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Primacy Effects in the Formation of Opinions on an Unfamiliar Environmental Topic: Experimental Evidence from Mineral Exploration and Mining

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Abstract

Transitioning to the green economy relies on new developments that may negatively affect people's localities and involve certain risks. This study investigates how people form opinions about such developments, using mineral exploration and mining as an example. A representative sample (N=1000) participated in a pre-registered online experiment where they were exposed to information supporting or opposing mining. We recorded a strong primacy effect: the information participants read first biased subsequent opinion. This effect was reinforced when people read counterargument that integrated information about both risks and benefits of mining and when they made a public stance.

Keywords: primacy effect; opinion formation; environment; climate crisis; energy crisis; place attachment

1. Introduction

Climate change and the global energy crisis have brought into focus topics that had previously been outside of mainstream public discourse. Governments and NGOs are devising a wide range of technological solutions to transition to a green economy, including many that involve substantial changes to public infrastructure and/or the deployment of new technologies – e.g., reallocating road space for active travel, developing new wind farms, installing district heating networks or constructing carbon capture and storage facilities. What these diverse solutions have in common is a risk of being halted or delayed by public opposition. Opposition may originate in genuine concerns about the risks involved, a general aversion to change or, potentially, misinformed or biased opinions. It is thus important that communication about these developments maximises people's capability to form unbiased attitudes, based on accurate perceptions and comprehension of the relevant benefits, drawbacks and risks.

When forming opinions on a controversial topic, the first piece of information that people receive is usually more influential than subsequent information. This phenomenon is known as the primacy effect (Asch, 1946, Murdock, 1962). Primacy effects have been recorded across multiple domains, from courtroom decisions (Lawson, 1969) to lunch choices (Andersson & Nelander, 2021). If the first piece of information people receive is one-sided, there is a risk that they will form biased opinions.

Primacy effects may have particular relevance for the global energy crisis. People are being continually exposed to technologies and developments with which they are unfamiliar and the information they receive about these developments is not always balanced and accurate. Understanding how to impart information that allows people to form unbiased attitudes, or how to counteract primacy effects where biased attitudes have formed, is therefore important for policy communication. Mineral exploration and mining are a key example of a type of development that has both benefits and drawbacks that require neutral communication to allow people to make an informed decision. The present study focuses on this domain.

The mining industry is of critical importance in transitioning toward clean energy as most green technologies rely on the continued extraction of specific minerals. For example, a wind plant requires nine times more mineral resources than a gas-fired plant (International Energy Agency, 2021). However, mineral extraction is a double-edged sword in relation to environmental impact: while minerals are used to create new greener technologies, extraction is environmentally hazardous and a source of carbon emissions.

If mining is subject to primacy effects, the first information that people receive on a new mining development may have a lasting effect on their opinions. If this information is negative, a primacy effect can lead them to disregard any benefits the development can bring and result in strong opposition to this development. Opposition and negative attitudes to existing or proposed mining, (although not necessarily mineral mining) projects have been recorded among communities affected by them (Akchurin, 2020; Holden & Jacobson, 2007; van der Plank et al., 2016). On the other hand, if the first information is positive, a primacy effect can lead to unrealistic expectations from the development and lack of consideration of risks that it may involve. Thus, it is important to understand which factors weaken primacy effects and thereby reduce bias in opinion formation and decision-making. We are aware of no research to date that has systematically explored psychological

processes underlying opinion formation towards mineral exploration and mining. This requires studying a context where mining is a novelty and where most people would not know much about the topic or have a clearly defined attitude on it.

There are some factors that can enhance primacy effects. When the topic is personally relevant, people may engage in information processing more actively, form opinions early and be less likely to update them in light of new information (Haugtvedt & Wegener, 1994; Petty et al, 2001). This can be explained by cognitive consistency, a psychological need "as basic as hunger or thirst" (Festinger, 1957, Gawronski, 2012; Gawronski & Brannon, 2019). It can help one to identify errors in their worldview (Gawronski, 2019). When people face an unfamiliar topic, the first piece of information they receive about it is perceived as credible and informs their opinion on this topic. When they encounter subsequent information that is inconsistent with the initial opinion, they experience negative affect that serves as a cue that something might be incorrect and that information they possess needs to be updated to allow for a more context-appropriate thinking and behaviour. However, instead of resolving inconsistency by revising their opinions, people often display motivated reasoning in how they process subsequent information, giving more weight to arguments that support their opinion than to arguments that challenge it (Kunda, 1990). This is even more likely when people have a higher "commitment" to the position they support (Schwarz et al, 1980; Kadous et al., 2003), for example when they explicitly state their position on an issue.

There is less clarity with regards to what works best to counteract primacy effects. Literature on misinformation suggests that so-called "corrections" need to provide a coherent narrative to be effective, rather than simply to refute the "incorrect" information (Walter & Tukachinsky, 2020; Lewandowsky et al., 2012), which can seem untrustworthy and lead to a backfire effect. Given this, providing balanced information that presents counterarguments in the context of the original arguments may be better for counteracting primacy effects. However, there is also a danger that repeating the original arguments reinforces them and enhances any primacy effect present (Dechêne et al., 2010). Furthermore, evidence for backfire effects is mixed; they may only occur for particularly contentious topics (Stanley et al., 2020; Wood & Porter, 2018).

Finally, differences in people's broader worldviews can influence how they initially process information about novel issues. People hold diverse environmental beliefs, such as beliefs about climate change, environmental attitudes and ecological concerns, which influence how they think about specific human activity that may cause environmental harms (Tsujikawa et al., 2016). Concern about the negative impact of mining on the environment is a leading reason for opposition to mining (Ashraf et al., 2011; van der Plank et al., 2016), while the potential for positive environmental impacts may appear counterintuitive. A second broader characteristic likely to influence attitudes to environmental topics is place attachment – an emotional bond between individual and place. Place attachment is linked to the level of public support or opposition to new developments near homes and communities (Lewicka, 2011; Scannell & Gifford, 2010), and has been used to explain the so-called NIMBY (not in my backyard) phenomenon (Ab & Devine-Wright, 2012; Devine-Wright, 2009).

2. Current study

The abovementioned research indicates strong potential for biased reasoning when it comes to support for, or opposition to, large-scale projects with important environmental impacts. The

current study set out to investigate how people integrate conflicting information when forming opinions on an unfamiliar environmental topic, using mineral exploration and mining as an example. We designed an experimental study to test for a primacy effect and to explore factors that strengthen or weaken the effect when people form first opinions on mineral exploration and mining. Participants read initial information followed by counterarguments. We manipulated (i) whether the first information was in support or opposition to mineral exploration and mining, (ii) whether participants stated their initial position on the topic after reading this first information, and (iii) whether the counterarguments included the initial information to present a balanced view of benefits and risks ("balanced counterargument" further in text) or whether they were given in isolation ("isolated counterargument" further in text). Hence the design was a 2x2x2 between-subjects design. We also measured participants' levels of environmental concern and place attachment.

The study was undertaken in Ireland. Our dependent variables were support of mineral exploration and mining in Ireland and in the participant's county. Ireland is a good context for the study because the topic would be unfamiliar to the majority of people. It is likely that in contexts where mining is a more familiar topic, other mechanisms explaining attitudes towards it would operate. The study was pre-registered on Open Science Framework: https://osf.io/st748/?view_only=6ff3ebb1e75f48a89acbd22bd124c114.

2.1. Pre-registered hypotheses

We formulated the following predictions. First of all, we expected to register a primacy effect. Specifically, we hypothesised that *the participants who read information in support of mining first would report higher support for mineral exploration and mining compared with the participants who read information against mining first (H1).*

Further, we expected that *the primacy effect would be moderated by whether counterarguments were balanced or isolated (H2).* We did not have a directional prediction for this effect, given that the existing literature suggests reasons why giving counterarguments together with the original arguments could either enhance or hinder any primacy effect.

We expected that expressing a stance after reading the first piece of information would reinforce any primacy effect. *In particular, we expected that there would be a greater difference in support for mineral exploration and mining between those who read information in support first and those who read information against first in the group of those who stated their position (H3).*

Finally, we predicted that *environmental concern (H4) and place attachment (H5) would be negatively associated with support for mineral exploration and mining*.

2.2. Additional exploratory questions

We asked several additional research questions that would allow us to gain a more in-depth understanding of any primacy effect detected. First, we asked *whether place attachment moderated the primacy effect (RQ1).* On the one hand, place attachment may increase motivation to think, therefore making people more susceptible to the primacy effect. In this case, we would find a larger difference in support for mineral exploration and mining among people with high levels of place attachment. On the other hand, people with high levels of place attachment might fear that their

locality would undergo undesired changes and consequently engage in place-protective thinking and action (e.g., Devine-Right, 2009). In this case, there would be no moderation effect, and people with high levels of place attachment would be generally less supportive of mineral exploration and mining that those with low levels of place attachment.

