Understanding wildlife responses to humans

Doug Whittaker and Richard L. Knight

A herd of 40 elk (*Cervus canadensis*) barely look up from grazing in a Yellowstone meadow as a dozen motorhomes crowd a nearby highway. A 450-kg brown bear (*Ursus arctos*) flees his fishing spot on an Alaskan stream at the sight of an 80-kg man. Canada geese (*Branta canadensis*) in a city park walk directly toward people in search of hand-outs. Different settings, different species, and different responses to humans or their environments, but each suggests the same underlying question: Why do wildlife exhibit such diverse behavior around people?

The general answer is that wildlife have developed situation-specific responses because some combination of learning and genetics have made them successful. As the human–wildlife interface changes, however, some of these responses may become detrimental for wildlife, or lead to conflicts with people. In order to manage these situations, wildlife professionals should differentiate between responses, identify their causes and consequences, and evaluate those consequences. While several research traditions provide concepts useful for this effort, variation exists in the way these concepts are understood and applied by researchers, managers, and the public. Some of these concepts have also become value-laden (always an issue when humans study phenomena connected to themselves), and this can become an obstacle in decision-making.

We think there is a need to reconsider how wildlife management describes and makes decisions about wildlife responses to humans. This should begin with attention to definitions of concepts and extend to the development of new models for describing, predicting, and evaluating responses. Hoping to stimulate discussion and the development of improved models, we review the basic concepts and identify 3 issues that wildlife professionals should consider when working in the area of human–wildlife interactions.

Definitions

Although wildlife responses to humans vary, it is possible to broadly describe 3 classes of wildlife responses as attraction, habituation, and avoidance (Knight and Cole 1991). In general, an animal can find human-provided stimuli reinforcing (leading to

Habituated brown bears at Katmai National Park, Alaska provide high-quality viewing opportunities, but habituation may make bears easier targets for poachers or hunters if they leave protected areas. Photo from Brooks River. Photo by J. Whittaker.

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attraction), aversive (leading to avoidance), or neutral (leading to habituation; Gilbert 1989). Most wildlife professionals have a general understanding of these terms, but the specific meanings they attach to these terms are influenced by their training. Some of the terms (particularly habituation) were developed from precise concepts in behavioral psychology and ethology, but they are also used by wildlife professionals in broader contexts. While recognizing the value of precise terminology, we believe these concepts should be widely understood across backgrounds. In this spirit, a brief review of terms follows.

Attraction

"Attraction" in wildlife management is defined as the strengthening of an animal's behavior because of positive reinforcement, and implies movement toward the stimuli (Knight and Cole 1991). Developed within the associative-learning tradition of behavioral psychology (Klopfer 1974, Domjan and Burkhard 1986, Manning and Dawkins 1992), wildlife attraction is often presumed to be about food-conditioning but is equally applicable to behaviors that attract wildlife to shelter or security. Examples of attraction include Clark's nutcrackers (*Nucifraga columbiana*) that fly to picnickers for handouts, cardinals (*Cardinalis cardinalis*) at bird baths or feeders, or rainbow trout (*Salmo gairdneri*) lured to the cold water of a dam tailwater (or the fly on the end of an angler's line).

Habituation

Of the 3 terms, "habituation" is the most often misapplied and is commonly confused with attraction. Unlike attraction, which involves a reinforcing stimuli, habituation is a waning of response to a repeated, neutral stimuli (Humphrey 1930, Thorpe 1956, Eibl-Eibelsfeldt 1970). This formal definition, used with precision in behavioral psychology and ethology, is less carefully used by some wildlife professionals. Habituation, for example, has little to do with the words "habitual" or "habit," even though they share a common root. A bear may be in the habit of going to a garbage dump to look for food, but this is attraction, not habituation (Gilbert 1989). Being habituated to human food would imply that the bear ignores it.

Wildlife are capable of becoming habituated to people, human-made environments, and most any human stimuli. The wildlife in the Galapagos Islands epitomize animals habituated to the presence of people, but habituation is also an apt description for crows (*Corvus* spp.) ignoring a scarecrow, or a red fox (*Vulpes vulpes*) ignoring the human activity of a suburban area.

