

Paper 8

Play and Agonistic Behavior in Young Captive Black Bears

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With few exceptions (Leyhausen 1948; Meyer-Holzappel 1957; Krott and Krott 1963; Stonorov and Stokes 1972) we have known little about social behavior in bears. Until recently, the often solitary black bear has been treated as a relatively non-social carnivore. Lorenz (1953), Krott (1961) and Ewer (1968) have maintained that the bear does not possess a consistent repertoire of social signals, and based their opinions on the solitary habits of bears in general. However, they neglected to consider the two major social episodes within a bear's lifetime: the breeding season (Rausch 1961; Jonkel 1967), and the sow's year and a half or longer association with her cubs (Jonkel 1967). Additionally, bears may meet at prime fishing spots or other concentrated food areas (Egbert and Stokes, this volume Paper 4). At these times not only are bears social, but communication should be frequent and necessary. This paper reviews two aspects of social behavior in the black bear, play and agonistic behavior, both of which may occur during breeding, rearing of the young and chance meetings. A more extensive discussion of these behaviors may be found elsewhere (Pruitt 1974; Pruitt and Burghardt, in press).

SUBJECTS AND PROCEDURES

Two seven month old captive female black bears, *Ursus americanus*, were observed in a semi-natural environment within the Great Smoky Mountains National Park. The bears were maintained together in an 18 x 18 meter enclosure over a three-year period. Burghardt and Burghardt (1972) have analyzed the cubs' behavior during the first eight months. The social behavior of these sibling cubs was observed intensively from August 1970 through November 1971. Instances of intraspecific social play, solitary play (with inanimate objects), naturally occurring aggression, and experimental manipulated aggression were singled out for particular emphasis during the research.

The bears' behavior was observed from the second floor of a storage shed located adjacent to the enclosure. Full view of the bears and the area was available from that site and allowed observations to be made without interacting with the animals. Data were collected in three ways: (1) written or taped descriptions of continuous, uninterrupted observations at one-half and one-minute intervals; (2) checklist notation during one-minute intervals; and (3) super-8 movie filming of play and agonistic encounters. The first two methods provided descriptive data for behavior patterns and a molar sequence of events, while the third method allowed a more detailed analysis of specific, fine body movements which occurred during the encounters.

During the study, 341 social play encounters were recorded. Additional interactions were filmed. 'Naturally occurring' aggression occurred only 55 times during the same observation period. In 'naturally occurring' aggression no experimental procedures were used to elicit the aggression. These episodes

occurred primarily during feeding sessions and in reaction to ear sucking attempts by the littermate.

Agonistic encounters were difficult to capture on film and analyze precisely in terms of latency to encounter, duration and defensive reactions. To observe and film aggressive behavior more reliably an artificial situation was created to elicit aggression. A hog feeder was altered so that only one bear could feed at a given time. After 20 hours of food deprivation, one bear was allowed to enter the feeding area. As soon as the first bear had begun to eat, the second was released into the area and timing begun. Records were kept of: the time which elapsed until onset of the attack (latency to attack), the length of any physical contact (duration of aggression), the methods by which the aggressor was challenged (confrontation) and the type of termination of the encounter (resolution). In 18 staged encounters, 15 agonistic sequences were recorded. In the remaining three, the second bear did not challenge the first, physically or vocally.

RESULTS

Social Initiation

The types of behavior shown during initiation of play or aggression were placed in five categories: biting; paw movements (swatting, pushing, pawing out); locomotion (run, walk, circle, jump); head movements (mouth open, jaw wrestle, sniff close, ear movements); and vocalization. As shown in Table 1, use of the several types of play initiation was fairly equally distributed, with biting only slightly preferred. The bears never vocalized during play, neither at the initiation nor in later phases. On the other hand, they often vocalized at the onset of aggression, using mostly long, low moans, jaw pops and gurgles. The concept of these vocalizations as threats or threat intentions has been further supported by recent studies (Jordan, this volume Paper 5). In another study, Henry and Herrero (1974) reported no vocalizing during bear play. In contrast, the closely related canids vocalize routinely in both play and agonistic encounters (Fentress 1967; Fox 1970, 1971; Bekoff 1973, 1974).

In aggression the bears did not use any locomotor movements to initiate an encounter. Instead visual threats in the form of head movements were important. The most common (and possibly most important) component of visual threat was the lip extension shown in conjunction with neck stretching, ear flattening and frontal orientation. Lip extensions and ear flattening were

TABLE 1. Types of behavior used by black bears in initiating social play and agonistic encounters.

	Play (N = 341)	Aggression (N = 55)
Biting	29.0%	38.2%
Paw Movements	23.6	5.4
Locomotion	22.4	0.0
Head Movements	20.8	27.3
Vocalizations	0.0	29.1
Unknown	4.2	0.0

rarely observed in initial phases of play; instead, the animal seemed gradually to work up to the higher intensity level characterized by those postures and subsequent play-biting. Bears used paw movements less often to initiate aggression than play. If seen at all during agonistic behavior, paw movements took the form of hard slaps to the face and rump of the partner, or to the ground. In play, paw movements were slower and directed to the limbs and shoulders of the partner.

