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The challenge of motivated cognition in promoting lake health among shoreline property owners: biased estimation of personal environmental impact

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ABSTRACT

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Habitat loss through shoreline development on inland lakes threatens biodiversity. Property owners can reduce their impact by growing vegetated shoreline buffers, but many do not adopt these land management behaviors. One factor that may influence individuals' decisions to participate in conservation initiatives to promote natural shorelines is beliefs about their personal impact. A field study tested whether motivation to protect positive self-view would influence property owners' judgments about their shoreline's impact on lake health. Participants rated photos of their own property and other participants' properties on 4 dimensions: beauty, usability, water quality, and habitat. Linear mixed-effect modeling revealed photos were rated higher by their owners than other participants on all dimensions (mean $\beta = 1.13$, $P < 0.05$ for all), consistent with the hypothesis that motivation to protect self-view biased property owners to judge their own shoreline development as less harmful than it was judged by others. These results identify a potential barrier to outreach efforts for enlisting property owner cooperation in mitigating habitat degradation from shoreline development.

KEYWORDS

Bias; lake; motivated cognition; natural shoreline; property owners; shoreline; shoreline restoration; vegetated buffer

Loss of habitat through shoreline development has been identified as the largest problem adversely affecting the health of lakes in the United States (US EPA 2010) and a cause of declining biodiversity across North America (Rahel 2002). Developed properties along pristine lakes can provide valuable space for enjoyment by property owners; however, that same development can also impair overall lake health. Fortunately, individual shoreline property owners can help reduce the impact of shoreline development by growing and maintaining a vegetated buffer (US EPA 2010).


Accurate information should be a key component of strategies to address the nature of environmental problems to improve the likelihood that individuals will cooperate in the protection of shared resources like lake health (Van Vugt 2009). Reaching an objective understanding of an environmental problem, however, may

be a challenge for individuals who have directly contributed to its cause because acknowledging their own culpability may threaten their positive self-view. The concept of self-view is similar to identity, which has previously been demonstrated to affect resource management decisions in other domains (Bliss and Martin 2008, Jang 2013). Motivation to maintain a positive self-view is a force that can influence a broad range of behaviors, judgments, and beliefs (Steele 1988, Aronson 1968). The Theory of Motivated Cognition argues that motivation for a preferred outcome can affect reasoning through biased selection of “strategies for accessing, constructing, and evaluating beliefs” (Kunda 1990).

Motivation to protect self-view has been shown to affect causal reasoning about personal attributes (Kunda 1987) and moral reasoning about

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environmental issues (Opotow and Weiss 2000). However, its effect on causal reasoning about features of the physical environment, such as property owners' assessments of their shoreline management practices and how these contribute to lake health, has not been investigated. The nature of that effect is important because shared natural resources such as water quality and biodiversity depend largely on the decisions of individual property owners. Their decisions, in turn, depend at least in part on judgments about how their personal property affects the shared resource in question. Most Americans value species conservation and ecological health (Simcox and Zube 1989, Czech and Krausman 1999), providing strong motivation for property owners to avoid concluding that their past actions have not been consistent with those values.

Lake managers across North America have developed a variety of outreach programs to encourage owners of ecologically impaired residential lakefront properties to take steps to restore their shoreline to a more natural vegetated state. Owners of impaired properties could be expected to hold overly positive beliefs about how their property contributes to the lake as a whole, however, because the current state of their shoreline is in part a result of decisions they have made (e.g., landscaping, building; Clayton and Opotow 2003, Dutcher et al. 2004, Amato et al. 2012). Furthermore, the shoreline area by definition transitions from a built environment (the house) to a natural environment (the lake), so judgments of "naturalness" fall on a continuum and are inherently ambiguous, providing ripe opportunity for positively biased evaluations (Dunning et al. 1989). Individuals who hold overly positive beliefs about how their property contributes to the lake are unlikely to take action and change their shoreline maintenance behaviors to improve that contribution, even if they support shared resource goals such as lake health.

To investigate the impact of motivated cognition in the domain of shoreline conservation, we conducted a field study drawing on a random sample of lake property owners to test the hypothesis that motivation to protect self-view would lead to overly positive evaluations of how their personal shoreline contributes to lake health. We hypothesized that participants would rate their own property more positively than other participants because of motivation to protect self-view from the threat of a negative evaluation.

Materials and methods

Surveys were mailed to 140 individuals who owned residential lakefront property in central Wisconsin. The number of participants was chosen to ensure a sufficient number of respondents to observe an effect if present, assuming an effect size similar to that observed in Balcetis and Dunning (2007), and assuming a conservative 36% response rate. The University of Wisconsin–Madison (UW) Education and Social/Behavioral Science Institutional Review Board approved the study protocol. The cover letter mailed with surveys is available as an online supplement to this article.

