

RESEARCH ARTICLE

Can Organized Deliberation Reduce Confirmation Bias?

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This article explores the potential of deliberative mini-publics for reducing confirmation bias, that is, the tendency to seek out information that confirms existing views over information that contradicts them. A deliberative mini-public exposes participants to diverse opinions in a constructive environment, which could potentially hinder biased information searches. In this study, participants of a local-level mini-public deliberated on the topic of transportation policies and completed surveys before and after deliberation. Measures of the participants' opinions on the use of private cars and a confirmation bias index were included in the surveys. The confirmation bias index was based on the participants' choices of news articles. Contrary to expectations, *deliberation did not reduce confirmation bias*. Additionally, extreme opinions were observed to be associated with higher levels of confirmation bias, independent of whether the respondent was for or against private car use.

Keywords: confirmation bias; confirmation bias reduction; deliberative discussion; mini-public; private car use

Instead of searching for information on all sides of a topic, people tend to seek out information that confirms their existing views over information that contradicts them. One of the problems of selective information searching is that it can boost attitude polarization (Taber & Lodge 2006; Taber, Cann & Kucsova 2009; Zhou & Shen 2022) and reduce understanding of people with opposing views. This poses threats to constructive political discussion within the public sphere. Selective searching of information is especially ill-suited to the ideals of deliberative democracy which emphasizes careful consideration of all reasons for and against a policy proposal (Jang 2014).

Deliberative democracy expects the force of the better argument to settle disagreements (Habermas 1984; 1996), and deliberative mini-publics (DMPs) aim to establish supportive conditions for deliberation (Gerber et al. 2018). Existing evidence suggests that mini-publics, while not perfect, and not the only venues for deliberative democracy, have succeeded rather well in promoting deliberation (Barabas 2004; Fishkin & Luskin 2005; Gastil & Dillard 1999; Gerber et al. 2018; Luskin, Fishkin & Jowell 2002).

There is ample evidence that confirmation bias characterizes information search at the individual level (Jonas et al. 2001; Jones & Sugden 2001; Hart et al. 2009;

Knobloch-Westerwick & Meng 2009; Koriat, Lichtenstein & Fischhoff 1980). Much less research has designed or tested methods to alleviate the bias. Nevertheless, some evidence suggests that certain methods, such as paying attention to preference-inconsistent information, can reduce the bias (Schwind & Buder 2012; Schwind et al. 2012). We ask whether participation in a DMP could promote open-mindedness and curiosity towards information on all sides of a topic, even towards information that opposes one's views? We tested this question in a mini-public organized to support the City of Turku, Finland, in its decision making on transportation policies. Participants filled in pre- and post-deliberation surveys, including a task in which they chose which articles to read based on the headlines. The articles were about the use of private cars, a central theme in the discussions.¹

In addition to the overall effect of deliberation on confirmation bias, we studied whether certain group- and individual-level factors were associated with confirmation bias, and whether participation influenced these associations. At the group level, we looked at group-level disagreement; at the individual-level, factors included issue knowledge, general political knowledge, opinion extremeness, opinion change, and pro/con opinions on the use of private cars.

We are not aware of previous empirical research on the ability of deliberation to reduce confirmation bias, although many theorists suggest that deliberation can boost accuracy motivation, and reduce biased information processing (Luskin et al. 2022; MacKenzie 2018; 2021; Ryfe 2005; Schwind & Buder 2012). We had a unique opportunity to study confirmation bias in a DMP

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that was connected to a real political decision-making process, as well as to study participants recruited from a representative sample.

Our main observation was that, while a confirmation bias was observed, and although participants' opinions did transform during discussion, there was no evidence that taking part in the DMP decreased the bias, when measured through a task in which the participants had to choose between news articles. Moreover, opinion extremeness was associated with confirmation bias, and this association was not reduced due to participation in the mini-public.

Literature Review

Confirmation bias

According to the theory of motivated reasoning, two types of goals can influence reasoning processes (Kunda 1987; 1990). When motivated by an *accuracy goal*, people engage in careful and balanced information processing with an aim to acquire correct evidence. When reasoning is motivated by a *directional goal*, information processing is unbalanced and directed at strengthening existing attitudes, beliefs or decisions already made. Directional motivation leads to a rejection or misinterpretation of information that conflicts with existing attitudes or beliefs. Directional information processing can occur through several mechanisms (Druckman & McGrath 2019; Strickland, Taber & Lodge 2011; Taber, Cann & Kucsova 2009). One of them is confirmation bias, which has been defined in different ways in literature. We follow those scholars who say that *confirmation bias occurs when people subconsciously search for information that confirms their existing views more often than information that contradicts them* (Jonas et al. 2001; Nickerson 1998; Westerwick, Johnson & Knobloch-Westerwick 2017; 2019). The confirmation bias measure we use only captures biases in information selection and not biases in the ways information is processed (Nickerson 1998; Johnson & Knobloch-Westerwick 2017). Confirmation bias is not equivalent to motivated reasoning, and evidence pertaining to motivated reasoning is not necessarily evidence about confirmation bias (Kahan 2015). Confirmation bias should also be distinguished from *selective exposure*, which refers to biased information searching more generally, not necessarily based on attitudes (Westerwick, Johnson & Knobloch-Westerwick 2017). For example, selective exposure can take place when someone searches for information based on how entertaining it is (Johnson et al. 2020).

Festinger's (1957) cognitive dissonance theory has been proposed as an explanation for confirmation bias. This means that people tend to gather information that supports their views and neglect unsupportive information to avoid the unpleasant state of cognitive dissonance (Hart et al. 2009). Others have emphasized affect, rather than cognition, as a catalyst for biased information processing (Strickland et al. 2011; Taber & Lodge 2006). Confirmation bias is problematic because it entails omitting information, for example, potential risks and warning signals (Jonas et al. 2001). In politics, confirmation bias is also problematic

because it contributes to opinion polarization (Taber & Lodge 2006; Taber, Cann & Kucsova 2009; Zhou & Shen 2022).

