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Beliefs about impacts matter little for attitudes on shale gas development

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ABSTRACT

Do facts lead to positive/negative views about energy development or vice versa? The answer matters crucially for policy and communication – if perceptions of what is true (beliefs) precede feelings (attitudes), additional information could shape views on an energy technology; yet, if attitudes precede beliefs, the usefulness of communication, either for influencing beliefs or simply making the public more informed, is far less clear. A long history of social-psychological research asserts that individuals' beliefs predict their attitudes on environmental issues. Nevertheless, other theories intimate the reverse – attitudes shape beliefs, specifically on newly emergent, controversial topics. We investigated whether attitudes (i.e., support and opposition) about the contentious issue of shale gas development stem from or lead to beliefs about development. We collected data from random-sample surveys – of residents in the Marcellus Shale region and of a national US sample. Factor analyses and structural equation modelling lead us to question the dominant assumption that beliefs precede attitudes – the reverse, or a recursive relationship, appears more likely. Broad values and place attachment precede attitude formation more reliably than beliefs about impacts do – suggesting need for a larger focus in energy policy on core values and the ways in which development could foster or compromise these values.

1. Introduction

Shale gas development via high-volume, slick-water hydraulic fracturing (often called "fracking"[1]) is an increasingly hot political issue in the USA, Canada, much of Europe, and beyond (Boersma and Johnson, 2012; Bomberg, 2017; Malakoff, 2014; Mazur, 2016; Montpetit and Lachapelle, 2017; Van de Graaf et al., 2017). Researchers, politicians, and partisans alike have sought to understand why people form the opinions they do about this issue. A review of public perceptions research on this issue reveals, in general, slightly more support for shale gas development than opposition in the United States, although high percentages of survey respondents are commonly undecided in their attitudes towards development and substantial regional variation in attitudes exists (Thomas et al., 2017a, 2017b). Some research suggests that attitudes towards development have become more divisive over time (Mazur, 2016), or that opposition has increased over the years (Perry, 2012; Pew Research Center, 2013). In Europe, a review of public perceptions of shale gas development in the UK, the Netherlands, Germany, and Poland indicated that with increased exposure to the issue, undecided members of the public increasingly opposed development (Lis et al., 2015). In this article's research, we focus on antecedents of attitudes (i.e., support and opposition) in the US, on both a national level and in areas close to substantial shale gas development.

Research on this topic has proliferated exponentially over the last decade. Perhaps due to the heavy policy focus on regulating and managing "impacts", much research focuses on impacts associated with development. Scientists have afforded particular attention to effects on:

1) Water quality (Llewellyn et al., 2015; Olmstead et al., 2013; Rahm and Riha, 2012; Stokstad, 2014; Vengosh et al., 2014; Vidic et al., 2013) – contamination has been shown to occur, often due to surface spills, but also due to cement well casings that have failed;
2) Air quality and air pollution (Alvarez et al., 2012; Allen et al., 2013; Moore et al., 2014; Newell and Raimi, 2014; Schrag, 2012; Schwietzke et al., 2016; Zavala-Araiza et al., 2015) – a fierce debate exists over whether life-cycle emissions from shale gas development exacerbate or mitigate climate change, with the answer depending on quality of regulations, measurement approach, leaky infrastructure, and the energy sources that shale gas either displaces or

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[1] Note: We use the term 'shale gas development' throughout this article to refer to the set of processes and associated effects that attend this form of energy extraction/development. Whilst no term is perfect, social-psychological research into how this word is used provides nuanced discussions of why to avoid use of 'fracking' (see Evensen et al., 2014, Evensen, 2016c, Wolske and Hoffman, 2013).

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augments; further, local air emissions (e.g., VOCs, ozone, and NO_x) produced by gas field infrastructure have become a concern due to public health;

3) Biota and ecosystems (Buchanan et al., 2017; Drohan et al., 2012; Kiviat, 2013; Souther et al., 2014; Milt et al., 2016) – well pads and pipeline corridors have caused much habitat disruption and increased the amount of edge habitats, preferencing some species over others; additionally, water withdrawals from streams at certain times of year can critically reduce flows needed for survival of aquatic species;
4) Human health (Adgate et al., 2014; Jacquet and Stedman, 2014; Kibble et al., 2013; Kovats et al., 2014; Mitchell et al., 2016) – a range of potential human health problems have been associated with the build out of a shale gas industry, including respiratory problems, issues arising from potential water contamination, endocrine disruption, the alleged possibility of cancer, psychosocial stress due to rapid changes in way of life, and occupational hazards for industry workers; due to the difficulty of establishing causality between the industrial operations and health problems, little is known for certain in this area;
5) Local and regional economics (Fry et al., 2015; Kinnaman, 2011; Melikoglu, 2014; Paredes et al., 2015; Weber, 2012) – job creation, economic growth, and increases in municipal and state-level taxes have been linked to shale gas development, although the magnitude of benefit has not been commensurate with predictions; concerns about negative economic outcomes exist, including increases in rental costs, crowding out of previously viable economic sectors, reductions in tourism, and reductions in property value;
6) Community well-being (Evensen, 2015; Evensen and Stedman, 2017; Fernando and Cooley, 2016a, 2016b; , 2014; Jacquet and Stedman, 2014; Seeliger et al., 2016; Boyle et al., 2016) – rapid changes in small, often rural communities can accompany a quick build out of the shale gas industry and bring a large, often transient, population to these areas; this can benefit communities by affording new services and economic and social opportunities, but also has been linked to diminished well-being due to marred aesthetics (visual, auditory, olfactory), loss of place meaning, changes in community character, and increased crime.

