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The ''Nasty Effect:'' Online Incivility and Risk Perceptions of Emerging Technologies*

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Uncivil discourse is a growing concern in American rhetoric, and this trend has expanded beyond traditional media to online sources, such as audience comments. Using an experiment given to a sample representative of the U.S. population, we examine the effects online incivility on perceptions

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toward a particular issue—namely, an emerging technology, nanotechnology. We found that exposure to uncivil blog comments can polarize risk perceptions of nanotechnology along the lines of religiosity and issue support.

Key words: blogs, online comments, incivility, nanotechnology, risk perceptions

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Introduction

Because of its ability to disseminate information and reach large audiences, the Internet and communication technologies that utilize it may provide an excellent forum for interpersonal discussion surrounding issues that may not be widely covered in traditional media. The Internet has the potential to foster discussion and deliberation among far-reaching audiences in spaces such as the comments section of news items and blog posts. However, such discussions are not always rational. Discussions on the Internet can take an uncivil route, with offensive comments or replies impeding the democratic ideal of healthy, heated discussion (Papacharissi, 2004; Shils, 1992).

The question remains as to whether online incivility affects the opinions of "lurkers," or people who read online discussions without participating in them. Smith and his colleagues (2009) argue that lurkers are in fact participating in deliberation when reading others' comments because a large part of rational discussion consists of reflecting on others' opinions, which may or may not coincide with lurkers' own opinions. In other words, audiences reading uncivil language in blog comments may find the messages hostile and make judgments about the issue based on their own preexisting values rather than on the information at hand. This may develop polarized perceptions on issues among different audience segments that hold different values.

The purpose of this study is to examine how uncivil online interpersonal discussion may contribute to polarization of perceptions about an issue. We examine these dynamics in the context of nanotechnology, which is an interesting case because it is a largely unfamiliar topic that offers a rare chance to examine attitude formation and development. The majority of the public does not have a clear understanding of nanotechnology, and tend to use mental shortcuts—or heuristics, such as value predispositions or knowledge about science—when forming attitudes about it (Brossard, Scheufele, Kim, & Lewenstein, 2009; Lee & Scheufele, 2006; Scheufele & Lewenstein, 2005). Nonetheless, more than 1,300 consumer products containing nanotechnology are currently on the market (Project on Emerging Nanotechnologies, 2011). Thus, nanotechnology is representative of advanced technologies that individuals increasingly have to manage and form judgments about in their daily lives. Yet, given that it is an issue of low familiarity, it is likely people invoke cognitive shortcuts when they encounter it in the context of incivility. Thus, the mental shortcut may mitigate the effects of incivility. For instance, high familiarity with an issue may attenuate any effects exposure to incivility might have on forming negative perceptions about an issue. Furthermore, a value-based predisposition, such as religiosity, can provide a vehicle for forming an opinion about a low-familiarity topic (Brossard et al., 2009). Thus, people who draw upon such a predisposition may rely on it more rather than the new information they encounter, and this may temper the effects of incivility.

In this study, we utilize an online experiment given to a sample representative of the U.S. population to examine whether people are influenced by online incivility in blog comments when forming risk perceptions of a presumably unfamiliar topic—nanotechnology. We also examine whether online incivility has polarizing effects on risk perceptions when individuals rely on various predispositions when forming these perceptions, including issue familiarity, issue support, and religiosity.

The Formation of Risk Perceptions

Most current definitions of risk share the underlying notion that natural or human activities have the potential to bring about an adverse state of reality (NRC, 1983). Although the concept of "risk" has been explicated differently by a number of academic disciplines, the sociological, cultural, and psychological perspectives of risk are all important in the context of this study because they have all integrated communication into their approaches. Taken together, these perspectives suggest that social, political, and environmental factors, in addition to individual factors such as cognition levels, can contribute to variation in risk perceptions (Kasperson et al., 1988). Thus, while communication messages from media certainly play a role in how people perceive risk, various predispositions also play a role (e.g., Kahan, Braman, Slovic, Gastil, & Cohen, 2009; Renn, Burns, Kasperson, Kasperson, & Slovic, 1992). In this study, we examine how audience predispositions interact with exposure to a particular type of communication, uncivil audience comments in a newspaper blog post, in the formation of risk perceptions about an emerging technology.

