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Public estimates of support for offshore wind energy: False consensus, pluralistic ignorance, and partisan effects

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ABSTRACT

Meeting future energy demands will require large-scale implementation of renewable energy projects. If one of these energy sources—offshore wind—becomes a common sight off coastlines, consideration of local public opinion and action will be critical. Previous research from the social sciences has lacked depth in examining the underlying factors that shape public opinion towards offshore wind development. The current research brings a new perspective to the literature by showing that how members of the public perceive support among others relates to their own opinions of offshore wind energy. We report results from two surveys. The first focused on opinion formation relating to offshore wind in general among New England residents, while the second focused on a specific offshore wind project in Rhode Island. We find evidence that both supporters and opponents of offshore wind underestimate levels of support among others, indicating a pluralistic ignorance effect and false consensus effect, respectively. We also find distinct patterns of perceived support among self-identified Republicans and Democrats. The findings hold important implications for policymakers and developers in understanding the nature of public support and opposition for offshore wind energy, particularly with respect to individuals' willingness to publicly engage with offshore wind projects.

1. Introduction

Many argue that offshore wind has been guaranteed a place in the future energy portfolio of both developed and developing nations, including the United States. While countries around the world have started to follow Europe's vigorous adoption of offshore wind, the United States has been slow to play catch up. The first offshore wind demonstration project, the Block Island Wind Farm, was only completed in late 2016. This 30-megawatt, 5-turbine project is located off the coast of Block Island, an island 21 km off the coast of Rhode Island. This first project, in combination with many federal and statewide renewable energy goals, may be the catalyst many have waited for to jumpstart offshore wind development in the US. Indeed, academic researchers, developers, and politicians have suggested that commercial offshore wind farms may soon be a common sight in U.S. waters, particularly in the Northeast (DOE and DOI, 2016). Before this can happen, however, both technical and social barriers to offshore wind development must be overcome, and it is clear that the latter challenges are not insignificant. Understanding how various actors—including developers, policymakers, various stakeholder groups, and the affected public—view these projects will determine the rate of development as well as the long-term success of this technology, regardless of the technical advances that are already being made (e.g., Wüstenhagen et al., 2007).

For several years, researchers and polling organizations alike have tracked public opinion regarding various types of renewable energy projects (Gallup, n.d.). Much of these data are argued to be superficial in nature (Klick and Smith, 2010). More recently, social scientists have set their sights on understanding the human dimensions of offshore wind (Firestone and Kempton, 2007; Wiersma and Devine-Wright, 2014). What has emerged is a literature rich with data that describes the public's opinion of offshore wind. The 'social gap' and 'individual gap' that emerge when high levels of broad support for offshore wind turns into low success of project implementation and local opposition has been one of the main foci of research (Bell et al., 2005, 2013). The other is attempting to more thoroughly explain this opposition and determine the true meaning of the term 'NIMBY' ('Not in my Backyard') in this context (Devine-Wright, 2005). However, little research has focused on the underlying psychological and social factors that shape these opinions, with the majority of extant work providing only descriptive insights rather than deeper empirical analyses of the drivers of public opinion on this issue.

The present research advances our understanding of public opinion

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regarding offshore wind by examining how *perceptions of other individuals'* support or opposition for such projects relates to one's own attitudes (and actions) towards offshore wind projects. Specifically, we show there exists a relationship between one's own opinion of offshore wind and one's perceptions of support among others, and that these perceptions are often incorrect.

2. Background and literature review

2.1. Public opinion of offshore wind

In recent years, a combination of technological advancements and increased incentives has lowered the price of offshore wind energy, making it a viable energy alternative for many countries (Firestone et al., 2015). Due to the economic and environmental benefits of this technology, development of wind arrays has increased, particularly in European waters. Offshore wind turbines in part aim to minimize the human impacts that have been seen with onshore wind (e.g., shadow flicker), however social concerns still play a large role in the siting and development of this technology (Haggett, 2011, 2008; Horbaty et al., 2012). These concerns stem from similar factors to those of onshore wind turbines (e.g., relationships with developers; Haggett, 2011), as well as unique factors (e.g., marine spatial planning; Wiersma and Devine-Wright, 2014). Surveys aiming to capture public attitudes have estimated that roughly 80–90% of people support the general idea of offshore wind (Bell et al., 2013; Funk and Kennedy, 2016). However, public perceptions of wind energy, in general, fall victim to the 'individual gap', where an individual's general support turns to opposition once a project is proposed locally (Bell et al., 2005). Relatedly (although importantly unique), the 'social gap' is used to explain low success rates of project implementation despite widespread public support. Although opposition is typically greater in local contexts, opponents still (usually) make up the minority. This gap can result in fierce local opposition in the form of organized protest, particularly in the face of the 'silent majority' of supporters (Swofford and Slattery, 2010). The actual influence of public opposition on project success has been debated. Whereas some argue the public can only delay a project (Aitken et al., 2008), others argue that projects can be directly thwarted through organized oppositional groups (Devine-Wright, 2010; Toke, 2005).

The term 'NIMBY' ('Not in my Backyard') is commonly used as a blanket term by developers, the media, and other members of the public to describe individuals who oppose proposed projects (e.g., offshore wind development), without regard to the reason for opposition (Ellis et al., 2007). Opponents are mistakenly seen as deviant (Aitken, 2010) and knowledge-deficient (Burningham et al., 2015). In actuality, opponents are usually well informed on details of the proposed project (Bush and Hoagland, 2016). The vast majority of social scientists publishing on the topic have disagreed with the use of the term NIMBY, and have questioned the existence of NIMBYs within the public sphere (e.g., Wolsink, 2000). Several alternative frameworks for considering public opinions have been proposed that include considering the public as rational actors with legitimate, multi-dimensional opinions and concerns (Devine-Wright, 2005; Petrova, 2016).

The term NIMBY was initially the only explanation used to explain the 'individual gap', however research has revealed that opposition among individuals is more nuanced (Bell et al., 2013). Descriptively, the most commonly cited reasons for opposition to offshore wind projects include aesthetic impacts, harm to wildlife, and impacts to recreation and the fishing industry (Firestone and Kempton, 2007). In assessing what underlies these concerns, the majority of research addressing alternates to the NIMBY framework has focused more on explaining the 'social gap' than the 'individual gap' (Bell et al., 2013). Much of the research to date has assigned project success or failure as the outcome variable, rather than focusing on the attitudes or actions of individuals involved in the development process. Of the human-focused and more psychological studies conducted to date, personal values, distance from the project, place attachment, and fairness of process and trust have been found to influence individual opinion. We briefly outline these below.

