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An Evaluation of Information Meetings as a Tool for Addressing Fear of Large Carnivores

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ABSTRACT

Managing authorities in Scandinavia arrange public information meetings when members of the public express fear because wolves or brown bears approach human settlements. This study aimed to increase the understanding of the potential effect of information meetings on self-reported fear of wolves and brown bears. In total, 198 participants completed questionnaires before and after the information meetings. Nine follow-up interviews were held 1 year later. The quantitative analyses revealed that participants who found the information credible reported a significant increase in social trust and a decrease in vulnerability and fear. The qualitative analyses pointed to the importance of information content and meta-communication, for example, nonverbal cues. It is proposed that, among participants who find the information credible, information meetings may change the appraisal of wolves and brown bears, and therefore they might prove useful as an intervention to address fear of these animals.

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information; interventions;
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Information and education have been proposed to reduce conflicts involving humans and large carnivores. However, Heberlein (2012) questions the applicability of cognitive fixes relying on facts to directly solve environmental problems. Cognitive approaches have been used, focusing on values, beliefs, and attitudes, to understand human–large carnivore conflicts (Manfredo, Teel, and Henry 2009; Decker, Riley, and Siemer 2012; Dressel, Sandström, and Ericsson 2015). These approaches may not be sufficient, since people's feelings toward nature are significant in forming environmental attitudes and behavior (Kals, Schumacher, and Montada 1999). Similarly, feelings toward wildlife play into attitudes toward management and conservation of large carnivores (Jacobs et al. 2014; Sponarski, Vaske, and Bath 2015).

When large carnivores come close to human settlements they may trigger interest and joy (Jacobs et al. 2014), but also feelings of anger and fear (Røskoft et al. 2003; Ericsson et al. 2010; Sakurai and Jacobson 2011; Treves, Naughton-Treves, and Shelley 2013). These intangible benefits and costs of large carnivores are frequently disregarded in attempts to understand conflicts between humans and large carnivores (Kansky and Knight 2014). Fear of large carnivores cannot usually be characterized as phobic fear (Flykt et al. 2013), but for

people who fear these animals the presence of large carnivores near where they live constitutes an environmental stressor that may affect quality of life, well-being, and health (Moser 2009).

The appearance of large carnivores close to human settlements, which might be unexpected or undesirable for many residents, calls for immediate management actions to address the public's concerns, as a complement to long-term activities to increase public involvement and trust by enhancing collaboration and participation (Decker, Riley, and Siemer 2012). The aims of this study are to understand how public large-carnivore information meetings arranged in response to the presence of wolves (*Canis lupus*) and brown bears (*Ursus arctos*) are perceived by participants, and to analyze whether the meetings have an effect on the participants' feeling of fear.

Previous Research

In order to be effective, information about environmental problems should be multifaceted, covering ecology, relevant procedures or actions, the effectiveness of these, and the social context (Hines et al. 1986/87; Kaiser and Fuhrer 2003; Roczen et al. 2014). If information is framed in terms of the environmental threat posed and the efficacy of actions people may undertake, information may alter emotions toward the environment (Li 2014), which in turn may affect attitudes and behavior (Carmi et al. 2015). The impact of knowledge on emotions is, as already indicated, most likely dependent on extensive cognitive elaboration of the information, and the outcome may go in both directions. For example, Glikman et al. (2012) showed that residents with more knowledge about wolf and brown bear biology reported more positive feelings toward the animals, associated with normative beliefs of protecting them. However, extensive knowledge based on personal experiences of wolves such as depredation seems to be associated with negative feelings (Ericsson and Heberlein 2003; Johansson et al. 2012).

There have been few comprehensive evaluations of informational approaches to human–large carnivore conflicts, and existing evaluations rarely capture effects on human dimension factors such as people's feelings of fear (Gore et al. 2006). Without evaluations it is difficult to know whether the intervention works better than no intervention at all, or whether the interventions may even exacerbate the conflict (Ferraro and Pattanayak 2006).

Knowledge about the sender of the message, quality of the message, nature of the audience, and effect of the medium is required to understand the outcome of information and education (Decker, Riley, and Siemer 2012). Meta-communication must also be considered. This is how the listener interprets the presenter in terms of, for example, nonverbal communication, such as facial expressions, gaze direction, voice parameters beyond words, and body language (see, e.g., Hall and Knapp 2013).

