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Controlled exposure reduces fear of brown bears

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ABSTRACT

Fear of large carnivores such as brown bears may restrict people's outdoor activities regardless of experts' estimated risk of attack. This research study empirically examined three exposure interventions in the form of guided walks intended to give people living in brown bear areas tools for coping with their fear. All interventions significantly reduced fear, decreased people's perceived vulnerability, and increased their social trust in wildlife management authorities. The walk including an encounter with a radio-collared bear in a wild bear habitat resulted in the largest reduction in fear, followed by the walk in the wild bear habitat only and then the walk in a park with captive bears. The wild bear habitat walk was the intervention best suited for further development as it may be used in any area where bears occur and without affecting animal welfare.

KEYWORDS

Fear; large carnivores; exposure; interventions

Introduction

Europe's large carnivore populations are increasing and some of this expansion is occurring in human-dominated landscapes outside protected areas (Chapron et al., 2014). In Sweden, the brown bear (*Ursus arctos*) population has increased six-fold over the last 40 years from approximately 500 bears to 3000 bears (Kindberg et al., 2011), which, in turn, increases the likelihood of interactions between humans and brown bears. Experts' objectively estimated risk of being injured or killed by a brown bear in Sweden is low, for people involved in non-hunting outdoor activities equalling an annual per capita risk of 0.00000025 (Støen et al., 2018). Nevertheless, feelings of fear are based on a wider set of appraisals than the objectively estimated risk, and surveys in Sweden show that more than 40% of the people living in areas with bears report being afraid of bears when outdoors (Ericsson, Sandström, Kindberg, & Støen, 2010).

Because of this feeling of fear people may avoid outdoor recreation and nature-based activities that play significant roles among those who live in the Swedish countryside (Fredman, Stenseke, Sandell, & Mossing, 2013). Fear of attacks on children, family members, or oneself, may constitute an irritant associated with elevated arousal (i.e., increased physiological activation) and negative valence (i.e., something being intrinsically bad), and become an environmental stressor (Baum, Singer, & Baum, 1982). The presence of an environmental stressor may result in an allocation of mental resources that reduces people's cognitive

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capacity to handle other tasks (Flykt, Johansson, Karlsson, Lindeberg, & Lipp, 2013). From a long-term perspective, such stress potentially affects perceived quality of life, well-being, and health (Moser, 2009). If the fear is widespread, these feelings may affect the individual's life, and effects policy support (Jacobs, Vaske, Dubois, & Fehres, 2014; Johansson, Sjostrom, Karlsson, & Brannlund, 2012; Slagle, Bruskotter, & Wilson, 2012).

Previous studies propose four groups of interventions that authorities may offer people who fear large carnivores: (a) information and education, (b) exposure to animals and habitat, (c) collaboration and participation, and (d) financial incentives. All four types of interventions potentially reduce fear responses to large carnivores, but evaluations are scarce and results contradictory (Johansson, Ferreira, Støen, Frank, & Flykt, 2016).

Theoretical Departure

According to emotional appraisal theory (Scherer, 2001), emotions are based on cognitive evaluations and appraisals of an event such as the presence of a brown bear. These appraisals result from mental processes that are characterized by different degrees of complexity, automaticity, and consciousness (Leventhal & Scherer, 1987). In the appraisal process, the perceived coping potential (i.e., the ability to handle or deal with a new event) to a potentially threatening event (i.e., the potential presence of a brown bear) is a key factor in fear (Scherer, 2001).

Fear of large carnivores is commonly captured by self-reports as either a general affective experience of negative valence (something intrinsically bad) or as a discrete feeling of fear (Jacobs, Fehres, & Campbell, 2012). Fear can also be expressed as physiological (Flykt & Bjärtå, 2008), central nervous (Flykt & Caldara, 2006), and behavioral changes (Flykt, 2006; Flykt, Bänziger, & Lindeberg, 2017; Flykt, Lindeberg, & Derakshan, 2012, see Jacobs et al., 2012 for an overview). Behavioral changes are among other noticeable in the time needed to perform cognitive tasks, which can be assessed by an experimental task, the Implicit Association Test (IAT) (Flykt et al., 2013; Teachman, Gregg, & Woody, 2001).

The relevant appraisals that build the individual's experienced fear may say something about to what extent an intervention may increase the coping potential. Research into human-wildlife interactions suggests that fear of brown bears results from appraisals at different levels of the environmental and social contexts of a potential bear encounter (Flykt et al., 2013; Johansson et al., 2016; Küller, 1991). The appraisal of the environmental context includes several dimensions of the animal species (Johansson & Karlsson, 2011; Prokop & Fancovicová, 2010). The relevant appraisal of the environmental contexts in a brown bear encounters are (a) the perceived degree of danger the animal represents (i.e., how much the animal could harm the person), (b) the perceived unpredictability of the animal's movements (i.e., uncertainty about whether the animal may approach or attempt to attack the person), and (c) perceived uncontrollability (i.e., the person's lack of control when responding to an animal encounter). These dimensions are equivalent to the variables in the Cognitive Vulnerability Model (CVM) of animal fear (Armfield, 2006, 2007; Johansson & Karlsson, 2011; Johansson, Karlsson, Pedersen, & Flykt, 2012).

For appraisals of the social context, social trust is relevant (Johansson et al., 2012; Johansson et al., 2016). According to the salient-value-similarity (SVS) model, social trust is the willingness to rely on those who are formally responsible for developing policies and taking measures (Cvetkovich & Winter, 2003). Social trust is affected by a person's

comparison between his or her own salient values and those values concluded to be salient for in the present case representatives of managing authorities.

The role of factual knowledge of the feared species in reducing fear is debatable (Field, 2001), but practical knowledge of how to behave has been demonstrated to reduce fear and improve coping in encounters with the feared animal, at least among people with dog phobia (Hoffman & Human, 2003; Hoffman & Odendaal, 2001).

Exposure to a feared animal *in vivo* under controlled conditions has been used in treating the phobic fear of smaller animals (Öst, 1985). This approach combined with role modeling appropriate behavior is expected to alter the appraisal of vulnerability and has been effective in reducing fear of spiders and snakes (Öst, 1985, 1989, 1996). A similar approach using animal or habitat exposure under controlled conditions to increase the predictability of animal behavior and reduce the uncontrollability of human reactions during an encounter is often proposed in environmental education (Almeida, Vasconcelos, & Strecht-Ribeiro, 2014; Prokop & Fancovicová, 2010; Røskaft, Bjerke, Kaltenborn, Linnell, & Andersen, 2003). One educational program showed that an experiential education approach in field resulted in a more positive view of interactions with coyotes (Sponarski, Vaske, Bath, & Loeffler, 2016). This approach may be difficult to apply to elusive species because they are hard to observe in the field. Studies of exposure therapy (Öst, 1985, 1989, 1996) suggest that people who do not move alone in the forest for fear of encountering the species may require firmer guidance and a supportive social setting than what is offered in the experiential education approach.