2.1.1. Personal values

Altruistic values have been associated with higher expectations for a wind project to provide positive economic benefits for a community, while more traditional values are correlated with pessimism regarding these impacts (Bidwell, 2017, 2013). The role of environmental values is conflicting both between and within individuals, as potential wildlife harm may influence opposition while supporters may value improved environmental quality (e.g., Warren and Birnie, 2009).

2.1.2. Distance from the project

For onshore wind turbines, there are mixed findings on an individual's physical proximity to a turbine and opinions of wind energy (Swofford and Slattery, 2010; Graham et al., 2009). van der Horst (2007) argues that proximity to proposed turbines may influence negative opinions, but there is little association between opinions and proximity to actual turbines. By moving turbines offshore, many individuals will face significant decreases in proximity to turbines, however aesthetics are still a concern. Bishop and Miller (2007) find that opinions of a hypothetical wind project are most supported when they are very far from shore, or 'out of sight, out of mind'.

2.1.3. Place attachment

Many individuals feel positively toward large bodies of water, particularly those who are only occasional visitors, finding them 'sacred', beautiful, and restorative (Devine-Wright, 2009; Gee, 2010). For those with strong place-related identity and positive attachment to an area, changes to the landscape can result in resistance and disapproval (e.g., Ladenburg, 2010). Attachment to place can be particularly influential in opinion formation of offshore wind turbines when the 'fit' of the landscape matches or is discrepant with the project. For instance, in more industrial settings, wind turbines are met with less resistance than when they are placed in more natural, serene areas (Devine-Wright and Howes, 2010).

2.1.4. Fairness of process and trust

Planned projects lacking in public engagement are often met with backlash, as citizens can perceive project decision-makers to be untrustworthy (Firestone et al., 2012). Wüstenhagen et al. (2007) argue that perceived justice of the process and outcomes are greatly influenced by community and individual trust of outside developers. Huijts et al. (2012) give a more nuanced explanation, and note that trust impacts affect, which then determines perceived fairness of process and project acceptance. In general, projects that relay benefits and minimize impacts to affected communities and those that engage with local decision-makers throughout planning and development are met with the most acceptance (Gross, 2007).

Although extant work on this topic provides important insight into public opinion towards offshore wind technology, largely missing is a theoretically-informed examination of more interpersonal and social factors that are known to shape opinion formation on other controversial topics. In particular, there is a need to better understand how normative beliefs regarding offshore wind potentially influence individuals' opinions and actions. Moreover, given the role that vocal public opposition has played historically in this domain, understanding how such factors relate to individuals' support or opposition is critically important.

2.2. Incorrectly estimating others' opinions

Humans are inherently social creatures. Marketing and social science research has demonstrated that communication of descriptive and

injunctive norms can be a powerful tool for changing both attitudes and behaviors (Cialdini et al., 1990). Injunctive norms communicate what others approve of or what opinions the majority of others hold, while descriptive norms reveal what others actually do. The habits and opinions of large groups are sometimes communicated directly to the public, for example, through media coverage of public opinion polls. In other cases, people learn about others' opinions either through direct observation of those around them (via descriptive norms) or else through more informal channels of interpersonal communication (i.e. 'word-of-mouth'). Because we lack direct access to others' minds (Kelley, 1967), there is sometimes a gap between the true normative opinion in a group or population (i.e. what the majority of people actually *do* believe) and what individuals perceive the norm to be (i.e. what an individual *believes* others think). This gap, when it exists, can result in several behaviorally-significant cognitive phenomena, including pluralistic ignorance and false consensus.

2.2.1. Pluralistic ignorance

Pluralistic ignorance occurs when individuals do not personally hold an opinion or engage in a behavior, but incorrectly assume that the majority of others do (or substantial minority, termed *partial* pluralistic ignorance). Although pluralistic ignorance appears to be an illogical phenomenon, it is a rather common cognitive bias that occurs among rational actors (Bjerring et al., 2014). Moreover, the existence and implications of the pluralistic ignorance effect have been well documented in health behaviors, race relations (Fields and Schuman, 1976), and in situations of uncertainty (e.g., the well known 'bystander effect'; Darley and Latané, 1968). In a recently conducted study, participants who believed that climate change is human induced overestimated that 20% of the Australian population believes climate change is not happening; the actual percentage of climate change deniers was closer to 6% in the sample (Leviston et al., 2013). Pluralistic ignorance has also been shown to impact behavior. Geiger and Swim (2016) found that individuals who overestimated the number of climate change deniers in the U.S. population were less likely to discuss climate change with others, creating a 'silencing effect'.

2.2.2. False consensus effect

Another possible outcome of incorrectly estimating a social norm is the false consensus effect. This occurs when individuals overestimate the prevalence of others who share their own beliefs or behaviors in a group (Ross et al., 1977). This overestimation is most common with individuals who hold minority opinions, or who engage in less common behaviors (Sanders and Mullen, 1983). Those who hold majority opinions are more likely to correctly estimate the size of their group or err on the side of slight underestimation. Like pluralistic ignorance, false consensus effects have been recorded in many domains, including engagement in everyday behaviors (Gilovich et al., 1983) and opinions on controversial topics (van der Pligt et al., 1982). False consensus effects influence behaviors and behavioral intentions. During a water ban on a college campus, Monin and Norton (2003) found that students who showered during the ban greatly overestimated the number of other students who were showering as well. A longitudinal study found that adolescents were more likely to begin smoking if they thought adults and the majority of their peers smoked (Botvin et al., 1992). Correcting misperceptions by providing individuals with actual normative information has been shown to impact behavior in some cases. For example, correcting underage college students' overestimations of their peers' drinking behaviors was effective in spurring long-term reductions in binge drinking (Schroeder and Prentice, 1998).

