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Public opinion on energy development: The interplay of issue framing, top-of-mind associations, and political ideology



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HIGHLIGHTS

- How an issue is presented (“framed”) influences how people perceive it.
- We applied this premise to oil/gas extraction via hydraulic fracturing (fracking).
- We examined two commonly used frames: *fracking* and *shale oil or gas development*.
- People viewed the former less favorably irrespective of political ideology.
- We discuss implications for communicating about energy development impacts.

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ABSTRACT

In this article, we examine framing effects regarding unconventional oil and gas extraction using hydraulic fracturing (or fracking): an issue involving considerable controversy over potential impacts as well as terminology used to describe it. Specifically, we explore how two commonly used terms to describe this issue – *fracking* or *shale oil or gas development* – serve as issue frames and influence public opinion. Extending existing research, we suggest that these frames elicit different top-of-mind associations that reflect positive or negative connotations and resonate with people’s political ideology. These associations, in turn, help explain direct and indirect framing effects on support/opposition as well as whether these effects differ by political ideology. Results of a split-ballot, national U.S. survey ($n=1000$) reveal that people are more supportive of the energy extraction process when it is referred to as *shale oil or gas development* versus *fracking*, and this relationship is mediated by greater perceptions of benefit versus risk. Political ideology did not moderate these effects. Further analysis suggests that these findings are partly explained by the tendency to associate *fracking* more with negative thoughts and impacts and *shale oil or gas development* more with positive thoughts and impacts. However, these associations also did not vary by political ideology. We discuss implications for communicating risk regarding energy development.

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1. Introduction

Are people more supportive of biofuels or ethanol? Are people more concerned about climate change or global warming? Advocates of contentious issues, as well as scholars studying those issues, have long recognized that (1) how an issue is framed in broader discourse potentially influences how people perceive it; (2) frames may resonate with people’s political ideology; and

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(3) frames may involve words or phrases that carry certain connotations (Cacciatore et al., 2012a; Schuldt et al., 2011). In this article, we investigate how the ways in which unconventional oil and gas extraction using hydraulic fracturing (also known as fracking) is described – as *fracking* and *shale oil or gas development* – may act as issue frames and influence public opinion. We view these phrases as frames because they are present within issue discourse, have come to represent the broader fossil fuel extraction process and help people make sense of an energy topic that has been the subject of considerable controversy over potential impacts and “a linguistic and political debate as controversial as what it defines” (Fahey, 2012).

In a broader sense, this article extends existing research on framing effects regarding contentious issues. Scholars have suggested that effects on support/opposition, risk perception, and other beliefs (see Cacciatore et al., 2012a; Schuldt et al., 2011) are manifestations of the content of issue frames becoming part of audience thoughts on that issue (i.e., audience frames) (Schuldt and Roh, 2014a). Our study, unlike past research, combines framing effects and mechanisms presumed to drive these effects, using unconventional oil and gas extraction as a case example. Specifically, we consider (1) how particular issue frames elicit different audience frames (top-of-mind associations; Boudet et al., 2014) and (2) how these associations, in turn, account for framing effects on audiences' issue opinions. We suggest that *fracking* and *shale oil and gas development*, as issue frames, elicit different top-of-mind associations that reflect positive or negative connotations and resonate with people's ideological dispositions. These associations, in turn, help explain direct and indirect framing effects on support/opposition as well as whether these effects differ by political ideology. We test these propositions using a split-ballot, nationally representative survey experiment in the United States, where unconventional energy extraction has emerged as a controversial issue. Our results have important implications for studying public opinion on – and communicating risk regarding-energy development.

1.1. Unconventional oil and gas extraction: background, impacts, and public opinion

Unconventional oil and natural gas reserves – those within rock formations like low-permeability sandstone, shale, and coal seams – are technologically and economically difficult to develop due to geological and other considerations (National Energy Technology Laboratory, 2013). Nonetheless, several factors have led to increased development,¹ including high energy prices, greater interest in domestically-produced fossil fuel energy, and advances in horizontal drilling and hydraulic fracturing technology (Wang and Krupnick, 2013). The latter involves pumping water, sand, and chemicals underground to fracture the rock and release oil and gas.

Unconventional energy extraction involves various potential impacts. Economic issues include job creation in local economies; increased income for private landowners who sign oil or gas

leases; and strains on public services due to increased demand from energy companies (Kay, 2011). There is also the effect on energy prices resulting from increased use of comparatively cheaper natural gas in manufacturing, power generation, and transportation as well as from potentially higher natural gas exports (United States Energy Information Administration, 2014). Moreover, environmental impacts involve land use disturbances from well drilling and operation (Entekin et al., 2011); contamination of ground and surface water via drilling, wastewater disposal, hydraulic fracturing, and other processes (Vengosh et al., 2013); and climate change implications associated with natural gas replacing coal for power generation and other uses (Newell and Raimi, 2014). Furthermore, health risks center on exposure to potentially toxic hydraulic fracturing chemicals (Colborn et al., 2011) and physical and psychological stress associated with living near industrial activity (Adgate et al., 2014). Finally, social impacts involve rapid population growth in communities, community conflict, and perceived changes in quality of life (Jacquet and Stedman, 2013, 2014; Jacquet, 2014).

Numerous public polls have been conducted on unconventional oil and gas extraction, with many asking about hydraulic fracturing or fracking specifically. National polls reveal varying familiarity with the issue and sharply-divided views (Clarke et al., 2013; Pew Center for the People and the Press, 2013). On the state and regional level, especially in areas with active or proposed development, people tend to be more familiar with it and aware of potential risks and benefits (Campbell, 2013). In addition, scholars have examined factors that are associated with these perceptions (Anderson and Theodori, 2009; Boudet et al., 2014; Brasier et al., 2011, 2013; Davis & Fisk, 2014; Theodori, 2009), drawing from studies of other contentious social issues (Besley, 2010; Gupta et al., 2012). Issue framing is one such factor.