Sensitization is an allied concept that is also commonly misused. "Sensitization" describes increased response to stimuli, and is the opposite of habituation (Domjam and Burkhard 1986, Immelmann and Beer 1989). Researchers have suggested that sensitization and habituation may occur simultaneously; only the net effect is observed (Groves and Thompson 1970). This dual-process theory explains phenomena such as recovery, in which habituation is replaced by a highly sensitized state with a slight change in the stimulus.

Avoidance

"Avoidance" is the opposite of attraction, an aversion to negative consequences associated with a stimulus (Knight and Cole 1991). Some behaviorists distinguish avoidance from escape; the former refers to actions that prevent aversive consequences, whereas the latter is a reaction to aversive consequences (Domjam and Burkhard 1986).

Avoidance can apply to a range of stimuli, including those in which the stimulus is aversive (unconditioned response) and those in which the stimulus is associated with aversive consequences (conditioned response). Deer (*Odocoileus* spp.) can learn to avoid touching an electrified fence, and wolves (*Canis lupus*) can learn to avoid towns or road systems because they associate them with human persecution (Thurber et al. 1994).

Issue 1: Wildlife responses and causality

Attraction, habituation, and avoidance are used to describe behavior in response to a known stimuli. In

Canada geese and other waterfowl may become attracted to urban parks and handouts, which may create unhealthy dependencies on artificial food sources. Photo from Anchorage, Alaska. Photo by J. Whittaker.

behavioral psychology, where these terms were first developed, this is often the case: research explores how animals (usually rock doves [*Columba livia*] and rats [*Ratus* spp.]) respond to stimuli (usually shocks or food reinforcement) in experimental settings where extraneous variables are tightly controlled (Domjan and Burkhard 1986). In this research tradition, the exploration of causality is central.

In the European ethology and wildlife management traditions, however, emphasis on observations in natural settings make causality far less certain (Klopfer 1974). In these settings, it is difficult to divorce stimuli from their context; this suggests a methodological shift from an experimental to a correlational perspective that explores more variables.

This is particularly relevant as we try to understand the underlying processes that cause wildlife responses. Although many wildlife researchers consider attraction, habituation, and avoidance to be functions of learning (Klopfer 1974, Newton 1979, Poole 1981, Buitron 1983, Fraser 1984, Knight and Temple 1986, Knight and Cole 1991, Manning and Dawkins 1992), others suggest genetic roots (Klopfer 1974, Knight and Temple 1995).

Hailman's (1967) concept of "learning an instinct" suggests how genetic and learned components may be intertwined and could have particular relevance for understanding avoidance responses. For example, bighorn sheep (*Ovis canadensis*) and mountain goats (*Oreamnos americanus*), withdraw to cliffs in response to sudden, loud noises such as rockfalls (Geist 1971, 1978). When gunshots invoke a similar response, it suggests a genetic component being reinforced through learning. In another example, studies of red-tailed hawks (*Buteo jamaicensis*) suggest that associations with human persecution may have become genetically coded in hawks because hawk populations in areas with longer histories of European settlement (which had firearms) were less aggressive and more oriented toward avoidance than those in areas with more recent settlement by Europeans (Knight et al. 1989).

It is also possible that wildlife responses to humans may be culturally transmitted across generations. Thurber et al. (1994) suggested that wolves teach their young to avoid certain human environments because of associations with persecution, and Douglas-Hamilton and Douglas-Hamilton (1975) suggested that the behavior of a band of unusually nocturnal and aggressive elephants (*Loxodonta africana*) could be traced to a persecution event in 1919—too long ago to be part of the living elephants' experience, but too recent to have become genetically encoded in their behavior. Considerable research has explored the cultural transmission of behavior in higher animals, particularly primates (McGrew et al. 1979, Bonner 1980, Goodall 1986), and most of this research suggests more extensive cultural transmission than previously believed.

The likelihood of genetic and culturally transmitted influences on wildlife responses suggests the need for richer models than those developed in the learning and behaviorist traditions. While differentiating these components will be challenging, the information could be useful. Management actions that take advantage of genetic predispositions or culturally transmitted responses are likely to be more successful than those that depend on learned behavior during the lifetimes of individual animals (e.g., aversive conditioning techniques that mimic stimuli that a species finds naturally aversive).