Aim of Study

Taking advantage of access to radio-collared wild brown bears and a wildlife park with bears in enclosures, we experimentally examined the effect of exposure interventions to brown bears and their natural habitat on human fear of brown bears. The objective was to compare the effects of three types of bear exposures during guided walks offered to people living in areas with brown bears: (a) Wild Bear Encounter Walk – participants with an experienced guide approached a wild radio-collared bear at close range resting in its natural habitat; (b) Wild Bear Habitat Walk – participants with an experienced guide walked in natural brown bear habitat visiting previous resting locations of radio-collared brown bears, but without monitoring or encountering radio-collared bears; and (c) Captive Bear Park Walk – participants with an experienced guide walked in a wildlife park observing captive bears in large enclosures. It was expected that the exposure interventions would change the outcome of the participants' appraisals of a potential brown bear encounter in the wild, more specifically it would be seen as:

H₁ a change in fear, in terms of decreased self-reported fear, negative valence, arousal, and avoidance.

H₂ behavior related change as expressed in reduced response times in an Implicit Association Test (IAT), and

H₃ changes in antecedents of the appraisal outcomes, in terms of decreased vulnerability, and increased social trust and knowledge.

Methods

Participants

The study involved 75 participants who reported being afraid of encountering brown bears in the wild (79% female and 21% male; age 20–84 years, $M = 51$ yrs, $SD = 15$ yrs). They were recruited via advertising in local media and at meeting spots such as grocery stores, libraries, cinemas, and gyms in an area with an established brown bear population. Participants were allocated to one of the three types of exposure interventions (see Table 1). Participants were paid compensation (SEK 500, approximately USD 55) after completing the study.

Study Area

The study was conducted in the County of Dalarna in south-central Sweden. Participants met outside Orsa Rovdjurspark, a wildlife park with captive brown bears in enclosures (<http://www.orsarovdjurspark.se/>). The park is surrounded by forests with a few scattered villages. The forests have a relatively dense brown bear population (approximately 30 bears per 1,000 km², Solberg, Bellemain, Drageset, Taberlet, & Swenson, 2006). The landscape is hilly with elevations of 200–1,000 m, and the vegetation consists of intensively managed forest dominated by Scots pine (*Pinus silvestris*) and Norway spruce (*Picea abies*), with heather (*Calluna vulgaris*), grasses (*Deschampsia spp.*), and berry-producing shrubs (*Vaccinium spp.*) dominating the understory layer (Nellemann et al., 2007).

Procedure

The participants were invited in groups of up to four people at a time. Upon arrival, participants were informed of the study's aim and general procedure and that they were allowed to withdraw at any time without any consequences. All participants signed an informed consent form. They were invited to a psychology laboratory, completed the first set of self-report questionnaires and did an IAT on a laptop (Time 1, T1). They then met their guides and departed on the allocated interventions. Upon return, participants completed post-tests comprising the similar self-reports, IAT, and written questions about their experience of the intervention (Time 2, T2). Before leaving, the participants were debriefed. Three months later (after the major mushroom and berry-picking season), participants were mailed a questionnaire and asked to complete the self-reports once more (Time 3, T3).

Exposure Interventions – Three Types of Guided Walks

The interventions were jointly developed by researchers in psychology and ecology and by the four guides. The format and information followed those used in the pilot study, in

Table 1. Participants in the three exposure interventions.

Type of walk	<i>n</i>	Gender (%)		Age (years)		
		Male	Female	Range	<i>M</i>	<i>SD</i>
Wild Bear Encounter Walk	24	12	88	26–72	52	14
Wild Bear Habitat Walk	27	30	70	20–84	49	17
Captive Bear Park Walk	24	30	70	22–74	53	13

which 25 people who reported being fearful of brown bears participated in two different walks in a within-subject design: (a) a guided walk within 50 m of a wild radio-collared brown bear resting during daytime (Wild Bear Encounter Walk) and (b) a guided forest walk in an area with a wild bear population, without encountering bears or signs of bears; or providing any information about bears (Forest Walk). The participants reported significantly reduced feelings of fear after the walk encountering bears, but not after the forest walk (Johansson et al., 2016).

In the present study, all three interventions intended to provide people with tools for coping with their fear of encountering bears by tapping into the appraisals that build the fear. In addition to the exposure component, the social setting and information content – both kept constant across the interventions – were considered in the design. The information presented during the interventions was based on bear research in Scandinavia. A set of general principles to be followed by the guides was developed:

- (1) Start from participants' motivations and establish a comfortable social setting – The guides were instructed to listen to participants' personal experiences and feelings in conversations. The information provided by guides should be the same in all groups, but the order of presentation flexible to participants' specific concerns. Scientific data and personal experiences of bear encounters should be presented without expressing personal values or commenting on policy.
- (2) Relate information content to the coping potential in the appraisal process – The content was designed to tap into identified antecedents of fear (i.e., appraisal of vulnerability and social trust). Based on behavioral studies of wolves and bears in Scandinavia, typical bear behavior near humans was described (relating to predictability of animal behavior). The frequency of attacks on humans in Sweden and globally was reported. Human behaviors known to increase risk of attack during outdoor activities (e.g., hunting or hiking with or without dogs) were also presented (relating to perceived danger of a potential encounter). Specific recommendations were made on how to behave in areas with brown bears and when encountering brown bears to reduce risk of attack (tapping into the perceived controllability of one's own behavior). As for social trust, the guides clarified the sender of the information, and briefly introduced themselves and their experience of field work.
- (3) Anchor the information in the physical environment – Point out characteristics of brown bear habitat and signs, for example, places with rugged terrain and dense vegetation used by brown bears as resting sites in daytime.
- (4) Model appropriate human behavior – Instruct in behavior to avoid encountering brown bears, for example, making sounds when walking in brown bear resting habitat.

