

Commentary

[Editor's note: the following articles are responses to Valerius Geist's article "Wildlife habituation: advances in understanding and management application", appearing in Human–Wildlife Interactions 5:9–12. Geist's rebuttal follows.]

Misconceptions about black bears: a response to Geist (2011)

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WE READ WITH INTEREST the commentary by Valerius Geist on habituation (Geist 2011). Dr. Geist is a world authority on ungulate behavior, but his statements about bears reflect misconceptions that he supported with anecdotes rather than with systematic observations that characterized his ungulate research. When someone of his stature uncritically extrapolates from ungulates to bears in this way, he sets back bear management, promotes the sensationalized image of bears, and makes people unwilling to coexist with animals that they fear.

Habituation is a waning of response to a repeated, neutral stimulus (Thorpe 1956, Whitaker and Knight 1998, Gilbert 1989, Smith et al. 2005, Herrero et al. 2005, Stringham 2009). Bears that are fully habituated to humans ignore them (Whitaker and Knight 1998). Geist's use of the word habituation was confusing because he often used it to mean bears that are conditioned or attracted to humans, which is the opposite of its true meaning.

Geist's main point was that "habituation" can lead to bear attacks. There is danger in anything, of course, but if habituated bears were as Geist says, we and our co-workers could not do the close-up black bear (*Ursus americanus*) studies that we have been doing for decades. Habituated individuals do not view us humans with "unconsummated interest" and attack. They behave as if we are of little consequence. We are neither friends nor enemies. We are neither significant food-givers nor competitors. Bears forage, nurse, and sleep with hardly a look in our direction, thus, providing insights into bear life that we would not have thought possible. This is not new, of course. Jane Goodall and

Dian Fossey did the same with great apes (Hominidae) years before.

To support his contention that habituation leads to attacks, Geist erroneously used the case of Timothy Treadwell who was killed by a brown bear (*Ursus arctos*) in Katmai National Park, Alaska, during 2002. In reality, Treadwell attacked the bear as much as the bear attacked him, and he did it first (more below). I [Rogers] have watched Treadwell with bears many times as I led groups of bear-viewers. As long as Treadwell behaved as usual, the bears tended to ignore him. For 13 summers, Treadwell waded next to the bears as they fished, approached them as they mated, and sat with them as they grazed or as mothers 3 m away played with their cubs. The occasional young bear approached him. Sometimes they touched, but it was not the beginning of an attack, as Geist implied. Guides and tourists had similar experiences. Guides recognized the situations for what they were—true habituation—and correctly judged the safety of it. They were not attacked, even when I watched as 2 tourists approached within 2 m of a large, sleeping bear that opened an eye and went back to sleep.

Why did Treadwell get killed? It had nothing to do with habituation. A bear investigated his camp when Treadwell had his gear and food packed up ready to be flown out. Treadwell probably burst out of his tent and went after the bear in his "samurai" mode, as he mentioned in the movie "Grizzly Man" (Herzog 2005). Did Treadwell know the bear? Was it habituated? No one knows. A sparse salmon run had brought new bears out of the interior, according to Clint Hlebechuk (personal communication), who owned Hallo Bay Bear Camp. Officials killed a

big bear that had fed on Treadwell's body, but big bears take over kills from smaller bears. Geist mentioned none of the above. His only citation was an *Anchorage Daily News* article by Craig Medred (2003), titled "Wildlife author killed, eaten by bears he loved." The article fit Geist's point, and he cited it.

In his section on the theoretical basis for habituation, Geist used the word habituation correctly and gave an excellent overview of how animals function, citing his good work from the 1970s. But, in the section on danger signals, discussing signals that show anxiety (Herrero et al. 2005), Geist followed the common practice of calling them threats. While it looks threatening when a nervous black bear lunges, slams its feet down, blows explosively, and clacks its teeth, it is a stretch to label these behaviors as signs of danger. In my 44 years of working with wild black bears, I have seen these ritualized displays hundreds of times and have never had one turn into an attack. These displays are not predictors of black bear attacks. They merely express nervous apprehension, as is shown in the bear language videos on the North American Bear Center's website (<<http://www.bear.org>>). As bears became habituated, they made fewer of these expressions of anxiety, not more.

If Geist were right about the danger of habituated bears, I would have been attacked decades ago, Treadwell could not have lasted 13 years among habituated brown bears, and bear viewers could not have sat next to habituated brown bears at McNeil River Falls for >3 decades without injury. There is a need to quantify or qualify statements of danger. In my decades of experience, habituated bears have proven to be less of a danger than taking a walk through the woods or doing home repairs.

In discussing dominance displays, Geist stated, "Most humans have a very difficult time recognizing this signal at all, let alone recognizing it as a signal of high danger." Count me as one of those humans. I interpret black bear behavior in terms of their fear, not human fear. Instead of seeing dominance displays, threats, and danger from bears, we see defensive displays that show anxiety and that are not coupled with attack. We use nonthreatening techniques. Over time, the bears become habituated to us within the limits of their individual personalities, enabling us to accompany them for research. We now

use trust rather than tranquilizers to radio-collar black bears, including mothers with cubs and males up to 578 pounds. These kinder and gentler research methods eliminate injury and cause far less stress than traps and tranquilizers (Cattet et al. 2003, 2008).

Geist stated, "When large mammals show an interest in the observer, or perform the first, faint dominance displays, it is high time for the observer to leave." In truth, if I had taken that advice a quarter century ago, I never would have remained with bears long enough to learn much. The same black bear displays that Geist and others call threats, warnings, and dominance displays, I call harmless bluster. Instead of leaving when I see bluster, I feel safe. Bluster means a black bear is apprehensive and wants to talk about it. Communication is a step toward trust.

Geist included the common advice that retreat should not be at a run because "fearfulness and timidity can trigger attacks!" This may be true with some dogs and big cats, but I know of no support for that statement with black bears. The warning not to run is perhaps the most common advice given for black bear encounters. But, I have yet to find 1 person who has given that advice who has an example. In reality, many people who see black bears tell me, "I ran 1 way and the bear ran the other." If a person is under attack, running can shift the attack to a new location, but I am still looking for an example of running clearly triggering a black bear attack. A 7-year-old female black bear in Minnesota provided the example closest to showing that. She attacked a man who stood his ground 1 day, attacked a man who ran the next, and became distracted by food when campers ran the day after that (Rogers and Garshelis 1988). Did the second man trigger an attack by running? Or did he simply shift the attack to a new location? Would 1 example truly show cause and effect rather than coincidence?

To test a bear's response to running, a co-worker ran from a nervous mother black bear that had an unusual tendency to charge right up to a person rather than performing a simple lunge or blustery hop-charge. We video-taped several of her charges, which can be seen on <www.bear.org>. When the mother charged again, my co-worker ran, glanced back at the bear on his heels, and fell flat. The bear

performed fancy athletics to avoid touching him while braking and turning back to her cubs.

Working as closely as we do with black bears, we have a more than passing interest in the role of habituation in attacks. Herrero et al. (2011) reported that 54 fatal attacks by black bears during 1960 to 2009 showed no pattern of habituation as the cause of the attacks. Most of the killings were in remote areas of Canada and Alaska where habituation is unlikely, while only three were in the eastern United States where habituation and food-conditioning are common (Herrero et al. 2011).

Black bears that attack people are far out in a tail of a bell-shaped curve. About 1 black bear in 950,000 kills someone. By comparison, 1 person in only 18,115 kills someone according to departments of justice and census bureaus in the United States and Canada.

The extent to which bears are the subjects of misconceptions and exaggerations is becoming ever more apparent. Misconceptions about black bears are too often the basis for advice, bear management decisions. With more and more people moving into bear habitat, there is a need to reexamine our beliefs about bears. Warnings about bears should go beyond agency desires to limit liability. Warnings should be quantified to provide the public with information useful in assessing risks and benefits of coexisting with bears.

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LYNN L. ROGERS spent many years trapping, tranquilizing, and radio-collaring black bears as a U.S. Forest Service research scientist. In the mid-1980s, he adapted the trust-based research methods of Jane Goodall to black bears in the forests of Minnesota and began accompanying wild bears for 24 hours at a time. Research topics include diet, habitat use, social relations, care of cubs, hibernation, vocalizations, body language, causes of death, and causes of bear–human conflict.



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Aggressive body language of bears and wildlife viewing: a response to Geist (2011)

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GEIST'S (2011) COMMENTARY has 3 main points: (1) habituation increases risk that large-bodied wildlife will injure people; (2) an animal's body language often provides reliable clues of impending assault; and (3) although some of those clues are obvious, others are easily overlooked by untrained people. Whereas Geist's emphasis is on ungulates, he also suggests that similar behaviors by bears have the same significance; this is an issue that requires clarification.

