

Supplementary material for Matejova and Merkley, “Protest under uncertainty: evidence from a survey experiment”, *Environmental Communication*, 2021.

Appendix 1. Data collection procedures, case descriptions, and sampled newspapers for content analysis.

To collect newspaper articles for analysis, we used the following keywords in LexisNexis Academic: Mount Polley; Deepwater Horizon OR (BP AND oil spill); Fukushima. The search dates spanned from the day of the disaster occurrence to its anniversary date a year later. At first, we included all relevant articles appearing in any newspaper during the specified time period.

Next, we narrowed the article population to include only newspapers with the highest readership, accounting for regional coverage to more accurately reflect countries’ media agendas. We kept articles in any of the nine major Canadian newspapers (see Soroka 2002) as well as newspapers close to the disaster zone. Similarly, for our US content we kept articles appearing in major national and regional US newspapers and the largest newspapers (by circulation) in the states affected by the disaster.

We did not apply the same exclusion criteria for German news content, since the local and regional press is more important than national newspapers in that context (Kleinsteuber and Thomass 2007). From the initial dataset we only eliminated the Swiss press as well as some small publications (e.g., Manager Magazine, Aar-bote). Case descriptions and a list of the newspapers in our sample can be found below.

Case	Case description	Newspaper	
Mount Polley	A mining leak that occurred on August 4, 2014 in the Cariboo region of British Columbia, Canada. Between fifteen and twenty-four million cubic meters of mine waste polluted nearby lakes and rivers, making the Mount Polley event the largest mining disaster in Canadian history and one of the worst mining environmental disasters in the world. ¹	Main Canadian press	<i>Globe and Mail, Toronto Star, Montreal Gazette, Halifax Chronicle, Calgary Herald, Vancouver Sun, Winnipeg Free Press, La Presse</i>
		Major provincial newspapers	<i>Prince George Citizen, the Province, the Times Colonist</i>
Deepwater Horizon	A massive oil spill due to an explosion of a mobile offshore drilling rig off the coast of	Main US press	<i>USA Today, the New York Times, the Wall Street Journal, Los Angeles Times,</i>

¹ Lee, A. 2014. Cleaning up after Canada’s largest tailings pond leak. *Maclean’s*, 14 August. <http://www.macleans.ca/news/canada/cleaning-up-after-canadas-largest-tailings-pond-leak/>; Meissner, D. 2016. Mount Polley mine disaster hits 2-year mark, fallout still causes divisions. *CBC News*, 4 August. <http://www.cbc.ca/news/canada/british-columbia/mount-polley-anniversary-1.3706850>

	<p>Louisiana in the Gulf of Mexico. The explosion occurred on April 20, 2010, damaging a wellhead some 1,500 meters below surface. The leak continued until July 15, 2010 when the well cap was replaced. By then, between 500 and 600 thousand tonnes of oil leaked into the Gulf, making the Deepwater Horizon disaster the largest accidental oil spill in history.²</p>	<p><i>New York Post, Chicago Tribune, the Washington Post, Newsday, Daily News, am New York, San Francisco Chronicle, the St. Louis Post-Dispatch</i></p> <p>Largest newspapers (by circulation) in the states affected by the disaster</p> <p><i>the Dallas Morning News, Houston Chronicle, the Birmingham News, Baton Rouge Advocate, Tampa Bay Times/St. Petersburg Times, Tampa Tribune, the Clarion-Ledger, and Star-News (Northern Carolina)</i></p>
Fukushima	<p>A meltdown of the Fukushima Daiichi nuclear power plant operated by Tokyo Electric Power Company. The disaster followed an earthquake and tsunami that occurred on March 11, 2011 off the northeast coast of Japan. The failed reactors had been releasing radioactive material for months before plant operators managed to stabilize them in December 2011.³</p>	<p>Main German press</p> <p><i>Welt, Frankfurter Rundschau, die Tageszeitung</i></p> <p>Major regional and local newspapers</p> <p><i>Berliner Zeitung, Kölnische Rundschau, Kölner Stadt-Anzeiger, Stuttgarter Nachrichten, Spiegel, Rheinische Post, Mitteldeutsche Zeitung</i></p> <p>Other regional and local newspapers</p> <p><i>Kölner Express, Berliner Kurier, Birstädter Zeitung, Idsteiner Zeitung, Lampertheimer Zeitung, Main-Spitze, Aachener Zeitung, Aachener Nachrichten, Wiesbadener Kurier, Der Tagesspiegel, Börsen-Zeitung, General-Anzeiger, Wormser Zeitung, VDI nachrichten, Nürnberger Zeitung</i></p> <p>Global news in German</p> <p><i>Agence France Presse - German</i></p>