Informational approaches regarding wolves and bears evaluated in terms of relevant human dimension factors are diverse, and report mixed outcomes. Quasi-experimental studies have shown that written information about behavior that can reduce human–black bear interactions can increase the public's perceptions of risk associated with black bears (Gore et al. 2008), and that brochures, posters, and signs about black bear attractants and appropriate behavior when encountering a black bear can increase knowledge among members of the public (Dunn, Elwell, and Tunberg 2008). However, Baruch-Mordo et al. (2011) found no significant effect of written signs with personal verbal information about

how to reduce black bear attractants. Slagle et al. (2013) stressed the importance of information about how to avoid bear problems and potential benefits of bears, in order to influence human attitudes toward black bears. A long-term educational program aimed at conserving the Andean bear (*Tremarctos ornatus*) habitat increased local people's knowledge, and behavioral intentions became more positive, but positive attitudes toward presence of bears had decreased 5 years later (Espinosa and Jacobson 2012). None of these evaluations specifically focused on people's feelings of fear.

The presence and location of large carnivores in Scandinavia are highly conflictual and characterized by mistrust between the public and managing authorities and between stakeholder groups. In particular, the social conflicts surrounding the presence of wolves are strong (Sjölander-Lindqvist, Johansson, and Sandström 2015). It has been argued that informational approaches may not be sufficient (Røskaft et al. 2007), and such approaches have been criticized for neglecting local perspectives and involvement (Blekesaune and Rønningen 2010). To be effective, it seems critical that the information be designed to tap into the key antecedents of fear of the large carnivores.

Theoretical Considerations

Emotional responses, in our case the feeling of fear toward large carnivores, are affected by different levels of cognitive processing (i.e., appraisal) in a continuous information transaction between humans and their environment (Küller 1991; Johansson et al. 2012). The information could be internal, triggered by activation inside the body, and external, triggered by stimuli in the natural environment (e.g., presence of a large carnivore) or in the social environment (e.g., relation between stakeholder groups). In situations where stimuli trigger basic levels of appraisal (Leventhal and Scherer 1987), such as with spiders and snakes (e.g., Öhman and Soares 1993), emotional responses are elicited automatically (Scherer 2001). In situations with more extensively cognitively elaborated appraisal of stimuli, such as for wolves and brown bears (Flykt et al. 2013), Küller (1991) proposes that the emotional response is influenced by (a) the activity a person is engaged in, (b) the perception of the environmental and social contexts people find themselves in, and (c) individual factors such as sociodemographic background, experiences, and personality.

The progression of the appraisal process differs between individuals (Scherer 2001). Previous experiences could explain why the same stimulus, for example, a bear, may result in joy in one person whereas to another person the stimulus may be irrelevant, and in a third person it may result in fear. If an information meeting should reduce fear of brown bears or wolves, the information presented must influence the individual's appraisal process in a way that alters the outcome of the process. This influence could be by means of both the content presented and the meta-communication, for instance, facial expressions and body language.

During the appraisal process, stimuli are processed for different aspects. Which appraisal aspects are most important for the outcome (i.e., the emotion elicited) differs slightly between theories, but coping or coping potential is considered a key factor in the process (see, e.g., Küller 1991; Scherer 2001). Coping potential is the ability of the individual to perceive that he or she can handle the situation, including the possibility of gaining control of the situation and the power to do so (e.g., Scherer 2001). That is the individual's framing of stimuli in terms of threat and efficacy in handling a situation.

Appraisal of the environmental context in fear of large carnivores seems related to a person's perceived vulnerability in relation to (i) perceived degree of danger or harm the animal represents, (ii) perceived unpredictability of the animal's movement (i.e., uncertainty about the animal approaching or attempting to attack the person), and (iii) perceived uncontrollability (i.e., the person's lack of control) when responding to an encounter with an animal (Johansson and Karlsson 2011; see also Prokop and Fancovicová 2010; Sponarski, Vaske, and Bath 2015). These appraisal dimensions are similar to those specified by the Cognitive Vulnerability Model of animal fear (Armfield 2006; 2007).

In appraisal of the social context, social trust, defined as the willingness to rely on those who are formally responsible for developing policies and taking measures (Cvetkovich and Winter 2003), seems to be important. Social trust is regarded as critical to management of natural resources (Stern 2008; Earle 2010). Social trust is based on the similarity between the individual and the person to be trusted, for example, in terms of shared values (Balliet and Van Lange 2013), and positive affect of the person to be trusted (Schoorman, Mayer, and Davis 2007), rather than on rational judgements of how an institution would act in a certain situation. This is captured by the Salient-Value-Similarity model (Cvetkovich and Winter 2003). Zajac et al. (2012) have shown an association between salient-value-similarity, social trust, and the perception of risk of black bears, including fear of encounters. Johansson et al. (2012) confirm that appraisal of vulnerability—a large carnivore encounter seen as dangerous, unpredictable, and uncertain—and lack of social trust in managing authorities were associated with relatively stronger self-reported fear of the carnivore.

