Chapter 10
Nonlinguistic Communication

10.1 Introduction

This chapter is concerned with nonlinguistic signals that may have been important to early hominins, as distinctively represented by baboon analogies. The term "distinctively" is important here because of the extent to which baboons are like many other primates and other animals in much of their communication system. The unusual features of baboon communication have special relevance to early hominins.

Molesti et al. (2019) listed 67 "communicative gestures"observed in a captive group of 47 olive baboons, aged 0–25 years. A gesture was defined as "a movement of the body or part of the body, directed to a specific partner or audience." Most of these gestures are represented in Table 10.1. Presumed idiosyncratic behaviors (performed by seven or fewer individuals) have been eliminated in order to simplify this discussion.

Many of the gestures observed by Molesti and colleagues are shared with numerous other primate species (e.g., grooming, embracing, bared-teeth signals) or many other animals (e.g., chase, flee). These provide no more insight into early hominin communication than more broadly comparative studies. Furthermore, some of these widely shared gestures have simple and obvious analogies with humans (e.g., staring as a threat), such that little discussion seems to be needed here. Finally, there are behaviors indicative of anatomical differences between baboons and hominins (e.g., sexual presenting and mounting) that offer only the simplest functional analogies.

Baboon vocalizations seem to offer the most distinctive and significant analogies for early hominins. Barks and grunts in particular are discussed at length in this chapter. A more complex set of communication signals occurs in baboon greetings. Some of these greeting patterns provide rather specific parallels with certain human behaviors, suggesting an evolutionary origin in early hominins. Preliminary work on baboon leave-taking also suggests analogies with humans and early hominins.

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Table 10.1 Communicative signals of captive olive baboons

Signal	Partial description	# of Events	# of Subj.	Adult context
Audible				
Ground slapping	Slap ground or other surface	127	17	
Lip smack	Rapid lip movement	753	46	
Object shake	Vigorous shaking of object	108	20	
Teeth grind	Exaggerated chewing motions	33	10	Agonistic
Tactile				
Bite	Literal	19	13	Agonistic
Body contact	Parts of bodies touch	162	37	
Body–body rubbing	Literal	10	10	
Embrace	Wraps arms/legs around other	72	25	
Grab	Establish hold of other	207	32	
Grooming initiation	Literal	482	46	
Hand–body touch	Literal	464	47	
Hand–genitals touch	Touch genitals of other	51	29	
Hand–hand touch	Literal	51	11	
Head push	Briefly pushes other with head	19	12	Affiliative
Head–body rubbing	Gentle rubbing	21	15	Affiliative
Jump on	Bounce on back of other	42	9	
Mating initiation	Male clasps female	51	12	Sexual
Mock bite	Gentle grip with teeth	410	40	
Mount	Mount w/out sexual function	86	28	
Mouth–body touch	Literal	29	16	
Mouth–genitals touch	Literal	66	30	
Mouth–mouth touch	Gentle contact	45	29	
Pull	Grab and pull other's body part	115	23	
Slap	Hit with open hand	44	15	
Visual				
Air bite	Literal	75	24	
Back and forth look	Exaggerated gaze alternation	36	15	
Bared-teeth	Literal	74	25	
Biting threat	Mouth wide, showing teeth	463	41	
Charge	Run at over short distance	153	35	
Chase	High speed pursuit	91	28	
Display	Body shaking, jumping	45	14	
Eyebrow raising	Eyes wide, brow raised	477	42	
Flee	Literal	139	33	
Freeze	Arm on ground, body lowered	51	23	
Give ground	Move away at moderate speed	939	44	
Greeting	Side by side with other	35	16	
Groom present	Shows other part to be groomed	457	44	

(continued)

Table 10.1 (continued)

