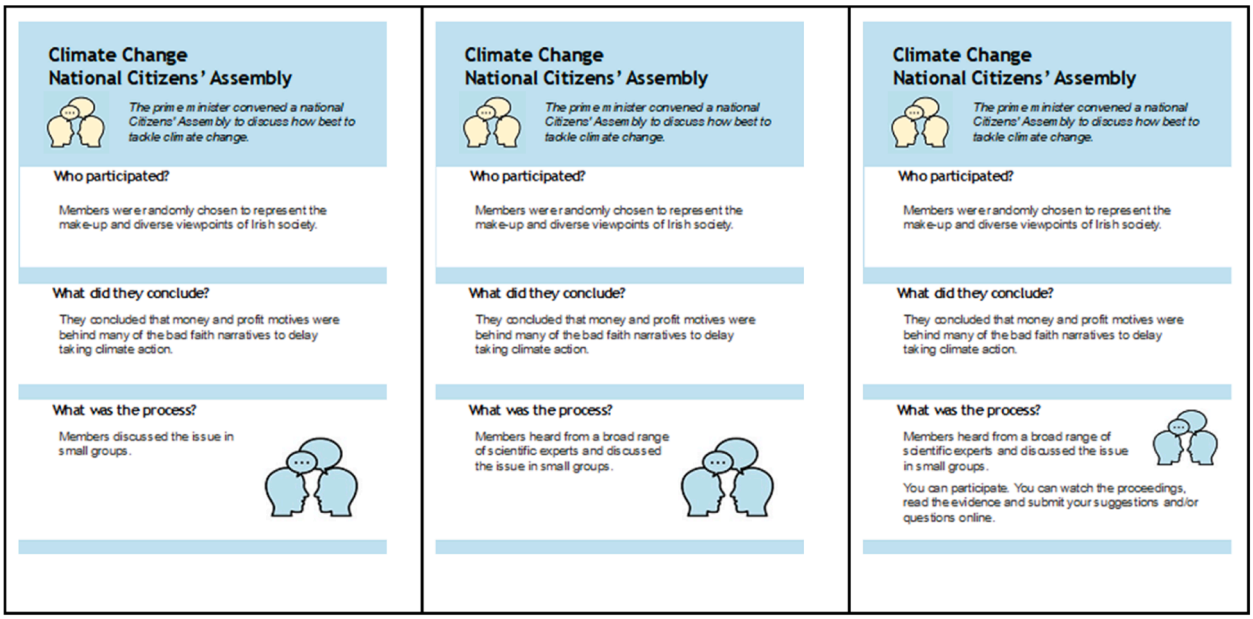

Fig. 1. Example of vignette used in each country to experimentally manipulate the process of the fictitious Climate Citizen Assemblies (CCA). Shown here are the vignettes shown to Irish respondents. Each vignette corresponds to a treatment condition, whereas the control group was not shown any. From left to right: Representation, Competence, and Voice.

proceedings of the deliberative minipublic and submit suggestions/questions online". Finally, participants assigned to the control group were routed directly to the post-treatment questionnaire and were not shown any information on the fictitious Climate change Assembly.

In terms of our dependent variable, we are interested in the Average Treatment Effect on the mitigation of climate policy misperceptions, which we refer to throughout the remainder of the paper as "climate misperceptions". As per the pre-registered analysis plan[2], we measure this attitude by asking participants their level of (dis)agreement with the following statement:

- "Climate change policies are counterproductive and even harmful to the economy, environment, and society more generally".
- "Climate change policies are ineffective, technological solutions will fix the problem in the future".