Empirically, confirmation bias can be measured when participants are first asked to indicate their attitudes and are then given an opportunity to search for information on the same topic (Hart et al. 2009). Confirmation bias occurs when more confirming information than contrasting information is selected. Empirical literature shows that confirmation bias is a typical characteristic of information selection (Jonas et al. 2001; Jones & Sugden 2001; Hart et al. 2009; Knobloch-Westerwick & Meng 2009; Koriatic, Lichtenstein & Fischhoff 1980). A meta-analysis has indicated a moderate preference for congenial information over uncongenial information ($d = 0.36$) (Hart et al. 2009).

Deliberative democracy and deliberative mini-publics

A central tenet of deliberation is that participants give reasons for their views and are open to the views and reasons that other people present (Cohen 1989; Mansbridge et al. 2010; Ryfe 2005). The process of formulating arguments and counterarguments requires a balanced processing method that weighs diverse proposals and reasons (Bächtiger & Parkinson 2019). The ideals of deliberative democracy encourage open mindedness to others' views and readiness for preference transformation. These tenets contrast confirmation bias which makes people "shield themselves from information that disagrees with their views" (Knobloch-Westerwick et al. 2019, 428). Confirmation bias means that evidence is gathered selectively, which is in strict contrast with the central ideals of deliberative democracy, that is, openness to all kinds of information. The ideals of deliberative democracy do not, however, imply that all types of information, dis- or misinformation, for example, should be given equal weight in decision-making. In the process of deliberation, people should evaluate whether information is reliable and whether the presented reasons are valid. These processes differ from resisting information only because they differ from one's own preferences. It is also noteworthy that avoidance of counterattitudinal information inhibits opinion changes (Knobloch-Westerwick & Meng 2009), implying that confirmation bias works against the opinion transformations assumed to take place in organized deliberation.

DMPs are forums for citizen participation organized to promote democratic deliberation (Setälä & Smith 2018), referring to respectful and equal discussion in which one's own views are justified, and those of others listened to (O'Flynn 2022). Mini-publics aim to create "supportive conditions for deliberation" (Gerber et al. 2018). Supportive conditions include, typically, diversity among the participants, balanced briefing materials, rules of discussion and moderated small groups discussions. The rules of discussion, which emphasize openness to others' arguments and readiness to reconsider one's opinions if others present convincing arguments, are essential for enhancing deliberative discussion. The rules of discussion are supposed to prime participants with a deliberative

mind-set that generates an open-minded attitude to all kinds of views (cf. Gollwitzer & Keller 2016). Moreover, mini-public participants are briefed with balanced information, which could reduce biased reasoning, although this is not a given (Baekgaard et al. 2019). Recruitment from a random sample helps ensure that mini-public discussions include diverse opinions. The supportive conditions enable learning, formulating own arguments as well as listening and taking into consideration others' arguments. The supportive conditions counteract biased information search, that is, not genuinely listening to the arguments of those people who disagree with oneself.

Scholars of deliberative democracy have identified four types of processes that are assumed to reduce biased information selection among mini-public participants: 1) Mercier and Landmore (2012) argue that deliberating groups with diverse beliefs and opinions will reach better decisions than people reasoning on their own because the group will rely on a broader set of views and beliefs. While Mercier and Landmore mainly talk about group level processes, they also argue that participation in group deliberation has the potential to lead to better private deliberation. One's own reasoning is likely to be reassessed when one hears opposing arguments in a constructive environment. 2) The process of formulating arguments and counterarguments requires thorough reflection on all sides of the topic (MacKenzie 2018; 2021). 3) The need to justify one's views in public contributes to a desire to be accurate (Ryfe 2005). 4) Deliberative mini-publics create a cooperative environment that should reduce biased information selection (Schwind & Buder 2012). Apart from the fourth factor, all mentioned processes are related to participants' exposure to disagreement. While these processes mainly influence information processing during deliberations, they may also induce openness towards information that contrasts with one's views after deliberations. Research literature on learning suggests that facing disagreements and preference-inconsistency tend to induce epistemic curiosity (Berlyne 1960) which triggers further information search and interest in understanding others' perspectives (Buchs et al. 2004; Schwind et al. 2012). Facing disagreement takes place in DMP small groups with opinion diversity, which suggests that similar epistemic curiosity may be induced when participating in a DMP. There is also evidence that discourse goals may be relevant for the reduction of confirmation bias. Participation in a chat-based dialogue that had a goal to reach consensus mitigated confirmation bias in a pots test, whereas a goal to persuade did not have such an effect (Villarroel et al. 2016; see also Felton et al. 2015). In the DMP in this study, participants were not asked to reach consensus or to persuade others, but they were instructed to be open to others' arguments and to be ready to change one's opinion if others presented convincing arguments. We anticipate that deliberations in a group with opinion diversity in a constructive environment that emphasizes openness triggers epistemic curiosity, which carries beyond the DMP discussions.

Existing evidence on DMPs give indirect evidence that they contribute to reducing biased information processing

because both learning and preference transformations have been frequently observed (Gastil & Dillard 1999; Luskin, Fishkin & Jowell 2002; Barabas 2004; Fishkin & Luskin 2005; Grönlund, Herne & Setälä 2015; Setälä et al. 2010). Furthermore, the observation that participation in deliberations enhances perspective-taking may be a sign of an increased epistemic curiosity (Grönlund, Herne & Setälä 2017; Muradova 2020).

Materials and Methods

Study design and hypotheses

Confirmation bias was measured at two time points, t1 and t3, before and after taking part in the mini-public. Ideally, a control group should also have been measured at t1 and t3 without the deliberation intervention. However, it would have been difficult to form a proper control group with the only difference to the treatment groups being the exclusion of deliberative discussion. For example, the connection to the decision-making process of the city would not have been possible in such a control group. However, we can compare mini-public participants to respondents who filled in the survey at t1, but who were not willing to participate further. Of the 12,000 citizens originally contacted, 2,462 responded to the t1 survey. A total of 171 citizens participated in the mini-public and filled in the t1, t2 and t3 surveys.