Signal	Partial description	# of Events	# of Subj.	Adult context
Ground rubbing	Rub ground/other support w palm	60	15	
Head shake	Literal	36	18	
Lift	Rhythmic raise/lower brows	132	36	
Lunge	Sudden intense forward movement	99	33	
Make room	Move part of body away from other	158	40	
Open mouth	Eyes wide, lips over teeth	60	15	
Peer	Intense look into other's eyes	164	37	
Presentation	Hindquarters presented to other	624	42	
Pursed lips	Lips protruded	48	12	
Scalp backward	Scalp/cheek retracted, ears flattened	206	41	
Spread leg	Stretch hind leg back toward other	42	16	
Stare	Literal	102	33	
Stretch arm	Extend arm(s) toward other	222	38	
Tail raising	Tail held straight and vertical	83	27	
Ventral presentation	Stand up, belly/genitals toward other	17	12	Affiliative

Modified from Molesti et al. (2019). Signals recorded from a captive troop of olive baboons, with total number of occurrences and total number of subjects displaying each signal. Behavioral context is noted where a signal appeared *only* in that context. All others were displayed in more than one context. Many adult patterns also were included in the play of immatures

10.2 Vocalizations

Humans have a set of nonlinguistic vocal signals, such as shouts and grunts, that are comparable to the call systems of other primates. A call system is a relatively fixed set of vocal signals used by a species that are conserved in the evolutionary sense, that is, they are little affected by genetic or ecological variation (Fischer 2021; Hammerschmidt and Fischer 2019). The conserved signals in humans that resemble those of other animals are presumably derived from early hominins. Analogies with baboon communication may suggest how these vocalizations functioned in early hominins, and why they were favored by natural selection in the context of hominin evolution.

10.2.1 A Flexible Call System

Vocal communication in all baboons is based on a call system like those of other primates. However, there are distinctive details in baboon systems that have implications for early hominin communication. Hammerschmidt and Fischer (2019)

considered *Papio* a good "model"for assessing links between social system characteristics and vocal communication because of the variation in social systems and social behavior across the genus.

When they analyzed acoustic variation in the call types of several baboon species, they found that the repertoires were composed of the same general types. However, quantitative analysis of acoustic features discerned subtle variations among chacma, olive, and Guinea baboons in two important categories: grunts and loud calls. The *grunts* of baboons are deep rhythmic sounds that are often emitted in rapid sequences. *Loud calls* are just that, calls that can be heard across fairly long distances and that demand attention from others.

Hammerschmidt and Fischer (2019) considered variation in baboon call rates and intensity to be great enough to support significant plasticity in social relationships, mating patterns, and social organization. A broad analogy with early hominins suggests that the hominins could have communicated flexibly with a relatively simple conserved signal system, at least with regard to various social interactions.

Of course, this functional analogy does not necessarily imply that hominins had the same call system as baboons or even a similar one. Nevertheless, there are analogies between some particular kinds of extant human and baboon utterances. As with other kinds of behavior, the hypothesis here is that hominins and baboons separately evolved comparable responses to similar social and environmental problems.

10.3 Loud Calls

Baboon loud calls are mostly barks, somewhat similar to vocalizations of some domestic dogs. Human analogy with baboon barks is loose and may apply only to males. Baboon barks are comparable to human shouts in volume and functions. They demonstrate how vocalizations like shouts might have been important to early hominins.

10.3.1 "Roars" in Humans

Loud, aggressive vocalizations in humans have been called "roars" or "roar-like vocalizations"by Raine et al. (2019). These researchers used playbacks to explore the form and function of such human vocalizations. Listeners accurately judged the upper body strength of vocalizers from aggressive speech and (separately) from roars. They made more accurate judgments based on the roars. These vocalizations could, therefore, be considered "honest signals," that is, they conveyed the physical reality to listeners independently of the senders' intent. However, the vocalizations conveyed some exaggeration of the associated feature (in accord with the competitive function of physical strength). This exaggeration effect occurred with male vocalizers and not with females.

Fukumori et al. (2023) researched "angry shouts" along with other loud vocalizations for the practical purpose of identifying threatening situations via public audio surveillance. It is not clear if these vocalizations resemble the roars described by Raine and colleagues. However, the functional connection between such loud vocalizations and social threat does seem to be clear.

