

SOCIAL PLAY IN ARABIAN BABBLERS

by

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Summary

Social play behavior was studied in eleven groups of tame, color-ringed Arabian babblers (*Turdoides squamiceps*) at the Shezaf nature reserve near Hazeva in the Rift Valley in Israel. 2500 instances of play were recorded in 950 hours of observations carried out from July 1981 to June 1983. Four hours of play interactions were recorded on video-tape and were analyzed using slow-motion techniques.

Babblers' play fits all the criteria for 'social play' described by Loizos (1967) and by Muller-Schwarze (1978). The most common forms of play observed were wrestling, displacement (king-of-the-hill), chases, and tug-of-war. Several play-signals were identified: crouching, rolling over, elevation of sticks, play bow, establishing eye contact and freezing briefly in the middle of play. No vocal play-signals were observed.

The ontogeny of play is briefly described. Play activity diminishes with age. Dominants play less than subordinates. Babblers tend to play with individuals close to them in rank. Breeding females rarely play. There was no effect of age, dominance or gender on the type of play. When playing, dominants use play-signals more often than subordinates do. Social tension in a group inhibited play activity. Babblers play more in summer than in winter. Bouts of play tend to alternate with bouts of allopreening. Food supplementation increased

¹⁾ Orit Pozis-Francois was diagnosed with cancer shortly after finishing her master's thesis on play in babblers (Tel-Aviv University, 1984, in Hebrew). She succumbed to the disease in 1993. This paper is a shortened version of her work, with some updated references. May her memory be blessed.

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both activities. Play is more demanding than allopreening, both physically and socially. It is suggested that in babblers testing the social bond is a major component in both social play and allopreening.

Keywords: aggression, allogrooming, allopreening, cooperative breeding bird, play-signals, prestige, testing the social bond.

Introduction

Social play behavior has been described in several birds: Gwinner (1966) and Heinrich & Smolker (1998) described play in corvids. Keller (1975) observed play behavior in keas (*Nestor notabilis*) in zoos and Diamond & Bond (1999) described their play in the wild. Gaston (1977) described play behavior in jungle babblers (*Turdoides striatus*) as well as in large gray babblers (*Turdoides malcolmi*). Pellis (1981a, b) showed that play behavior of Australian magpies (*Gymnorhina tibicen*) meet all the criteria of social play. Social play behavior has also been described in captive white-fronted Amazon Parrots (*Amazonia albifrons*) (Skeate, 1985); and Reid (1994) observed galahs (*Elophus roseicapillus*) play. Zahavi (1990) briefly described play in Arabian babblers.

Arabian babblers, especially young ones, play — sometimes for several hours each day. The aim of the present research is to describe babblers' play and investigate the social and environmental conditions affecting their play.

The Arabian babbler is a cooperatively-breeding bird resident in year-round territories. Their life history and their social behaviors have been described (Zahavi, 1989, 1990; Zahavi & Zahavi, 1997). Groups are composed of two to twenty individuals. In each territory there is a single nest. Male babblers often spend their whole lives in their natal group. Females usually stay in their natal group for at least two years, and then disperse to breed in another group. Within each group there is a strict dominance hierarchy: older birds dominate younger ones and males dominate females that join the group. Among fledglings, females may dominate males; but by their second or third year of life, young males usually rise in rank above all their female sibs. In our study area the birds are tame, allowing for close observations. Most individuals are color-ringed as nestlings, and their detailed life history is known from that point on.

Methods

The study was conducted at the Shezaf Nature Reserve, near Hazeva Field Study Center, in the Rift Valley, 30 km south of the Dead Sea, Israel (coordinates: 30°46'N, 35°14'E). The site is an extreme desert, summers are hot and dry. Mean winter rainfall amounts to 35 mm, but it may be as low as a few millimeters in dry years. This babbler population has been studied since 1972 (Zahavi, 1974, 1989, 1990; Zahavi & Zahavi, 1997). Eleven groups were observed between July 1981 and June 1983. Four of these groups were observed more closely for at least two days per month (usually more). The best time for observation was determined after six days of preliminary observations from dawn to sunset. As a result, an observation day was set as 3-4 h in the morning and 2-3 h in the afternoon. Altogether about 2,500 play sessions were recorded on 175 days, a total of 950 h of observations. Many play sessions were video-filmed (a total of four hours). Details of movements were studied by repeated viewing of the video in slow motion.

Notes taken during observations included the following:

Who initiated the play; whether others joined in; how they joined; the position of the participating individuals relative to each other; who terminated the play session; how was it terminated; whether there was any vocalization? and the response of individuals that did not participate in the play. It was not always possible to perceive all these details for every play session.

In addition, general observations on the behavior of the group were also noted. Personal shorthand codes were used for notations.

Definitions used in recording play sessions

Contact play: play in which body contact was established. Such play was recorded as beginning when contact was first established and as ending when there had been no contact for at least 5 seconds.

Tug-of-war: two or more players pull at an object without direct body contact. The play was recorded as beginning once two individuals were pulling at the object and ending when at least one of them had left the object for at least 5 seconds.

Chase: individuals chase each other around, without bodily contact. Such play was recorded as starting when at least two individuals were running at the same time and as ending when all had ceased running for at least 5 seconds.

In all of the above cases, a renewal of activity after a lapse of more than 5 seconds was considered as a new play session.

Initiator and terminator: an individual was considered initiator if it solicited play by play signals. When no signals were used, the one that charged, picked up an object, or started running was considered the initiator. The first to leave, whether as winner, as loser, or because of loss of interest, was considered the terminator of the play session.

Age groups: a fledgling is defined as being less than three months since leaving the nest. A juvenile is three months to one year old. A yearling is between one and two years of age. An adult is over two years of age.