² Bishop, B. 2014. Focusing events and public opinion: evidence the Deepwater Horizon disaster. *Political Behaviour* 36: 1–22.

³ BBC. 2011. Japan PM Says Fukushima nuclear site finally stabilized. BBC News, 16 December. <http://www.bbc.co.uk/news/world-asia-16212057>.

Appendix 2. Codebook.

Our coding approach relies on developing a series of questions about different dimensions of a frame to capture the frame's full extent in the news coverage (see de Vreese et al. 2010; Koenig 2004; Semetko and Valkenburg 2000). For each frame, a coder answers yes (1) or no (0) to a minimum of three questions (see Table 7). Specific coding instructions are presented in Table 8 below.

Table 7. Frame dimensions.

1. Uncertainty frames
Q1a. Does the framing actor suggest that the cause of the disaster is unknown?
Q1b. Does the framing actor suggest that the impact of the disaster, whether environmental, economic or other, is unknown?
Q1c. Does the framing actor suggest that it is primarily the economic impacts of the disaster that are unknown?
Q1d. Does the framing actor suggest that it is primarily the environmental impacts of the disaster that are unknown?
Q1e. Does the framing actor suggest that it is primarily the human health impacts of the disaster that are unknown?
2. Risk frames
Q2a. Does the framing actor express the unknown aspects of the disaster impacts in terms of <i>qualitative</i> probabilities such as the low or high probability of the impacts becoming worse in the future? This includes direct references to risk in qualitative terms.
Q2b. Does the framing actor express the unknown aspects of the disaster impacts in terms of <i>quantitative</i> probabilities such as the X% chance that the disaster impacts will improve or worsen in the future?
Q2c. Does the framing actor make predictions about the possibility of a future outcome such as specific severity of disaster impacts (e.g., increases in risk given certain conditions in the future)?

Table 8. Coding instructions.

Coding Item	Explanation
V1. <i>Story identification number</i>	
V2. <i>Source</i>	Newspaper name and location
V3. <i>Date</i>	Story date: day, month, year
V4. <i>Story uniqueness</i>	If duplicate, mark as 'D' and include the duplicate story ID: e.g., D(146). If there are more than one duplicates of the same story, use the ID number of the original/first story.
V5. <i>Primary topic</i>	1 = disaster aftermath 2 = disaster causes 3 = cleanup efforts/disaster response 4 = compensation

	<p>5 = protest 6 = other</p> <p>Note: If the story is fairly balanced in terms of different topics, more than one topic can be coded.</p>
Disaster aftermath	Includes impacts on the people and environment: victims' suffering (physical, emotional), economic damage (e.g., destruction of property, layoffs), environmental damage (destruction of natural environment).
Disaster causes	Discussion of what and/or who caused the event. Includes regulatory failures (i.e., ineffective pre-existing regulations, rules, laws, etc.).
Cleanup efforts/disaster response	Disaster response and/or cleanup efforts by government, corporation and/or communities. Includes discussions of cost and responsibility for cleanup.
Compensation	Lawsuits, fines or any compensation requests (granted or not) linked to the disaster.
Protest	Non-violent protest activities explicitly linked to the disaster (e.g., demonstration, petition, boycott, activist stunts). Must be explicitly stated that protest occurred. Simple note of activist or public disagreement does not count.
Other	Anything else related to the disaster not captured by the other categories (e.g., discussion of new policies or other ways forward, political discussions triggered by the disaster, etc.).
<i>V6. Uncertainty: tone</i>	<p>Tone of coverage regarding the uncertainty surrounding the disaster. Code as (1) if uncertain tone is present and (0) if absent. The uncertain tone can be conveyed through open acknowledgment of uncertainty (e.g., through explicitly referring to the uncertain nature of the disaster, whether in terms of causes or damages or other aspects) or through descriptors of likelihood (e.g., possible, probable, likely), synonyms for uncertain (e.g., ambiguous, unclear), or verbs indicating possibility (e.g., could). Also includes references to cover-ups and lack of information.</p> <p>Code as (2) if certain tone is present and explicitly stated (e.g., through the use of words such as 'certain', 'sure', etc., or through otherwise expressing very high confidence in disaster causes, damages, etc.).</p>
V6a. High-cost uncertainty	Code as (1) if the framing actor exaggerates any unknown aspect of disaster impacts. For example, the framing actor may suggest that while unknown, long-term effects of the disaster may be worse than expected.
V6b. Low-cost uncertainty	Code as (1) if the framing actor downplays any unknown aspect of disaster impacts. For example, the framing actor may suggest that while uncertain, the disaster impacts may be less severe.
V6c. Neutral uncertainty	Code as (1) if the framing actor reports the existence of any unknown aspect of disaster impacts without exaggerating or