Contact information was obtained from county records, and participants were randomly selected from all eligible shoreline property owners in 3 counties. The final sample of participants was drawn from 36 different lakes, with a median number of 2 participants from each lake. Publicly available photographs of each property's shoreline, taken from a boat in the lake during summer at a distance of ~25 m, were obtained from previously conducted county lakes assessment projects. All photos were taken during daylight hours; none had been taken on rainy days. All photos had a minimum resolution of 1024 × 768 pixels and were cropped to a size of 16.5 × 5.7 cm on the printed page. Property owners were considered eligible if their property's photograph (1) showed a moderate level of shoreline development to ensure sufficient ambiguity, and (2) clearly depicted a single property parcel. Each photo was independently rated for suitability on both dimensions by 2 research assistants. From an initial recruitment frame of 400 photos, the final sample of 140 was chosen based on these ratings.

Surveys presented participants with 8 photographs and asked them to rate each on 4 dimensions: shoreline contribution to natural beauty (beauty), shoreline contribution to good water quality (water), habitat provided for aquatic wildlife (habitat), and usefulness for enjoying the lake and recreation (usability). Likert ratings ranged from 1 (low) to 7 (high). Each participant rated their own property's shoreline (self-ratings) and the shorelines of 7 other participants (other-ratings). Participants did not rate any photos from their home lake other than the photo of their own shoreline to avoid rating properties of people they knew. Participants' own shorelines were randomly presented in the third through eighth position. An instruction page



Figure 1. Sample shoreline photograph.

immediately preceding the to-be-rated photos presented 2 invariant example photos without ratings to provide participants a common contextual anchor for evaluation. A cover letter informed participants that they might see their own property in one of the photos, and if so instructed them to “rate it just like the others” (Fig. 1).

Independence of the 4 rated dimensions was assessed with 2 correlation matrices, the first for other-ratings and the second for self-ratings. Correlations were calculated as Spearman’s rho because responses were not normally distributed.

Ratings of the 4 dimensions were separately analyzed with linear mixed effects regression to test the hypothesis that participants would exhibit a positive bias when rating their own shoreline. Linear mixed effect regression is functionally similar to an ordinary least squares regression model but is capable of simultaneously controlling error due to 2 random variables; in this case, participant and photo (compared to repeated measures ANOVA, which can control error due to only a single random variable). Participant and photo were included as random effects; ownership status (self = 1, other = 0) was included as the sole fixed effect. A significant effect of ownership status would suggest an effect of motivated cognition on the rating judgments. Mean differences for the effect of ownership are presented as betas with 95% confidence intervals. Analyses were conducted with R 3.0.1 and the lme4 package.

Results

Of the 140 surveys, 80 were returned for a 57% response rate. A 100% response rate would have collected ratings from 7 non-owners for each photo because photos were perfectly counterbalanced across the full set of mailed surveys. Because some surveys were not returned, the mean actual number of non-owners who rated each

photo was 4.09 (SD = 1.27). Participants had owned their lakefront properties a mean of 24 years. About one-fourth of participants (23%) were year-round residents; 17% lived at the property 6–11 months per year, 29% lived at the property 2–5 months per year, and 31% lived at the property <2 months per year.

Pairwise correlations among the 4 rated dimensions ranged from 0.04 to 0.77 (Table 1. Usability was the most independent. Beauty, water, and habitat shared 31 to 59% of the variance they measured but were not collinear.

Bias was revealed in judgments on all 4 dimensions, supporting our central hypotheses. Participants rated photos of their own shoreline higher than they rated photos of others’ shorelines on beauty ($\beta = 1.21$, [0.86, 1.56]), habitat ($\beta = 1.03$, [0.72, 1.34]), water quality ($\beta = 1.25$, [0.92, 1.58]), and usability ($\beta = 1.01$, [0.69, 1.58]). Condition means are presented graphically (Fig. 2).

Discussion

This field study provides evidence that shoreline property owners tend to judge their personal shoreline’s contribution to lake health more positively than it is

Table 1. Correlation matrices for photo ratings.

	Other-ratings			
	Beauty	Water	Habitat	Usability
Beauty	1			
Water	0.69	1		
Habitat	0.56	0.77	1	
Usability	0.33	0.15	0.04	1
	Self-ratings			
	Beauty	Water	Habitat	Usability
Beauty	1			
Water	0.66	1		
Habitat	0.55	0.62	1	
Usability	0.54	0.44	0.28	1

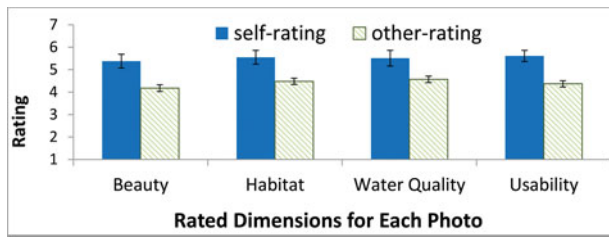


Figure 2. Mean photo ratings by ownership status. Error bars show 95% confidence intervals.

judged by others. The effect was found for all 4 rated dimensions of lake quality.