People's self-reports of fear can be assessed in terms of emotional responses to environmental stimuli: valence varying along unpleasantness–pleasantness and arousal varying along deactivation–activation (Mehrabian and Russell 1974; Küller 1991), a feeling of fear (Jacobs, Fehres, and Campbell 2012), and/or specified as a feeling of fear of attacks of the large carnivore (Frank, Johansson, and Flykt 2015). The reliance on extensive cognitive elaboration in the appraisal process behind self-reported fear of brown bears and wolves suggests that reducing the feeling of fear via the information meeting would require changing a persons' expectancies regarding (a) the environmental context, that is, perceived vulnerability—a large-carnivore encounter would be considered less dangerous, more predictable and the person would be more certain about how they would react in a potential encounter, and (b) the social context, that is, authorities would be considered as more trustworthy.

Objectives

The aims of this study were to understand how public large-carnivore information meetings focusing on wolves and brown bears are perceived by the participants, and to analyze whether the meetings had an effect on the participants' appraisal and thereby also on fear of these animals.

Specifically, we predicted:

- H1: a decrease in vulnerability, that is, the appraisal of an encounter with the animal species as dangerous, unpredictable, and uncontrollable.
- H2: an increase in social trust in managing authorities.
- H3: a decrease in fear (e.g., increased valence combined with decreased arousal, and a decreased specific feeling of fear).

Due to the relatively stronger social conflicts surrounding the presence of wolves than for the presence of brown bears, we expected effects to be moderated by animal species and the perceived credibility of the information presented.

Method

Sample

In total, 198 persons who attended public large-carnivore information meetings participated in the study. At the wolf information meetings, 135 participants returned completed questionnaires before and after the meeting (approximately 200 attendees, 67% response rate). The wolf information meeting sample (W-sample) comprised 40% women and 60% men, 18–83 years ($M_{\text{age}} = 56$ years, $SD = 14$ years). Of the sample, 54% had seen wolves, 36% had heard wolves, 73% had seen tracks of wolves in the area where they live, and 7% owned an animal attacked by wolves.

Sixty-three participants returned completed questionnaires both before and after the brown bear information meetings (approximately 75 attendees, 83% response rate). The brown bear information meeting sample (BB-sample) comprised 39% women and 61% men, 33–82 years, ($M_{\text{age}} = 63$ years, $SD = 11$ years). In this sample, 21% had seen brown bears, 43% had seen tracks, and 5% owned an animal attacked by brown bear.

Due to social conflicts surrounding wolves, approximately 1 year after the wolf information meetings, in-depth interviews were held with all nine persons (two females and seven males, ages 47–74 years, $M = 60$ years) who had expressed willingness to participate in further evaluations of the wolf information meetings in the postevent questionnaire. These informants represented different stakeholder groups, including hunters, livestock owners and members of environmental organizations, and people with diverse views on wolves and managing authorities (Johansson and Frank 2016).

Procedure

In Sweden, the 21 County Administrative Boards (CABs) are responsible for large-carnivore management. The CABs regularly arrange meetings where rangers and officials from the CAB provide information about large carnivores and carnivore management. Scientists from universities are often engaged to provide general information on animal biology and effectiveness of various interventions. Data were collected at information meetings organized in collaboration between a CAB, the Swedish Wildlife Damage Centre (WDC), and the Scandinavian Brown Bear Research Project (SBBRP) during spring 2013. The wolf information meetings were initiated by a CAB in response to wolf presence near human settlements, whereas the brown bear information meetings were initiated by a CAB on request from SBBRP.

All meetings were held in areas with resident wolves and/or brown bears, and were advertised in the local press as an invitation to a meeting about “wolves/brown bears close to human settlements.” The information stated that participants would have an opportunity to participate in a survey addressing their concerns about the presence of wolves/brown bears.

Meetings started with a short introduction by the CAB representative. All participants were then invited to respond to the pre-event questionnaire. They were informed that they could decline the invitation without consequences by returning a blank questionnaire. The meetings continued with presentations from the WDC/SSBRP for 1 hour, followed by a coffee break and postevent questionnaire, and a short session allowing questions in plenum. The official program lasted 1½–2 hours and is further described in the following.

The Organizations

SBBRP, which was started in Sweden in 1984, is a joint Scandinavian research project aiming to understand the ecology of the Scandinavian brown bear, to provide a scientific basis for the management of the species, and to provide information to the general public (<http://bearproject.info>).

The WDC has been part of the Department of Ecology at the Swedish University of Agricultural Sciences since 1996. The main objectives are evaluating management interventions aimed at reducing attacks on livestock, dogs, and humans, as well as training of government field personnel and officials (<http://www.slu.se/viltskadecenter>).

The Information

The information presented at the meetings was based on scientific research conducted on bears and wolves in Scandinavia. The content was chosen to relate to coping potential in the appraisal process, for example, framing wolves/brown bears in terms of threat and efficacy in handling an encounter. The content covered the same topics for both species and was designed to tap into identified antecedents of fear, that is, appraisal of vulnerability and social trust.