Second, to better understand the underlying mechanisms, we asked *whether beliefs about mineral exploration and mining mediated the primacy effect (RQ2).* Specifically, we wanted to know whether people formed more positive (negative) about specific aspects of mineral exploration and mining (as distinct from general support for mining) if they had read information about benefits (risks) of mineral exploration and mining first, and whether these beliefs could explain their subsequent higher (lower) support for mineral exploration and mining.

Finally, we asked *whether there were differences in susceptibility to the primacy effect among those who were new to the topic and those who had previous exposure to it (RQ3)*. Our sample included a share of people who had previous exposure to the topic of mineral exploration and mining. We assumed that these people would have pre-existing beliefs on the topic. As people with pre-existing beliefs tend to pay more attention to and give more weight to the information that confirms their pre-existing beliefs, they should be less susceptible to primacy effect.

3. Method

3.1. Participants

A nationally representative sample (N = 1000) was recruited by a market research company to participate in an online study. When determining our sample size, we aimed to collect a sufficient number of observations to be able to reliably test the hypothesized two-way interaction effects (200-250 per cell). With this sample size, we aimed to reduce the standard errors while keeping the costs of the project feasible. As for quality controls, no participants indicated that their data could not be used, and all those who did not pass attention checks were excluded automatically without being able to finish the survey. Hence, the final sample suitable for the analysis consisted of 1000 participants.

The final sample closely matched the Irish population distribution by gender (52% female), age (36% aged 18-40, 38% aged 40-59) and region (50% of participants living in Leinster, including 25% in Dublin, 28% of participants in Munster, and 23% in Connacht or Ulster). The majority had lived in their local area for longer than 10 years, and only 18% planned to move away in the next 3 years. Awareness and prior exposure to the topic were low – 13% said that they were very or moderately familiar with mineral exploration and mining, 14% had lived close to a site of mineral exploration and 14% had either worked or known someone who worked in the mining sector. There was a substantial overlap between these groups.

3.2. Procedure

Figure 1 presents the overall design and procedure of the experiment. We collected the data online using the Gorilla platform (https://gorilla.sc/) to host the study. After giving consent, all participants read a short introduction explaining what minerals, mineral exploration and mining were. It was emphasised that the study was about mining for minerals, not coal mining.

Figure 1 Experimental design and procedure.
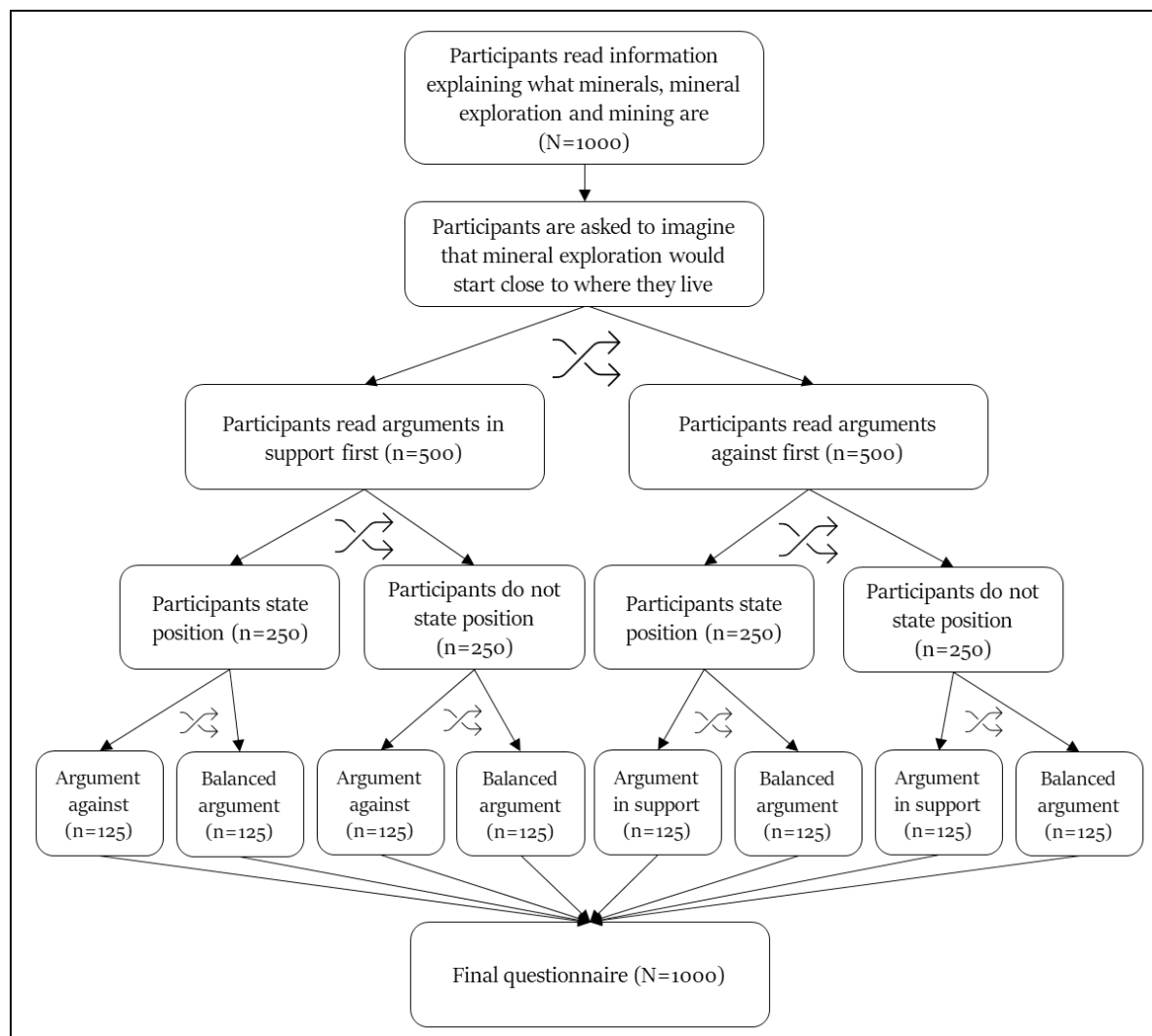
Note. ⤬ = randomisation

We asked the participants to imagine that mineral exploration was about to start in their local area and to keep this in mind during their participation. We then randomly assigned the participants to either read information in support of or opposition to exploration and mining.

After reading the initial information, participants were again randomly assigned such that half were asked to state their position on mineral exploration and mining in Ireland while half were not. Those in the "statement of position" group could choose between four response options: (1) I strongly oppose mineral exploration and mining in Ireland, (2) I somewhat oppose mineral exploration and mining in Ireland, (3) I somewhat support mineral exploration and mining in Ireland, (4) I strongly support mineral exploration and mining. After stating their position, the participants were asked to choose any actions they might take in response to the news of possible mine development in their county from a list. Depending on their answers to the previous question, the participants were presented with either actions in support (e.g., attending an information meeting held by the mining company, enquiring about new jobs created by the development) or against (e.g., taking part in a

lawful protest against the development, contacting local government with a complaint) mineral exploration and mining.

Participants then read counterarguments to the initial information. They were randomly assigned to see either balanced or isolated counterarguments. Finally, all participants filled out a questionnaire to capture dependent variables and observed measures.

The texts with information in support of and against mining were followed by attention checks. These consisted of two factual questions based on information presented in the arguments. The questionnaire contained two additional attention checks – standard items asking participants to choose a certain response.

3.3. Materials and Measures

3.3.1. Information that supports and opposes mining

We used 10 arguments in support, 10 arguments against mineral exploration and mining, and 10 arguments that integrated both the information in favour and against. The arguments covered 10 different topics: (1) the importance of minerals, (2) the impact of mineral exploration, (3) the impact of mining on the landscape, (4) the impact of mining on biodiversity, (5) mining and pollution, (6) mine closure, (7) usage of natural resources, (8) mining and employment, (9) mining in Ireland as opposed to other countries, and (10) mining and occupational safety. The arguments were developed in collaboration with Geological survey Ireland using the information from the variety of sources. The order of topics was randomised. Below are the examples of arguments on the topic of the economic impact of mining.

- Argument in support: "*Mines create jobs and give a boost to the local economy. Employees can later use their skills to move on to jobs elsewhere in the sector*".

- Argument against: "*Overreliance on mining can weaken the economy. The sector depends on commodity prices that go up and down. When they go down, this leads to a drop in revenue and potential job cuts*".

