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Play Activity in Young Montagu's Harriers (*Circus pygargus*)

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Studies of play behavior (e.g. Ficken 1977, Fagen 1981, Bekoff and Byers 1981, Bekoff 1984) indicate that play is widespread among birds and mammals. However, play behavior is not nearly as well documented in birds as it is in mammals (Ortega and Bekoff 1987, Gill 1990), even though it is easily observable. Young raptors, for example, exhibit play activities that occupy a large part of air time, starting from their first week of flight (Fagen 1981). In general, there is much confusion and misunderstanding as to what behaviors constitute play (Chisolm 1958, Newton 1979, Fagen 1981).

Definitions of play are available in Fagen (1981) and Martin and Caro (1985). Here, I adopt the broad definition by Bekoff and Byers (1981), i.e. all motor activity performed postnatally that appears to be purposeless, in which motor patterns from other contexts often may be used in modified forms and temporal sequencing. Bekoff and Byers also distinguish "locomotor" play (frantic flight about the environment), "object" play (activity directed toward an inanimate object), and "social" play (activity directed toward another living object). All of these behaviors occur in Montagu's Harrier (*Circus pygargus*). Here, I describe the activities of young Montagu's Harriers that have some characteristics of play. I also suggest functions for these acts, relating them to inter- and intraspecific aggression, locomotor skills, and learning of important trophic behaviors (e.g. the "food pass") and courtship displays (e.g. "flight play").

Study area and methods.—Between 1988 and 1993, I monitored 23 nesting pairs of Montagu's Harriers in an area of 60 ha of badlands and fields 15 km SE of Urbino, Italy (43°46'N, 0°24'E). The badlands environment consists of a covered clay layer with herbaceous and shrub vegetation consisting largely of *Arundo plinii, Inula viscosa,* and *Spartium junceum.* The fields consist mainly of agricultural crops (wheat and alfalfa).

In central Italy, young Montagu's Harriers usually fledge from 1 to 20 July. The period between hatching and fledging is about 3.5 weeks. Adult females commence migration about 10 days before adult males, which subsequently leave the nesting area at the same time as the young. In this area the harriers nest in loose assemblages of three to five pairs, with distances between nests ranging from 55 to 400 m. I observed Montagu's Harriers for 444 h during the postfledging period. Observations normally averaged 4 h and were conducted during all daylight hours from dawn to sunset. Harriers were observed with binoculars or a variable-power spotting scope. When possible, individual birds were distinguished by morphological characteristics (e.g. plumage, missing feathers). They were not captured and marked because trapping caused nest desertions.

During this study, I observed 23 pairs, of which 13 fledged 36 young. Overall breeding success averaged 1.6 fledged young per nesting attempt and 2.8 young per successful attempt. As with hatching, fledging was asynchronous. Fledging of each member of a multiple-chick brood was observed at 7 of 23 nests; five of these broods fledged asynchronously over periods of two to five days. The average length of stay in the nest area by fledglings prior to their departure was 24.3 days, with a minimum of 13 days in 1990 and a maximum of 38 days in 1989.

I considered behaviors to constitute play based on the following criteria (Bekoff and Byers 1981): (1) they had no apparent motivation relative to fundamental biological functions, such as feeding, courtship, and territory defense; (2) they were similar to displays widely used by adults (in the case of chasing pursuits, young birds continued to repeat in a modified and sometimes simplified form, displays essential in feeding behavior or courtship); and (3) they functioned in a social context when repeated reciprocally and when lasting longer than typical displays. Interspecific interactions have been defined as play when the member of the other species was not actively chased away from the site, and when the two (or more) partners continued to perform displays and soaring for a long period of time (sometimes for 25 min). The motor patterns of interspecific play are similar to those of intraspecific play (fighting play).

Play behaviors.—During the first two weeks of flight, young harriers normally were not able to perform all play displays (although flying ability improved quickly). They were not able to carry out aerial food passes and, thus, they were fed by parents only through ground food passes. During the second week of flight, as their flight techniques improved, young harriers were able to accomplish aerial food passes and, thereafter, were able to perform all patterns of play described here. Interactions between fledglings and adult females decreased after the second week

TABLE 1. Temporal patterns and durations of play in Montagu's Harrier.

Behavior	*n*	% of total	Time[a] of day	Duration (min)
Flight play	91	34.7	0630–0730	2–20
Fighting play (intraspecific)	91	34.7	1300–1400	2–10
Fighting play (interspecific)	43	16.4	0800–0930	2–25
Communal soaring	30	11.5	—	3–5
Aerial food-passing	7	2.7	—	—

[a] Time of day when behavior typically performed.

TABLE 2. Number of play and aggressive interactions between young Montagu's Harrier and other species.

