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Awareness of opinion change: evidence from two deliberative mini-publics

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Although opinion changes during discussions and negotiations have been studied extensively in different fields of research, surprisingly little effort has been put into studying whether people correctly recognize that they revised their opinions. This is important because it has implications for both the cognitive mechanisms underpinning these changes and their likely consequences. We in this study examine whether participants in two deliberative mini-publics (DMP) were able to determine the extent to which they revised their opinions (DMP1 = 135; DMP2 = 207). We measure awareness with two questions asking respondents to indicate the extent to which their opinions and views changed during the processes, while we ascertain the actual developments with three measures that capture developments in opinions and attitude consistency. Our results suggest that people are generally unaware of revising their opinions during these processes, and it is only for drastic opinion changes that people have some level of awareness. The difference in how people perceive opinion change compared to how they respond to statements about policy issues shows that probing opinion changes by asking people directly about this can be problematic from a methodological standpoint.

KEYWORDS

opinion change, attitude awareness, measurement, deliberation, political science

Introduction

The aim of this study is to gain more knowledge on the extent to which people accurately perceive they change opinions over time and how this can be measured. Although opinion changes have been examined extensively, there is relatively little research on people's awareness of how their opinions change (see Hellqvist, 2023 for a recent exception). Our understanding of opinion change awareness is to a large degree based on how opinion change is examined and explained in different studies. Moreover, these explanations and the evidence they are based on seem to point in different directions.

Some classic work suggests that people generally hold few stable opinions, basically making up answers when asked in a more or less random fashion or based on perceived ideological heuristics and cues (Converse, 1964; Zaller, 1992; Zaller and Feldman, 1992). There is also psychological research suggesting that people are unlikely to update their opinions in an appropriate manner when faced with convincing evidence that contradicts their priors (Festinger, 1957; Kunda, 1990; Taber and Lodge, 2006). These results suggest that it is unlikely that people are aware of any opinion change.

Other studies contradict this argument and suggest instead that people are able to accurately determine the extent to which they revise their opinions as a consequence of a particular occasion (Pratt et al., 2000; Hill and Betz, 2005). These findings are aligned with assumptions and evidence from the field of deliberative democracy, where opinions are seen

as malleable and transformable rather than predetermined, and rationally motivated opinion change plays a prominent role (Warren, 1992). The main reasons why deliberation should be conducive to rational opinion change is that participants are expected to, on the one hand, justify their opinions in terms of reasons that all could accept and, on the other hand, listen and reflect on opinions presented by others (Cohen, 1989; Bohman, 1996; Dryzek, 2002). Consequently, a large body of literature has examined the extent to which opinion changes occur as a result of taking part in a deliberative process and what forms these changes may take (Luskin et al., 2002; Setälä et al., 2010; Himmelroos and Christensen, 2014; Grönlund et al., 2015; Westwood, 2015; Suiter et al., 2016; Lindell et al., 2017; Strandberg et al., 2019; Niemeyer et al., 2023). The gist of this body of research is that deliberative communication and behavior explain a substantial amount of the opinion changes taking place in deliberative events, such as mini-publics. In other words, opinions change as people discuss and reflect upon their opinions, which should indicate that they are aware of how their opinions develop.

The question of whether people can accurately determine the extent to which they revise their opinions when faced with new evidence is an important topic for the social sciences for several reasons. It tells us something about the cognitive processes that sustain the updating of opinions and citizens' ability to engage in a rational processing of information. In this sense, it can be seen as important from the standpoint of a functioning democratic society, as it may help us understand when and how people are able to evaluate their own perspective in societies that are increasingly plagued by polarized views and alternative facts. There are also more practical reasons for gaining a better understanding of the extent to which people realize the opinion changes they undergo during involvement in experimental studies. How participants understand measurements has methodological implications for how opinion changes should be measured and ethical implications regarding the involvement of citizens in such experiments.

Considering the information-processing and interactive reflection that public deliberation involves, deliberative processes should offer a valuable testing ground for examining whether people are at all aware of the opinion changes that they incur. Deliberative forums, like mini-publics that encourage deliberative communication and reasoning, should be the most likely environment for people to recognize how their opinions change. If there is little awareness of opinion change among participants in mini-public, it is likely to be even lower elsewhere. Hence, we explore to what extent people participating in deliberative mini-publics recognize the changes of opinion they experience. To do this, we compare responses from survey items where participants were asked to evaluate whether they had changed their minds due to deliberation with items measuring their policy attitudes before and after the deliberative event. We use data from two experimental deliberative mini-publics organized in Finland to better understand this relationship.

Our findings suggest that there is limited awareness of opinion changes. The participants in the mini-publics were most likely to recognize opinion change for statements where they had changed sides, i.e., changed from positive to negative, or vice versa, on the different opinion items. However, the participants were unable (or unwilling) to recognize opinion change that took them toward more extreme viewpoints. Interestingly, the negative awareness effect found for opinion polarization was the most prominent finding in both mini-publics we examined.

Opinion change awareness

Opinion change is a topic that is associated with conflicting assumptions. In traditional microeconomics, preferences are seen as relatively stable, and preference change thus as a relatively uninteresting phenomenon (Grüne-Yanoff and Hansson, 2009). However, in psychology and public opinion research, it is often suggested that most people do not have established opinions on most issues and are likely to change their response in a more or less random manner when responding to the same statement multiple times (e.g., Converse, 1964; Kahneman et al., 1982).