In order to clarify the sender of the information and to establish a basis for trust, the presenter gave a short introduction of himself and the role of the organization (SBBRP/WDC). The first part of the information focused on present wolf/bear populations, including range and population size, with specific reference to the latest official monitoring reports and tailored to the area of the meeting. This was to establish a common frame for the meeting. The second part of the information covered basic biology, including research methods and study areas. The presentation also explained radio-collaring of bears and wolves, home range sizes, prey species, social organization, and reproduction. The third part of the presentation was specifically designed for this study, and focused on the interaction with humans.

Based on behavioral studies of wolves and bears in Scandinavia, typical wolf and bear behavior close to humans was described (relating to predictability of animal behavior). Frequency of attacks on humans in Sweden, and globally, was reported. Human behaviors known to increase risk of an attack when encountering large carnivores during outdoor activities (e.g., hiking with and without dogs, hunting) were also presented (relating to perceived danger of a potential encounter). Finally, specific recommendations were given on how to behave in areas with large carnivores and when encountering carnivores, in order to reduce risk of attacks (tapping into perceived controllability of one's own behavior).

The presenters had many years of experience from fieldwork and research on large carnivores, and extensive experience of communicating at public information meetings.

Presenters were instructed to present data and personal experiences of encounters with bears and wolves, without commenting on political decisions or adding personal values. They were instructed to listen to participants' personal experiences and feelings in conversations. During presentations, questions posed for clarification were answered, but other issues raised were discussed at the end of the meetings, to ensure that the structure of the meetings was as similar as possible.

Questionnaires and Statistical Analyses

A sequential exploratory research design was employed where priority was given to collection of quantitative data, followed by gathering of qualitative information aiming to explain and interpret statistical findings (Robson 2011). Most data were collected using previously published questionnaire items to assess fear-related variables, that is, vulnerability, social trust, valence, arousal, and the specific feeling of fear. The postevent questionnaire included items on participants' perception of the meeting, including perceived credibility of the information rated on a 5-point Likert scale (1 = not at all, 2 = rather little, 3 = neither/or, 4 = rather much, 5 = very much) and an open-ended question about the most important information. An overview of individual items, response scales, and the internal reliability of indices is given in Table 1. In the statistical analyses the participants were divided into those who attended the brown bear meetings (BB-sample: $n = 63$) and those who attended wolf information meetings (W-sample: $n = 135$). Since several participants in the W-sample (but not in the BB-sample) were hesitant about the credibility of the information, this sample was further divided into those who perceived the information as credible (scoring 4–5 on the Likert scale; see Table 1, last row, "Did you find the information credible?"; WC-sample: $n = 98$) and those who were not convinced that the information was credible (scoring 1–3 on the Likert scale for the same item; WNC-sample: $n = 37$). In the BB-sample 61 participants scored 4–5 on the Likert scale and two participants scored 3. Mixed-design analyses of variance (ANOVAs) with group affiliation (BB-sample, WC-sample, and WNC-sample) as between-subject variable (i.e., allowing for comparisons between different respondents), and measurement time (pre/post event) as within-subject variable (i.e., allowing for comparisons of the same person's responses given at two different occasions), were carried out to test the effect of the information meeting on the fear-related variables in IBM SPSS 22. The level of significance was set to $p = .05$.

Interviews and Qualitative Analyses

The interviews were organized according to a semistructured guide that allowed the informants who had participated in the wolf-information meetings to expand on themes that they considered to be of particular interest. The guide covered the following overarching topics: memories of the information meetings, view of wolves and managing authorities, and view of mitigation measures. The latter theme is not reported here. The interviews were held by telephone and each lasted approximately 1 hour. All informants consented to recording of the conversation. A thematic analysis across interviews was carried out with the objective of understanding the informant's experience of attending the meeting (Braun and Clarke 2008). An inductive approach was employed in the analysis to identify semantic

Table 1. Overview of the concepts measured by means of the questionnaire including formulation of items, response scale, and for calculated indices the internal reliability.