The second statement, although *prima facie* double barrelled, refers to common misperceptions as outlined earlier. These questions were administered twice, before and after treatment, and the responses were originally coded on a 0–10 scale, where 0 corresponds to "strongly disagree" and 10 means "strongly agree". In line with a within-subject analysis and our focus on the effect of Citizen Assemblies on policy misperceptions among the maxi-public (non-participants), we subtract the post- from the pre-treatment score for each participant, which gives us a minimum value of −10 and a maximum of 10. To bring the scale in line with other predictors (10-point scales), we then rescale between −5 and 5. Accordingly, a respondent who after treatment, shifted from a value of 10 (Strongly agree) to a value of 0 (Strongly disagree), will score 5 on the new scale. As such our Dependent Variables measure the mitigation effect of our experimental manipulations, where respondents with a positive value are moderators, non-movers have a score of 0, and entrenchers who hardened their stances on climate policies have a negative score. We provide the distribution of our dependent variables in Fig. 2, which suggests that our experiment led to both moderation of stances towards climate policies (positive value), but almost equally entrenchment towards negative views following our experiment.

Online survey experiments can introduce a selection bias by over-representing segments of society. Hence, the data is weighted according to age, gender, and education and NUTS1 or NUTS2 regions in the

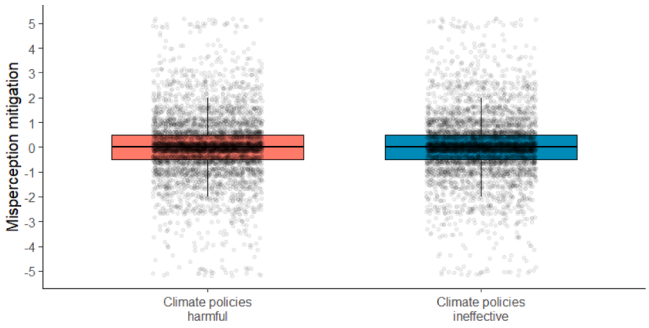

Fig. 2. Boxplot showing the distribution of both Dependent Variables calculated as pre-post within-subject difference indexes ranging between −5 and 5. Sample sizes: N = 5551 (left) and N = 5556 (right).

case of Ireland, to reflect a nationally representative sample. As shown in Appendix A, all experimental conditions are equivalent to one another, and well-balanced.[3] In addition to these socio-demographics we further control for other political predispositions (left-right ideology, political interest, efficacy) and we differentiate between respondents for whom the environment is Most Important Problem (MIP). Although 25 % identified the environment as the MIP, we are aware that in the absence of elite cues—which we do not control nor manipulate here—attitudes are relatively sticky (Zaller, 1992). In fact we do not expect these pro-climate respondents to correct their perception of climate policies.

To test perhaps the most resistant cohort (H2a and H2b), the climate sceptics, we asked three questions that capture beliefs in accepted scientific facts regarding climate change, originally coded 0–10 where 0 means "not certain" and 10 means "certain" (see Appendix A for the question wording). We then created an additive index that places respondents on a continuum ranging from 0 = least climate sceptic, to 10 = most climate sceptic (alpha=0.51), that we eventually divide into discrete categories based on distance from country means: "Low" (below 1 SD), "Medium", or "High" (Above 1 SD) climate scepticism. Although

[3] See Table A.2 in Appendix A.

the Dependent Variables, misperceptions, are moderately correlated with climate scepticism (r = 0.48 for the 'harmful', and r = 0.39 for the 'ineffective' statements), both indicators are conceptually independent. We provide more detailed information on this point in A. B.

In what follows, we attempt to get behind the black box of deliberative assemblies by formally checking for statistically significant differences between the pre- and post-treatment responses using a within-subject design. In the first instance, we will perform paired-sample T-tests using the full sample in line with an Intent-To-Treat approach. This approach is widely recommended in the experimental science literature (Gerber *et al.* 2014). We will then introduce results from weight OLS regressions at the aggregate level to test for the second hypothesis relating to the climate sceptics cohort.