2.2.3. Imagined publics

Although pluralistic ignorance and false consensus effects have not been empirically examined in the context of offshore wind energy, there is descriptive evidence of norm misperception and its implications with respect to the development of these projects. Developers of these renewable energy projects tend to interact most with individuals who hold oppositional opinions and make up the 'vocal minority', and less so with supportive 'silent majority' members (Devine-Wright, 2005; Maranta et al., 2003). Although developers understand that most individuals support offshore wind, they expect that oppositional groups can materialize (Walker et al., 2010). This paints a picture of an 'imagined public' for the developer which may not accurately describe the true opinions of the relevant population. This potentially results in developers seeing the opposition as knowledge deficient or as an irrational actor (e.g., NIMBY) that cannot be reasoned with (Heidenreich, 2015). Furthermore, Burningham et al. (2015) argue that these skewed views of the public can hinder interactions between developers and the public and can potentially impact the opinions of members of the public themselves. To date, there has been no research on how members of the public perceive public opinion in regards to offshore wind development.

2.3. Partisan opinions

Empirical evidence from Europe has shown political party affiliation to be a meaningful differentiator of support for different sources of energy, including onshore wind and other renewables (Karlstrøm and Ryghaug, 2014). However, little research has included party affiliation as a predictor of support for offshore wind. In the U.S., the misperception of norms intersects with and is often moderated by deep partisan divides on nearly every social, economic, and environmental issue of significance (Pew Research Center, 2014). Democrats and Republicans fiercely debate many issues, from gun laws to climate change. Partisanship-driven divisions in opinion on these controversial topics are further enhanced by selective exposure to information (e.g., Garrett, 2009; Stroud, 2008). There is evidence that individuals can detect biases in news stories, but will still agree with a news story that aligns with their partisan views (Feldman, 2011). There is also evidence that false consensus effects are perpetuated through selective exposure to media (Tsfati et al., 2013). Because *different* normative information is sometimes communicated through these information channels to different audiences, there is significant potential for consumers of diverse media channels (e.g., Fox News vs. MSNBC) to perceive public opinion on these controversial topics quite differently (Feldman et al., 2011). This is the case even where the accuracy of the information being provided is debated (Searles et al., 2016). Additionally, information gathered by these information sources regarding the views of out-group members may further skew one's view of the opposing political party.

Preferences for environmental policies and energy development stem in part from the deeply partisan issue of climate change. Republicans generally prefer developing fossil fuels, while Democrats support renewable energy development (Kennedy, 2017). Democrats commonly promote renewable energy development as a tool for mitigating climate change, which often deters support from Republicans (McCright and Dunlap, 2011). Focusing on renewable energy and fossil fuels overall, however, does not capture the differential support for particular technologies. The very strong partisan differences in development of coal mining, for instance, are likely well known by Republicans and Democrats, creating clear norms within the parties (Osofsky and Peel, 2016). Offshore wind, however, does not seem to be viewed as a partisan issue, with polls showing high support from both parties (Klick and Smith, 2010; Funk and Kennedy, 2016). Although a 'green energy' source, wind has been supported by numerous Republican politicians, such as Governor Baker of Massachusetts (Chesto, 2016). Additionally, wind energy does not appear to be a largely discussed news topic in mainstream media, and there is an overall lack of knowledge about the technology (Wiersma and Devine-Wright, 2014; Bidwell, 2016). Discussion of energy technologies within political parties creates norms, and influences how party members view these technologies. Due to the lack of media coverage and knowledge, and apparent bipartisan support, the actual and perceived approval of wind

energy within political parties may not be clearly defined.

2.4. Current study

To date, little work has examined individuals' perceptions of attitudinal norms regarding offshore wind energy (and very little work has been done in the broader context of perceived opinions of others regarding renewable energy technologies; although see van der Pligt et al., 1982). Additionally, as the existing literature reveals, our current understanding of the underlying factors that influence individuals' opinions regarding wind energy projects remains weak and gap-filled (Aitken, 2010; though see early work by Devine-Wright, 2009). Given the presence of significant incorrect norm estimation effects in related domains (e.g., perceptions of climate change public opinion), we hypothesized that there may be significant pluralistic ignorance and/or false consensus effects present in the context of support for offshore wind projects and that such effects may play an important role in shaping how individuals think about offshore wind adoption. Specifically, we hypothesized that those who hold oppositional (minority) opinions to offshore wind will greatly underestimate the levels of support among various target populations and that those who hold supportive (majority) opinions will slightly underestimate the levels of support among various target populations. In addition to these primary hypotheses, we also anticipated finding differences in estimates of support as a function of political party identification. Although this latter research question is largely exploratory, we expected to find that Republicans would underestimate the level of support within their own party to a greater extent than Democrats, due to less clear norms and elite cues in the Republican Party (Druckman et al., 2013).

To test our hypotheses, we conducted two studies to determine whether pluralistic ignorance and/or false consensus effects could partially explain public opinion on offshore wind. The first study was conducted online and aimed to determine whether an individual's own opinion on offshore wind is related to his/her estimated level of support among similar others. The second study was conducted on Block Island to investigate these effects in a real world setting and with a larger sample. This latter study also collected data on partisanship and perceived support as a function of political identity.

3. Study 1

3.1. Methods

Participants residing in New England were recruited from Amazon's Mechanical Turk marketplace (MTurk) between March and April, 2016 to fill out a survey on renewable energy (Buhrmester et al., 2011). MTurk provides an online platform that connects interested survey respondents with researchers; it allows researchers to restrict participant location by country or U.S. state via users' IP address. Although the online platform is not wholly representative of the U.S. population, it has been shown to provide more reliable data than traditional online surveys (Buhrmester et al., 2011). Only individuals residing in the states of Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont were eligible to participate. We chose this geographic area (i.e. New England) due to its past and ongoing history of leadership and public engagement challenges regarding offshore wind developments (Chesto, 2016; Firestone and Kempton, 2007). Furthermore, the New England states are in close proximity to the large contiguous areas of the outer continental shelf that have been leased by the U.S. government for future offshore wind energy development.

Participants were given information about the potential development of an offshore wind farm off the coast of New England, and were asked to give their own opinion on the general idea of offshore wind off the coast (using a six-point scale, from strongly oppose to strongly support). Next, participants were asked to estimate what percent of other New England residents they thought support offshore wind. Participants were also asked to estimate the level of support among New England coastal residents and residents of their own community (data not reported here). Similar questions were asked regarding respondents' own support and perceived support of community solar and community wind (results briefly reported on here; see Section 2.2). Participants were then asked how likely they would be to perform five signaling behaviors on behalf of their opinion on offshore wind (e.g., place a sign on their lawn to share their opinion, share their opinion with members of their community). Participants were also asked demographic questions, including age, income, education, political ideology and proximity to the Atlantic coast.