Existing literature identifies both contextual- and individual-level variables that contribute to biased information processing (Flynn, Nyhan & Reifler 2017; Guay & Johnston 2022). In the present study, contextual variables include participation in the mini-public and small group disagreement. Individual-level variables include political knowledge, opinion extremeness, opinion change and pro or con attitudes towards the use of private cars.

While theoretical analysis suggests that participation in deliberations can decrease confirmation bias, we are not aware of any direct empirical evidence on the matter. However, in deliberative forums, opinion changes have been observed frequently (Barabas 2004; Fishkin 2009; Grönlund, Herne & Setälä 2015), whereas polarization has not (Luskin et al. 2022; Grönlund, Herne & Setälä 2015). These observations can be indirect signs of balanced information processing, but they may also be due to other processes such as affectively engaging with others' positions, conformism or social desirability.

Based on a large body of evidence about confirmation bias, we assume that the bias will be observed when measured before DMPs. However, more importantly, based on the processes described in the previous section, we hypothesize that *there will be a decline in confirmation bias between the pre-(t1) and post-(t3) deliberation measures (H1)*. Notably, H1 implies that an openness to opposing information that supposedly characterized the mini-public discussions is expected to carry over to participants' information selection immediately after the DMP.

In addition to the effect of participation in the DMP, there are certain small group-level factors that can influence confirmation bias. These factors may also

help explain how deliberation can mitigate bias. Most small group variables were held constant in the *Turku deliberates* citizens panel: The same rules of discussion and the same briefing materials were applied, and in each small group, a trained moderator ensured that discussions were inclusive and that discussion rules were followed. Participants were randomly allocated into small groups to prevent small group disagreement from varying significantly between the groups. However, since the groups were rather small, the level of disagreement did vary to a certain extent. If exposure to diverse opinions is essential to reducing biased information searching, group-level opinion diversity should be associated with confirmation bias. In other words, the more disagreement there is within a small group, the more participants will hear opinions different to their own and the more they will encounter counterarguments. We assume that this would increase openness to all kinds of information and therefore decrease biased information searching. We thereby hypothesize that *the greater the group-level disagreement, the less confirmation bias will be observed (H2)*.

We also study individual-level characteristics that could increase the likelihood of biased information searching. Several individual-level factors have been associated with confirmation bias (Knobloch-Westerwick & Kleinman 2012; Knobloch-Westerwick & Meng 2009; Taber & Lodge 2006). We focus on political knowledge, opinion extremeness, opinion change and pro or con attitudes toward the use of private cars. Evidence shows that people who have high levels of political knowledge are better at finding weaknesses in information that conflicts with their views, leading to biased information processing (Biek, Wood & Chaiken 1996; Chaiken, Liberman & Eagly 1989). People who have high levels of political knowledge are likely to have opinions that are based on a large pool of information, which can make them more certain about their attitudes, less likely to change their opinions, and less likely to search for information that contrasts with their opinions compared to people who are less politically knowledgeable. Taber and Lodge (2006) observed more opinion polarization among politically knowledgeable participants as well as an association between polarization and confirmation bias. Baekgaard et al. (2019) observed that politicians were no less biased than lay citizens in their reasoning; moreover, biased reasoning increased among politicians when the amount of information provided was increased. Taber, Cann & Kucsova (2009) observed an association between political knowledge and disconfirmation bias: Participants with high political knowledge gave more thought to arguments that were not in line with their own attitudes. People with high levels of political knowledge also evaluated the strength of arguments in a more biased manner compared to those with low political knowledge. Finally, Slothuus & de Vreese (2010) observed that political sophistication increased a biased attitude towards issue frames promoted by parties the respondents opposed. We expect to see a similar positive association between political knowledge and confirmation bias, but

we also assume that the association will have weakened in the post deliberation measurement. We measured both general political knowledge and knowledge on transportation issues. We hypothesize that *general political knowledge and issue knowledge are positively associated with confirmation bias at t1 (H3a) but that this association has weakened at t3 (H3b)*.

Existing evidence suggests that confidence in one's decision is negatively associated with information-seeking (Desender, Boldt & Yeung 2018; Desender et al. 2019). Furthermore, there is evidence that opinion strength moderates confirmation bias (Zhou & Shen 2022). It seems that those who are certain about their opinion tend not to seek out information that would counter their existing views. Confidence in one's opinions also seems to lead to biased information processing and lower likelihood of changing one's opinion (Rollwage et al. 2020). While opinion strength and opinion extremity can be conceptually distinguished, they seem to be empirically associated (Lebreton, Abitbol & Daunizeau 2015; Heinzelmann & Tran 2024), which suggests that opinion extremity could also be associated with confirmation bias. Furthermore, there is evidence that biased information searching is associated with opinion polarization (Taber & Lodge 2006; Taber, Cann & Kucsova 2009; Zhou & Shen 2022). This indicates that those who are not inclined to seek information that contradicts their opinions are likely to move into a more extreme position after being given a chance to acquire new information. We asked whether the opposite would also hold, that is, whether those with existing extreme views would be reluctant to seek out new information. We are not aware of any direct evidence on this, but in one study, opinion extremity predicted a biased endorsement of opinion-congruent political messages (Sude, Pearson & Knobloch-Westerwick 2021). We assume that opinion extremity would be associated with confirmation bias at t1, and that this association would be weakened during deliberation. We thereby hypothesize that *attitude extremity is positively associated with confirmation bias at t1 (H4a) but that this association has weakened at t3 (H4b)*.

Finally, we compare confirmation bias among those who promoted the use of private cars and those who opposed it. A relevant characteristic regarding issue positions is whether a participant holds a majority or minority view. Minority views are not heard in discussions as often as majority views simply based on the number of people who hold each view. Social conformism can also influence the ways in which minority and majority view holders present their views in a group. These kinds of processes may have an impact on participants' openness to new information. Indeed, there is evidence that minority members are more open to information than majority members (van Swol 2007). We therefore hypothesize that *the reduction of confirmation bias will be greater among those who hold minority views (H5)*. **Figure 1** illustrates our hypotheses. The figure separates the influence of the DMP, the discussion group and individual characteristics.

