

Group norm violations in an online environmental social network: Effects on impression formation and intergroup judgments

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Abstract

Much research has demonstrated the power of social norms to affect proenvironmental behavior and conservation-related attitudes and beliefs in traditional “offline” social contexts. With the emergence of social media and citizen science platforms that allow for socially coordinated conservation efforts at scale comes a need to better understand the influence of social norms in online contexts. The present experiment explored effects of norm violations on impression formation and intergroup judgments within the context of Habitat Network, a socially networked mapping application where users create and share virtual representations (maps) of their properties. Results revealed that when participants viewed a map depicting the violation of a strongly held group norm—namely, the presence of an outdoor (vs. indoor) pet cat—they judged the map owner as significantly less likely to engage in a variety of proenvironmental behaviors. Importantly, this effect emerged despite evidence that the owner was already engaging in various sustainable practices. Moreover, the effect was mediated by the perceived quality of wildlife habitat represented by the map and moderated by participants’ group membership status (as a cat owner) in a manner consistent with theories of impression formation and intergroup judgments. We discuss implications for social cognition and intergroup relations in proenvironmental online contexts.

Keywords

halo effect, intergroup judgment, norm violation, outgroup polarization, social networks

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Social psychologists and group scholars interested in environmental attitudes, beliefs, and behavior have long examined the influence of social norms (Cialdini, Reno, & Kallgren, 1990), which have emerged as a powerful factor in psychological outcomes related to conservation and sustainability.

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Although the literature makes a clear and compelling case that prevailing norms guide conservation decisions in a variety of everyday contexts (e.g., Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007), limited research has explored effects of environmental social norms in online social environments. The rise of the Internet has brought unprecedented opportunities for examining the influence of social norms at scale, including across geographically dispersed individuals and groups with shared interests. These opportunities are especially rich within applications and websites that feature user-generated content, such as major social media platforms like Facebook and Twitter (e.g., Segerberg & Bennett, 2011), and platforms focused specifically on conservation and sustainability (Dickinson, Crain, Reeve, & Schuldt, 2013). Environmental behaviors and behavioral norms represented on these networks have an influence potential that may far exceed that of offline behaviors because of their large user bases and ease of information transmission (e.g., Kinzig et al., 2013; Spartz, Su, Griffin, Brossard, & Dunwoody, 2017).

The role of online communication and social media in how people form and manage impressions has also attracted considerable research interest (Cunningham, 2013; Tanis & Postmes, 2003). A central question in this area is the impact of social media on impressions of whether other people share one's norms, values, and identities (e.g., Goel, Mason, & Watts, 2010), and in turn how those impressions affect judgments of others' behaviors. The present research seeks to integrate theories of person perception and impression formation with theories of normative persuasion within an online environmental social network. Specifically, we investigate how the violation of a single, deeply held norm in a conservation-focused social media platform influences users' judgments about those who violate the norm and how those judgments spill over to affect inferences about the violators' future environmental behaviors. In so doing, the present work extends the growing literature on the power of social norms in the environmental domain to online social spaces, thus carrying implications for socially coordinated environmental activities occurring at scale.

Social Norms and Sustainability-Related Outcomes

There is growing interest and evidence for the idea that social norms exert powerful effects on environmental behaviors. In an early and frequently cited field experiment (Cialdini et al., 1990), participants were more likely to litter when the adjacent area was already heavily littered than when it was clean. Further, the tendency to litter increased when a research confederate littered while walking by, thereby drawing participants' attention to the act. In the intervening two decades, additional research within this focus theory of norms framework has demonstrated effects of salient social norms on conservation behaviors in a variety of real-world settings that have clear implications for energy use and sustainability-related outcomes. For instance, Goldstein, Cialdini, and Griskevicius (2008) showed that placing messages in hotel rooms describing towel reuse as a social norm caused more people to adopt this behavior than did messages focusing on environmental protection. This effect was bolstered when the normative messages were localized (e.g., highlighting the behavior of past guests in a particular hotel room). Interestingly, people may not be aware of the power of normative influence; in one demonstration, although norms exerted a stronger influence over conservation behavior than did other factors, participants rated these other factors as the stronger determinant of their conservation decisions (Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008).

Impression Formation: Assessing Others' Proenvironmental Attitudes and Actions

The large literatures on person perception and impression formation point to a suite of cognitive processes that govern the information that we notice, encode, remember, and use when formulating judgments about other people in social contexts (e.g., Hastie et al., 2014). Challenging

our commonly held intuitions, numerous studies demonstrate that seemingly trivial situational factors can strongly shape our perceptions of the attributes of other people. For example, classic research on the halo effect in impression formation (e.g., Asch, 1946; Kelley, 1950; Thorndike, 1920) suggests that a single, salient positive attribute can lead observers to form a more favorable impression of a target person, which, in turn, leads observers to judge the target person more favorably on other (often invisible and logically unrelated) trait dimensions (for a review, see Forgas & Laham, 2016). In an often-cited demonstration, physically attractive (vs. unattractive) individuals were assumed to have more positive personality traits and a greater chance of succeeding in life, a halo effect known as the “what-is-beautiful-is-good stereotype” (Dion, Berscheid, & Walster, 1972). More recently, scholars have investigated and found evidence for halo effects that are rooted in proenvironmental actions, leading observers to assume, for example, that a company that acts eco-friendly in one domain will perform similarly in another (Smith, Read, & López-Rodríguez, 2010) or that a company’s eco-friendly food products (e.g., “organic” cookies) will have other positive, but unrelated, attributes (fewer calories; Schuldt & Schwarz, 2010).