These principles were practiced in all three interventions, but the locations and contexts of the interventions differed: The *Wild Bear Encounter Walk* followed exactly the same format as the pilot study (Johansson et al., 2016). The guide first drove the participants to the starting point. The walk then followed the standard Scandinavian Brown Bear Research Project (SBBRP) protocol for studying the behavior of brown bears when encountering humans (Moen, Støen, Sahlén, & Swenson, 2012; Sahlén, Ordiz, Swenson, & Støen, 2015). The guide and participants walked together towards the bear. During the walk, the bear was monitored using signals from a radio collar on the bear. The participants did not see the bear, which is

normal for most encounters, but its presence could be continuously determined from the signals emitted by the VHF tracking equipment (Moen et al., 2012; Sahlén et al., 2015). The walk started a few hundred metres from the bear and was directed so that the participants would pass the bear at a distance of approximately 50 m. The guide and participants spoke with each other during the walk and kept a normal hiking pace. The walks took place in dense vegetation and difficult walking conditions when near the bears because bears choose their daytime resting sites in dense vegetation and rugged terrain away from infrastructure (Ordiz, Støen, Delibes, & Swenson, 2011). The *Wild Bear Habitat Walk* was conducted in a similar manner, but without a radio-collared bear. The information, vegetation, and terrain were the same, but instead of passing within 50 m of a wild radio-collared bear, the group visited locations where radio-collared bears had earlier been approached by humans. During the *Captive Bear ParWalk*, the same information was given as in the other two walks, but instead of experiencing the terrain wild bears use, the participants walked in a wildlife park with the guide observing captive brown bears in enclosures.

The guides were all males (aged 25–62 years) and had at least five years of experience of fieldwork, research on bears linked to the SBBRP, and extensive experience of communicating with the public. The guides were rotated between types of walks. Initial analyses showed no significant differences in the outcomes of the walks between guides. Each walk lasted 1–2 h, depending on the driving distance to the starting point and the walking conditions.

Instruments and Test Procedures

Most self-report data were collected using previously published questionnaire items for assessing fear-related variables (Johansson et al., 2016; Johansson, Frank, Støen, & Flykt, 2017). At T1 the self-reported *feeling of fear* was evaluated using the following questions: Anticipate the following situations and assess your worry/fear right now of being attacked by a single brown bear in each of the situations described. 1) You are walking alone in the forest in an area in which you know there are bears. You see a solitary bear that weighs over 80 kg and is 150 cm long, 50 m away. How strong is your worry/fear that the bear will attack you? 2) You are in a group of three people walking together in the forest in an area in which you know there are bears. You see a solitary bear that weighs over 80 kg and is 150 cm long, 50 m away. How strong is your worry/fear that the bear will attack one of you? 3) You are walking in the forest with your dog in an area in which you know there are bears. You see a solitary bear that weighs over 80 kg and is 150 cm long, 50 m away. How strong is your worry/fear that the bear will attack the dog and you? 4) You are walking in the forest with your child or grandchild (under 12 years old) in an area in which you know there are bears. You see a solitary bear that weighs over 80 kg and is 150 cm long, 50 m away. How strong is your worry/fear that the bear will attack the child and you? Each situation was also described for a female bear with cubs. This yielded a total of eight different situations for which the participants assessed their worry/fear on a scale ranging from 0 = none at all to 10 = very strong. The responses were highly correlated and an averaged index of self-reported fear was computed (Cronbach's $\alpha = .96$). *Valence* and *arousal* were assessed using the following question: "How do you feel about encountering a bear near where you live?" Answers were given using an affect grid with the axis *valence*, ranging from 1 = unpleasant to 5 = pleasant, and *arousal*, ranging from 1 = not aroused to

5 = aroused. *Avoidance* was also assessed with the following question: “Have you during the last two months avoided any of the following activities in the forest (walking alone, picking berries or mushrooms, exercising, walking the dog, and bringing small children into the forest) because there might be brown bears in the forest?” The frequency of avoidance was rated as 1 = never, 2 = sometimes, 3 = often, 4 = always, or 5 = n/a.

The fear-related variables were complemented with an experimental measure for observing behavioral change in allocation of mental resources – *IAT*. In the *IAT* participants were asked task to sort “good” respectively “bad” words with animal pictures, while their response times were measured. Shortened response times indicate a reduced conflict in the association between a word category and an animal category (Flykt et al., 2013; Greenwald, McGhee, & Schwartz, 1998). The task consisted of four blocks. In two blocks, bear pictures were to be sorted with bad words (8 trials per block) and hare (*Lepus timidus*) pictures with good words (8 trials per block). In the remaining two blocks, the bear pictures were to be sorted with good words (8 trials per block) and hare pictures with bad words (8 trials per block). Each block consisted of 32 trials, of which half were animal pictures (equal numbers of each animal) and half were words (half “good” and half “bad” words). Inter-trial intervals were approximately 4 s (Flykt et al., 2013). During the experiment, a word or an animal picture appeared in the lower center of the screen. The participants were instructed that their task was to sort the animal pictures and the words according to the categories in the upper corners of the screen. The participants were encouraged to respond as quickly as possible without jeopardizing accuracy. In the analyses, we only considered the good words associated with bears and bad words associated with hares.

Vulnerability was based on the CVM-variables and assessed using six items: “I believe that if I came close to a brown bear I would be harmed;” “*I do not believe bears could be dangerous to me;*” “*I believe that I would be able to deal effectively with a brown bear by myself if encountered;*” “If a brown bear came near me, I would probably not feel in control;” “I think that the movement of brown bears is impossible to understand in advance;” and “*I find brown bears to be predictable in their movements*”. Items in italics were reversed. Responses ranged from 1 = completely disagree to 5 = completely agree. An averaged index was computed (Cronbach’s $\alpha = .80$). *Social trust* was based on the SVS-model and assessed using four items: “I trust the County Administration Board to manage problematic situations involving brown bears with consideration for people who live in bear areas;” “I trust the Swedish Wildlife Damage Centre to manage problematic situations involving brown bears with consideration for people who live in bear areas;” “I trust the Swedish Environmental Protection Agency to manage problematic situations involving brown bears with consideration for people who live in bear areas;” and “I trust the government to manage the brown bear population with consideration for people who live in bear areas”. Responses ranged from 1 = completely disagree to 5 = completely agree. An averaged index was computed (Cronbach’s $\alpha = .86$). *Factual knowledge* was assessed using nine multiple-choice items capturing participants’ knowledge related to bears and formulated to fit the context of the survey. The three first items concerned tracks and signs of bears in the terrain, such as footprints, scats, and claw marks, while an additional biological question asked about the weight of an adult male bear in spring. The next three questions dealt with situations in which the likelihood of attack is higher, and how to interpret the behavior of a bear standing on its hind legs or vocalizing when meeting a human. The final two questions concerned the recommended behavior if one does not wish to see a bear while in the forest and how to act if one meets a bear at

a distance of 30 m. A total knowledge score was calculated for correct answers. This score could vary between 1 and 9. In addition, the questionnaires at T2 and T3 contained open-ended questions about the participants' most significant experience and memories of the walks.