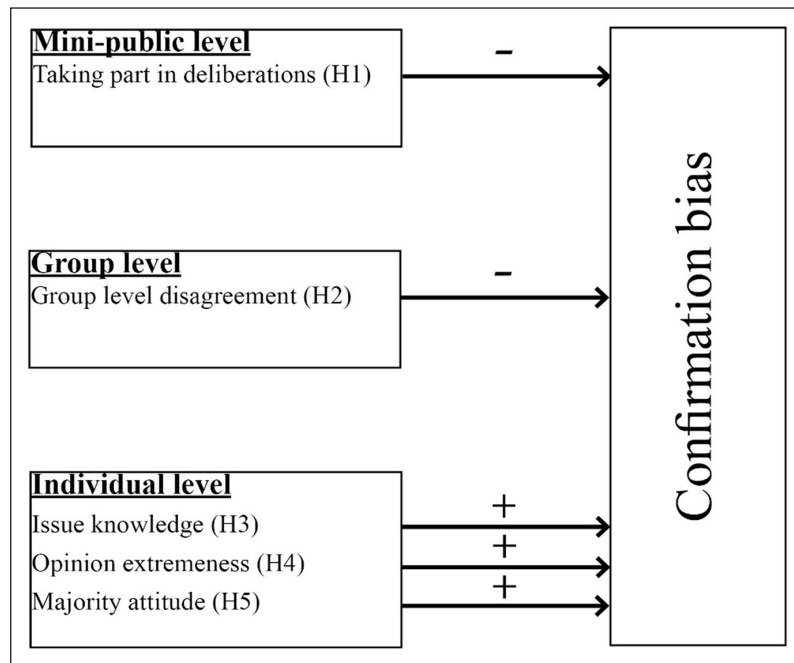


Figure 1: Mini-public, group- and individual-level associations with confirmation bias.

Procedures

The *Turku deliberates* mini-public was organized jointly with the City of Turku, Finland, and it was connected to the city council's decision-making process regarding a new master plan for the city center. The event was first planned to be held face-to-face but was moved online due to the outbreak of the COVID-19 pandemic.²

The recruitment process started with an invitation to participate in the *Turku deliberates* mini-public together with the first survey (t1) mailed to a random sample of 12,000 citizens of Turku. The respondents also had an option to only fill in the survey. The invitation letter indicated that the results of the citizens' panel would be presented to the city council. The letter also included a privacy statement summary and a link to the project's website for the full data projection statement. A total of 2,462 citizens responded to the survey, and of these, 370 indicated their willingness to participate. A request to confirm participation and to fill in a second survey (t2) was then mailed to those interested in participation. At this point, respondents were informed that a fifty euros remuneration would be given to participants. Of the 370 initially willing to participate, 171 people ultimately confirmed their participation and showed up.

Of the 171 participants, 55 percent (94) were male, and 45 percent (76) female. The group was not entirely representative: Most notably, participants were more educated than the general public (see Table S1 in the Supplementary material for a comparison of demographics between the group of participants and the residents of Turku). Due to time limits imposed by the City of Turku, we were unable to remind those in the sample several times—this would have improved representativeness. Compared to a convenience sample of students, the participant group was more diverse in terms of education, gender and age, which ranged from 15 to 79 years with a mean age of

45 years. The mean age in the general population within the same age range is 47.

The first pre-deliberation survey mailed together with the invitation (t1) consisted of questions related to opinions on transportation issues, trust, efficacy, background variables and the confirmation bias measure, 33 items in total. The second survey (t2) was mailed to participants who were asked to fill in the survey about a week before the DMP. The t2 survey consisted of questions on general political knowledge, transportation issue knowledge and a perspective-taking scale (Davis 1980). The last survey (t3) was administered immediately after the small group discussions, and it repeated most of the items in t1, including the confirmation bias measure, as well as the knowledge questions from t2.

Three design features were essential for ensuring the deliberativeness of the process: Participants were given balanced background information on the topic, they were informed about rules of discussion, and small group discussions were moderated. Briefing material about current traffic problems and three alternative scenarios for a future transportation system were mailed to the volunteers along with the discussion rules before deliberations. The scenarios varied mainly in terms of how radically they changed transport policies toward the goal of a carbon-neutral city. The discussion rules emphasized respect for the other participants, giving justifications for one's opinions, listening to others and being cooperative.

The online event took place in May 2020. The participants were randomly assigned into small groups consisting of 5 to 11 citizens per group. Because of last minute dropouts, complete control over the number of participants in the small groups was not possible. To allow discussions in the two official languages of the country, discussions were organised in Finnish (19 groups) and Swedish (2

groups). The participants remained in the same group throughout the DMP. Trained moderators facilitated the small group discussions, and technical moderators helped with problems related to the online platform (Zoom). Moderators' work was based on instructions that described their role, as well as a detailed timetable and steps for small group discussions. At the beginning of each small group discussion, a recorded video clip showing a civil servant presenting the three alternative scenarios was played. After the briefing, moderators asked each participant to present a theme they wanted to discuss. Deliberations then started and the participants asked for turns to speak by raising their hands. Each small group deliberated for three hours with a short break in the middle. The moderator did not interfere unless the rules of discussion were violated. The moderator proposed one of the themes the participants had mentioned if deliberations seemed to die down. Half an hour before the end, everyone in the group was given a chance to summarise their thoughts. The moderator then asked the participants to fill in the post deliberation survey (t3) and informed them about an online debriefing webinar to be held about two weeks after the panel. With these procedures, especially the diverse participant pool based on a random sample, balanced briefing materials, rules of discussion and moderated small group discussions, we aimed at creating supportive conditions for deliberation, supposed to reduce confirmations bias.

After the discussions, participants filled in a post deliberation survey (t3), which repeated most of the items in t1, including the confirmation bias measure, as well as the knowledge questions from t2. Participants also "voted" on the three scenarios in t3, that is, they chose in the survey, which of the three scenarios they found the best. A more detailed description of the *Turku deliberates* process and results on opinion transformations can be found in Grönlund et al. (2022). **Figure 2** describes the timeline of the *Turku deliberates* process.