The importance of recognizing signals that sometimes preface attack is beyond questioning for those of us who frequently encounter potentially dangerous wildlife, whether as professional or recreational observers. However, as Geist agrees (personal communication), that information is most valuable if one also knows of any benign contexts in which the same or similar signals appear and their relative frequency in each context. Otherwise, a person is not only at risk from overlooking or misinterpreting threats, but also from mistaking benign behaviors for preludes to attack. This can cause people to overreact in ways that actually increase their likelihood of being assaulted, albeit defensively.

Craighead (1972) describes a classic example. Even a grizzly bear (*Ursus arctos*) that would normally flee from a human will sometimes approach. A person who does not realize that the bear is approaching out of curiosity may make the mistake of not alerting the bear (e.g., by snapping branches or thrashing brush) while it is still far away, and instead try to hide. This reaction increases the risk that the bear would not recognize the situation until it is within its attack distance. In such a case, the bear's approach, especially at a run, often is misinterpreted as aggressive and may lead someone to run from the bear or to shoot it.

Shooting risks retaliation by the bear, a risk that is especially high for emergency shooting

(Stringham 2008, Smith et al., in press). Defensiveness is the major cause of serious or fatal injuries inflicted by brown bears (*Ursus arctos*) and a cause of lesser injury by black bears (*Ursus americanus*) Herrero 1985, Herrero and Higgins 1995, 2003).

Geist (1978) and Walther (1984) provide much of the information on contexts for agonistic signals by ungulates; but little of it has been published for bears, and that little is widely scattered through the literature. In this paper, I summarize that literature plus my own findings. These are based on 22 field seasons observing bears and bear viewers—15 seasons with brown bears in Alaska and 7 with black bears in Alaska, New York, Vermont and California. During 13 of these field seasons, I worked part-time guiding bear viewers and observing the bears. As director of the Bear Viewing Association, I track and analyze broad-scale patterns in viewing. Analysis of my data has proceeded far enough to permit qualitative descriptions, ordinal comparisons, and order of magnitude numerics. More precise quantitative results and methodological details will be published later. Unless otherwise stated, all references to "bears" herein refer just to Alaskan brown bears and black bears. How well these findings apply to other ursidae remains to be determined.

Viewing bears and other wildlife

Over recent decades, viewing of wild ungulates, especially large carnivores, has grown from the pastime of an eccentric minority of North Americans to a major form of ecotourism that attracts visitors from around the globe. No large carnivores are more accessible or more charismatic than bears. The continent's 4 most popular bear-viewing sites—Wolverine Creek and Brooks River in Alaska, the North American Bear Center, and Vince Shute wildlife sanctuary in Minnesota—together amount to



Figure 1. At some popular viewing areas on the Alaska seacoast, viewers can legally approach brown and black bears to within 50 to 100 m. Viewers can also legally allow bears to approach as close as they want. The decision of “how close is too close?” is left to the guide. So long as viewers remain seated, bears learn to feel confident in approaching closely; and a guide standing up is often sufficient to deter the bear from coming closer.

roughly 70,000 viewer-days per year. Continent wide, the total is estimated at >100,000 viewer-days at sites where bears are reliably seen, in addition to Yellowstone and some other national parks where bear sightings are much more chancy (Stringham, unpublished report). Whereas visitors can enjoy the Minnesota and Yellowstone sites for little more than the cost of driving, visits to roadless Alaskan sites can cost >\$200/hour for viewing.

Alaska has all 3 species of North American bears. These are most reliably viewed at concentrations of high-energy foods, such as a beached whale carcasses or salmon streams. These features, plus spectacular scenery, provide some of the most varied, abundant, and high-quality bear-viewing sites on our planet (Stringham 2007). Viewing has, thus, become a substantial source of income for Alaska and an economic cornerstone of some communities, such as Kaktovik on the Beaufort Sea, Kodiak on the Gulf of Alaska, and Homer, the so-called bear-viewing capital of the world, on Cook Inlet. When all wildlife species are considered, viewing in Alaska generates around \$700 million per year (DeBruyn and Smith 2009).

At only a handful of sites is bear viewing

done from vehicles or platforms that minimize exposure of humans to bears. At the >100 other North American sites, viewing is done on the ground, often at distances of 5 to 100 m from the bears, which is close enough for bears to reach the people at will (Figure 1; Stringham 2007, 2008, 2009; <www.bear-viewing-in-alaska.info>).

Safety for people at exposed sites depends primarily on the bears’ tolerance and self restraint. In the event that a bear does become aggressive, viewers commonly expect deterrents, such as pepper spray or flares, to keep them safe. But these chemical and mechanical deterrents are merely handy backups, of limited effectiveness. They should not be relied on as a substitute for being able to avoid or quell aggression by assessing a bear’s mood and intentions from its body language, then responding appropriately (Stringham 2002, 2008, 2009) Failure to do so can have tragic consequences, as exemplified by the fatalities of bear naturalist Vitaly Nikolayenko (Mosolov and Gordienko 2004) and of various photographers, such as Michio Hoshino, Timothy Treadwell, and Amy Huguenard (Jans 2005).

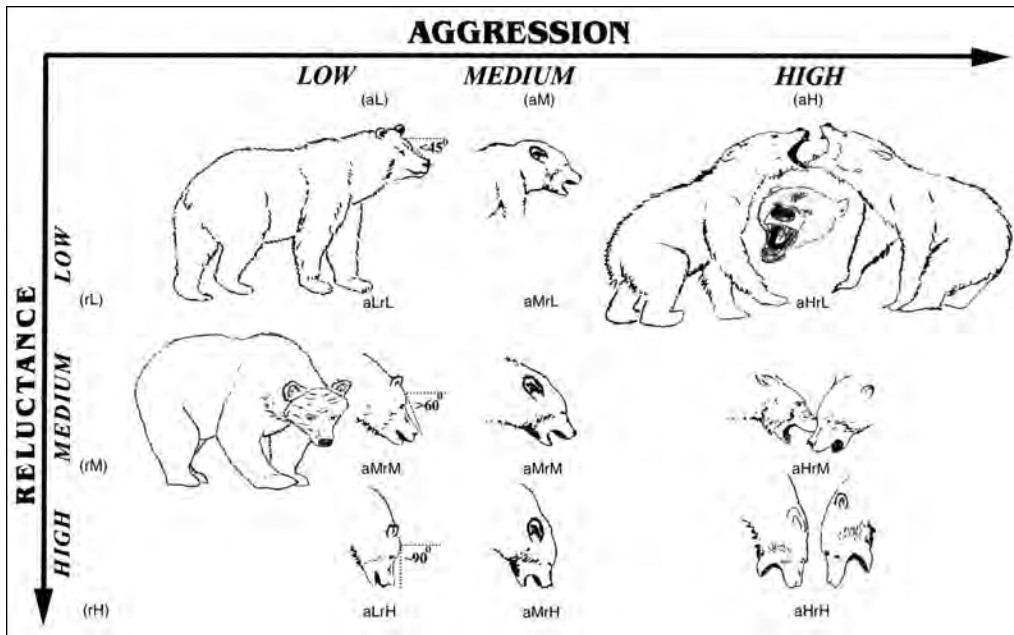


Figure 2. Body language associated with various combinations of competing motivations—aggression versus reluctance for combat. Levels of aggression: Low (aL), Medium (aM), High (aH). Levels of reluctance: Low (rL), Medium (rM), High (rH). Top, left to right, from the upper left corner: in a confident, assertive, slightly aggressive mood, a bear commonly walks or stands with its face 30 to 45° below horizontal and its neck at an angle between 30 and 45° above or below horizontal. As aggression increases, the mouth gapes more widely, the upper lip extends farther, and the upper canines are exposed to the opponent’s view. Simultaneously, vocalizations become harsher and more prolonged until the bear is roaring. Bottom left: assuming that the function of threats is to win without chancing injury through fighting, a bear reduces risk that its escalating aggression will provoke attack by the opponent by aiming its jaws away from the opponent. I refer to this counter-signaling as reluctance. Bottom center: as reluctance increases, neck angle tends to drop farther below horizontal, and face angle drops towards vertical. Bottom right: aggression and reluctance are both intense, signaling a highly unstable balance of motivations that can suddenly tip into either attack or submission. A bear eventually tries to de-escalate a confrontation by turning its head and jaws to the right or left, away from the opponent, watching the latter with peripheral vision only. Another form of reluctance is seen when mothers threaten cubs with lowered head to prevent them from nursing or stealing pieces of salmon. Assertive cubs respond with head-low threats.

Bear threats that even novices can recognize

Postures and gestures

Elements of body language commonly used by brown and black bears during agonistic encounters with conspecifics have been described by Herrero (1970, 1983), Burghardt and Burghardt (1972), Stonorov and Stokes (1972), Craighead (1972), Henry and Herrero (1974), Egbert and Stokes (1976), Pruitt (1976), Pruitt and Burghardt (1977), Jordan (1974), Jordan and Burghardt (1986), Ludlow (1976), Bledsoe (1987), and Stringham (2002, 2008, 2009). Elements used toward fellow bears appear to be identical to those used towards humans.