TABLE 1. *Types of play*

Type	Number	% of total	% Dyadic
I. Contact plays			
Heap	456	25	67
King-of-the-hill	343	18	64
Pendulum	86	5	100
Cock-fights	67	4	100
II. Chases	707	38	46
III. Tugs-of-war	168	9	86
IV. Additional plays	26	1	–
Total number of plays analyzed	1853	100	

Experiments with food supplementation

Each experiment consisted of two consecutive days. In the first day a group was observed without any supplementation. On the following day, food (bread crumbs) was supplied ad libitum. The number and type of plays were recorded on both days. As an additional control, each experimental group was observed for two further consecutive days, without food supplementation.

Descriptions of babblers' play

Contact play

Contact plays make up about half of the total of play sessions (Table 1). Contact can be through pushing, pulling, pecking, jumping, and rolling on the ground or on a branch. Most of these are dyadic (72%), but sometimes up to 8 individuals may participate. These sessions last from three seconds to several minutes and may be divided into the following categories:

Wrestling (heap) (Fig. 1A). (Gaston, 1977, calls these plays 'rough and tumble'): This is the most common contact play. One or more individuals lies on the ground while others roll on top of it or them, trying to pin it or them to the ground. The one or ones on top often push their beak into the beak of the one on the ground, or peck it gently. Sometimes these peckings turn into short bouts of allopreening and back to pecking. Pecking is directed mainly at the head and rump. The play often starts with two babblers looking at each other, followed by one jumping on top of the other. Sometimes one babbler jumps on top of another without the other one being aware of its coming. At other times play signals precede the game with one partner crouching

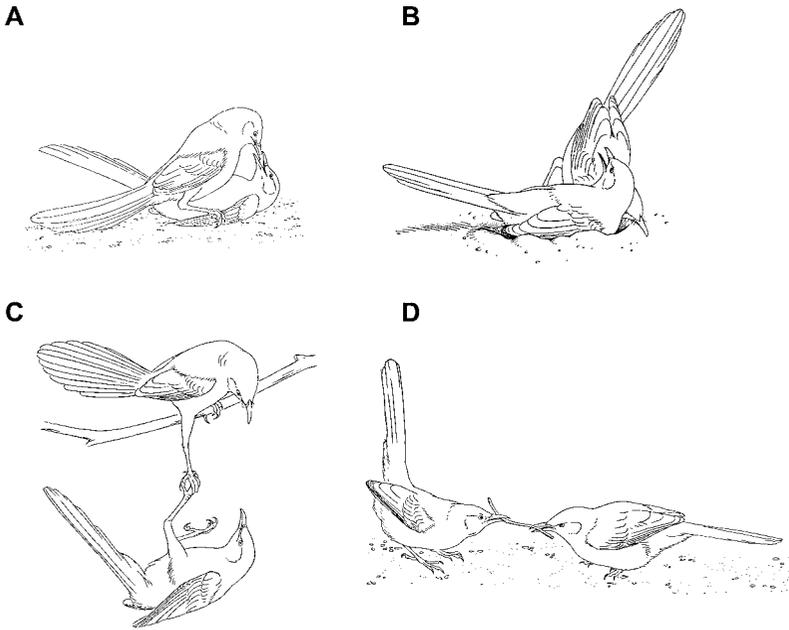


Fig. 1. Types of play: A. 'Heap'. B. 'King of the hill'. C. 'Pendulum'. D. 'Tug-of-war'.

low or rolling over. Jumps can come from any direction, sometimes from a low branch. The 'attacked' babbler responds in one of several ways: it may crouch without moving, sometimes opening its beak; it may try to exchange positions with the attacking babbler, sometimes pecking it; it may flee; or it may attack its play partner.

Heap plays often consists of many attacks and counterattacks in which the roles change frequently. Sometimes both participants lie on their backs, holding each other with their beaks and legs, or roll on top of each other, trying to peck at each other. When a heap involves more than two individuals, one individual is usually attacked by all the rest, with frequent changes of roles. Sometimes babblers attack simultaneously and it is impossible to tag one of them as being 'attacked.'

Heap play sessions vary in vigor from very gentle touches to very rough tumbles. In a typical heap the participants often freeze suddenly for a split second and then resume playing. A heap session may turn into allopreening, or it may end when the one on top gets off, or when one of the participants runs away. In the latter case, the play will either terminate or turn into a crazy chase (see below).

'Cock fight'. Two individuals jump head-on at each other, each trying to make the other lose balance. This has been observed on 67 occasions. When one of the two succeeds in pushing the other one down, the play may turn into a heap. Otherwise, one of the two individuals escapes, and the play may become a crazy chase.

'King of the hill' (Fig. 1B). In this type of play babblers compete over a certain spot, which for the moment becomes 'the hill.' The players try to push one another off the spot. The spot may be a depression in the ground, a position on a branch, etc. In some cases babblers pushed each other from a barrel or even an empty can. The spot has no real importance; it may change frequently, and as soon as the play session stops it loses all meaning. The play starts when one babbler crouches on a site or a branch, its partner peck it and try to push it and take its place. The first one may tighten its hold, pushing the others back. The game ends when one of the players gains 'the hill' and the others leave it alone, or when all crouch together without a winner — in which case the game often leads to allopreening, or may turn into a 'crazy chase' (see below).

Pendulum (Fig. 1C). The play starts when one babbler suddenly pushes its mate from a branch — holding its leg in its own. Usually both babblers fall to the ground, although in some cases the one pushed manages to stay on the branch and only the attacker falls down. Once the individuals are on the ground, the play is usually followed by a 'crazy chase'. This type of play has been observed 86 times (Table 1).

Tug-of-war

Such games (Fig. 1D) start when one babbler holds up a twig, a feather, a piece of plastic, or even a small snake, and another pulls at the same item. Sometimes several players join the play. It ends when one individual 'gains' the item, or when they all lose interest. This play often turns into play-wrestling — a heap or a cock fight.