Considering the conflicting assumptions about opinion change, it may come as no surprise that there are different perspectives on whether people are aware of opinion changes as well. Based on the studies suggesting that people do not hold stable and consistent political opinions, it would seem like recognizing opinion changes would be impossible for most people. And surely enough, studies do suggest that self-knowledge about attitude changes is generally limited (Wilson and Dunn, 2004).

Cognitive dissonance theory (Festinger, 1957) provides a compelling reason why people may be unable to recognize that they have changed their minds. According to this social psychology theory, people strive for cognitive consistency. Consequently, when individuals hold two or more inconsistent beliefs, attitudes, or behaviors, they experience psychological discomfort or cognitive dissonance. For example, the discomfort individuals feel from having conflicting opinions motivates them to change their attitudes or behavior. A well-known example is the fable about the fox and the grapes, where the fox insists that the grapes must be sour because he cannot reach them (Elster, 1983).

If we apply this idea to the circumstances of opinion change, we expect awareness of opinion change to be limited because it requires us to recognize a conflict between our opinions (Tavris and Aronson, 2020). For this reason, people may be unwilling to acknowledge a change of mind when confronted with evidence that dispels their original beliefs. To reduce the discomfort of being wrong or thinking about our incompatible opinions, people simply ignore the prior opinions and disregard that an opinion change has occurred. Research on self-knowledge suggests that the repression of unpleasant or anxiety-provoking thoughts usually is so successful that people do not understand how limited their self-knowledge is Wilson and Dunn (2004).

This notion is supported by research on knowledge awareness, which suggests that the scope of people's ignorance is largely invisible to them (Dunning, 2011). According to the well-known Dunning-Kruger effect, people generally overestimate their knowledge of a specific subject, and the less they know, the more unaware they are of how deficient their expertise is Kruger and Dunning (1999). The understanding of one's ignorance, or opinions for that matter, will always be incomplete, and Dunning (2011, p. 251) points out that "it is nearly impossible, left to one's own

devices, for one to surmise what one does not know." Even if these findings concern awareness of knowledge rather than opinions, it fits with the general understanding of self-knowledge. It also resonates with what we know about political opinion formation more generally. More knowledgeable voters tend to have more stable and coherent opinions on policy issues (Zaller, 1992).

This disconnect between opinions and awareness of opinion changes is affirmed by research on explicit and implicit attitude measures of opinion change (Oskamp and Schultz, 2005). Explicit measures of attitudes are exemplified by traditional self-report measures. In contrast, implicit measures of attitudes generally rely on automatic responses to the attitude object, such as response latency when observing a social issue (Dovidio et al., 1997). From this research, we, e.g., learn that there is a noticeable disconnect between implicit negative racial attitudes and self-reported prejudice. We tend to (or want to) think we are less prejudiced than we are. Looking specifically at explicit measures of opinion change, Graham and Coppock (2021) find that they also exhibit poor measurement properties and tend to be unreflective of actual opinion changes.

Hence there is compelling evidence to suggest that people are unaware of their opinions and opinion changes, or at least prefer to ignore them when faced with the inconsistencies that changes would suggest. Nevertheless, there are also different strands of research suggesting that people are aware of their opinions and can be aware of developments in them occurring due to reflection and new evidence. We here focus on two types of literature, both of which suggest that people can recognize when they experience opinion changes.

The first strand is a methodological approach to measuring opinion changes. Opinion changes are often measured with a pretest/posttest design, where attitudes are measured before and after an occurrence, either in a one-group design or in an experimental design that includes a control group that does not receive the treatment (Shadish et al., 2002). However, this approach suffers from some potential weaknesses such as attrition, retest effects, and social desirability bias (Little et al., 2020). For this reason, some suggest a different approach where people are asked to indicate how they perceive their opinions changed because of the intervention (Pratt et al., 2000; Hill and Betz, 2005). There are slightly different variants in use, but they all rest on the common assumption that respondents are able to assess how their attitudes developed as a result of a particular occurrence such as a policy change or an experimental treatment. In this sense, these methods rely on people being adequately aware of their opinions and potential developments in these. These methods have been used, for example to measure the effect of being active in political participation on political trust (Åström et al., 2017; Christensen, 2019) and are argued to provide a simple, convenient, and expeditious method for assessing program effects in responsive interventions (Pratt et al., 2000).

The second strand of research where awareness of opinion changes is central is deliberative democratic theory. The study of deliberative democracy and its potential for replacing or at least reinvigorating traditional representative democracy has been a popular field of research in recent decades (Fishkin, 1991, 2009; Chambers, 1996; Dryzek, 2002). While important differences exist, most scholars within this field at least implicitly assume that people are aware of their opinions and can tell when they have changed. According to Dryzek (2002, p. 1), deliberation is distinguished from other forms of political communication "in that deliberators are amenable to changing their judgments, preferences, and views during the course of the interaction."

Opinion change plays a prominent role in research on public deliberation since participants are expected to justify their opinions in terms of reasons that all could accept and be open-minded toward opinions and arguments presented by others. In deliberation, opinion changes should take place after participants have reflected on the matter at hand and accepted a particular position or argument as valid. According to the communicative rationality inherent to a Habermasian understanding of deliberative democracy, those taking part in the deliberations are expected to change or adjust their opinions to the extent they are presented with a better argument in a matter where opinions differ (Habermas, 1984, 1996). In other words, opinion change induced by public deliberation is expected to happen after participants have engaged in an extensive process of communicative reasoning and concluded that a particular opinion is supported by stronger arguments than other opinions. To the extent that opinion change is not the result of a deliberate choice of the participant, the process would not live up to the ideals of deliberative democracy (Habermas, 1984; Cohen, 1989). This also entails that participants ought to be aware of having revised their original position, and to some extent even be willing to admit it, since they should see it as achieving a more enlightened opinion.