1.2. Framing overview

Framing has conceptual roots across disciplines. Sociologists have studied how “interpretive packages” are “constructed, tailored, and communicated by a variety of competing social actors” (Druckman and Bolsen, 2011, p. 2; Borah, 2011). Psychologists have examined the strategic selection, emphasis, or omission of information about an issue and subsequent effects on audience perceptions. Within the latter area, there are two broad types. In equivalency framing, information that conveys the same underlying message is presented in different ways, eliciting different responses. For example, people tend to choose riskier options when losses are highlighted but become risk averse when gains are emphasized (Tversky and Kahneman, 1981). In contrast, emphasis framing involves information with different underlying messages. These messages focus on different aspects of the same issue, such as problem definitions, causes, and/or solutions (Entman, 1989). Framing effects occur when individuals use these frames “when constructing meaning, processing information, and making evaluations or decisions” (Nisbet et al., 2013, p. 2; Chong and Druckman, 2007). Emphasis framing may also involve using terms with certain connotations that bring “attention to certain aspects of the issue at the expense of others” (Schuldt et al., 2011, p. 116). In essence, it conveys an issue's central idea, and actors compete to convey desired frames and influence public opinion (Pralle and Boscarino, 2011).

Emphasis framing effects have been studied across a host of contentious issues, including energy development (Cacciatore et al., 2012a) and climate change (Nisbet et al., 2013). For example, although the terms *global warming* and *climate change* are often treated as synonymous within public discourse, research suggests that they may elicit different audience responses (Akerlof and Maibach, 2011; Schuldt et al., 2011). In a recent survey of

¹ Over the next two decades, USEIA (2014) projects a sizable increase in domestic oil and natural gas production from unconventional sources. Shale gas, in particular, is expected to drive much of the 56% increase in domestic natural gas production from 2012 to 2040. In this scenario, shale gas will account for 53% of domestic production by 2040, up from 40% in 2012. Moreover, unconventional sources such as shale now account for 35% of domestic crude oil production as of 2012 and is expected to reach 50% by 2019 (United States Energy Information Administration, 2014). During this time, total U.S. oil production is expected to reach 9.6 million barrels/day in 2019, up from 6.5 million barrels/day in 2012. However, the magnitude of these increases – and their effects – could vary considerably based on resource recovery, available technology, production costs, policy, consumption patterns, and other factors.

Americans, Leiserowitz et al. (2014) found that respondents were more certain that *global warming* (versus *climate change*) was happening, perceived greater risks associated with it, and considered it a higher priority for federal lawmakers (see also Schuldt et al., in press).

In this study, we argue that the use of *fracking* and *shale oil and gas development* within discourse on unconventional energy extraction represents emphasis framing. Although the technical meanings of these terms differ, as *fracking* is just one component of the energy extraction process (EnergyFromShale, 2013), both have come to represent this broader process in public discourse (Bailin, 2013). As Wolske and Hoffman (2013, p. 2) observed:

“The public [views] *fracking* as the entirety of the natural gas development process from leasing and permitting, to drilling and well completion, to transporting and storing wastewater and chemicals. Industry and regulatory agencies hold a much narrower definition that is limited to...injecting hydraulic fracturing fluids into a well.” (p. 2).

Moreover, these frames potentially elicit different reactions. Goidel and Climek (2012) and Climek et al. (2013) found that survey respondents who answered questions about natural gas development that used the phrase *hydraulic fracturing* were less likely to consider such development safe compared to those who answered the same question but without that phrase.

Following Schuldt and Roh. (2014a, 2014b), we view the phrases *fracking* and *shale oil or gas development* as issue frames that are present within issue discourse and help people make sense of this controversial energy topic. We also believe that these frames impact people's opinions on this topic. This process, we contend, occurs when the content of issue frames become part of audience thoughts about that issue (i.e., audience frames). These audience frames “exist in the minds of message recipients” and are “packages of stored knowledge, or schemata that become temporarily accessible and help to organize experience and facilitate information processing” (p. 3). We call these audience frames “top-of-mind associations” (Boudet et al., 2014). Moreover, in the typical framing study, audience frames frequently go unmeasured: a point that Schuldt and Roh (2014a) suggest may be problematic:

Researchers typically measure [an] outcome variable of interest (often, some attitude, preference, or belief) and take any observed difference as evidence that the media frames did indeed instantiate distinct audience frames...[However,] without directly measuring the audience's cognitive response to different media frames, we are left to speculate about which concepts and schemata are rendered accessible and whether they might vary [based on] relevant individual difference variables (e.g. political orientation)...” (p. 3).

Our study more fully accounts for outcomes and mechanisms underlying framing effects. We suggest that *fracking* and *shale oil and gas development* elicit different top-of-mind associations that reflect positive or negative connotations and resonate with people's political ideology. These associations also help explain direct and indirect framing effects on support/opposition as well as whether these effects differ by political ideology.