Figure 2 shows a matrix of postures manifesting low, medium and high levels of aggression and comparable levels of reluctance

to fight, resulting in 9 combinations of the 2 motivations (Stringham 2008, 2009). Aggression and likelihood of combat peak at cell aHrL (= aggression High, reluctance Low), where 2 bears face off with their nostrils <1 m apart, each bruin’s head high above its shoulders, and body weight centered on its legs to free its arms for grappling, swatting, clawing and fending off attacks. The upper lip puckers forward as the mouth gapes widely and is tilted upwards far enough that the upper canines are exposed to the opponent’s view. Each bear tilts its head to the right or left so as to better grasp and neutralize or damage the opponent’s jaws (Geist 1972). Each bear may alternately raise and lower its head momentarily as though seeking an opening to bite the opponent’s neck or cheek. Alternately, changes in relative head height may reflect momentary changes in self-

confidence, with the currently more confident bear holding its head highest. Both bears typically roar loudly and continuously.

As Jordan (1976), Egbert and Stokes (1976), and Bledsoe (1987) emphasize, the elements of threat behavior may be stereotyped, but the sequences, durations, and combinations of elements vary from instance to instance due in part to constant adjustment by each bear to its opponent. Only suites of actions can be grouped into relatively predictable stages (Pruitt 1976). Combat is usually preceded by head-high threats, which are usually preceded by head-low threats, which are very occasionally preceded by broadside displays. Likelihood of immediate combat is higher when bears face off with heads high and jaws—their primary weapon—aimed at the opponent, than when their heads are low, aiming jaws away from the opponent, usually at the ground (Egbert and Stokes 1976, Jordan 1976).

Lowering the jaws to ground level (Figure 2, aHrH) while roaring continuously or bellowing in rapid pulses can be thought of as extreme ursine saber rattling. Aiming one's weapons away from an opponent allows one to express intense aggression with less risk of triggering attack by the opponent.

Whereas head-high weapon threats normally begin when the nostrils of the 2 bears are <1 m apart, head-low threats may begin while the 2 bears are several meters away. Further, whereas head-high threats are virtually always made face to face, a head-low threat may be made from any angle from which the aggressor happens to approach its opponent.

Offensive challenges

When a brown bear walks deliberately towards an opponent, escalation of aggression is unlikely if the opponent acknowledges subordination by backing up a few paces and turning its neck and head to the side. If the approaching bear has made no overt threat display (Figure 2, cells aLrL–aMrL), the



Figure 3. Appeasement of a subordinate by a dominant bear. (A) A subordinate brown bear, S1 (upper left in photo) threatened a higher-ranking adult male, D1, when D1 ventured too close, even though D1 did not overtly threaten S1. S1's fearful assertiveness is indicated by its moderate-aggression, low reluctance threat with head high, ears back tightly against its skull, and fully gaping jaws aimed at D1. S1's upper canines were not exposed, and much of its weight was on its arms, rather than shifted to its legs, suggesting that it was defensive and not ready to fight. D1 responded with combined displays of dominance and reluctance to fight. D1's dominance was indicated by its ears forward and head high, while it appeased S1 by holding his jaws at only half-gape and turned away from S1. D1's head-high posture also kept its jaws in position to counterattack if S1 tried to bite.

(B) S1 was calming down, with its mouth now at only half-gape and its jaws lowered and turned aside, even though its body was still aimed at D1. (Photos courtesy T. Guzzi)

opponent may even sit down, likely facing away from the challenger. However, if the opponent does not acknowledge subordination, the challenger may stiffen its gait, thereby escalating its threat. If the opponent still fails to submit or counter threatens, then aggression is much more likely to escalate into more intense visible and audible threats, and, perhaps, into combat (Craighead 1972, Stonorov and Stokes 1972).

Whether or not combat occurs, confrontations typically end with gradual de-escalation of tensions. This culminates in each bear pointing its jaws toward the ground and lowering its head, with the loser's head lowest. Then one or both bears turn their head aside. If the rank difference is small, the loser usually turns its head aside first, perhaps after having backed

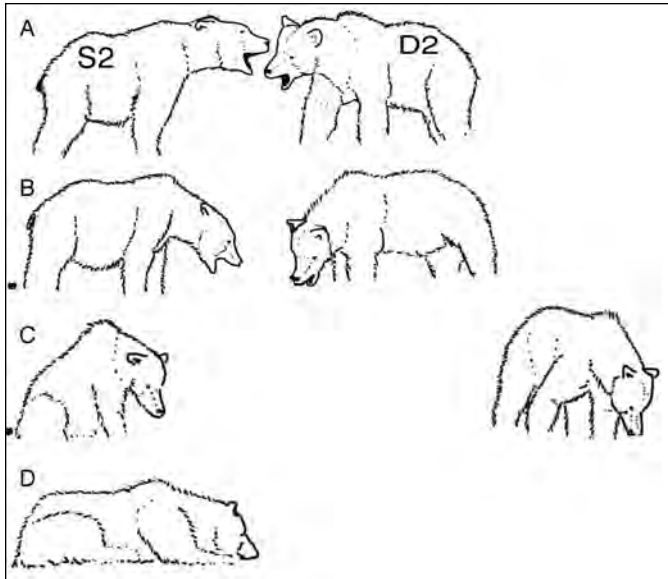


Figure 4. Subordinate appeasing a dominant. **(A)** Defensive aggression where an adolescent male S2 threatened adult male D2. Although much of the body language in this case is like that in Figure 3, there are important differences. First, S2's head was initially higher than D2's, indicating a brief period of high self-confidence before D2's imperturbability unnerved S1. S1's failing confidence is manifest in the flattening of his ears and the lifting of his tail and then defecation. Even though D2 held his head lower than S2, he clearly dominated the encounter, never becoming excited. **(B)** When these bears began to de-escalate, they did so by both lowering their heads, before either bear turned away. **(C)** S2's subordinate status was confirmed as he sat down with his head lowered and turned partly aside as he closely watched D2 who resumed grazing and turned away from S2, as though unconcerned with S2 as a potential threat. **(D)** Finally, S2 lay down, still facing D2. Although lying down can be an extreme form of submission, it is far less common in bears than in dogs or wolves, and occurs only when attack risk is low, not during a tense, close encounter.

up ≥ 1 steps. However, if the rank difference is large, the loser may not dare turn aside and increase its vulnerability; so, the dominant is left to do so first. Losers almost never challenge a winner even during these moments of vulnerability (Craighead 1972). At this stage of a conflict, the movements of a subordinate bear often seem stiffer than those of a dominant, the ultimate expression of stiffness being immobility. Perhaps a subordinate bear, like a human, can be too afraid to move lest it trigger attack. In any event, Stonorov and Stokes (1972) found that subordinates are 4-fold ($n = 12$ versus 3) more likely than dominants to turn their head and neck broadside to an opponent. In the uncommon event that an infant or yearling challenges an adult, it is likely to be ignored, even as the adult watches lest the cub's mother appear to back up its threats.

Defensive challenges

When a bear with its neck roughly level (Figure 2, aMrL) defensively threatens a much higher-ranking opponent, the dominant individual may refrain from chastising its challenger and instead try to appease it by facing away from the subordinate, while holding its head at a similar height (Figures 3a and 4a). Facing away simultaneously signals the dominant's imperturbability and its benign intent. Typically, neither bear has its head high enough to reveal its upper canines. As the aggressive subordinate calms down (Figures 3b and 4b), it will eventually back up and turn away from the dominant, perhaps lowering its head even if the dominant does not.

This scenario is common when a mother deters an adult male from approaching her cubs, even though the male is just passing by, not hunting her cubs. Furthermore, even during the most intense phase of roaring match with an adult male, a mother may momentarily turn her head aside to check on her cubs without this acknowledging

subordinance.

A bear, especially the loser, can be so physically and emotionally exhausted by a confrontation that it soon sits down and may even lie down, while remaining wary of the winner (Figures 4c and 4d). Although depression is more typical of losers than of winners, I have seen a mother who saved her cub from a predatory male soon lie down and hardly move for >6 hours, providing no care to the injured cub and ignoring pleas by both her cubs to nurse.

Audible signals

Ursid postures indicating low to medium aggression (aL to aM), combined with medium to high reluctance (rM-rH), are often accompanied by distinctive sounds. These include 1 or 2 explosive woofs, followed by a series of pant huffs and by jaw popping (i.e., a combination of

snapping the jaws together and popping the lips as the mouth opens). These signals may precede or accompany the bear hopping or running forward a few steps towards the opponent, terminating with a single explosive woof as the bear slams one or both hands against a tree or the ground, much as some ungulates do with their hooves. This is commonly followed by further pant-huffing and jaw-popping.