Considering this, it should come as no surprise that much of the empirical work within this field of research has focused on examining the extent to which opinion changes occur during deliberative processes, usually in the form of a deliberative mini-public. Deliberative mini-publics are designed to foster the type of ideal discussion climate envisioned in deliberative democratic theory. To this end, they involve a limited number of citizens who engage in structured and facilitated discussion about a specific issue. The goal is to ensure that all participants have an opportunity to share their perspectives and to help them reach a well-informed and well-considered conclusion on the matter at hand. For the findings to be representative, or at least more relevant to a broader public, the participants in the mini-public represent a diverse range of views and perspectives (Grönlund et al., 2014; Fishkin, 2018). Most of the studies find that participants do revise their opinions during deliberation, although the form and extent of these revisions are still debated (Luskin et al., 2002; Setälä et al., 2010; Himmelroos and Christensen, 2014; Grönlund et al., 2015; Westwood, 2015; Suiter et al., 2016; Lindell et al., 2017; Strandberg et al., 2019; Niemeyer et al., 2023). Moreover, there is evidence to suggest that opinion changes in deliberative events take place because participants exchange information and reflect on different policy alternatives. There are e.g. studies linking knowledge gains and learning to opinion change (Luskin et al., 2002; Suiter et al., 2016; Christensen, 2019), while other studies show that the deliberative quality of the communication can determine how opinions change (Himmelroos and Christensen, 2014; Westwood, 2015). Hence, even if we don't expect real-life political communication and reasoning to live up to the lofty ideals of deliberative democracy,

TABLE 1 Characteristics of mini-publics.

	DMP1	DMP2
Topic for discussion	Building a new nuclear power plant	Immigration policies
Year	2006	2012
Meeting days	1	2
Number of participants	135	207
Number of discussion groups	12	26
Moderator and discussion rules	Yes	Yes
Information packages	Yes	Yes
Expert panel	Yes	No
Mode of meeting	Face-to-face	Face-to-face
Treatment	Secret ballot vs. common statement	Like-minded vs. Mixed discussion groups

there is reason to expect participants in deliberative mini-publics to recognize opinion changes they experience during the event.

However, it may be important to be aware of the subtle differences that can exist between deliberative processes to fully grasp the opinion changes that occur. Some studies suggest that opinions change differently depending on the conditions in the deliberative mini-public. For example, when comparing opinion change in two types of deliberative discussion treatments to a control group, Himmelroos and Christensen (2020) found that participants in a deliberative treatment with diverse opinions were more likely to change opinions compared to both people discussing with like-minded people and the control group. Moreover, Strandberg et al. (2019), using an experimental design with participants taking part in either facilitated or non-facilitated small groups in a deliberative mini-public, show that the presence of facilitation according to deliberative rules reduces attitude polarization. These two studies indicate first of all that carefully designed deliberative environments may facilitate more opinion changes compared to non-deliberative conditions, but also that even within a deliberative setting small procedural differences may matter for the form of opinion change.

To sum up, there is conflicting expectations as to whether people are willing and able to recognize opinion changes. However, we have reasons to believe that people should be more willing to recognize such opinion changes when they occur following a deliberative process. We therefore argue that deliberative mini-publics constitute a most-likely case for examining whether people are able to recognize changing their opinions. If people are unable to recognize opinion changes here, they are unlikely to do it under less favorable conditions.

In the following, we explain how we examine the link between observed opinion changes and awareness of these changes in two deliberative mini-publics.

Data and variables

To explore the relationship between opinion change and self-reported awareness of said changes we rely on data from two deliberative mini-publics with suitable measures for our purposes, where participants were recruited through a random sample of the adult population in the southwestern region of Finland. The first mini-public concerned nuclear power and energy policies (henceforth DMP1), whereas the second mini-public concerned immigration (hereafter DMP2). Table 1 shows the main characteristics of the two mini-publics (see Herne et al., 2019 for more information).

An important difference that may be argued to affect the results is that the two DMPs concern seemingly different issues. It may be argued that nuclear policies are more technical compared to immigration policies, which have a strong emotional component. Nevertheless, both topics were selected for discussion because they were highly contentious and were frequently debated in the public discourse at the time of the discussions. Although we cannot entirely rule out that the difference in topics would have an impact on the results, differences due to the contentiousness or publicity of the issues should be negligible.

To measure developments in attitudes and opinions concerning the topics, surveys were administered before and after the deliberative process. The measuring points are in both mini-publics, referred to as T1 before deliberation and T4 after the conclusion of the deliberation. These surveys also included items on other relevant aspects since as general background variables and political attitudes and opinions on the deliberative events. In both mini-publics, the small-group discussions were informed by discussion rules derived from the ideals of deliberative democracy (Strandberg et al., 2019). Trained moderators who led the discussions read the rules aloud in the beginning of the small group discussions, and the rules were also handed out to participants.

Both mini-publics were organized as experiments designed to test the influence of a certain manipulation in the conditions of deliberation. In DMP1, discussing nuclear power, the 135 participants were distributed into 12 smaller discussion groups and had to decide whether they thought a sixth nuclear power plant should be built in Finland (Setälä et al., 2010). The treatment was the decision-making method for making these decisions in each group. Six groups made the decision with a secret ballot where the majority would prevail, whereas the other half wrote a common statement where they aimed to find consensus. Writing a common statement entails that participants must scrutinize both their own beliefs and those of others to a greater extent and may thus enhance meta-consensus on participants' values, beliefs, and preferences (Dryzek and Niemeyer, 2006), even if a full consensus cannot be reached. Hence, it can be expected to have a larger impact on participants' views than a secret vote (Setälä et al., 2010). We, therefore, expect that there is a stronger link between subjective and objective opinion change in groups where decisions were made through a common statement.