A total of 119 participants responded. Thirty participants had missing data or did not read the instructions fully, leaving a total of 89 participants with complete data. The majority of these remaining participants were from Massachusetts (39.3%) and Connecticut (23.6%). The average age of participants in the sample was 34 years old (SD = 12 years), and females made up 69% of the sample. Political affiliation in the sample leaned Democratic, with Republicans making up 10.1%, Independents 32.5% and Democrats comprising 52.8%. Although Republicans were underrepresented in the sample, it is worth noting that they are also underrepresented in the study's geographic area relative to the rest of the U.S.; most states in the area, with the exception of Maine and New Hampshire (both swing states), are generally considered Democratic strongholds (Jones, 2017).

3.2. Results

Support for offshore wind within the sample was high: 93% of participants said they slightly, moderately, or strongly support offshore wind off the coast of New England. Only 6 participants said they slightly or moderately oppose offshore wind. On average, participants estimated that roughly 53.8% of other New Englanders support offshore wind.

A linear regression was used to test whether perceptions of support for offshore wind among New England residents differed as a result of the participant's own opinion. We first looked at correlations between estimates of support and one's own opinion as well as basic demographic variables (age, education, and income). Own opinion was positively correlated (r = .33) with perceptions of support among New Englanders. None of the demographic variables were significantly correlated with estimates of support for offshore wind ($p's > .05$), however we did observe significant negative correlations between age and estimates of support for community wind (r = − .27) and community solar (r = − .32; additional data not reported here). Correlations are reported in Appendix A. Age and own opinion were subsequently entered into the regression model to predict estimates of support. Overall, the model was significant, F (1, 85) = 8.05, p = .001, R^2_{adj} = .14. One's own opinion of offshore wind significantly predicted estimates of support (β = .37, p = .001), as did age (β = − .22, p = .03). Our results indicate that participants who are opposed to offshore wind underestimate levels of support far more than individuals who are supportive, as do older participants. Fig. 1 demonstrates the linear trend found between one's own opinion of offshore wind and estimates of support among New Englanders.

3.3. Discussion

The results from Study 1 revealed two important findings. First, participants who responded that they support offshore wind off the coast of New England significantly underestimated the extent to which they hold the majority opinion. To put this differently, these participants overestimated the level of opposition among New Englanders. This is based on recorded levels of support within the sample (93%), as well as results from other surveys that estimate very high levels of broad support for offshore wind (e.g., Funk and Kennedy, 2016). Second, opinion extremity was associated with more accurate estimates

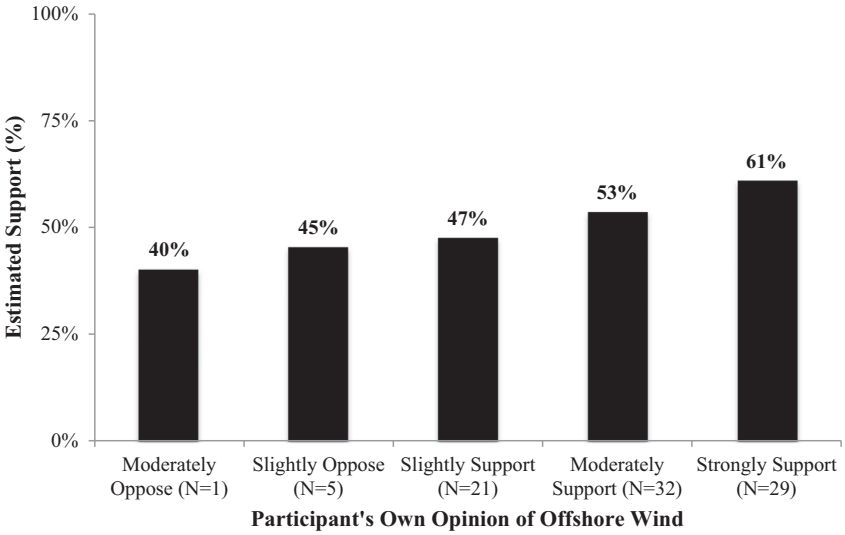

Fig. 1. Estimates of support for offshore wind among New Englanders.

of support (i.e. strong supporters were more accurate than weak supporters). It is interesting to note that as a whole, participants who said they slightly supported offshore wind estimated that they held the minority opinion. Overall, it appears that supporters of offshore wind in our sample are falling victim to partial pluralistic ignorance by overestimating the level of opposition in the region. In sharp contrast, the few participants in our sample opposed to offshore wind severely underestimated the level of support for the technology among other New Englanders. In other words, they incorrectly overestimated the size of their group to the point of believing they hold the majority opinion. These findings may be suggestive of a false consensus effect among opponents to offshore wind. However, due to the extremely small number of opponents included in this initial study, we are hesitant to make any strong claims regarding the presence of false consensus effects among opponents. Still, we include these initial findings as they suggest the possibility that such effects may indeed exist in the context of offshore wind energy.

Although the results of Study 1 are clearly preliminary, we offer them as a starting point for considering how basic psychological phenomena such as pluralistic ignorance and false consensus effects may play a previously unidentified role in shaping opinion formation and thus the policymaking environment in the context of offshore wind development. In addition, by asking participants about their opinions regarding offshore wind in general, we start with a more general case before moving to examine these effects in the context of a specific project or case study. This provides an important baseline of sorts, as past work has shown significant differences between generalized attitudes towards offshore wind energy and attitudes towards specific projects (e.g., Bell et al., 2005).

4. Study 2

The results of our first study, although limited due to a small sample size, provide valuable insight into the possible presence of both false consensus and pluralistic ignorance effects in the context of the public's attitudes towards offshore wind projects. In Study 2, we were interested in expanding on these results by collecting a larger sample of respondents and assessing beliefs about a specific offshore wind project. Given previously observed differences between support for generic offshore wind projects (which tends to be strong and broad) and opposition to specific projects (at the local level), we felt it was important to examine these dynamics in the context of a specific, tangible offshore wind project: the Block Island Wind Farm off the coast of Rhode Island.