Threats versus attacks

Those signals can all be highly intimidating to opponents, including humans. However, only a minority of such displays leads to attack, especially if the displaying bear is appeased by its opponent, that is, by a human giving it more space or ceasing to threaten it (Leslie 1968, Stringham 2009; Herrero 1972 *a, b*; Herrero et al. 2011). Each summer for the past few years, Ann Bryant (director, BEAR League, Lake Tahoe, California, personal communication) and her assistants have chased black bears out of yards and homes at Lake Tahoe on the California-Nevada border, without suffering even slight injury, despite being threatened in the above ways on hundreds of occasions. Rogers, Mansfield, and their colleagues have faced these displays by black bears many times, none of which has ever caused them even moderate injury, although they have rarely suffered scratches and bruises. Other biologists (e.g., Faro, personal communication) and guides (e.g., B. Josephs, B. Wilde and K. Fredriksson, guides, Katmai Coastal Bear Tours, personal communication), myself included, have escaped being attacked, despite having faced hundreds of threats, sometimes including short rushes or hop-slams, by brown bears on the seacoasts of Alaska and British Columbia.

One reason that attacks so rarely follow threat displays is that threats are not announcements that an animal plans to attack, but attempts by the animal to achieve its goals by manipulating its opponent, without risking a fight (Geist 1978). Although an offensive threat does warn that attack is imminent if its goals are not met (e.g., unless a competitor retreats or surrenders food), the aggressor seldom follows through, perhaps out of fear. Attack is even less likely following a defensive threat, which warns that the individual will, in theory, retaliate only if attacked, threatened, or otherwise provoked

(Ewer 1968). Threats can also be used to manipulate a social partner (e.g., an infant that insists on nursing or that keeps biting in play) without risk of injuring the partner.

In the uncommon event that a bear is motivated to attack a person, the attack is more likely to be inhibited by fear of retaliation than by concern for the human. Nevertheless, when a bear is in a benign mood, it may go to considerable trouble to deter a person without doing harm. On several occasions, I have had a captive bear stop me from touching it by catching the skin of my hand in its incisors, then letting go, without breaking or bruising the skin. Kilham (2002) refers to restrained bites to a human or fellow bear as message bites. Restrained swats, with claws lifted so they do not make contact, are also used to deliver messages. On occasion, a wild black bear has deterred contact by my hand by directing its gaping mouth at me, even though the bear was otherwise content have its body within inches of me or sometimes pressed against me.

In lieu of inhibition, an angry animal would theoretically just attack without preamble (Lorenz 1966). I have seen numerous instances of a black or brown bear suddenly lash out at a conspecific standing beside it feeding on an animal carcass or an insect laden log. If any warning was given, it was not apparent to human eyes or ears. In each case, the bears were siblings or constant companions. Where the 2 bears differed appreciably in size, it was usually the larger that attacked the smaller.

According to the same theory, a fearful animal that is not inhibited from withdrawing (e.g., by its own aggression or by expectation of attack from the rear) would just flee. Some bears run as soon as they detect a person nearby; others approach and threaten a person, then stalk off stiffly, occasionally spinning back to face the person, threaten, and continue to move away for a few hundred meters away before suddenly accelerating into a run, sometimes continuing for miles and disappearing from sight (Russell 1972).

There is no indication that bears so clearly reveal fear, anger or frustration during predatory attempts (Herrero 1985), despite the likelihood that each of these emotions sometimes occurs while trying to kill powerful prey, such as moose (*Alces americanus*), caribou (*Rangifer*

tarandus) or a fellow bear. I have seen video footage and photos of an adult male walking up to a distracted subordinate and attacking without preamble. In a 1997 incident at Brooks Falls, in Katmai National Park, the aggressor quickly began eating the subordinate, ripping flesh from its back; the adolescent hardly resisted as though immobilized by terror and shock. In a 2010 incident at the Russian River Falls, on the Kenai Peninsula, the adult male tore off a patch of skin from the victim's rump roughly 0.3 m in diameter, then held on, as though trying to force the adolescent underwater. Again, the victim did not fight back. This continued several minutes before the adult male desisted and shifted to fishing on salmon. At no time did the attacker make a detectable visible or audible threat.

In any attempt to assess attack risk, it is critical to keep in mind that probability that a threat display will be followed by attack is NOT directly related to intensity of the display; sometimes just the opposite. This is akin to the situation between 2 men or boys insulting one another, where the louder and longer the harangue continues, the less likely it is to end with fighting. In fact, it can serve as an alternative way of letting off steam. At least, that was my own experience as a youth, when fistfights occurred several times a day. Rogers and Mansfield, thus, refer to intense pant-huffing, jaw-popping and hop-charging as blustering. One hypothesis is that these signals have become so ritualized that they, like human cussing or dog barking, reveal less about intentions than about emotions.

Any attempt to determine how well a given display predicts assault should distinguish how often assault is prefaced by the display versus how often the signal prefaces aggression versus other behavior. Even if all assaults were preceded by a certain gesture, this would not preclude that same gesture from preceding or accompanying other actions. Indeed, elements of aggressive body language are common during play (e.g., puckered upper lip, ears back against the skull, head tossing, biting, and wrestling). The fact that a display is typical of aggression does not mean it is diagnostic thereof. Diagnosis requires recognition of entire gestalts of signals and of their contexts.

Ungulates versus bears

Cryptic displays

Recall that the focus of Geist's (2011) paper was not such obvious threats, but what he called "silent signals" that only trained observers are likely to recognize as such. Three of the most common of these are broadside displays, averted gaze, and deceptive grazing.

Even novices are likely to recognize the threat implied when a cervid or bovid faces them and directs its antlers or horns at them. However, according to Geist (1978, 2011) and Walther (1984), novices are less likely to recognize the significance of a broadside display. When such a display is performed by 2 ungulates, they walk parallel to one another or circle in reverse parallel positions, with each animal's head toward the opponent's tail.

Even when a broadside display is directed toward people, "the displayer does not approach directly, but at a tangent; that is, it circles onto the object of display" (Geist 2011). People could easily mistake this for the animal just walking past them—a misinterpreted impression augmented by the tendency of a displaying ungulate to direct its gaze or at least its muzzle away from the conspecific or human opponent, as though uninterested in the opponent. Threat is particularly hard to recognize when an ungulate grazes as it approaches an opponent.

The danger to someone who misinterprets a broadside display is greatest with species like mountain goats (*Oreamnos americanus*) that normally attack from a broadside position, rather than head to head, as with bighorn sheep (*Ovis canadensis*; Geist 1964). A mountain goat lowering its head and turning it away from an opponent might just be cocking its neck and shoulders in preparation for attack.

Geist suggests that broadside displays, averted gaze, and deceptive grazing have the same significance in bears as in ungulates. However, even if those behaviors do occasionally precede assaults—if only on a fellow bear—they are not diagnostic of pending assault. In situations where Rogers and Mansfield (personal communication), and I have observed black and brown bears, those behaviors are orders of magnitude more likely to accompany nonvio-



Figure 5. Old Snagletooth (right) and a second male (not visible in photo) were strutting in circles around one another, while an estrus female grazed nearby. Note how Snagletooth's arms and legs are spread much wider than those of the female, who is in a normal quadrupedal stance, with her right and left feet separated <0.5 m, whereas his extended 1.2 m. The male's body, especially his hindquarters, are covered with mud from wallowing where he had just urinated, such that he reeked of his own pheromones.

lent interactions with conspecifics or with people. When attacks do occur, they are typically prefaced by the overt displays described earlier; or the bear charges without warning, whether defensively or offensively. Sudden attacks seem more typical of brown bears than of black bears.

Broadside displays

Geist (2011) states: "In both ungulates and bears, the most important [cryptic] signal to watch for is the dominance display. ... [T]he usual dominance display of large terrestrial mammals, primates excluded, is a broadside display...." Geist (1978) and Walther (1984) describe broadside displays by a spectrum of ungulate genera. Except in those species, such as mountain goats that fight standing side by side, a broadside display seldom leads directly to fighting. The uncertainty of whether it will do so adds to the display's capacity to intimidate rivals. However, in the normal course of events, if a dominance contest cannot be settled with broadside displays, the animals escalate to frontal weapon threats, and only if that fails to establish a winner do they resort to fighting.

One would likewise suspect that among carnivores, which normally fight head-to-head, combat is much more likely to follow head

to head threats than broadside dominance displays. I have seen both dogs and wolves begin fighting while they stood head to head, but not while they were in full anti-parallel orientation, as each individual sniffed the anus of its opponent.

During thousands of bear encounters, I have experienced no more than 10 occasions when a black or brown bear has walked past me, gotten partly or fully behind me, then rushed toward me several paces before terminating the rush, sometimes by slamming its hands on the ground. There was no way to tell whether the bear would have made contact had I not turned to face it; but taking my eyes off the animal likely gave it confidence, much as resuming eye contact halted its approach. However, in none of these cases was the bear making a stereotyped broadside display. The only forewarning of the impending threat was that, in each case, the bear walked toward me much more directly and perhaps more stiffly than normal, and with its eyes locked on me. A few colleagues have told me of similar experiences, and Jordan (1976) reports one with a black bear. Seldom have I seen 1 bear attack another that way, and it was always with a single bite or swat that caused no visible injury.