1.3. Top-of-mind associations

Top-of-mind associations are mental representations of an issue—the first pictures, sounds, smells, symbols, words, or thoughts that come to mind when thinking about it (Boudet et al., 2014; Damasio, 1999)—that shape subsequent decisions about that issue. We argue that they represent audience frames (or thoughts) elicited in response to the content of issue frames. For example,

global warming and *climate change* produce difference audience reactions despite being commonly treated as synonymous in public discourse (Schuldt et al., 2011). Unique associations with these terms evoke may help explain such differences. *Global warming* seems to elicit relatively stronger associations of human influence, heat, and rising temperatures, whereas *climate change* may elicit relatively stronger associations of natural causation and broader climatic impacts (Whitmarsh, 2009). Also, these differences may depend on audience political orientation (Schuldt and Roh, 2014a). More specific to unconventional oil and gas extraction, Boudet et al. (2014) found that those who associated hydraulic fracturing with economic impacts (i.e. job creation) were more supportive, while those who associated it with environmental impacts (i.e. water contamination) were more opposed.

In comparing reactions to *fracking* versus *shale oil or gas development* as issue frames within public discourse, evidence shows that both terms have come to refer to the broader oil and gas extraction process, with *fracking* no longer limited to describing just hydraulic fracturing (Evensen et al., 2014a). As a result, proponents and opponents have tied the meaning of these terms to broader impacts beyond hydraulically fracturing rock (Bailin, 2013). *Fracking* seems to be a preferred term of opponents who link it with negative connotations and impacts. The Natural Resources Defense Council (2012, p. 1) argued that “unbridled growth of fracking has allowed the gas industry to run roughshod over communities, leaving a host of serious impacts in their wake—from poisoned water wells, to contaminated rivers and streams, toxic air pollution, and devastated property values in towns and rural areas across the country” (see also Catskill Mountainkeeper, n.d.). Others have observed that *fracking* sounds negative and thus stokes opposition (Brady, 2013; Fahey, 2012; Kent, 2012; Kyff, 2011). Proponents, however, have worked to counteract these efforts by mentioning positive connotations and impacts, but they are less apt to use *fracking* (as opposed to hydraulic fracturing) and arguably haven't had the persuasive success of opponents. The website EnergyFromShale (n.d.) argues that *hydraulic fracturing* has “boosted local economies—generating royalty payments to property owners, providing tax revenues to the government, and creating much-needed high-paying American jobs.” Also, an article from Bloomberg (Efstathiou, 2013) declared that in 2012, “surging oil and natural gas production brought on by hydraulic fracturing supported 2.1 million jobs, added almost \$75 billion in federal and state revenues, contributed \$283 billion to the gross domestic product, and lifted household income by more than \$1200.”

While there has been some focus on potential health and environmental risks of *shale oil or gas development* (National Academy of Sciences, Board on Environmental Change and Society, Division of Behavior and Social Sciences and Education, 2013), this term seems to have comparatively more positive connotations. In particular, it draws attention to positive impacts that use the same moniker, such as economic development in communities in close proximity to resource extraction. Moreover, the energy industry often discusses “responsible” natural gas development (Chevron Corporation, 2012), while the Center for Sustainable Shale Development (2013) emphasizes “safe, sustainable shale resource development.”

Overall, as we argue that connotations for *fracking* are more negative, while those for *shale oil and gas development* are more positive, we hypothesize the following:

- H1: *Fracking* will elicit more negative top-of-mind associations, while *shale oil or gas development* will elicit more positive associations.
- H2: *Fracking* will elicit associations tied to environmental impacts, while *shale oil or gas development* will elicit associations tied to economic impacts.

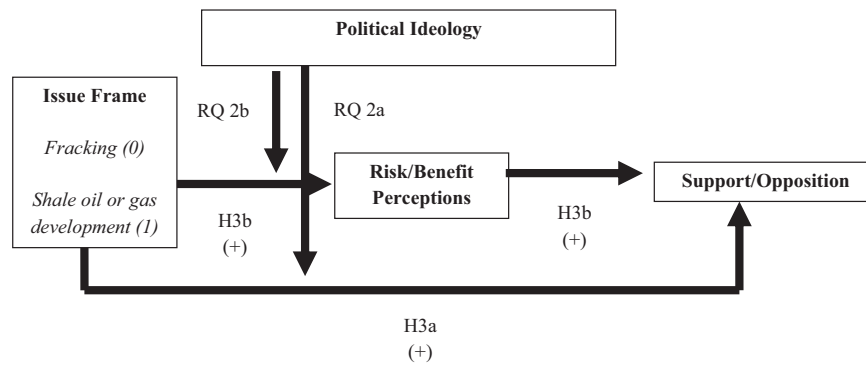


Fig. 1. Proposed Moderated-Mediation Model.

As mentioned earlier, audience thoughts elicited in response to issue frames are believed to drive framing effects on issue beliefs (Schuldt and Roh, 2014a, 2014b). If associations for *fracking* are comparatively more negative, we expect that people will perceive more risks than benefits and oppose rather than support it. Furthermore, risk/benefit perceptions are often related to support/opposition (Visschers and Siegrist, 2012). Thus, we hypothesize that

- H3: Issue framing will be (a) directly associated with support/opposition as well as (b) mediated by perceived risk/benefit. Specifically, use of the phrase *shale oil or gas development* (compared to *fracking*) will be associated with *stronger* issue support as well as *higher* perception of benefit versus risk. Higher perceived benefit, in turn, will be associated with stronger issue support. (Fig. 1 illustrates these relationships).

1.4. Political ideology

We now turn the role of political ideology in (1) influencing top-of-mind associations the aforementioned frames elicit as well as (2) moderating the influence of issue framing on support/opposition via perceptions of risk/benefit. Broadly speaking, McCright and Dunlap (2011, p. 156) have observed a “recent polarization on a range of social, economic, and cultural issues [on] the basis of ideology and party identification,” including fossil fuel extraction (Boudet et al., 2014). Several reasons account for this phenomenon. First, individuals rely on political ideology as a cognitive shortcut when forming opinions about controversial issues (Scheufele and Lewenstein, 2005). Oftentimes, such issues tap into broader ideology-based concerns (Davis & Fisk, 2014). Second, partisans often form perceptions in line with elite cues: patterns of polarization or consensus on the part of elected officials, political strategies, and others in positions of power and influence (Brulle et al., 2012). The more familiar people become with elite positions, the more likely their issue perceptions will reflect those cues.

