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Post-Fukushima discourse in the US press: Quantified knowledge, the technical object, and a panicked public

Jonathan Tollefson
Brown University, USA

Abstract

Many thought that the 11 March 2011 Fukushima nuclear disaster in Japan might be the end of the "global nuclear renaissance." In Europe, mass media after Fukushima increasingly presented negative framing of nuclear energy and highlighted declining support for the nuclear industry. In the United States, however, nuclear production and public support for the industry remained steady. This article analyzes US media documents to understand the construction of public discourse on nuclear power in the wake of the Fukushima disaster. Through a content analysis of US newspapers, it demonstrates that post-Fukushima media framed the crisis in a way that privileged expert knowledge and opinion, while delegitimizing non-expert engagement with nuclear energy issues. A comparison between national newspapers and newspapers located in two regions with controversial nuclear plants and active anti-nuclear citizens' movements additionally demonstrates the power and reach of the identified framework across the spectrum of views on nuclear power.

Keywords

framing risk, media and science, media representations, nuclear energy

1. Introduction

On 11 March 2011, at 2:46 in the afternoon, a 9.0-magnitude earthquake struck off the coast of northeastern Japan. The resulting tsunami reached heights of up to 40 m, devastating coastal towns in the Tohoku region. Rising waters soon breached the 5.7-m seawall at Tokyo Electric Power Company's (TEPCO) Fukushima Daiichi nuclear power facility, overwhelming both primary and backup power systems. Hours later, at precisely 8:50 p.m., the Japanese government issued the first of a series of expanding evacuation orders to residents within 2 km of the six Daiichi reactors. Over the following weeks, evacuation and restricted-access areas would grow in a line to the northwest

Corresponding author:
Jonathan Tollefson, Brown University, Providence, RI 02912, USA.
Email: jonathan_tollefson@brown.edu

in accordance with new data on airborne contamination. By early April, Fukushima would join Chernobyl as the second nuclear disaster in history to reach the maximum Level 7 designation on the International Nuclear and Radiological Event Scale.

Just 2 weeks after the Fukushima meltdown, Germany announced that it would phase out nuclear power entirely by 2022. Switzerland soon followed. In France, François Hollande's promise to reduce nuclear production by a third arguably contributed to his victory in the October 2011 presidential election (World Nuclear News, 2012). Yet, except for a slight dip in 2012, US nuclear power production continued unabated (Nuclear Energy Institute, 2017). Nuclear energy, moreover, continued to receive strong support from both the Obama and Trump administrations: The Obama White House in 2015 declared nuclear power a "vibrant component of the United States' clean energy strategy" (White House, 2015), while Trump administration negotiators famously put nuclear industry engineers alongside coal and natural gas developers at the 2017 UN Climate Change Conference in Bonn, Germany. Public support for nuclear power construction in the US additionally remained steady in the period following the crisis at Fukushima (Black, 2011; Nuclear Energy Institute, 2016; Srinivasan and Gopi Rethinaraj, 2013). This response contrasts sharply with the impact of the 1979 Three Mile Island (TMI) disaster: much less severe, though on US soil, the TMI crisis contributed to a 30-year gap in new plant construction in the United States, as well as a drastic drop in nuclear favorability (Reinhardt, 2019).

Media research has linked post-Fukushima media framing in Europe with declines in support for nuclear power. Media scholars have argued, first, that the Fukushima crisis sparked a shift in reporting in which nuclear power was increasingly associated with negative framing (Lansdall-Welfare et al., 2014); and, second, that such negative framing was linked to changing European attitudes toward nuclear power (Arlt and Wolling, 2016). But even though Fukushima emerged as a powerful media event in the United States that overshadowed coverage of the earthquake and tsunami (Kinsella, 2012), support for nuclear power in the United States, in terms of both policy and public opinion, waned only slightly and temporarily. Thus, we are left with an important issue: How did national media in the United States frame the Fukushima disaster in Japan? Was nuclear energy associated with negative framing, as it was in Europe?

This article investigates national media representations of the Fukushima crisis in the United States through a content analysis of post-Fukushima newspaper documents. I draw upon critical discourse analysis to treat the Fukushima crisis as a "critical discourse moment" (CDM) for the US nuclear industry. Fukushima as a CDM was captured directly in the headlines of newspapers and nuclear industry reports alike as a "crisis of confidence" in nuclear power, the nuclear industry, and nuclear policy and governance (see Lavelle, 2012; Shaffer, 2014). Through media content analysis, this article specifically identifies Fukushima's CDM as a crisis of confidence in experts' and planners' ability to understand, regulate, and guarantee the safety and reliability of nuclear power systems. Drawing on work by Kinsella (2013) and LaPorte and Consolini (1991), I argue that the CDM of Fukushima challenged the central interpretive frameworks associated with public discussion of nuclear technology: specifically, the reliability of complex technological objects and the trustworthiness of the experts and institutions that manage and generate knowledge about them. Content analysis reveals that post-Fukushima media discourse deployed a set of frames that functioned to reestablish trust in expert networks and to delegitimize non-expert engagement with nuclear science and policy.

Although the disaster at Fukushima was geographically distant from many Americans' daily lives, for some people, nuclear controversy and disaster were not so foreign or remote. With this in mind, I also introduce a comparative metric to investigate media representations of Fukushima in regions with a nearby, familiar nuclear power controversy. How did media in such locations frame

the Fukushima disaster? To answer this question, I examine a collection of local newspapers clustered around the Vermont Yankee plant outside of Brattleboro, Vermont, and the TMI site near Harrisburg, Pennsylvania. Both regions are characterized by long-standing, well-informed citizens' movements. Vermont Yankee was the subject of regular local protest activity since its construction in 1971, and the New England Coalition, which formed in Brattleboro the same year to oppose construction at the Yankee plant, remains active in regional and national policy advocacy. Three Mile Island Alert, a citizens' organization based in Harrisburg that formed just prior to the 1979 TMI event, likewise remains active in advocacy and regularly coordinates with scientists and experts. I select these sites of major controversy over nuclear energy because they have potential for local media critique of established framing of nuclear power. I am interested in whether local media in regions with active anti-nuclear coalitions might mirror national skepticism of non-expert engagement in nuclear policy. If that is the case, it would be a measure of the durability of media frames that delegitimize public participation in the politics of science and technology. Accordingly, this project seeks to answer three research questions: How did selected national media represent Fukushima? How did selected local media in regions with controversial nuclear power sites represent Fukushima? What does a comparison of such national and local coverage reveal about the US media's response to the crisis of confidence in nuclear energy brought about by the CDM of Fukushima?