Concept	Items	Response scale	Internal reliability, Cronbach's α
Vulnerability ^a	<p>I believe that if I came close to a wolf/bear I would be harmed</p> <p><i>I do not believe wolves/bears could be dangerous to me</i></p> <p><i>I believe that I would be able to deal effectively with a wolf/bear by myself if encountered</i></p> <p>If a wolf/bear came nearby I would probably not feel in control</p> <p>I think that the movement of wolves/bears is impossible to understand in advance</p> <p><i>I find a wolf/bear to be predictable in their movements</i></p> <p>I trust that the County Administration Board manages problematic situations involving wolves/bears with consideration to people who live in wolf/ bear areas</p> <p>I trust that the Wildlife Damage Centre manages problematic situations involving wolves/bears with consideration to people who live in wolf/ bear areas</p> <p>I trust that the Swedish Environmental Protection Agency manages problematic situations involving wolves/bears with consideration to people who live in wolf/ bear areas</p> <p>I trust that the government manages the wolf/bear population with consideration to people who live in wolf/bear areas</p> <p>How do you feel about encountering a wolf near where you live?</p>	<p>Likert scale, 1 = completely disagree, 5 = completely agree</p>	<p>pre-event $\alpha = .82$, postevent $\alpha = .80$</p>
Social trust ^b	<p>I trust that the County Administration Board manages problematic situations involving wolves/bears with consideration to people who live in wolf/ bear areas</p> <p>I trust that the Wildlife Damage Centre manages problematic situations involving wolves/bears with consideration to people who live in wolf/ bear areas</p> <p>I trust that the Swedish Environmental Protection Agency manages problematic situations involving wolves/bears with consideration to people who live in wolf/ bear areas</p> <p>I trust that the government manages the wolf/bear population with consideration to people who live in wolf/bear areas</p> <p>How do you feel about encountering a wolf near where you live?</p>	<p>Likert scale, 1 = completely disagree, 5 = completely agree</p>	<p>pre-event $\alpha = .79$, postevent $\alpha = .89$</p>
Valence ^{c,d} Arousal ^{c,d}	<p>I trust that the County Administration Board manages problematic situations involving wolves/bears with consideration to people who live in wolf/ bear areas</p> <p>I trust that the Wildlife Damage Centre manages problematic situations involving wolves/bears with consideration to people who live in wolf/ bear areas</p> <p>I trust that the Swedish Environmental Protection Agency manages problematic situations involving wolves/bears with consideration to people who live in wolf/ bear areas</p> <p>I trust that the government manages the wolf/bear population with consideration to people who live in wolf/bear areas</p> <p>How do you feel about encountering a wolf near where you live?</p>	<p>Semantic differentials^c Valence: 1 = sad, depressed, displeased; 5 = glad, happy, pleased Arousal: 1 = dull, passive, sleepy; 5 = peppy, active, awake Affect grid^d Valence: 1 = unpleasant, 5 = pleasant Arousal: 1 = not aroused, 5 = aroused</p>	<p>Semantic differentials +affect grid Valence: pre-event $\alpha = .94$, postevent $\alpha = .96$ Arousal: pre-event $\alpha = .72$, postevent $\alpha = .75$</p>

Specific feeling of fear ^a	The thought of encountering a wolf could raise specific feelings. How do you feel?	Likert scale, fear:
Socio-demographics	Age	0 = not at all,
	Gender	6 = very strong
Perception of the meeting, measured at posttest only	Did you find the information interesting?	Years
	Did you find the information credible?	Male/female
	Did you learn something new?	Likert scale:
	What was the most important information?	1 = not at all,
		2 = rather little,
		3 = neither nor,
		4 = rather much,
		5 = very much,
		open-ended

Note. Items in italics indicate reversed in coding.

^aThe cognitive vulnerability model, Armfield and Mattiske (1996); Johansson et al. (2012).

^bSalient-value similarity, Johansson et al. (2012); Winter and Knap (2001).

^cThe Swedish Core Affect Scale, Västfjäll and Gärling, (2007).

^dAffect grid Russell, Weiss, and Mendelsohn (1989); Johansson et al. (2012).

^eSpecific feeling of fear, Jacobs et al. (2014).

themes, focusing on field-specific concepts and understandings revealed in the interviews (Patton 1990).

Results

In the postevent questionnaire, most participants reported that the information was interesting (W-sample: 81%, BB-sample: 100%) and that they learned something new (W-sample: 63%, BB-sample: 89%). These results suggest that most participants appreciated and elaborated on the information provided, so the meetings could potentially tap into the appraisal process regarding large carnivores. Most participants also reported that the information was rather or very credible (W-sample: 73%, credibility Likert scale $M = 3.90$, $SD = 1.10$; BB-sample: 97%, credibility Likert scale $M = 4.71$, $SD = 0.60$).

Perceived Vulnerability

In line with H1, participants reported a reduced perceived vulnerability after the information meetings. They appraised a potential encounter with wolves/brown bears as less dangerous, unpredictable, and uncontrollable, as indicated by a significant decrease between pre-event and postevent ratings (main effect rating time vulnerability: $F(1,195) = 101.81$, $p < .001$, $\eta_p^2 = .34$). Participants in the BB-sample and the WC-sample, who found the information more credible, seemed more strongly affected than participants in the WNC-sample (interaction effect rating time vulnerability \times group: $F(2,195) = 26.08$, $p < .001$, $\eta_p^2 = .21$; Figure 1A). There was also a significant difference between groups, suggesting that the BB-, WC-, and WNC-samples generally differed in their appraisal of brown bears and wolves (main effect group: $F(2,195) = 8.23$, $p < .001$, $\eta_p^2 = .08$, Figure 1A).