Raine et al. (2019) hypothesized a "homology" between humans and other mammals resulting from natural selection for acoustic structure of aggressive vocalizations that communicates strength (i.e., physical fighting ability) to competitors. Such vocalizations are typically low pitched and structurally "noisy." If Raine and colleagues are correct, these aspects of threat vocalization in humans are more than analogies with baboons—they have a common origin in the evolution of mammals. Whether homology or not, an important function of these vocalizations is to settle disputes without dangerous physical combat. Even an animal much stronger than an opponent may suffer a serious injury that can lead to death, for example, a severed artery or an infection.

10.3.2 "Wahoos" in Baboons

Physical fights in a chacma baboon population were observed to cause potentially fatal injuries, but most disputes were resolved by displays in which a distinctive vocalization was prominent (Kitchen et al. 2013). Males produced a loud call that sounds like two syllables. The *wa-* is a kind of bark that is "ingressive" (i.e., emitted with inhalation); the *-hoo* is a kind of grunt (Boë et al. 2018). Male chacma baboons give these calls in response to predators (alarms) and during aggressive displays that sometimes involve chasing other baboons (contest wahoos). Acoustic analysis revealed significant but subtle differences between the alarm and contest calls that can be difficult for humans to distinguish.

For baboons it is adaptive for listeners to discriminate among calls that are given in qualitatively different contexts. This is particularly true for female chacma baboons because of the varied dangers that they face. In playback experiments, females responded for significantly longer durations to alarm than to contest wahoos and only alarm wahoos caused females to flee. Despite the acoustic similarity of the calls, female baboons appeared to associate alarm and contest wahoos with qualitatively different events (Kitchen et al. 2003).

Male perception of the contest vocalization is entwined with social dominance, which is "fiercely contested" (Kitchen et al. 2013). Physical fighting, a costly behavior, is relatively rare because disputes are frequently resolved by displays that include loud, repetitive wahoos. Males of all ranks adjusted their contest behavior based on the relative fighting ability of opponents. Fighting ability is reliably indicated by calling rate, fundamental frequency, and length of the second syllable *(-hoo)* (Kitchen et al. 2003, 2013).

Wahoos occur in baboon species other than chacmas, but they are rare in wild populations of Guinea baboons (Hammerschmidt and Fischer 2019). This is not

because they lack the capability; numerous wahoos were recorded in a captive group of the species (Boë et al. 2018). Rather, wahoos are not stimulated in Guinea baboons under natural conditions because of the high level of male–male tolerance and the consequent rarity of aggressive interactions (Chap. 7).

There seems to be an analogy between male "roars" (or "angry shouts") in humans and male wahoo barks in baboons. This applies to function, but may also be relevant to some aspects of vocal quality. A human tendency for a serious argument to devolve into a "shouting match" may be derived from an early hominin pattern of dominance competition.

Guinea baboons share with chacma baboons an adjunct to the wahoo. In chacmas the vocalization is often preceded by "a short series of throaty roar-grunts" (Hammerschmidt and Fischer 2019). Guinea baboons sometimes emit "such roar-grunts" during branch shaking or chasing females. It would be interesting to know if these roar-grunts have any structural similarity to the roars reported for humans. It seems possible that these apparently softer vocalizations are analogous to human attention-getting exclamations such as the American *hey!* and the British *oi!*

10.3.3 Female Barks

The simpler barks of female chacma baboons parallel the predator warning function of wahoos, but not the competitive aspect. Female barks were also associated with separation from other group members (Cheney et al. 1996). This might seem to suggest intent on the part of the caller. However, though the calls did function to maintain contact between dispersed animals, there was apparently no intent to inform others of location. This was demonstrated by the timing of the calls. Females were more likely to give a contact bark in the 5 min after they themselves had called than to utter the vocalization in the 5 min after another female had called. Playback experiments suggested that separated females responded primarily to the contact barks of close relatives rather than other members of the troop.

Fischer et al. (2001a) studied variation in the barks of female chacmas and found a graded continuum from tonal and harmonically rich calls to calls with a "noisier" and harsher structure. Tonal barks were typically given when the signaler was at risk of losing contact with the group or when a mother and infant had become separated (contact barks). The harsher variants were given in response to large predators (alarm barks). Within the alarm bark category, there are significant differences between calls given in response to mammalian carnivores and those in response to crocodiles (Chap. 6), a distinction that in other species has been attributed to referential understanding (but see Fischer 2021).