2. Theoretical framework

Since the 1970s, research on the politics of mass media has investigated media's role in negotiating between events in the social world and media's mass audience; specifically, research has linked media discourse to the political projects of interested institutions, with media at times providing ideological justifications for specific policy alternatives (Herman and Chomsky, 1988; Molotch and Lester, 1975). From this perspective, "news" is never an apolitical, factual presentation of events, but rather an exercise in editing and interpreting, and reducing multiple, messy details into a more-or-less coherent narrative (Molotch and Lester, 1974), as part of the process by which meaning is constructed in public discourse. This work has drawn on research that emerged after the critical turn in linguistics in the early 1970s, including critical discourse analysis (Fairclough, 2013), an approach to discourse and language use as social and political phenomena necessarily implicated in questions of power and epistemology. Media, public discourse, and policy in this way are linked in the process of the public construction of meaning.

Gamson and Modigliani's (1989) foundational analysis of media discourse on nuclear power specifically modeled nuclear power policy, public opinion, and media discourse as a three-part, non-causal "cultural system," in which all are shaped by one another through their entanglement in social processes of the construction of meaning and interpretation. Their approach to understanding the social construction of meaning is as an architecture of interpretive frames—each frame, in Gamson and Modigliani's (1987) words, "a central organizing idea or story line that provides meaning to an unfolding strip of events" (p. 143). The "non-causal" relation between media discourse and public opinion can thus be understood as a relation between "media frames" and "individual frames" (Scheufele, 1999): between "devices embedded in political discourse," on the one hand, and "internal structures of the mind," on the other (Kinder and Sanders, 1990: 74). As identified in media texts, media frames provide an interpretation as to "what the controversy is about" (Gamson and Modigliani, 1987: 143).

Insofar as "media discourse is part of the process by which individuals construct meaning, and public opinion is part of the process by which journalists and other cultural entrepreneurs develop

and crystallize meaning in public discourse" (Gamson and Modigliani, 1989: 2), the interlinked fields of media discourse and public opinion must be said to be contextually specific, geographically and temporally. Underlying the comparative logic of this article is the suggestion that a consistency of a particular frame across divergent contexts might identify that frame as having broader, general significance, and as having relevance at multiple levels of public discourse.

Contestations over public meaning necessarily take on a heightened tenor and greater consequence in moments of public crisis. Following Butler et al. (2011) and Pizziconi (2015), this article treats the Fukushima crisis as a "critical discourse moment". Critical discourse analysis treats a CDM as a point where established assumptions break down—as a result, for example, of a dramatic challenge to a core component of a particular frame. Chilton (1987) suggests that "discourse producers," that is, official and expert networks, might respond to a CDM with a strategy to "mobilize meaning," particularly through mass media, in order to reconstruct and reinforce frames that support their preferred policy options (p. 17). This article identifies one central media frame as it arose through media discourse after Fukushima, though it does not seek to trace its genesis in specific agential actions. (Of course, the landscape of media discourse is shaped by highly active agents—"sponsors," in Gamson and Modigliani's model—many with strong positions that influence media framing). Rather, what is important, here, is how a CDM introduces a dynamic of crisis and response. A CDM renders established frames vulnerable to critique; a CDM might "open apparently rigid circumstances and stir them up" (Beck, 1997: 22).

Before Fukushima, these "rigid circumstances" included a particular framing of the nuclear power industry that was comprised of three mutually reinforcing discursive moves: (1) constructing the nuclear industry as a high-reliability organization (HRO), that is, an organization that "must not make serious errors because their work is too important and the effects of their failures too disastrous" (LaPorte and Consolini, 1991: 19); (2) treating nuclear power as risk-free, or, if not entirely without risk, "risky but effectively managed" (Kinsella, 2013); and (3) siloing nuclear science and politics within a "black box," a complex system "opaque to non-experts but amenable to expert control" (Kinsella, 2013). Under this durable frame, the experts in the nuclear industry HRO know a disaster to be impossible precisely because "they claim sufficient technical knowledge to prevent it" (LaPorte and Consolini, 1991: 20). These discursive moves hinge on what Gieryn terms "boundary-work," which refers in part to the production of differentiated, bounded fields of knowledge (Gieryn, 1983). The "rigid" framing described above discursively removes nuclear science and policy from the public sphere and encloses it entirely in the technical (Kinsella et al., 2013: 285).

In the analysis that follows, I argue that post-Fukushima media discourse worked to rebuild the trust in expert knowledge and decision-making that the nuclear disaster had called into question. Fukushima represented a CDM in which prevailing public understandings of nuclear power were temporarily challenged; post-Fukushima media discourse functioned, in part, to reconstruct and reinforce the three-part approach to nuclear framing described above, through the application of a particular media frame (which I refer to as the *technoscience* frame) built out of a set of mutually reinforcing discursive themes. As I will show below, *technoscience* framing is visible both in national newspaper sources and in newspapers published in regions with long-standing nuclear controversies and well-organized anti-nuclear citizens' movements. That is, despite some differences between local and national coverage, both local and national media relied on a set of common assumptions about the sources of trustworthy knowledge and information and how that knowledge forms the basis for decision-making authority.