Species	Interactions	
	Play	Aggressive
Honey Buzzard (*Pernis apivorus*)	1	1
Black Kite (*Milvus migrans*)	1	2
Eurasian Kestrel (*Falco tinnunculus*)	13	4
Eurasian Hobby (*Falco subbuteo*)	2	—
Common Buzzard (*Buteo buteo*)	9	5
Black-billed Magpie (*Pica pica*)	9	1
Hooded Crow (*Corvus corone*)	8	—

because the females started hunting far from the breeding site as they received less food from adult males.

From observations of 262 cases of play, four principal behaviors emerged: (1) chasing pursuits with flight play; (2) fighting play; (3) communal soaring; and (4) simulation of aerial food passes (see Table 1). Chasing pursuits with flight play consisted of reciprocal chases by young birds for short distances (10–50 m) and included dives (normally not more than 10) by one young bird after the other. Such dives sometimes included partial rolls with or without talon presentations. Flight play was observed 91 times (34.7% of all cases of play; Table 1). It was performed mainly between two young birds (71.6%) and to a lesser extent between pairs of four young at the same time (9.5%). It also involved interactions among young from different broods. In 19.3% of the cases, it was performed with adult males ($n = 14$) or adult females ($n = 5$).

The second pattern, fighting play, was observed in 134 cases (51.1%; Table 1) and consisted of chasing, both simple and reciprocal, with sudden bursts of acceleration and gliding in the same direction, and sometimes was accompanied by flight rolls and talon presentations. Fighting play occurred between conspecifics and different species, sometimes involving other raptor species or corvids (Tables 1 and 2). Intraspecific fighting play always took place between young harriers. With regard to sibling relationships, 68.9% of observations involved young from different nests, whereas only a small number (17.8%) of cases involved young from the same nest. In the remaining cases (13.3%), it was not possible to distinguish relationships of the participants. Interspecific fighting play (see Table 2) involved Eurasian Kestrels (*Falco tinnunculus*; 30.2%), Common Buzzards (*Buteo buteo*; 20.9%), Black-billed Magpies (*Pica pica*; 20.9%), Hooded Crows (*Corvus corone cornix*; 18.6%), and, to a lesser extent, Eurasian Hobbies (*Falco subbuteo*), Black Kites (*Milvus migrans*), and Honey Buzzards (*Pernis apivorus*). Of 56 interspecific interactions that I observed, 76.8% were nonaggressive (i.e. were considered play as described in Methods), whereas the other 23.2% were aggressive encounters (Table 2). In interspecific play, harriers used essentially the same behavior as intraspecific fighting play, but with some variations. The partners performed reciprocal chasing, flight rolls, and more frequent dives, but without talon presentations. Two to four Montagu's Harriers participated in play in 28.9% of the observations.

Communal soaring ($n = 30$) occurred when several harriers flew together in high circles (Pandolfi and Pino d'Astore 1992). This display normally is performed by adults, but fledglings also may participate on occasion. Unlike communal soaring among adults, soaring among young usually was disrupted when one made repeated dives toward another during ascent flight.

Simulation of the aerial food pass involved young harriers using fragments of vegetation instead of prey items. The behavior resembled an aerial food pass except that the young passed fragments of vegetable matter (such as small branches or grass) instead of food items.

I observed adults participating in play behavior in 66 of 272 cases. Interactions with adults have not been recorded in interspecific play, or in play with objects. Male parents were involved in 62.1% of the interactions, females in 33.3%, and males and females together in 4.6%. Adult males participated in play significantly more often than did adult females ($\chi^2 = 5.14$, $P < 0.05$).

Temporal distribution and duration of play.—I also recorded the relative frequency of play activities throughout the day. The peak of simulated flight play and food passes occurred early in the morning, interspecific play peaked between 0800 and 0930, and fighting play among young harriers reached its peak between 1300 and 1400 (Table 1). Much of the play was of long duration, especially for flight play and interspecific fighting in which the partners were involved for up to 25 min (Table 1).

Discussion.—The observed patterns of play can be interpreted within the framework of a complex refinement of behaviors of fundamental importance to

individual harriers (i.e. flight play, food passing, aggression, and hunting). According to the classification of play types by Bekoff and Byers (1981), the play behaviors I observed may be defined "locomotor" play because they improved the development of flight ability, and "social" play because they allowed the development of social relationships among young. Simulation of aerial food passes also may be considered "object" play. Young harriers appeared to learn certain displays from their parents in the first few days after fledging. Subsequently, they "practiced" with each other. The active participation by adults in the first weeks after their young fledged probably aided young to refine these displays, which require very precise movements and considerable flying skill.