Although spillover effects of positive and negative first impressions on subsequent judgments are well documented (Forgas & Laham, 2016), these effects are unlikely to unfold uniformly across observers, but instead, may interact with group processes in important and nuanced ways. In particular, research suggests that the same piece of positive or negative information can exert differential effects on impression formation as a function of whether the behavior is enacted by an ingroup or outgroup member. For example, scholars have argued that positive and negative actions of outgroup members may lead to more extreme judgments relative to those of ingroup members—that is, the “outgroup polarization effect”—due to the more elaborate cognitive schemas humans hold for ingroup (vs. outgroup) members. Consistent with this reasoning, an experiment by Linville and Jones (1980; see also

Linville, 1982) found that when evaluating law school applicants, White participants rated a Black applicant with strong credentials as more likeable, but a Black applicant with weak credentials as *less* likeable, relative to White applicants with comparable credentials.

A different line of research shows that positive and negative impressions can evoke more extreme judgments for *ingroup* members than for outgroup members. Specifically, research based on subjective group dynamics theory (Marques, Abrams, & Seródio, 2001) has examined the “black sheep effect” (Marques & Yzerbyt, 1988) wherein judgments about ingroup members are more extreme than are judgments about outgroup members. Marques et al. (2001) showed that this effect could be explained by the greater relevance of ingroup behavior than of outgroup behavior for people’s social identity. An example of the considerable empirical support for the black sheep effect is an experiment by Marques (1990) in which military school students evaluated a member of their own school or another school, who either did or did not comply with various norms. Results showed that when the target was an ingroup member, norm compliance led to the target being judged more positively, whereas norm violation led to the target being judged more negatively compared to when the target was an outgroup member—an effect that was strongest for norms that participants rated as highly important.

A recent meta-analysis has helped to reconcile these inconsistent findings by examining the conditions under which outgroup polarization or black sheep effects emerge (Bettencourt et al., 2016). The findings suggest that evaluative extremity results from a complex interaction of factors, including whether the target shares group membership with the observer, whether person-based information individuating the target is positively or negatively valenced, whether the target complies with or violates group norms, the social status of the groups involved, and whether the violated norm is linked to stereotype-based expectations. Given this complexity, as described next, we explore, rather than make a specific prediction about, whether

evaluative judgments will be more extreme toward ingroup versus outgroup members when they violate a strongly established norm in an online environmental social network.

Study Context and Group-Specific Norms

Drawing on prior research on normative influence, halo effects, and impression formation in intergroup contexts, the present research examined the influence of normative violations on social judgments in an online environmental social network that asks people to contribute data on their place-based conservation practices. Habitat Network (www.yardmap.org)¹ is an online conservation-focused citizen science project maintained jointly by the Cornell Lab of Ornithology² and the Nature Conservancy. The central feature of Habitat Network is a set of mapping tools that allow users to create and share virtual “maps” of their properties. Through this function, users can display proenvironmental practices they undertake to support healthy bird habitat. In addition to practices directly linked to birds’ health (e.g., reduced use of herbicides and pesticides), displayable practices include those that support bird habitat indirectly, such as renewable energy practices (e.g., the installation of solar panels) and other forms of greenhouse gas reduction (e.g., using reel instead of gas-powered mowers). Furthermore, as a citizen science project, Habitat Network provides educational materials on best practices and offers commonplace social networking tools, encouraging users to observe and model each other’s best practices (e.g., follower lists, a newsfeed with commenting features, interest groups, posting of user-generated content).

For this study, Habitat Network afforded an opportunity to test the effects of social norms on impression formation in an environment with high ecological validity for online communities oriented toward promoting sustainable practices. Because global environmental threats such as climate change have impacts that transcend state and national boundaries, there is a need for behavioral scientists to examine relevant social processes that

have the potential to unfold at larger scales (Pearson, Schuldt, & Romero-Canyas, 2016). To increase knowledge about social interactions among users within online communities that span geographic boundaries, the current study capitalized on naturally occurring social norms and group process dynamics among Habitat Network users, as well as the site’s design features and functionalities outlined earlier.

Indoor Versus Outdoor Cats

A strong norm within the Habitat Network and greater bird conservation community favors keeping domestic cats (*Felis catus*) indoors (for explicit arguments for the wildlife benefits of doing so, see Cornell Lab of Ornithology, 2016). The environmental impact of free-roaming feral, stray, and owned domestic cats has generated considerable research attention and is an ongoing public controversy (e.g., King, 2016; Marra & Santella, 2016). The controversy focuses on strategies for managing colonies of feral and stray cats and norms about practices with owned cats. On one side of the controversy are those with a relatively lenient attitude toward allowing cats to roam freely. This position is based on an animal rights perspective that emphasizes respect for the natural history of cats and points to the important bond that exists between cats and humans (e.g., Centonze & Levy, 2002). Advocates of this position also point to data suggesting that estimates of the negative impact of cat predation are overblown (e.g., Barratt, 1997) and based on flawed research (Alley Cat Allies, 2016), and cite research on the success of nonlethal methods of managing colonies of stray and feral cats (e.g., Levy, Gale, & Gale, 2003).