Scholars addressing information and knowledge production related to Fukushima have often avoided media content in favor of studying the practices and discourses of individual institutions, industries, citizen groups, social movements, or governments (Abe, 2013; Visschers and Wallquist,

2013; Weston, 2013). Scholars drawing on content analysis methods to analyze Fukushima discourse have compared media treatment of nuclear power across time (Schmidt et al., 2013) or place (Katchanovski, 2012); other studies have compared media type (Friedman, 2011; Yamamura, 2012) or focused on a small number of overarching discursive frames (Lazic, 2013; Lazic and Kaigo, 2013). This article is unique in its focus on the emergence of science- and knowledge-related media frames, the implications of this process for public engagement in nuclear energy policy, and its comparative approach.

3. Methodology

The national newspaper sample includes the *New York Times* (*NYT*), *Washington Post* (*WP*), and *Christian Science Monitor* (*CSM*), following Bengston et al.'s (2004) selection of national news sources which "accurately reflect the national debate" (p. 379). The *NYT* and *WP* are "newspapers of record" (Martin and Hansen, 1998) read by elites and others who have important influence in policy making. The *CSM* is a respected nonprofit newspaper often included alongside the *NYT* and *WP* for its high trust rankings (Grantham and Vieira, 2014). Newspapers in the Vermont Yankee region include the *Berkshire Eagle* in Pittsfield, Massachusetts, the *Brattleboro Reformer* in Brattleboro, Vermont, and the *Sentinel & Enterprise* in Fitchburg, Massachusetts. Newspapers in the TMI region include the *Intelligencer Journal/New Era* in Lancaster, the *Patriot-News* in Harrisburg, and the *York Dispatch* in York, Pennsylvania. The *Reformer* and the *Patriot-News* averaged higher publication frequencies than the remaining four local newspapers; together, they made up about 75% of the local newspaper coverage analyzed here.

Content analysis was conducted as a two-step process. The first step drew upon a sample of 120 articles from all US newspapers included in the LexisNexis database that responded to the search terms "Fukushima" and "nuclear" dated between 11 March 2011 and 11 March 2014. Using "open coding" (Strauss and Corbin, 1998), this initial step produced, inductively, a list of potential themes that could form the basis for the second step of analysis of the specified newspapers. Articles were hand-coded and tracked in a spreadsheet.

Following Schmidt et al. (2013), the second analytical step drew upon a random sample of articles generated by the two search terms in the nine newspapers listed above, netting 261 articles total (a sample size comparable to Arlt and Wolling, 2016). The cutoff date chosen was 11 March 2014 because it was the last month in which at least one of the sampled newspapers published an article that responded to the listed search terms; after 11 March 2014, no new articles appeared until June of that year.

Theme codes generated in step 1 were first applied to articles appearing in national newspapers ($n = 202$). The coding index was expanded as new themes emerged, and articles were periodically recoded to take into account themes that may not have been defined at the time of their initial coding, until saturation was achieved. Codes were then applied to articles appearing in the six local newspapers ($n = 59$); saturation was reached with the addition of one additional theme to the coding index (*it could happen here*), which prompted a recode of the national newspaper sample for instances of the newly identified theme. Coded themes were grouped into broader categories as they emerged in the data; media frames were identified through an analysis of thematic categories in conversation with the theoretical framework (Maxwell, 2005). Section 2 of the results section focuses on the *technoscience* frame, the most theoretically significant frame to emerge out of the coding process.

Almost a third of the 261 articles appeared during the first month following 11 March 2011—over 80 in total (see Figure 1). The figures presented in this article, therefore, divide media

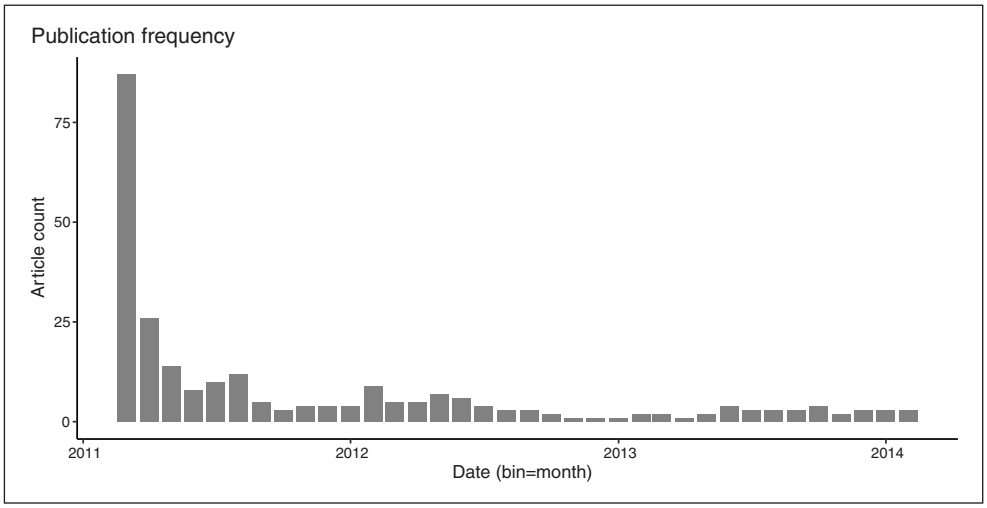

Figure 1. Full sample publication frequency ($n = 261$). Each bar represents the total number of articles published in a given month.

content into two categories demarcated by the significant decline in coverage frequency after 11 April 2011. The first category represents the first 4 weeks following 11 March 2011—the period which accounts for over 30% of the total articles published over the sampled period; the second category represents the subsequent months of the sample period. Where relevant, differences between initial coverage and later coverage are discussed alongside possible explanations and consequences.

4. Results

Content analysis identified 27 themes across the sample of newspaper texts (see Supplemental Material for coding index). Figures 2 and 3 display the frequencies of coded themes for national and local newspapers, respectively.