4. Results

Before testing our theoretical expectations a brief descriptive analysis is warranted to ensure workable variability in the data. If we pool respondents pre-treatment scores across both statements that "climate policies are harmful" and "climate policies are ineffective" (Appendix B), we find that Poland (M=5.7), France (M=5.4), and Italy (M=5) appear to hold the strongest contrarian beliefs about climate change policies, somewhat in contrast with Germany (M=4.5) and Ireland (M=4.5) who tend to be on the pro-climate side of the spectrum on average. Overall, these trends are in line with prior work emphasising varying salience and public acceptance of climate policies across our five cases (e.g. Dechezlepretre et al., 2022). In terms of the shape of the distribution, density plots in Fig. 4 suggest that irrespective of the treatment condition, misperceptions shifted in both directions in equal proportion (32 %) as regards the first statement (harmful). The second statement was more sensitive: on average 3 % more respondents shifted towards the pro-climate side compared to the opposite direction, while in both cases 36 % did not shift at all. Interestingly, Fig. 2[4] suggests a slight depolarisation in both "harmful" and "ineffective", where standard deviation decreased from 3.04 to 2.92, and from 2.89 to 2.83 respectively. Overall aggregate data suggests that, if anything, respondents did not respond to the outcome of the CCA, and a study of the differential impact of group assignment is warranted.

To investigate the mechanism which links mitigation of climate

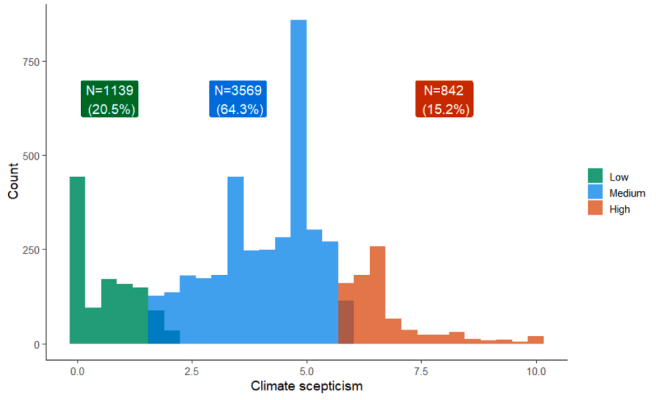

Fig. 3. Distribution of the additive index of climate scepticism in the aggregate dataset. A value of 0 means no climate scepticism while a value of 10 indicates extreme scepticism. The corresponding discrete categories used for the interaction term are calculated based on a division by + /- 1 Standard Deviation from the country mean.

policy perceptions to communication of Climate Citizen Assemblies (H1a and H1b), we randomly assigned respondents to one of four conditions: Control (n = 1000), Representation (n = 1436), Competence (1714), and Voice (n = 1406). In line with a within-subject analysis we look at pre-post mitigation indexes. Fig. 5 summarises the results of paired-sample T-tests using the full sample in respect of both differential indexes of interest, and Appendix D includes a more complete summary. Beginning with the first statement, 'harmfulness', none of the conditions appear to have any significant impact. If anything, compared to the Control group, the Representation and Competence conditions entrenched rather than moderated their views, although this effect is driven by the positive shift of the control group (Mshift=0.05 on the 10-points scale). The second statement, "ineffective" was, however, more significantly impacted by the experiment. In particular, the Voice condition has the greatest impact, t(2.403) = 2.37,[5] implying that significantly more counter-arguing was reported compared to the Control, p = 0.02, d= 0.13. Importantly, this finding does not stem from a shift in the reference group, which barely moved (Mshift=-0.012; Means summarised in Appendix C). With regard to the other conditions, the effects are smaller still. Compared to the control group, the mean score in the Competence condition is small, t(2.710) = -0.94, p = 0.34, d= 0.05 and outside the normal range of significance testing. Similarly, most of the respondents in the Representation condition did not shift their opinion in the pro-climate policy direction, t(2432)= -0.59, p = 0.5, d= 0.03. Although previous studies tend to focus on participation in deliberative assemblies and its expert component (Kuntze and Fesenfeld, 2021), simply conveying to the wider public the process employed to reach a conclusion compels only a minority of citizens to reconsider their beliefs on the effectiveness of environmental policies, but fails to mitigate misperceptions on their 'harmfulness'.