In the open-ended question, participants in the brown bear information meetings stated that the most important information provided regarding vulnerability was how brown bears react when close to humans, and how to act in the event of a close encounter. Participants in the wolf information meetings stated that particularly valuable information concerned wolf characteristics (i.e., how to differentiate between a wolf and a dog) and behavior, especially how wolves act when people and dogs get close.

Similarly, the follow-up interviews of the wolf information meetings emphasized data on size and local range of population and on wolf behavior toward dogs as being especially interesting parts of the information, illustrated in the following quotation.

The most interesting for me personally is that if a wolf seems to be curious near buildings, there's nothing wrong with that wolf, it's perfectly normal, very probably a young wolf that is curious and doesn't know better.—I had thought that the wolf was really timid but it was completely normal behavior. (#6 male)

Social Trust

Participants reported a higher degree of social trust in authorities, confirming H2, after the information meetings. This was shown by a significant increase between pre-event and postevent ratings (main effect rating time trust: $F(1,195) = 33.82$, $p < .001$, $\eta_p^2 = .15$). The increase in trust was especially pronounced among those who found the information credible, namely, the BB-sample and the WC-sample, whereas the effect seemed marginal in the WNC-sample,

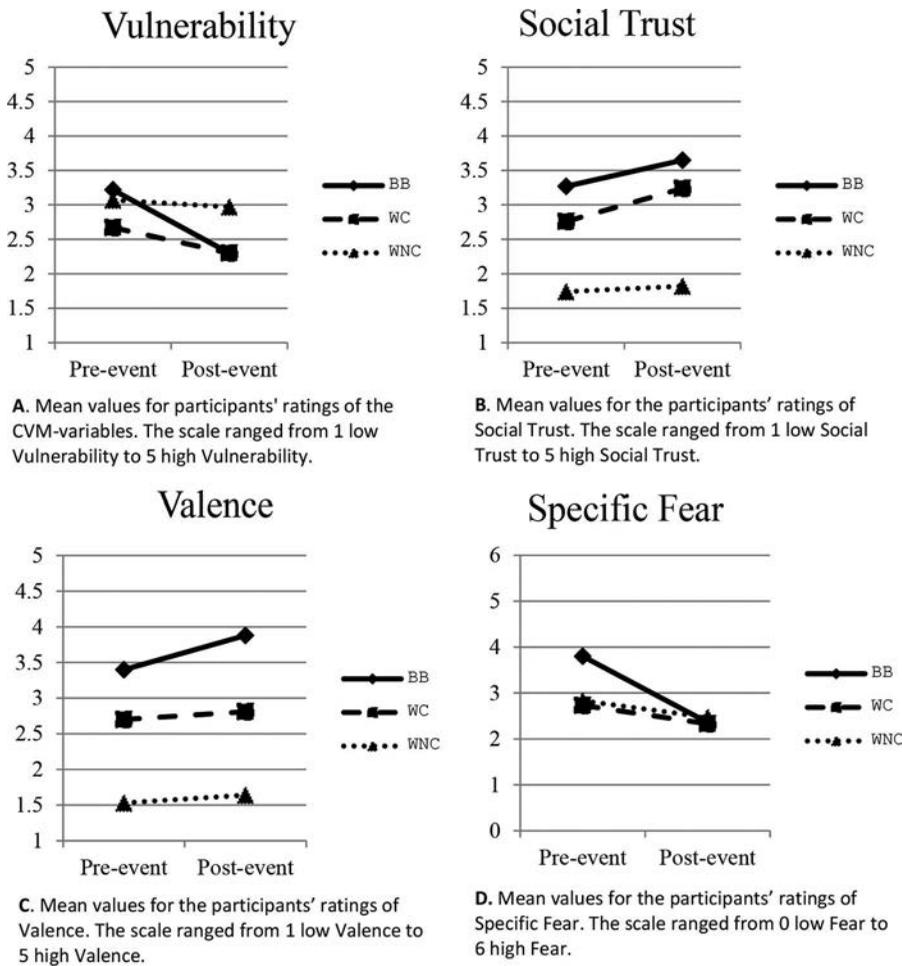


Figure 1. The three groups of participants ratings of (A) vulnerability, (B) social trust, (C) valence, and (D) specific fear pre event and post event. BB—participants in brown bear information meetings, WC—participants in wolf information meetings who found the information to be credible, WNC—participants in wolf information meetings who questioned the credibility of the information.

with the mean value in the last case increasing from $M = 1.74$, $SD = 0.90$, to $M = 1.82$, $SD = 0.89$ (interaction effect trust \times group: $F(2,195) = 4.48$, $p = .013$, $\eta_p^2 = .04$; Figure 1B). A significant main effect of group suggests that the three samples initially differed in social trust (main effect group: $F(2,195) = 44.45$; $p < .001$, $\eta_p^2 = .31$; Figure 1B).