- Balanced argument: *"Mines create jobs and can give a boost to the local economy. Employees can later use their skills to move on to jobs elsewhere in the sector. On the other hand, overreliance on mining can weaken the economy. The sector depends on commodity prices that go up and down. When they go down, this leads to a drop in revenue and potential job losses for those employed in the industry".*

Before the main study, we conducted a pilot with 40 people from different backgrounds to ensure that the arguments included in the study were perceived as easy to understand, believable and convincing.[1] Arguments that integrated information in support and against were not pretested; these were constructed after the main sets of one-sided arguments had been selected based on the results of the pretest. The final texts presenting information in support, against and blended information contained 524, 384, and 878 words, respectively.

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[1] In the pilot, each topic was represented by two arguments in support and two arguments against mineral exploration and mining. We selected arguments with the highest means and lowest standard deviations on the three parameters (clarity, credibility and persuasiveness).

In the main study, the average time that participants took to read the texts was 126, 92 and 192 seconds, respectively. The arguments can be found in the Appendices A-C. Participants assessed the texts as moderately easy to understand, convincing and believable (see Appendix D for descriptive statistics). Information against mining was perceived to be slightly more convincing and believable.

3.3.2.   Dependent variables

We used the following dependent variables (the first two were of primary importance to our study):

1) Support of/opposition to mineral exploration and mining in Ireland (1 item, numeric response scale: 1 = "I strongly oppose mineral exploration and mining in Ireland", 7 = "I strongly support mineral exploration and mining in Ireland").

2) Support of/opposition to mineral exploration and mining in the participant's country (1 item, numeric response scale: 1 = "I strongly oppose mineral exploration and mining in my county" and 7 = "I strongly support mineral exploration and mining in my county").

3) Willingness to take action in support of/opposition to mineral exploration and mining in Ireland and the participant's county (7 items, 7-point response scale). Sample item: "Based on the information about mineral exploration and mining that you read today, how likely would you be to support the development of mineral exploration and mining in Ireland (for example, by sharing a post on social media)?

4) Perceived simplicity, persuasiveness and credibility of information of support and against (one item for each attribute, 7-point response scale).

5) Beliefs about specific aspects of mineral exploration and mining (10 items. Sample item: "It is better to mine the minerals we need here in Ireland rather than import them from elsewhere", 7-point response scale). The questions reflected the topics covered in the texts with information in support and against. The central aspects were environmental and economic impacts of mineral exploration and mining.

3.3.3.   Observed independent variables and controls

Environmental concern was measured using four items from the New Environmental Paradigm scale (Dunlap et al., 2000), an example of which is "If things continue on the present course, we will soon experience a major ecological catastrophe" (1-7 response scale). Place attachment was assessed using a single item: "How attached are you to your local area?" (1-7 response scale).

We included a standard set of socio-demographic variables and several variables to capture participants' previous exposure and knowledge of the topic. Specifically, we asked the participants how familiar they were with the topic of mining (response options: 1 = not at all familiar, 2 = slightly familiar, 3 = moderately familiar, 4 = very familiar), whether mineral exploration had ever taken place close to where they lived (response options: 1 = yes – currently, 2 = yes – in the past but not anymore, 3 = no – but it has been proposed, 4 = no, 5 = not sure), whether they had ever lived close to an active mine (1 = yes – currently, 2 = yes – in the past but not anymore, 3 = no, 3 = not sure), and whether they or anyone they know had ever been employed in mining or a related industry (1 = yes – myself, 2 = yes – a close relative or friend, 3 = yes – an acquaintance, 4 = no, 5 = not sure).

Preliminary analysis identified that the responses on items assessing perceptions of arguments, the environmental concern scale and place attachment item were heavily skewed to the right. We recoded these as dichotomous variables. For variables measuring perceptions of arguments, responses were grouped into the following categories: (1) high (a score of 5 and higher on a 7-point scale), and (2) lower (a score of 4 and lower). For environmental concern and place attachment, the two categories represented those who had very high (a score of 6 and above on a 7-point rating scale) or lower (a score of 5 and below) levels of environmental concern and place attachment, respectively. We also transformed some of the socio-demographic variables to obtain dichotomous variables for sex (female vs. other), type of area (rural vs. urban), region (Connacht/Ulster[2] vs. other), duration of living in the local area (more than 10 years vs. other) and plans to move to a different area in the future (yes vs. no). Similarly, we transformed familiarity (high familiarity vs. low or no familiarity) and previous exposure to the topic of mining into binary variables (having lived or currently living close to exploration/mining site vs. no). We performed all transformations before undertaking any statistical tests of hypotheses.

3.4. Analytical strategy

All analyses were done in R. We followed the analysis plan outlined in OSF preregistration. At the preliminary stage, we checked the distributions of our dependent variables. We anticipated non-normally distributed responses, and this was confirmed by the Shapiro-Wilk test. This led us to use non-parametric tests.

3.4.1. Main analyses

In the first stage, we conducted a bivariate analysis by Wilcoxon-Mann-Whitney test to assess the effects of order of information on support for mineral exploration and mining in Ireland and the participant's county (H1), and the effects of individual differences (H4 and H5). Further, we conducted Scheirer–Ray–Hare tests (Sokal & Rohlf, 1996) – a two-factor extension of the Kruskal-Wallis test – to assess the "order of information x format of counterarguments" (H2) interaction and the "order of information x statement of position" (H3) interaction. Post-hoc analyses were undertaken by a Dunn test with Bonferroni correction to adjust for multiple comparisons.

In the final stage, we conducted logistic regression analyses to test the robustness of our findings. Socio-demographic variables and variables assessing prior exposure and familiarity with the topic were added to the models as robustness checks. We ran the same set of models for different dependent variables, including willingness to take action in support of mineral exploration and mining, beliefs about exploration and mining and perceptions of the arguments we used as easy to understand, convincing and believable. However, due to limited space, in the main text of the article we describe in detail the results for the two main dependent variables (level of support for mineral exploration and mining in Ireland and the participant's county) only. The models for other dependent variables can be found in Appendices.

We planned to run ordered logistic regressions for most dependent variables. The proportional odds assumption of ordered regression is that the influence of the independent variables should be the

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[2] We were interested in Connacht as, at the time of the experiment, the region had a higher level of activity in opposition to mining due to a local project in early development.

same for each category of the dependent variable. The standard test of this assumption is the Brant test. All models for the two main dependent variables (support for exploration and mining in Ireland and participant's county), and two additional dependent variables (willingness to take action to support mineral exploration and mining in Ireland and participant's county), passed the Brant test (p > 0.1). The models for the dependent variables that represent beliefs about different aspects of mineral exploration and mining did not pass the Brant test and, therefore, were transformed into dichotomous variables. We ran binary logistic regression models for these instead. We also ran binary models for perceptions of arguments as easy to understand, convincing and believable, as variables assessing those were transformed into dichotomous in the previous step.

3.4.2. Additional exploratory analyses

To answer the questions about possible moderating effects of place attachment and familiarity (RQ1 and RQ3), we conducted Scheirer–Ray–Hare tests to assess the "order of information x place attachment" and "order of information x topic familiarity" interactions. When the interaction effect was significant, we followed up on it using a Dunn test with Bonferroni correction. To test mediation (RQ2), we ran a causal mediation analysis using package "mediation" in R (Tingley et al., 2013).

4. Results

4.1. Primacy Effect (H1)

Mean levels of support for mineral exploration and mining in Ireland were 4.17 (SD = 1.7, SE = .08) out of 7 for those who read information in support first and 3.75 (SD = 1.66, SE = .07) for those who read opposing information first. This difference was highly statistically significant (Mann-Whitney-Wilcoxon W = 106383, p < .001, one-tailed), indicating the presence of a primacy effect. A similar pattern was observed with regard to support for mineral exploration and mining specifically in the participant's county. Mean support was 4.01 (SD = 1.83, SE = .08) for those who read information in support first versus 3.54 (SD = 1.75, SE = .08) for those who read information against first (W = 106019, p < .001, one-tailed).
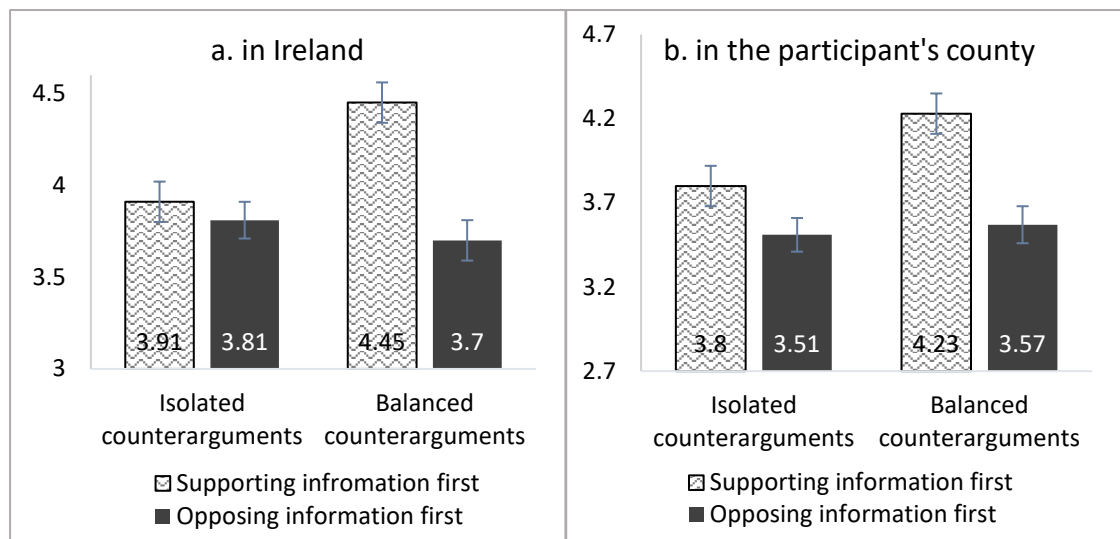
4.2. Moderating Effect of the Format of Counterarguments (H2)