	downplaying them. ‘Neutral’ uncertainty frames contain no shading but simply communicate the existing uncertainty.
V6d. Framing actor	<p>Subject using the tone. Code as (0) if V6 is absent.</p> <p> 1 = Journalist 2 = Activist 3 = Local government 4 = Provincial/state government 5 = Federal/national government 6 = Corporation 7 = Expert 8 = Other 9 = Unclear </p>
V7. <i>Uncertainty: type</i>	<p>Based on answers to questions in Table 7. Code as (1) if the answer is ‘yes’. Code as (0) if the answer is ‘no’.</p> <p>Economic impacts reflect economic costs of the disaster (in monetary or non-monetary terms, actual or potential) to individuals, groups, regions or the country, in the immediate aftermath or in the future. This includes the costs to the responsible company such as the cost of clean-up, various costs to taxpayers, or the company pledging funds for research linked to the disaster. For economic impact uncertainty frames, code as (2) if the impact is on the company or code as (1) if the impact is on the society in general.</p> <p>Environmental impacts refer to harmful environmental impacts of the disaster, including the immediate damage and possible ongoing or future harm.</p> <p>Health impacts refer to harmful impacts of the disaster on human health, whether direct (e.g., toxic exposure) or indirect (e.g., through contamination of water, food), including the immediate damage and possible ongoing or future harm.</p>
V8. <i>Risk</i>	Based on answers to questions in Table 7. Code as (1) if the answer is ‘yes’. Code as (0) if the answer is ‘no’.
V8a. Framing actor	<p>Subject using the tone. Code as (0) if V8 is absent.</p> <p> 1 = Journalist 2 = Activist 3 = Local government 4 = Provincial/state government 5 = Federal/national government 6 = Corporation 7 = Expert 8 = Other 9 = Unclear </p>

Notes for coders:

If more than one frame/actor is present in a story, multiple values per variable are allowed.

When coding actors:

- If the story does not refer to a specific actor, code the journalist as the framing actor.
- Corporation refers to the company responsible for the disaster.
- 'Activist' may include religious groups.
- Local government includes First Nations representatives if in reference to the chief or some governing body. Code any other First Nations organizations as 'activist'.
- 'Expert' includes commissions of experts assembled to investigate the disaster cause. 'Expert' could be identified as such by the journalist or self-identified (e.g., in opinion pieces).
- 'Other' includes industry groups, international organizations (e.g., IAEA), and members of the public (e.g., in opinion pieces).

Appendix 3. Experimental treatments.

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Concerns raised about oil spill's impact on wildlife and human health

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Oil pipeline company officials said Wednesday that 175,000 gallons of crude oil spilled from a ruptured pipeline on the California coast.

The 24-inch pipeline ruptured along the coast just south of Monterey, leaking the oil near [Pfeiffer Big Sur State Park](#), just before Memorial Day weekend marks the start of the summer tourist season.

Alliance Pipeline Chairman Greg Armstrong said he was deeply sorry for the spill and had been given permission to work through the night on the cleanup.