Measures

The dependent variable, *Confirmation bias index*, was measured at times t1 and t3. The index captured the extent to which respondents preferred to select news headlines that aligned with their own opinions on private cars. The

index ranged from -8 to +8, with higher values indicating a stronger tendency to select headlines that were congruent with their own views (i.e., greater confirmation bias).

The construction of the confirmation bias index involved three steps: assessing opinions on private cars, the selection of headlines, and scoring based on the alignment between headline choices and participants' opinions. First, participants' attitudes toward private cars (*Opinion on private cars index*) were assessed using four survey items, which were presented after the following stem question: "What is your opinion regarding the following statements about the traffic arrangements in the center of Turku?" The items were: 1) The speed limit for cars in the city center should be 30 kilometers per hour; 2) The use of private cars should be restricted in the city center; 3) The number of street parking spaces cannot be decreased; and 4) Drive-through traffic in the city center must decrease. Likert scale responses ranged from *completely disagree* to *completely agree* and were coded from -2 to 2, with positive values corresponding to favorable attitudes toward the use of private cars and negative values to unfavorable attitudes. *Cannot say* was treated as a neutral position and coded as 0. Cronbach's alpha analysis showed that the scale was internally consistent among the participants: 0.82 (t1) and 0.83 (t3).

Second, the participants were presented with eight news headlines about private cars (Table S2, Supplementary materials).³ They were instructed as follows: "You will next be presented with eight headlines and editorials picked from the internet. Which articles would you be interested in reading based on their headlines? Consider which headlines you find interesting enough to read the whole article." The headlines were drawn from real websites, all pertaining to the use of private cars, with four promoting their use and four opposing it. The headlines were presented in the same random order to all respondents. For each headline and editorial, the participants were asked, "Would you be willing to read this article?" with the response alternatives *yes* or *no*. Because we first contacted a large random sample through regular mail, we could not offer an online test in which the participants could read articles and we could measure the time they spent reading them.⁴ However, there is evidence that selection

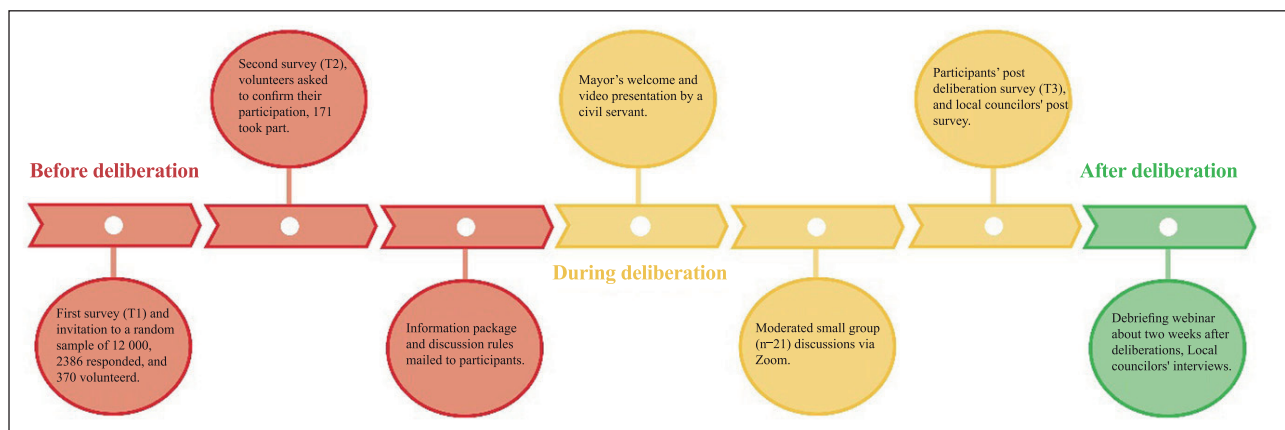


Figure 2: Turku deliberates timeline.

Source: Grönlund et al. (2022).

and reading time tend to correlate and produce similar results (Winter & Krämer 2012; Jang 2014; Westerwick, Johnson & Knobloch-Westerwick 2017).

Third, headline selection was cross-tabulated with participants' opinions on private cars. For each headline, a score was assigned based on the alignment between the participant's attitude toward private cars and the headline's framing. A value of 1 was assigned each time a participant selected a headline that matched their opinion on private cars, while a value of -1 was assigned if the headline did not align with their opinion. Participants whose opinion index on private cars was zero received a confirmation bias score of zero. Finally, the scores for all eight headlines were summed to form the confirmation bias index. Because each of the eight headlines could contribute either +1 or -1, the index could range from -8 (all selections incongruent with one's opinion) to +8 (all selections congruent with one's opinion).

Regarding the independent variables, we first present the group-level variable. *Small group opinion variance* measured how much variation there was in opinions on private cars in each small group at time t1. The standard deviation of the opinion on private cars index was calculated for all members in *i*'s small group, but by excluding participant *i*'s own attitude to capture the opinion variance observed by each person (see Esterling, Fung & Lee 2015, p. 537). The higher the standard deviation, the greater deviation in the small group's opinions on private cars.

To measure knowledge, we prompted participants to answer multiple-choice questions, six of which addressed *Issue knowledge* (i.e., transport issues) and three *General political knowledge*. Both were measured at time t2, before deliberations. Participants were instructed as follows: "Answer the following questions to the best of your knowledge. Do not search for answers on the internet by googling or by asking your friends. Answers will only be used for research purposes." An example of an issue knowledge item is "Which is the most popular mode of transportation among the citizens of Turku?" Answer options were: "walking, bicycle, private car, public

transportation, do not know". (For all knowledge questions and correct answers, see Supplementary materials).

To account for opinion extremity, we used both the simple and the squared term of the *Opinion on private cars index* in the regression models instead of modelling the absolute value. Including the squared term allowed us to model the assumed curvilinear relationship (participants with both negative extreme and positive extreme opinions in terms of the use of private cars had greater confirmation bias).