Results

The results showed that all three exposure interventions reduced the self-reported fear of encountering brown bears. Although the Wild Bear Encounter Walk was the most effective intervention in reducing feelings of fear, the results suggested that both the Wild Bear Habitat Walk and Captive Bear Park Walk were also effective in reducing fear of brown bears (Figures 1 and 2, mean values and standard deviations presented in Appendix 1).

Effects on Self-Reported Feeling of Fear

The expected effect on fear (H_1) was tested in repeated-measures ANOVAs of feelings of fear, valence, and avoidance of the three different exposure interventions. Self-reported *feeling of fear* of a brown bear encounter significantly decreased for the Wild Bear Encounter Walk ($F(1, 23) = 64.58, p < .001, \eta_p^2 = .74$), Wild Bear Habitat Walk ($F(1, 26) = 36.16, p < .001, \eta_p^2 = .58$), and Captive Bear Park Walk ($F(1, 23) = 41.99, p < .001, \eta_p^2 = .65$). In all three interventions, the significant decrease occurred from T1 to T2 and T3. The self-reported *valence* significantly increased from T1 to T2 and T3 for the Wild Bear Encounter Walk ($F(1, 23) = 37.28, p < .001, \eta_p^2 = .62$), Wild Bear Habitat Walk ($F(1, 26) = 24.20, p < .001, \eta_p^2 = .48$), and Captive Bear Park Walk ($F(1, 23) = 20.25, p < .001, \eta_p^2 = .47$). The self-reported *arousal* significantly decreased for the Wild Bear Encounter Walk ($F(1, 23) = 3.72, p = .032, \eta_p^2 = .14$); significant change was identified between T2 and T1 and T3, with the highest *arousal* reported at T2. No significant changes were identified in self-reported *arousal* for the Wild Bear Habitat Walk or Captive Bear Park Walk. The participants in the Wild Bear Encounter Walk and Wild Bear Habitat Walk reported less *avoidance* of activities in the forest from T1 to T3, whereas participants in the Captive Bear Park Walk did not (Wild Bear Encounter Walk: $F(1, 23) = 27.32, p < .001, \eta_p^2 = .54$; Wild Bear Habitat Walk: $F(1, 26) = 20.14, p < .001, \eta_p^2 = .44$; and Captive Bear Park Walk $F(1, 23) = 1.41, n.s.$).

Effects on Experimental Measure of Fear – IAT

The hypothesized *behavior related change* operationalized as delayed response times in IAT (H_2) was tested in repeated-measures ANOVAs of the association between positive words and brown bear pictures versus negative words and hare pictures. The analysis was conducted for each of the three exposure interventions. A tendency was found for the Wild Bear Encounter Walk to promote an association between positive words and bear pictures versus between negative words and hare pictures ($F(1, 24) = 3.13, p = .09, \eta_p^2 = .13$). This tendency was not found for the other two interventions.

Effects on Self-Reported Antecedents of Fear

As for the expected effects on vulnerability, social trust and knowledge (H_3), *Vulnerability* significantly decreased from T1 to T2 and T3 for the Wild Bear Encounter Walk

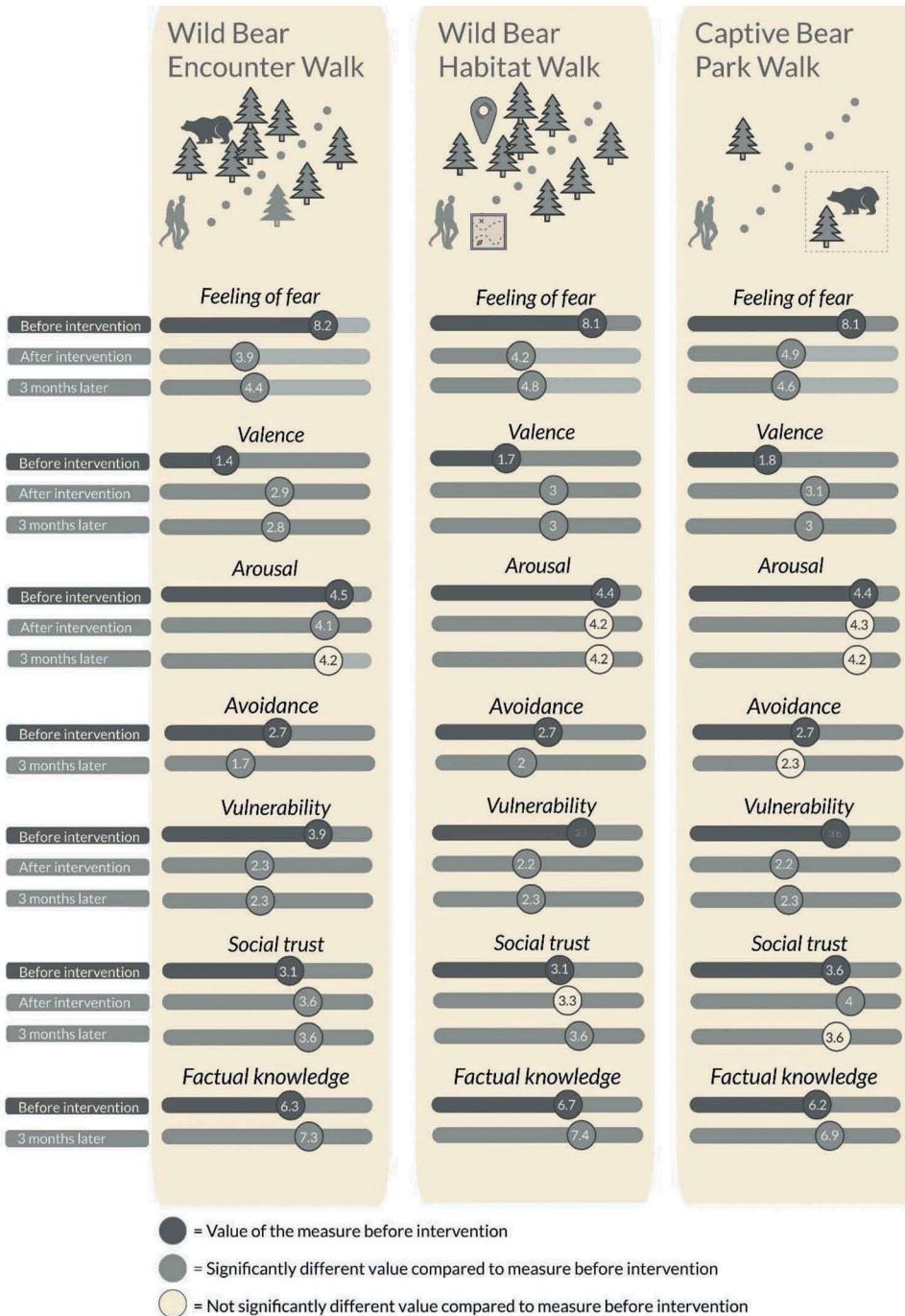


Figure 1. Mean values of measured variables for the three types of exposure interventions before, immediately after, and three months after the interventions.