4.1. Effect on climate sceptics

We now turn to our second set of expectations regarding a specific cohort: The climate sceptics, who, due to their distance from country averages, are more likely to correct their misperceptions than already convinced pro-climate activists. That being said, as discussed in the methods section the correlation between climate scepticism and climate misperceptions is far from perfect; we are particularly interested in the 14.7 percent of participants who have Low (High) climate scepticism but negative (positive) views of climate policies. To this end and to confirm the results of T-tests, we employ weighted OLS regressions with country fixed-effects and control variables, and summarise the effects and confidence levels of all predictors in Fig. 6 (full model tables are in Appendix E). In line with earlier results the "harmfulness" statement was not sensitive to our experimental manipulations even after accounting for potential confounders such as education, climate salience, or climate scepticism. However, if we turn to the second statement, "effectiveness", Fig. 6 confirms our prior finding that the Voice condition is more impactful; holding all else equal, the impact of communicating the process involved in a climate assembly on mitigation of misperceptions is modest but significant at the 0.95 confidence level. Substantively, the Average Treatment Effect on the mitigation of climate misperception is 0.12, or a 1.2 % positive shift. Moreover, Fig. 6 suggests that while effects are rather modest, the two Dependent Variables operate in distinct ways. Participants who moderated their views on the 'harmfulness' statement tend to be less educated with low political efficacy, which is in line with prior CCA research (Pilet et al. 2023). Conversely male respondents are more likely than women to correct their stance on the second statement by a magnitude comparable to being assigned to the Voice condition. In fact we find that this effect is primarily driven by Polish and Italian respondents (See country models in Appendix F),

[4] In Appendix B we present more fine-grained density plots within experimental groups and within countries.

[5] When adjusted for pairwise comparisons, the p-value for this effect is p = 0.10.

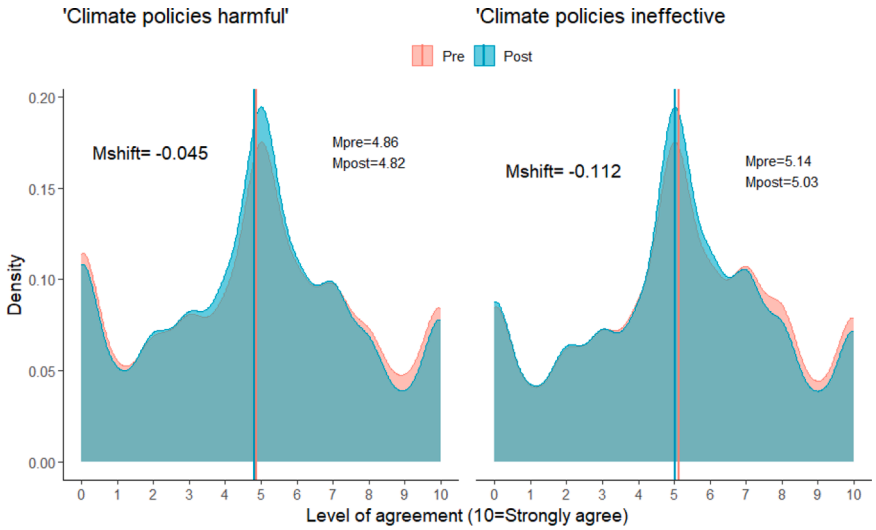

Fig. 4. Density plots showing the distribution of raw agreement scores with both contrarian statements of interest before and after treatment. Sample is aggregated across all four experimental conditions (N = 5556) and unweighted.