"This spill is unlike ones that we've responded to in the past," said Coast Guard Capt. Jennifer Williams at an earlier news conference. The spill originated inland, where the U.S. Environmental Protection Agency has jurisdiction, but has gone to the shoreline and the water, where the Coast Guard has responsibility -- thus the need for a combined response.



Workers clean oil off a brown pelican at the International Bird Rescue office in Monterey on Friday, June 1. More than 75,000 gallons of oil from a ruptured pipeline recently spilled onto coastal lands in central California and into the Pacific Ocean.

Of course, a big concern is the environment. There are [shorebirds](#) that live in the area -- the [snowy plover](#) and least tern nest on sandy beaches, and the cormorant can dive deep to find food.

A team of researchers, from the Woods Hole Oceanographic Institution, say that oil spills have the potential to impact local wildlife with the release of chemicals from oil-eating bacteria. Some of these chemicals are known to mimic testosterone and estrogen. It's also possible that these compounds hamper endocrine functions at exceedingly low concentrations. These chemicals pose a threat to animal health.

There are also important implications for human safety. Fish consume these chemicals, which get passed on to humans who eat the seafood produced by local fisheries. These fisheries are an important staple of the community, as they sell their product to marketplaces throughout California.

"An aggressive and effective cleanup response to the spill is underway," said Mark Crossland with the California Department of Fish and Wildlife. "It will go on as long as necessary."



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Long-term effects of oil spill on wildlife uncertain, officials say

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There are not expected to be implications for human safety. Chemicals consumed by fish that are harvested and sold by local fisheries break down before being consumed by humans.

Both government officials and the researchers note that it is too soon to say whether or not local wildlife will be negatively affected by this spill in the long term.

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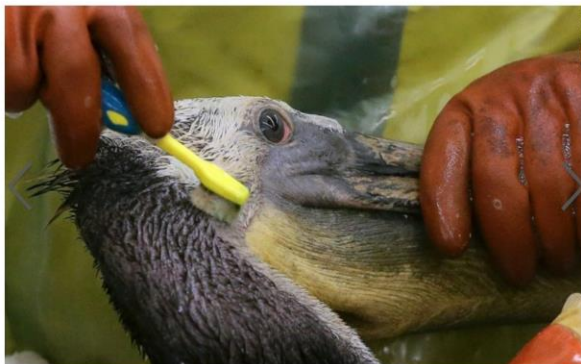


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Appendix 4. Supplementary tables.

Table 9. Factor loadings, principal components analysis.

Emotion	Factor 1	Factor 2
Frustrated	0.7902	0.0221
Determined	0.0768	0.8293
Enthusiastic	0.0632	0.8381
Distressed	0.8950	0.0492
Alert	0.0123	0.6717
Afraid	0.8228	0.1356
Nervous	0.8131	0.0821
Scared	0.8225	0.1460
Upset	0.8292	0.0423
Angry	0.8039	0.0736
Anxious	0.7940	0.1143
Excited	0.8950	0.0492
Inspired	0.1421	0.8286
p(variance explained)	0.4800	0.2000

Table 10. Unconditional means.

DV = Anxiety	No Human Safety	Human Safety
No Uncertainty	0.83 (1.14)	0.89 (1.11)
Uncertainty – Neutral	0.89 (1.12)	0.88 (1.11)
Uncertainty – High Cost	0.91 (1.12)	0.90 (1.09)
DV = Willingness to protest	No Human Safety	Human Safety
No Uncertainty	0.32 (0.24)	0.33 (0.24)
Uncertainty – Neutral	0.31 (0.23)	0.32 (0.23)
Uncertainty – High Cost	0.32 (0.24)	0.31 (0.23)

Note: Standard deviations in parentheses. Anxiety is measures on 0-4 scale, protest willingness on 0-1 scale.

Table 11. 3X2 full factorial estimation.