Chase plays

In about 38% of plays, the participants chase each other without bodily contact between the players (Table 1).

Crazy chase is the most frequent of these. The birds run or fly around very fast, among and inside bushes, over an area up to 3 meters in diameter.

Many babblers may participate; in one case up to thirteen individuals were observed in one chase. Only about half of these plays are dyadic.

A crazy chase starts with one babbler running suddenly toward or away from the others. Other babblers join in and run in the same or in the opposite direction. If there is no response, the initiator either stops or continues alone. There are several abrupt pauses during chases, usually followed by running in a new, unexpected direction. The initiator may solicit the game with a bow, or several individuals may bow during a pause, followed by a renewed chase. A crazy chase is very energy-consuming. It may last for a few seconds or continue for several minutes. Individuals may join and leave the chase at any time. The chase ends when all participants have stopped running.

Mad flights. Gaston (1977) observed rapid aimless flight under the canopy. These are rare in Hazeva, as there is no under-canopy to speak of. However, there are some planted orchards in which such flights have been observed.

Slow chase or 'Hide and seek'. Very young fledglings can be observed walking one after another around trees or bushes. From time to time one of them stops, looks at the other from behind a tree, and changes direction. The other responds by changing its own direction; this can recur several times. Rarely, in winter, older individuals also play slow chases.

Other plays

About 26 times during the present research babblers were observed playing games that did not fall into any of the above categories. Most were some kind of 'swinging': one babbler takes hold of a low branch, swinging upside down, and other babblers observe it and mimic it, taking hold of other branches in the same bush or tree, swinging upside down. In most cases these games ended in crazy chases. In one case a babbler was swinging upside down on a copper wire hanging from an agricultural structure for about two seconds. When it let go, another individual took its place and so on, until all five youngsters of the group participated in the play. Each one that finished swinging came down to the ground and watched its fellows swing. On still another occasion, twelve babblers climbed from one rung of a tall electric pole to another, jumping down once they reached the top. The twelve players were the majority of the group; only the dominant male and female and two very young fledglings did not participate.

In Table 1, the different types of play, number of times observed, their percentage out of the total play sessions, and the percentage of each type

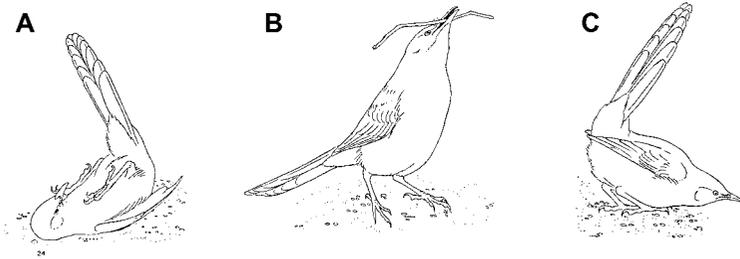


Fig. 2. Play signals: A. Rolling over. B. Holding up a twig. C. The 'Bow'.

played by two players (dyadic) are presented. In some play sessions different types of play are highly intermixed, preventing the assignment of the session into any one type of play.

Play signals

Loizos (1967) defined play signals as movements or gestures that occur only in play and not in any other activity; they can occur at the beginning or during play. These movements differ from the regular sequence of play movements.

A play signal may occur at any stage of a play session, or not at all. Play signals are likelier to appear in some specific circumstances, which include the following: beginning of a play; after a break in playing; in a play session in which there is a noticeable difference in age or dominance between players (usually the signaler is the higher-ranking individual); or in a play that has turned aggressive.

It is difficult to observe play signals in the field. Most of the following material was observed in videotaped play sessions.

Crouching. This often occurs before and during heap and king-of-the-hill play sessions. Signal-crouching differs from normal crouching (at rest or during allopreening) in that it is characterised by a raised head and tail. An exchange of eye contact is often evident: a babbler looks at its potential playmate, crouches down, and the other jumps on its back, starting a play-wrestling session. Participants often pause, crouch, and then resume playing. Sometime an individual that did not participate in the play crouches close to the players; they may then turn and include that individual in the play session.

Rolling over (Fig. 2A). This signal is used in play-wrestling, mainly when there is a big age difference between the players. It is invariably performed

by the more senior of the two. The individual who rolls over is in a very inconvenient position: it exposes its belly, and it cannot run away or charge without first rolling back onto its feet.

Holding up a twig (Fig. 2B). The signaler picks up a twig or some other object in its beak, raises its head and stretches its neck, standing or hopping for some 2-20 seconds. This is usually the prelude to a tug-of-war. Similar twig-holding is found in courtship: a female raising sticks may be the first sign of the start of the breeding cycle. Later, the male holds up a twig or some food item as an invitation to the breeding female to follow him away from the group in order to copulate (Zahavi & Zahavi, 1997). The context is clearly different from that of play: courting babblers do not play as a rule (see below).

The bow (Fig. 2C). The signaler stands with its head pointing down to the ground, its legs stretched, its rear end up. This signal is frequently used to initiate chases, or during chases. This position is the opposite of the threat position, in which the body is parallel to the ground. It also differs from the normal body position at a start of a run, when the head and chest are elevated and the tail is held low. A bow is sometimes performed during a pause in the middle of a very rough play-wrestling session. The dominant bows first, followed immediately by the other player. In one fierce wrestling session the participants were two four-month-old female fledglings and their three-month-old brother. Fifty seconds into the play, the brother tried to leave. One of his sisters grabbed hold of his wing and restrained his movements. He tried to get away. Suddenly the sister let go of his wing and performed a bow. The brother returned a bow. They jumped away and the wrestling play was resumed.

All the above-mentioned play signals are handicaps: they are postures that are inefficient as starting positions for running, fleeing or attacking; rolling over is actually dangerous, exposing the babbler to assault.