In the open-ended question about wolf information meetings, there were some critical comments about trustworthiness of the sender of the information and facts presented. Some of the informants in the follow-up interviews speculated about a hidden agenda and indicated lack of credibility in how facts and figures were presented. One informant described how mistrust develops when his personal experiences of wolves did not match the content, in this case the CAB's description of wolves.

They present their information. I'm doubtful to the credibility, they only present what looks good. They can present anything, because we can't know whether it's correct. It's down to

confidence. Are they 100% reliable? Do they present in an honest and accurate way? What are their aims, have they discussed how they will put forward the problem? (#1 male)

Other informants stated that the information was objective and well balanced, and that the authorities came across as trustworthy at the meeting. As an example, information about the technology used and the specific choice of technology for wolf tracking and monitoring, such as global positioning system (GPS) data and DNA analysis, was described as something that had increased their trust. That was also illustrated by their view on increased openness regarding data on wolf movements.

The openness from the authorities has become much better. That's just super-positive for the wolf, for everyone. That they really say that something's going on, so that you're prepared. (#2 female)

Trust and mistrust were further fueled by the informants' interpretation of meta-communication. For example, the informants referred to how the discussion was steered by the authorities, what issues emerged, and which stakeholders were allowed to speak. Inconsistencies in the information provided were highlighted, which was linked to mistrust, as the interpretation was that the authorities gave diverging signals in their messages.

She [the CAB representative] said that the wolf did not care about horses in fields, but those who were there for the horses were worried. It wasn't right at all [that the wolf does not care about horses]. But he [the WDC representative] who was there would follow that question up with the horse owners. It's different, which hat they're wearing then. (#8 male)

Fear

For the hypothesized effect on fear, H3, the participants reported higher valence and a lower specific feeling of fear after the meetings. The effect on valence was shown by a significant increase between pre-event and postevent ratings (main effect rating time valence: $F(1,195) = 23.54$, $p < .001$, $\eta_p^2 = .11$). This effect seemed to be explained by the increase in valence recorded by the BB-sample, whereas the WC-sample and WCN-sample did not substantially change between pre-event and postevent ratings (interaction rating time valence \times group: $F(2,195) = 7.29$; $p < .001$; $\eta_p^2 = .07$). The groups also differed significantly in level of valence (main effect group: $F(2,195) = 31.48$, $p < .001$; $\eta_p^2 = .24$; see [Figure 1C](#)). No significant changes in arousal could be identified.

For the specific feeling of fear, a significant decrease was identified in postevent ratings (main effect of rating time specific fear: $F(1,195) = 27.73$, $p < .001$, $\eta_p^2 = .12$). Again, the change seems to be largest in the BB-sample (interaction rating time specific fear \times group: $F(2,195) = 7.13$; $p < .001$, $\eta_p^2 = .07$). No other effects were shown (see [Figure 1D](#)). Taken together, the significant interactions between rating time of valence and specific fear on the one hand and group on the other hand suggest that information meetings were more efficient in reducing self-reported fear of brown bear than fear of wolves.

Discussion

Managing authorities in Scandinavia commonly arrange public information meetings when the public expresses fear of wolves or bears near human settlements. The goal is to reduce

the proportion of Swedes who report that they are worried or afraid of encountering wolves and brown bears (Swedish Environmental Protection Agency 2014a; 2014b). Informational approaches are considered acceptable interventions among people who are fearful of large carnivores (Frank, Johansson, and Flykt 2015). To date, these meetings have been introduced without any scientific evidence for effect on fear. This study was an attempt to address this gap in knowledge in a highly valid context—among people who live in villages in areas with large carnivores and who had voluntarily chosen to attend an information meeting.

The results suggest that information meetings may help to reduce people's feeling of fear. Significant changes were identified in most participants' self-reported antecedents of fear, for example, a decrease in the appraisal of vulnerability in a potential encounter, an increase in the appraisal of social trust in managing authorities, and changes in subjective assessments of valence and specific feeling of fear. The change was relatively more pertinent among participants in the bear information meetings compared to those in the wolf information meetings. Change was primarily identified among participants in the wolf information meetings who found the information presented credible. The results could be compared with those of Johansson and Frank (2016), who, during the same period, could not identify any similar trend in a reference sample of people not attending information meetings who lived in areas with wolves.

The present results are important to the management of large carnivores and in the context of human–large carnivore conflict, since people's feelings of fear have implications for attitudes toward management and conservation (Jacobs et al. 2014; Frank, Johansson, and Flykt 2015; Sponarski, Vaske, and Bath 2015). The study emphasizes the need to complement cognitive approaches, for example, wildlife orientations (Manfredo, Teel, and Henry 2009), with perspectives capturing intangible costs associated with people's feelings of fear toward large carnivores (Kansky and Knight 2014).