Fischer et al. (2001b) tested whether wild baboons made the following discriminations among recorded vocalizations of females: (1) clear contact barks versus harsh alarm barks, and (2) clear contact barks versus intermediate alarm barks. Calls were selected according to an analysis of a suite of acoustic parameters. In these experiments, the baboons responded only to the playback of a harsh alarm bark.

Apparently, only this harsh variant was perceived as warranting a response. The researchers hypothesized that baboons' responses were to a large degree influenced by their assessment of context. This distinction seems to parallel the one made by females with regard to male alarm and contest wahoos.

10.4 Grunts

Grunts are deep rhythmic sounds that occur in all baboon species and convey various meanings, mostly positive, ranging from contact maintenance to friendliness to cooperation. Owren et al. (1997) characterized the grunts of chacma baboons as "tonal, harmonically rich vocalizations." Grunts demonstrate the social versatility of a single call type. They occur in both baboons and humans, with similar vocal characteristics and behavioral implications. Because of the similarity in both form and function, grunts are probably the mode of communication most likely to be analogous between humans and baboons.

10.4.1 An Evolutionary Theory of Human Grunts

McCune (2021) presented a theory of hominin language origins based on grunts. Across mammalian species, including humans, grunts are an initial reflex response to autonomic demand (e.g., effort). In some species, including chimpanzees and vervets, grunting was co-opted for communication. McCune noted that chimpanzee and vervet infants are similar to humans in the shift of grunts from effort to communication.

Throughout the first 18 months of life, human infants produce a growing variety of vocalizations. In studies of referential word onset, McCune and colleagues discovered that one prominent laryngeal vocalization, when produced communicatively, was predictive of each child's referential word onset (McCune et al. 2020). They defined this "grunt"in line with nonhuman primate literature as a laryngeal articulation characterized by abrupt glottal onset and short duration. In infants that were followed from 9 to 16 months of age, grunt production occurred in three contexts: physiological effort, focused attention, and communication.

The evolutionary hypothesis is that the connection between a physiological state (physiological challenge or effort) and an accompanying vocalization (the autonomic grunt) has been an engine in the origin of protolanguage(s) in species with sufficient levels of mental representation. The fact that many primate species' call repertoires include a vocal signal related to travel, an effortful activity, is relevant to the grunt/effort hypothesis. This association occurs in gorillas, vervet monkeys, and chimpanzees.

In addition to the primate species cited by McCune, baboons emit grunts before and during group movements (Hammerschmidt and Fischer 2019). In chacma

baboons, at least, grunts may be important for initiation of movement across open areas (Owren et al. 1997). Thus, the McCune hypothesis is supported by the primate genus that is probably most closely analogous to early hominins with regard to group movement, especially across open areas.

Beyond that, the baboon analogy demonstrates the co-optation of grunting into other forms of social communications. Owren et al. (1997) reported chacma baboon grunts in two distinct behavioral contexts: initiation of movement and approach to a mother in an attempt to inspect or handle her infant. The grunts appeared to be acoustically distinct and elicited different responses from receivers.

10.4.2 Grunts and Social Interaction

Humans (at least in Western societies) use soft and simple phrases to soothe others, such as *okay* or *there-there*. Whether or not these have any formal relation to ancestral grunts, baboon use of grunts suggests how comparable vocalizations might have evolved in early hominins. All baboons use grunts to facilitate affiliative social interactions (Hammerschmidt and Ficher 2019). They are produced by both sexes, in all age classes, in situations that vary with individual relationships and social organization.

In olive baboons, "decisions" about whether to grunt or remain silent are influenced by the social context, particularly the likely response of a potential partner to the approach (Silk et al. 2016). When a female emits low amplitude grunts after approaching another female, she is less likely to behave aggressively toward the other female, and more likely to be affiliative and to handle the partner's infant. The female baboons are more likely to grunt when they approach lower-ranking females, who may be anxious about the interaction, than in approaching higher-ranking females. They are less likely to grunt after approaching their own mothers and daughters, presumably because behavioral expectations are clear. Similar to olive baboons, quiet, tonal grunts by female chacma baboons mollified lower-ranking females, facilitating friendly social interactions that included inspection and handling of an infant (Cheney et al. 1995; Owren et al. 1997). Taken together, the patterning of grunts in olive and chacma baboon suggests that these vocalizations play an important role in reducing uncertainty in others about an actor's intentions. This facilitates nonaggressive social interactions (Silk et al. 2018).