Other play signals. Close analysis of video films reveals other, very subtle play signals, such as eye contact and some special stances. We found that, with time, we could often predict the imminent beginning of a play session, usually by noticing an exchange of eye contact or special stances. A clear distinction between a play fight and a real fight is the frequent freezes that occur in the middle of plays, but not in fights. Bekoff (1974) report that, in canids, some subtle eye contact and stances that preceded play sessions were only revealed by close analysis of video films.

Vocalizations. Most play sessions are quiet. On 47 occasions a babbler squealed in distress during play; in every single one of these cases the play session stopped right away. Thus, vocalizations cannot be considered as play signals. However, fledglings who are a few weeks old and are slowly chasing one another occasionally emit soft sounds similar to the ones used by babblers going up to their night roost.

Ontogeny of playing

Play and play signals do not appear fully formed, but rather develop gradually in the first few weeks of a fledgling's life. Various play movements appear from the first days out of the nest, but only at the age of 3-4 weeks do they coalesce into a sequence that can be identified as 'play'.

Play and aggression

Four or five days after fledging, long before they start playing, the fledglings begin fighting over dominance, to determine the social hierarchy among the brood. The winner dominates the loser of the same sex as long as they remain members of the same group, except for a few cases in which dominance changes in the first few months of their life (Carlilse & Zahavi, 1986; Dagai, 2002). Aggressive contests over dominance prior to the onset of playing has also been reported in coyotes (*Canis latrans*) (Bekoff, 1995) and in spotted hyenas (*Crocuta crocuta*) (Drea *et al.*, 1996). Additional cases are cited by Thompson (1998). When fledglings begin playing with each other they are very aggressive and hit one another often during play. At this period many play sessions end with a babbler screaming in distress or fleeing after being hit.

Aggressiveness in play decreases gradually: the playing of one-month-old fledglings turns aggressive in 25% of the cases, three-month-olds turn aggressive in 10% of the cases, and yearlings rarely use aggression. A decrease with age in the level of violence in play is reported also in sea lions (*Eumetopias jubatus*) (Gentry, 1974), in rhesus monkeys (*Macaca mulatta*) (Symons, 1978), and in Australian magpie (Pellis, 1981a, b).

Sequential appearance of various play types

Different forms of play appear in babblers in order of the complexity of the motions involved. Chases and twig-carrying appear first; play-wrestling, which demands better coordination, appears later.

The first play motion that appears in babblers is carrying objects: in the fourth or fifth day after leaving the nest, fledglings start lifting twigs, feathers, and similar objects and holding them for up to 20 seconds while standing or walking. In these same first days after leaving the nest, babblers explore their surroundings and examine objects in their environment — looking, pecking, pinching, pulling, pushing them with their feet, etc. Such explorations are not evident when a fledgling carries a twig: it simply holds it. Of course, sometimes a fledgling may explore an object, and then, when it tires of exploring it, pick it up and hold it in its beak: such an object is usually long and narrow.

Only from the 12th day after leaving the nest do other fledglings respond to twig holding. They approach and touch the twig with their beaks, but usually lose interest within a few seconds. From the 20th day out of the nest they may hold a tug-of-war for some 5-20 seconds, and exchange ‘ownership’ of the twig.

Chases appear on about the 12th day after leaving the nest: ‘slow’ and ‘fast’ chases appear more or less simultaneously, but in the first few weeks of their lives babblers hold ‘slow’ chases much more often. With time they tend more and more to switch to ‘crazy chases.’ Very young fledglings of Australian magpies also engage in slow play interactions (Pellis, 1981a).

The various play-wrestlings demand many complex movements, and it is hard to pin-point the day they appear. Fledglings crouch together many hours a day, and occasionally one may push another and climb over it. With time, movements that at first appear accidental and out-of-context join into meaningful sequences. Fledglings from two weeks old engage in clumsy play that lasts a few seconds; fledglings more than 25 days old hold complex play sessions.

Play signals

Play signals first appear without play activity, which does not yet exist; they then join gradually with playing activity. Again, the order in which signals appear is from the easy to the more difficult. Holding twigs and crouching

appear first; the bow — which hinders running or attacking — comes next; and rolling over, which leaves a babbler in the most exposed and indefensible position, comes last. Rolling over may appear some 20 days after leaving the nest, but fledglings rarely use it as a signal before they are 6 months old.

Playing with 'grownups'

In the first few weeks of their lives, fledglings play only among themselves — that is, with their nest mates. They do not play with their older siblings, even when the latter 'invite' them to play. When there are two broods from the same year — that is, when fledglings have siblings who are only 1-2 months older — the two broods start playing together some 15-20 days after the younger brood leaves the nest. Fledglings do not start playing with siblings of the previous year until 25-30 days have passed since their leaving the nest. This pattern occurred with no exceptions in the 7 groups of fledglings that had no siblings of the same year, and in the 4 groups of siblings where fledglings had siblings of the same year. The only variance was in fledglings that had no brood-mates at all.

In one group in 1982 there was only one fledgling of the second brood. He had three sisters older than himself by a month. As he had no playmates of his own age, he started playing with his older sisters one week after leaving the nest. His sisters were, of course, much stronger than he and in fact 'forced' him to play with them: in the first months of his life, he was hit many times a day during various play sessions. We often noticed him trying to escape a play session that had turned violent, but his sisters rarely let him escape, and continued with what seemed to us — and apparently to him — like bullying. He had no choice but to play with his elders, since he had no siblings of his own age. Fledglings that do have siblings of the same brood prefer to play with them in the first month or two of their lives, rather than with their elders.