Specific terms used to describe contentious issues may have connotations that resonate with people’s ideological dispositions and thus elicit divergent top-of-mind associations. Schuldt and Roh (2014a), for instance, found that conservatives associate rising temperatures more with *global warming* than *climate change*, whereas liberals mention this phenomenon irrespective of the term used. In addition, conservatives reported less belief in *global warming* (but not *climate change*) after being subtly reminded of an unseasonably cold weather event that recently occurred where they live (Schuldt and Roh 2014b). As Republicans and conservative elites have been openly critical of the role of human activities in rising global temperatures (McCright and Dunlap,

2011), the term *global warming* elicits more unfavorable reactions among these individuals. However, because *climate change* speaks to broader temperature changes that can accommodate both hot and cold weather, human and natural causation, and impacts beyond rising temperatures, it engenders less defensive reactions. For Democrats, conversely, both terms are associated with impacts about which they are likely to be disproportionately more concerned. Other research, moreover, suggests that partisan-specific associations potentially explain framing effects on public opinion. Schuldt et al. (2011) found that Republicans were more likely to believe that *climate change* (vs. *global warming*) was occurring; Democrats displayed no such differences. However, other studies have observed narrower or counterintuitive partisan differences (Leiserowitz et al., 2014; Schuldt et al., in press).

In terms of energy issues, Cacciatore et al. (2012a) found that Democrats more strongly endorsed economic benefits of *biofuels* compared to *ethanol*, while Republicans perceived lower economic benefits irrespective of word choice. Cacciatore et al. suggested that Democrats view *biofuels* as a “green” energy source: a moniker that gives them an opportunity to reaffirm commitment to the environment (see also Cacciatore et al., 2012b). Ethanol, however, has more negative connotations, such as the diversion of food crops for fuel. For Republicans, either term is associated with unwanted government intervention in energy production (i.e. subsidies, renewable fuel mandates, etc).

Drawing on this research, we examine whether *fracking* and *shale oil or gas development* carry different connotations that resonate with people’s political ideology and elicit different top-of-mind associations. On one hand, partisan difference may emerge. Political ideology is strongly related to views on energy development (Boudet et al., 2014; Davis and Fisk, 2014). Conservatives/Republicans tend to favor a free-market economic system predicated on fossil fuel use (McCright and Dunlap, 2011) and act to safeguard that system by downplaying environmental risks and opposing regulation (Feygina et al., 2010). Liberals/Democrats, conversely, tend to challenge this system amid concerns about environmental risks and support regulation. Goidel and Climek (2012) found that Democrats regarded natural gas development as safer when the process was described but *hydraulic fracturing* was not mentioned. No differences were found for Republicans. Although the study did not include *shale oil and gas development* as a comparison term, we believe that the latter will elicit more positive associations irrespective of partisanship. Thus, when comparing the two terms, liberals may be more likely to mention negative associations for *fracking* (i.e., environmental impacts) but less likely to do so for *shale oil or gas development*. They may even perceive positive associations like economic benefits. Conservatives, however, would likely mention positive associations irrespective of terminology.

On the other hand, partisan differences in top-of-mind associations may not be as apparent. Climek et al. (2013) found that both Republicans and Democrats considered natural gas development to be safer, and were more supportive of it, when *hydraulic fracturing* was omitted in the question (compared to when it was included). In addition, elite cues on this issue do not point to polarization, and partisan groups do not seem to have latched onto specific terms to describe it. For example, President Obama's has "[lauded] fracking for promoting American energy independence, economic growth, and reduction of greenhouse gases" ("The Politics of Fracking.", 2014, p. 1). Disagreement instead centers on how it should be regulated, whether excess natural gas supply should be exported, and other policy issues ("Central European Nations Appeal to Congress for Faster Exports of US Natural Gas", 2014; Dayen, 2014). Contentious debates that have emerged, moreover, often involve *internal* divides among Democrats, with many seeking to balance perceived economic benefits with environmental risks (Adler, 2014; Dayen, 2014). Harder (2014) noted that "the energy boom is shaping a new kind of Democrat in national politics: lawmakers who are giving greater support to the oil and gas industry even at the risk of alienating environmental groups, a core of the party's base."

With conflicting indications about whether top-of-mind associations elicited by *fracking* or *shale oil or gas development* will differ by political ideology, we ask the following:

- RQ 1: Will political ideology moderate the relationship between framing condition and top-of-mind associations?

Finally, we examine whether political ideology moderates the effect of issue framing on support/opposition via perceptions of risk/benefit. Although partisan differences in these associations could translate into partisan differences in these perceptions, we are ultimately unsure whether polarization will occur. Thus, we ask the following (see Fig. 1):

- RQ 2: Will political ideology moderate (a) the direct effect of issue framing on support/opposition and (b) the indirect effect as mediated by risk/benefit perceptions?