Bears make at least 2 forms of stereotyped broadside displays, both of which are highly distinctive and not readily mistaken for simply strolling past a person.

Sumo strut

Judging from experiences with brown bears in coastal Alaska, the most common form of broadside display exhibited by this species is the sumo strut. The bear walks forward, urinating. Urine flows onto its legs and runs down the fur, presumably picking up its scent, which is then ground into the soil by a repeated twisting motion of the feet. Its arms and legs are widely spread and its knee and perhaps elbow joints stiffened (Figure 5), as in the ceremonial preface to human sumo wrestling. The jaws of a sumo-strutting bear are aimed at the ground, not toward the opponent.

Sumo strutting is almost always made by pairs of rival adult males during the breeding season. Unlike ungulates and canids that circle one another within striking distance, sumo-strutting bears are usually separated by 2 to 10

body lengths. In the >100 cases of strutting that I have observed, never has a bear attacked from a broadside position. Seldom has a bear gone from a broadside display into a head-high, frontal threat and then begun fighting.

All cases of sumo strutting that I observed have been performed by an adult male toward another adult male, never by or towards any other age-sex class, although an estrus female is often nearby, raising the question of whether sumo strutting can serve a courtship role. Only twice have I seen a female (in each case a juvenile) perform something that resembled a mild, truncated sumo strut, and then for just a few steps while retreating facing away from me. S. Bryant (director, Bear League, Lake Tahoe, California, personal communication) has twice seen 2 mother black bears sumo strutting at one another.

I know of only 3 cases of sumo strutting being aimed at a person. V. Geist (personal communication) twice observed this when he drove a large adult male black bear away from him. Neither of those broadside displays was followed by frontal threats, much less by attack. In the third case, an adult male brown bear, Old Snagletooth (Figure 5), strutted directly towards me just after losing a confrontation with a larger male over an estrus female. When I spoke, "Don't do that," he immediately swung sideways to me, continuing to strut only briefly before walking off in a normal gait. In some cases, strutting seems to be a way of enhancing a bear's self confidence, as do the associated behaviors of wallowing or tree marking.

Stomp walk

Black bears also exhibit a second form of broadside display, dubbed stomp walking by L. Rogers and S. Mansfield (personal communication). As a bear walks forward, with its head nearly level with its shoulders, each forearm is alternately lifted to near horizontal position; then that forepaw is slammed down against the ground, whereupon it may slide forward <1 m.

Goosestep slide

Jordan (1976) describes a related behavior by a female, except that her forearms were locked, and she moved forward in something like a goosestep, with her hands sliding forward

with each step. Her legs were not locked. But otherwise, as in sumo strutting, urine ran down her legs, and her body shook with each step.

The goosestep and slide, which seems transitional between stomp walking and sumo strutting, was frequently triggered by a human, but was not obviously oriented at the human. According to Jordan (1976), each bear's orientation relative to a person seemed random. In some cases, the bear was in an enclosure and was not free to circle the person or to walk far in any direction; so, the appearance of random orientation may have been an artifact. Or it may simply be an advertisement of the bear's mood that is broadcast "to whom it may concern" rather than to a specific opponent. This display was made by both males and females. It might be the same display that I earlier likened to a truncated sumo strut when I saw it made on 2 occasions by a juvenile female brown bear.

When a brown bear sumo struts, it may occasionally produce slide tracks similar to those made by a stomp walking black bear, further suggesting that sumo strutting and stomp walking may be polar forms of a display with several intergradations.

Cowboy walk

Black bears and, possibly, brown bears also make a face-to-face display where the forearms are lifted only several centimeters before the hands are slammed against the ground, step after step, accompanied by pant-huffing. This display typically ends with a hop-slam, accompanied by an explosive woof. This third form of stiff-legged gait is called cowboy walk because the elbows are sometimes turned out so far that the arms resemble the legs of a bowlegged horseman. Each time I have seen this, it accompanied a head-low threat.

Direct and diagonal charges

When a bear makes a full-fledged charge, it typically runs with its neck and spine aimed at the opponent. During some charges, the spine remains fairly level. In other charges, the spine oscillates up and down in kind of a rockinghorse motion; indeed, the bear may seem to be bouncing as much as running forward. My impression is that the greater the degree of rocking, the less likely the bear is to make physical contact with its opponent. Indeed,

rocking may serve to increase its apparent size, making it more intimidating to its opponent. An even less assertive brown bear will sometimes advance several paces with a rocking hop, during which its spine and neck are diagonal to the opponent, sometimes at just a slight angle and at other times at $>45^\circ$ angle. Stonorov and Stokes (1972) interpret angling of the body as a sign of ambivalence. Perhaps the angle increases along with strength of the motivation to flee, or at least to display broadside. A frustrated bear will sometimes hop in place without approaching its opponent, perhaps while flinging its head back and forth and casting saliva far and wide.

Predatory body language

None of that body language is seen during predation except for running, with or without a rocking motion. Bears that run through a stream to capture salmon move with a little rocking motion through water that is less than belly deep. But as depth increases, so does the height with which a bear lifts its forequarters before landing on its forefeet. Elevation of the forequarters not only lessens the effort of plowing through the water, but it may provide better visibility without having to stop and stand bipedally. The higher the angle from which a bear or person looks into water, the less visibility is impaired by surface reflections.

When hunting elk or moose calves, a bear may search by standing upright to see farther and to catch airborne scent, or by walking quadrupedally while following scent in the air or on the ground. Once prey is located, it may be circled or stalked, as the bear hides behind available cover with its gaze locked on the prey until the bear is close enough to attack. In rare cases, a bear will stalk prey in a crouched posture reminiscent of an African lion (*Panthera leo*; Pezzenti 2001) or crawl forward on its forearms with its chest against the ground, as observed on Kodiak Island on 2 occasions by deer hunter B. Garrett (personal communication). There have also been numerous reports of polar bears (*Ursus maritimus*) crawling or swimming toward seals; an example of this behavior can be seen in BBC footage on YouTube (<http://www.youtube.com/watch?v=B0DCOTaZgtA>). If prey is discovered at close range, a bear may skip any searching or stalking and immediately charge the prey, pinning it with paws and biting into it.

All of those behaviors, except perhaps the predatory crouch (Shelton 2001), are seen in other behavioral contexts. So distinguishing instances of attempted predation from other motivations relies on gestalts of actions plus contextual cues, which are beyond the scope of this paper.

Some forms of predatory approach by a carnivore might indeed be mistaken as benign searching or curiosity, exemplified by coyotes (*Canis latrans*; Baker and Timm 1998) and wolves (*Canis lupus*; Geist 2007, 2011). Geist notes that predatory curiosity is commonly manifest in “attention to and following” or approaching another animal or person. This may culminate in physical contact and perhaps licking or nipping potential prey, eventually followed by attack (Geist 2007). However, he provides no other clues for distinguishing predatory versus nonpredatory curiosity among wolves or any other large bodied carnivores, or how often each occurs.

In the thousands of times that I have observed people, including myself, being followed or approached and investigated by a brown or black bear, none of those bears has ever made a recognizable attempt to test the focal person as prey. The only bears that mouthed any person were playful cubs. So long as a person does not try to touch a bear, injuries have been rare and usually limited to scratches; touching sometimes triggers more intense bite or clawing, but seldom prolonged mauling (Herrero 1985).

People who want to avoid a potentially dangerous animal should indeed be especially wary if the animal stares at them >30 seconds without sign of being alarmed or if it approaches or follows them with its eyes locked on them. However, no one should overreact by jumping to the conclusion that this reveals either agonistic or predatory aggression. There are many reasons besides aggression for a bear walking or even running toward a person or following the person. For example, I have had bears run at me to initiate play or to take shelter behind me from other bears. So, too, bears of all ages sometimes walk up to within a few meters of viewers, lie down, and go to sleep, apparently counting on proximity to humans to shield them from other bears – a phenomenon sometimes called shielding (Stringham 2009).

Which displays signal threat or dominance?

I have interpreted virtually all behaviors described thus far as agonistic in the contexts considered. Jaw-popping seems to be an intention movement to bite, comparable to jaw snapping in some canids or perhaps to molar grinding in moose and some other ungulates, even though these ungulates no longer use teeth as weapons (Stringham 1974, Geist 1978). Rushing toward an opponent is intimidating in a wide range of mammals because the aggressor is both coming closer and appears to suddenly increase in size (Geist 1978). When a rush terminates with swatting the ground or a tree, accompanied by an explosive woof, this not only provides a sudden increase in noise, another widespread means of intimidation (Geist 1978), but it demonstrates the animal's power. Also, substrate slamming may draw attention to the bear's hands and its claws, and it can be interpreted as an intention to swat the opponent. For the same reasons, stomp walking and cowboy walking appear to signal intention to slam an opponent. Furthermore, both sumo strutting and sometimes stomp walking display the bear in broadside, which maximizes its apparent size, similar to what one sees in the majority of mammals and some other vertebrates (Geist 1978, 2011). When a bear near me tensely claws the ground or chews on a log while it stares at me, I likewise interpret those as threats to claw and bite me, even if those same bears, when later frightened by the appearance of a larger bear, then move behind me for protection. This is perhaps reminiscent of human adolescents who are aggressive toward adults, until need for adult assistance shifts them into a more juvenile role.