As the academic world continues to investigate and publish findings focused on the impacts of shale gas development, our research suggests that beliefs about impacts of development may contribute little to development of attitudes about shale gas development (i.e., support and opposition).

In addition to the numerous studies that examine the impacts themselves, empirical research on *public perceptions* of shale gas development often assumes that the primary predictors of attitudes about shale gas development are beliefs about impacts associated with development (Braiser et al., 2011; Jacquet and Stedman, 2013; Kriesky et al., 2013; Ladd, 2013; Schafft et al., 2013; Theodori, 2009, 2013; Wynveen, 2011; for a review see Thomas et al., 2017b). These claims stem from a theoretical tradition that assumes beliefs about the effects of a new process or action will lead to an individual's support or opposition (Fishbein and Ajzen, 2011). Based on these often implicit theoretical assumptions, empirical research frequently employs data analysis techniques that reveal only correlational relationships; yet when discussing the implications of such findings, the relationships are treated as causally predictive.

Our survey research and data analysis suggest these assumptions may not be appropriate – attitudes about shale gas extraction (i.e., support or opposition) may *lead to* beliefs about the impacts of this relatively novel form of energy development, or, at minimum, recursive feedback loops might exist that mean causality is not uni-directional. Debates of this sort draw attention to research that repeatedly establishes the importance of public perceptions and social structures in shaping views on energy production technologies and processes (Kasperson and Ram, 2013; Rayner, 2010; Sovacool, 2014; Stephenson, 2016; Webler and Tuler, 2010; Wüstenhagen et al., 2007).

If the causal direction of the relationship between attitudes and beliefs about shale gas development is not as straight-forward as many researchers have assumed, this would have substantial implications for social-psychological research broadly and particularly for communication and policy on this topic. Politicians, policy makers, and partisans seek to understand why members of the public feel as they do about shale gas development. They want to know how to regulate shale gas development in a way that responds to public concerns – this has often focused on ways to address specific impacts – take, for example, the heavy focus on "impact assessments" in regulation on shale gas development and other energy development technologies. However, if beliefs about impacts are not the key driver of attitudes about development, then responding directly to impacts might not be the most effective way to address public concerns – we consider alternatives in the discussion below. Perhaps more cynically, many politicians and partisans also want to know whether certain messaging strategies and/or approaches to engagement in the policy process will or will not be effective in changing attitudes towards development.

In this article, we provide evidence from two random-sample surveys. Our exploratory factor analyses and structural equation modelling suggest that the commonly asserted pathway needs—at minimum—re-engagement (in this debate in particular, and within social psychology about emergent attitudes and beliefs more generally). After shedding light on the relationship between beliefs about and attitudes towards shale gas development, we explore other factors that might foster support and opposition. We discuss implications of these findings for social psychological research and for policy and communication about shale gas development. We begin, however, by briefly reviewing social-psychological theories that posit a causal pathway between attitudes and beliefs – some with beliefs predicting attitudes and others with attitudes predicting beliefs.

2. Theoretical background

2.1. Defining attitudes and beliefs

Whilst quotidian colloquial conversation does not always distinguish between attitudes and beliefs, these concepts are importantly distinct in social-psychology; equally important is whether beliefs lead to attitudes or vice versa. Beliefs are the 'cognitive component of attitudes' (Heberlein, 2012, p. 15); they are statements, presumed to be true, although the actual truth of the statement does not matter. What matters is presumption of truth to the holder of the belief. Heberlein (2012, p. 16) explains, 'what makes it a belief is the absence of emotion'. Attitudes, on the other hand, 'differ from knowledge because they are driven by the love-hate, good-bad aspect of emotion'. This emotive basis for attitudes is often called 'affect' in social-psychology (Slovic et al., 2004). Attitudes, then, are valenced (positive, negative) views towards a specific object.

2.2. Causal relationships between beliefs and attitudes

Within Fishbein and Ajzen's (2011) reasoned action approach and its antecedents (i.e., the theory of planned behaviour and the theory of reasoned action), beliefs about specific objects and issues are posited as leading to attitudes about those objects/issues (hence the label *reasoned* action). This causal relationship has been exceptionally influential in social psychological research for over four decades (e.g., according to Google Scholar, the initial monograph on this topic by Fishbein and Ajzen, 1975 has been cited over 44,000 times). Fishbein and Ajzen (2011, 96–97)contend explicitly:

> Within our reasoned action framework, attitudes follow directly from beliefs about the attitude object. Generally speaking, we form