The information content of the meetings seemed to meet basic characteristics of environmental information to reach the intended audience; the information caught participants' attention, it concerned an issue where participants were highly involved, and to most people the information was credible (Gardner and Stern 1996). The framing of information has been shown to be critical in changing public attitudes toward the environment (Gardner and Stern 1996), including black bears (Slagle et al. 2013). If adequately framed, environmental information may also change people's feelings toward the environment (Li 2014). Considering fear of large carnivores, it seems essential that the framing of the information can change the outcome of the appraisal process at a cognitively elaborated level (Flykt et al. 2013). The content of the information and the participants' possible interpretation of the meta-communication should preferably be linked to people's appraisal of large carnivore encounters with regard to the environmental context, that is, the perceived vulnerability, and the social context, that is, trust in managing authorities. The participants' own words confirmed that public information meetings have the potential to tap into the appraisal process, via content and meta-communication, that is, how participants interpret the way organizers present information and how they respond or not to different questions and comments by the audience.

The lack of clear effects among participants who did not find the information credible indicates, in line with previous findings, that trust is difficult to establish in issues concerning wolves, where it would be most important in order to reduce fear (Johansson

et al. 2012; Sjölander-Lindqvist, Johansson, and Sandström 2015). Public information meetings arranged by managing authorities in Sweden are primarily based on one-way communication, and this was also the case in the meetings evaluated in this study. However, dialogue might be more efficient in developing trust (Blekesaune and Rønningen 2010). It would be interesting to develop a format for public information meetings based on dialogue. It would also be advisable to systematically vary content to identify whether some aspects were more important to communicate (Slagle et al. 2013), and to change presenters to control for effects on meta-communication. Collection of observational data could enable a more detailed analysis of the role of social interaction and meta-communication.

All effects were most prominent among participants in the brown bear information meetings. Whether this was due to a generally stronger fear of brown bears (Ericsson et al. 2010), context of meetings, information presented, and/or trust in presenters is impossible to say from this study. The focus of the presentations, although structured in a similar way, may also have different effects due to variation in situational context and present status of the biological research that is more extensive on bear–human interactions (e.g., Smith, Herrero, and DeBruyn 2005; Sahlén et al. 2015) than on wolf–human (e.g., Karlsson, Eriksson, and Liberg 2007; Wam, Eldegard, and Hjeljord 2014) interactions in Scandinavia. Although the respective presenters at the wolf information meetings and the brown bear information meetings had extensive experience and similar training for the task, possible differences due to personal style cannot be ruled out.

Participants reflected the groups usually attracted to public information meetings about large carnivores in Sweden. This includes a majority of elderly people who have time to attend meetings, and people who commonly have heard wolves/brown bears, seen tracks of the animals, and had incidents involving pets and livestock. Moreover, members of the public in Sweden tend to express a relatively high trust in authorities (Rothstein and Stolle 2003). These sample characteristics set limitations for generalizations to a wider audience, for example, people who live in more urbanized areas.

The study was based on the one group pretest/posttest design (Cook and Campbell 1979). It could be argued that the results would be due to expectancy effects rather than the information meeting per se. Expectancy effects cannot be disregarded, but considering that the participants reported that they learned something new, and the match between the content of the information and antecedents of self-reported fear of large carnivores, it seems unlikely that this would be the full explanation of the identified changes. Further studies should attempt to include a control group. The study design employed has weaknesses regarding effects of history and maturation of participants, but data were collected within a short time interval, rendering results less susceptible to these threats to validity. The short time span between pre-event and postevent sets limitations with regard to the effect of the information meetings over time. Further studies should also strive to follow-up on long-term effects.

Conclusions

The effect of information in human–large carnivore conflicts is disputed. Previous studies are inconsistent in content and format of information provided, species concerned, and outcome variables assessed (e.g., Dunn, Elwell, and Tunberg 2008; Gore et al. 2008; Baruch-Mordo et al. 2011; Slagle et al. 2013). None of these results could be translated into

the effect on fear of wolves and brown bears in Scandinavia. In the present study, a majority of the people who chose to attend the meetings found the information interesting and reported they learned something new. The results also suggest that information meetings may tap into the appraisal process behind the feeling of fear among people who live in large-carnivore areas. Information meetings may be particularly useful as an intervention to address fear of brown bears, but also to some extent fear of wolves. The presence of a group of participants who did not find the wolf information credible indicates the importance of considering the match between sender, content, medium, and audience in attempts to address fear (Decker, Riley, and Siemer 2012). An important result (or lack of result) in this context is that there was no indication that the meetings would increase people's feelings of fear in the group of participants who did not find the wolf information credible. This implies that introducing information meetings would at least not exacerbate the social conflict.

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