Older siblings try to play with their younger sibs: they 'invite' them to play many days before they get any response. Siblings of previous broods and year-old siblings may circle a fledgling and signal frequently by bowing and by rolling over. They may squeeze against a fledgling, push it, and play with other babblers next to it — all without any response on the part of the fledgling. In fact, fledglings often get up and move elsewhere as if to get away from the bother. In one group, the lowest-ranking yearling repeatedly approached her fledgling sibs, bowed next to them, and started a 'crazy

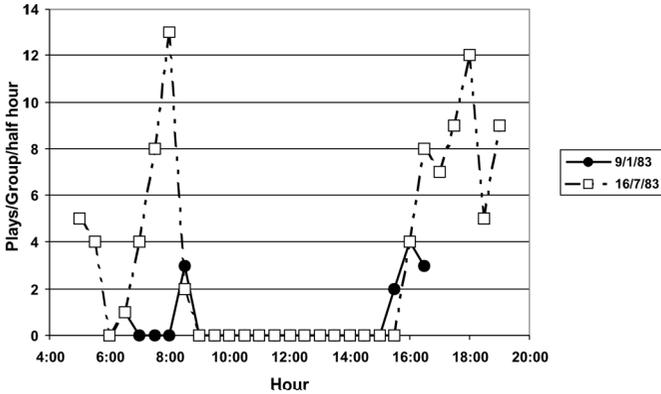


Fig. 3. Timing of play in summer and in winter (KEN group, 1983).

chase' over and over for four days, but only on the fifth day did her fledgling siblings start playing 'crazy chase' with her — 26 days after they had left the nest. This same brood, a year later, circled their fledgling sibs 20 days after the later left the nest, play-wrestled next to them, squeezed against them and ran around them, with many bows. Only seven days later, 27 days after leaving the nest, did the fledglings start playing 'crazy chase' with the their yearling sibs. De Vore (1963) describes very similar behavior in baboons (*Pabio anubis*), in which yearlings pull babies off their mothers and play with them. De Vore remarks that yearlings devote a great deal of effort to playing with those younger than themselves.

In three groups in which there were more than three yearling sibs, the lowest-ranking of them were the first to start playing with their younger sibs. In one case there were 10 yearlings in a group; the lowest ranking of them started play-wrestling with his fledgling siblings 27 days after they had left the nest, often rolling over and letting them climb onto his belly and peck it. His next lowest-ranking sister was the next to start playing with the fledglings — a gentle wrestling game. Only three days later did the dominant male yearlings start playing with the fledglings.

Factors affecting the play

Environmental effects

Time of day. Play is not distributed evenly throughout the day (Fig. 3). Babblers often spend a brief time play-wrestling and twig-holding in the morn-

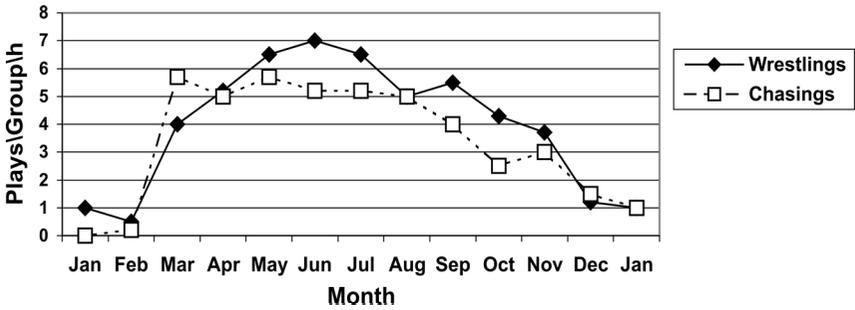


Fig. 4. Frequency of play at different times of year.

ing when they come down from the roost tree, but soon afterward they start searching for food. One to two hours later play resumes, intermixed with periods of searching for food. Babblers usually take a siesta in the middle of the day, clumped together, sleeping or allopreening. Play sessions resume in the afternoon and often last into the evening, even after sunset, in the twilight, before going up into the roost tree.

Other animals, too, tend to play at certain hours of the day: langurs (*Presbytis entellus*) play in the morning, then during morning and midday breaks, and again in the evening (Poirier, 1970). Lions (*Panthera leo*) play mainly in the afternoon (Schaller, 1972).

Seasonal effects. In summer babblers play for many hours. Some groups play up to five or six hours almost daily. In winter, both the number and the type of plays are different (Fig. 4). Chase plays are relatively rare in winter: in January-March 1982, 22% of the plays in Ken group were chases, compared with 56% chases in April-June of the same year. The type of chases also changes: yearlings usually engage in 'crazy chases.' In winter, however, we observed them playing 'slow chases.' It seems that crazy chases, being very vigorous, consume a lot of energy — a luxury that babblers cannot afford in winter (see next section).

Food. The availability of food is one of the main differences between summer and winter. In winter, most babblers are hungry. They fly great distances to get some breadcrumbs from us, something they do not do when they are satiated. Their normal diet consists mainly of insects, other invertebrates and small reptiles, supplemented by flowers and some fruits. In winter, all these food sources are scarce (Anava *et al.*, 2000). Hunger may therefore be the reason why play is reduced in winter.

TABLE 2. *Effects of food supplementation on the number and type of plays*

Time	Month	Group ¹⁾	Control ²⁾		Supplemented ³⁾	
			Wrestlings	Chases	Wrestlings	Chases
<i>Winter</i>						
Morning	January	BSF	0	0	5	2 ^{a)}
		KEN	0	0	8 ^{a)}	4
Afternoon	February	KEN	0	0	10	2 ^{a)}
		SHD	0	0	8	4 ^{a)}
	January	BSF	2	0	15	4
		KEN	4	2	27	9
February	KEN	5	3	49	15	
	SHD	0	0	14	11	
<i>Spring</i>						
Morning	March	BSF	14	12	41	23
		STV	13	8	28	21
Afternoon	March	TOK	3	3	35	11

The figures are number of plays in 3 h sessions.

¹⁾ For groups with access to garbage only.

²⁾ Control: no supplementation on the first day.