There was a significant interaction effect between order of information and format of counterarguments on support for mineral exploration and mining in Ireland (H = 8.859, p = .002). Follow-up analysis revealed that the primacy effect was only significant for the group who read the balanced counterarguments (Figure 2a and see Appendix E for details on simple effects). Support for mineral exploration and mining in Ireland was highest among those who read information in support first and then were presented with the balanced version of the counterarguments, suggesting that repeated exposure to information about the benefits of mineral exploration led people to form more positive opinions about it. However, among those who read counterarguments in isolation, the mean levels of support did not differ depending on whether they had read the supporting or opposing information first.

The pattern of results was the same for support for mineral exploration and mining in the participant's county. We also found a significant (but weaker) interaction effect (H = 4.343, p =.037). While there was a small primacy effect when counterarguments were isolated, the difference in the levels of support between those who read information in support of and against mining first was

significant only when counterarguments were balanced (Figure 2b and see Appendix E for details on simple effects).

Figure 2 Interaction effect of order of information and format of counterarguments on support for mineral exploration and mining in (a) Ireland and (b) the participant's county.

Note. The difference between the maximum and minimum bounds on the y-scale equals to one standard deviation. Error bars are standard errors.

4.3. Moderating Effect of the Statement of Position (H3)

The interaction effect between order of information and statement of position on support for mineral exploration and mining in Ireland was marginally significant ($H = 3.50$, $p = .06$). There was a significant difference in attitudes in the group who stated their position but not in the control group (Figure 3a and see Appendix F for details on simple effects).

Figure 3 Interaction effect of order of information and statement of position on support for mineral exploration and mining in (a) Ireland and (b) the participant's county.
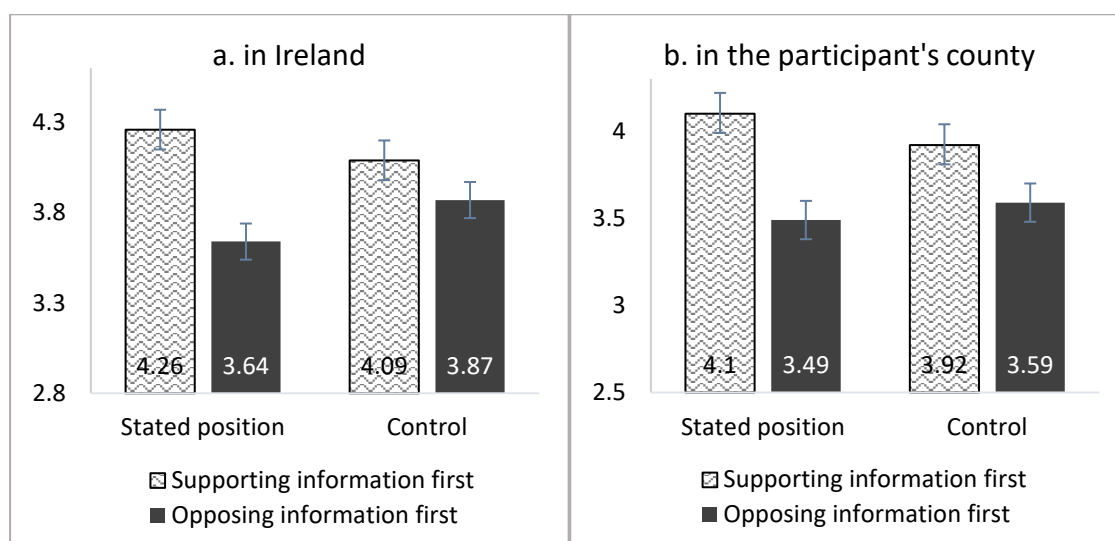

Note. The difference between the maximum and minimum bounds on the y-scale equals to one standard deviation. Error bars are standard errors.

There was no significant interaction effect between order of information and statement of position on support for mineral exploration and mining in the participant's county ($H = 1.44$, $p = .231$). There was a primacy effect present both among those who stated their position and those who did not, although it was larger among those who stated their position (Figure 3b and see Appendix F for simple effects). However, the pattern of results was similar to that for support in Ireland.

We expected that most would state a position congruent to the information they read previously (i.e., those who read information in support would say that they supported mineral exploration, and those who read arguments against would say that they opposed exploration); the results confirmed this. However, 133 people out of the 500 asked this question stated an incongruent position. We repeated the analyses excluding those who stated a position incongruent with the first information they read as a sensitivity check and found a larger interaction effect (Appendix G).

4.4. The Effects of Individual Differences (H4 and H5)

People with high levels of environmental concern expressed lower support of mineral exploration and mining in Ireland ($M = 3.66$, $SD = 1.71$, $SE = .06$, $N = 691$) than people with low-to-average levels of environmental concern ($M = 4.62$, $SD = 1.46$, $SE = .08$, $N = 309$). The difference was highly statistically significant ($W = 141024$, $p < .001$, one-tailed). Similarly, people with high levels of environmental concern expressed lower support of mineral exploration and mining in the participant's county ($M = 3.45$, $SD = 1.79$, $SE = .07$) than people with low-to-average levels of environmental concern ($M = 4.47$, $SD = 1.64$, $SE = .09$). The results were also statistically significant ($W = 141041$, $p < .001$, one-tailed).

The pattern of results was similar for place attachment. People with high levels of place attachment expressed significantly ($W = 125548$, $p = .009$, one-tailed) lower support of mineral exploration and mining in Ireland ($M = 3.86$, $SD = 1.75$, $SE = .07$, $N = 646$) than people with low-to-average levels of place attachment ($M = 4.15$, $SD = 1.57$, $SE = .08$, $N = 354$). Similarly, people with high levels of place attachment expressed significantly ($W = 128882$, $p = .001$, one-tailed) lower support of mineral exploration and mining in the participant's county ($M = 3.63$, $SD = 1.86$, $SE = .07$) than people with low-to-average levels of place attachment ($M = 4.02$, $SD = 1.66$, $SE = .09$).

4.5. Modelling

To check the robustness of our findings, we ran a series of ordered logistic regression models for support of mineral exploration and mining in Ireland and the participant's county (Table 1). Model 1 included experimental manipulations, interactions between them and two psychological characteristics – environmental concern and place attachment – as predictors. Model 2 included socio-demographic characteristics and variables assessing prior exposure to the topic of mineral exploration and mining as robustness checks. Across all dependent variables, model 2 had an improved model fit as indicated by likelihood ratio test.

Overall, modelling confirmed the results of previous analyses. The interaction between order of information and format of counterarguments in support of mineral exploration and mining in Ireland was robust. The effect held when background variables were added. Interaction between order of information and statement of position was nonsignificant but in the same direction as in the

previous analysis. The effects of environmental concern and place attachment were significant and large across both models.

As for support for exploration in the participant's county, the effects of environmental concern and place attachment were stable across both models. The interaction effect between order of information and format of counterargument was nonsignificant but was in the same direction as indicated in the previous analysis.

Among background variables, age and having lived close to an exploration site were significant predictors of support of mineral exploration and mining in Ireland. People aged over 60 were more positive towards exploration and mining than younger participants. Those living in Connacht – a region in Ireland known for higher opposition to mining at the time of the experiment – expressed lower levels of support for mineral exploration and mining in their county.

Table 1 Ordered logistic regression models for support for mineral exploration and mining (a) in Ireland and (b) the participant's county. N = 1000.