More research is needed to explore the links between attraction, habituation, and avoidance. Evidence exists, for example, that attraction can lead to habituation. Primate researchers often gain access to their subjects by providing food attractants during the initial stages of field observation; over time the animals learn to ignore human presence and the attraction can be removed (Goodall 1986, Lofstrom and Stallings 1973). Wildlife professionals also have suggested that habituation may lead to attraction, particularly among bears (McCullough 1982, Herrero 1985, Jope 1985, Olson et al. 1997). In learning to ignore people, habituated wildlife have greater opportunities to find attraction stimuli in human environments. Because humans generally attempt to avoid attracting potentially dangerous animals, understanding these types of links may be critical.

Issue 2: Response events or response tendencies?

In the behaviorist and ethology traditions, attraction, habituation, and avoidance are descriptions of behavioral events or processes—specific stimuli and specific responses. These events are also carefully placed in context with descriptions of the conditions under which the animal was attracted to the stimulus. Wildlife professionals, however, sometimes label an animal, a sub-group, or an entire population based on limited responses from a few animals. Observing an animal that does not withdraw from stimuli, ethologists might describe the behavior as habituation; in contrast, some wildlife professionals might extend this conclusion and describe the animal as habituated.

This kind of conceptual extension has undeniable utility for comparing the response tendencies of indi-

vidual animals or groups of animals. But it also invites confusion because the labels go beyond observed events. The event is concrete; the tendency to behave is more abstract and uncertain. Our purpose is not to discourage this kind of labeling, but to encourage clarity about whether the label refers to past behavior or predicted future tendencies.

Labeling animals or populations may also direct attention away from context variables. The concepts of attraction, habituation, and avoidance do not suggest that wildlife learn the same responses for all situations. For animals with greater cognitive abilities and longer rearing periods, new settings or additional stimuli may invoke considerably different responses (Orians 1981, Gilbert 1989, Manning and Dawkins 1992).

Models that recognize greater complexity and subtlety in wildlife responses are needed. Nest-defense studies, for example, have suggested that birds distinguish different types of predators, different individuals, and different postures of predators when choosing their defense response (Knight and Temple 1986, Knight et al. 1987). Wildlife also behave differently in different locations and during different activities, and the learned outcomes of all these interactions affect subsequent interactions (Gilbert 1989). Success in understanding wildlife responses requires careful measurement of these contextual variables. The focus should not be simply, "Are these animals habituated?" More interesting questions include, "Under what conditions does habituated behavior exist?" and "How long does habituation take to appear?" and "How will additional stimuli affect responses?"

Researchers might also consider treating wildlife responses as continuous rather than dichotomous variables. For example, an animal's behavior is not simply habituated or nonhabituated, but a matter of degree. Wildlife responses occur in context and in differing magnitudes in different contexts. This is commonly understood by field biologists who develop decision-rules to identify whether an animal is exhibiting habituation, attraction, or avoidance. But these decision rules may fail to capture important levels of these responses. Attraction, habituation, and avoidance are broad, latent, or intangible dispositions that we measure through outward responses. While 1 yes-or-no variable may offer initial understanding, finer-grained analyses that feature scaled variables are also possible and should be developed.

Moose may become attracted to the landscaping in suburban environments, which can create conflicts with humans. Subdivision in Wasilla, Alaska, near Anchorage. Photo by J. Whittaker.

Issue 3: Evaluating wildlife responses

Attraction, habituation, or avoidance responses are not intrinsically good or bad. Value judgments, however, are commonly attached to these terms, and can be an obstacle to effective management. The consequences of wildlife responses are not always immediate, direct, or obvious; history is replete with examples of misguided judgments about the consequences of an animal's behavior (Steinbeck and Ricketts 1941). In addition, even when we understand these consequences, disagreement may arise about the acceptability of them. Responses harmful to 1 species may be beneficial to another; it is a philosophical, rather than a scientific position to suggest which should prevail (Fleischman 1969). Value judgments about "what should be" are an essential component of resource decisions, but premature integration with information about "what is" can lead to misapplications (Shelby and Heberlein 1986, Bekoff and Jamieson 1991).