In DMP2 discussing immigration policies, the 207 participants were distributed into 26 smaller discussion groups. The discussion groups' composition was manipulated so that in 11 of the small groups ($n = 88$), deliberation was cross-cutting, meaning that

TABLE 2 Percentages for awareness.

Indicator (n)	DMP 1: Nuclear power %					Indicator (n)	DMP 2: Immigration %				
	Totally disagree	Somewhat disagree	Somewhat agree	Totally agree			Strongly disagree	Disagree	Cannot say	Agree	Strongly agree
My position on nuclear policies changed (127)	54.33	23.62	20.47	1.57		*My position on immigration policies changed (207)*	17.39	54.59	6.76	19.81	1.45
My views on energy policies changed (128)	25.78	29.69	37.50	7.03		*My views on immigration policies changed (205)*	16.59	51.22	9.27	20.00	2.93

The entries show percentages of respondents selecting each answer category for each question on perceived opinion change.

some participants were positive toward immigration and others were negative. In the remaining 15 groups, deliberation was like-minded, which entailed that all participants (n=119) were all either positive or negative toward immigration (Grönlund et al., 2015). The manipulation of the group composition entailed that people who held no clear opinions on immigration, i.e., those who were in the middle of the distribution, were excluded from taking part to ensure that all participants were firmly either positive or negative. We here expect that people the link between subjective and objective opinion change is stronger in groups with cross-cutting deliberation. Presumably, the participants who took part in cross-cutting deliberation were exposed to a diverse set of arguments, which may make them question previously held beliefs (Grönlund et al., 2015; Strandberg et al., 2019; Himmelroos and Christensen, 2020). We, therefore, expect that they become more aware of any opinion changes that occurred during the deliberative process.

Awareness of opinion change

We measure awareness of opinion change with a similar question in both mini-publics, where respondents were asked about whether they thought that they had revised their opinions during the proceedings:

1. *DMP1: My position on nuclear power changed during the citizen assembly* (four- point Likert scale *Totally disagree-Totally agree*).
2. *DMP2: My position on immigration changed as a result of the discussions* (5-point Likert scale *Strongly disagree – Strongly agree* including intermediate category *Cannot say*).

There are minor differences in phrasing and answer categories, but these are unlikely to influence the results, especially since few respondents choose the intermediate category when given the chance in DMP2, as shown in Table 1. These two questions will form the main dependent variables during the presentation of the analyses. Two more questions that also probe awareness of opinion changes will be used as a robustness test to see whether we get similar results for other types of questions. While both questions also probe awareness of opinion changes, they are more difficult to compare since the question in DMP1 asks about energy policies more generally, whereas the question in DMP2 asks whether respondents changed their perceptions of immigration policies:

1. *DMP1: My views on energy policies changed during the citizen assembly* (four-point Likert scale *Totally disagree-Totally agree*).
2. *DMP2: My views on immigration policies changed during the citizen assembly* (5-point Likert scale *Strongly disagree–Strongly agree* including intermediate category *Cannot say*).

Table 2 presents descriptive information on all four questions.

TABLE 3 Descriptive statistics for empirical measures.

	DMP 1: Nuclear power					DMP 2: Immigration			
Measure (n)	Mean	SD	Min	Max	Measure (n)	Mean	SD	Min	Max
Directional change (83)	0.19	1.30	−2.67	4.00	*Opinion change (183)*	0.56	1.33	−3.77	3.97
Changing side-index (121)	2.07	1.91	0.00	7.00	*Changing side-index (183)*	2.15	2.02	0.00	9.00
Polarization (127)	2.82	2.44	0.00	8.00	*Polarization (183)*	4.15	3.30	0.00	14.00

The entries show descriptive statistics for the three empirical measures of opinion change.

Empirical measures of opinion change

We use three indexes to measure opinion changes without asking respondents directly. These are all constructed based on answers to attitudinal questions that were asked about the topics of the deliberative mini-publics before and after deliberation, but different arithmetic operations give slightly different insights into the potential opinion change (see Appendix for a list of all items).

DMP1 included eight questions probing attitudes to the use of nuclear energy. The answers to these questions were all given on a four-graded scale totally disagree-Totally agree. All "Don't know" answers are coded as missing.

In DMP2, there were 14 items measuring attitudes to immigration that were measured at T1 and T4: The answers to questions 1–3 were presented on a scale from 0 to 10, while the answers to questions 3–14 were presented as a Likert scale with four values.

In both experiments, exploratory factor analysis showed that the questions form a single latent construct (see Appendix). This one-dimensionality entails that we can reasonably assume that respondents perceive the questions as involving the same topic, which entails that we can form indexes measuring different forms of opinion changes.

Based on these questions, we develop three different measures that we use in both mini-publics to empirically capture developments in opinions and attitude consistency (Answers to some questions were reversed to ensure that answers have a similar interpretation):

1. ***Directional change***: *the directional change to either pole from T1-T4 (becoming either more positive or more negative toward the issue). This was constructed by summing the change on each question from T1-T4, thereby capturing the extent to which respondents became more for or against the topic.*
2. ***Change side***: *whether respondents changed side (went from positive to negative or vice versa) on each item, thereby forming an index of changing side. For each question, we here coded whether the respondent reversed their opinion and used these to create a sum index measuring the extent of reversal.*
3. ***Polarization (changes toward extremes)***: *This measure was developed by Herne et al. (2019) based on the work of Wojcieszak (2011) and is an index that measures whether respondents became more extreme. For each question, we code whether respondents moved further to the pole at T4 they were leaning toward at T1 and sum the results to construct an index measuring the extent of polarization.*

Although these indexes are by no means perfect indicators of all possible changes, they present a variety of measures that are frequently used to capture opinion changes on empirical research on opinion changes in deliberative mini-publics.