	(a) in Ireland		(b) in county	
	Model 1	Model 2	Model 1	Model 2
Read information in support first	-.034	-.037	.179	.267
	(.197)	(.198)	(.200)	(.198)
Balanced counterarguments	-.072	-.088	.013	.007
	(.156)	(.157)	(.154)	(.155)
Read information in support first and balanced counterarguments	**.606****	**.640****	.386	.412
	(.225)	**(.227)**	(.224)	(.226)
Stated position	-.251	-.225	-.088	-.058
	(.156)	(.158)	(.154)	(.156)
Read information in support first and stated position	**.401*[3]**	.342	.199	.129
	(.225)	(.227)	(.225)	(.227)
Environmental concern	**-.981*****	**-.991*****	**-.985*****	**-.982*****
	(.123)	**(.124)**	**(.124)**	**(.125)**
Place attachment	-.199	**-.318***	**-.298***	**-.445****
	(.117)	**(.124)**	**(.117)**	**(.123)**
Female		**-.340***		**-.351***
		(.115)		**(.114)**
Age (Ref = 40-60 yo)				
Below 40 yo		-.147		-.164
		(.134)		(.133)
Above 60 yo		**.405***		**.431***
		(.146)		**(.146)**
Lives in Connacht		-.262		**-.368***
		(.135)		**(.137)**
Plans to leave Ireland		-.145		-.227
		(.159)		(.160)
Lived near exploration		**.406***		**.488***
		(.181)		**(.179)**
Lived close to a mine		-.075		.034
		(.223)		(.226)
Worked in mining		.208		.220

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[3] Significant in a one-tailed test

		(.174)		(.171)
Log-likelihood	-1823.41	-1802.7	-1853.03	-1826.16

Note. *** p < .001; ** p < .01; * p < .05

The pattern of results was similar for beliefs about exploration and mining for willingness to take action. The analyses revealed significant effects of environmental concern and "order of information x format of counterarguments" interaction on beliefs about mineral exploration and mining being good for the Irish economy and beliefs about mining as being safe. The same interaction effect was nonsignificant on willingness to take action in support of exploration and mining in Ireland and participant's county, but it was in same direction as in models predicting support of exploration and mining presented in this section. Detailed results can be found in Appendices I and J.

Those who read arguments in support first evaluated them as slightly easier to understand, more convincing and more credible than those who read arguments against first. By contrast, people who read arguments against first evaluated them as slightly easier to understand, more convincing and credible. However, these differences were small and nonsignificant in the models that included psychological and background variables. High levels of environmental concern predicted lower perceived credibility and persuasiveness of arguments in support, and higher perceived credibility, persuasiveness and clarity of arguments again exploration and mining. People with high levels of place attachment were more likely to find arguments against easy to understand, convincing and credible. The results are summarised in Appendix K.

4.6. Additional exploratory analyses

4.6.1. *Does place attachment moderate the primacy effect? (RQ1)*

While both order and place identity affected support for mineral exploration and mining, we found no significant interaction effect between them (in Ireland: $H = 0.44$, $p = .507$, in the county: $H = 0.97$, $p = .32$). This suggests that people with high levels of place attachment express lower levels of support for mineral exploration and mining regardless of the content of the information they read first.

4.6.2. *Do beliefs about mineral exploration and mining mediate the primacy effect? (RQ2)*

Mediation analyses revealed significant indirect effects both for beliefs that mineral exploration and mining are good for the Irish economy and that these activities are safe. The direct effects remained significant too, suggesting partial mediation. The detailed statistics can be found in Appendix L.

4.6.3. *Does familiarity with the topic moderate the primacy effect? (RQ3)*

Although our study focussed on formation of opinions on a topic that most people had no previous knowledge of, our sample included a small proportion who were already familiar with the topic. Assuming that the mechanisms guiding how people process information about a more familiar topic would not be the same, we tested whether familiarity had any impact on the order effect we established. We found significant interaction effects between order of information and familiarity of the topic on support for mineral exploration and mining in Ireland ($H = 5.785$, $p = .016$) and participant's county ($H = 4.633$ $p = .031$). People familiar with the topic were not susceptible to the primacy effect, confirming that the mechanisms guiding integration of information about unfamiliar and familiar topics are different. It might be that people familiar with the topic display motivated

reasoning and are more influenced by information that confirms their beliefs, regardless of which order it is presented in. This proposition, however, needs to be tested empirically. For details of the current test, please refer to Appendix H. These results should be interpreted with caution as the sample of those familiar with the topic was small. As an additional robustness check, we ran our analysis on a sample that did not include those familiar with the topic and got the same results.

5. Discussion

The transition to a green economy relies on new developments that are unfamiliar to most people, involve changes to their localities and sometimes carry environmental risks. It is important that information is disseminated in a way that enables people to determine their support for, or opposition to, such developments without being prone to manipulation or bias. Using mineral exploration and mining as an example, our study sheds light on the mechanisms involved when people integrate conflicting information about an unfamiliar environmental topic. Specifically, we designed an experimental study to investigate primacy effects in opinion formation and its possible moderators.

As predicted, we found a significant primacy effect. People who first read information in support of mineral exploration and mining reported higher levels of support compared to those who first read information against. When people deal with the information on a new topic, they may rely more heavily on the first pieces of information they receive. The opinion formed on the basis of the initial information may then be resistant to change. This finding has implications for policy. Opinions and levels of support within communities are likely to depend on the first information about a development that people receive, so the more accurate this initial information is, the more informed will be the resulting opinions. Early, pro-active, factual communication might therefore be considered a policy priority.

A more in-depth look into the interaction effects that we tested allowed for a more nuanced analysis of the primacy effect. As we hypothesised, it was moderated by the format of counterarguments. Specifically, the primacy effect was limited to those who read balanced version of counterarguments suggesting that being exposed to the same line of argumentation, even if presented in the context of opposing information, helped the participants to maintain their initial opinion formed after reading the first set of arguments. This might be attributable to confirmation bias (Vedejová & Čavojová, 2022; Nickerson, 1998) and illusory truth from repeated exposure (Dechêne et al., 2010; Hassan & Barber, 2021; Henderson et al., 2021). At the same time, among those who read arguments against first, levels of support of mineral exploration did not differ regardless of whether people read balanced or isolated counterarguments. This could mean that people displayed negativity bias (Rozin & Royzman, 2001; Soroka, Fournier & Nir, 2019), such that they were generally more attentive to the negative information and gave it more weight. If so, the arguments against, when presented first, were more difficult to offset. Alternatively, people may have found the information about risks of mineral exploration and mining prior to participating in our study less surprising than the information about the benefits. In this case, repeating arguments against mining in the balanced counterarguments might have not have any additional effect. Our data do not allow us to tease apart these possible explanations.

Our hypothesis about the moderating role of statement of a position for or against mineral exploration was also supported, although the interaction effects were small. The primacy effect was larger among

those who stated their position, suggesting that people who did not make an early commitment were more likely to give equal weight to information, regardless of whether they read it first or not. It should be noted that the statement of position in our study was made in the context of an anonymous survey. Had people made the initial statement of position to another individual or, for example, to friends or family members, the effect might have been substantially stronger. Thus, the effect we measure could be considered a lower bound on the likely impact of stating an early position on willingness to change an opinion subsequently. Overall, the results suggest that taking a public stance can make people more critical of the information that is opposing their view and thus more resistant to opinion change. This again has implications, especially as social media provides opportunities to make public statements that leave enduring digital records.

Turning to individual differences, our results confirmed the importance of pre-existing beliefs to opinion formation. As predicted, we found a negative effect of environmental concern that was unsurprisingly large and significant for both support for exploration and mining in Ireland and in the participant's county. The effects of place attachment were smaller than those of environmental concern, but also significant and in the predicted direction. This finding confirms results from previous research that identified place attachment as an important predictor of public opposition to new developments near homes and communities (Lewicka, 2011; Scannell & Gifford, 2010). Environmental concern and place attachment were important not only for the final support or opposition to the mineral exploration and mining, but also for the way people perceived information in support and against the topic.

Our study has several limitations. First, the text presenting information in support of mining was somewhat longer than the text presenting arguments against. We determined that equalising the two in the experimental design was not a methodological possibility – it is the nature of some arguments that they are more succinct than others. The upshot is that participants might not have read the text presenting supporting information as attentively due to its length and this could have impacted our results on the moderating effect of the format of counterarguments. However, some experimental control was exerted by asking questions about the content of the arguments as an attention check. Those who did not answer these questions correctly were not included in the final sample. Nevertheless, future research can establish more firmly how our findings generalise to other contexts and arguments.