4.1. Methods

The second study was conducted on Block Island in the summer of 2016, during project construction but before the turbines were operational. A team of research assistants asked individuals walking around the island to fill out several questions on a paper survey. Surveys were administered over 14 weeks, generally on one randomly selected weekend day and one weekday each week. Researchers spent time at three locations on the island that are characterized by substantial foot traffic in summer months: the exterior of a visitors' center located near the passenger ferry dock; the entrance to the public library; and a dock at an interior harbor frequented by private boats. In each case, researchers determined a point of intercept and approached each third adult to cross the designated point, inviting him or her to complete the survey. A total of 429 (24.7% response rate) participants responded (Age: $M = 48.4$, $SD = 16.4$ years; Gender: 50% female). The majority of respondents (76%) were visitors to the island. Participants were asked to indicate how supportive they were of the Block Island wind project using a seven-point scale (strongly oppose to strongly support, with the mid-point serving as a neutral option). Later in the survey, participants were also asked to estimate what percent of various groups they believed were supportive of the project: visitors to Block Island, Rhode Island residents, and Block Island residents. Participants were then asked to estimate what percent of Democrats and Republicans supported the project, separately. Demographics were collected, including age, income, education, political party identification and self-identification as a visitor, seasonal resident, or full-time resident of the island.

4.2. Results

Overall, support for the Block Island wind project within the sample was high. See Table 1 for levels of support and opposition among the various groups. On average, participants in the sample estimated that

Table 1
Opinions of the Block Island project from various groups in the sample.

Group	Count[a]	% Support	% Neutral	% Oppose
Visitors	314	72.0%	17.5%	10.5%
Block Island Residents	14	71.4%	7.1%	21.4%
Seasonal Block Island Residents	70	82.9%	12.9%	4.3%
Rhode Island Residents	95	75.7%	11.6%	13.7%
Sample total	429	74.2%	15.4%	10.4%

[a] Count does not total 429 as individuals may belong to more than one group.

52% of Block Islanders and 61.8% of visitors to the island supported the wind project.

A linear regression was run to determine if perceptions of project support among Block Island residents (i.e. all Block Island residents, not those in the sample) differed depending on the participant's own opinion of the project. As in Study 1, we also considered basic demographics (age, education, and income) in the regression model. Own opinion of the project ($r = .43$) and income ($r = -.13$) were significantly correlated with estimations of support among Block Island residents (see Appendix B for all correlations). Own opinion of the project and income were entered into the model to predict perceptions of support among Block Island residents. The overall model was significant, $F(1, 319) = 39.61$, $p < .001$, $R^2_{adj} = .19$. Own support for the project significantly predicted estimations of support among Block Island residents ($\beta = .43$, $p < .001$), however income did not ($p = .27$). Participants who oppose the offshore wind project underestimated levels of support far more than individuals who are supportive. A similar model was run to determine if participants perceive differences in support among visitors to the island, depending on the participant's own opinion of the project. No basic demographic variables were correlated with estimations of support, and therefore were not entered into the regression equation. Own opinion of the project was entered into the model to predict perceptions of support among visitors to the island. The overall model was significant, $F(1, 360) = 77.76$, $p < .001$, $R^2_{adj} = .18$. The regression equation shows a similar pattern as the previous model. Fig. 2 gives a visual representation of these linear trends.

Since participants appeared to perceive that visitors to the island were overall more supportive of the project than Block Island residents (dependent on their own opinion), we explored if these differences were significant. A post-hoc mixed-model ANOVA was conducted to determine if there were significant differences between participants' estimations of support between Block Island residents and visitors to the island. A 2-level within-subjects variable (perceived support; Block Island residents, visitors) by a 3-level between subjects variable (own opinion; oppose, neutral, support) model was run. Overall, the model and the within subjects variable were not significant. Although Fig. 2 descriptively shows higher estimates of support among visitors for each opinion group, these differences were not significant.

Next, analyses were conducted to determine if perceptions of support among Republicans and Democrats were related to the participant's own political affiliation. It should be noted that these analyses were exploratory, and were conducted after descriptively looking at the data. A total of 127 Democrats, 122 Independents, and 72 Republicans responded to the 'perceived support of others' questions. Overall, these participants estimated that 43.8% of Republicans supported the Block Island wind project and 65.1% of Democrats supported the project, both well below the actual levels of support reported by participants themselves in the survey (see Table 2).

Table 2
Opinions of the Block Island project between political parties in the sample.

Group	Count	% Support	% Neutral	% Oppose
Republicans	90	65.6%	14.4%	20.0%
Democrats	148	84.5%	10.1%	5.4%
Independents	156	67.9%	22.4%	9.0%
Sample total	394	73.6%	15.9%	10.5%

A one-way ANOVA was run to determine if participants' own political affiliation predicted their perception of support *among Democrats* as a group (i.e. among all Democrats, not those in the sample). The overall model was significant, $F(2, 317) = 9.92$, $p < .001$, suggesting that estimated support among Democrats differed depending on the participant's own political identity. Post-hoc, listwise comparisons revealed that estimates of support among Democrats differed significantly between all partisan groups in the sample. Notably, Democratic participants in the sample perceived significantly more support among Democrats ($M = 70.59\%$, $SD = 18.42$) than did Republican participants ($M = 56.79\%$; $SD = 27.03$; $t(195) = 6.50$, $p < .001$, $d = .66$). Independently identified participants ($M = 64.06\%$, $SD = 19.69$) estimated significantly greater support compared to Republican participants, $t(189) = 3.38$, $p = .02$, $d = .35$, but significantly less support compared to Democratic participants, $t(246) = -3.46$, $p = .02$, $d = .31$. See Fig. 3 for plotted means.