The Effects of Incivility

The definition of incivility has been debated by various scholars (see, Papacharissi, 2004), but for the purposes of this study it will be defined as a manner of offensive discussion that impedes the democratic ideal of deliberation (Papacharissi, 2004; Shils, 1992). In this sense, incivility online can range from unrelated, rude critiques and name-calling (Jamieson, 1997) to outrageous claims and incensed discussion, which is also known as flaming (Papacharissi, 2004). However, concerns over incivility extend beyond online communication.

Over the past 50 years, incivility has been on the rise in the American political arena as well as in its coverage in mass media (Mutz & Reeves, 2005). Not only has Congressional debate become increasingly uncivil (Uslaner, 1993), such incivility is made strikingly apparent to the American public via television and the Internet. When considering current popularity of political pundits and cable news-entertainment programming, it not surprising that past studies have found that debate coverage on television highlighting political conflict is on the rise (Funk, 2001; McGraw, Willey, & Anderson, 1999; Robinson & Appel, 1979). Even print media have followed television's example of showcasing political incivility in order to remain competitive (Sigelman & Bullock, 1991). Incivility and conflict in media is not limited to the U.S. Congress, however. Many science issues have been politicized and framed as controversies by mainstream media (Nisbet & Mooney, 2007; Nisbet & Scheufele, 2007). Incivility and a focus on political conflict may be promoting political polarization in the United States, since it has become a mainstay in mass media coverage (Prior, 2007; Wilson, 2006).

This oversaturation of incivility in media has several profound effects on the public. Television coverage of uncivil Congressional debate is significantly related to dissatisfaction with the Senate (Elving, 1994); journalist commentaries and narratives that emphasize political incivility are also associated with negative attitudes towards politicians (Cappella & Jamieson, 1997; Patterson, 1993). Mutz and Reeves (2005) found that although political incivility on television promotes interest, it lowers political trust. It has been suggested that these negative attitudes associated with incivility exist because media portrayals of uncivil conversation violate social norms that expect a certain level of polite behavior, and television exacerbates these negative feelings because depictions of real people and close-up shots mimic the intimacy of face-to-face interactions (Mutz, 2007). These studies highlight effects of incivility by political actors, but lay individuals can also instigate incivility in discussions on news websites and blogs.

Social reprimands such as nonverbal communication and isolation can curb incivility in face-to-face discussion, but the Internet may foster uncivil discussion because of its lack of offline, in-person consequences (Dutton, 1996; Hill & Hughes, 1998; Papacharissi, 2002). While incivility on the Internet

may produce robust and diverse viewpoints, the heated, volatile expression can also fall short of the democratic ideal of rational and reasoned deliberation.

Although online incivility has the potential to increase cognitive recall of oppositional opinions, empirical evidence has shown that individuals respond negatively to online incivility directed at them or their views (Phillips & Smith, 2004). Other research suggests that incivility is linked to negative affective responses, such as hatred or humiliation, in those who utilize online deliberation (King, 2001). Furthermore, research demonstrates individuals' judgments of a blogger's comments are influenced by the author's tone (Hwang, Borah, Namkoong, & Veenstra, 2008; Price, Nir, & Cappella, 2006), and uncivil expression decreases perceptions of source and message credibility (Ng & Detenber, 2005). Finally—and most provocatively—when incivility targets an individual's ideological beliefs, it may influence the formation of negative attitudes about the issue at hand (Hwang, et al., 2008).

These findings all suggest that incivility on the Internet can have negative influences on individuals. If reading online incivility can incite negative feelings of hatred, negative attitudes towards a topic, and a reduction of source credibility, it is likely that it may also incite negative risk perceptions on a topic of emerging technology. Therefore, we pose the following hypothesis:

> H1: Exposure to incivility in online comments of a newspaper blog post on the issue of nanotechnology will be positively related to risk perceptions of nanotechnology.

However, people draw upon various predispositions when they process media messages, and it is likely these are an important part of how uncivil audience comments influence risk perceptions.

The Effects of Predispositions

People rely on shortcuts in information processing to make social judgments about complex policy issues (Popkin, 1991). In the context of an unfamiliar emerging technology, such as the issue of interest in this study, people will rely on cognitive shortcuts, otherwise known as heuristics, in order to form judgments (Scheufele & Lewenstein, 2005). Mental shortcuts may be employed when encountering uncivil online discussion because hostile language may cause individuals to be less receptive to new information. In this study, we examine whether issue familiarity, issue support, and religiosity, three common heuristics that influence perceptions about nanotechnology, make a difference in how individuals form judgments in the context of uncivil audience comments. In other words, will incivility further accentuate differences among individuals that rely on different mental shortcuts when making judgments about debate in an online setting?