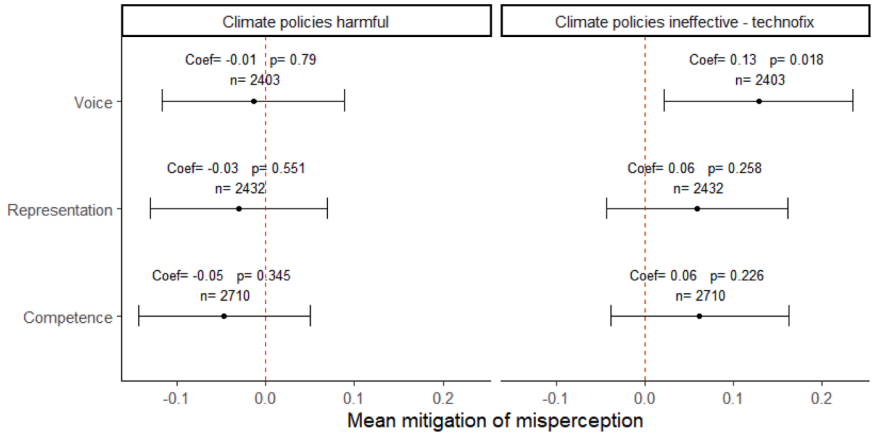

Fig. 5. Effect of treatment on mitigation of climate policies misperceptions using paired-sample T-tests. Reference is the Control group (N = 1000). Weighted by age, gender, region and education attainments.

which is surprising considering previous research in Poland showing a gender divide on environmental issues, with women being more progressive than men (Rowland et al. 2022). Future analyses should investigate these contradicting results, but generally, we can say that in our representative sample, countervailing effects are at play, which dilutes our experiment's effects at the aggregate analysis level.

In terms of the effect on the climate sceptics, the picture painted by the data is rather nuanced. On the one hand the experiment did not challenge by any significant measure respondents' views on the 'harmfulness' argument. However, strikingly, they were particularly amenable to moderating their views on the "effectiveness/technofix" statement (Fig. 7; Full models are in D). Although on average climate sceptics are less likely to mitigate their misperceptions, we find that in the Representation condition the more sceptical of the scientific basis for, or the human impact on climate change, the more likely individuals will correct their beliefs on the effectiveness of environmental policies. In other words, being informed of the representative component of a climate assembly has a 1.8 % positive impact on ($p < 0.01$) on mitigation effect among respondents with a high degree of climate scepticism (H2a). Among the respondents who shifted their opinion on climate policies towards the expected direction formalised in hypothesis H1a (33 % on average), 11 % of them hold above average (6.3 % in the high scepticism category overall) climate sceptical views. These are, of course, outliers, but given the stickiness of climate attitudes and the fact that they are the cohort most difficult to reach, it is noteworthy, especially as the direction of the interaction effect only occurs in the Representation condition (Fig. 7).

To investigate potential countervailing effects, we run separate OLS regressions in each country which is a sensible approach given that randomisation was performed at the country-level (Appendix F). Focusing on the 'harmful' statement first, significant shifts in the control group tend to bias pairwise group comparisons, leading to potentially misleading results, as can be seen in France and Germany, for example. Overall, we can say that that our experiment has not changed people's minds on the perceived 'harmfulness' of climate policies and we offer potential explanations in the discussion section below. Conversely, if we turn to the second statement on the perceived 'ineffectiveness' of climate policies, the control group is considerably more stable throughout the experiment. In Appendix F, country-level models indicate that the impact of voice is most marked in Germany where the effect is twice as large as that in the aggregate ($b=0.25$, $p < 0.01$). That the experiment worked especially well in this country is a significant finding because Germany, often regarded as a climate pioneer with its energiewende, has much lower levels of climate policy salience (EB 2023; Leiserowitz et al., 2023). Although outside of normal significance testing range, the Voice condition works reasonably well in France, and Ireland.