³⁾ Supplemented with bread crumbs ad libitum on the 2nd day.

The difference in number of plays between control and supplementation was significant ($p < 0.05-0.001$) except for figures designated with ^{a)}.

In order to test this assumption, we conducted experiments in which food was supplemented (see Methods for details). In most groups, supplementing food greatly increased the amount of playing, even in spring, when food is most abundant (Table 2). We already mentioned the reduction in energy-consuming play-chases in winter. Food supplementation increased play-wrestling much more than play-chases (Table 2). However, in two groups play was not induced by food supplementation in winter, even when food was supplied for 2 consecutive days. These two groups were the only ones in this experiment that had no access to human garbage or agriculture, and thus had even less food in winter than other groups (these groups were not included in Table 2). It is possible that this very profound difference in their ecology was responsible for the differences in their response to food supplementation. By the end of March play resumed in these two groups as well.

Food and allopreening. Food supplementation markedly increased allopreening in all the groups. This was especially clear in the two groups in

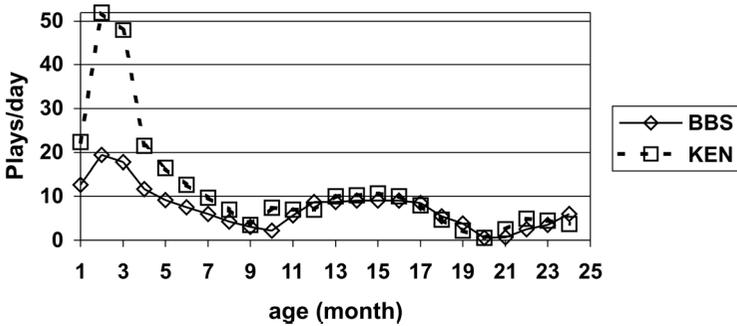


Fig. 5. Effects of babblers' age on the number of plays in BBS and KEN groups.

which food supplementation did not induce playing: throughout the day, as soon as the babblers became satiated, they would clump and allopreen one another, stopping this activity only to get some more bread.

The effect of food supply on play has been recorded in other animals as well: Baldwin & Baldwin (1972) did not record any play in squirrel monkeys (*Saimiri sciureus*) during a two month observation period in Panama, although squirrel monkeys are known to play a good bit in other places. The researchers write that the monkeys were searching for food 95% of the time, leaving no time for play. Schaller (1972) writes that, in the Serengeti, lion cubs do not play in May to September, when food is scarce. Van Lawick-Goodal (1968) also point out that hunger and thirst greatly reduce play in chimpanzees (*Pan troglodytes*), and Loy (1970) reports that in rhesus monkeys play was reduced by almost 90% by hunger.

Effects of artifacts. Babblers are very inquisitive. Many plays start when a babbler examines some artifact, such as a piece of paper, an empty food can, etc. Other interested babblers would come near, and this often led to play-wrestling or play-chases around the artifact. Many of the play sessions occurred near the edge of a garbage heap or a vegetable garden. Play-wrestling often occurs within barrels, and empty food cans often serve as the 'hill.' Aldis (1975) suggested that an environment with 'interesting' articles can entice animals to play, and Baldwin & Baldwin (1974) observed that 'in squirrel monkeys the frequency and form of exploration and social play vary considerably among different environments.' Diamond and Bond (1999) observed that in Kea '...object play is highly facilitative.'

TABLE 3. *Who plays with whom among the youngsters*

Name:	MLVT	SHCT	TVLS	TASZ	AHTS	TCVH	CATT	ATTZ	HTHH	ZTHL	
Rank:	1	2	3	4	5	6	7	8	9	10	
Sex:	M	M	F	F	M	M	F	F	F	F	
Year fledged:	1981					1982					
Date fledged:	14/3	28/4	28/4	28/4	15/6	2/6	22/4	22/4	11/7	11/7	
Name	Sex	Number of plays									
MLVT	M	–	0	4	0	9	2	0	0	1	1
SHCT	M	0	–	0	0	4	0	0	0	0	0
TVLS	F	4	0	–	2	2	3	4	0	0	0
TASZ	F	0	0	2	–	2	4	3	0	0	1
AHTS	M	9	4	2	2	–	6	2	3	0	0
TCVH	M	2	0	3	4	6	–	7	6	8	2
CATT	F	0	0	4	3	2	7	–	5	7	4
ATTZ	F	0	0	0	0	3	6	5	–	5	5
HTHH	F	1	0	0	0	0	8	7	5	–	13
ZTHL	F	1	0	0	1	0	2	4	5	13	–

Number of dyadic wrestling session among juveniles and yearlings (KEN group Jan-March 1983).

Social effects

Age. There is an inverse relationship between an individual's age and the time it spends playing (Fig. 5). Play is maximal at the age of about 2-3 months, and then declines sharply towards winter. The following summer the amount of time allocated to play is much less than in the first summer of a babbler's life. Babblers over two years old do not play much, and the amount of their playing is affected by gender and by social status. As to types of play, the only age-related difference was in slow chases, which rarely occur except among fledglings up to 8 weeks old.

Gender. We could not find any difference in types of play exhibited by male and female fledglings and youngsters. Reproductive females were rarely observed playing. The dominant males sometime play with their offspring. Gaston (1977) reports that, in jungle babblers, reproductives of both genders did not play.