Issue familiarity

For the issue of nanotechnology, a positive association exists between self-assessed knowledge and lower perceptions of risk, but exposing low-informed individuals to information about the technology does not automatically elicit support (Kahan, et al., 2007; Peter D. Hart Associates, 2007). Past scholarship has used measurements of self-perceived familiarity with nanotechnology interchangeably with factual knowledge about nanotechnology (see, Kahan et al., 2009; Satterfield, Kandlikar, Beaudrie, Conti, & Harthorn, 2009), but recent research suggests these two operationalizations of knowledge do not measure the same construct (Ladwig, Dalrymple, Scheufele, Brossard, & Corley, 2012). Issue familiarity was used in this study because it acts a heuristic that may mirror levels of confidence with the issue. High factual knowledge, on the other hand, does not necessarily reflect confidence with the issue. Furthermore, individuals who report knowing a lot about nanotechnology may already hold positive

views because of other heuristic factors such as an interest in technology and deference to scientists. Therefore, we assume that a perceived familiarity with nanotechnology will mitigate any negative effects of exposure to incivility. We pose the following hypothesis:

> H2: Compared to those with high levels of perceived familiarity of nanotechnology who are exposed to civil comments, those with high levels of perceived familiarity who are exposed to uncivil comments will have lower risk perceptions.

Issue support

Several studies have shown a negative relationship between support for nanotechnology and risk perceptions (Cacciatore, Scheufele, & Corley, 2011; Scheufele & Lewenstein, 2005). In the context of exposure to hostile communication in uncivil comments, preexisting support for the issue likely attenuates any negative effects of incivility. Therefore, we pose the following hypothesis:

> H3: Compared to those who are highly supportive of nanotechnology and exposed to civil comments, those who are highly supportive of nanotechnology and exposed to uncivil comments will have lower risk perceptions.

Religiosity

Past research indicates that religiosity influences beliefs about technologies (Brossard & Nisbet, 2007; Brossard, et al., 2009; Cacciatore et al., 2011; Nisbet & Nisbet, 2005). Highly religious individuals may have higher risk perceptions of nanotechnology if they perceive the science is "playing God" or is disturbing natural order (Sjöberg, 2004; Sjöberg & Winroth, 1986). Thus, uncivil language may encourage those who are highly religious to focus more on that relationship between religiosity and risk perceptions. We therefore pose the following hypothesis:

> H4: Compared to highly religious people exposed to civil comments, highly religious people exposed to uncivil comments will have higher risk perceptions.

Methods

Study Context

Nanotechnology is an interdisciplinary field of science conducted at the nanoscale. To provide perspective of its scale, a nanometer is one billionth of a meter, and a single sheet of paper is about 100,000 nanometers thick (National Nanotechnology Initiative, 2011). Because of size-to-volume ratios, materials behave differently at the nanoscale, and nanotechnology exploits these properties in order to create new products. For example, nanotechnology can be applied to improve drug delivery systems or to create waterproof and antibacterial garments (National Nanotechnology Initiative, 2011). Materials behave in different ways at the nanoscale, which allows for new applications, but also introduces potential risks and benefits, many of which are yet unknown.

Participants

This study employed a nationally representative sample of the American population ($N = 2{,}338$) for an online survey with an embedded experiment conducted by Knowledge Networks with a completion rate of 54.2 percent.

Experimental Design

Participants were asked to complete a pretest survey that asked about media use habits, science knowledge and efficacy, and nanotechnology support, among other items. The experiment was a between-subjects design and consisted of a neutral blog post from a Canadian newspaper that detailed equivalent risk and benefit information about nanotechnology. Specifically, the nanotechnology blog post discussed nanosilver particles and compared risks (e.g. water contamination) with benefits (e.g. antibacterial properties). Participants were given one of eight manipulations that varied by "user" comments under the post. We chose to utilize blog comments as a space for deliberation because this is a standard and stable platform utilized on most blog and news websites. Thus, the concept of commenting in online sites is a familiar one to most people who are Internet users, while other discussion platforms, such as discussion forums or social media sites, are not as widely used or have only gained traction in recent years.