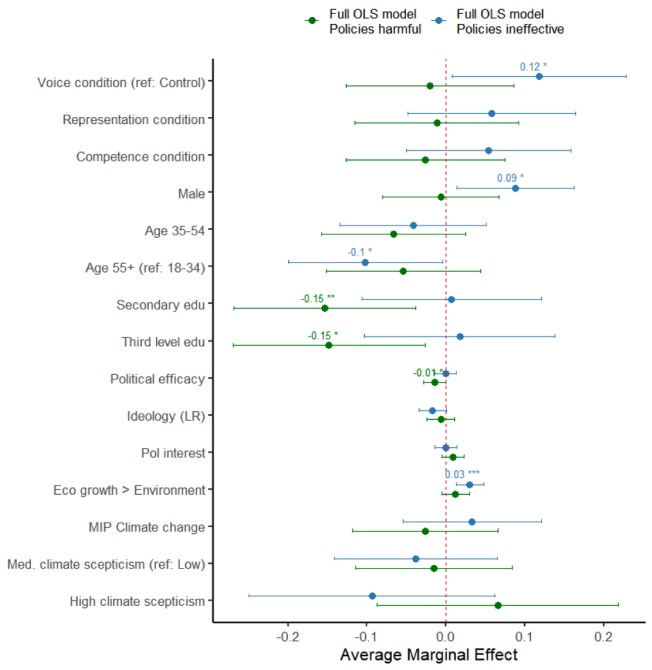

Fig. 6. Average Marginal Effect plot based on full models 2 and 5 (Appendix E) in which weighted OLS regression results are displayed. These models include country FE.

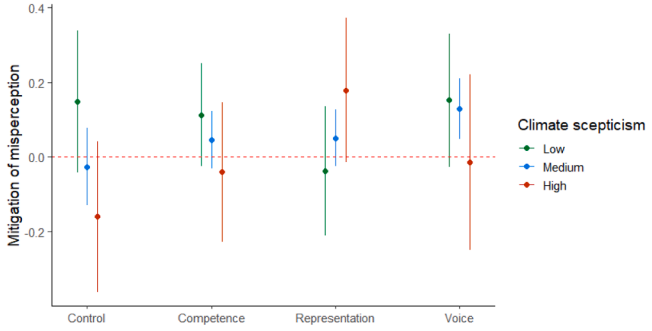

Fig. 7. Interaction effect of climate scepticism on mitigation of climate policies misperceptions. DV: pre-post differential index scaled −5–5 in respect of agreement with statement: "climate policies are ineffective, technology will fix the issue". Results based on model 6 (Appendix E).

5. Discussion and conclusion

Our ambition was to uncover whether a climate assembly may be effective at mitigating particular misperceptions on climate policies and if so, which procedural elements of an assembly are most efficacious thus adding to the literature on the mixed effects of Climate Change Assemblies for non-participating citizens (van der Does and Jacquet, 2023). Importantly, in light of such prior findings our study kept an open mind regarding the direction of the effect, by formulating expectations that participants will either mitigate (H1a) or entrench (H1b) their views on climate policies. First, with regards to our first dependent variable that climate policies are harmful, we find largely null results for H1(a) and H1(b). Simply put we don't find much variation in our choice of variable. It would seem that for most people reading about a climate citizens' assembly irrespective of whether the representation, competence or voice aspects are highlighted makes little difference to their perceptions of the harmfulness of climate policies. Of course, mitigating misperceptions, particularly when it is associated with a strong underlying identity is hard, and here respondents were merely exposed to a single vignette. Thus while these contrarian statements are pervasive it would seem that they are not what climate assemblies should be targeted at correcting. Nonetheless, we do see that people do moderate or mitigate their attitudes a little in aggregate but not in sufficient numbers to achieve statistical significance.

In relation to our second dependent variable that climate policies are ineffective and that technological solutions will fix the issue, we do find a moderating effect towards a pro-climate stance at aggregate level particularly in the voice condition confirming H1(a). Again there is some entrenchment in France but not at a statistically significant level. This is in line with previous findings that both techno-optimistic and techno-pessimistic attitudes are positively associated with behavioural intentions through an increase in climate change concern (Cologna et al. 2024; Whitmarsh, Xenias, and Jones, 2019).

In terms of our H2 regarding climate sceptics we again find little evidence of a willingness to either moderate (H2a) or entrench misperceptions (H2b) that climate policies are harmful, but a little more movement in the position that policies are ineffective. Importantly, it is the representative condition that matters most for these cohorts. Thus we can argue that there are likely myriad possible positive impacts of holding client citizens' assemblies to enable climate policies, but large-scale mitigation of misperception does not appear to be one of them. Nonetheless, we do have some insights which may be useful for policymakers and for future scientific inquiry.