The second limitation is that while we presented people with accurate information about the risks and benefits associated with mineral exploration and mining, we did not provide sources alongside the arguments. Given that sources can be important predictors of the credibility of information (Kassin, 1983), generalisations from our results should consider the difference this might make. Our results might have been different if the arguments in support and against mineral exploration were clearly coming from sources perceived as biased.

Our research offers insights into the mechanisms underlying formation of public opinion on an environmental topic that people had little or no previous exposure to. The findings attest to the importance of the first information one encounters and suggest that opinions formed on the basis of this information can be difficult to change, especially if they are negative. Additionally, primacy effects may be reinforced by taking a public stance. This knowledge is valuable as new environmental topics

are becoming more salient. It highlights the importance of providing people with early access to unbiased information.

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APPENDIX A

Arguments in Support of Mining

1. Mineral exploration and mining are essential in the modern world. The minerals extracted through mining are required for many aspects of modern life, including electronics, green technologies, and human health. Without mineral resources, industry would collapse and living standards would plummet. Without minerals, we wouldn't be able to produce cars, computers, appliances, concrete roads, houses, tractors, fertilizer, electrical transmission lines.

2. Mineral exploration does not disrupt the local area. Surface damage is very minor and can be compared with that caused by farm machinery. Permission is normally sought from landowners and efforts are made to rehabilitate any surface damage. Some exploration projects end at early stages, before any drilling takes place at all.

3. Mining does not cause severe damage to the landscape. Underground mines do not look different from a small industrial complex. In fact, old mines are sometimes transformed into popular tourist attractions, like Glengowla mines in Connemara and Arigna mines in Roscommon.

4. Mines can be operated without significant damage to the ecosystem – to open a mine in Ireland there must be plans in place to protect the local ecosystem from disturbance. Efforts are also made to remediate mining sites after closure to restore their ecological integrity. For example, an ecologically important wetland habitat has been created at the former Galmoy mine site. Other areas have been returned to their original agricultural use.

5. Modern mining uses techniques to reduce waste and minimise pollution. Many companies are replacing diesel engines with electric engines where possible, which can significantly reduce the amount of CO_2 produced by mining operations. Environmental impacts are heavily regulated here in Ireland, and water and air quality around mines are monitored by the Environmental Protection Agency.

6. Proper planning ensures that mines do not cause problems after they are closed. Nowadays mine closure plans must be in place before a mine can be opened in the first place.

7. Mining allows us to make the most of Ireland's rich natural resources. Ireland now ranks as the seventh largest producer of zinc concentrates in the world - its export is an important part of our country's economy. A 2013 study showed mining's economic value at €800 million with over 3000 jobs. Mining companies contribute to the Irish economy through royalties and a tax rate of 25%, higher than the standard corporate tax rate.

8. Mines create jobs and give a boost to the local economy. Employees can later use their skills to move on to jobs elsewhere in the sector.

9. We should mine the minerals we need here in Ireland rather than importing them from elsewhere. Mining in Ireland, as opposed to mining in countries with weaker regulations or poor human rights records, will ensure that it is done responsibly.

10. Mining is a relatively safe profession here in Ireland. Mines have strict health and safety regulations, which cover such areas as vehicle and traffic rules, ventilation, emergency rules and procedures, hoisting, inspection, mines training, health and safety operations procedures, rescue work, and the transportation of explosives. There are many more deaths (approximately 20 times more) from agriculture in Ireland than there are from mining and quarrying.

APPENDIX B
Arguments Against Mining

1. There is no need to rely on mineral exploration and mining entirely as a source of minerals in the modern world. We should be focusing on reducing our consumption and investing our resources so that we can recycle more minerals rather than mine for new ones.
2. Mineral exploration causes severe disturbance to the local area. It involves drilling and heavy machinery – it is impossible to avoid surface damage when those are used. Exploration can be done without landowner's permission, there is no legal obligation to seek it.
3. Mines are ugly and a blight on the landscape. They destroy Ireland's beautiful scenery that we are known for around the world.
4. Mining causes severe damage to local ecosystems, including protected species. While mine remediation might reduce the damage done, it is impossible to restore a site to full ecological integrity.
5. Mining can cause serious pollution. There is especially a risk from a mine's tailings dam that contains sludge-like waste. Toxic chemicals are sometimes used to process minerals after they've been mined and can leach into groundwater.
6. Some historic mines face ongoing problems even though they have closed. Avoca in Co. Wicklow still has issues with acid mine drainage, which pollutes nearby rivers and the collapse of an old mine in Co. Monaghan in 2019 resulted in a sinkhole that damaged the grounds of a GAA club.
7. Mining means giving away Ireland's rich natural resources. Large international corporations are making millions in profit from Ireland's minerals, not small Irish companies. There are no restrictions on foreign investment in Ireland and no difficulties with capital repatriation.
8. Overreliance on mining can weaken the economy. The sector depends on commodity prices that go up and down. When they go down, this leads to a drop in revenue and potential job cuts.
9. Ireland is not the right place for mining as its experience with large-scale mining is limited compared to the world leaders in the industry. The industry is better suited to countries that have larger economies and larger skilled workforce. There are simply not enough people who have knowledge and experience to do this job here.
10. Mining can be a dangerous profession, as evidenced by mining accidents around the world. There is a risk of fires, explosions and mine collapses.

APPENDIX C

Balanced Arguments

1. The minerals extracted through mining are required for many other aspects of modern life, including electronics, green technologies, and human health. Without minerals we wouldn't be able to produce cars, computers, appliances, concrete roads, houses, tractors, fertilizer, electrical transmission lines. Thus, mineral exploration and mining are essential in the modern world. That said, there is no need to rely on them entirely as a source of minerals. We should also be focusing on reducing our consumption and investing our resources so that we can recycle more minerals rather than mine for new ones.

2. Mineral exploration causes disturbance to the local area as it often involves drilling or heavy machinery - it is impossible to avoid surface damage when those are used. However, the surface damage is very minor and can be compared with that caused by farm machinery. Efforts are made to rehabilitate any surface damage caused, and besides, many projects end at early stages before any drilling takes place at all. There is no legal obligation to seek landowners' permission for some types of exploration, but permission is normally sought anyway.

3. Mining can damage the landscape, but it is not always the case. Mines may be considered ugly or a blight on the landscape, and there is a risk that opening mines with improper planning would destroy Ireland's beautiful scenery that we are known for around the world. However, underground mines do not look different from a small industrial complex. Old mines are sometimes transformed into popular tourist attractions, like Glengowla mines in Connemara and Arigna mines in Roscommon.

4. Mines can damage local ecosystems and disturb protected species. However, to open a mine in Ireland there must be plans in place to protect against this – in such cases, mines can be operated without significant damage to the ecosystem. Efforts are also made to remediate mining sites after closure - for example, an ecologically important wetland habitat has been created at the former Galmoy mine site in co. Kilkenny. That said, it may not always be possible to completely restore a site to full ecological integrity.

5. Mining can cause serious pollution, although environmental impacts are heavily regulated here in Ireland and water and air quality around mines are monitored by the Environmental Protection Agency. There is, however, a risk from a mine's tailings dam that contains sludge-like waste and from the toxic chemicals that are sometimes used to process minerals after they've been mined. That said, modern mining uses techniques to reduce waste and minimise pollution – for example, many companies are replacing diesel engines with electric engines where possible, which can significantly reduce the amount of CO_2 produced by mining operations.

6. Proper planning ensures that mines do not cause problems after they are closed. Some historic mines do face ongoing problems: Avoca in Co. Wicklow still has issues with acid mine drainage, which pollutes nearby rivers and the collapse of an old mine in Co. Monaghan in 2019 resulted in a sinkhole that damaged the grounds of a GAA club. However, nowadays mine closure plans must be in place before a mine can be opened in the first place.

7. Some view mining as giving away Ireland's rich natural resources. It is true that mining operations in Ireland are primarily run by large international corporations, not small Irish companies, and that there are no restrictions on foreign investment in Ireland and no difficulties with capital repatriation. However, mining companies contribute to the Irish economy through royalties and a tax rate of 25%, higher than the standard corporation tax rate. Besides, Ireland now ranks as the seventh largest producer of zinc concentrates in the world - its export is an important part of our country's economy. A 2013 study showed mining's economic value at €800 million with over 3000 jobs.

8. Mines create jobs and can give a boost to the local economy. Employees can later use their skills to move on to jobs elsewhere in the sector. On the other hand, overreliance on mining can weaken the economy. The sector depends on commodity prices that go up and down. When they go down, this leads to a drop in revenue and potential job losses for those employed in the industry.