The manipulations of interest in this study were that of civil vs. uncivil comments. For example, an uncivil comment began with "If you don't see the benefits of using nanotechnology in these products, you're an idiot." Alternatively, civil comments made the same argument as their uncivil counterparts, but used polite language and acknowledgement of other users by names and not expletives. After reading the stimulus, respondents were asked to complete a posttest survey that asked about the blog and comments, risk and benefit perceptions, and demographic information, among other items. This study focuses on respondents who received the nanotechnology issue, which gave a final sample size of $n = 1{,}183$[1].

Condition variables

Civility was a dichotomous variable based on the manipulation that each participant received, where 0 = uncivil condition and 1 = civil condition. *Read comments* ascertained the level of attention paid to the blog post's comments by asking participants their rate of agreement on a 10-point scale with the statement, "I read all of the comments," where 1 = "Do not agree at all" and 10 = "Agree very much" ($M = 7.73$; $SD = 3.08$).

Measurement

Dependent variable

To assess polarization of an attitude due to online incivility, we employed *risk perception* as the dependent variable in this study. The item asked respondents, "On the issue of nanotechnology, do you think the benefits outweigh the risks, the risks outweigh the benefits, or the risks and benefits are about the same?" This was measured on a 5-point scale where 1 = "Benefits far outweigh the risks" and 5 = "Risks far outweigh the benefits" ($M = 3.22$; $SD = 1.12$).

Independent variables

All independent variables, with the exception of demographic and condition variables, were measured prior to the experimental manipulation.

Demographic variables

Age was measured on a 7-point scale, where 1 = "18-24" and 7 = "75+" (*Median* = 4; $SD = 1.67$). *Gender* was a dichotomous variable with 0 = male and 1 = female (49.9 percent female). Socioeconomic status (*SES*) was created by compiling an index of two variables: level of education and family income (scale ranged from 3 to 16.5; $M = 10.79$; $SD = 2.72$).

Value predispositions

Religiosity was measured by asking respondents, "How much guidance does religion provide in your everyday life?" with 1 = "No guidance at all" and 10 = "A great deal of guidance" ($M = 5.97$; $SD = 3.23$). *Ideology* was measured by asking respondents to rate how socially liberal or conservative they are on a 6-point scale, with 1 = "Very liberal" and 6 = "Very conservative" ($M = 3.61$; $SD = 1.36$).

Media use

Newspaper use was assessed by asking respondents, "How much attention do you pay to news stories about the following topics when you read the newspaper, either in print or online?" Responses were measured on a 5-point scale, where 1 = "None" and 5 = "A lot." An index was created of three items: (1) "Stories related to science or technology," (2) "Stories about scientific studies in new areas of research, such as nanotechnology," and (3) "Stories about social or ethical implications of emerging technologies" ($M = 2.60$; $SD = .99$; *Cronbach's alpha* = .91). *Television use* was assessed by asking respondents the question, "How much attention do you pay to news stories about the following topics when you watch television news, either on a traditional television or in online sources (such as Hulu or websites of television networks, such as ABC, CBS, NBC, or Fox)?" Again, an index was created from three items worded identically to the items that made up the newspaper variable ($M = 2.68$; $SD = .99$; *Cronbach's alpha* = .92). *Internet use* was assessed by asking respondents the question, "How much attention do you pay to news about the following topics when you go online for news and information? Please exclude online versions of print newspapers or television shows and answer this question based on your usage of blogs, websites, and online-only newspapers." An index was created using the same topics that were examined in the newspaper and television items ($M = 2.17$; $SD = 1.06$; *Cronbach's alpha* = .95).

Nanotechnology familiarity, efficacy, and attitude

Familiarity was assessed by asking participants the question, "How much have you heard, read, or seen about nanotechnology?" This was measured on a 10-point scale with 1 = "Nothing at all" and 10 = "Very much" ($M = 2.81$; $SD = 2.19$). Familiarity is often used instead of factual knowledge questions because it allows respondents to judge their levels of knowledge according to their own terms rather than through what experts believe are the facts people must know in order to be scientifically literate (see Brossard & Shanahan, 2006). *Support* was assessed by indexing two 10-point items (1) "Overall, I support the use of nanotechnology," and (2) "Overall, I support federal funding of nanotechnology," where 1 = "Do not agree at all" and 10 = "Agree very much" ($M = 5.26$; $SD = 2.39$; *Pearson's R* = .78). *Efficacy* was created by indexing two 10-point items: (1) "Nanotechnology seems so complicated that a person like me can't really understand it," and (2) "I would need more information about nanotechnology before I could make any decisions about it." These items were recoded so that 1 = low efficacy and 10 = high efficacy ($M = 5.87$; $SD = 2.42$; *Pearson's R* = .68).