The higher beauty and usability ratings owners gave to their own shorelines were possibly due to personal preferences (i.e., people maintain their shoreline in a state they aesthetically enjoy and that serves their usage interests). Reasonable people can disagree about whether one shoreline landscaping practice is subjectively more beautiful than another or their shoreline is more optimally useful for their own recreation preferences; however, an explanation based exclusively on preferences is less likely for the differences observed in the habitat and water quality ratings. For those 2 dimensions, standardized metrics exist and can be used for empirical comparison. Even without awareness of these standardized metrics, we suggest it is less likely that equally informed observers would reach substantially different conclusions about how a particular shoreline segment contributes to water quality or wildlife habitat, absent the motivational phenomenon explored in this study.

Yet that result is precisely what we observed. The similarly sized coefficients for ownership on each dimension suggests motivation to avoid negative conclusions about one's own past behaviors and decisions had a similar influence on all 4 judgments.

One limitation of this study is that it does not examine the effect of motivation to protect self-view on behavior, but on beliefs. Owners of the pictured properties believed their shorelines made a more beneficial contribution to the lake compared to the evaluations each photo received from other participants. Owners of impaired properties may be unlikely to change the state of their shoreline unless they believe its current state is in some way undesirable. Shaw et al. (2011) found that beliefs about how one's property contributes to lake health are related to behavior intentions, and Amato et al. (2015) also found that beliefs are related to self-reported shoreline maintenance behaviors among

lakeshore property owners. Although the general relationship of beliefs with behavior has strongly theoretical grounding (Rokeach 1968), further research is needed to measure the relationship of specific beliefs about shoreline maintenance and quality with actual shoreline behavior change.

Experimentally manipulating the magnitude of self-affirmation bias and then measuring the resulting effect on behavior change would be one method to measure that relationship. One possible strategy for experimentally manipulating self-affirmation bias could be to provide individuals with objective information about their property's contribution, thereby reducing the ambiguity of the evaluation. In many cases, however, that information about past behavior would be negative, creating the undesirable possibility that they could resolve the dissonance between their beliefs (lake health is good) and their behavior (not supportive of lake health) by changing their beliefs about the importance of natural shorelines to lake health. Previous research by Aronson (1968) and colleagues on the relationship of cognitive dissonance to environmental behavior has avoided that outcome by reinforcing participants' relevant beliefs immediately before they were confronted by potentially threatening information. In one study, participants who signed their names on a public document supporting water conservation before answering a series of questions about their past water consumption took shorter showers compared to participants who only signed the document or answered the questions (Dickerson et al. 1992). Such a strategy might be used by lake managers attempting to communicate with property owners about shoreline effects on lake health.

Lake and reservoir managers may also try other strategies to mitigate the propensity of property owners to make overly positive assessments of their own shoreline and increase their motivation to adopt more lake friends land management practices. In personal conversations, lake managers might start interactions with property owners by noting their positive actions but then also point out possible improvements. This may be one way that property owners would consider adopting more natural shorelines without threatening their positive self-concept and producing unintended consequences such as psychological reactance. Another strategy to consider, which some lake managers already use, is to offer lakeshore property owners a self-administered assessment tool that allows them to draw

their own conclusions about how their own shoreline contributes to water quality and wildlife habitat. Future research should empirically test these strategies to determine whether they reduce the effects of property owners making overly positive self-assessments that may prevent them from adopting more natural shorelines to protect wildlife habitat and water quality in and around North American lakes.

Another potential limitation of the study is the 57% response rate. Although this is generally a good response rate for an applied study, we do not know if our respondents were representative of all property owners in our sample. For example, respondents may have been more proud of their property than non-respondents. Future research on this phenomenon should explore this possibility.

The magnitude of self-affirmation bias in judgments of shoreline quality is likely moderated by other personal variables, such as environmental concern. Environmental variables may also moderate judgments. For example, owners on large lakes may feel their shoreline has a lower incremental impact on lake health compared to owners on small lakes. If so, that reduced efficacy may result in less motivational pressure for a positive evaluation of their shoreline's contribution.

The present research expands our understanding of how motivation affects perception and reasoning. While motivation to preserve positive self-view moderated estimation of physical environmental features by participants in Balcetis and Dunning (2007), in the current study, that motivation moderated reasoning about the relationship between lake health-related features and abstract concepts such as contributions to wildlife habitat and water quality. More broadly, motivated cognition has also been shown to affect reasoning in other natural resource domains. American participants in Jang (2013) attributed less responsibility for climate change to anthropogenic causes (versus natural causes) after reading a news article critical of US energy consumption compared to participants who read an article critical of Chinese consumption, providing evidence that participants were motivated to select a causal theory that did not threaten their in-group.

Taken together, these studies suggest that effects of motivation are common in judgments about the environment. Biased perceptions of environmental risk and how one's past decisions contribute to shared resource quality seem to be common. The implications are important for lake and reservoir managers.

Motivation to preserve self-view likely presents a challenge to interventions that encourage behavior change. This study improves understanding of the processes by which motivation affects reasoning and offers valuable insights about why property owners may indicate they support the goals of natural shorelines and yet not adopt such practices themselves. Our findings suggest that even when property owners agree that natural shorelines are important for lake health, they may also perceive they are already doing better than their neighbors.

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