Advocates on the other side of the controversy point to research based on surveys (e.g., Lepczyk, Mertig, & Liu, 2004), literature reviews (e.g., Loss, Will, & Marra, 2013), and direct tracking of cat behavior (e.g., Loyd, Hernandez, Carroll, Abernathy, & Marshall, 2013) suggesting that cat predation poses a widespread and serious threat to native fauna. Even as early as 1996,

researchers reported that the domestic cat was implicated in the extinction and endangerment of several species of birds and small mammals through direct predation and through predation of these species' food sources (Coleman, Temple, & Craven, 1996). Further, previous research may have underestimated the negative impact of free-roaming owned cats (Loyd *et al.*, 2013), which have advantages over feral and stray cats (*i.e.*, freedom from competition over food and territory, and from routine health threats; Coleman *et al.*, 1996). People on this side of the controversy argue for keeping owned cats indoors and tend to favor using lethal strategies for controlling wild colonies.

Advocacy by organized groups has contributed to the polarization over this issue, typically characterized as pitting conservation organizations (*e.g.*, National Audubon Society, American Bird Conservancy) against animal rights and cat-lover organizations (*e.g.*, Alley Cat Allies, Animal Liberation Front). Recently, researchers have begun to examine the relationship between public opinion and the normative positions advocated by such organizations (Loyd & Hernandez, 2012; Peterson, Hartis, Rodriguez, Green, & Lepczyk, 2012; Wald, Jacobson, & Levy, 2013). In one study, Loyd and Hernandez (2012) found that membership in conservation or animal rights groups affected attitudes toward cat management practices and policies. For example, members of animal rights groups were less likely to support treating feral cats as an invasive species, and more likely to emphasize prevention of cat euthanasia than were members of conservation groups. Peterson *et al.* (2012), in a study comparing attitudes of bird conservation professionals with those of caretakers of roaming cat colonies, reported results consistent with Loyd and Hernandez (2012): conservation professionals were more likely than colony caretakers to support treating wild cats as pests. Peterson *et al.* (2012) reported further that the caretakers' understanding of the environmental impacts of roaming cats was less accurate than that of conservation professionals. Wald *et al.* (2013) compared attitudes of Audubon Society

members, members of advocacy groups for trap-neuter-return (TNR) colony management, and members of the general public. Like the aforementioned studies, they found wide contrasts between the groups at the poles of the controversy. For example, relative to members of TNR groups, Audubon Society members were less favorable about outdoor cats in general, were more likely to believe that freely roaming cats have negative impacts and pose risks for wildlife and people, and were more supportive of lethal methods to manage colonies. Moreover, when compared with the general public, Audubon Society members held more negative attitudes, and perceived more negative impacts and higher risk to wildlife (but not to humans), when asked about outdoor cats. These intergroup comparisons suggest that birders' distinctively negative view toward outdoor cats is driven more by concerns about bird conservation than by the safety of cats or health of human population.

Against the backdrop of the controversy over allowing domestic cats to venture outdoors, and the strong norm violation that it represents among the bird conservation community, we expected that keeping pet cats indoors would represent the normative position to be endorsed by the majority of our sample of Habitat Network users. Moreover, because of the attention drawn by this controversy within communities of bird enthusiasts, we expected it to be highly salient to our participants. Thus, we expected that seeing a fellow user who allows pet cats to venture outdoors would negatively bias Habitat Network members' judgments about the target's proenvironmental practices—despite direct evidence that the person engages in proenvironmental practices. Therefore, consistent with the literature on halo effects discussed before, we hypothesized:

H1. Habitat Network users will judge a target map owner as less likely to engage in sustainable practices not depicted on the map when the map depicts the violation of a strongly held norm in this community (*i.e.*, when the owner allows his or her cat outdoors).

In addition, consistent with halo effects theory, we expected that these negative judgments about an actor's behavioral intentions would be driven by negative impressions of the map owner's habitat (as represented on the map; see Figure 1), which we consider as a more proximal evaluation than inferred judgments about a map owner's behavioral intentions. In other words, we expected that those viewing a map depicting the violation of a strongly held norm (i.e., a map showing an outdoor cat) would judge that map as representing a lower quality habitat for wildlife, and that this judgment would negatively color more conceptually distal judgments about the map owner's likelihood of pursuing other sustainable practices. We thus hypothesized:

H2. The effect of the norm violation on judgments of the target's sustainable practices will be mediated by participants' impressions of the wildlife habitat displayed in the map they viewed.

Finally, we recognized that the hypothesized effects of a norm violation on impression formation may not manifest equally for all participants. In the context of our research, cat ownership may be a group membership status that affects how people respond to the violation of the indoor-cat social norm. We thus explored whether the effect of norm violation on judgments about the target map owner would differ between cat owners and non-cat-owners. Because the maps used in our study display the presence of an indoor versus an outdoor cat, the maps all portray cat owners. Therefore, the cat owners in the sample will be judging ingroup members whereas the non-cat-owners will be judging outgroup members.