Table 3 provides descriptive information on these three measures.

All measures indicate some developments, but there is also a tendency that these are limited on most accounts since the mean values are closer to zero compared to the feasible maximum scores.

By examining the relationship between these objective and subjective measures of opinion change, we aim to discern whether respondents were aware of the changes that occurred.

Analysis

To examine the connections between subjective and objective opinion changes, we plot the distributions of observed and subjective developments (see Figure 1). These results indicate a weak relationship between objective and subjective opinion change. For directional change, or whether respondents move uniformly toward either side, the relationship in DMP1 is virtually non-existent as indicated by the horizontal fitted line, whereas it is weakly positive in DMP2, which may show that there is some correct awareness of the opinion changes. The relationships are somewhat more pronounced for changing side, which indicates that respondents are more aware of this form of opinion change, which seems reasonable since it involves directly reversing previously held opinions. Finally, we can see that there is a negative relationship with polarization, which indicates that to the extent that any relationship exists, respondents tend to be directly wrong about becoming more extreme.

The results indicate that people may be aware of reversing previous positions, but more subtle opinion changes are harder to be aware of. We explore this next by examining correlations between the measures reported in Table 4. We here report the results of both Pearson's and Spearman's correlations to take into account the few categories in the measures of awareness of opinion changes.

For DMP1, we see that Pearson's and Spearman's correlation coefficients have different signs for two of the three empirical

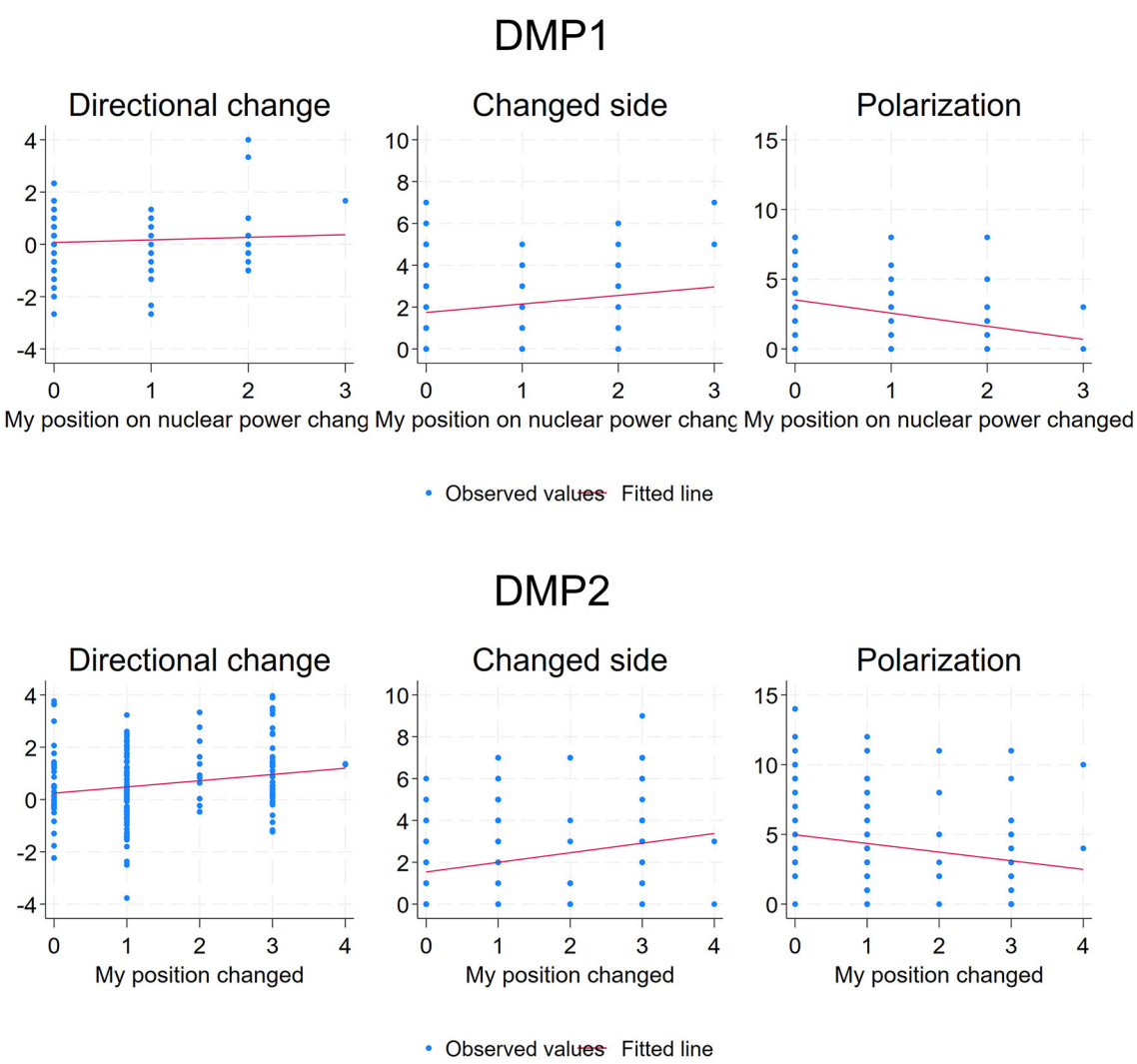

FIGURE 1
Distribution of subjective and objective opinion change.

measures, which is because of the awareness measure having only four categories and there being few respondents with a high awareness of opinion changes. The results from the Pearson's coefficient are therefore in this case uncertain. However, regardless of the type of coefficient, the relationships are weak for both opinion changes and changing side, even when they are significant For polarization, the results are somewhat more encouraging, but even here the Spearman's coefficient fails to reach significance at a traditional $p < 0.05$, and the relationship is moderate at best. The evidence in favor of awareness of opinion changes are therefore at best weak in this experiment.