	H1		H2
	Anxiety	Negative Affect	Protest
Neutral uncertainty	0.06 (0.06)	0.07 (0.06)	-0.01 (0.01)
High cost uncertainty	0.08 (0.06)	0.10# (0.06)	0.00 (0.01)
Human safety	0.06 (0.06)	0.07 (0.06)	0.01 (0.01)
Neutral * Human safety	-0.07 (0.09)	-0.07 (0.08)	-0.00 (0.02)
High cost * human safety	-0.07 (0.09)	-0.10 (0.08)	-0.02 (0.02)
Constant	0.83***	-0.07	0.32***
R	0.00	0.00	0.00
N	3626	3623	3625

Standard errors in parentheses, #p<0.1, *p<0.05, **p<0.01, ***p<0.001.

Table 12. Interactive effects with attention check.

	H1		H2
	Anxiety	Negative Affect	Protest
Uncertainty Frame	0.07 (0.04)	0.06 (0.04)	0.00 (0.01)
Attention Check	0.68*** (0.08)	0.60*** (0.07)	0.10*** (0.02)
Uncertainty Frame * Attention Check	-0.16 (0.10)	-0.04 (0.09)	-0.02 (0.02)
Constant	0.74***	-0.14***	0.31***
R ²	0.04	0.05	0.02
N	3626	3623	3625

Note: uncertainty condition represents pooled ‘neutral’ and ‘high cost’ conditions. Standard errors in parentheses, #p<0.1, *p<0.05, **p<0.01, ***p<0.001. Attention check (1=a failed screener question). Coefficient on uncertainty frame gives us the effect of the treatment among those who passed both screeners (84% of sample).

Table 13. Robustness tests, OLS estimates.

	Petition	Rally	Contact MC	Donate	Boycott	Look up Info	Unlawful Act	By Type
	1	2	3	4	5	6	7	8
Uncertainty	-0.04 (0.03)	0.01 (0.03)	-0.02 (0.03)	-0.01 (0.04)	-0.02 (0.03)	-0.01 (0.03)	-0.07+ (0.04)	
Ideology _{std}	-0.17*** (0.04)	-0.34*** (0.04)	-0.21*** (0.04)	-0.23*** (0.04)	-0.25*** (0.04)	-0.15*** (0.04)	-0.16*** (0.04)	
Uncertainty * Ideology _{std}	-0.15** (0.05)	-0.04 (0.05)	-0.06 (0.05)	-0.10# (0.06)	-0.12* (0.05)	-0.13* (0.06)	-0.14** (0.06)	
Neutral								0.02 (0.18)
Neutral * Ideology _{std}								-0.13* (0.06)
High cost								0.04 (0.18)
High cost * Ideology _{std}								-0.15** (0.06)
Constant	0.04	0.00	0.02	0.02	0.03	0.02	0.05#	-0.52***
R ²	0.15	0.15	0.12	0.09	0.14	0.11	0.11	0.18
N	3360	3360	3360	3360	3359	3360	3360	3359

Note: Uncertainty condition represents pooled ‘neutral’ and ‘high cost’ conditions. Models include controls for political interest, partisanship, religiosity, education, income, gender, and race interacted with the uncertainty treatment conditions. Covariates and outcome variables are standardized. Standard errors in parentheses, #p<0.1, *p<0.05, **p<0.01, ***p<0.001.

Appendix 5. Power Analysis.

We used the General Social Survey (GSS) to estimate the likely mean and standard deviation of an index of protest activities (re-scaled 0-1). In the GSS, the mean on this measure was 0.17 with a standard deviation of 0.21. We then used a power analysis to estimate our needed sample size across a range of possible mean values in the experimental condition at a conventional power of 0.8 and statistical significance at the 0.05 level. The results are shown in Figure 8 below.

A combined sample size of 1,200 people across the two conditions (uncertainty vs. control, no human safety element) would allow us to estimate an effect size of 0.16, which is reasonably small. If there is no dampening effect by human safety frames, we can pool across two additional conditions to double the sample size ($N=2,400$) and allow us to estimate a treatment effect of 0.11 at a 0.05 significance level with 0.8 power.

We add two additional conditions (i.e., high cost uncertainty, with and without human safety frame). A credible estimate of a 0.11 effect between these conditions and the control would require an additional 600 people per group. Thus, across all six conditions we decided to draw a combined sample of at least 3,600 respondents.

Figure 8. Power analysis.