Nevertheless, there is reason for caution in labeling any of these displays as threats. First, stomp walking and sumo strutting, along with wallowing and tree rubbing, are also forms of scent marking. Mammals commonly use distinctive postures or gestures for drawing visual attention to where and when they scent mark, for instance with urine or feces. L. Rogers and S. Mansfield (personal communication), thus, hypothesize that stomp walking and perhaps sumo strutting may have become so ritualized that they are no more threatening than the leg lifting of a male dog or wolf. Second,

some of these displays (e.g., pant huffing, woofing, and jaw popping) are made by bears of all ages and social ranks, whether they are facing an opponent or alone. It is not only adult males, but also by adult females and adolescents of both sexes that stomp walk, contrary to sumo strutting and ungulate dominance displays. So, stomp walking and pant huffing may not, in fact, be dominance displays.

The fact that a display is associated with agonistic activity does not prove that the display itself is agonistic. This is illustrated by the exaggerated gait used by sumo wrestlers just prior to a match, the gait for which ursine sumo strutting is named. A naïve observer might jump to the conclusion that this is a dominance display. Actually, it is a religious purification ceremony (Benjamin 2010).

This issue is neither just academic nor semantic, but highly pragmatic. For if pant huffing, woofing, jaw popping or scent marking are labeled as threats, which in the broadest sense include dominance displays, then, any animal making them in the presence of a human might be condemned for daring to threaten a human. Many bears have been killed for no worse crime. Rather than foster such misunderstandings, some biologists prefer referring to these displays as signs of stress (e.g., Herrero et al. 2005).

By far, the most thorough analyzes of bear attacks are those published by Herrero and his colleagues (Herrero 1980, 1985, 2002; Herrero and Higgins 1999, 2003; Herrero et al. 2011). These reports include cases where nonpredatory attacks followed frontal threats; but, no mention is made of attacks that followed a broadside display. Again, predatory attacks were not prefaced by any kind of display.

Geist's statement that an ursine broadside display is a "signal of high danger" is certainly true if "high" refers to severity of injury if the display is followed by attack. However, in all contexts where I have seen it, it indicates low probability of attack. That said, Geist is correct that any dominance display by a bear, either frontal or broadside, warrants extra caution. If the bear is acting offensively (e.g., to usurp the space occupied by people or to steal their food), the people might best leave or dominate the bear by using appropriate body language. A group of viewers often achieves dominance

accidentally just by failing to react, if only out of ignorance that a bear is trying to intimidate them. A lone person can sometimes achieve the same thing by seeming imperturbable. But this takes proverbial nerves of steel and does not always work, in which case one may have to rely on other tactics, such as those detailed by Stringham (2009) or by using pepper spray.

Withdrawal is also 1 option for appeasing a defensive bear (e.g., one defending an animal carcass or protecting small cubs). However, if a person's goal is to observe the bear, a more useful tactic may be to assure the bear that it is in no danger. Viewers commonly appease bears by kneeling, sitting down, or lying down (Figure 1; Stringham 2009). Although a domineering bear can also sometimes be appeased, this should not be done in a manner that rewards its bullying.

Eye contact

Geist emphasizes the importance of maintaining eye contact with any potentially dangerous large mammal. He refers to attacks during a lapse of eye contact when someone thought that a passing ungulate was ignoring them. I earlier described similar experiences with bears. I personally always try to maintain direct eye contact with a domineering bear, but may avert my gaze if the bear is defensive (Stringham 2009). Loss of eye contact also seems to be a factor triggering predatory attacks by cougars (*Puma concolor*) and other large felids (Etling 2001).

Geist notes that dominance displays by ungulates are commonly made with the eyes averted; the opponent is viewed through the rear of the eye. His description does not reveal whether the averted gaze is a consequence of antler or horn orientation. For example, if these weapons are pointed toward an opponent, is the chin necessarily pointed away?

The eyes of a cervid or bovid are oriented somewhat to the side of the head, enabling these animals to see behind themselves. Bears, of course, do not. They cannot watch an opponent if their head is averted much past broadside to the opponent. In that position, the opponent is seen peripherally. The mere fact that a bear averts its eyes is not an indication that it is making a dominance display. On the contrary, this is normally a sign of appeasement in all situations where I have observed bears, except for sumo strutting and stomp walking.

For example, at Wolverine Creek in Alaska, both brown and black bears commonly rest on shore or fish for salmon within 1 to 10 m of several skiffs filled with people. These bears are usually careful to avoid looking directly at people, much in the manner of submissive dogs (Stringham 2008; Figure 6). At sites with fewer visitors, bears commonly investigate people much as they investigate one another, grazing as they move ever closer. If they stare directly at people, they usually do so when alarmed and from distances >50 m.

When a bear is approached by a higher-ranking opponent that makes no weapon threat, the subordinate may turn its head aside (perhaps after sitting back on its haunches), watching the dominant with peripheral vision (Stonorov and Stokes 1972).

So, too, when peaceful bears pass one another, either because they are walking in opposite directions along a trail or because of mutual investigation, they commonly avert their gazes and watch each other peripherally. Averted gaze is especially important when 1 bear runs in the direction of another, perhaps to catch a salmon or to escape an enemy. When a rapidly approaching bear aims its eyes away from another individual (thereby exposing a crescent of whitish sclera of the outside of the closest eye), this can signal that the approaching bear is not threatening the other individual. I am not sure how often bears recognize this distinction, but I have found it reliable in hundreds of cases of a bear walking or running toward me (Stringham 2009). Poulsen (2009) reports that a captive bear uses the direction of its gaze to direct keepers to the focus of its attention, perhaps food or a toy that the bear cannot reach or something that the bear wants removed from its cage.

Deceptive grazing

Geist notes that mountain sheep rams sometimes attack just after grazing up to a rival, as though grazing, like averting its gaze, were a deception that allowed the attacking animal to approach and catch its opponent off guard. By contrast, in thousands of cases of bears feeding near one another, I have never seen grazing immediately precede attack. At most, when the movements of 2 bears bring them uncomfortably close to one another, one may make a short rush (perhaps only 1 or 2 steps)

toward the other bear, which is more likely to retreat than to reciprocate. In other cases, where 2 grazing bears tolerate a mutual approach, they may pass within a few meters of each other without ceasing to feed; or they may raise their heads, walk together, and begin sniffing one another's faces. In the case of adolescents or pre-adolescents, this may eventually lead to mouthing each other's cheeks, then to playful wrestling. Accordingly, when a bear grazes up to me, while watching me peripherally, I interpret this as a sign that it is curious or playful. Cases where the bear just goes through the motions of feeding, seldom biting off vegetation or ingesting it, suggest that the behavior is either a ritualized or insightful means of signaling benign intent, not veiled aggression.

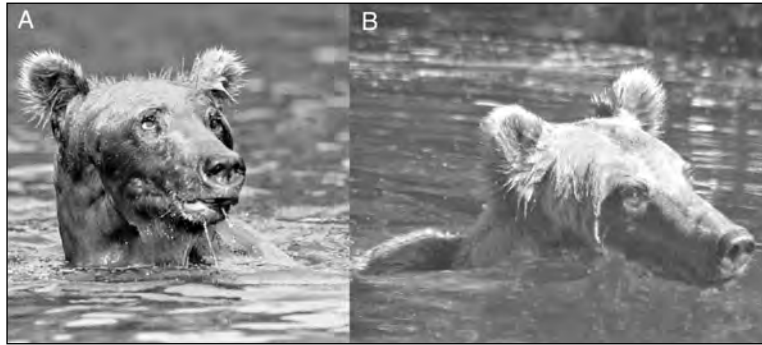


Figure 6. Adult female brown bears fishing for salmon avoided looking directly at boats filled with people a few meters away. In photo B, the bear is watching the people peripherally while facing away from them.

Risk

An unfortunate trait of hazard analysis based on scant information is that one ends up emphasizing the possibility of tragic consequences without being able to quantify their probability even ordinarily, much less on an interval scale. Interval analysis also is limited to a narrow range of conditions from which it is difficult to extrapolate. For example, consider Herrero et al.'s (2011) finding that of 36 black bear attacks that killed a person, 92% of the killers were adults or adolescent males. What does that reveal about the relative risk of being injured by male versus female black bears in regions where they are especially shy towards people, perhaps because shy bears have been the most likely to survive hunters? Again, the mere fact that some trait is commonly associated with agonistic or predatory aggression does not mean that it is diagnostic of aggression or even most commonly seen in that context.