Common to both play and agonistic behavior was redirection (Burghardt 1973). If a partner terminated play, the other animal frequently began solitary play (especially with trees) or initiated play with a human. Similarly, in the manipulated agonistic setting, the non-feeding animal was observed to threaten vocally and visually. Upon receiving no response it in turn attacked a nearby object. Over the course of the staged encounters the bears totally demolished through redirected activities an originally 2 meter high, 5 centimeter diameter tree located next to the feeder.

Duration of Play and Aggression

Play sessions recorded on film lasted an average of 14 seconds. In addition, play occurred in bouts at 30 second to 5.0 minute intervals. This short latency between play acts gave an impression of longer play periods. Naturally occurring aggression lasted 39 seconds. While agonistic encounters lasted longer than play, they occurred as single, non-repetitive episodes and presumably resolved a conflict situation. The latency to a second agonistic interaction was at least 10 to 24 hours.

In contrast to play, agonistic behavior had three clear major stages: preparation to attack, physical contact or threat, and resolution (Figures 1, 2, 3). In a typical aggressive encounter, the threatening animal approached, looked toward the opponent, might at times vocalize, partially flattened the ears, and extended the lip with neck out-stretched during the first stage of experimentally induced aggression. In stage two the aggressor made physical contact (usually biting or swatting) in response to which the opponent would charge or leave. In the final stage both bears looked toward each other, with heads lowered. This position was held for several seconds, after which one animal claimed the objects or area over which the conflict was begun. Mean duration of each of the stages of experimentally induced aggression was as follows: 4 minutes and 5 seconds for the preparation to attack; 29 seconds for the actual physical contact, and 7 seconds for resolution of the conflict. The average duration of contact and resolution lasted 36 seconds, about the same as the 39 second duration of naturally occurring aggression. Photographs of the various stages are published elsewhere (Burghardt, 1975).

CAUSAL FACTORS IN PLAY AND AGGRESSION

Specific factors causing social play were not determined. However, play periods reliably could be predicted after feeding periods or with the approach of persons involved in the study. This supports the theory that play is more likely to occur after the satisfaction of more basic physiological needs (Meyer-Holzapfel 1956; Bekoff 1972). In contrast with play, several precipitating factors were recognized for naturally occurring agonistic behavior. Potential conflict situations, involving food objects, ear sucking, human presence or attention and object possession, were likely to elicit agonistic behavior in one

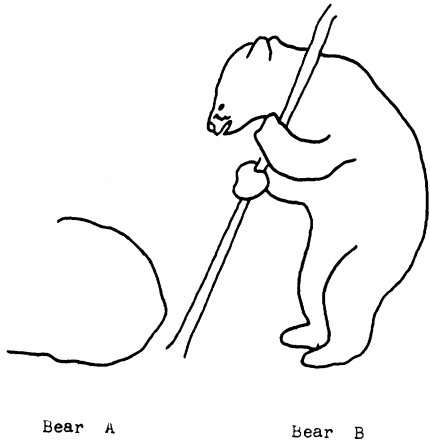


Fig. 1 Display of visual threat during preparation to attack in experimentally induced aggression.

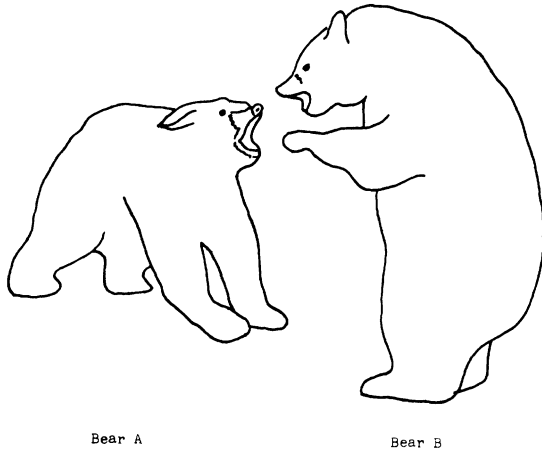


Fig. 2 Postures immediately following physical contact in experimentally induced aggression. Bear A is in a charge position and bear B is in a bipedal stand posture.

or both bears. Given a thorough knowledge of the bears' daily habits, it was possible to predict onset of aggression far more reliably than for play.

Film Analysis

To further explore the predictability and possible signal value of bodily expressions in social interactions, 8 mm movie films of play and aggression were analyzed frame by frame. From the analysis of 10 filmed play sessions, certain postural relationships emerged. For example, laterally oriented ears and mouth droop occurred simultaneously, with durations averaging less than one second. The most pervasive aspect of the analysis was the relatively short duration of discrete body movements. Durations of ear position within a one-minute film segment, for example, ranged from .06 seconds to 2.4 seconds.