2. Methods

We conducted a split-ballot framing experiment as part of the Cornell National Social Survey: a nationally representative, random-digit dial omnibus telephone survey of 1000 American adult

within the continental U.S. The survey was managed and administered by the Survey Research Institute at Cornell University; fielded from August 7 to November 2, 2013; and used Computer Assisted Telephone Interviewing software. The response rate was 38%, and the cooperation rate was 70% (see American Association for Public Opinion Research, 2015, response rate formula #4). Sample characteristics were as follows: age ($M=47.18$; $SD=17.47$; median=47.0), 50.2% female, and 43% with a 4-year college degree or above. Our sample fairly approximated the U.S. population in terms of gender (51% female), but it was noticeably older (median U.S. age=37 years) and more educated, as nationwide only 28.5% of adults age ≥ 25 have a Bachelor's degree or higher (United States Census Bureau, 2013).

Issue frames were manipulated by having approximately half of the sample (493 respondents) answer questions with *fracking*, while the other half (501 respondents) answered questions with *shale oil or gas development*. Otherwise, question wording was identical across conditions. Table 1 lists close-ended measures of our key variables. The order they appeared in the survey was as follows: top-of-mind associations, a covariate (issue familiarity), the dependent variable (support/opposition), and the mediating variable (risk/benefit perceptions).

We elicited people's top-of-minds associations in accordance with Boudet et al. (2014): "When you think of [TERM], what's the first word, phrase, or thought that comes to your mind?" All but 4 of the 1000 respondents provided at least one association. We coded the entirety of respondents' statements, although nearly all of them took the form of single word answers (i.e. "oil") or short comments (i.e. "pollution of water supplies" or "drilling for natural gas"). Two researchers used a coding scheme developed by Boudet et al. (see Table 2) and achieved acceptable reliability (Krippendorff's $\alpha=0.77$). These codes were not mutually exclusive. For instance, a statement such as "we shouldn't pursue this because of the environmental impacts" would be coded as a negative association as well as an environmental association. Finally, we excluded associations that we considered irrelevant to the topic.

Our moderating variable (political ideology) was measured at the end of the survey and used a scale of 1 (extremely liberal) to 7 (extremely conservative) ($M=4.0$; $SD=1.61$).

3. Results

H1 – that *fracking* would elicit negative top-of-mind associations, and *shale oil or gas development* would elicit positive associations – was supported. As shown in Table 2, negative associations were mentioned more for *fracking* (19.3% vs. 12.5%; $X^2(1)=$

Table 1
Variable measures and response scales.

Variable	Question	Response scale	M (SD) – Total sample	M (SD) <i>fracking</i>	M (SD) <i>shale oil or gas development</i>
Perceived risk/benefit	In your view, will [TERM] increase or decrease overall quality of life in communities where it is occurring? (reverse-coded)	1=increase greatly 5=decrease greatly	2.85 (1.28) $\alpha=0.83$ $N=608$	2.66 (1.3) $\alpha=0.85$ $N=257$	3.0 (1.23) $\alpha=0.81$ $N=351$
	Overall, what are your views on the benefits and risks of [TERM]?	1=risks far outweigh benefits 5=benefits far outweigh risks			
Support/Opposition	Overall, to what extent do you support or oppose [TERM]?	1=strongly oppose it 4=strongly support it	2.6 (1.07) $N=558$	2.35 (1.1) $N=235$	2.75 (1.03) $N=323$
Issue familiarity	How much have you heard or read about [TERM]?	0=not at all 3=a lot	1.43 (1.13) $N=874$	1.44 (1.2) $N=405$	1.44 (1.07) $N=469$

Note: Approximately half of respondents ($n=493$) were randomly assigned to see questions containing the word *fracking*, while the other half saw questions with *shale gas and oil development* ($n=501$). Descriptive statistics above do not include respondents who indicated they did not know or otherwise did not provide an answer.

Table 2
Frequency of top-of-mind associations by framing condition.

Association	Examples	% fracking	% shale oil or gas development	X ² (df)
General references to oil, gas, energy	Oil; (natural) gas; energy; shale; fossil fuels	12% (59/491)	12.5% (63/505)	(1)=0.05
References to process of unconventional oil and gas extraction (while mentioning oil/gas)	Get gas out of the ground; drilling for gas; getting gas/oil from shale; hydrofracking	7.3% (36/491)	10.7% (54/505)	(1)=3.4
Statements that may be relevant to the process (no mention of oil/gas)	Drilling/mining; cracking the rock; breaking; fracturing; fuel; water; sand	4.9% (24/491)	3.2% (16/505)	(1)=1.91
Environmental impacts	Earthquakes; water contamination; environment; pollution, poison, dirty	6.9% (34/491)	3.6% (18/505)	(1)=5.7*
Economic impacts	Economic development; jobs; lower/higher energy prices; increase in oil, gas supply; energy independence	3.9% (19/491)	15.6% (79/505)	(1)=39***
Good/supportive comments	Good, OK, let's do it; they should allow it	2.9% (14/491)	9.9% (50/505)	(1)=20.6***
Bad/opposition comments	Bad, don't do it, dangerous	19.3% (95/491)	12.5% (63/505)	(1)=8.8**
Respondent doesn't know/is not sure	Participant states that s/he can't think of a response; is unsure or undecided	26.7% (131/491)	9.3 (47/505)	(1)=51.2***

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

8.8, $p=0.003$, Cramer's $V=0.09$), with comments about it being bad or harmful. Conversely, positive associations were mentioned more frequently for *shale oil or gas development* (10% vs. 3%; $X^2(1)=20.6$, $p < 0.001$, Cramer's $V=0.144$), with comments about it being good or desirable.

H2 – that *fracking* would elicit environmental associations, and *shale oil or gas development* would elicit economic associations – was also supported. Environmental associations such as environmental degradation and water contamination were mentioned more frequently for *fracking* (6.9% vs. 3.6%; $X^2(1)=5.7$, $p=0.017$, Cramer's $V=0.076$). Economic associations such as job creation and other economic benefits were mentioned more often for *shale oil or gas development* (15.6% vs. 4%; $X^2(1)=39$, $p < 0.001$, Cramer's $V=0.2$).