($F(1, 23) = 107.26, p < .001, \eta_p^2 = .82$), Wild Bear Habitat Walk ($F(1, 26) = 71.50, p < .001, \eta_p^2 = .73$), and Captive Bear Park Walk ($F(1, 23) = 80.78, p < .001, \eta_p^2 = .78$). Post hoc comparisons indicated no significant effect between T2 and T3 in any of the interventions.

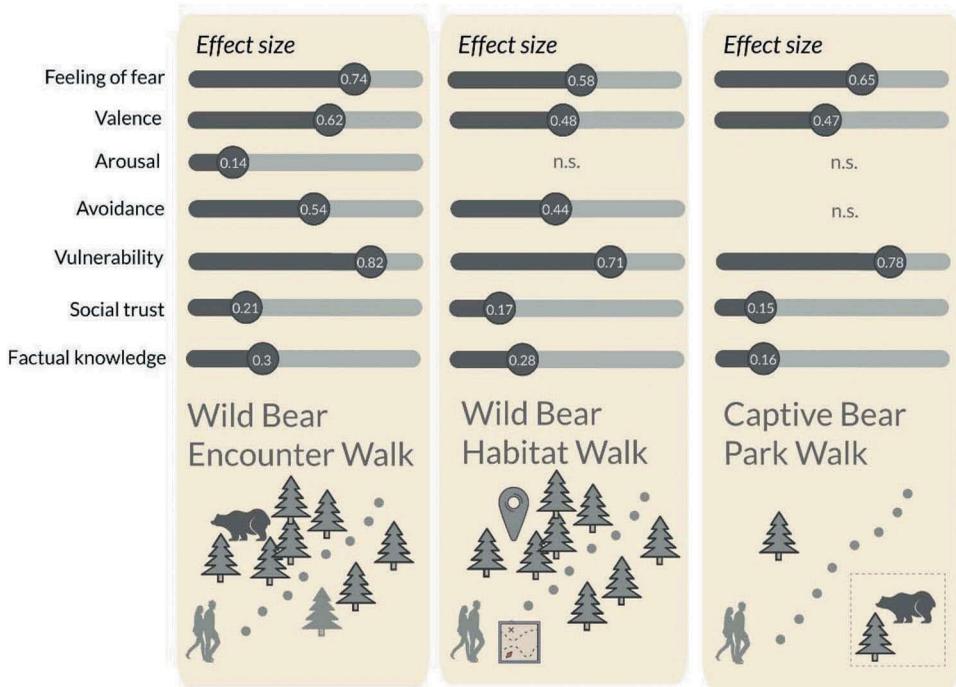


Figure 2. Effect sizes of measured variables for the three types of exposure interventions.

Social trust significantly increased from T1 to T2 and T3 for the Wild Bear Encounter Walk ($F(1, 23) = 6.21, p = .004, \eta_p^2 = .21$). Trust also increased for the Wild Bear Habitat Walk ($F(1, 26) = 5.34, p = .008, \eta_p^2 = .17$), significant change being identified between T1 and T3. Similarly, trust increased for the Captive Bear Park Walk ($F(1, 23) = 3.92, p = .027, \eta_p^2 = .15$); significant change was identified from T2 to T1 and T3, with the highest trust reported at T2. *Knowledge* significantly increased from T1 to T2 for the Wild Bear Encounter Walk ($F(1, 23) = 9.83, p = .005, \eta_p^2 = .30$) and Wild Bear Habitat Walk ($F(1, 26) = 9.93, p = .004, \eta_p^2 = .28$), whereas the effect was somewhat less prominent for the Captive Bear Park Walk ($F(1, 23) = 4.39, p = .047, \eta_p^2 = .16$).

Effect Sizes

The Wild Bear Encounter Walk had as reported above the largest effect size for all measured variables, for a summary see Figure 2. The Wild Bear Habitat Walk was ranked second in effect size for three variables, i.e., valence, social trust, and knowledge, and third for feeling of fear and vulnerability. Arousal and IAT were non-significant. The Captive Bear Park Walk was ranked second in effect size for only two variables and, notably, the three-month follow-up on avoidance was non-significant.

Important Aspects of the Guided Walks: The Participants' Perspective

The written answers to the open-ended questions were extensive and thematically analyzed (Braun & Clarke, 2008). An inductive approach was employed that identified

semantic themes related to the participant's experience of the walks. Coding and analysis were performed with ATLAS.ti 7.5.

The participant's words supported the quantitative results. Most participants felt more relaxed and safer when walking in the forest than before the experiment.

“When I am in the forest I have been able to relax more, and feel safe.”

T3 Woman who participated in Captive Bear Park Walk

Some participants that previously had avoided walking alone in the forest now felt comfortable doing so. Three participants had no use for the guided walks, but had not had the opportunity to walk in the forest since the guided walk. The strongest memory of the walk was the exposure component – the experience of being close to a brown bear and/or seeing signs of bears in the wild under controlled conditions. Especially participants who visited the habitat mentioned brown bears' avoidance of people and choice of rough terrain and concluded that they themselves would never have chosen this terrain.

“The Eureka moment I got when I was shown the terrain bears prefer at daytime”

T3 Woman who participated in Wild Bear Habitat Walk

The participants' words also supported that the guided walks tapped into the appraisal process by stating that they had received relevant and credible information about brown bears in the wild. This relates to the formation of social trust. The information retold about brown bear behavior close to people referred to that the bear avoids people, is not aggressive and other bear behaviors including diurnal pattern. Participants also referred to what they had learned about how they should behave themselves to avoid brown bears, i.e., by making sounds and to avoid the dense parts of the forest. Some participants also wrote about having the experience of their own reaction to being close to a brown bear as unexpectedly being positive. These reflections refer to vulnerability.

The role of the guide and being part of a group was brought forward. The participants referred to the guides' extensive knowledge of brown bears and their personal experiences of situations close to brown bears. Participants felt that the guides created a calm and safe atmosphere in the group that allowed the participants to expose their worry and put all sorts of related questions also those they usually would not dare to ask the so-called “stupid questions”.

Discussion

The results show that exposure to brown bears and typical brown bear habitat may reduce people's fear of encountering brown bears in the forest. The results thereby give support to H_1 . In this study, the exposure was part of guided walks designed to tap into the participants' emotional appraisal of a potential brown bear encounter.