First it would seem that voice is an important condition that may have more potential to alter perceptions than other more usual considerations such as representation. In other words, citizens in the wider public may find it most persuasive that they had the opportunity to have their voice heard or included in the assembly more than simply relying on others to represent them or on expert opinion. This is potentially because while the majority of EU citizens are concerned about climate change and want to see climate action, beliefs about the effectiveness and progressiveness of a given policy are important drivers of support in Germany, France, Italy and Poland (Dechezleprêtre et al. 2024). This research found that "a significant share of the baseline opposition can be swayed by explanations of how the policies work and who they impact'' (p36). These aspects, which are underpinned by ideas of fairness in policymaking, are most strongly highlighted in the Voice condition. That also fits with other research on the potential for combining synchronous citizens' assemblies with online participation procedures for the larger public (Itten and Mouter, 2022). Further, as CAs do not often encompass these formula connections with the maxi-public we should perhaps consider this more often. But this may backfire at least in France and hence more research is required.

Second, it is also worth noting that our preliminary findings suggest that public communication about the representative aspect of a mini-public and its outcomes is a persuasive factor for non-participating citizens with climate sceptical views - a cohort that is most likely to be resistant to transformative climate action. It is interesting that those with outlier climate sceptic views may be willing to correct their misperceptions on climate policy when exposed to communication about key processes for engaging citizens in a CA. Our study found that the Representation condition was the most persuasive among climate sceptical citizens. However, this was only true for the statement that 'climate policies are ineffective and technological solutions will fix the problem' rather than the statement 'climate policies are harmful'. Thus there may well be incentives for organisers to talk about their recruitment and how they ensure better descriptive representation. This is significant in the context of increasing political polarisation and rising far-right politics around climate policy across Europe.

This finding suggests that those with alternative and/or minority views may want to see their perspectives aired in a formal climate policy deliberation forum. This would suggest that CAs are most persuasive when they are shown to provide a platform for the politics of dissensus in a mainstream fora. This finding is also consistent with Kuntze and Fesenfield's (2021) study, which found that CAs are beneficial, when the

Representation condition is highlighted, at least in the German context. As noted above this is in line with previous survey analysis on public attitudes towards citizen assemblies (Kuntze and Fesenfeld, 2021) who found that, in Germany, a citizen assembly can increase public support for climate policies. The findings showed that the climate sceptic cohort was also more likely to shift in the expected direction in the Representation condition in Ireland compared to the control group

Of course, there are limitations to this study and suggestions for further research. As the scope of our research was restricted to five countries, further research is needed to ascertain whether these findings are replicated in other countries and among other cohorts. Our finding that the Voice condition has the most impact is robust to manipulation and attentiveness checks, in addition to weighting of participants' responses, and should be explored using alternative experimental designs. Indeed, we leveraged screening questions such as attention check and speeders (see Appendix G). Although the direction of the effects does not change, its size does, and this could be due to the perennial issue of statistical power and the modest effect size one can expect from a vignette experiment. Unfortunately, we could not formally establish a causal link by isolating the non-compliers because doing so would put randomisation in jeopardy. We maintain that the screener questions appear valid as they correlate with known demographics (see Appendix C, figure C.1). Our compliance rate is 61 % and future work should tackle the same question with a design that should hopefully appeal to a higher percentage of respondents.

Upon close scrutiny of country-level results (Appendix F) we find sizable countervailing effects, most notably among respondents in the control group who shifted on the 'harmful' argument by a comparable if not greater magnitude than respondents assigned to a treatment condition. We can see two explanations for this phenomenon. First, our design was conscious of priming effects and questions were rotated to minimise them. Nonetheless for many respondents the pre-treatment measure occurred prior to administering a long battery of questions on environmental attitudes which may have biased their perceptions. Relatedly, we are aware that 'climate policies are harmful' may evoke strong emotional responses and the need for social desirability may have subsequently compelled respondents to either moderate or entrench their views without any experimental manipulation. Likewise, survey fatigue may have aggravated those who initially assigned a low score. Indeed we found that the spread of responses (Standard Deviation) generally declined throughout the experimental process for both dependent variables which indicates that respondents shifted towards the mean. Furthermore, the size of the effect is smaller than initially anticipated. On the one hand, although 40 % of our sample identified climate change as an important problem (25 % if we only consider the number one issue; See Appendix B), previous research suggests that this is in fact relatively low. For example, a similar question from EC (2023) research that assessed participants' views on the importance of Climate Change puts this figure at 80 % for all but Poland. Similarly, survey responses to views on the single most important problem were over 40 % (apart from Poland 28 %). This suggests that the respondents in our survey are somewhat more critical than what prior work suggests despite a rigorous sampling method.