Finally, three interaction terms were created by separately multiplying the standardized value of *civility* by the standardized values of *support, familiarity*, and *religiosity*.

Analysis

This study employed an ordinary least squares hierarchical linear regression model with *risk perception* as the dependent variable. The independent variables were entered into the model in six different blocks based on their assumed causality. Block 1 contained variables related to the experimental manipulation, exposure to civility or incivility and read blog comments. Read blog comments was used as a control variable. Blocks 2 and 3 contained demographics and value predispositions, respectively, and both

represent stable characteristics. Blocks 4 and 5 contained specific characteristics related to individuals' experiences with science, with general science-related variables coming first and nanotechnology-specific variables coming second. Block 4 contained science media use, and Block 5 contained specific nanotechnology familiarity, support, and efficacy. Finally, Block 6 tested interactions between civility and predispositions.

Results

Overall, the regression model explained 17.0 percent of the variation of *risk perception* (see Table 1).

The condition and demographic blocks contributed to 2.0 and 4.5 percent of the explained variance, respectively. Our findings did not demonstrate a significant direct relationship between exposure to incivility and risk perceptions. Thus, our first hypothesis was not supported. *Age* was positively related to nanotechnology risk perception, and this demographic remained significant after adding the nanotechnology *familiarity*, *support*, and *efficacy* variables to the model ($\beta = .07$; $p < .05$). Women showed stronger perceptions of risk related to nanotechnology, although this relationship became nonsignificant after adding the *familiarity*, *support*, and *efficacy* variables. Neither *religiosity* nor *ideology* had a direct significant relationship with nanotechnology risk perception, and this block only contributed 0.2 percent to the regression's explained variation.

Newspaper use was positively related to risk perception ($\beta = .12$; $p < .01$), but *television use* showed no relationship. *Internet use* was significantly and negatively related to risk perception of nanotechnology ($\beta = -.15$; $p < .001$). The media use block had an incremental R^2 of 3.5 percent.

Nanotechnology *familiarity* ($\beta = -.12$; $p < .01$) and nanotechnology *support* ($\beta = -.23$; $p < .001$) were both significantly and negatively related to risk perception of nanotechnology. Nanotechnology *efficacy* was positively related to risk perception ($\beta = .10$; $p < .01$), and this block contributed 7.1 percent to the explained variation of this model.

The interaction block (incremental $R^2 = 1.0$ percent) showed that online incivility does indeed have a polarizing effect on attitudes when considering certain predispositions of support and religiosity. However, the interaction between familiarity with nanotechnology and incivility was not significant. Thus, our second hypothesis was not supported. We did find a significant interaction between support for nanotechnology and incivility on risk perceptions ($\beta = .09$; $p < .01$). When exposed to uncivil comments, those who have higher levels of support for nanotechnology were more likely to report lower levels of risk perception and those with low levels of support were more likely to report higher levels of risk perception (see Figure 1). This supports our third hypothesis. Our findings also reveal a significant interaction between religiosity and incivility on risk perception ($\beta = -.07$; $p < .05$). Among those exposed to uncivil comments, those with high levels of religiosity were more likely to report higher levels of risk perception and those with low levels of religiosity were more likely to report lower levels of risk perception (see Figure 2). This finding supports our fourth hypothesis.

Discussion

The purpose of this study was to explore online incivility's role in polarizing attitudes when reading deliberation in a blog setting. We employed a topic with low familiarity among the general public, nanotechnology, and assessed formation of the perception of its risk in order to shed light on online incivility's impact. The data reveal several important predictors of risk perception of nanotechnology as well as two significant interactions between civil or uncivil blog comments and value predispositions that individuals employ when processing information and making judgments about new technologies. Most

Table 1 Predictors of Nanotechnology Risk Perception (benefits < risk)