Although the Wild Bear Encounter Walk was most effective in reducing self-reported feelings of fear and was associated with less cognitive interference, our results suggest that the Wild Bear Habitat Walk and Captive Bear Park Walk may also be useful. The results of the three guided walks clearly differ from those of the “Forest Walks” in the same area that had no effect on self-reported feelings of fear (Johansson et al., 2016). Three months after

the guided walks, participants were less prone to avoid outdoor recreational activities than before the walks.

In line with H₃, the exposure interventions altered the emotional appraisal of a brown bear encounter, by changing the antecedents of fear (i.e., perceived vulnerability, social trust, factual knowledge of brown bears). In general, the Wild Bear Encounter Walk and Bear Habitat Walk produced larger effects than did the Captive Bear Park Walk.

The guided walks had a stronger effect on vulnerability than on social trust. This is unsurprising, as vulnerability operationalized as the CVM-variables has previously been shown to play an important role in human fear of bears (Johansson et al., 2012). Vulnerability was also directly addressed in the information content relating to the three relevant dimensions of CVM (predictability of brown bear behavior, controllability of personal reaction of being near brown bears, and danger in terms of risks and incidents), which likely affected the perceived coping potential in an encounter. Social trust, here operationalized according to the SVS-model, may be more difficult to establish as it was likely not only associated with the guides but also influenced by the organizations the guides represented and Swedish policy of brown bear management in general (Johansson et al., 2012, Johansson, Sandström, Pedersen, & Ericsson, 2016).

Level of knowledge was relatively high even before the intervention, but factual knowledge still increased with the intervention. Knowledge of brown bear biology alone may however not pinpoint critical factors in the appraisal process of feelings of fear (Field, 2001).

The IAT is commonly used to assess behavioral change in automatic associations between good or bad connoted words operationalized as measured response times. For example, snake-fearful participants were slower to categorize pictures of snakes with positive words and pictures of spiders with negative words than vice versa, while the inverse result has been shown among spider-fearful participants (Teachman et al., 2001). A feared animal is more readily associated with bad words than with good connoted words. In the present study, the response times for the IAT at T1 and T2 gave some support to H₂ as the participants in the Wild Bear Habitat Walk tended to go from faster associating bears with “bad” words to faster associating them with “good” words. This result is comparable with pre- and post-measures of IAT in relation to exposure treatment of spider phobia (Teachman & Woody, 2003), and indicates that the participants in the Wild Bear Habitat Walk have made a reappraisal of a potential brown bear encounter at an automatic mental processing level.

The guides were instructed to listen to the participants’ motivations and needs and to display appropriate behavior near brown bears. Similar to group treatment in exposure therapy and environmental education programs, participants took part in groups (Öst, 1989; Sponarski, Vaske, & Bath, 2015; Sponarski et al., 2016). That participants were not left alone with their fear, and the positive social atmosphere of the groups was repeatedly mentioned as an appreciated feature of the walks in the open-ended questions. The participants frequently referred to the calmness of the guides and the sense of safety they created, a modeling component also stressed in exposure therapy (Hellström & Öst, 1995; Öst, 1985, 1989, 1996).

The Wild Bear Encounter Walks were more effective in reducing fear than were the Wild Bear Habitat Walks or Captive Bear Park Walks, though the difference in effect size was relatively small. However, developing Wild Bear Encounter Walks on a larger scale is not

feasible as it requires radio-collared bears (with the associated animal welfare concerns as well as costs and logistics of getting people to the right location). Still the Wild Bear Encounter Walks has the closest resemblance to a real encounter and would according to exposure therapy have the highest potential to reduce fear (e.g. Hellström & Öst, 1995; Öst, 1985). To include the Wild Bear Encounter Walk gave the possibility to compare it with the Wild Bear Habitat Walks and Captive Bear Park Walks that would be more feasible and easier to scale up. Of these two, the Wild Bear Habitat Walk is probably the better choice, as this intervention was more effective in providing people with tools for coping with their fear of bears. The Wild Bear Habitat Walks can be used in all areas with bear populations; it does not have to be precisely timed and does not affect the animals' welfare.

More women than men showed interest in participating in the guided walks. One reason may be that in brown bear areas fear of bears among women to a higher degree than among men can be explained by perceived vulnerability (Johansson et al., 2012). Another reason may be that hunters, who are primarily males, are offered courses by hunting organizations. These courses partly focus upon brown bear behavior (Støen et al., 2018).

Participants in all three types of guided walks were exposed not only to bears or bear habitat but also in line with exposure therapy, to a guide who provided information about how to interpret bear behavior and gave instructions on how to act when encountering a bear. In addition, the social setting and information content were tailored to maximize the interventions' effects on perceived fear. Future studies could also focus on analyzing the relative impact of effects of the different components, exposure per se, the role of the guide and social setting, and the information content.

Conclusion

The exposure interventions examined here have clear potential to change the appraisal outcomes of a potential brown bear encounter among people living in brown bear areas and motivated to learn by experience how to cope with their fear of brown bears. Taken together, the results are in line with previous research identifying exposure under controlled conditions as an effective intervention to reduce people's fear of animals such as spiders and snakes. The results are parallel with environmental educational approaches stressing direct experience of wildlife as a way to establish positive relations to animals (Randler, Hummel, & Prokop, 2012; Sponarski et al., 2016). Here, we have demonstrated that it is also possible to obtain such controlled conditions in the context of fear of large carnivores, i.e., brown bears. This was obtained by using guided walks in typical brown bear habitat in which an experienced guide provided information about how brown bears behave near humans. Importantly the information was specifically relating to coping in the appraisal process and combined with modeling of appropriate behavior to avoid bears. This provides people in all areas where bears occur with tools for coping with fear of bears without affecting animal welfare.