Males also modify their communication signals in accord with social relationships. In a study of chacma baboons, Palombit et al. (1999) found two patterns of adult male grunts during interactions with females. First, higher-ranking males grunted significantly more often than subordinates when approaching females in most of the females' reproductive states. Second, males grunted more often when approaching females with which social interaction was potentially highly beneficial and/or social interaction was unlikely to occur due to female evasion, that is, estrus females and lactating females. In chacma baboons, male grunts had contrasting effects on the probability of supplanting a female or interacting in an affinitive

manner with her. Supplanting of females was just as common when the approaching male grunted as when he did not. Instead, variance in supplanting was better explained by female avoidance of high-ranking and non-friend males than by the male's vocal behavior.

These results suggest that male grunts themselves do not determine the female's response in all situations. Rather, the female's reproductive state and social relationship with the male (i.e., his "friendship" status and/or rank) affect *both* the male's tendency to call to her and the female's tendency to move away from him. In contrast to supplanting, affinitive interaction occurred significantly more often when males grunted than when they silently approached females. Taken together, results suggest that a female chacma baboon's spatial response to a male's approach (stay or leave) depends on her assessment of nonvocal factors, but her "social" response (interact or not) is influenced by the grunts given by the male (Palombit et al. 1999).

In Guinea baboons, as in olive and chacma baboons, the presence of an infant affects social communication. In females, the probability of grunting was higher when the relationship strength was low, but only when an infant was present. Males were also more likely to grunt when an infant was near a female partner (Faraut et al. 2019). In the tolerant society of Guinea baboons (Chap. 7), males often grunted to each other (Maciej et al. 2013a, b).

Faraut et al. (2019) suggested that grunt usage in baboons can be best conceived as a combination of a motivational and a strategic component. The motivational component expresses the increased disposition to interact in an affiliative fashion, while the strategic component refers to the modulation of grunt usage with regard to relationship quality and context. The motivational component appears to be shared between baboon species. The strategic component varies with social organization and places different premiums on the potential benefits of signaling, resulting in variation in grunting patterns between species (Faraut et al. 2019). With the proliferation of hominin species that were contemporary with each other (Chap. 1), and may have had differing forms of social organization, potential analogies like this one increase in significance.

10.4.3 Grunts and Referential Communication

In the study cited above, Owren et al. (1997) described distinctive grunts uttered by chacma baboons in two different contexts: initiation of movement and approach to a mother. The researchers hypothesized this to be a rudimentary capacity for *referential signaling*, that is, communication *about* something. In playback experiments (Rendall et al. 1999), the subjects differentiated between the two kinds of grunts based only on acoustic features and their distinct responses matched the behaviors in naturally occurring situations. However, some responses to playbacks were also affected by context, such as rank differences between callers and the subjects. The researchers concluded that baboon grunts can function in rudimentary referential fashion, but that context and social identity can also affect recipients' responses.

These results suggested that baboons make inferences about the directedness of vocalizations even in the absence of visual cues, and that the nature of prior interactions affects subsequent behavior. When attending to vocal signals, baboons appeared to recognize the signaler's identity and her probable subsequent behavior, and also the target of her attention. The ability to integrate these cues could be interpreted as a first step toward the recognition of other individuals' intentions and motives (i.e., the cognitive capability known as "theory of mind" or "mind-reading").

Fischer (2021) clarified the general issue by applying the distinction between first-order and second-order intentionality. In first-order systems, the intent or motivation is to influence the behavior of the receiver(s). Second-order communication differs in that the signaler intends to convey information. First-order communication is sufficient in the social systems of baboons and other primates because signals that express motivation (e.g., desire to touch an infant) allow the receiver to predict the sender's behavior. This adds to the comparative inference that early hominins could have engaged in complex social behavior with relatively simple vocal systems (cf. Hammerschmidt and Fischer 2019).