Young raptors are altricial, and they undergo a prolonged posthatching period in and around the nest. Consequently, they spend considerable time socializing with adults and nest mates (Ortega and Bekoff 1987). Flight play is a courtship display essential both for pair formation and mating (Cramp and Simmons 1980, Pandolfi and Barocci 1994) and is considered to be a ritualized food pass (Glutz von Blotzheim et al. 1971, Pandolfi and Pino d'Astore 1990). Besides practicing individually, young harriers appear to learn correct execution of displays from adults, because this type of play is performed between young and adults in almost 20% of the observations. The training of young by parents has been described in a number of other raptors, e.g. Peregrine Falcon (*Falco peregrinus;* Beebe 1960, Sherrod 1983), Osprey (*Pandion haliaetus;* Meinertzhagen 1954), and several other species (Newton 1979). This type of play can be interpreted as training (i.e. the collective refinement of ability to execute a fundamental display) and shows all the characteristics identified by Bekoff and Byers (1981) of locomotor, object, and social play.

In its initial execution, fighting play is identical to an aggressive behavior common in Montagu's Harrier and defined as Escort (*in* Cramp and Simmons 1980), where intruders are chased with sudden bursts of acceleration until they are driven from the area. If the aggressive interaction continues, then fighting may occur, including flight rolls, talon presentations, and talon grappling (Cramp and Simmons 1980, Pandolfi and Pino d'Astore 1992). Only talon presentation was seen in intraspecific play (i.e. strongly aggressive components of fighting behavior were absent in play behavior). That this was play and not aggressive behavior can be inferred from the following: (1) the partner was not chased away, (2) two young birds often performed the display one after the other, and (3) the display was repeated for long stretches of time with interactions that lasted up to 10 min. The numerous interactions among young birds of different nests seem to promote social relations among neighboring broods. It is likely that this play among young harriers from different nests is triggered by antagonism, as shown by chasing, but that the aggressive component is maintained only as simulation of fighting, which can have the purpose of physical training and the development of skill, as well as training or practice by the young for future aggressive encounters.

Communal soaring among young harriers also can be considered play. This display, which consists of circular rising by groups of harriers (Pandolfi and Pino d'Astore 1990), normally is performed by adults without any interactions. On the other hand, when the display is executed by young, they do many dives towards each other. The repeated dives can be considered, at least in the preliminary stages, false aggressive manifestations functioning as physical training and interpreted as "nuisance play" (Fagen 1981) among young birds, whereas communal soaring itself performed by young may function as flight practice. Young vultures (e.g. *Gyps africanus* and *G. rueppellii*) also spend long periods in both solitary and communal flights, which have been interpreted as training (Houston 1976). That young Northern Harriers (*Circus cyaneus*) carry out "flight training" in communal soaring has been reported earlier (Newton 1979), but the specific function of reciprocal dives never has been suggested.

Young harriers do not conduct food passes with each other on a regular basis. On only one occasion did I observe an aerial food pass of prey from one young (who had received the prey from its parent) to another. Among adults, the food pass is performed only by the male toward the female. During play, however, adult females train the young with food passes in spite of the fact that females do not perform food passes during courtship, incubation, or when provided with food by their mates. In this mode of play, training in motor skills is extremely important. Young Montagu's Harriers probably need to practice aerial food passes in order to perform them correctly. Indeed, young harriers are more likely to be unable to grasp prey during a food pass than are adults (young: 11% failure, $n = 131$; adults: 3% failure, $n = 174$; unpubl. data). Moreover, the incidence of aerial food passes among young increases from the first to the fourth week postfledging (Piangerelli 1993). In seven cases, young transferred fragments of vegetable matter as a substitute for real prey. This behavior is similar to behaviors noted in Peregrine Falcons (Parker 1975) and to play with feathers observed in Eurasian Kestrels (Shrubb 1993) and with a corn cob in Northern Harriers (Bildstein 1980).

The incidents noted above involved the use of objects in social play by raptors. The diversity of behaviors classified as object play in birds is wide and not surprising, given that birds are so visually oriented (Ficken 1977, Ortega and Bekoff 1987). Parrots also play with objects, which may help them learn to manipulate food (Fagen 1981, Ortega and Bekoff 1987). In agreement with Bildstein (1980), I believe that in raptors, play with objects functions in physical train-

ing that improves the coordination necessary for them to subdue prey.

To date, interspecific play in birds has been observed infrequently (e.g. Neelakantan 1952, Ficken 1977, Fagen 1981). Thus, the high incidence of this behavior involving Montagu's Harrier is particularly interesting, and it may suggest that interspecific play is more common in birds than previously thought (as reported in mammals [Fagen 1981]).

Conclusions.—Play in young Montagu's Harriers seems to be a prominent feature in much of their postfledging activities and probably has an important role in aspects of socialization among conspecifics. Play activities of young also are tied to the learning of hunting and food-grasping behaviors. Furthermore, there is obvious value in perfecting the ability to fly and more generally in improving the survival of individuals that have become "trained" through play behavior. Play in Montagu's Harriers involves nearly all of the principal displays used in social and trophic contexts as well as those used in both intra- and interspecific interactions. Presumably, play behavior permits motor training and provides practice for eventual serious competition in a ritualized, nondamaging form.

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