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References

- Almeida, A., Vasconcelos, C., & Strecht-Ribeiro, O. (2014). Attitudes towards animals: A study of Portuguese children. *Anthrozoös*, 27, 173–190. doi:10.2752/175303714X13903827487403
- Armfield, J. M. (2006). Cognitive vulnerability: A model of the etiology of fear. *Clinical Psychology Review*, 26, 746–768. doi:10.1016/j.cpr.2006.03.007
- Armfield, J. M. (2007). Understanding animal fears: A comparison of the cognitive vulnerability and harm-looming models. *BMC Psychiatry*, 7. doi:10.1186/1471-244X-7-68
- Baum, A., Singer, J. E., & Baum, C. S. (1982). Stress and the environment. In G. W. Evans (Ed.), *Environmental stress* (pp. 15–74). Cambridge, UK: Cambridge University Press.
- Braun, V., & Clarke, V. (2008). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77–101. doi:10.1191/1478088706qp063oa
- Chapron, G., Kaczensky, P., Linnell, J., von Arx, M., Huber, D., Andrén, H., ... Boitani, L. (2014). Recovery of large carnivores in Europe's modern human-dominated landscapes. *Science*, 346, 1517–1519. doi:10.1126/science.1255826
- Cvetkovich, G., & Winter, P. L. (2003). Trust and social representations of the management of threatened and endangered species. *Environment and Behavior*, 35, 286–307. doi:10.1177/0013916502250139
- Ericsson, G., Sandström, C., Kindberg, J., & Støen, O.-G. (2010). *Om svenskars rädsla för stora rovdjur, älg och vildsvin* [The fear of large carnivores, moose and wildboar in Sweden] Report 2010: 1. Umeå, Sweden: Swedish University of Agricultural Sciences.
- Field, J. (2001). Lifelong education. *International Journal of Lifelong Education*, 20(1–2), 3–15. doi:10.1080/09638280010008291
- Flykt, A. (2006). Preparedness for action: Responding to the snake in the grass. *The American Journal of Psychology*, 119, 29–44. doi:10.2307/20445317
- Flykt, A., Bänziger, T., & Lindeberg, S. (2017). Intensity of vocal responses to spider and snake pictures in fearful individuals. *Australian Journal of Psychology*, 69, 184–191. doi:10.1111/ajpy.2017.69.issue-3
- Flykt, A., & Bjärtå, A. (2008). The time course of resource allocation in spider-fearful participants during fear reactions. *Cognition & Emotion*, 22, 1381–1400. doi:10.1080/02699930701799603
- Flykt, A., & Caldara, R. (2006). Tracking fear snake and spider fearful participants during visual search: A multiresponse domain study. *Cognition and Emotion*, 20, 1075–1091. doi:10.1080/02699930500381405
- Flykt, A., Johansson, M., Karlsson, J., Lindeberg, S., & Lipp, O. (2013). Fear of wolf and bear. *Human Dimensions of Wildlife*, 18, 416–443. doi:10.1080/10871209.2013.810314
- Flykt, A., Lindeberg, S., & Derakshan, N. (2012). Fear makes you stronger: Responding to feared animal targets in visual search. *Attention, Perception, & Psychophysics*, 74, 1437–1445. doi:10.3758/s13414-012-0336-6
- Fredman, P., Stenseke, M., Sandell, K., & Mossing, A. (2013). *Friluftsliv i förändring* [Outdoorlife in transition]. Report 6547. Stockholm, Sweden: Swedish Environmental Protection Agency.
- Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, 74, 1464–1480.
- Hellström, K., & Öst, L.-G. (1995). One-session therapist directed exposure vs two forms of manual directed self-exposure in the treatment of spider phobia. *Behaviour Research and Therapy*, 33, 959–965. doi:10.1016/0005-7967(95)00028-V

- Hoffman, W. A., & Human, L. H. (2003). Experiences, characteristics and treatment of women suffering from dog phobia. *Anthrozoös*, *16*, 28–42. doi:10.2752/089279303786992323
- Hoffman, W. A., & Odendaal, J. S. J. (2001). The effect of behavioral therapy on dog phobia response patterns. *Anthrozoös*, *14*, 29–37. doi:10.2752/089279301786999571
- Jacobs, M., Vaske, J. J., Dubois, S., & Fehres, P. (2014). More than fear: Role of emotions in acceptability of lethal control of wolves. *European Journal of Wildlife Research*, *60*, 589–598. doi:10.1007/s10344-014-0823-2
- Jacobs, M. H., Fehres, P., & Campbell, M. (2012). Measuring emotions toward wildlife: A review of generic methods and instruments. *Human Dimensions of Wildlife*, *17*, 233–247. doi:10.1080/10871209.2012.680175
- Johansson, M., Støen, O.-G., & Flykt, A. (2016). Exposure as an intervention to address human fear of bears. *Human Dimensions of Wildlife*, *21*, 311–327. doi:10.1080/10871209.2016.1152419Q17
- Johansson, M., Ferreira, I., Støen, O.-G., Frank, J., & Flykt, A. (2016). Targeting human fear of large carnivores — Many ideas but few known effects. *Biological Conservation*, *20*, 261–269. doi:10.1016/j.biocon.2016.07.010
- Johansson, M., Frank, J., Støen, O. G., & Flykt, A. (2017). An evaluation of information meetings as a tool for addressing fear of large carnivores. *Society and Natural Resources*, *30*, 281–298. doi:10.1080/08941920.2016.1239290
- Johansson, M., & Karlsson, J. (2011). Subjective experience of fear and the cognitive interpretation of large carnivores. *Human Dimensions of Wildlife*, *16*, 15–29. doi:10.1080/10871209.2011.535240
- Johansson, M., Karlsson, J., Pedersen, E., & Flykt, A. (2012). Factors governing human fear of brown bear and wolf. *Human Dimensions of Wildlife*, *17*, 58–74. doi:10.1080/10871209.2012.619001
- Johansson, M., Sandström, C., Pedersen, E., & Ericsson, G. (2016). Factors governing human fear of wolves: Moderating effects of geographical location and standpoint on protected nature. *European Journal of Wildlife Research*, *62*, 749–760. doi:10.1007/s10344-016-1054-5
- Johansson, M., Sjöstrom, M., Karlsson, J., & Brannlund, R. (2012). Is human fear affecting public willingness to pay for the management and conservation of large carnivores? *Society & Natural Resources*, *25*, 610–620. doi:10.1080/08941920.2011.622734
- Johansson, M., Støen, O.-G., & Flykt, A. (2016). Exposure as an intervention to address human fear of bears. *Human Dimensions of Wildlife*, *21*, 311–327. doi:10.1080/10871209.2016.1152419
- Kindberg, J., Swenson, J. E., Ericsson, G., Bellemain, E., Miquel, C., & Taberlet, P. (2011). Estimating population size and trends of the Swedish brown bear *Ursus arctos* population. *Wildlife Biology*, *17*, 114–123. doi:10.2981/10-100
- Küller, R. (1991). Environmental assessment from a neuropsychological perspective. In T. Gärling & G. W. Evans (Eds.), *Environment, cognition and action* (pp. 111–147). New York, NY: Oxford Univ. Press.
- Leventhal, H., & Scherer, K. (1987). The relationship of emotion to cognition: A functional approach to a semantic controversy. *Cognition and Emotion*, *1*, 3–28. doi:10.1080/02699938708408361
- Moen, G. K., Støen, O. G., Sahlén, V., & Swenson, J. E. (2012). Behavior of solitary adult Scandinavian brown bears (*Ursus arctos*) when approached by humans on foot. *PloS One*, *7*, e31699. doi:10.1371/journal.pone.0031699
- Moser, G. (2009). Quality of life and sustainability: Toward person-environment congruity. *Journal of Environmental Psychology*, *29*, 351–357. doi:10.1016/j.jenvp.2009.02.002
- Nellemann, C., Støen, O.-G., Kindberg, J., Swenson, J. E., Vistnes, I., Ericsson, G., ... Ordiz, A. (2007). Terrain use by an expanding brown bear population in relation to age, recreational resorts and human settlements. *Biological Conservation*, *138*, 157–165. doi:10.1016/j.biocon.2007.04.011
- Ordiz, A., Støen, O.-G., Delibes, M., & Swenson, J. E. (2011). Predators or prey? Spatio-temporal discrimination of human-derived risk by brown bears. *Oecologia*, *166*, 59–67. PMID:21298447. doi:10.1007/s00442-011-1920-5
- Öst, L.-G. (1985). Single-session exposure treatment of injection phobia: A case study with continuous heart rate measurement. *Scandinavian Journal of Behavior Therapy*, *14*, 125–131. doi:10.1080/16506078509456232
- Öst, L.-G. (1989). One session treatment for specific phobias. *Behavior Research and Therapy*, *27*, 1–7. doi:10.1016/0005-7967(89)90113-7