Results are presented in two sections below. The first section examines differences in framing between national and local newspapers, demonstrating that local newspapers treated the Fukushima crisis as a possible warning sign for their own controversial nuclear sites; in contrast, national media presented the crisis in Japan as only indirectly related to US nuclear energy policy. The differences examined in the first section, therefore, establish that local newspapers surrounding TMI and Vermont Yankee did not simply mirror national-level framing. The second section presents key commonalities between local and national media content and reveals that Fukushima coverage became a debate over who has the right to produce knowledge of and have opinions about the complex technical and political questions posed by nuclear power policy. These commonalities are identified through a set of mutually reinforcing coded themes that, together, make up what I call the *technoscience* media frame. The results presented in section 2 thus demonstrate that media framing worked to reinforce trust in expert knowledge and official institutions, while simultaneously working to delegitimize local concerns over nuclear regulation and safety. Thus, despite divergences in coded themes evident in section 1, local newspapers did converge with national-level discourse in a media frame that conveys trust in expert knowledge systems.

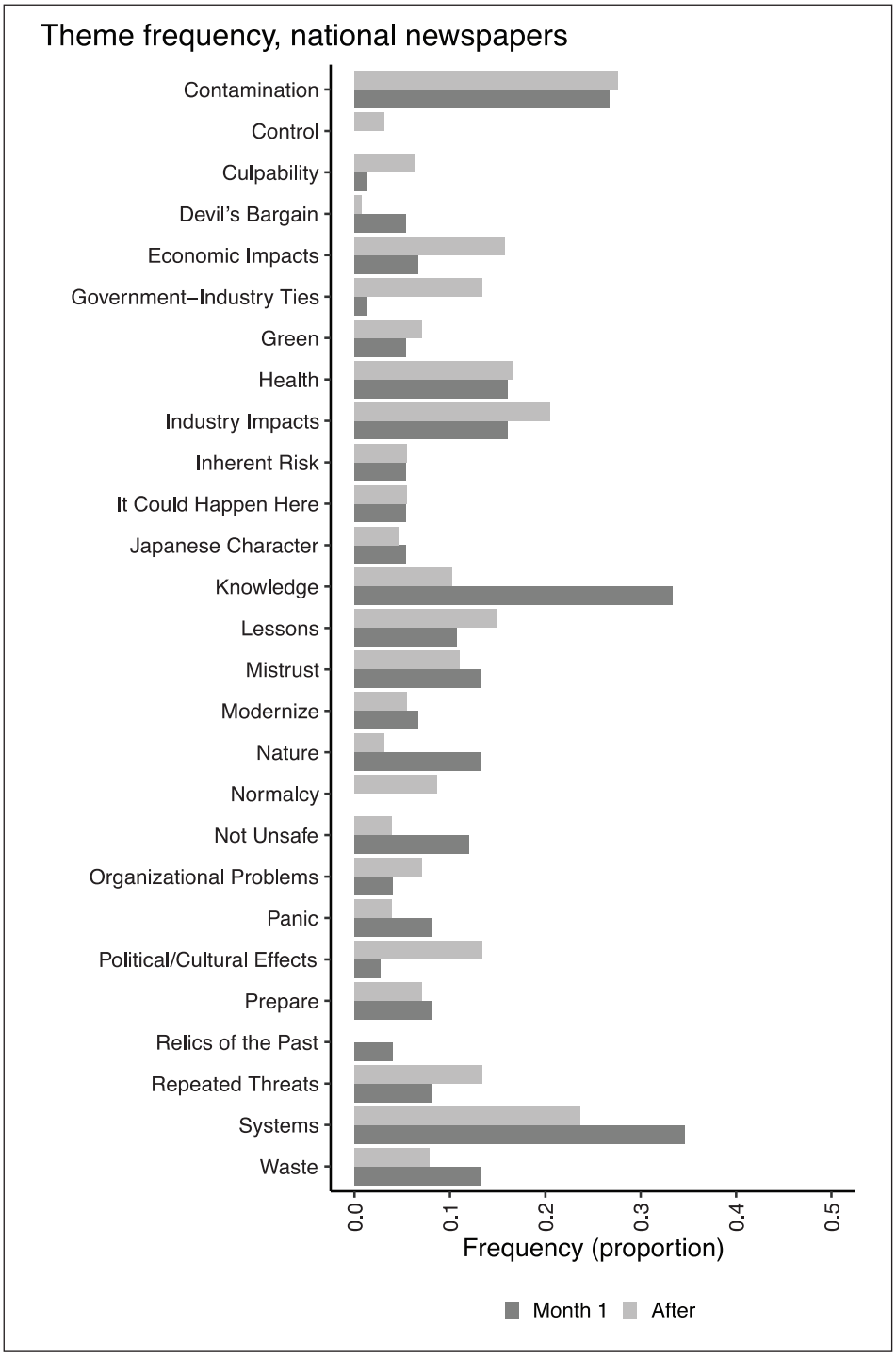

Figure 2. Coded theme frequency, national newspapers.
Each bar represents the proportion of articles published in national newspapers that included each of the coded themes, split between the first month following the 11 March 2011 disaster and thereafter.