In DMP2, the results are more encouraging as all measures reach significance for both Spearman's and Pearson's coefficients. However, this may be due to the larger number of respondents. While the correlations are also generally stronger, they are still weak or moderate at best, as judged by common thresholds in social sciences (Cohen, 1992; Lovakov and Agadullina, 2021).

In both mini-publics, we find moderately strong negative associations between polarization and changing positions. While these directly contradict the idea of awareness of opinion changes, these results may indicate that respondents are particularly unaware of going to extremes, whereas they are more likely to be aware of revising opinions when changing sides completely. Hence, when polarization occurs, it seems to be an unconscious process where those who become polarized are more likely to think they did not polarize than those who did not.

Nevertheless, the evidence so far does not indicate that participants are aware of how their opinions change during the proceedings. At best, they may have some idea of how they develop if they are totally reversed. As a next step, we examine whether there are differences in effects depending on the treatment of the experiments. As mentioned above, there are reasons to believe that making decisions by unanimity in DMP1 and taking part in cross-cutting deliberations in DMP2 should be particularly conducive for participants to be aware of their opinion changes. We therefore in the following examine whether there are differences in the associations depending on the treatments. For this endeavor, we use regression analyses where we regress the awareness variable on each

TABLE 4 Pairwise correlations between awareness and empirical measures.

	DMP1: Nuclear power				DMP2: Immigration			
	Pearson	p	Spearman	p	Pearson	p	Spearman	p
Directional change	0.065	0.572	−0.046	0.686	0.186	0.012	0.164	0.026
Change side	0.187	0.045	−0.014	0.904	0.237	0.001	0.197	0.008
Polarization	−0.322	0.000	−0.217	0.055	−0.195	0.008	−0.224	0.002

Entries are pairwise correlations between awareness of opinion changes and the three empirical measures of opinion changes (Pearson's and Spearman's correlations).

TABLE 5 Differences in associations depending on treatment.

	DMP1: Nuclear power			DMP2: Immigration		
	Directional change	Change side	Polarization	Directional change	Change side	Polarization
Treatment	0.061	0.678	−0.391	0.109	0.045	−0.626
	(0.342)	(0.428)	(0.549)	(0.324)	(0.475)	(0.793)
Awareness	−0.084	0.626*	−0.924**	0.173	0.201	−0.380
	(0.240)	(0.269)	(0.335)	(0.124)	(0.182)	(0.303)
Treatment # Awareness	0.408	−0.458	−0.107	0.124	0.527	−0.437
	(0.349)	(0.404)	(0.521)	(0.190)	(0.278)	(0.464)
Constant	0.033	1.392***	3.726***	0.209	1.543***	5.181***
	(0.249)	(0.309)	(0.394)	(0.200)	(0.293)	(0.489)
Observations	79	115	120	183	183	183
R^2	0.035	0.057	0.113	0.047	0.108	0.076

The entries are coefficients from linear regressions with standard errors in parentheses. Treatment in DMP1 is decision-making rule (vote or common statement). Treatment in DMP2 is composition (like-minded or cross-cutting). * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

measure of opinion change. To examine whether the associations differ across treatments, we include an interaction term with the type of treatment; decision-making rule in DMP1, and composition in DMP2. We report the results in Table 5.

Here we see no indication that the associations between awareness of changes and the empirical measures differ depending on the treatments in the two mini-publics. All three interaction effects are non-significant at $p < 0.05$, which entails that there is no evidence that the correct awareness of opinion changes is higher under more conducive circumstances.

All in all, we find feeble evidence for participants being able to correctly identify whether their opinion changed, no matter how we measure this opinion change empirically. Nevertheless, since these non-convincing results may be determined by several factors, we conducted a number of robustness tests to examine whether the conclusions are affected by some of the key choices made during the research process.

Robustness

First, we examined whether the results differ if we use different questions probing the awareness aspect. As mentioned in the research design, the data contains additional questions that probe awareness of opinion changes that are less comparable but may nonetheless lead to different conclusions. We therefore examined whether the results differed for these questions. We in Table 6 report the pairwise correlation coefficients corresponding to the results reported in Table 4, but other analyses lead to similar conclusions.

The results resemble those obtained previously. In DMP1, there are no signs of significant associations. Even if the negative Pearson's correlation for polarization comes close at $p = 0.083$, the strengths of all associations are weak. For DMP2, there is stronger evidence of significant relationships, but the strengths of the relationships are at best moderate ($r = 0.34$). Although these results indicate that there may be some awareness, the results for polarization run squarely against this proposition, and overall, this is hardly conclusive evidence that participants are aware of empirical developments.

Second, it may also be possible to detect more subtle differences if we group respondents who totally and somewhat (dis-)agree, so we get two groups who are either aware or unaware of developments and then compare mean scores. This way we avoid the problems with few respondents and can focus on the key difference between being aware or unaware. We examine this with *t*-tests comparing group means in Table 7.