The theories and empirical evidence we reviewed earlier point to two equally plausible ways these two groups could differ in their response to the norm violation. The outgroup polarization effect would lead to the prediction that non-cat-owners would display more extreme judgments on others violating the

norm that cats should be kept indoors, relative to cat owners. The black sheep effect, on the other hand, would predict that cat owners would be more extreme in their judgments of the norm violation, relative to non-cat-owners. We explored the following research question about which of these two explanations for cat ownership group status best fits our findings on extremity of judgments:

RQ1. How does participants' status as a cat owner (i.e., as a member of the target's ingroup or outgroup) moderate the predicted effect of a target's norm violation on participants' impression formation?

Method

To test how violating a strongly held group norm may influence social judgments related to sustainable practices in Habitat Network, we conducted an online experiment in which participants judged features of the map itself (e.g., its quality as wildlife habitat) as well as characteristics of the map owner. The map's owner was depicted as a cat owner either complying with or violating a key norm in the Habitat Network community, by keeping his or her pet cat indoors or allowing it to venture outdoors, respectively. Participants also reported their personal attitudes regarding the indoor/outdoor cat controversy. The dependent variables included observers' assessment of the quality of the wildlife habitat displayed on the map and their assessment of the map owner's intention to engage in additional sustainable behaviors.

Participants

Participants were selected from among the registrants to Habitat Network. We sent 2,141 emails to registered Habitat Network users inviting them to give their opinions of "some new Habitat Network webpage designs" meant to improve user experience. Participants were offered \$10.00 gift cards as compensation for completing the survey. Out of the 2,097 emails



Figure 1. Screenshots used as experimental stimuli for the indoor cat condition (top) and the outdoor cat condition (bottom). The indoor cat icon is a silhouetted cat within a house, and the outdoor cat icon is a cat in stride on the map's lawn. The only differences between the two screenshots are that the top map had an indoor cat on the site, an indoor cat featured in "This site's features" in the panel left to the map, and an indoor cat picture among the photos underneath the map. The bottom map had an outdoor cat icon, an outdoor cat site feature, and a photo of an outdoor cat. Otherwise the graphics were the same.

successfully delivered, 382 participants (18%) started the survey and 309 (15%) completed the survey. An additional 17 respondents were

dropped due to a programming error while running the experiment, resulting in a final analytic sample of $N = 292$.

Procedure and Materials

After clicking on a link to the study contained within the recruitment email, participants were directed to an online questionnaire administered on the Qualtrics platform. After completing the consent form, participants answered questions gauging relevant background information, such as their gardening and bird-identification skills, characteristics of their living environment (urban, suburban, rural), and whether they owned or rented their home. The survey then assessed key attitude and judgment questions that allowed us to test the study's two hypotheses and examine the moderating effects of participants' cat ownership status.

Attitude towards outdoor pet cats. In order to obscure the focus of the study, participants reported on their ownership of various pets (i.e., dogs, cats, birds) and on their attitude toward whether pet cats as well as pet dogs should be "allowed to go in and out at will" or "kept indoors at all times." Participants responded on an 8-point bipolar scale where these labels served as anchors for opposite endpoints.

Map evaluation. Next, participants were randomly assigned to view one of two versions of a mock map, identical except for their depiction of whether the map owner's pet cat was kept indoors or allowed to be outdoors. Screenshots of the maps (Figure 1) featured an ostensibly newly designed Habitat Network user interface that included a number of icons indicative of sustainability-related practices and displayed four photos shared by the owner. The experimental treatment (indoor cat vs. outdoor cat) was delivered in multiple ways. First, the map contained an icon depicted under a "property features" label that represented the pet cat. In the indoor cat condition, the icon portrayed a cat inside a building and was placed both in the "site's features" panel at the left to the map and within the house represented on the map; in the outdoor cat condition, the icon portrayed a cat walking on grass and was placed both in the "site's features" panel at the left to the map and on the lawn area of the map

(Figure 1). In addition, in the indoor cat condition, one of the photos showed a cat sitting inside the house on a window sill alongside the caption, "Tiger enjoying the view from his favorite window." In the outdoor cat condition, one of the photos showed a cat sitting outside on green grass alongside the caption, "Tiger enjoying an evening on our freshly mowed lawn." Finally, both maps depicted a variety of sustainable practices, specifically solar panel installations, limited use of chemicals and pesticides, and maintaining a small lawn. These latter features were identical and located at the same place in both versions of the map.

To bolster the cover story and the experimental treatment, participants were asked to evaluate six elements depicted on the map: the cat icon, the solar panel icon, the low chemicals icon, the small lawn icon, the color-coding scheme of different parts of the property, and the owner's photos with the appended captions. Each element was evaluated along the three dimensions of *informativeness*, *ease of understanding*, and *aesthetic desirability*, with the scale for each ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). As they are not the focus of the study, these evaluations are not discussed further.