- Öst, L.-G. (1996). One-session group treatment of spider phobia. *Behavior Research and Therapy*, 34, 707–715. doi:10.1016/0005-7967(96)00022-8
- Prokop, P., & Fancovicová, J. (2010). Perceived body condition is associated with fear of a large carnivore predator in humans. *Annales Zoologici Fennici*, 47, 417–425. doi:10.5735/086.047.0606
- Randler, C., Hummel, E., & Prokop, P. (2012). Practical work at school reduces disgust and fear of unpopular animals. *Society & Animals*, 20, 61–74. doi:10.1163/156853012X614369
- Røskaft, E., Bjerke, T., Kaltenborn, B., Linnell, J. D. C., & Andersen, R. (2003). Patterns of self-reported fear towards large carnivores among the Norwegian public. *Evolution and Human Behavior*, 24, 184–198. doi:10.1016/S1090-5138(03)00011-4
- Sahlén, V., Ordiz, A., Swenson, J. E., & Støen, O. G. (2015). Behavioral differences between single scandinavian brown bears (*Ursus arctos*) and females with dependent young when experimentally approached by humans. *PLoS One*, 10, e0121576. doi:10.1371/journal.pone.0121576
- Scherer, K. R. (2001). Appraisal considered as a multi-level sequential checking. In K. R. Scherer, A. Schorr, & T. Johnstone (Eds.), *Appraisal processes in emotion: Theory, methods, research* (pp. 92–120). New York, USA: Oxford University Press.
- Slagle, K. M., Bruskotter, J. T., & Wilson, R. S. (2012). The role of affect in public support and opposition to wolf management. *Human Dimensions of Wildlife*, 17, 44–57. doi:10.1080/10871209.2012.633237
- Solberg, K. H., Bellemain, E., Drageset, O.-M., Taberlet, P., & Swenson, J. E. (2006). An evaluation of field and non-invasive genetic methods to estimate brown bear (*Ursus arctos*) population size. *Biological Conservation*, 128, 158–168. doi:10.1016/j.biocon.2005.09.025
- Sponarski, C. C., Vaske, J. J., & Bath, A. J. (2015). The role of cognitions and emotions in human-coyote interactions. *Human Dimensions of Wildlife*, 20, 238–254. doi:10.1080/10871209.2015.1010756
- Sponarski, C. C., Vaske, J. J., Bath, A. J., & Loeffler, T. A. (2016). Changing attitudes and emotions toward coyotes with experiential education. *The Journal of Environmental Education*, 47, 296–306. doi:10.1080/00958964.2016.1158142
- Støen, O.-G., Ordiz, A., Sahlén, V., Arnemo, J. M., Sæbø, S., Mattsing, G., ... Swenson, J. E. (2018). Brown bear (*Ursus arctos*) attacks resulting in human casualties in Scandinavia 1977–2016; management implications and recommendations. *PLoS One*, 13, e0196876. doi:10.1371/journal.pone.0196876
- Teachman, B. A., Gregg, A. P., & Woody, S. R. (2001). Implicit associations for fear-relevant stimuli among individuals with snake and spider fears. *Journal of Abnormal Psychology*, 110, 226–235. doi:10.1037/0021-843X.110.2.226
- Teachman, B. A., & Woody, S. R. (2003). Automatic processing in spider phobia: Implicit fear associations over the course of treatment. *Journal of Abnormal Psychology*, 112, 100–109. doi:10.1037/0021-843X.112.1.100

Appendix 1. Mean values and standard deviations at three measurement times: T1, before the interventions; T2, immediately after the interventions; and T3, three months after the interventions

Variable	Wild Bear Encounter Walk <i>n</i> = 24		Wild Bear Habitat Walk <i>n</i> = 27		Captive Bear Park Walk <i>n</i> = 24	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Fear T1	8.21	2.00	8.08	2.26	8.21	1.43
Fear T2	3.97	2.10	4.24	2.33	4.96	2.59
Fear T3	4.44	2.01	4.84	2.56	4.64	2.46
Valence T1	1.39	0.61	1.72	1.00	1.85	0.88
Valence T2	2.93	0.94	3.00	1.16	3.09	0.96
Valence T3	2.75	0.80	3.02	1.12	2.95	1.19
Arousal T1	4.53	0.65	4.39	0.79	4.44	0.58
Arousal T2	4.14	0.76	4.24	0.78	4.26	0.73
Arousal T3	4.25	0.72	4.22	0.65	4.21	0.69
Avoidance T1	2.69	0.79	2.73	1.11	2.69	1.11
Avoidance T3	1.66	0.74	1.97	0.93	2.33	1.28
IAT (good words associated with bear) T1	1.23	0.49	1.20	0.47	1.44	0.76
IAT (good words associated with bear) T2	1.09	0.34	1.08	0.47	1.13	0.31
IAT (bad words associated with hare) T1	1.16	0.36	1.49	1.33	1.42	0.70
IAT (bad words associated with hare) T2	1.14	0.30	1.21	0.74	1.12	0.36
Vulnerability T1	3.88	0.73	3.74	0.82	3.62	0.68
Vulnerability T2	2.32	0.53	2.18	0.54	2.19	0.33
Vulnerability T3	2.27	0.42	2.30	0.56	2.28	0.59
Social trust T1	3.06	0.94	3.11	0.74	3.58	0.99
Social trust T2	3.61	0.95	3.33	0.92	3.96	0.91
Social trust T3	3.59	1.03	3.65	0.75	3.59	0.80
Knowledge T1	6.28	1.99	6.74	1.37	6.25	1.65
Knowledge T2	7.32	1.07	7.42	1.01	6.93	1.46