	Model 1 β	Model 2 β	Model 3 β	Model 4 β	Model 5 β	Model 6 β
Condition (N = 1,183)						
Online Civility (Civility = 1)	−.03	−.03	−.03	−.04	−.04	−.04
Read Blog Comments	.10***	.09**	.09**	.10**	.13***	.14***
Incremental R^2 (%)	2.0					
Demographics						
Age		.16***	.15***	.13***	.07*	.07*
Sex (Female = 1)		.10***	.10***	.08**	.04	.03
SES		−.05	−.05	−.02	.00	.01
Incremental R^2 (%)		4.5				
Value Predispositions						
Religiosity			.00	.01	.00	.01
Ideology (Lib < Cons)			.05	.05	.01	.02
Incremental R^2 (%)			0.2			
Media Use						
Newspaper				.10*	.13***	.12**
Television				−.04	.05	.06
Internet				−.21***	−.16***	−.15***
Incremental R^2 (%)				3.5		
Nanotechnology						
Nano Familiarity					−.13**	−.12**
Nano Support					−.22***	−.23***
Nano Efficacy					.09**	.10***
Incremental R^2 (%)					7.1	
Interactions						
Support*Civility						.09**
Familiarity*Civility						.03
Religiosity*Civility						−.07*
Incremental R^2 (%)						1.0
Total R^2 (%)						17.0

Cell entries are final standardized regression coefficients for Blocks 1 through 5 and before-entry standardized regression coefficients for Block 6. *p < .05, **p < .01, ***p < .001.

importantly, this study found that uncivil blog comments contribute to polarization of risk perception of an issue depending on an individual's level of religiosity and support of that entity. Specifically, among individuals who do not support nanotechnology, those who are exposed to uncivil deliberation in blog comments are more likely to perceive the technology as risky than those who are exposed to civil comments. Similarly, highly religious individuals are more likely to perceive nanotechnology as risky when exposed to uncivil comments compared to less religious individuals exposed to uncivil comments.

These findings support past research that suggests people use certain heuristics as interpretational lenses of media. Because one's expectations about a message's validity are already established when employing value predispositions as heuristics (Eagly & Chaiken, 1993), these shortcuts influence the

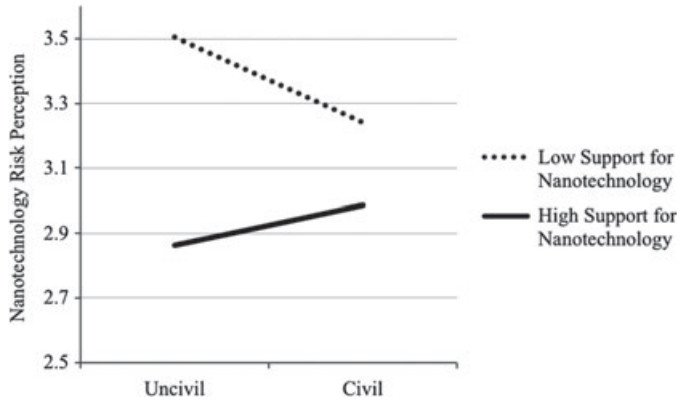

Figure 1 Interaction Effect of Online Civility Condition and Support for Nanotechnology on Risk Perception of Nanotechnology
Note: Nanotechnology Risk Perception is measured from 1–5 (benefit < risk).

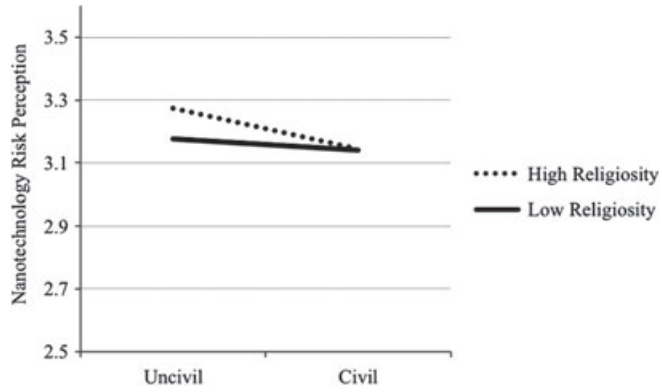

Figure 2 Interaction Effect of Online Civility Condition and Religiosity on Risk Perception of Nanotechnology
Note: Nanotechnology Risk Perception is measured from 1–5 (benefit < risk).

evaluation of arguments surrounding unfamiliar issues such as nanotechnology. Individuals may be focusing on congruent messages about the topic at hand and discrediting incongruent messages, thereby strengthening their preexisting beliefs about the technology. And it appears that online incivility may drive this polarization.