Map recall (manipulation check). Participants were then asked a series of questions about their recall of the map, with the rationale offered that researchers were interested in "how various map features affect the memorability of the map." Importantly, we disabled the back button in the survey interface so that participants were unable to return to the map image when answering these questions. Embedded among these items were manipulation check questions asking which cat icon they saw and which sustainable practices were displayed on the map.

Judgment of wildlife habitat quality. Respondents were next asked to judge the quality of the habitat depicted on the map with the question, "Do you think the map represented in the image was an example of a property that provided good habitat for wildlife?" (Response scale: 1 = *no, it provided extremely poor habitat for wildlife*, 5 = *yes, it provided excellent habitat for wildlife*).

Inferred behavioral intentions of map owner. Respondents were next asked to judge the map owner's likelihood of engaging in various types of sustainable practices. Specifically, the question read, "How likely do you think the owner of the property represented in the map will take the following actions in the next 12 months?" (1 = *definitely not*, 5 = *definitely will*). Five sustainable practices were assessed: start composting, plant a bird- or pollinator-friendly plant, reduce or eliminate use of gas-powered lawnmowers, install bird feeders or nest boxes, adopt water saving methods (e.g., rain barrels, low-volume toilets). None of these five practices were displayed on the map images used as stimuli.

Individual differences. Finally, at the end of the survey, participants reported on demographic variables that have predicted environmental judgments in past research, including gender, political ideology, and educational attainment. Education level was recoded into three levels prior to analysis: less than a 4-year college degree, 4-year college degree, and postgraduate degree. Reflecting the broader population of Habitat Network users from which the sample was drawn, the sample was majority female (60%), leaned liberal ($M = 2.35$, $SD = 1.00$; where 1 = *very liberal* and 5 = *very conservative*), and was highly educated (with 72% reporting a 4-year college degree or higher). In addition, as a measure of usage frequency for the Habitat Network, we imported a variable counting the number of days each participant logged in to the website before and during the study. This variable was log-transformed prior to analysis.

Results

First, we report on participants' cat ownership status and attitudes regarding allowing cats to venture outdoors. Of the total sample of $N = 292$, $n = 131$ (45%) reported owning a cat. Confirming our assumption that restricting pet cats from going outdoors would be a dominant norm within this population, a strong majority of participants expressed the belief that cats should be kept indoors at all times: 79% selected a point

on the half of the scale (4 to 7) that represented the "kept indoors at all times" attitude (for all participants, $M = 5.36$, $SD = 2.21$ on the 0 to 7 scale). Moreover, nearly half (49.0%) of the participants endorsed the most extreme option available (i.e., 7), constituting the modal response. The two experimental conditions did not differ in cat ownership, $\chi^2(1, N = 292) = 0.55$, $p = .482$, or attitudes toward cat placement, $t(290) = 0.61$, $p = .546$, suggesting that random assignment to conditions was successful. Cat owners were slightly more in favor of allowing cats outdoors ($M = 5.09$) than were non-cat-owners ($M = 5.57$), but this difference did not reach conventional levels of significance, $t(264.88) = 1.81$, $p = .072$.

Manipulation Check

Across the two experimental conditions, 21 participants (nine in the indoor cat condition and 12 in the outdoor cat condition) failed to correctly recall the type of cat appearing on their map (i.e., 93% correctly recalled the cat type). Because results do not change when these 21 responses are removed from our analysis, we report results based on the full sample in what follows.

Sustainable practices featured on both maps were correctly noticed by most participants (solar panels: 97%, low chemical usage: 85%, small lawn: 90%). A series of chi-square tests of independence indicated that although participants in the indoor cat condition were slightly more likely to correctly recognize the small lawn than were those in the outdoor cat condition, $\chi^2(1, N = 292) = 4.15$, $p = .042$, the recognition rate did not differ between the two conditions for the other two sustainable practice recall items, solar panels, $\chi^2(1, N = 292) = 1.49$, $p = .222$, and low usage of chemicals, $\chi^2(1, N = 292) = 1.35$, $p = .246$.

Direct and Indirect Effect of Norm Violation on Inferred Behavioral Intentions

To examine our hypothesis that violating a strongly held norm within a sustainability-focused social network site would lead to negative impressions of

Table 1. Means and standard deviations of key dependent variables by experimental condition.

| Measure | Indoor cat | | Outdoor cat | |
|-------------------------------|------------|-----------|-------------|-----------|
| | <i>M</i> | <i>SD</i> | <i>M</i> | <i>SD</i> |
| Habitat quality | 3.06 | 0.66 | 2.64 | 0.94 |
| Inferred behavioral intention | 3.61 | 0.50 | 3.41 | 0.55 |

the norm violator's likelihood of pursuing unrelated proenvironmental behaviors (H1), we first created a composite variable (inferred behavioral intentions) by averaging across the five sustainable practices judged by participants (e.g., start composting). The reliability of this measure was acceptable (Cronbach's $\alpha = .79$). Descriptive statistics for the effect of norm violation on inferred behavioral intentions are displayed in Table 1. An independent samples *t* test examining the influence of the independent variable (indoor cat vs. outdoor cat) on this composite variable supported our hypothesis. Relative to participants in the indoor cat condition, participants in the outdoor cat condition judged the property owner as significantly less likely to pursue these sustainable practices, $t(287) = 3.21, p = .001, d = 0.38$.³