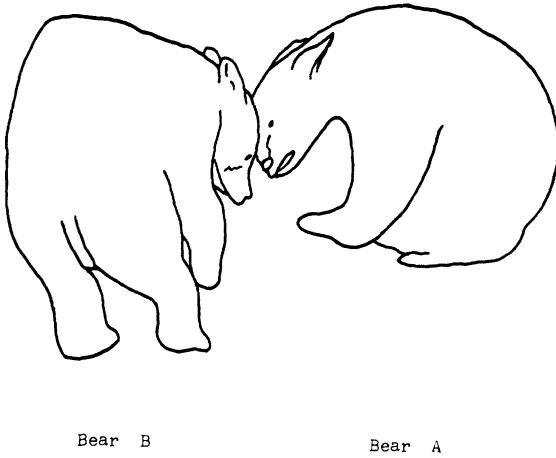


Fig. 3 Postures assumed by black bears during the resolution of conflict in experimentally induced aggression. Bear B is coming down from a bipedal stand and is turning away from bear A and toward the feeder.

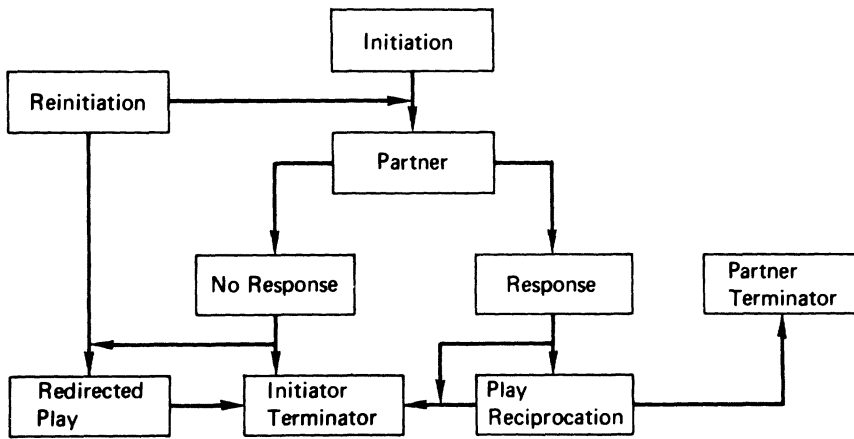


Fig. 4 Model of intraspecific interaction in young captive black bears.

Given the rapid change and short duration of specific body positions, it is no wonder that mammalian play patterns have been considered so unpredictable. It is possible, however, to devise a model of social interaction in the black bear in which one can predict the *course* of a play session or agonistic encounter given certain decision points (Figure 4).

From the data obtained in these observations, particular postures can be used as guidelines for the model's decision points. For example, if the bear is displaying a lip extension during play, that bear is not likely to terminate the play, inasmuch as a lip extension did not occur simultaneously with walking or running away from the partner. A specific example of the use of the model can be drawn from the staged agonistic encounters. The initiator's lip extension and vocalization to the partner (Fig. 1, Bear 2) indicates that aggression,

or the threat of it, is about to occur, rather than play. If the partner responds with a charge or vocalizations we would predict reciprocation or termination by the initiator (see the right side of Fig. 4). If a bear visually threatens the partner and receives no response, termination, redirection or reinitiation by the initiator will occur (left side of Fig. 4).

Several relatively stereotyped behaviors are common to both play and aggression (e.g., ear flattening, lip extension) but occur at different points in each type of interaction. It has been suggested that the selection of body expressions is more limited in aggression, leading to a notion of aggression as a more highly stereotyped, predictable behavior than play. In fact, play has been theorized as a means of practice for the more 'serious' adult behaviors such as aggression (Meyer-Holzapfel 1956). As such a practice behaviour one would expect the immature animal to draw upon a wider repertoire of skills and expressions, gradually eliminating those with lesser signal value (Ewer 1968). Further analysis of the data is currently in progress to determine precise signal values of the expressions observed in play and aggression. The hypothesis behind that analysis holds that a specific body position (e.g., muzzle wrinkle, lip extension, flattened ears) may not possess highly specific signal value in itself, but may contribute to a pattern or Gestalt, which conveys specific information to the partner during the social interaction. Additionally, the contextual aspect of a situation may aid in determining 'correct' responses to the body posturing.

With the advent of ethological studies such as this one, we are beginning to assemble a more complete picture of the black bear and its habits. Not only will we understand its reproductive and dietary habits, but we will have gathered further knowledge of its behavioral and perceptual capabilities. The anecdotal and historical views of the black bear as a non-expressive species quickly are refuted by behavioral data from this and other recent studies (Stonorov and Stokes 1972; Henry and Herrero 1974; Bacon 1974). The precision and extensive patterning of social interactions in young bear cubs provides very vivid evidence for the expressive aspect of their behavior. Unfortunately, the ursids too often are compared to their more social canid relatives and on that basis their behavior has been judged less expressive and predictable. Also, human interactions or contacts with bears are less frequent than with many other carnivores, thereby limiting our expertise at 'judging' the social signals given when we do meet a bear in the wilds. Given further behavioral investigations on the bears, we may be able to apply this ethological data to the conservation and management of the species, particularly in their interactions with humans in public access areas such as the national parks.

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