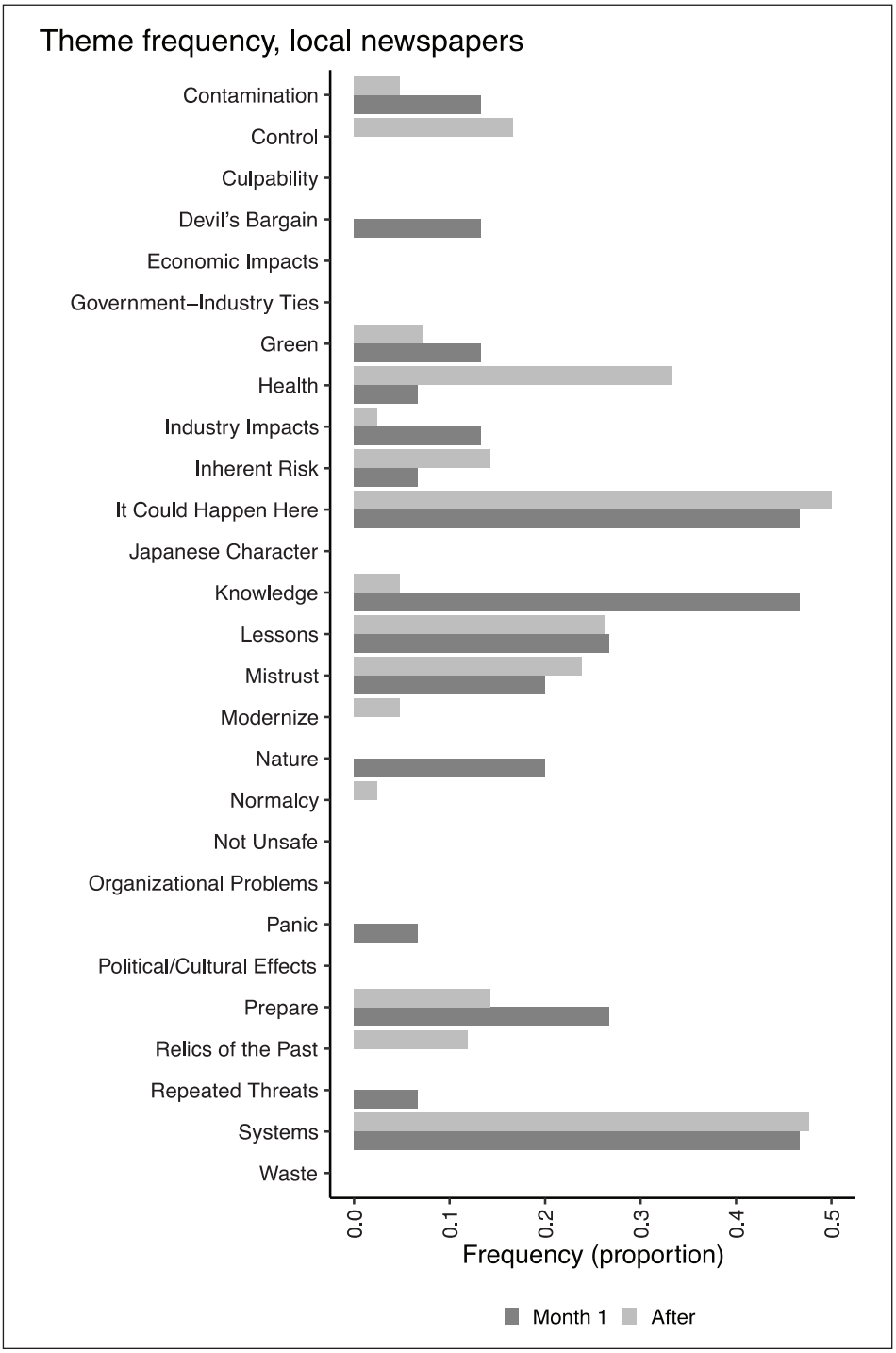

Figure 3. Coded theme frequency, local newspapers.
Each bar represents the proportion of articles published in local newspapers that included each of the coded themes, split between the first month following the 11 March 2011 disaster and thereafter.

Section 1: Divergence in national and local framing

Local particularities are evident in two key discursive themes: *it could happen here* and *control*. *Here* represents the single greatest divergence of local from national Fukushima discourse (see Figures 2 and 3). Not only did questions of the local applicability of the Fukushima crisis dominate initial newspaper discourse in the TMI and Yankee regions, but more than half of the articles published in the Vermont and Pennsylvania newspaper sample after the first month of media coverage included at least some discussion of the relevance of the Fukushima crisis to the situation at home. While *here* is not the only discursive theme that followed these local trends, it is striking that *here* was almost totally absent from the national press. *Here*, then, is a useful path to understand how the Fukushima crisis interacted with local nuclear controversies at TMI and Vermont Yankee.

Here clearly displays the Vermont- and Pennsylvania-specific effort to interpret Fukushima as an event with particular local relevance. Although most discursive themes focus specifically on one or more components of the Fukushima disaster narrative, *here* subordinates Fukushima to local nuclear debates. Under this inversion, the Fukushima disaster became a reference point by which local possibilities of—and preparedness for—nuclear disasters were adjudicated. To say *it could happen here*, then, is to place emphasis on "here" (local concerns) rather than "it" (the Fukushima disaster).

Here was strongest in Brattleboro, Vermont, where *here* revolved around a narrative of contamination, risk, and transparency, with the legal struggle over Yankee's relicensing as its primary reference point. At its most direct, the Fukushima represented by *here* was a clear warning of the danger posed by Yankee's similar design to the Fukushima plant:

> The agenda of the vigil was to remember victims of Fukushima and to draw attention to the fact that Vermont Yankee has the same basic boiling water reactor design as the Fukushima 3 plant. (Van der Does, *Brattleboro Reformer*, 19 April 2011)

Beyond direct technical similarities, Fukushima was also a marker for a commonality of experience: of risk and contamination, certainly, but also of the difficulties of dealing with officials and experts who did not appear, to some, to act in the best interests of victims on the ground. In Pennsylvania, former Governor Dick Thornburgh stood at the center of a persistent storyline that linked communities in Japan and Pennsylvania through their shared difficulty in interacting with volatile nuclear politics and untrustworthy disaster response mechanisms:

> Thornburgh said his greatest challenge in 1979 was "trying to get a firm grasp on the facts." It was very frustrating to realize various experts were either telling him more than they knew or less than they knew, he said . . . "Where there's a similarity between TMI and Fukushima is the reluctance of the industry to be frank about the severity of the accident," [TMI activist Eric Epstein] said. (*Patriot-News*, 13 March 2011)

But *here* was not the sole divergence exhibited by Pennsylvania and Vermont newspapers. The *control* theme, which codes for articles that are concerned with questions of who holds decision-making power in nuclear policy debates, also illustrates the gap between local and national concerns. Questions of *control* over nuclear policy were almost entirely limited to local media. Starting in early April, nearly one of five articles published in local newspapers drew on the *control* theme, while just 3% of articles at the national level did so over the same period. Indeed, a *CSM* article (Clayton, 19 July 2011) referenced *control* only in the context of the Vermont Yankee controversy, stating that "the debate over whether to renew [Yankee's] licenses gained even more urgency after the Fukushima nuclear disaster in Japan earlier this year."