The second hypothesis (H2) posited that the effect of the experimental treatment on inferences about the property owner's behavioral intentions would be mediated by the judged quality of the wildlife habitat displayed on the map. Prior to testing a mediation model, we first tested the main effect of our manipulation on the hypothesized mediator, judged habitat quality, with and without demographic covariates (i.e., cat placement attitude, usage frequency, gender, political ideology, educational attainment). Descriptive statistics for this relationship are displayed in Table 1. In the model without covariates (Table 2, Model 1), as predicted, participants in the outdoor cat condition judged the quality of wildlife habitat displayed on their map more negatively than did those in the indoor cat condition, $t(265.81) = 4.42, p < .001, d = 0.51$. This effect remained significant controlling for attitudes regarding whether cats should be allowed

outdoors, $F(1, 289) = 18.84, p < .001, \eta_p^2 = .06$ (Table 2, Model 2). Similarly, in the model with website usage frequency and three demographic variables (Table 2, Model 3) added to Model 2, the effect of the experimental treatment remained significant, $F(1, 256) = 13.65, p < .001, \eta_p^2 = .05$.

Next, using the PROCESS macro (Version 2.16, Model 4) for SPSS developed by Hayes (2013), we tested the model with the experimental condition as the predictor (X), inferred behavioral intentions as the outcome variable (Y), and judged wildlife habitat quality as the mediator (M). We found that the bootstrapped bias-corrected confidence interval for the unstandardized indirect effect of experimental condition did not include zero (indirect effect = .12, $SE = 0.03$, 95% CI [0.07, 0.19], $R^2_{\text{med}} = .03$), indicating a significant indirect effect. Moreover, the direct effect between these variables was no longer significant under this model, $b = .08, t = 1.38, p = .169$. Results of the Sobel test further confirmed the mediation effect, $z = 3.89, p < .001$.

To further examine the processes underlying these effects, our research question asked whether this mediating effect of habitat judgment would be further moderated by participants' cat ownership status (RQ1). Prior to running the moderated mediation analysis, we tested whether the relationship among the variables in our model fits the description of a moderated mediation (Muller, Judd, & Yzerbyt, 2005). First, we found that the overall effect of the map stimulus on inferred behavioral intentions was not moderated by cat ownership, $F(1, 285) = 1.01, p = .317$. Second, we tested the interaction effect between experimental condition and cat ownership on the proposed mediator, judged habitat quality. This effect was significant, $F(1, 288) = 4.50, p = .035, \eta_p^2 = .02$, such that for non-cat-owners, the outdoor-cat map elicited more negative judgments of habitat quality than did the indoor-cat map, $b = .60, t = 4.58, p < .001$, but not for cat owners, $b = .20, t = 1.48, p = .142$. Finally, the partial effect of habitat quality judgment on inferred behavioral intentions was significant, $b = .28, t = 8.04, p < .001$.⁴

Finding that these results fit the pattern of a moderated mediation, we used PROCESS

Table 2. Regression analysis predicting habitat quality judgments in models with and without demographic variables.

| Predictors | Model 1 | | Model 2 | | Model 3 | |
|--------------------------|---------|-----------|---------|-----------|---------|-----------|
| | β | <i>SE</i> | β | <i>SE</i> | β | <i>SE</i> |
| Intercept | 2.64 | 0.07 | 2.92 | 0.13 | 2.91 | 0.26 |
| Experimental condition | | | | | | |
| Outdoor cat | 0.42*** | 0.10 | 0.41*** | 0.10 | 0.36*** | 0.10 |
| Cat placement attitude | | | | | | |
| Approval of keeping | | | | | | |
| Cats indoors all times | - | - | -0.05* | 0.02 | -0.05* | 0.02 |
| Individual differences | | | | | | |
| Usage frequency | - | - | - | - | 0.03 | 0.05 |
| Gender (male) | - | - | - | - | 0.03 | 0.10 |
| Political identification | - | - | - | - | 0.07 | 0.05 |
| Education | - | - | - | - | -0.08 | 0.06 |
| R^2 | .06 | | .08 | | .09 | |
| Adjusted R^2 | .06 | | .07 | | .07 | |

* $p < .05$. *** $p < .001$.

(Model 7) to run a moderated mediation model (Muller et al., 2005) in which cat ownership (W) was allowed to moderate the path from experimental condition to judged habitat quality in the previous mediation model. As illustrated in Figure 2, we found that the conditional indirect effect was significant only among those who did not own pet cats. Specifically, the bootstrapped confidence interval for the indirect effect of the experimental condition included zero for cat owners (indirect effect = .06, $SE = 0.04$, 95% CI [-0.02, 0.14], $R^2_{\text{med}} = .01$), but did not include zero for those who did not own cats (indirect effect = .17, $SE = 0.04$, 95% CI [0.10, 0.27], $R^2_{\text{med}} = .05$). In addition, the bootstrapped confidence interval for the index of moderated mediation did not include zero, index = -0.12 , $SE = 0.05$, 95% CI [-0.23, -0.02]), indicating that the conditional indirect effects were significantly different between cat owners and non-cat-owners. These results remained unchanged when participants' attitude on whether cats should be allowed to roam outside was entered as a covariate with paths to the mediator and the outcome variable (cat owners: indirect effect = .05, $SE = 0.04$,

95% CI [-0.03, 0.13]; non-cat-owners: indirect effect = .18, $SE = 0.04$, 95% CI [0.10, 0.26]).