These results to some extent indicate that people who are aware of opinion changes also change their opinions when measured empirically. The evidence is again strongest for changing sides, where the mean differences are significant in both experiments and in the expected direction, as those who are aware of opinion changes are also more likely to receive a higher score. For directional changes, the differences are also significant in DMP2,

TABLE 6 Pairwise correlations between awareness and empirical measures, alternative questions.

	DMP1: Nuclear power				DMP2: Immigration			
	Pearson	p	Spearman	p	Pearson	p	Spearman	p
Directional change	−0.008	0.943	−0.076	0.508	0.178	0.016	0.172	0.020
Change side	0.017	0.855	−0.027	0.815	0.335	0.000	0.318	0.000
Polarization	−0.159	0.083	−0.126	0.268	−0.280	0.000	−0.279	0.000

Entries are pairwise correlations between awareness of opinion changes and the three empirical measures of opinion changes (Pearson's and Spearman's correlations).

TABLE 7 Mean scores and *t*-tests of differences.

	DMP1: Nuclear power			DMP2: Immigration		
	Directional change	Change side	Polarization	Directional change	Change side	Polarization
Mean disagree	0.05 (0.15)	1.81 (0.18)	3.18 (0.26)	0.36 (0.11)	1.86 (0.16)	4.38 (0.29)
Mean agree	0.50 (0.41)	2.75 (0.42)	1.76 (0.40)	1.07 (0.21)	3.08 (0.37)	3.15 (0.49)
t-test (df, t) = p	(77, −1.241) = 0.109	(113, −2.255) = 0.013	(118, 2.625) = 0.005	(169, −3.015) = 0.002	(169, −3.498) = 0.000	(169, 2.104) = 0.018
Cohen's d [CI]	−0.37 [−0.94–0.22]	−0.52 [−0.97– −0.06]	0.59 [0.14–1.04]	−0.54 [−0.90– −0.19]	−0.63 [−0.99– −0.27]	−0.38 [0.02–0.74]

but not in DMP1, which makes the findings here less clearcut. Finally, for polarization we again observe that those who indicate not having changed their minds are more likely to polarize in both experiments. However, it should again be noted that the effect sizes are of moderate strength at best, meaning the substantial implications are limited.

Our third robustness test focuses on the interaction analyses, where the awareness variable was coded as a continuous variable. Since this may affect the results, we tested an alternative coding where this is considered a categorical variable instead. The results are reported in Table 8. Since there are few respondents in the Totally agree category in DMP1, we rely on the dichotomous coding used above (Totally + Somewhat Agree vs. Totally + Somewhat disagree). This coding should give the best possibilities for detecting any differences in awareness depending on treatment.

Even with this simpler coding, we see no evidence whatsoever that awareness should hinge on the treatments for any of the empirical measures. We therefore remain confident that there are no reasons to believe that this has any effect.

Conclusion

We here examined the extent to which people are aware of their opinion changes during two deliberative mini-publics. This in our view constitute a most-likely case for observing such awareness, which has been question in previous research (Wilson and Dunn, 2004; Tavris and Aronson, 2020). During deliberative mini-publics, participants receive new information, hear experts, and deliberate with each-other with the purpose of reaching new insights. While opinion changes do not always occur, it should be more likely that participants are able to spot whether they revised their original opinions.

On most accounts, our results indicate that participants were unaware of revising their opinions, including in what manner they did so. Even when the results do indicate that participants were correctly aware of their opinion changes, the associations were generally weak and wrong estimates were plentiful. Especially when it comes to polarization, those who believed that they did not revise their initial opinions were more likely to polarize, indicating a low level of awareness indeed. All of this suggests that awareness of exact opinion changes is low at best, even in a constructive setting, where it is likely that participants become aware of opinion changes and are willing to admit to them. This would entail that despite the favorable conditions, we are unable to conclude that people are aware of their opinion changes.

These findings do bear some important consequences for deliberative democracy understood more broadly, as they seem to suggest that opinion changes taking place in deliberative events are less deliberate than deliberative theory would like to assume. Even though the findings in no way indicate that the opinion changes take place for problematic reasons, e.g., in quality between participants or nefarious group dynamics, they suggest that the processing of opinion changes by individuals may not be as explicit as we might expect from deliberative democratic theory.

Our results also corroborate previous research suggesting that explicit or self-assessment measures are problematic measures of attitudes (Dovidio et al., 1997; Graham and Coppock, 2021). This, in turn, has consequences for research that relies on respondents adequately indicating how their opinions changed because of a given intervention (Åström et al., 2017; Christensen, 2019), which has been argued to constitute a viable alternative to measuring attitudes at several time points (Pratt et al., 2000; Hill and Betz, 2005). While it is possible that such measures can be used to detect certain attitudinal changes, our results indicate that they are not a good alternative to the more demanding repeated measurements. Measures that rely on asking participants directly about how they perceived the proceedings are unlikely to grasp the quality of deliberation since participants appear to be unable to detect empirical realities related to their own behavior.

However, it is also possible to interpret at least some of the results in a more positive light. Especially in the robustness tests,

TABLE 8 Alternative coding of interaction terms.