Results

Figure 3 shows the distribution of the confirmation bias scores at the two time points. Before deliberation, most respondents had a confirmation bias score of zero or less, indicating openness to reading a mix of offered headlines. However, a sizeable portion exhibited some or a high degree confirmation bias (an inclination to select opinion-congruent headlines). Of the participants, 20 percent had a positive score below four, and 22 percent scored four or higher. **Table 1** shows that the standard deviations were above 2.7 at both measurements, indicating medium variability given the possible range from -8 to 8. The mean score increased slightly from 1.01 to 1.05 between t1 and t3. A paired samples t-test revealed that the difference between the mean scores was not statistically significant, $t(170) = 0.18, p = 0.43$. Additionally, no significant change in confirmation bias emerged depending on initial opinions regarding private cars, that is being against, neutral, or in favour. We therefore do not find support for our first hypothesis stating that there would be a decline in confirmation bias between the pre(t1)- and post(t3)-deliberation measures.

To test hypotheses H2–H5, we used mixed-effects linear regression, also known as multilevel or hierarchical linear regression, which accounts for nested or clustered data. Such models are commonly used for panel data. Repeated observations (level 1) were nested within individuals (level 2). This method provides more accurate estimates of fixed effects and their standard errors compared with traditional linear regression, which assumes independent

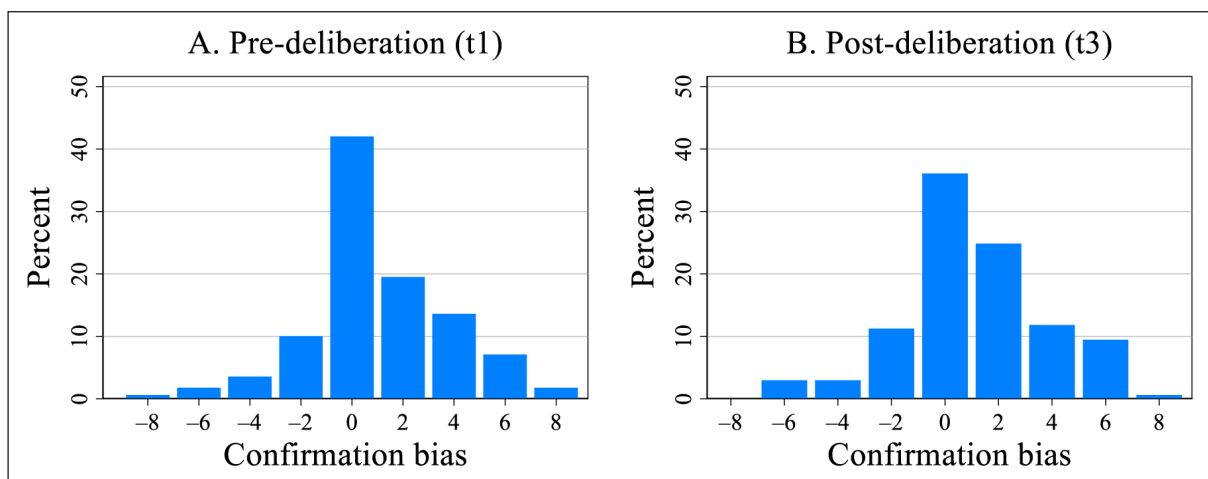


Figure 3: Distribution of confirmation bias among mini-public participants before deliberation (panel A) and after deliberation (panel B).

Table 1: Change in confirmation bias among mini-public participants.

	Time t1		Time t3		Diff.	t-test for dependent samples
	m	sd	m	sd		
All participants (n = 171)	1.01	(2.76)	1.05	(2.73)	0.04	t = 0.18, p = 0.43
Against private cars at t1 (n = 115)	1.23	(2.75)	1.30	(2.65)	0.06	t = 0.24, p = 0.40
Neutral at t1 (n = 10)	0.00	(0.00)	-1.00	(2.54)	-1.00	t = -1.25, p = 0.88
In favor of private cars at t1 (n = 46)	0.65	(3.01)	0.87	(2.67)	0.22	t = 0.39, p = 0.35

observations. The results can be interpreted similarly to traditional regression, with the addition of random effects that capture variability within and between groups. Each predictor measured at t1 was interacted with a time dummy to estimate whether certain participants developed more or less confirmation bias over time. First, the post-deliberation dummy coefficient shows the average rate of change in confirmation bias across the sample. Second, the coefficient for each predictor reveals how initial levels of confirmation bias (at t1) differed between groups. Third, each interaction term estimates whether confirmation bias increased or decreased in specific participant groups. The addition of a random slope for time did not improve model fit; thus, we did not include a random slope into the models. We report results for 169 participants who provided valid responses for all variables at both time points.

We hypothesized that greater group-level disagreement would reduce confirmation bias (H2). Group-level disagreement, measured by the standard deviation of the opinion on private cars index, ranged from 0.3 to 1.7 with a mean of 1.1. The coefficient for initial level small group opinion variance was positive and significant (0.90, $p = 0.03$) in the full model (Model 1) in **Table 2**, meaning that confirmation bias was higher in groups with higher disagreement from the onset. However, no support for H2 was found, as the interaction term between the post-deliberation dummy and group opinion variance was statistically insignificant. We conducted a sensitivity analysis to estimate the likelihood of detecting statistically significant results when using mixed-effects modelling with a cross-level interaction (see Murayama, Usami, Sakaki 2022). Fixing the sample size to that of this study with 80% power at a 5% significance level showed that an absolute t-value of 2.8 would be needed to for even a small effect size. In addition, to address potential statistical power issues due to many variables, we also tested models that included only the relevant variables for each hypothesis. When the other independent variables were excluded, neither the main effect of small group opinion variance nor the interaction term were statistically significant (see Model 2).

Hypothesis H3 consisted of two parts: H3a proposed that both general political knowledge and issue-specific knowledge would be positively associated with confirmation bias at t1, while H3b proposed that this association would weaken by t3. We found no support for these hypotheses. Confirmation bias did not vary based on issue-specific knowledge on transportation or general

political knowledge before small group discussion, as the coefficients for both knowledge variables were not significant. Furthermore, the association did not weaken by t3, as indicated by the insignificant interaction terms between the post-deliberation dummy and each of the knowledge variables. In a multi-level model with two time points, a non-significant interaction term between an independent variable and a time dummy indicates that the relationship between the independent variable and the outcome did not change significantly over time.