A one-way ANOVA was also run to determine if participants' own political affiliation was associated with their perception of support *among Republicans* as a group (i.e. all Republicans, not those in the sample). Overall, the model was significant, $F(2, 316) = 11.50$, $p < .001$, suggesting that estimated support among Republicans differed based on a participant's own political identity. Post-hoc listwise comparisons were examined. As before, all partisan groups differed significantly from one another in their estimates of support among Republicans. Democratic participants estimated significantly less support among Republicans ($M = 37.69\%$, $SD = 19.92$) than did Republican participants ($M = 53.06\%$, $SD = 25.39$; $t(205) = -7.18$, $p < .001$, $d = .71$). Independently identified participants ($M = 44.64\%$, $SD = 21.33$) estimated significantly less Republican support compared to Republican participants, $t(192) = -3.81$, $p = .01$, $d = .39$, and significantly more support compared to Democratic

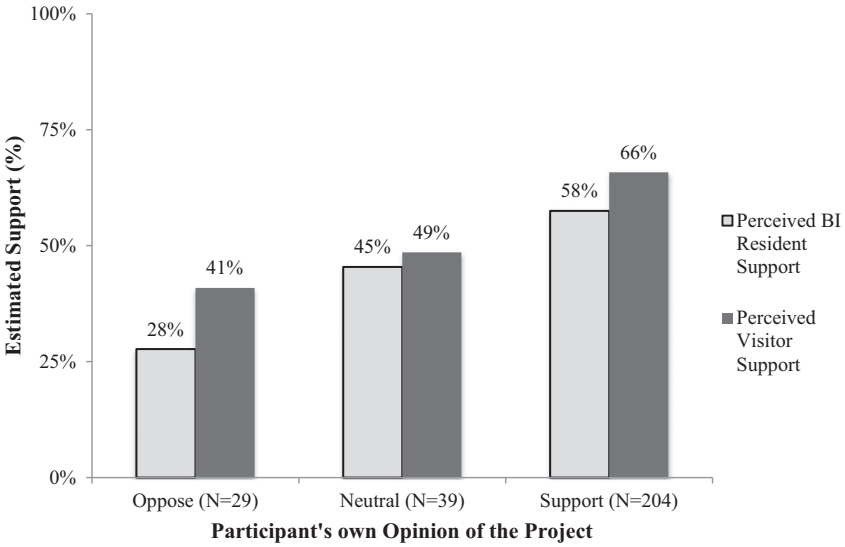

Fig. 2. Estimates of support for the Block Island wind project among Block Island residents and visitors.

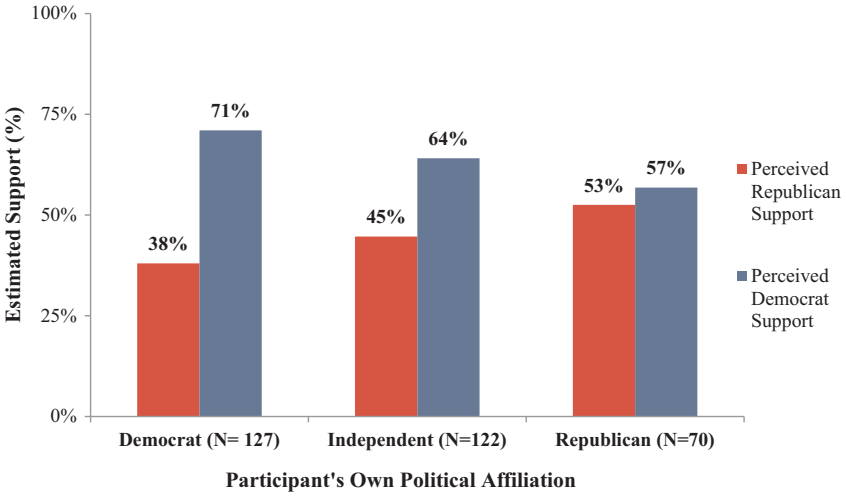

Fig. 3. Estimations of support of the Block Island project among political parties with consideration to participant's own political affiliation.

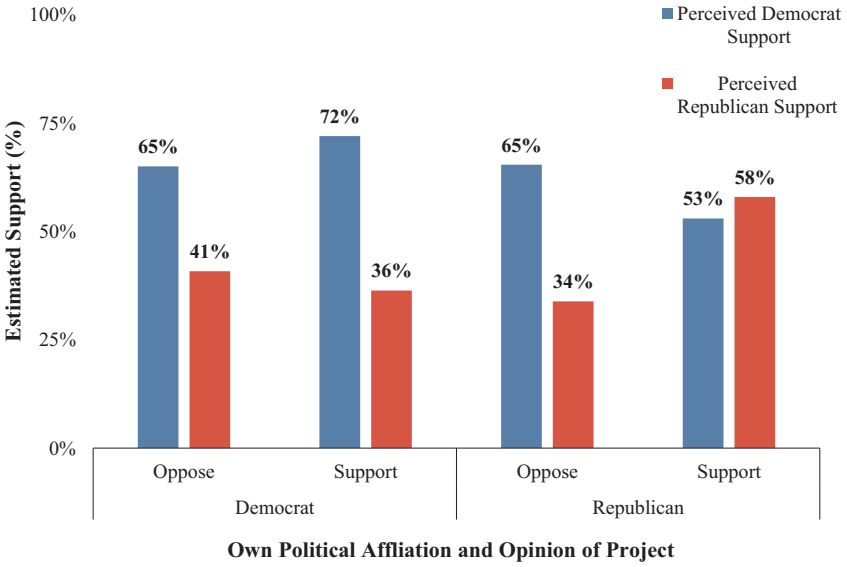

Fig. 4. Estimations of support of the Block Island project among political parties with consideration to participant's own political affiliation and opinion.

participants, $t(245) = 3.55$, $p = .01$, $d = .32$. See Fig. 3 for plotted means.

Taken together, the results indicate that estimations of Democratic and Republican support differed based on the participant's own political affiliation. Self-identified Republicans estimated similar levels of support among Democrats and Republicans, whereas self-identified Democrats estimated that support was much higher among Democrats relative to Republicans.

Next, we added the participant's own support of the project into the model. A mixed model ANOVA was run to determine if a participant's own political affiliation and their own opinion of the project interacted to predict if perceptions of support differed significantly between Republicans as a collective and Democrats as a collective. For this analysis, we excluded participants who self-identified as Independent in order to focus on any further partisan effects. We collapsed weakly and strongly identifying individuals into one category for each political party. Participants who responded that they were neutral to the Block Island project were also dropped in order to focus on differences between those who support and those who oppose the project. A 2 (own political affiliation; Republican, Democrat) × 2 (own opinion; support, oppose) × 2 (within subjects; estimations of Democrat support, Republican support) analysis was conducted. The three-way interaction was significant, indicating that estimates of support between Democrats and Republicans differed based on the interaction between one's own opinion and political affiliation, $F(1, 191) = 5.06$, $p = .03$, $\eta^2_{partial} = .03$. The pattern of results (shown in Fig. 4) suggests that the interactive effects are driven by self-identifying Republicans in the sample who also support the Block Island project: these individuals (65.6% of Republicans in the sample) perceive relatively stronger levels of support amongst both Democrats and Republicans than we would expect based on their partisanship alone. Democrats in the sample, on the other hand, report similar perceptions of support regardless of their own attitudes towards the project.