Discussion

Facilitating positive social judgments among fellow users is essential for maintaining solidarity in online citizen science communities where users are expected to cooperate toward shared goals and model the desirable practices of other users. However, despite ample research evidence on the power of social norms to influence proenvironmental attitudes and behaviors in traditional, offline settings, limited research has investigated these processes in online spaces, where proenvironmental influence increasingly occurs. The Habitat Network platform and its web-based community afforded an ideal natural setting in which to test effects of social norms information on impressions about other users, given the platform's numerous subtle signals indicating group membership and users' adherence to and violation of established behavioral norms.

Our findings suggest that considerations of a dominant group norm within the online community (i.e., pet cats should not be allowed outdoors)

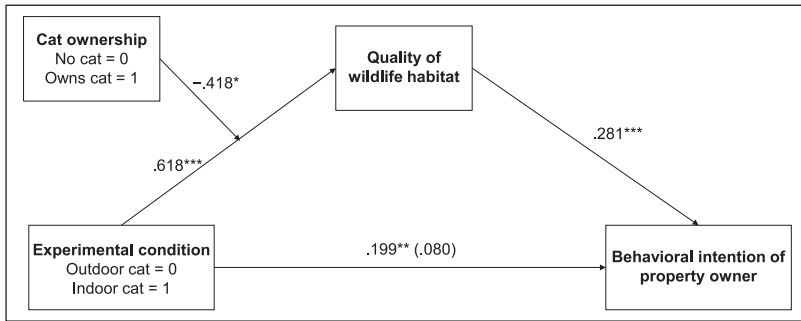


Figure 2. Model of moderated mediation with judged quality of wildlife habitat as mediator and cat ownership as moderator. Path coefficients are unstandardized. For the direct path between experimental condition and behavioral intention of property owner, the coefficient controlling for the quality of wildlife habitat is displayed in parentheses.

* $p < .05$. ** $p < .01$. *** $p < .001$.

strongly influenced judgments of the target's proenvironmental practices. Results related to our first hypothesis indicated that, when an ostensible member of the Habitat Network community was portrayed as violating the norm that cats should be kept inside, participants judged the target as less likely to engage in a variety of sustainable practices that were not displayed on the map. Importantly, this effect emerged despite the existence of numerous signals that the target map owner was, in fact, already engaged in a variety of proenvironmental practices: both maps featured solar panels, small lawn sizes, and low usage of chemicals, and manipulation checks demonstrated that participants noticed these features. Nevertheless, simple cues (i.e., outdoor vs. indoor cat icons) indicating whether the target complies with a single, strongly held group norm affected impressions of the target's likelihood of enacting additional sustainable practices in the future.

Furthermore, our results conform to predictions derived from halo effects theory, whereby the effect of the manipulation signaling the target's norm compliance status influenced a conceptually more relevant judgment that, in turn, spilled over to influence more distal impressions about the owner's commitment to sustainability. In other words, the distal effect of norm violation on inferred behavioral intentions was mediated by the proximal judgment of wildlife habitat quality

represented by the map. Participants who saw a map depicting an outdoor cat judged the map's habitat to be lower in quality than the one depicting an indoor cat, which, in turn, reduced the perceived likelihood that the map's owner would engage in sustainable behaviors.

Shedding additional light on the psychological mechanisms underlying these effects, further analysis revealed that this mediation effect was moderated by participants' status as a cat owner. Non-cat-owners rated the norm-complying target more positively than the norm-violating target in terms of quality of wildlife habitat and inferred behavioral intentions, whereas cat owners did not judge the two targets differently. We reason that the icons signaling the presence of a pet cat activated intergroup processes which may have led to these differences in judgments. Both versions of the map portrayed cat owners, and therefore to the extent that cat ownership represented a meaningful social group, the cat owners in our sample were judging ingroup members whereas the non-cat-owners were judging outgroup members.

Our finding that the norm violation resulted in more extreme judgments from outgroup than from ingroup members is more consistent with the outgroup polarization effect than with the black sheep effect. Outgroup polarization posits that positive and negative behaviors performed by

an outgroup member (here, a cat owner judged by a non-cat-owner) give rise to greater polarization in judgment than do behaviors by an ingroup member. The presumed mechanism is a complexity–extremity process whereby people hold less elaborate cognitive schemas for outgroup than for ingroup members (Linville, 1980; Linville & Jones, 1980). Complexity is theorized to drive extremity in judgment because the relatively less complex information used in generating a judgment about outgroups means that each single piece of information carries relatively more weight. Information about the ingroup is more nuanced and less likely to be perceived in stark “good versus bad” terms. Applying this reasoning to our study, cat owners may have been willing to give a fellow cat owner the benefit of the doubt because they may have considered a wider variety of factors associated with owning a cat and the decision to keep it indoors or not (e.g., the desire to acclimate a recently adopted stray cat to being indoors) than would have non-cat-owners. Some cat owners in the sample undoubtedly allow their cats to go outdoors, which may have promoted leniency toward this practice and reduced the extremity in judgment between the indoor- and outdoor-cat maps. We did not ask this question directly, however, in order to avoid drawing attention to the true purpose of the study.