RQ 1 asked whether political ideology would moderate the relationship between framing condition and top-of-mind associations. Using the PROCESS macro² for SPSS (model #1) (Hayes, 2013), we estimated a series of interaction models with framing condition (1=*shale oil or gas development*; 0=*fracking*) as the independent variable, aforementioned top-of-mind association categories as the dependent variables (see Table 2 for a complete list), and political ideology as the moderator. We only found a significant interaction for environmental associations (unstandardized $b=0.42$, $p=0.038$). Liberals who encountered *shale oil or gas development* were less likely to mention environmental associations than those who saw *fracking*. This relationship remained statistically significant for those who scored a 1 on the ideology scale (very liberal; $b=-1.59$) to approximately a 3 (somewhat liberal; $b=-0.71$).

H3a posited that issue framing would be directly associated with support/opposition, while H3b stated that this effect would be mediated by risk/benefit perceptions. We tested these hypotheses using PROCESS model #4. Framing condition comparison was the independent variable, support/opposition was the dependent variable, and risk/benefit perceptions was the mediator. We also included the following covariates: age, gender, and political ideology. These variables were significantly correlated with risk/benefit perceptions and support/opposition (all $r > 0.2$), and prior research (Boudet et al., 2014) suggests that they may account for additional explained variance in multivariate analyses.

Results of the mediation analysis are provided in Table 3. Compared to *fracking* (coded 0), those who saw *shale oil or gas development* (coded 1) perceived more benefits than risks ($b=0.3$, $p < 0.01$). In turn, perceptions of benefit were positively associated with issue support ($b=0.56$, $p < 0.001$). The 95% bootstrapped confidence interval for the indirect effect (0.17) excluded 0 (0.053, 0.28), suggesting a statistically meaningful effect. The completely standardized indirect effect – a measure of effect size – was 0.09 (95% CI: 0.03, 0.15). In addition, there was also a direct effect of framing condition on support/opposition ($b=0.16$, $p < 0.01$). Those who saw *shale oil or gas development* were more supportive than those who saw *fracking*. Thus, H3a and H3b were supported.

RQ 2a and RQ 2b asked whether political ideology would moderate the aforementioned direct and indirect framing effects

² According to Hayes (2014), p. 1, the PROCESS macro for SPSS “uses an ordinary least squares or logistic regression-based path analytic framework for estimating direct and indirect effects in simple and multiple mediator models.” It provides various model types that, among other things, estimate “interactions in moderation models along with simple slopes and regions of significance for probing interactions, conditional indirect effects in moderated mediation models with a single or multiple mediators and moderators, and indirect effects of interactions in mediated moderation models also with a single or multiple mediators. Bootstrap and Monte Carlo confidence intervals are implemented for inference about indirect effects.” This program is ideal for us to examine (1) the indirect effect of issue framing on issue support/opposition via perceived risk/benefit and (2) whether political ideology moderates this indirect effect.

Table 3
Output for mediation analysis (Process Model #4).

Coefficients	Equation predicting mediator (risk/benefit perceptions) $r^2=0.31$	Equation predicting dependent variable (support/opposition) $r^2=0.64$
Constant	1.1***	0.45***
Condition: Hydraulic fracturing (0) versus shale oil or gas development (1)	0.3**	0.16**
Risk/benefit perceptions	–	0.56***
Age	0.01***	0.0016
Gender	–0.46***	–0.07
Political ideology	0.32***	0.098***

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

(see Fig. 1). We ran PROCESS model #8 with two interactions: issue framing condition comparison X ideology on risk/benefit perceptions and condition comparison X ideology on support/opposition. Each model used the same covariates as above. Both interactions were not significant ($p > 0.9$).

4. Discussion

Using a split-ballot, nationally representative survey experiment of United States adults, we investigated how the use of specific terms to describe unconventional oil and gas extraction using hydraulic fracturing—specifically, *fracking* and *shale oil or gas development*—act as issue frames and influence public opinion. We explore how the content of issue frames become part of audience thoughts and how those thoughts drive broader framing effects (see Schuldt et al., in press). Our study design has numerous strengths. We selected an issue that has been the subject of considerable controversy over potential impacts as well as the terminology used to describe it (Fahey, 2012) and for which there is a considerable need for effective risk communication about potential impacts (Clarke et al., 2012; Evensen et al., 2014b). Our nationally representative survey helps enhance the generalizability of our findings to the U.S. population: a key advantage, given that unconventional energy extraction is currently occurring throughout the country. At the same time, *fracking* and *shale oil or gas development* arguably represent what Borah (2011, p. 249) calls “idiosyncratic frames” that are unique to this issue. In an effort to link this work to “broader theoretical or conceptual issues of framing” (p. 256), we have examined processes through which framing effects on public opinion occur that we believe generalize to other contentious topics.