4.3. Discussion

Several interesting findings arose from the second study. First, the pluralistic ignorance effects found among supporters in Study 1 were replicated. It should be noted that the effect does not appear to be as strong in Study 2, possibly because participants were allowed to indicate a neutral opinion. Study 2 was also successful in replicating false consensus effects seen with those who oppose the project. This finding is more robust, as a larger number of people who opposed the project were recruited into the study as compared to Study 1.

The study also revealed important differences in individuals' perceptions of support among political partisans as a function of one's own party identification. Republicans in the study, regardless of their own opinions about offshore wind, estimated relatively equal levels of

support for the project among Democrats and Republicans. Democrats, however, estimated large political differences in support, with strongly affiliated partisans estimating an almost 40-point gap between Democrats and Republicans. When these differences were examined in the context of the participant's own opinion, these perceived political disparities were found amongst both project opposing and supporting Democrats, as well as opposing Republicans. Project supporting Republicans, on the other hand, estimated relatively equal levels of (majority) support amongst both Democrats and Republicans. Interestingly, Republicans who support the project perceived slightly higher levels of support among fellow Republicans, compared to Democrats. Taken together, these results appear to suggest that whereas partisanship is the driving factor behind Democrats' estimates of support and opposition amongst political partisans, for Republicans it is their own support or opposition that plays a central role in driving perceptions of others' support.

5. General discussion

We conducted two studies in which we examined individuals' perceptions of support and opposition to offshore wind projects in the northeastern U.S. Both studies provide evidence that members of the public inaccurately underestimate levels of support for offshore wind projects. Evidence of partial pluralistic ignorance is apparent among supporters: individuals supportive of the technology overestimated opposition to offshore wind, though as a group they did not perceive majority opposition. Among those (few) who are opposed to offshore wind projects, evidence of a false consensus effect was present. Opponents in both studies not only overestimated levels of opposition, they perceived that they held the majority opinion, a classic demonstration of a false consensus effect (Ross et al., 1977).

It should be noted that we cannot claim causality between one's own opinion and perceptions of the opinions of others. While it is possible (and, we believe likely) that one's own opinion influences their perceptions of others, we cannot rule out the possibility that perceptions of normative beliefs regarding offshore wind likewise influence individuals' own opinions. Indeed, it is likely that both of these processes are simultaneously at work and influencing each other recursively. Future work should aim to address this important unresolved question, perhaps by examining how corrective information influences (or not) individuals' own attitudes and behavior.

We also find suggestive, if preliminary, moderating effects of political party identity on perceptions of offshore wind public opinion. Democrats erred on the side of underestimating support for the Block Island wind project within their own party, but only slightly. Although this likely suggests a pluralistic ignorance effect, this may also be an indication of the 'illusion of uniqueness' effect, where members of the Democratic Party recognize widespread Democratic support for renewable technology, but want to appear unique in their views (Stern et al., 2014a, 2014b).

Democrats traditionally support renewable technologies and policies as tools for mitigating climate change (Szarka, 2004). As there are strong political differences in support for climate change mitigation policies (e.g., Kahan, 2012), both Democrats and Republicans may perceive lower levels of support among Republicans. However, our results replicate others' polling data, which suggest that the majority of *both* Democrats and Republicans in fact support renewable technologies (Funk and Kennedy, 2016), including offshore wind. This conflicting information creates an unclear injunctive norm, particularly regarding Republicans' (as a group) support for this emerging technology. Our data confirm that the broad level of support that exists, particularly among Republicans, is not widely understood or appreciated by partisans of either group, but especially among Democrats.

Although the majority of Republicans in our second study showed support for the Block Island wind farm, Republicans who oppose the project adopted what looks like a Democrat's view of the Republican Party, greatly underestimating levels of Republican support. Those Republicans who support the project, however, correctly perceived that the majority of members in their own party supported the project (underestimating support by a relatively small margin). Congruent with findings that Republicans strive to perceive within-party consensus (Stern et al., 2014b), these differences appear to be driven strongly by individuals' own attitudes towards the project, possibly abetted by unclear norms within the party with respect to opinions about renewable energy technologies more broadly.

These findings are most immediately relevant to the U.S. policy context surrounding offshore wind, however they may also hold insights for understanding emerging debates over the technology in other parts of the world as well. There is evidence that opinions on emerging technologies differ as a function of political affiliation in European countries (Karlstrøm and Ryghaug, 2014). Furthermore, our results suggest that when information (e.g., support and opposition towards a technology or specific project) is unclear or unavailable to members of the public, stakeholders with differing agendas may "fill in the holes" based on pre-existing assumptions (e.g., "conservatives are anti-wind power," "liberals support offshore wind"), potentially developing incorrect perceptions of one another in the process. Our findings may be helpful for leaders and developers in any country aiming to interact with the affected public, particularly in cases where unclear or incorrect information about supporters or opponents is perpetuated. Furthermore, our findings may help overseas developers tackling offshore wind projects in the U.S. (e.g., DONG Energy) to understand the arguably unique political and cultural context found in the states (Rand and Hoen, 2017).

Incorrect estimations of the norm may influence behaviors among both supporters and opponents of offshore wind in general and of specific projects. False consensus effects have been shown to influence drinking behaviors among college students (Larimer et al., 2004), and pluralistic ignorance effects are potentially responsible for reducing climate change discussions (Geiger and Swim, 2016). Although we do not find any direct evidence of behavioral impacts of the observed pluralistic ignorance and false consensus effects here, further work is needed to investigate these dynamics in the context of offshore wind. It seems plausible that the presence of a vocal minority of opponents to these projects significantly shifts both public discourse as well as individuals' perceptions of the issue, leading to a 'silent majority'-type situation. The 'spiral-of-silence' theory reasons that those who are aware of holding a minority opinion are generally less vocal of their opinions (Noelle-Neumann, 1974). Although supporters appear to be aware they hold majority status, it is possible that the overestimation of opponents to offshore wind by these individuals may lead to fewer public displays of support, which reinforces the silence of this group. Among Republican supporters, this silence may be more pronounced, as offshore wind energy is generally discussed as a tool to mitigate climate change. Republican proponents of offshore wind are potentially even less likely to engage in behaviors if they feel they are deviating from the norms of their group, even if these norms are not clear. On the other hand, false consensus beliefs among opponents of either party may support their willingness to speak out in opposition to these projects, further biasing public discourse relative to actual levels of support and opposition.