It is possible that when people encounter incensed comments in online discussions, they would employ their knowledge of the issue to process the information from the blog. According to this perspective, people with low knowledge would not have a cognitive store from which to draw in order to counteract the effects of incivility and therefore be more affected by it. Nevertheless, our study did not demonstrate enough evidence that people with low levels of knowledge respond differently than people with high levels of knowledge to uncivil comments.

The most striking—and perhaps most unsettling—aspect of our study is that the actual blog post about the topic of nanotechnology was neutral, with equal amounts of risk and benefit information

across conditions. The incivility instigated by lay (albeit fictional) online users induced an increase in polarization of risk perception about nanotechnology. This study's findings suggest perceptions towards science are shaped in the online blog setting not only by "top-down information," but by others' civil or uncivil viewpoints, as well. While the Internet opens new doors for public deliberation of emerging technologies, it also gives new voice to nonexpert, and sometimes rude, individuals.

It is important to note limitations of this study before discussing the findings further. Concerning measurements, this study employed self-assessment items instead of factual nanotechnology knowledge. This is not too concerning, considering that this study assumed that previous nanotechnology familiarity might act as a heuristic when judging new information (e.g., the toxicity of silver nanoparticles). Future research may focus on breaking down the nanotechnology familiarity variable, perhaps by looking at an individual's deference to scientists, general interest in nanotechnology, or trust in science media. Another limitation of this study relates to the total amount of explained variance by our model, which was 17.0% of the total variance of our dependent variable. While this may be quite low for a model with six blocks of predictors, we were mainly interested in the effects of the stimulus. However, the stimulus we used was fairly weak with the main manipulation appearing at the end, and the exposure only occurred once. Our results are robust considering these limitations.

While we did not formally test the effects of all manipulations in our experimental design, it is possible that the other elements tested in the experiment played a role in our results. The other two elements included agreement vs. disagreement and emotion vs. reason. For instance, an emotional claim (e.g., on having hope about the benefits of a new technology) could be interpreted differently by people with high vs. low levels of familiarity. It is possible that someone with low familiarity would be more influenced by an emotional claim, although it is likely the effects of incivility would override that. Similarly, it is possible that a claim of disagreement made in conjunction with an uncivil statement has a greater chance of influencing risk perceptions than does a statement of incivility couched among commenters who agree with each other. We also controlled for these manipulations in the first block of our model.

Keeping these limitations in mind, this study offers several insights on how the online environment may shape and polarize perceptions about topics, including new technologies such as nanotechnology. Contrary to past research concerning our case study, our analyses found that the value predispositions of religiosity and ideology had no direct relationship with perceived risks of nanotechnology. Considering the cultural and sociological perspectives of risk communication, risk perceptions of certain issues may change for social groups based on certain events or changing cultural patterns in society (Dietz, Frey, & Rosa, 2002; Krimsky & Golding, 1992). For example, most conservative Americans long denied the existence of global warming, but recently a growing number of conservative evangelical groups have been advocating for climate change regulation based on the belief that Christians are "stewards of the Earth" (Janofsky, 2005; Michaud, 2008). While this study cannot provide evidence of changing attitudes about nanotechnology among different subsets of society, increasing coverage about the issue in the online environment may influence and drive polarization of perceptions about the technology for these groups in the future.

Conclusion

Online communication and discussion of new topics such as emerging technologies has the potential to enrich public deliberation. Nevertheless, this study's findings show that online incivility may impede this democratic goal. Much in the same way that watching uncivil politicians argue on television causes polarization among individuals, impolite and incensed blog comments can polarize online users based on value predispositions utilized as heuristics when processing the blog's information. The effects

of online, user-to-user incivility on perceptions towards emerging technologies may prove especially troublesome for science experts and communicators that rely on public acceptance of their information. The effects of online incivility may be even stronger for more well-known and contentious science issues such as the evolution vs. intelligent design debate or climate change. Future research may explore these issues to gain a better understanding of the formation of risk perceptions for controversial political or science topics in the context of user-generated online comments.

Notes

1 The experiment originally consisted of blog posts about nanotechnology and nuclear energy and the comments varied by civil vs. uncivil language, agreement vs. disagreement of opinions, and reasoned vs. emotional appeals ($N = 2{,}338$). This study focuses solely on participants who received the nanotechnology blog post ($n = 1{,}183$) and looks only at the effects of incivility (the other manipulations are controlled for in our analysis). This subset of the sample is representative of the population from which the entire sample draws because individuals were randomized across experimental conditions.

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