Our analysis of H4, which also consisted of two parts, examined whether attitude extremity was positively associated with confirmation bias at t1 (H4a) and whether this association weakened by t3 (H4b). We found support for H4a, but not for H4b. The significant estimates for opinions on private cars and its squared term in **Table 1** indicate a curvilinear relationship at t1. However, the interaction terms between the time dummy and the variables are close to zero and statistically insignificant. Also, statistical comparisons of the predicted confirmation bias at different levels of attitude extremity between t1 and t3 revealed no significant differences. This suggests that the shape of the curvilinear relationship remains unchanged after small group discussion. These patterns can also be seen in **Figure 4**, where predicted confirmation bias over private cars opinion is plotted. Panel A presents the average predictive margins based on the full model (Model 1), while the predictive margins in Panel B are derived from a robustness test excluding individuals who scored zero on the private cars index and thus also had zero on the confirmation bias index. Both plots show similar curves where the confidence intervals overlap (see also Figure S1 in the Supplementary material for a descriptive analysis of the bivariate relationship).

Figure 4 also allows us to visually assess whether individuals who had differing views on private cars before deliberation developed different levels of confirmation bias, as predicted by hypothesis H5. Individuals critical of the use of private cars were in the majority, almost 2.5 times more than those who had a positive view of private cars. We found no evidence to support the hypothesis that the reduction in confirmation bias was greater among those who held minority views. This was evident not only from **Figure 4** but also from non-significant contrasts of margins, which compared changes in confirmation bias across the range of values of the private cars opinion index (not reported in any table). Even with a reduced set of predictors in Model 5, the null finding persisted.

Table 2: Two-wave panel model to predict confirmation bias: mixed-effects regression.

	Model 1	Model 2	Model 3	Model 4	Model 5
<i>Fixed effects</i>					
Post-deliberation dummy	0.22 (0.29)	0.05 (0.20)	0.05 (0.20)	0.05 (0.20)	0.16 (0.31)
Small group opinion variance	0.90* (0.40)	0.40 (0.60)	—	—	—
Post-deliberation dummy × Small group opinion variance	−0.83 (0.70)	−0.74 (0.78)	—	—	—
Issue knowledge	0.01 (0.14)	—	−0.03 (0.14)	—	—
Post-deliberation dummy × Issue knowledge	0.03 (0.17)	—	0.11 (0.15)	—	—
General political knowledge	0.10 (0.34)	—	—	0.22 (0.33)	—
Post-deliberation dummy × General political knowledge	0.24 (0.31)	—	—	0.25 (0.25)	—
Opinion on private cars	−0.69** (0.23)	—	—	—	−0.70** (0.21)
Post-deliberation dummy × Opinion on private cars	0.02 (0.32)	—	—	—	−0.01 (0.29)
Opinion on private cars squared	0.66** (0.14)	—	—	—	0.64** (0.14)
Post-deliberation dummy × Opinion on private cars squared	−0.13 (0.16)	—	—	—	−0.09 (0.18)
Intercept	0.18 (0.28)	0.99 (0.15)	0.99 (0.16)	0.99 (0.17)	0.21 (0.21)
<i>Random effects</i>					
Intercept	2.36 (0.73)	3.07 (0.81)	3.07 (0.80)	2.99 (0.77)	2.39 (0.74)
Residual	4.43 (0.80)	4.47 (0.82)	4.48 (0.81)	4.46 (0.83)	4.48 (0.78)

Note. Cell entries are unstandardized *B* coefficients with cluster-robust standard errors in parentheses to adjust for clustering at the small group level. * $p < 0.05$; ** $p < 0.01$.

Discussion and Conclusion

We analyzed whether participation in a DMP would reduce confirmation bias. We anticipated observing a reduction because participants were exposed to diverse opinions and constructive argumentation during deliberation. However, we did not find evidence that deliberation had such an effect. Confirmation bias was observed among participants at the outset, and the level remained the same after deliberation. Both among the opponents and supporters of private car use, confirmation bias was higher the more extreme their opinion was. Moreover, opinion extremity was positively associated with confirmation bias at t1 and t3; that is, deliberation did not affect this

association. None of the other variables, small group disagreement, political knowledge, or opinion change were found to be associated with confirmation bias.

Why did we not see a reduction in confirmation bias among the participants of the DMP? We cannot rule out the possibility that three hours of online discussion was not enough to influence confirmation bias. Perhaps longer exposure to diverse opinions would be needed. It may also be that online deliberation does not have the same effects on confirmation bias as face-to-face deliberation would have, although existing literature suggests that online and offline deliberations produce similar outcomes regarding opinion transformations and

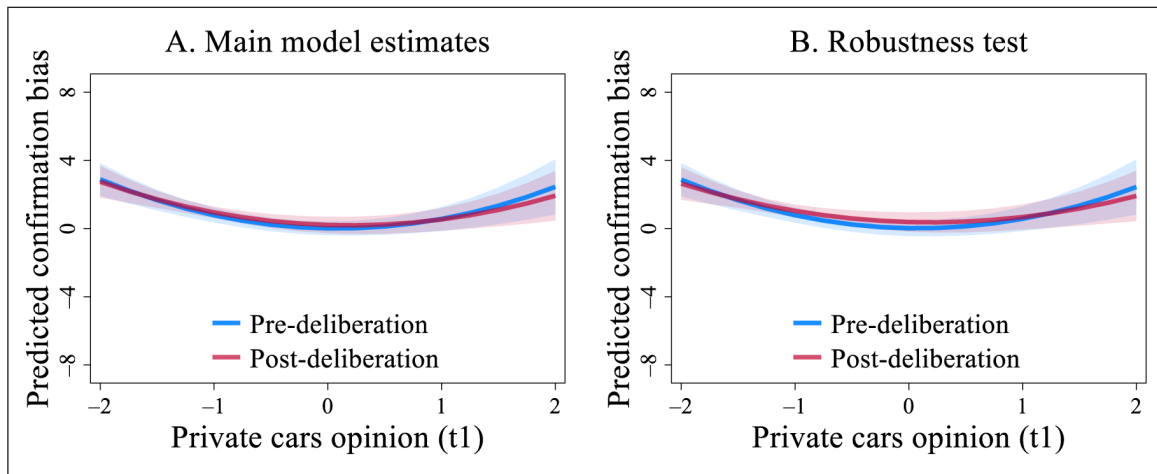


Figure 4: Predicted confirmation bias according to opinion on the use of private cars (shaded areas indicate 95% confidence intervals).