Only national newspapers appeared to be concerned with assigning responsibility for the Fukushima crisis itself. *Culpability* codes directly for assigning responsibility, as in one 2013 *NYT* article (Tabuchi, July 10), which stated that a former TEPCO engineer had been "faulted . . . for failing to invest in adequate tsunami walls at the company's nuclear power plants." *Government-industry ties* and *organizational problems*, meanwhile, point to a set of government, industry, and regulatory structures as factors that shaped the disaster's severity. The *culpability* issue in the TMI and Yankee regions, however, was limited solely to the question of decision-making power encapsulated within the *control* theme. Fukushima became a referent for questions of whether *it could happen here*, while *here*, again, was subsidiary to the ongoing nuclear policy debate captured by *control*.

In summary, Fukushima coverage was dynamic and varied, with newspapers in the TMI and Yankee regions diverging significantly from national coverage. The absence of *here* from the national press suggests that the relevance of the Fukushima crisis to US nuclear plants was relegated to being a locals-only concern, while the critical connections between Fukushima and local nuclear power politics, so important to the small, low-circulation papers immediately surrounding the TMI and Yankee sites, were largely absent from the national media discourses in which policies are debated and decided. At the same time, divergences in framing exhibited by local newspapers were not due to the addition of local nuclear controversies to a standard set of Fukushima-related themes; rather, the Fukushima crisis was often interpreted through local experiences of nuclear controversy, and used to reflect upon and inform discourses that preceded the crisis at Fukushima.

Despite these differences between national and local coverage of the Fukushima crisis, important commonalities are evident among all media sources. These commonalities, explored in section 2, reveal the contribution of media discourse to providing an ideological justification for continuing reliance on nuclear energy in the United States.

Section 2: Convergence in national and local framing

This section turns to important commonalities in national and local coverage. Analysis reveals that both local and national media coverage was characterized by a set of discursive themes that positioned the crisis and possible responses around a *technoscience* approach to the construction of knowledge and policy (Pellizzoni and Ylönen, 2012). This approach privileges knowledge based on data and information generated by officials and scientific-technical experts; separates the political from the scientific and technical; and considers only credentialed experts and insiders—but not citizens—to be trustworthy and rational policy actors.

Accordingly, this section analyzes themes associated with three interrelated processes of producing and defending technoscientific knowledge: (1) quantifying the disaster through a careful gathering, ordering, and cataloging of information; (2) arranging this information into scientific understandings and technological objects, which are formed into response plans to be executed by technical and scientific experts; and (3) delegitimizing other forms of knowledge construction and disaster response by rendering them irrational, backwards, and anti-modern. Each of these three processes is described below. I argue that, together, the set of themes associated with these three sections represent a cohesive media frame—the *technoscience* frame—that expresses clearly "what the controversy is about" (Gamson and Modigliani, 1987: 143).

Quantification. Reports in the first few days following the earthquake, tsunami, and nuclear crisis were largely focused on quantifying and categorizing the disaster along metrics that could be manipulated, scaled, and translated. The size of the quake and its aftershocks; numbers killed, injured, missing, or displaced; expected, normal, and dangerous doses of radiation; evacuation radii and populations—all were measured and meticulously ordered:

> . . . a soil sample from Iitate, a village of 7,000 people about 25 miles northwest of the plant, showed very high concentrations of cesium 137—an isotope that produces harmful gamma rays, accumulates in the food chain and persists in the environment for hundreds of years . . . The cesium levels were about double the minimums found in the area declared uninhabitable around the Chernobyl nuclear plant in Ukraine, raising the question whether the evacuation zones around Fukushima should be extended beyond the current 18 miles. (Fountain, *NYT*, 1 April 2011)

Here, we see the consequences of earthquake and nuclear disaster tallied along a number of axes: geographic and temporal measurements of the disaster, population statistics, radiation data, safety standards, and evacuation radii. Other reports included information on earthquake magnitude, wave size, numbers of dead, injured, and displaced, and measurements of economic damage in terms of local economies, global markets, and the nuclear industry. Early coverage, in this way, built a ledger of the disaster, its effects and responses.

Quantification is, in part, an exercise in reassurance: Quantification "tame[s] uncertainties into more calculable probabilities" (Hébert, 2016: 121). But measurement in itself is arbitrary without a set of reference points, so news coverage placed the earthquake, tsunami, and nuclear disaster within well-known hierarchies of risk and damage. For the earthquake, this task was as simple as reporting magnitude. For the less tangible, less immediate dangers posed by radiation, however, more complex strategies were necessary. Many reports took a comparative angle, expressing radiation readings, doses, or rates in terms deemed understandable to a scientifically illiterate public. Fukushima was compared to Chernobyl and radiation to "normal background radiation" or to chest x-rays—"'it won't even be at the level of a chest X-ray,' Ms. Classic said" (Harris, *NYT*, 22 March 2011)—while the disaster was continually upgraded from its initial classification as a "Level 4" disaster up through "Level 7" (the highest rating) on 12 April 2011. Constructing a numerically legible picture of Fukushima transposed messy experience into clean, fixed, knowable numbers.

These treatments of quantified knowledge are tracked across the sample by the *knowledge* theme, in which technoscientific knowledge comes to dominate assessment of the disaster, including its severity, reach, impact, and significance, through quantified and expert-certified data. *Knowledge* dominated the first 4 weeks of coverage across the sample, but it was later eclipsed by a greater reliance on the *mistrust* theme, especially at the local level. *Mistrust* describes a broad suspicion of official narratives. *Mistrust* themes, however, were often limited to a questioning of the sources of technoscientific data, rather than the data itself. Throughout the Thornburgh storyline, for instance, the primary critique of official interpretations focused on Thornburgh's complaint that political or economic motivations had overshadowed the scientific endeavor. The underlying question was not about the reliability or completeness of expert-produced scientific knowledge, but the reliability of particular experts. "Ultimately," the *Patriot-News* wrote, "[Thornburgh] requested that President Jimmy Carter provide an outside expert he could trust" (*Patriot-News*, 13 March 2011). Technoscientific expertise, generally accepted to be "trustworthy," continued to be understood as a necessary and sufficient tool to understand and control the risks at hand.