Who plays with whom. Table 3 summarizes the number dyadic wrestling interactions among young babblers during January-March 1983 in the KEN group. This group produced a total of six broods in 1981-82, allowing a close examination of the interactions among the young (Table 3). In dyadic

TABLE 4. *Relation between rank and play in yearling male and female babblers*

Group	Rank	STV	BBS	KEN
Males	1	141	27	33
	2	156	65	66
	3	172	70	71
Females	1		46	18
	2		93	36
	3		166	

Figures are number of plays/10 h observations.

playwrestling and in tug-of-war, babblers tend to play with partners close to themselves in the dominance hierarchy. The exception is the lowest-ranking individual in each age group, who is likely to play with everybody, and often join others at play. Many other animals likewise tend to play with individuals close to themselves in the social hierarchy: this was reported for the Australian magpies (Pellis, 1981a, b), stump-tail macaques (Rhine, 1973), rhesus monkeys (Symons, 1978), and baboons (Owens, 1975). All tend to play with playmates of comparable age and size, who are usually also close in the hierarchy.

Social hierarchy. In the first few months of a babbler's life, it plays a great deal, and all young babblers spend equal amounts of time playing. From six months and up, there is an inverse correlation between a babbler's social status and the time it spends playing: lower-ranking babblers play more than higher-ranked ones (Table 4).

In play-wrestling, the more dominant individual is more often found on top, and the lower-ranking one tends to be the first to leave (Table 5). Often the dominant tries to prevent the lower-ranking one from leaving, almost forcing it to continue wrestling. Similar findings have been reported for rhesus monkeys (Symons, 1978), and baboons (Owens, 1975). Such differences were not observed in play-chases, where high- and low-ranking individuals were equally likely to be the chaser or the chased, with frequent changing of roles (Table 5).

Invitations to play. Babblers higher in the dominance hierarchy tend to initiate play with ones lower in the hierarchy. There was, however, no difference in the percentage of acceptance of invitations by higher — or lower —

TABLE 5. *Roles of dominants (D) and subordinates (S) in different games*

Group	Wrestling				Chases	
	Upper position		1st to leave		Chaser	
	D	S	D	S	D	S
BBS	45	23	18	24	11	11
KEN	95	36	27	65	26	23
SHD	41	20	13	38	7	8
STV	25	11	4	10	15	16
	$\chi^2 < 0.001$		$\chi^2 < 0.001$		NS	

TABLE 6. *Number of invitations to play and percentage of acceptance of the invitation by dominants (D) and by subordinates (S)*

Group	Invitations		Acceptance (%)	
	D	S	D	S
KEN	81	59	0.63	0.71
BBS	38	31	0.42	0.48
STV	47	27	0.51	0.52
SHD	11	4	0.45	0.50
Total	177	121	0.54	0.55
	$\chi^2 < 0.001$			

ranking individuals (Table 6). Similarly in the Australian magpie, wherever the juveniles could choose with whom to play, the juveniles only initiated one percent of the play fights with the adults (Pellis, 1981b). Adults initiated most of the play fights also in vervet monkeys (*Cercopithecus aethiops*) (Fedigan, 1972), and baboons (Owens, 1975).

The effect of social events

First egg. On seven occasions, groups were observed on the day the first egg was laid in a nest (in five different groups). The babblers did not play on any of these days.

Tension among dominants. At one point there was tension between the dominant male and males Nos 2 and 3 in a particular group. We did not see any play on three afternoon visits to the group in the week before male No. 2 was ousted from the group. Playing resumed the next day. Shortly after,

male No. 3 left as well. Again, playing was not observed in the group in the two days before its departure. These two sequences of days were the only visits to this group in which play was not observed. It seems that the tension among the dominants affected the young and the yearlings and repressed their tendency to play.

Intermissions in border fights with other groups. Border fights with neighboring groups are quite common. These encounters involve the exchange of shouts, chases in the air, and wrestling. There are frequent intermissions during the fighting, in which the groups gather on or near bushes, each group in clear view of the rival group. Usually members of each group allopreen one another, and the youngsters often play. A fight often ends with prolonged sessions of allopreening and playing within each group, until one of the groups leaves the area.

Discussion

There is no general agreement on why animals play. The evolutionary function of play has recently been amply discussed in the literature (Bekoff & Byers, 1998; Bekoff, 2001; Burghardt, 1999; Thompson, 1998; and others). We agree with Thompson (1998) that play enables babblers to assess their own capabilities, and that it provides them with a non-aggressive means to compare their own capabilities with those of their play partners. We shall therefore restrict our discussion mainly to a neglected aspect of play, that of testing the social bond (Zahavi, 1977; Zahavi & Zahavi, 1997), and we shall stress the importance of prestige in babbler's life.

Babblers' play, like that of the Australian magpie, clearly fits the parameters of 'social play': There is social interaction between the participants, and there are clear 'play signals,' which, according to Muller-Schwarze (1978), occur only in the 'more highly evolved forms of social play.'

The purpose of play signals

Loizos (1967) and others suggest that play signals define a certain activity as 'play' (see detailed discussions in several chapters of Bekoff & Byers, 1998). However, many animals play without the use of play signals (Heinrich & Smolker, 1998), and even among animals that have such signals, many play sessions start without them. This means that animals can recognize play as

such without a signal. Thus, the question is, what is the purpose of play signals?

Several authors show that play signals handicap the signaler (Owens, 1975; Symons, 1978; Pellis, 1981a). For example, rolling over as a play signal exposes the belly, leaving the signaler vulnerable; also, it is difficult to respond to an attack from that position. This signal is often used to entice young fledglings to play with yearlings; by handicapping itself, the initiator reassures its prospective playmate that no harm is intended. Rolling over is used by many other animals as a play signal: stumptail macaques and baboons (Owens, 1975), rhesus monkeys (Symons, 1978), Australian magpies (Pellis, 1981a, b) and keas (Diamond & Bond, 1999). The bow displaces the center of gravity of the body forward, a very awkward position for attack or for running. A bow is used as a play signal also by lions (Schaller, 1972), baboons, rhesus monkeys (Symons, 1978), and canids (Bekoff & Allen, 1998). The amount of forward inclination can serve as a measurement of eagerness to play. A babbler holding a twig cannot peck. The inclination of its neck further handicaps the signaler, thus demonstrating its eagerness to play.