Before discussing the implications of our specific analyses, we acknowledge two limitations. First, we used single-item measures for many of our variables, including support/opposition and risk/benefit perceptions. This decision was largely born out of necessity, as we were limited as to how many questions we could include in the omnibus survey. Future research should consider multi-item measures that would allow researchers to parse out the role of measurement error in the framing effects we observed. However, given that measurement error is retained in our case, our use of single-item measures is actually a conservative test of these framing effects (see also Cacciatori et al., 2012a). Second, our questions were imbedded within a larger omnibus survey (including items on weather preparedness, living wills, privacy, beverage taxes, global warming, hunting, and other topics), the length of which prevented us from including other items of research value (e.g., a definition of *fracking* or *shale oil or gas*

development prior to participants answering the questions). Responses may therefore reflect more uninformed reactions than if participants were briefed about the issue a-priori. We note, though, that previous surveys indicate that unfamiliarity with this topic is high, even if a brief definition is provided (Clarke et al., 2013). Moreover, questions on the related topic of global warming (i.e., whether it is occurring, and support for specific policies) immediately preceded our questions. Unconventional gas extraction, in particular, is increasingly garnering attention in terms of whether its use reduces or increases carbon emissions (Newell and Raimi, 2014). Participants may have been primed to consider environmental impacts once they saw our questions. However, we consider this outcome unlikely; issue unfamiliarity on the national level remains widespread, and very few participants who mentioned environmental associations actually touched on climate change.

4.1. Top-of-mind associations

We hypothesized that *fracking* and *shale oil or gas development*—two terms that have become part of issue discourse—would elicit different audience frames in the form of top-of-mind associations. These associations, we believe, reflect negative and positive connotations (respectively) to which those terms are linked (see Bailin, 2013; Brady, 2013; Center for Sustainable Shale Development, 2013; Chevron Corporation, 2012). Consistent with our hypotheses, *fracking* elicited more negative associations and comments related to environmental impacts (i.e. water contamination). By contrast, *shale oil or gas development* engendered more positive associations and comments about economic impacts (i.e., creating energy-related jobs in communities). Although these differences were statistically significant, we note that comparatively few people mentioned these associations in response to either phrase: no more than 7% of respondents for environmental associations; no more than 15.6% for economic associations; no more than 10% for positive associations; and no more than 19.3% for negative associations. One explanation is that these associations were not salient in people’s minds, given broader unfamiliarity with hydraulic fracturing. We may have even inflated their frequency by coding for multiple associations within a statement (i.e., “I do not like fracking because it pollutes groundwater”). We believe, though, that it is important to code for complexity of thought in situations where people justified their impressions of this topic. The larger issue is that people were only asked the first word, phrase, or thought that came to mind when thinking of the topic: a method previously used (Boudet et al., 2014). Had we probed for additional ones, we may have seen a higher number of economic, environmental, positive, and negative associations. Such impacts may be salient but not necessarily the first to come to mind.

Moreover, we did not ask participants to assign a positive or negative valence to the economic or environmental associations. Future research should assess people’s top-of-mind associations as well as how good/bad people consider those thoughts to be. Such an approach is consistent with affective imagery: “sights, sounds, smells, ideas, and words to which positive and negative affect or feeling states have become attached” (Slovic and Peters, 1998, p. 292). Affective imagery, furthermore, helps drive “fundamental psychological processes such as attention, memory, and information processing” (p. 292). For example, scholars have argued that low climate change risk perception results, in part, from psychologically distant imagery (i.e. far-removed impacts like melting glaciers; see Leiserowitz, 2005; Smith and Leiserowitz, 2012). In another case study, moreover, Keller et al. (2012) found that opponents of building new nuclear power plants mentioned negative associations such as accidents, radioactivity, waste disposal,

military uses, and consequences for health and the environment. Conversely, supporters discussed positive connotations such as energy generation.

Scholars should also consider moving beyond top-of-mind associations and affective imagery entirely, as both are arguably explicit in nature. People actively reflect on the first words or thoughts that come to mind and whether those words/thoughts are good or bad. By contrast, *implicit* associations are “mental processes [that] lie beyond one’s introspective capability” (Dohle et al., 2010, p. 1117) and shape issue perceptions without requiring conscious awareness of one’s thoughts (Greenwald and Banaji, 1995). A common measure involves observing how long it takes participants to pair a given concept with an affective category (good or bad). Faster response times suggest stronger implicit associations (Greenwald et al., 1998). In light of recent work suggesting that implicit associations predict attitudes toward and support/opposition regarding energy issues over and above affective imagery (Truelove et al., 2013), future work that explores the role of implicit associations with *fracking* or *shale oil or gas development* in the effects reported here may prove fruitful.

4.2. Mediation model

We also suggested that top-of-mind associations explain how issue frames influence issue support/opposition directly and indirectly via perceptions of risk/benefit. When people saw *shale oil or gas development* (vs. *fracking*), they perceived more benefits than risks. The latter, in turn, was associated with more support. However, two limitations are worth noting. First, the completely standardized indirect effect was modest (0.09). We were not surprised, though, as we only presented respondents with different issue frames at one point in time and immediately assessed reactions. Studying longer-term effects may provide insight into cumulative, delayed effects of repeated exposure. Second, while the link between risk/benefit perceptions and support/opposition is consistent with previous research (Visschers and Siegrist, 2012), we cannot rule out the possibility of reverse or even dual causation. Our question on support/opposition came before the question on risk/benefit perceptions. More broadly, motivated reasoning (Druckman, 2012) suggests that people may form perceptions of risk and benefit based on whether they already support or oppose unconventional oil and gas extraction. Thus, future research should collect public opinion data at multiple time points and explore recursive and lagged relationships among these variables over time.