Even if one cannot yet quantify how well a display or situation predicts attack, one should be cautious of advising people on the consequences of this vagueness. Any implication that some factor is a good predictor of aggression, when

in fact it is rarely followed by aggression, is easily discredited in the public eye. Even if one cannot provide a precise numerical estimate of risk (e.g., 1 attack per 500,000 viewer days), one might provide comparisons with equally severe injury from more familiar hazards (e.g., playing Russian Roulette versus slipping and falling versus driving without a seatbelt fastened).

Through guilt by association, crying wolf can also discredit other warnings and safety recommendations as mere superstitions, as the late Timothy Treadwell and many other viewers, hunters, and anglers have voiced to me. This is but one more example of the constant challenge safety advisors face in trying to protect the public against low frequency but high consequence hazards.

People seldom respect warnings contradicted by their own experience, however limited. One tactic for curbing skepticism is to become much better at identifying the conditions that govern the degree of risk, as Mattson et al. (2011) have done with particular sophistication regarding cougars. For example, what environmental, social, or physiological factors (e.g., stage of the reproductive cycle) might enable an observer to distinguish instances where a broadside display, averted gaze, or grazing represents high attack risk versus negligible risk? Suppose hypothetically that sumo strutting toward a human were followed by attack only 1 in 10,000 times when all cases are considered, but in 10% of those cases where the bear is a previously dominant male who has just lost a fight with another male in competition for an estrus female. The latter generality could be more readily tested than the former. As uncertainty

narrows, credibility rises. The more we know, the more closely management can be tailored to avoid high-risk situations without unduly constraining public freedom to enjoy wildlife and wildlands. For example, in national forests where bears abound, is risk of attack on bicyclists or people walking dogs high enough to warrant managers forbidding those activities?

Conclusions

The intensity of research on body language that characterized early ethology has, unfortunately, waned in the face of newer theoretical priorities. Until recently, few researchers or wildlife managers recognized the pragmatic value of ethological knowledge for people viewing large, potentially dangerous wildlife, much less that viewing would become so popular. At least occasionally, viewer safety may depend critically on being accompanied by a specialist (e.g., interpretive guide or ranger) who understands enough about the behavior of each species to distinguish a wide range of motivations and who knows how to respond appropriately to each. We should not wait until more viewers are mauled before we begin elevating the qualifications of viewing guides and managers to the levels of professionalism long since achieved for hunting guides and managers. Biologists should compile knowledge on behavior of charismatic wildlife into multimedia safety manuals, with elementary versions for casual viewers as well as detailed volumes for professionals (e.g., Stringham 1974, 2002, 2008, 2009; <www.bear-viewing-in-alaska.info>).

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(*Editor's note: Following is the author's rebuttal of responses made by Lynn L. Rogers and Susan A. Mansfield (2011), and Stephen Stringham (2011) to his commentary, "Wildlife habituation: advances in understanding and management application", which appeared in Human–Wildlife Interactions 5:9–12.*)

Response to Rogers and Mansfield (2011) and Stringham (2011)

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THREE VALUED COLLEAGUES, extremely knowledgeable of bear behavior, have taken exception to some of my writing. I am grateful to be able to reply. There are a number of points of contention. Regarding habituation, I am well aware of the definitions proposed, but I find them wanting. How does "a waning of responses to a repeated, neutral stimulus" differentiate adequately between habituation and taming? Put another way: how could one disprove the claim of Rogers and others that they are working not with habituated, but with tame bears? Bears do tame, after all, quite easily. But if they tame, then how does that differ from habituation?

I experienced working not only with habituated, and also with thoroughly tamed, but free-ranging mountain sheep (*Ovis canadensis*). Further, the animal may continue exploring the observer not only when habituated, but also when tame. Therefore, even tameness may be a state of unconsummated exploration. I have observed free-roaming sheep in 4 stages of acquaintance: (1) those that I saw at a distance with spotting scope and binoculars; (2) those that I habituated to my presence till they ignored me and went about their daily lives (very much as Rogers and Mansfield described it for their work with black bears [*Ursus americanus*]); (3) those that I tamed systematically; and (4) those that proceeded to address me as a conspecific. It may be worth examining this 4-stage progression, as it was unexpected.

First, the changeover from habituation to taming was initiated always by the habituated sheep. It began when the sheep, after observing me noticeably, approached me and began to explore me physically. They sniffed my clothing, touched it with their muzzle and licked at it. I allowed this to happen and that

then let them touch and lick a piece of rock salt I held in hand. This they licked eagerly, at which time I placed my fingers on their nose and then proceeded to systematically touch and stroke their faces till they allowed me to clear hair off the small aluminum ear-tags that park wardens had placed there earlier, usually when the sheep were lambs. They tagged adult sheep by slipping the ear-tag over the lower ear and clamping down, releasing the pliers at once as the sheep bounded back, shook its head and came back and resumed licking the salt. I tagged lambs by hunching beside a female while it licked salt. As the lamb approached, I touched it on the breast until it accepted the human hand, then it was gently lifted up right beside the female's head. No lamb protested. Tags were clamped into the ears, and the lamb was slowly and gently released, the female licking salt all the while. Thus, no drugs, traps, or wrestling to the ground of panic-stricken animals was necessary. I could freely walk up to the tame sheep and touch them. That is why I know, for instance, that bighorns are ticklish. The tame sheep, otherwise, went about their daily business much as they had when merely habituated.

This continued for nearly 2 years, but, then, sheep began a new phase of interaction: they started including me into their social system, with the females treating me as a super-female, and the rams as a rival. This last phase began with females and lambs associating with me, using me as a center of their activity. This was followed by them taking notice of my departures from the herd in the evening, followed by an old female running to me then blocking my further progress by body contact, very much like a lamb blocking a female before suckling. I could play hide-and-seek with the

sheep and discover that they did not simply follow where I disappeared, but, they had a conception of where I should reappear and they awaited me there. They were spatial strategists. However, they would also track me—their nose to the ground—for hundreds of yards till they found my hiding place. Further, bands of females followed me into the valley. Soon after leaving the open hills, they clustered behind me and assumed body contact. They could be led anywhere, but they broke into a run when I returned them to within 100 m or so of their home range.

Then the first ram addressed me suddenly with its head high horn display, one of 2 horn displays, dominance or status displays. This was a serious challenge. However, in mountain sheep, it can be easily terminated by stepping up to the ram and sharply shoving him downhill so that he stumbles. Stumbling is essential. In dominance fights, the ram who stumbles after a clash is the looser. He gives up by turning, feeding, and accepting the full-fledged, ongoing courtship procedure of the dominant, mounting included. A subordinate does not leave the band after losing status, but remains being treated as a female by the dominants.

I was attacked once when I was surrounded by a large, rutting band of sheep on a steep slope. I tried to disengage by suddenly turning and running down hill and was at once struck by a large ram. My second escape attempt resulted in another attack. I escaped injury as the clash is a twisting downward blow in which the horn edge acts much as a hand in a karate blow. The horns brushed down my back and the ram slammed his head into the scree. I gave him a piece of salt that he could not readily spit out, and as other sheep crowded in to partake of the salt, I escaped. However, that ram came for me subsequently every morning from as far as nearly half a mile away. He would rear running on his hind legs showing readiness to clash. I would then step behind a female, allowed the ram to run past and then rear towards me on the downhill side. Now, however, I was taller than he, and I simply stared at him (rams cannot clash uphill). He would blink, eventually, drop to all fours, give me the head-high display—I would not budge—then turn and start grazing (peace signal), at which point I stepped forward and gave him a little swat on his bum. He would

hop forward and at once continue grazing. After that he was just fine all day long. Come morning, the whole procedure was repeated. This ram surprised and knocked one of my colleagues unconscious. Fortunately, the ram soon disappeared, never to be seen again.

Subsequently, I took pains to insure that none of the animals I observed would be anything but habituated. There is no way to handle the attack of any male deer, elk, moose, bison, etc. I, thus, do not counsel working with free-ranging, tame, large mammals. As an aside, I have no doubt that the proclivity for taming by bighorn sheep was known to native people, and this allowed them to manage the sheep. Petroglyphs in the canyons of Utah and elsewhere attest to this.

Different species end habituation differently. In my experience, exploration by sheep and whiskey-jacks (i.e., Canada jays [*Perisoreus canadensis*]) was gustatory (how did I taste?). In free-ranging wolves (*Canis lupus*) and coyotes (*Canis latrans*), habituation may change to an exploration of an alternative food source, resulting in an attack. This was originally discovered in coyotes targeting children in urban parks by Baker and Timm (1998), and independently discovered for wolves by myself (See Appendix B in Geist 2007). Woolpy and Ginsburg (1967) found that wolves also did their final exploration as an attack. In short, my account of habituation is based on contrast with taming and its consequences.