Cataloging the consequences of wildlife responses is beyond the scope of this paper. Some examples, however, may suggest why value judgments should be cautiously applied:

- Bird feeding may attract and boost populations such as chickadees (*Parus atricapillus*) or bald eagles (*Haliaeetus leucocephalus*; Brittingham and Temple 1988, Knight and Anderson 1990) and is widely accepted. But bird feeding may also have subtle long-term consequences by favoring certain species and contributing to an overall decline in diversity (George 1982). Feeders may also make birds dependent on artificial food sources, alter the quality of their diet, and change intraspecific interactions in an area.
- Attraction of brown bears to garbage dumps is typically discouraged because it increases risks of injury to people or bears (Herrero 1985, Gilbert 1989, Albert and Bowyer 1991).

Some researchers, however, have suggested that human-provided food centers (e.g., elk carcasses) may help support a threatened population (Craighead et al. 1995).

- The ability to habituate to humans is considered an essential survival skill for many urban wildlife species, particularly song birds (Burger and Gochfeld 1991). Disturbances from approaching humans would affect many birds' ability to feed, breed, and rest if they were unable to habituate. Bald eagles on salmon rivers with heavy recreational use face the same problem (Knight and Knight 1984). This same habituation response, however, may make these birds susceptible to human persecution.
- Brown bears that become habituated to humans at salmon streams provide people with the opportunity to view bears and allow bears to fish without disruption. Habituation responses may also create "sanctuaries" for subadults and family groups, because large boars are more likely to avoid some of these viewing areas (Olson et al. 1997). Other consequences of habituated behavior in bears, however, may be less positive. Bears that ignore people at bear-viewing areas are easier targets for hunters or poachers outside protected areas. Habituated bears are also more likely to encounter attraction stimuli in the human environment (Hererro 1985; R. Squibb, Summary of bear management issues, unpubl. rep., Katmai Natl. Park and Preserve Headquarters, King Salmon, Alas., 1991).
- Avoidance responses are beneficial to persecuted species for which a human encounter can mean death, yet these same responses may prevent the animals from using otherwise suitable environments, or cause elevated and damaging levels of stress. Some animals, such as black bears (*Ursus americanus*), become adept at using areas of intense human use while still avoiding people. From a park manager's point of view this may be a "model" response, but it still prevents the bears from using their entire home range (McCutchen 1989). Extreme avoidance may be an effective survival strategy for an isolated subpopulation (e.g., Grumbine's [1992] "ghost bears" of the North Cascades), but it may also have detrimental long-term effects on their genetic viability, because they may be unable to use narrow corridors that would connect them to other subpopulations.

Although judgments about what is "right" or "natural" in these examples may seem easy, not all wildlife professionals, interest groups, or the public share the same values. These are not strictly scientific issues; they require social and political input, the focus of human dimensions research (Vaske et al. 1995).

Conclusion

Wildlife management is often concerned with how humans will coexist with wild animals, but there are many variations on the coexistence ideal. In an urban setting like Anchorage, Alaska, the ideal might include brown bear populations that demonstrate avoidance behavior; in a protected area like Alaska's Katmai National Park, habituation responses may be preferred. Either situation allows coexistence, but each has different consequences for bears and for people. Improved management requires better information about how human actions affect wildlife responses, as well as clarity about which coexistence ideal is appropriate for the area. In research, the need is for models that explore the complexity of wildlife responses and relate those responses to human management regimes. In management, the need is for explicit statements about the desired coexistence ideal and the development of standards that define acceptable consequences.

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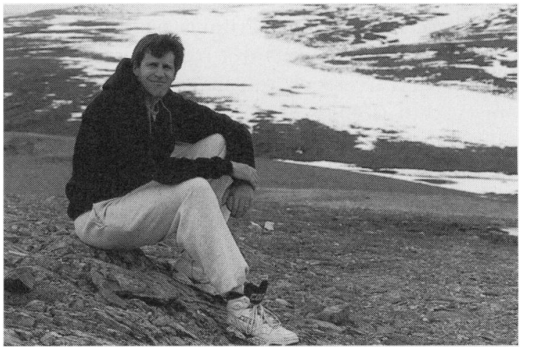

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