In this paper, we did not aim to contribute to the psychological literature on underlying explanations for incorrect estimations of the norm. We instead suggested that incorrect estimations of public opinion do exist among rational actors in the context of an emerging and contested technology. As developers and members of the public interact, actual levels of support within a community should be assessed. Incorrectly perceiving attitudes towards a proposed offshore wind project may negatively influence developers' perceptions of the affected community (Heidenreich, 2015), cyclically bringing forth more opposition from the community than truly exists. This is not to suggest that those who oppose offshore wind energy development are irrational in

their opinions, or that opposition is inherently wrong (Aitken, 2010). However, in assessing levels of support or opposition, it is important to understand if *perceptions* of support are being substituted for reality. The impact of relaying actual representative opinions back to the affected community has yet to be explored, and should be pursued with caution.

5.1. Limitations and future directions

There are a number of important limitations and strengths to the current work. First, the sample size in our first study only permits us to make very cautious statements about the phenomena of interest, particularly with respect to individuals who oppose offshore wind projects. Similarly, a significant amount of missing data in Study 2 raises questions regarding the representativeness of our findings. The questions regarding perceptions of the opinions of others were placed towards the end of the survey, so it is possible that participants simply skipped these by accident. Alternatively, participants may not often explicitly think about the opinions of others and therefore did not know how to answer these questions. We do not believe these potential issues undercut our findings; however, future investigations into these effects will ensure that all participants fully understand what is being asked of them. Moreover, the consistency demonstrated between the two distinct samples provides some measure of reassurance that the effects discussed above are robust. Additionally, whereas much of the past work on pluralistic ignorance and false consensus effects has been conducted in laboratory settings (Mullen et al., 1985), our use of a field survey focused on a specific project boosts the ecological validity of the present work.

Very few studies have investigated the behavioral implications of incorrect norm estimation, and no studies that we are aware of have analyzed potential behaviors regarding offshore wind support or opposition. In Study 1, we attempted to investigate potential signaling behaviors participants might take to share their opinion (e.g., writing a letter to a local paper), however the small sample size made analysis impractical. As public, communicative behaviors are critical tools for signaling norms to others, future work should attempt to investigate relevant behaviors that proponents and opponents of wind energy might take. In addition, providing correct normative information has been shown to change behavior (Schroeder and Prentice, 1998). This is an area ripe for exploration in the realm of offshore wind energy, particularly as local populations become more influential in renewable energy decision-making (Bidwell, 2016). Additionally, to our knowledge this study is one of the first to examine norm estimation in the context of renewable energy and partisanship. Further studies could help to elucidate the underlying explanations of our findings as well as implications for partisan splits on perceptions of renewable energy approval.

6. Conclusion and policy implications

The present paper highlights the importance of examining not only individuals' own beliefs regarding emerging renewable energy technologies, but also their beliefs about others' opinions. We find evidence of significant incorrect estimation regarding public support for offshore wind projects both generally and with respect to a specific case (i.e. Block Island), with both opponents and supporters alike overestimating public opposition to offshore wind energy. Such perceptions may play an important role in shaping public discourse and broader debates over the development and implementation of these technologies in the future, yet they are infrequently considered by developers, policymakers, as well as advocates and opponents alike. As the coast of New England is likely to see many offshore wind projects, both domestic and international developers and stakeholders will face unique challenges developing in an area that has a politically-charged history of opposing wind development (e.g., Firestone and Kempton, 2007).

Although the current study focused on the possible existence of pluralistic ignorance and/or false consensus effects in the U.S. offshore wind context, these are mechanisms that may be influential in shaping public support or opposition to a wide variety of emerging energy technologies in various geographic areas around the globe. Indeed, any issue that involves public discourse and engagement related to personally and politically sensitive siting and development decisions may be influenced, in part, by factors that can affect individuals' willingness to voice their own opinion (including pluralistic ignorance and false consensus effects). The present findings may help better inform policymakers, community advocates and project developers as they approach public engagement efforts around emerging technology development, particularly by raising awareness of the ways in which such mechanisms could lead to a "self-silencing" effect among supporters (and the opposite among opponents) in terms of opinion sharing (see, e.g., Geiger and Swim, 2016).

In addition, our findings could ultimately help support creation of policies and procedures that more effectively and accurately incorporate public opinion into the development process. For example, one strategy may be to survey individuals likely to be impacted (positively or negatively) by a newly proposed project, and then to relay the public's opinions back to community members and relevant stakeholders. Similar strategies have been used to curb underage drinking among college students with some success (Schroeder and Prentice, 1998). In the context of offshore wind, such straightforward strategies may be quite influential in allowing a wider range of opinions to be heard by decision-makers and the public, with important downstream effects on how developers and policymakers go about involving diverse stakeholders moving forward.

Ultimately, it is critical for policymakers, developers, advocates, and others to fully understand and appreciate the role of the public and public discourse in shaping the offshore wind development landscape as the technology begins to take off (or not) in the U.S. and elsewhere. In turn, this will require a better understanding of the underlying psychological, social, cultural, and other factors that influence opinion formation and sharing behaviors. Much work remains to be done in this respect, including further exploration of individuals' perceptions of normative beliefs regarding offshore wind energy projects and how these beliefs influence individuals' engagement with the technology.

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Conflict of interest

The authors declare no conflict of interest.

Appendix A

See Table A.1.

Table A.1
Correlations for relevant variables in Study 1.

	Est. of support	Income	Age	Education
Own Opinion	.33**	− .15	.17	− .16
Est. of Support		− .11	− .16	.03
Income			− .05	.28**
Age				− .04

Note: **$p < .01$.

Appendix B

See Table B.1.

Table B.1
Correlations for relevant variables in Study 2.

	Est. of support: BI residents	Est. of support: visitors	Income	Age	Education
Own Opinion	.43**	.42**	− .13*	− .06	.05
Est. of Support: BI Residents		.38**	− .13*	− .02	− .09
Est. of Support: Visitors			− .03	.01	− .03
Income				.24**	.33**
Age					.19**

Note:.
* $p < .05$.
** $p < .01$.

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