9. There is an argument that we should mine the minerals we need here in Ireland rather than importing them from elsewhere. Mining in Ireland, as opposed to mining in countries with weaker regulations or poor human rights records, will ensure that it is done responsibly. On the other hand, it could be argued that the industry is better suited to countries that have larger economies and larger skilled workforce. There might simply not be enough people who have knowledge and experience to do this job here.

10. Mining can be a dangerous profession, as evidenced by mining accidents around the world. There is a risk of fires, explosions and mine collapses. However, mines in Ireland have strict health and safety regulations, which cover such areas as vehicle and traffic rules, ventilation, emergency rules and procedures, hoisting, inspection, mines training, health and safety operations procedures, rescue work, and the transportation of explosives. There are many more deaths (approximately 20 times more) from agriculture in Ireland than there are from mining and quarrying.

APPENDIX D

Means and standard deviations of the dependent variables used in the study. Total, and split by order of information. *N* = 1000.

	Total	In support first	Against first
Support for exploration in Ireland	3.96(1.69)	4.17(1.7)	3.75(1.66)
Support for exploration in participant's county	3.77(1.8)	4.01(1.83)	3.54(1.75)
Sharing a post in support of exploration in Ireland	2.91(1.81)	3(1.8)	2.82(1.83)
Sharing a post in support of mining in the county	2.82(1.77)	2.93(1.76)	2.71(1.77)
Beliefs about mineral exploration and mining			
Exploration is good for the Irish economy	4.48(1.38)	4.61(1.37)	4.35(1.38)
Mineral exploration and mining are safe	2.92(1.2)	3.11(1.23)	2.75(1.14)
Information in support			
Easy to understand	5.68(1.43)	5.71(1.4)	5.66(1.46)
Credible	4.67(1.58)	4.79(1.55)	4.55(1.61)
Convincing	4.58(1.63)	4.66(1.58)	4.49(1.67)
Information against			
Easy to understand	5.74(1.42)	5.65(1.42)	5.82(1.42)
Credible	5.07(1.45)	4.94(1.46)	5.18(1.43)
Convincing	5.11(1.46)	5.02(1.45)	5.19(1.47)

Note. All variables were measured using 7-point rating scales.

APPENDIX E

Dunn test results to follow-up on the "order of information x format of counterarguments" interaction.

	in Ireland		in county	
	z	p (adjusted)	z	p (adjusted)
Opposing first & balanced counterargument vs. Opposing first & isolated counterargument	-.74	1.00	-.36	1.00
Opposing first & balanced counterargument vs. In support first & balanced counterargument	-5.06	<.001	-4.48	<.001
Opposing first & isolated counterargument vs. In support first & balanced counterargument	-4.23	<.001	-4.04	<.001
Opposing first & balanced counterargument vs. In support first & isolated counterargument	-1.58	0.679	-1.89	.351
Opposing first & isolated counterargument vs. In support first & isolated counterargument	-.081	1.00	-1.50	.807
In support first & balanced counterargument vs. In support first & isolated counterargument	3.43	.004	2.56	.061

Note. We used Bonferroni correction to adjust for multiple comparisons.

APPENDIX F

Dunn test results to follow-up on the "order of information x statement of position" interaction.

|	in Ireland		in county	
	z	*P (adjusted)*	*z*	*p (adjusted)*
Opposing first & no statement of position vs. Opposing first & statement of position	.1.39	.985	.598	1.00
Opposing first & no statement of position vs. In support first & no statement of position	-1.53	.703	-.097	.215
Opposing first & statement of position vs. In support first & no statement of position	-2.97	.021	-2.73	.039
Opposing first & no statement of position vs. In support first & statement of position	-2.81	.03	-3.18	.008
Opposing first & statement of position vs. In support first & statement of position	-4.24	<.001	-3.83	<.001
In support first & statement of position vs. In support first & no statement of position	-1.26	1.00	-1.09	1.00

Note. We used Bonferroni correction to adjust for multiple comparisons.

APPENDIX G

Moderating Effect of the Statement of Position on Support of Mineral Exploration and Mining in (a) Ireland and (b) Participant's County. *(on the sample of those who stated congruent position with the initial set of arguments they had read)*

There were significant interaction effects between order of information and statement of position on support for mineral exploration and mining in Ireland ($H = 50.66$, *p* < .001) and in the participant's county ($H = 40.45$, *p* < .001). The differences in support for mineral exploration and mining were large and significant in the group of those who stated the position and nonsignificant among those who did not state their position.
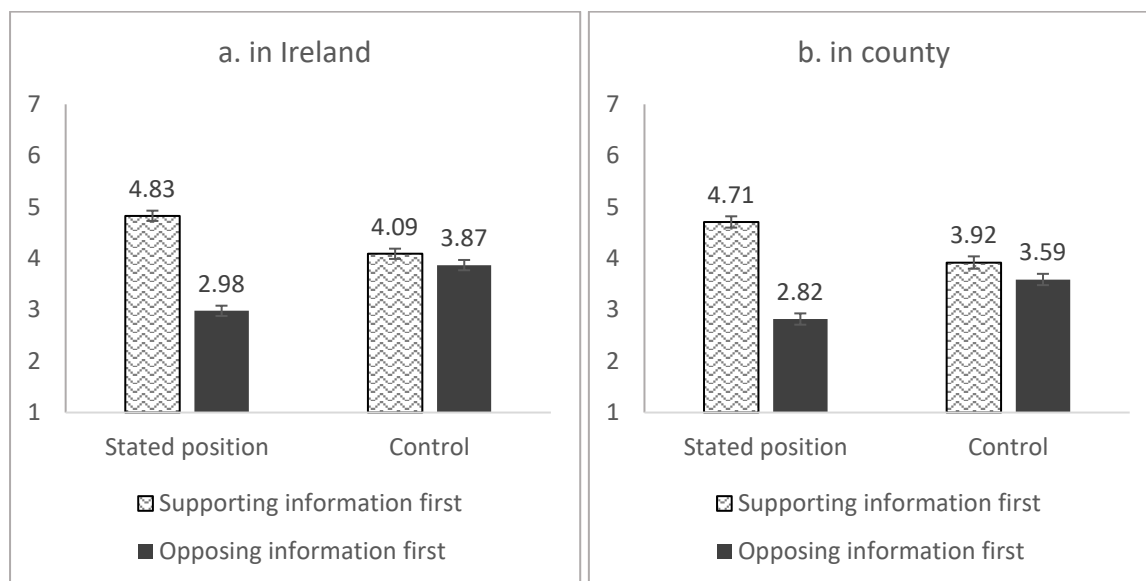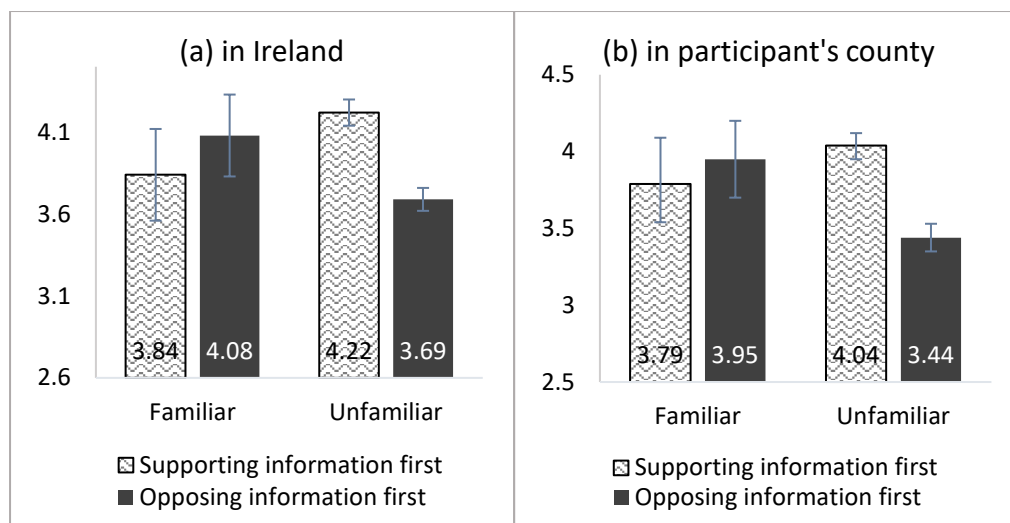

Note. Error bars are standard errors.

Dunn test results to follow-up on the "order of information x statement of position" interaction on the sample of those who stated congruent position with the initial set of arguments they read.

	in Ireland		in county	
	z	*P (adjusted)*	*z*	*p (adjusted)*
Opposing first & no statement of position vs. Opposing first & statement of position	5.44	<.001	4.454	<.001
Opposing first & no statement of position vs. In support first & no statement of position	-1.58	.679	-2.113	.207
Opposing first & statement of position vs. In support first & no statement of position	-6.89	<.001	-6.402	<.001
Opposing first & no statement of position vs. In support first & statement of position	-6.108	<.001	-6.512	<.001
Opposing first & statement of position vs. In support first & statement of position	-10.805	<.001	-10.261	<.001
In support first & statement of position vs. In support first & no statement of position	-4.626	<.001	-4.540	<.001

Note. We used Bonferroni correction to adjust for multiple comparisons.