	DMP1: Nuclear power			DMP2: Immigration		
	Directional change	Changing side	Polarization	Directional change	Changing side	Polarization
Treatment	0.129	0.528	−0.631	0.155	0.499	−0.769
	(0.307)	(0.380)	(0.495)	(0.239)	(0.342)	(0.570)
Awareness	0.022	1.311*	−1.911**	0.488	1.146*	−1.094
	(0.518)	(0.573)	(0.718)	(0.324)	(0.463)	(0.774)
Treatment # Awareness (ref. Treatment # Totally disagree)	0.871	−0.737	1.031	0.024	0.573	−0.815
	(0.729)	(0.833)	(1.100)	(0.461)	(0.660)	(1.102)
Constant	−0.022	1.535***	3.511***	0.344*	1.521***	4.808***
	(0.222)	(0.276)	(0.359)	(0.153)	(0.219)	(0.366)
Observations	79	115	120	168	168	168
R^2	0.051	0.060	0.070	0.034	0.140	0.075

The entries are coefficients from linear regressions with standard errors in parentheses. Treatment in DMP1 is decision-making rule (vote or common statement). Treatment in DMP2 is composition (like-minded or cross-cutting). *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

there was some evidence to suggest that participants were correctly aware of their opinion changes. We find that participants at least to some extent recognize opinion changes when they report positions that are completely reversed compared with their initial position on the issue. Although this entails that opinion changes must be fairly drastic before participants become aware of them, it nonetheless indicates that participants deliberately update their initial opinions when faced with new evidence and arguments (Habermas, 1984, 1996; Cohen, 1989). It is worth noting that both mini-publics we used to examine these changes were experimental in nature and had no real impact or influence on policy-making. It is possible that opinion change taking place as a result of deliberation in real-world policy processes would be easier to recall since they would be more consequential.

Furthermore, it is worthwhile to dwell on the insight that participants were particularly likely to be unaware of their opinions becoming more polarized. While this finding was both consistent and fairly strong compared to other findings, it contradicts the notion that people are aware of their own opinion changes. Nevertheless, it suggests that polarization may be particularly treacherous since it is a subconscious process that happens without people recognizing it as opinion change. That people may become extreme in their views without even recognizing can help explain the signs of polarization evident in many established democracies (Graham and Svolik, 2020; Hobolt et al., 2020; Bernaerts et al., 2022).

We cannot entirely rule out the possibility that the lacking correspondence between objective and subjective measures of opinion change is due to our measures not adequately capturing existing opinion changes. However, all measures have been used in previous studies of opinion change. In this sense, our findings provide an insight into whether people sense the same opinion changes that researchers capture with their measurements, even if we cannot be certain that these opinion changes also actually occur. At the same time, the results also reveal the need for future research on the topic. An important question is whether there are systematic differences in who is able or willing to recognize a change of opinion? On one hand, the politically sophisticated may be more aware of their initial opinions and should therefore also be more aware when these opinions change. On the other hand, some studies indicate that the sophisticated are less likely to change opinions, thereby also calling into question whether they would admit to doing so. As interesting as this question is, it is beyond the scope of this study. To do the individual level explanations justice it would require a level of theoretical discussion and empirical analyses that is beyond what it is possible to include here. That said, the findings from this study should be very useful to anyone who wants to examine how different individual level factors are related to opinion change awareness.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: https://services.fsd.tuni.fi/catalogue/FSD2355?lang=en&study_language=en; https://services.fsd.tuni.fi/catalogue/FSD2958?lang=en&study_language=en.

Ethics statement

Ethical approval was not required for the study involving humans in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was not required from the participants or the participants' legal guardians/next of

kin in accordance with the national legislation and the institutional requirements.

Author contributions

SH: Writing – original draft, Writing – review & editing. HC: Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Appendix

TABLE A1 Items for measuring opinion change.

#	DMP1	DMP2
v1	*A sixth nuclear power plant should be built in Finland*	*Finland should take more immigrants. Do you think this is a bad suggestion or a good suggestion*
v2	*The use of nuclear power in Finnish energy production should be increased*	*Migration of foreigners into Finland should be restricted as long as there is unemployment in Finland. Do you think this is a bad or a good suggestion? (r)*
v3	*Nuclear power should be used to a larger extent in order to impede climate change*	*Do you think Finland will change into a better or a worse place to live when people from other countries move to Finland?*
v4	*The possibility of an accident is a noteworthy risk related to the use of nuclear energy (r)*	*It is good for the Finnish economy that people from other countries move to Finland*
v5	*Extracting uranium for the use of nuclear power causes significant damage (r)*	*Immigrants take away jobs from Finnish natives (r)*
v6	*There are considerable risks related to the storage of nuclear waste (r)*	*Immigrants should have the same right to social security as Finns even if they were not Finnish citizens*
v7	*There are no considerable risks related to the use of nuclear power in Finland*	*The state and the municipalities use too much money to aid immigrants (r)*
v8	*The mining of uranium should be allowed in Finland*	*Immigration poses a serious threat to our national originality (r)*
V9		*Everyone that wants to come to Finland to live and work must be allowed to do so*
V10		*Immigration policy should primarily favor christians instead of other religions (r)*
V11		*Generally speaking, immigrants adapt well into the Finnish society*
V12		*I would be happy to have an immigrant as a co-worker*
V13		*I would accept an immigrant as a family member*
V14		*I would accept immigrants in my neighborhood*

TABLE A2 Factor analysis.

Variable	DMP1	DMP2
v1	0.90	0.85
v2	0.90	0.79
v3	0.87	0.81
v4	0.70	0.82
v5	0.75	0.72
v6	0.80	0.65
v7	0.85	0.83
v8	0.78	0.81
v9		0.61
v10		0.67
v11		0.70
v12		0.82
v13		0.78
v14		0.77
Eigenvalue	5.41	8.17
Eigenvalue component 2	0.98	0.93
n	89	189