Scientific understanding and the technical object. The *technoscience* frame also relied on discursively disassociating the crisis from the operations of the reactor itself, primarily by displacing the technical failures at Fukushima onto individual technical components. Repeated discussion of particular failed objects, such as a waterlogged pump or a faulty valve, meant that the objects took the fall for the crisis as a whole, and helped to distance the nuclear disaster from corporate, political or policy-level culpability:

> [TEPCO officials] reported that four out of five water pumps being used to flood the reactor had failed and that the other pump had briefly stopped working. As a result [the fuel rods] were completely exposed for 140 minutes. (Mufson, *WP*, 15 March 2011)

Even while the (unreliable) pump and valve were blamed rather than system failure, coverage of the disaster response relied heavily on a vision of reliable technological solutions. Far from giving up on the technical object, Fukushima discourse instead worked to reinforce particular technologies as mechanisms of safety and reliability, and as tools to inscribe the diffuse disaster with a quantifiable logic:

> Each worker would carry a dosimeter, which measures radiation exposure . . . Suits and air packs are meant to keep radioactive particles off the skin and out of the lungs until the workers return to a safer area . . . Workers are trained to remove the gear in a specific way to avoid leaving any particles on their skin that would result in continuing exposure. (Fountain, *NYT*, 15 March 2011)

Information drawn from exhaustive measurements performed by experts is discursively transformed into certain knowledge of the situation—for instance, the "12-mile radius," the border between danger and safety. Knowledge in turn informs action, alternatively "call[ing] for an evacuation" or declaring the level of risk to be one that merely requires "remain[ing] indoors" (White House, 2011). The themes *prepare* and *lessons* track this discursive operation in which technical safety plans form the entirety of the field of possible disaster responses, and in which the disaster serves as a model to improve technical safety systems. It is this scientific and technological system, characterized by the amalgamation of safety technologies, disaster response strategies, and safety standards, that forms the sole legitimate determinant of nuclear safety. It is this system, too, that is referenced by nuclear industry promoters to discursively protect the nuclear industry from claims that it is "unsafe," and by anti-nuclear activists as well—such as those in Brattleboro, who claimed that the Yankee plant was dangerous due to faulty safety valves:

> [The Fukushima reactors] have the same Mark 1 containment, so flawed that a valve needed to be installed to release steam and pressure in the event of an accident. It appears that some of the problems at Fukushima-2 are caused by a failure of that very "safety" valve to open. (Hass, letter to the *Brattleboro Reformer*, 24 March 2011)

The production of data, its aggregation into quantified knowledge, and the operationalization of knowledge into coherent disaster response strategies all rely on a set of technological objects and knowledge practices. Through discursive fascination with failed pumps and replacement generators, with failed containment vessels, imported cement trucks, and other technical details, media represented technology as both culprit and solution. The limiting of conceivable problems and solutions to technical questions both obscures issues of policy and marks nuclear policy and disaster response as expert fields inaccessible to public understanding. As shown below, this public is constructed to be neither rational nor sufficiently prepared to participate in decision-making; instead, it is characterized by irrational panic.

Delegitimizing local understandings. The rationality and impartiality of dosimeters, pumps, and other technical objects contrasts with post-Fukushima media treatment of the non-expert public. Non-expert voices appeared far less frequently than technical or policy experts, and when laypeople were asked to comment on the disaster, their interpretations, emotions, and experiences were at

times described in terms of a panicked irrationality. *Panic* codes for this treatment of the irrational public, for whom rational decision-making and analysis were often implied to be out of reach. Whereas the *panic* theme occurred less frequently than more common themes such as *here*, the theme of *panic* reveals the ancillary—or even obstructive—role that media discourse assigned to public, non-expert voices.

Panic was applied in a variety of circumstances: a description of Pennsylvanians who had fled the TMI disaster despite the lack of official order (*Patriot-News*, 19 March 2011); an account of Russian citizens as being "in a panic" over events in Japan (Shwirtz, *NYT*, 18 March 2011); a 21 April 2011 summation of the preceding weeks as characterized by "[the government] trying to prevent the Japanese public from panicking" (Bradsher, *NYT*). Sneider (2013) identifies these tropes of the panicked public as "public shaming," a form of discursive discipline that "redirect[s] attention away from institutional and industry accountability" and that renders the non-expert public unqualified to weigh in on disaster response and nuclear decision-making. *Panic* at times co-occurred with *mistrust*, suggesting that a mistrust of official sources is another form of the irrationality implied in the *panic* frame:

> Shuji Urashima, a gas station manager, said he sent 20 kilograms of rice, two boxes of ramen, and a supply of batteries to his sister in Tokyo, where post-earthquake panic has stripped many stores . . . "The government is in a real mess. I have no idea how much I can trust them," he says. (*CSM*, 16 March 2011)

This March 16 article goes on to contrast Tokyo's panicked run on stores and Urashima's mistrust with the down-home realism of those nearer the disaster site: "Politics were a distant concern for those with loved ones in northern Japan. 'Our focus is on finding family members,' says English teacher Tim Detmer." Direct knowledge of the disaster, here, prompts the public to know its place. The same day, the *NYT* ran a story in which an investment researcher identified the link between *mistrust* and *panic* as the reason for a small crash in the Nikkei stock index: "[There is] a certain panic thinking that is going on. I think the main thing is, people just don't know. And they don't necessarily trust the information they have been hearing."