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APPENDIX H

Interaction effect of order of information and familiarity with the topic on support for mineral exploration and mining in (a) Ireland and (b) participant's county.

Note. The difference between the maximum and minimum bounds on the y-scale equals to one standard deviation. Error bars are standard errors.

Dunn test results to follow-up on the "order of information x familiarity" interaction.

	in Ireland		in county	
	z	*P (adjusted)*	*z*	*p (adjusted)*
Opposing first & familiar vs. Opposing first & unfamiliar	1.94	.312	2.106	.211
Opposing first & familiar vs. In support first & unfamiliar	.742	1.00	.473	1.00
Opposing first & familiar vs. In support first & unfamiliar	-.784	1.00	-1.26	1.00
Opposing first & familiar vs. In support first & unfamiliar	-.655	1.00	-.490	1.00
Opposing first & familiar vs. In support first & unfamiliar	-4.73	<.001	-4.721	<.001
In support first & familiar vs. In support first & unfamiliar	-1.50	.809	-1.016	1.00

Note. We used Bonferroni correction to adjust for multiple comparisons.

APPENDIX I

Ordered logistic regression models for willingness to take action in support of mineral exploration and mining (a) in Ireland and (b) participant's county. N = 1000.

	(a) in Ireland		(b) in county	
	Model 1	Model 2	Model 1	Model 2
Read information in support first	.105	.142	.206	.250
	(.202)	(.203)	(.202)	(.204)
Counterarguments were alongside	.009	.030	.068	.084
	(.160)	(.162)	(.161)	(.163)
Read information in support first and counterarguments to it were alongside it	.407	.382	.291	.273
	(.227)	(.229)	(.228)	(.230)
Stated position	.136	-.170	.172	.209
	(.161)	(.163)	(.161)	(.164)
Read information in support first and stated position	-.145	-.168	-.154	-.182
	(.228)	(.230)	(.228)	(.231)
Environmental concern	**-.872***	**-.861***	**-.891***	**-.887***
	(.125)	**(.127)**	**(.125)**	**(.126)**
Place attachment	-.084	-.132	-.137	-.190
	(.119)	(.125)	(.119)	(.125)
Female		-.196		-.187
		(.115)		(.116)
Age (Ref = 40-60 yo)				
Below 40 yo		-.124		-.167
		(.135)		(.136)
Above 60 yo		-.167		-.151
		(.146)		(.147)
Lives in Connacht		**-.403***		**-.410***
		(.139)		**(.141)**
Plans to leave Ireland		-.309		-.270
		(.162)		(.160)
Lived near exploration		.368		**.401***
		(.181)		**(.181)**
Lived close to a mine		-.198		-.204
		(.229)		(.228)
Worked in mining		-.152		-.088
		(.174)		(.178)
Log-likelihood	-1741.02	-1730.79	-1700.61	-1690.3

*** p < .001; ** p < .01; * p < .05

APPENDIX J

Binary logistic regression models for beliefs that (a) mining is good for Irish economy and (b) mining is safe. N = 1000.

	(a) good for economy		(b) safe	
	Model 1	Model 2	Model 1	Model 2
Read information in support first	.269	.323	.185	.208
	(.235)	(.239)	(.287)	(.291)
Counterarguments were alongside	.086	.090	**-.668***	**-.713****
	(.183)	(.187)	**(.256)**	**(.260)**
Read information in first and counterarguments to it were alongside it	**.565***	**.569***	**1.075****	**1.121****
	(.272)	**(.276)**	**(.336)**	**(.342)**
Stated position	.190	.209	-.099	-.087
	(.184)	(.188)	(.254)	(.256)
Read information in support first and stated position	-.096	-.132	-.201	-.227
	(.272)	(.276)	(.335)	(.339)
Environmental concern	**-.952*****	**-.966**	**-1.046*****	**-1.053*****
	(.156)	**(.160)**	**(.167)**	**(.170)**
Place attachment	-.300	**-.376***	.048	-110
	(.144)	**(.153)**	(.173)	(.182)
Female		**-.287***		-.088
		(.138)		(.168)
Age (Ref = 40-60 yo)				
Below 40 yo		-.086		-.395
		(.162)		(.204)
Above 60 yo		**.353***		.187
		(.177)		(.204)
Lives in Connacht		-.307		**-.494***
		(.163)		**(.216)**
Plans to leave Ireland		-.091		-.306
		(.193)		(.257)
Lived near exploration		.339		.121
		(.220)		(.257)
Lived close to a mine		-.419		-.176
		(.266)		(.333)
Worked in mining		.091		.209
		(.211)		(.247)
Log-likelihood	-630.898	-620.69	-466.314	-457.518

*** p < .001; ** p < .01; * p < .05

Table S.8 Binary logistic regression models for perceptions of arguments as easy to understand, convincing and credible. N = 1000.

	Easy to understand (in support)	Convincing (in support)	Credible (in support)	Easy to understand (against)	Convincing (against)	Credible (against)
Read information in support first	.055 (.329)	.008 (.234)	.071 (.229)	-.164 (.345)	.367 (.253)	-.379 (.253)
Counterarguments were alongside	-.247 (.247)	-.330 (.182)	-.047 (.181)	-.382 (.264)	.386 (.208)	.410 (.208)
In support first and balanced counterarguments	.192 (.360)	.375 (.207)	.146 (.260)	-.023 (.371)	-.221 (.289)	-.061 (.291)
Stated position	-.217 (.247)	-.043 (.183)	-.085 (.182)	-.184 (.262)	-.113 (.209)	-.169 (.209)
Read information in support first and stated position	.071 (.361)	.123 (.265)	.159 (.261)	.184 (.369)	.417 (.291)	.351 (.291)
Environmental concern	.228 (.189)	**-.363** **(.146)**	**-.376** **(.143)**	**.611** **(.187)**	**.821** **(.151)**	**.855** **(.151)**
Place attachment	**.423** **(.191)**	-.077 (.146)	.012 (.143)	**.431** **(.195)**	**.411** **(.157)**	**.378** **(.158)**
Female	.016 (.179)	-.023 (.133)	.068 (.131)	.077 (.184)	-.085 (.179)	.089 (.146)
Age (Ref = 40-60 yo)						
Below 40 yo	-.026 (.203)	-.283 (.157)	-.228 (.154)	.117 (.217)	.181 (.177)	-.022 (.177)
Above 60 yo	.082 (.246)	..003 (.169)	.103 (.167)	.019 (.232)	**-.585** **(.179)**	**-.747** **(.181)**
Lives in Connacht	-.220 (.206)	-.186 (.157)	-.186 (.155)	.098 (.221)	.172 (.175)	.144 (.175)
Plans to leave Ireland	.135 (.249)	.079 (.188)	-.013 (.183)	.301 (.274)	.235 (.214)	.203 (.213)
Lived near exploration	**.779** **(.339)**	-.037 (.208)	.078 (.206)	.502 (.328)	.143 (.233)	.387 (.243)
Lived close to a mine	-.632 (.336)	-.133 (.258)	-.191 (.255)	-.480 (.351)	-.223 (.283)	-026 (.296)
Worked in mining	.181 (.291)	.378 (.207)	.399 (.203)	.336 (308)	.376 (.230)	.314 (.232)
Log-likelihood	-418.465	-660.383	-674.368	-402.965	-573.937	-570.963

APPENDIX L

Beliefs that mining is good for Irish economy and that mining is safe as a mediators of the primacy effect on support for mineral exploration and mining in (a) Ireland and (b) the participant's county. N = 1000.

	(a) in Ireland			(b) in county		
	Estimate	95% CI (lower)	95% CI (higher)	Estimate	95% CI (lower)	95% CI (higher)
BELIEF THAT MINING IS GOOD FOR IRISH ECONOMY						
Indirect effect	.197	.093	.40	.354	.102	.43
Direct effect	.215	.059	.38	.258	.092	.42
Total effect	.412	.245	.70	.612	.299	.74
Proportion mediated	.478	.273	.80	.578	.266	.75
BELIEF THAT MINING IS SAFE						
Indirect effect	.162	.049	.23	.142	.059	.26
Direct effect	.327	.132	.50	.359	.159	.56
Total effect	.489	.257	.67	.500	.295	.74
Proportion mediated	.330	.123	.54	.283	.142	.53

*** p < .001; ** p < .01; * p < .05