The similarity of play signals in different animals is striking. All these signals handicap the signaler and thus serve as honest messages of the signaler's intent actually to play, rather than to attack or use its superiority to harm its playmates. Dominant babblers use play signals more often than lower-ranking ones (Table 6). These handicaps also signal the readiness of the more dominant individual to enable its play partners to have a chance of winning in a play session.

We saw that individuals often do not accept invitations to play (in about 50% of occurrences, Table 6). The invited individual may be busy doing something else, or it may be afraid of being hit during playing, or that it would end up the loser in a play session. By performing a play signal the initiator may increase the likelihood that a play will materialize.

Vocalization

Like babblers, many other animals do not vocalize during play. This has been reported by Poirier (1970) and Poirier & Smith (1974) for langurs, by Schaller (1972) for lions, by Aldis (1975) for canines and felines, and by Symons (1978) for Rhesus monkeys. This is not a general phenomenon,

however; Pellis (1981a) counts vocalization among play signals in the Australian magpie, and keas vocalize continuously during arboreal play (Diamond & Bond, 1999).

Clearly, vocalization can transmit information and is very important in the daily life of babblers. Even so, there are some other social activities in which vocalizations are not used, such as allopreening and the morning 'dance'. At present, we cannot suggest why vocalization is not used in play. Vocalizations are used, however, when play turns too aggressive, and serve to stop the play.

Testing the social bond

A group of babblers is a coalition of individuals. Sometimes members of a group are expelled, or groups break up, and even young fledglings sometimes move out of the group. An individual needs to know to what extent its group members are willing to cooperate with it. The only way to obtain reliable information about another's commitment to the social bond is to impose on that partner (Zahavi, 1977; Zahavi & Zahavi, 1997). It makes sense that an individual will be willing to accept the physical burden imposed by the testing individual in proportion to the strength of its interest in the tester. Play can be a good mechanism for testing the bond between group members. Playing can involve physical discomfort, and even actual pain. Playing demands an investment of time and energy that could be used more profitably in a purely utilitarian sense. The fact that hungry babblers do not play testifies to the amount of energy that playing requires. During play, the more dominant partner often gives up part of its advantages and disregards for a time its dominance over its play partner. It is sometimes even willing to be the 'loser' in a play session.

There are several findings that support this view of play as a test of the social bond. For example, it stands to reason that in a newly formed group there is more need for testing of social bonds than in a well-established group. Indeed, when a new group formed in May 1983, its founding members — who were two, three and four years old — spent a great deal of time playing in the first few weeks of the group's existence. The amount of play declined considerably after about four weeks. Poirier (1970) describes a similar finding when three adult male langurs joined an existing group: they, too, spent a great deal of time playing in their first week as members, and the playing ceased once they had been 'accepted.'

Social prestige

Social prestige is the respect accorded to an individual by others. It enables a dominant to dominate a subordinate without using threat or overt aggression, while the prestige of a subordinate enables it to resist control by the dominant.

There is a risk of losing social prestige in the realm of play. Young babblers whose invitations to play were not accepted, and babblers who came out as losers in a play session, turned sometimes to abuse lower-ranking individuals, presumably in order to regain some of their lost prestige. In one case, a yearling invited his 3-year-old brother to play, and when his invitation was not accepted, he went over to his 2-year-old sister and hit her. In another case, a brother and his lower-ranking sister were playing together, and when the brother lost, he stopped playing, threatened his sister, and then threatened two other babblers who happened to be nearby.

Rank in babblers is basically determined by age. A two-year old young adult may be stronger and more agile than an older dominant, and win a play with that individual. A loss in play may be involved with a loss of prestige. The cost of playing for a dominant who has competitors that may gain directly from any decrease in his prestige, is much higher than that of a dominant without competitors. During this research there were two cases in which new females displaced the breeding females and joined a group. The displaced females were the mothers of all the males in those groups, except the dominants. As babblers avoid incest (Zahavi, 1990), the sons had no interest in copulating with their mothers. However, as soon as the new breeding females joined the groups, the male offspring became their father's potential competitors over breeding. In both groups the dominant males stopped playing with their sons.

Play and allopreening

Babblers often mix playing and allopreening. Many play-wrestling sessions end with allopreening, and often sessions of allopreening turn into play. Crouching, which serves as a play signal, often precedes allopreening as well. It was sometimes difficult to predict whether crouching would evolve into play or into a session of allopreening. Similar environmental factors that affect play also affect allopreening (see above). Diamond & Bond

(1999) also report that brief episodes of allopreening are sometimes scattered through extended play sessions. We believe that allopreening in birds is similar to allogrooming in mammals, and probably serves the same purpose. The relationship of play and allogrooming in mammals has often been observed (De Vore, 1963; Rhine, 1973; Aldis, 1975). In rhesus monkeys, Symons (1978) observed the mix of allogrooming and play. Similarly, allogrooming often occurs in Macropodids interspersed with ritualized fights (Watson, 1998). Van Lawick-Goodall (1968) writes that, in chimpanzees, a reduction in playing was almost directly proportional to an increase in allogrooming.

Loizos (1967) writes that grooming and playing clearly serve similar functions: As individuals mature, both in nature and in captivity, grooming takes over the time and role that playing fills for younger individuals (pp. 208-9). We have suggested that allopreening serves to test the social bond between individuals (Zahavi, 1977; Zahavi & Zahavi, 1997).

Play can put considerable bodily pressure on participants and thus can serve as a good mechanism for a vigorous testing of the social bond. Allopreening (as well as allogrooming) is a quiet, relaxed activity. The higher social risk of play for the older, more dominant individuals may explain the replacement of play by allopreening in those individuals. Thus, young individuals use play, while older individuals tend to turn to allopreening in birds, allogrooming in mammals, as tools for testing their social bond.

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