Although our results are more consistent with outgroup polarization than with black sheep effects, we offer this conclusion with caution because the study design did not include all of the conditions that would allow for differentiating these processes. For example, because our stimuli only portrayed cat owners, we could not test how a non-cat-owner might be judged when violating some other comparable norm. We further point out the lack of balance in the design in that cat owners only judged ingroup and never outgroup members, and vice versa for non-cat-owners. It should be noted that the norm we used to create our stimuli was shared by both cat owners and non-cat-owners within the Habitat Network community. Attitudes toward norms may differ not only in valence but also in strength (Krosnick & Petty, 1995), and a minimal threshold of strength

may be required in order for norm violations to influence judgments (Marques, 1990). Whereas we selected as our stimulus a violation of a presumably strong norm to enable clear hypothesis testing, future research may examine whether the pattern of judgments observed here would emerge from different (e.g., weaker) types of norm violations. An additional characteristic of norms that may affect differences in how ingroups and outgroups are judged is the extent to which norms are localized to specific subgroups (e.g., cat owners vs. non-cat-owners) as compared to more generalized norms (Otten & Gordijn, 2014).

Another limitation relevant to differentiating outgroup polarization from black sheep effects was the kind of information implied about the property owner in our stimulus maps. We presented only positive person-based (individuating) information (i.e., the proenvironmental practices portrayed on the maps). Bettencourt *et al.* (2016) found that the valence of the individuating information conveyed about the judgment target affected how people responded to norm violations by ingroup and outgroup members. Their meta-analysis showed evidence for black sheep effects when the person-based information was negative—ingroup members who violated norms were judged less favorably than were outgroup members. When the person-based information was positive, however, contrary to the expectation that ingroup targets would be judged more favorably than outgroup targets, they found no differences in evaluation of ingroup and outgroup norm violators. Their analysis, thus, found only partial support for black sheep effects. Our study found that despite of positive individuating information, norm violation led to negative evaluations of outgroup members but made no difference in evaluations of ingroup members. But because our design did not include negative information conditions, it is difficult to compare ours directly to Bettencourt *et al.*'s results. We are therefore reluctant to rule out the possibility that black sheep effects could operate in the kinds of judgments we studied.

More generally, the current study extends the application of normative social influence literature to the domain of online social networks

promoting proenvironmental behaviors that carry consequences for climate change mitigation and adaptation. The findings conform to predictions derived from social psychological research on the effects of social norms, halo effects, and polarized judgments of outgroup members. These findings can also help inform practitioners managing online social networking platforms to promote common prosocial goals. Our results suggest that even minor or logically unrelated cues can activate judgments between users based on group norm violation while also signaling the presence of distinctive subgroups within the larger community that may negatively impact the common goals of these online communities.

Future research can further reveal the extent to which violations of deeply held norms shape online community dynamics between users and affect their behavior. For example, the present findings suggest that a cue that another user engages in a controversial behavior (here, by allowing a cat to go outdoors) can impact social perceptions in a manner that may erode the solidarity of the overall network. That is, if users assume (correctly or incorrectly) on the basis of a single normative transgression that others are unlikely to pursue other desirable actions that contribute to the common goals of the community, it is possible that their own attitudes and behaviors may, over time, begin to conform to an inferred (and perhaps, misperceived) norm (e.g., Prentice & Miller, 1993)—an important possibility that future research should explore. In these and other ways, online citizen science platforms represent promising venues for examining basic group processes as the web affords ever-increasing opportunities for wide-scale social coordination to address pressing conservation and sustainability challenges.

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Notes

1. Originally launched in 2012 by the Cornell Lab of Ornithology as YardMap, this platform changed its name to Habitat Network in 2016 following the formation of a partnership with the Nature Conservancy. Although data collection for this study occurred before this name change, we use its new name in this paper to reflect its current status.
2. The Cornell Lab of Ornithology is a unit at Cornell University, whose mission is “to interpret and conserve the earth’s biological diversity through research, education, and citizen science focused on birds” (Cornell Lab of Ornithology, 2017).
3. Three cases had missing values for this analysis.
4. We further explored whether the interaction effect of Experimental Condition \times Cat Ownership on judged habitat quality is contingent on attitudes towards whether cats should be allowed outdoors. This three-way interaction (Experimental Condition \times Cat Ownership \times Cat Placement Attitude) was not significant, $\beta = -0.10$, $t = -1.16$, $p = .246$. Also, in the model where this three-way interaction term was removed, the two-way interaction terms involving cat placement attitude were not significant, Experimental Condition \times Placement Attitude: $\beta = 0.06$, $t = 0.12$, $p = .905$; Cat Ownership \times Placement Attitude: $\beta = 0.01$, $t = 1.28$, $p = .202$.

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