Representations of citizen voices differ across the nine publications. *Panic* tropes were more common in national newspapers than at the local level, and local newspapers were more likely to call upon non-expert voices and activists. While this difference in the frequency of citizen voices is certainly a reflection of the limited journalistic scope of local newspapers—the *Brattleboro Reformer* does not have the budget to send reporters to Tokyo—it also indicates that activists and politicized local citizens, at least in the towns surrounding TMI and Yankee, were afforded a certain level of political legitimacy. This legitimacy, however, rests upon the ability of public voices to call upon independent analysts with the same forms of credibility as the policymakers and industry experts they sought to challenge. That is, claims by the public were articulated in the same language of safety systems, regulatory inspections, and faulty components:

> Gundersen [a local activist and former nuclear engineer] wrote that it was troubling because the HPCI [high pressure coolant injection system] had a pin-hole leak in a 1-inch drain line . . . Even though the hole was later fixed, the problem occurred during a time when the safety valves were leaking. (Stilts, *Brattleboro Reformer*, 31 March 2011)

5. Discussion and conclusion: Fukushima's CDM in context

This article has argued that US newspapers organized coverage of the Fukushima crisis in part through a *technoscience* media frame. The *technoscience* frame is built out of an architecture of

discursive themes that describe how credible knowledge is produced (*knowledge*) and organized (*systems, lessons, prepare*), and who might access it (*panic*). These three processes enact three different discursive moves: (1) quantifying and categorizing the disaster in a manner which "tame[s] uncertainties into more calculable probabilities" (Hébert, 2016: 121); (2) operationalizing quantified knowledge through disaster response systems and technologies, relying on a vision of trustworthy technical solutions; and (3) casting nuclear policy, technology, knowledge, and disaster response as a technical field external to an irrational public. Nuclear power production sites might be understood as a complex network, made up of a collection of technical components, discursive strategies, institutional and individual actors, and conflicting ideologies, constantly negotiated and renegotiated along axes of power, politics, and legitimacy. *Technoscience* framing hides these processes of negotiation, and instead presents a vision of the nuclear system as wholly risk-free by reinforcing discursive boundaries as to how knowledge is produced, who might access it, and how it might be acted upon. It is a process that works to reinforce, perhaps, the boundaries defined by what Michel Callon terms the "double delegation" of science and politics: the delegation of political work to professional politicians, and knowledge production to scientific experts (Callon et al., 2009).

The *technoscience* frame is significant, moreover, because it is shown to be operating even in locations with controversial nuclear sites and active anti-nuclear citizen movements. The smaller, local newspapers surrounding TMI and the Vermont Yankee plant varied significantly from national media discourse in their treatment of the crisis as a whole (see section 1 of the "Results" section); nonetheless, even these local newspapers relied upon the *technoscience* frame to construct knowledge of the disaster in Japan and its consequences. That the set of themes forming the *technoscience* frame extended even to regions that one might expect to be uniquely skeptical of nuclear expertise is evidence of the power and reach of *technoscience* framing across the spectrum of views on nuclear power.

Although Fukushima's CDM threatened the "nuclear renaissance" of the past two decades (World Nuclear Association, 2014) by challenging the efficacy of nuclear safety technology and by calling into question the infallibility of nuclear science (cf. Kinsella, 2013), it is no surprise that the post-Fukushima years saw little drop in public, state, and industry support for nuclear power production in the United States, insofar as US media worked to rebuild trust in expert-driven, state-sponsored technoscience.

In addition, the construction of a realm of technical expertise off-limits to public understanding has implications that go beyond questions of nuclear policy and disaster response. The ways we construct "science" and "the public" (or "science" and "society") reflect ontological and epistemological positions. If these positions mark the public as ancillary to scientific knowledge production, then the goals of participation and democracy cannot be addressed merely by providing greater access to information, but instead require a rethinking of more fundamental category systems. Although seldom given space alongside the "quantification-technology-panic" coverage of Fukushima, these projects of rethinking and reimagining are numerous and ongoing (see Weston, 2013 on "technostruggle"). To understand post-Fukushima discourse, then, it is necessary to recognize that politics and science are intrinsically related and mutually constitutive, and that science discourse, at times, does the ideological work of politics as well.

But Fukushima was not the first international nuclear disaster to threaten global confidence in nuclear power production. The 1986 Chernobyl disaster, which led to a drastic increase in opposition to nuclear energy across Europe, was also associated with a significant—but temporary—rise in anti-nuclear sentiment in the United States as well, to levels even greater than were observed in the wake of TMI (Renn, 1990). Mass media's approach to quantifying a nuclear crisis also varied between Chernobyl and Fukushima. For example, Friedman (2011) describes newspaper coverage

of radiation data at Chernobyl as "infrequent and unspecific," in contrast with what she describes as the "particularly compelling and nuanced radiation reporting" of the *NYT* in the aftermath of the Fukushima meltdown (pp. 59–60). Further research is needed to establish a causal link between such differences in Fukushima and Chernobyl reporting and differences in public responses to nuclear power that followed those disasters.

This article leaves several additional openings for further investigation. Media content analysis methods are shifting to accommodate non-traditional media, including social media (cf. Lai and To, 2015), aided by computational approaches to analyzing text content (cf. Wetts, 2020). Further work might analyze post-Fukushima non-traditional media for its treatment of *technoscience* framing. Even so, traditional media remains a central source for information and a key site to analyze how issues are framed: in the Tokyo area, even college-age students placed greater importance on traditional news sources than social media immediately following the disaster (Jung, 2012); and traditional media framing has been shown to influence social media framing as well (Van der Meer and Verhoeven, 2013).

This study draws upon prior research to establish a correspondence between media framing and public opinion and proposes a mechanism to understand their connection in the Fukushima case by identifying a specific, broadly applied media frame (*technoscience*). The *technoscience* frame is understood through an application of prior theoretical work on nuclear power and high-reliability organizations (Kinsella, 2013; Kinsella et al., 2013; LaPorte and Consolini, 1991). Further work might therefore empirically examine the specific connection between post-Fukushima media framing and public opinion. The social action of *technoscience* framing, as well as the public consequences of the *technoscience* frame for nuclear policy, may also present fruitful areas for future research on the legacy of the 2011 disaster.

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ORCID iD

Jonathan Tollefson https://orcid.org/0000-0002-1392-5841

Supplemental material

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Author biography

Jonathan Tollefson is a PhD student at the Department of Sociology, Brown University, focusing on the politics of knowledge and expertise and the geography of urban environmental hazards.