learning (Grönlund, Strandberg & Himmelroos 2009; Strandberg, Himmelroos & Grönlund 2019; Gelauff et al. 2023). Further studies should address whether a) longer and b) face-to-face deliberations lead to parallel outcomes to ours, or whether they can reduce confirmation bias. It also seems possible that even the supportive conditions of a mini-public discussion (Gerber et al. 2018) do not remove biases in searching for information. Certain studies suggest that information is not processed in an unbiased manner in discussions. These studies may give insights into why we did not observe a reduction in the bias. Evidence regarding group discussions suggests that information is not evaluated equally; rather, people tend to value information they hold prior to discussion, information that is congruent with their opinions, and information they share with others (Mojzisch, Grouneva & Schulz-Hardt 2010). People may also feel that their role is to defend their own preferences in a group discussion (Mojzisch, Grouneva & Schulz-Hardt 2010; Stasser & Titus 1985). Declaring one's opinion at the beginning of a discussion may intensify this process (Baccaro, Bächtiger & Deville 2014). While participants in *Turku deliberates* were not asked to reveal their opinion at the start of the small group discussion, they were not forbidden to do so either and many of them may have expressed what they thought about transportation policies. Hence, the outcome may have been a discussion in which information was not shared or talked about in an unbiased manner but where people predominantly presented information that supported their views as well as valued information others presented according to their pre-existing views. Furthermore, mini-public participation can stimulate “internal deliberation” which may intensify confirmation bias (Dickinson 2020; Dickinson & Kakoschke 2021).

Another possibility for not observing a reduction in confirmation bias pertains to social identities. If the use of private cars was connected to the participants' social identities, biased information searching could serve “as a psychological defense mechanism for social identity threat” (Wright 2022). If preference-incongruent article

headlines were (subconsciously) perceived as threats to participants' social identities, they may have avoided choosing them. Being against private cars or being a private car driver may well present social identities for some people working counter to processes that would alleviate biased information searching.

Participants' information searching may have been influenced by their position in an opinion majority or minority. While *Turku deliberates* participants held diverse opinions, the majority was critical about the use of private cars, and opinions developed in a more critical direction during deliberations. There is evidence that those who hold minority views rate information that is incongruent with their own view as more important compared with those who hold majority views (van Swol 2007). In the *Turku deliberates* mini-public, however, being in an opinion minority or majority did not influence confirmation bias. Opinion extremity was associated with confirmation bias, and deliberation did not influence this association. The observation that people with extreme opinions were reluctant to acquire information that contrasted with their opinions is worrying because it may undermine the potential of deliberation to ease polarization.

Are these results bad news for deliberative democracy? On the one hand, it is possible that it is too much to expect that three hours of deliberation would reduce confirmation bias, a consistent characteristic of information searching. On the other hand, it can be argued that reducing individual level confirmation bias is not what deliberation is supposed to do, but that it is rather expected to take care that diverse views and diverse information are considered in group deliberation. When these processes are in place, “group reasoning will outperform individual reasoning” (Mercier & Landemore 2012, p. 243).

There are certain limitations to our study. First, the confirmation bias measure we used is somewhat limited because it only pertains to the selection of information, whereas information processing is not captured by it. It is possible that we did not capture confirmation bias because the participants were only asked to select

article headlines, whereas reading the articles was not possible. Further studies could examine the potential of deliberation to mitigate confirmation bias with a reading task. Furthermore, we cannot rule out that processes such as interest in the topic may have influenced headline selection, rather than being reluctant to read materials that contrast one's views. It is noteworthy though that the headlines used were evaluated to be equally interesting in a pilot test. Further studies could look at the influence of the topic on confirmation bias. In our case, the topic was likely to be connected to social identities, which may have reduced the possibility that the bias would be reduced. Further studies could also experiment with different types of discussion rules, emphasizing openness to opposing opinions and information that contradicts existing views, to see whether explicitly promoting openness to all kinds of information is needed to decrease confirmation bias. Finally, we did not have a control group, and further studies could address this limitation by a comparison to a group who does not deliberate, but engages with another task, for example, reading or writing on the topic.

Notes

- ¹ According to an analysis of the frequencies of different themes in the small group discussions (with MAXQDA software) the use of private cars was among the three most often discussed themes.
- ² The mini-public participants were randomly allocated into two types of groups. Citizens only groups contained only lay citizens, whereas Citizens plus politicians groups had two local politicians deliberating with the citizens. The intervention was designed with a view to study the possibility to connect a citizens' engagement methods to the work of the city council. This intervention was not designed to influence confirmation bias, and no difference in confirmation bias was observed between the two types of groups either before or after deliberation.
- ³ The headlines plus editorials were between 37 and 58 words in length. The eight headlines in the actual survey were chosen on the basis of a pretest in which twenty-one students evaluated twenty headlines and editorials according to whether they were for or against the use of private cars, as well as how interesting the headlines were. Eight headlines that were clearly identified as being for or against the use of private cars and that were also perceived to be interesting were selected to be used in the actual study.
- ⁴ The possibility to fill in and return a paper copy was allowed because the initial sample only included postal addresses and participants were first contacted by regular mail.

Additional File

The additional file for this article can be found as follows:

- **Supplementary material.** Tables S1–S2, Knowledge questions and Figure S1. DOI: <https://doi.org/10.1691/jdd.1617.s1>

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Competing Interests

The authors have no competing interests to declare.

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