Rogers and Mansfield (2011), and Stringham (2011) reported that in their professional experience habituated bears are harmless. Unfortunately, bears are not always treated with caution and skill as done by professional observers and viewing guides. Bears in the Canadian national parks where I worked were routinely molested, especially through photography, and had a very high rate of mortality (Nielsen et al. 2004). For example, a young female grizzly bear (*Ursus arctos*) showed up in my study area in the back country of Banff National Park. She did not flee from my vehicle as other grizzlies did (habituated?). A district warden and I were fishing at a beaver pond when we were charged by this female. She appeared suddenly across a narrows and charged instantly, jumping into the water and swimming for us. I escaped by climbing, the

warden by diving. Shortly thereafter, she treed this same warden and a horse wrangler. When she appeared a third time, the warden was carrying a rifle. A student of mine also was treed when he surprised a large male grizzly on an elk kill. Years later he and a warden were deep inside the wilderness of a newly-minted national park out in the wide open when they were met by a an old female grizzly with a 2-year old cub. After “dancing about” apparently examining the intruders, the female and cub charged. My former student shot both bears, one of which was on top of the warden. One bear attack by a (habituated) black bear resulted in a kill-order to remove all habituated black bears; 256 bears subsequently were killed. The wardens who did the executions secretly informed me of this while we worked in the parks. Subsequently, colleagues in parks have worked hard, and successfully, to reduce the carnage.

Do bears terminate habituation with attacks? I suspect that, unless they are professionally handled, they occasionally do. And that is where the lesson resides, thanks to the dedicated professional efforts and successes of the likes of Lynn Rogers, Susan Mansfield, and Stephen Stringham. I counsel caution with animals that do not flee, that look “habituated”, unless one knows their history.

Another bone of contention between my colleagues and myself was signaling by bears. Dominance or status displays are signals universal to vertebrates, and bears are no exception. Displays of status cannot be understood in isolation from the subject of aggression (Geist 1978a). Status displays vary considerably. In mammals, they tend to be body displays in their primitive form, but may be weapon displays in other species. An individual thus signals its superiority and may back it up with an attack. In humans, dominance displays reach the highest diversity of expression through the cultural elaboration of the biological basis. We use art to enhance innate display structures that we share with old world primates (face, head-hair, chest, penis, butt) followed by sophisticated cultural elaborations. Our displays express pride, humor, and also the antithesis of dominance—courtesy—and incorporate, among others Thorstein Veblen’s “conspicuous consumption”. There are at least

10 rules we follow in showing off our status. (Geist 1978b).

Because dominance displays are species-specific and quite different from species to species, its study in ungulates has the advantage of many species to compare. Moreover, the large size of the animals and visual orientation have fostered picture planes during the display that closely follow artistic theory. Show and explain such to students of art, architecture, or design, and they instantly recognize the code and follow matters with enthusiasm, while biologists sit there with glum faces! (It, of course, suggests that large mammals use much the same neural mechanisms to evaluate and interpret space). The trouble is that unlike primates, ungulates notoriously avert eyes from the individual displayed to, so that we may not even notice that we are being signaled. A friend working in a zoo barely escaped with his life, though not without injury, when he was attacked by a rutting, white-tailed deer (*Odocoileus virginianus*) buck that apparently ignored him. Some captive stags approaching with their eyes averted respond with an instant attack into the fence if one looks away from them. Looking away made a victim of a good acquaintance of mine (also a zoo worker) who, while close to the wire fence, looked away from an approaching bull elk (*Cervus canadensis*) that appeared to ignore him. The elk’s fourth tine penetrated my friend’s chest just above his heart. Fortunately, he was saved. My late friend Fritz Walther, himself a former zoo director, and a great student of ungulate communication, talked of a number of similar happenings, some with tragic outcomes because the eye-aversion threw off the human victim. Unfortunately, I can go on with such war stories. Standing with friends, students, and colleagues in front of zoo exhibits or showing them films, I found again and again that they overlooked the displays of ungulates, but quickly caught on once it was explained. As primates, we understand primates better. They look at us!

In 1963, I showed to graduate students at the University of British Columbia my first film, featuring mountain goats, including the long, stiff dominance displays of big rutting males. Maurice Hornocker spoke up, pointing out that grizzly bears had a very similar display. Hornocker had done a masters thesis

on grizzly bears. He was, of course correct, as the dominance display of bears was later described in detail by Stringham (2010) and labeled “sumo display”. It is so similar to that of primitive ungulates (broadside orientation, aversion of eyes, stiff motion, release of urine) that one might be forgiven looking for horn-on-the-head of the displaying bears. As expected, this is primarily a display of large males to one another. Dominance displays signal intent to dominate. They are not “harmless bluster” as has been claimed.

Stringham (personal communication) related to me that in all the years of his work with black and grizzly bears he has never been addressed with a “sumo display”. This speaks legions about the tactful, careful approach in observing bears used by this exceptionally capable scholar. I have been, however, addressed with the “sumo display” by very large black bear males for perfectly logical reasons. For the past 16 years, I have resided with black bears (and misbehaving wolves) in an agricultural district on Vancouver Island. Two salmon streams pass through our acreage close to our house, where we also have poultry, fruit trees, and grape arbors. These are great attractants for bears, and I set myself the task of keeping bears out, as shy bears avoiding humans are the only live bears hereabouts. A dog announces the arrival of a bear, and at any hour of the day or night I respond, clattering the action of a pump shotgun (super-teeth-clapping) moving at the bear till it flees. Young bears and most old male bears fled at once and usually stayed away (although snowfalls revealed that they were constantly monitoring me). However, 2 large males “objected” in their species-specific ways and pushed back, which included sumo displays! I have seen these displays performed by large males in their interactions. Bears learned quickly to avoid the vicinity of our house, but continued making use of the salmon streams and meadows close by. From our veranda, we can hear them fishing.

The study of animal behavior is not a monolithic discipline, but it contains different lineages that evolved their own language and conceptions. Konrad Lorenz introduced the notion of expressions as resultants of different, conflicting emotions, and bear biologists still hang onto that. Others, in particular ungulate

ethologists, pointed out that such a scheme falls to pieces the moment one does an interspecific comparison of dominance displays, as even closely related species may have greatly different status displays. Secondly, emotions are inferences, not observations as illustrated by the sentence “The ant stamps its feet in anger”. We preferred to stick to observable phenomena, avoiding deliberately terms like anxiety, fear, or nervous apprehension. Note the difference: Rogers and Mansfield describe beautifully the threat behavior of black bears. They then add that from their experience, there is no follow up with attacks, and even the threats diminish with time spent with bears—very important observations. However, the phenomenon involved is still a threat as recognized by the universals of threat behavior, namely the orientation toward an opponent, intimating the use of weapons (mouth and paws), even if the chances of attack are low. I concur that threats are mostly a defensive behavior. However, one does not ignore them, even if there is low danger, and I do not think that Rogers and Mansfield counsel such.

Ignoring threat signals (i.e., defensive ones) can be costly. For instance, one threat behavior of moose (*Alces americanus*) is to lift a hind leg slightly off the ground, cocking it, ready to strike. A warden in Yellowstone National Park, faced by a young bull blocking the plowed snow road to snowmobilers, though the moose was injured. He tried to haze the bull into the deep snow. In vain. (When confronted by predators, moose seek out small areas of low snow and hard footing, on which they can spin around unimpeded striking with their front legs and lashing out with their hind legs. The power is great and the aim very accurate). He managed to make the bull move to an edge, using bangers, upon which he signaled the snowmobiles to proceed. The moose attacked the first snowmobile instantly, leaving 1 man with a broken neck. The court case against the park was dismissed on the basis of sovereign immunity.

I am grateful to Lynn Rogers for elaborating on the Timothy Treadwell case. I was aware of Treadwell’s “samurai” mode. I also practice it very frequently and have done so for 16 years, with the aim of teaching black bears where they will be confronted and where not, where they

can feed in peace (salmon stream, grazing or mousing in meadows) and where not (garden, chicken coops, apple trees close to house etc.). For years, very few large males did not accept being displaced without protest! I am well aware that bears (and wolves) are, paradoxically, timid compared to ungulates and that assertive behavior on our part is good protection from harm. Large mammals that readily draw blood are, as a rule of thumb, unlikely to enter into overt combat. Retaliation by the victim sees to that (Geist 1966, 1978a). I think bears fall into this category, especially black bears who are products of the competitive large predator fauna in Pleistocene North America. I saw Treadwell's behavior on film, and was appalled. I am impressed that he lasted as long as he did.

The great achievement of Rogers, Mansfield, Stringham, and bear-viewing guides is to demonstrate how knowledgeable habituation can result in safe bear viewing. This knowledge needs to be spread (see Stringham 2002, 2007, 2009, 2010). In national parks, I have seen a lot of misbehavior towards wildlife by tourists, as well as by park staff, which is not likely to cease, nor are the dangers arising from this behavior. A good understanding of the body language of large mammals, bears included, not only makes viewing more interesting, but can save the lives of humans and wildlife. I do not think we disagree on this point. As for the rest—I pass.

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