4.3. Moderation and moderated-mediation: the role of political ideology

We also believed that political ideology would play a key role in the framing process. Energy development involves a number of politically controversial issues, including the role of fossil fuels in economic development and the role of government regulation in the energy sector (Boudet et al., 2014; Davis and Fisk, 2014). Also, advocates have linked *fracking* and *shale oil or gas development* with negative and positive connotations respectively. We believed, therefore, that these terms would elicit different top-of-mind associations because their underlying connotations resonate with ideological dispositions in different ways. As liberals are more apt to be concerned about environmental risk (Cacciatore et al., 2012a), they would be more sensitive to issue framing than conservatives. In particular they would associate *fracking* with more negative impacts (i.e., environmental risk) compared to *shale oil or gas development*. Conversely, conservatives would focus on positive impacts irrespective of terms used because they don’t recognize potential environmental harm and/or focus on positive

attributes regardless. Contrary to our expectations, however, political ideology largely did not influence top-of-mind associations. Perhaps the differences lie in their valence. For example, *fracking* and *shale oil or gas development* both elicited economic associations irrespective of partisan affiliation. Perhaps liberals felt they were bad (i.e. industry adversely affecting local economies), and conservatives felt they were good (i.e. more jobs).

This lack of partisan-based differences in top-of-mind associations also explains why political ideology did not moderate the effect of framing condition on support/opposition via risk/benefit perceptions. If issue frames do not elicit divergent associations among conservatives and liberals, then it is not surprising to see no differences in risk/benefit perceptions and support/opposition. Although political ideology is a key driver of views on energy and other contentious issues (see Boudet et al., 2014), perhaps partisan differences do not emerge without polarized elite cues as well (see Leeper and Slothuus, 2014). Political polarization widens as people selectively attend to issue-related cues in broader discourse (i.e. via news media coverage) that resonate with their ideological dispositions (Guber, 2012; Hart and Nisbet, 2012). However, political elites do not seem to be significantly divided over unconventional oil and gas extraction. Many Democratic and Republican officials agree on whether it should occur, with differences mainly focusing on issues of regulation. Moreover, news coverage has focused on differences *within* the Democratic party on these issues rather than a Democratic-Republican divide (Dayen, 2014). Should inter-party differences increase, and if news media highlight these cues, political polarization among the broader population would likely increase and elicit different responses to our issue frames.

5. Conclusions and policy implications

Our findings have important implications related to effective policy-making and risk communication regarding impacts of unconventional energy development. Federal, state, and local officials must discuss, develop, and implement policies that target various components of the development process. Issues include water use and quality; management of wastewater; air quality; methane leakage; and socioeconomic impacts on nearby communities. There has been considerable variation within and across levels of government in terms of policies enacted (see Davis, 2012; National Conference of State Legislatures, 2011; New York State Department of Environmental Conservation, 2011; New York State Department of Environmental Conservation, n.d.; Revesz, 2014). Key to effective policy-making, we contend, is effective risk communication about these impacts (Clarke et al., 2012).

Issue framing is a potentially problematic tool for communicating about these impacts and informing policy discourse. Our findings, as well other studies and commentaries (Bailin, 2013; Evensen et al., 2014a; Goidel and Climek, 2012), suggest that *shale oil or gas development* and especially *fracking* are “loaded” terms. They are linked to different connotations and diverse social, economic, environmental, and health impacts. These frames can create contentious debates: people are using terminology that mean different things to different audiences and, as our data show, elicits different top-of-mind associations, perceptions of risk and benefit, and support/opposition. Although such debates may not necessarily fall along partisan lines, Wolske and Hoffman (2013, p. 2) nonetheless observe that “difference in [word] meaning can lead to miscommunication that ultimately increase mistrust among stakeholders.” In particular, the use of *fracking* versus *shale oil or gas development* may affect the types of impacts on which policy-makers focus. While considerable policy attention on *fracking* has centered on water quality, socioeconomic impacts on

communities do not seem as salient. Thus, socioeconomic impacts, with exceptions (see [New York State Department of Environmental Conservation, 2011](#)), may not receive as much policy emphasis despite calls for greater attention ([Jacquet and Stedman, 2014](#)).

Furthermore, even when words like *fracking* elicit similar associations (i.e., environmental impacts), there can still be contentious debates over their probability or severity that may adversely affect policy discourse ([Evensen et al., 2014a](#)). For instance, proponents deny that hydraulic fracturing can cause or has caused drinking water contamination. To these individuals, it represents the process of fracturing rock to release oil and gas, and there is limited evidence that chemicals or fossil fuel can migrate through overlaying layers of rock to reach surface or groundwater ([Osborn et al., 2011](#)). At the same time, they may also take a broader view on this issue, linking it to positive impacts beyond the fracturing process (i.e., job creation in local economies) ([EnergyFromShale. n.d. Benefits of Fracking](#)). For such reasons, the energy industry may be opposed to additional regulation. Conversely, in arguing that it can contaminate drinking water, opponents take a different but equally broad view on what “counts” as hydraulic fracturing. They embrace a broader set of impacts that industry may not, including methane escaping into aquifers from poorly cemented wells; spills of chemicals and wastewater into surface waters; and pockets of methane mobilized by drilling that migrate into groundwater ([Vidic et al., 2013](#)). In their view, additional regulation is needed.

How might issue framing be leveraged as part of effective risk communication and policy-making in the context of energy development? [Evensen et al. \(2014a\)](#) recommended being clear about the processes and impacts of unconventional energy extraction to which one is referring. For instance, conveying potential water quality risks associated with *fracking* could involve statements specifying that when it does occur, it is often tied to processes like wastewater and fracturing fluid disposal that some view as part of “fracking” while others do not. In this way, the fact that *fracking* is linked to variety of impacts is acknowledged. Also, to the extent that one desires to convey positive and negative impacts, phrases like “shale gas development via hydraulic fracturing” may be useful additions to issue discourse.

Public opinion on unconventional oil and gas extraction will undoubtedly help determine its long-term viability within U.S. energy policy and how it is regulated ([Boudet et al., 2014](#); [Davis and Fisk, 2014](#)). Greater attention to the outcomes and processes of framing effects in this context can provide additional insight into public opinion and risk communication.

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