But beyond motivational aspects and cognisant of the cost it would incur, we also think that future work could operationalise different dependent variables with a greater degree of precision by asking a more specific range of questions, perhaps testing the influence of CAs on different policy formulations comparing more acceptable and more challenging policies. Indeed, authors such as Crawley et al. (2022) have noted the distinction between survey research examining climate action as an abstract idea versus specific policies in the national context and highlighted the need to focus on climate policy salience. Other survey studies of citizen perceptions confirm this point. For example, Abou--Chadi et al. (2024) found high levels of public concern about climate change, but much lower levels of support for transformative policy options such as banning combustion engine cars and reducing fossil fuels. In particular, Abou-Chadi et al. 2024 have shown that resistance to transformative policies runs across the political spectrum. As with much climate perception and opinion research, our study posed an abstract question about climate policy. This could explain the low effect levels of the treatments, as people are not resistant to climate policy as an abstract concept. Therefore, future research should focus on specific policy formulations and test public responses to policies with both high and low levels of support (i.e.) by drawing on climate policy formulations in Abou-Chadi et al. (2024).

Relatedly, while 0–10 scales are defensible insofar as they offer fine-grained measures in easy-to-interpret models (OLS), they may be slightly tedious for respondents in opt-in online surveys. Future research should work to find a healthy balance between ease of response by adopting a smaller scale, and alleviating risks of floor effects—where the control group moves in tandem with the treatment group. A further caveat in this novel experiment is that our vignettes are built upon each other in such a way that processing information in the Competence condition is built upon Representation, and Voice is built upon the latter two in terms. In order to conclusively isolate the empowering effect of communication on climate assemblies, future work should more precisely manipulate information on the process of climate assemblies. Moreover, our questionnaire did not include the fine-grained information on group membership (e.g. ethnic) that would allow us to capture the empowering function of climate assemblies. Further, our experiment was included at the end of a relatively long survey as part of a broader project (approx 20 minutes long). Online experiments are fraught with compliance issues related to the lack of supervision. Future experimental research should restrict the scope of the questionnaire in order to retain participants' full attention. It could also capture respondents' agreement with the outcomes, and then particularly focussing on the effect on the perceptions of those opposed.

Nonetheless, our study is important as it takes place in a new context for climate governance and policy-making in the EU, in which the rise of far-right rhetoric is driving climate scepticism and fostering new societal divisions, thereby adding to climate misinformation. Our finding that Voice is most important for the correction of misperceptions generally could underpin choices when it comes to the design of these processes, ensuring there is plenty of opportunity for the wider public to insert their views into the process. The finding that the Representation condition is a key persuasive factor in the reduction of climate misperceptions among sceptical cohorts in the wider public suggests that communication about CAs could help to foster more democratic debate about climate policy in the context of rising climate sceptic rhetoric.

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Author statement

Author contribution: All authors have accepted responsibility for the entire content of this manuscript and consented to its submission to the journal, reviewed all the results and approved the final version of the manuscript. JS provided the conceptualisation and designed the experiment, and KS conducted the analysis and contributed to the diussion and conclusion. BMcN provided the conceptual work on climate misinformation and contributed to the literature review and interpretation of data as well as the discussion.

CRediT authorship contribution statement

Brenda McNally: Writing – original draft. **Jane Suiter:** Writing – review & editing, Writing – original draft, Supervision, Resources,

Project administration, Investigation, Funding acquisition, Conceptualization. **Kevin Saude:** Methodology, Investigation, Data curation.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests. Jane Suiter reports financial support was provided by Horizon Europe. Jane Suiter reports financial support was provided by Irish Research Council. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.envsci.2025.103995.

Data availability

Data will be made available on request.

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