10.5 Gestures

There seems to be little description of gestures in wild baboons, especially when compared with the work on chimpanzees. This might be connected with the relative freedom of the arms and hands in chimpanzees compared with the quadrupedal baboons. However, a captive study indicates that baboons have a substantial capacity for gestural communication in a broad sense. Molesti et al. (2019) studied gestural communication in three social groups of captive olive baboons for 1 year. They defined a communicative gesture as any movement of the body or part of the body that is directed to a specific partner or audience. The definition included facial expressions. A gesture could be directed to a partner by gaze, body orientation, or physical contact.

The researchers recorded almost 9000 gestures that they classified into 67 gesture types (Table 10.1). The majority of the types were visual: 39 types, 58% of the repertoire. Of the rest, 24 were tactile and only 4 were audible. Some gesture types were common and others rare. Of the total number of gestures, 74% were performed as an unaccompanied signal while 26% were combined with another gesture. The prominence of visual signals here is consistent with a long-standing hypothesis that associates the modality with increased terrestriality and reduced interference from vegetational barriers. In this context, Molesti and colleagues noted that baboons evolved in environments very much like those of many early hominins.

This baboon evidence supports inference from the *Pan* species that early hominins might have communicated extensively with gestures at close quarters. Longer range communication might have been encouraged by expansion into more open

habitats with less vegetational cover. The baboons in the Molesti study inhabited a large open enclosure (with access to shelter in a building).

10.6 Salutations

Salutations are signals that acknowledge an individual's arrival or departure. Greetings are important signals of peaceful intention and trust between males in both baboon and human societies. The baboon evidence suggests that such behavior may have been adaptive in early hominins. Further, some specific behaviors may have evolved in both lineages because of their social effectiveness. Recent work demonstrates the existence of salutations (or, at least, notifications) of departure in baboons. Baboon greetings have been used as a prime example of the concept of *sequence organization* as applied to social interactions of primates.

10.6.1 Greetings

Ritualized greetings are exchanges of nonaggressive signals. They are important in complex societies, such as those of baboons and humans, and are especially elaborate in the multilevel societies of the hamadryas and Guinea baboons. They are common among the males and are thought by some to balance the trade-offs of male co-residence between the risk of aggression and the need for co-existence (Dal Pesco and Fischer 2018). The signals used by baboons include some that specifically resemble gestures used in some human societies, including males touching or grasping one another's genitals to show trust and imply tolerance and willingness to cooperate. Thus, analogy with baboons suggests that the practice of (need for?) greeting originated in early hominins (Wickler 1972).

While ritualized greetings are widespread in the animal kingdom, the behavioral repertoire described in the genus *Papio* is exceptional, as it involves potentially harmful behaviors such as genital fondling. Although greetings are one of the most striking male social interactions in baboons, their function has been subject to dispute. Dal Pesco and Fischer (2018) examined the social behavior of 24 adolescent and adult male Guinea baboons to test whether greetings reflect relationship quality or function to buffer tension. Greetings were ten times more frequent than aggression and twice as frequent as affiliation. Neither dyadic aggression nor tense context predicted greeting rate, discounting the buffering hypothesis. Greetings occurred almost exclusively between males of the same party, even when other parties were around. Within parties, spatially tolerant partners greeted more frequently but those in dyadic relationships did not greet each other because they were usually in proximity.

Although affiliation did not predict overall greeting rate, intense and potentially costly greetings were more likely between males with stronger affiliative

relationships. Greetings in Guinea baboons appear to signal commitment among party members, test relationships among spatially tolerant partners, and accentuate relationship strength among highly affiliated males. Looking at the comparative evidence, the researchers concluded that, although ritualized baboon greetings lack the symbolic component of human rituals, they appear to serve similar functions of strengthening in-group affiliation and promoting cooperation (Dal Pesco and Fischer 2018)

The authors also considered comparative evidence from other baboon species (Dal Pesco and Fischer 2020). These ritualized signals differ between species in their occurrence, form, and function. While ritualized greetings are rare in species with the most intense contest competition, the complexity of and risk involved in greeting rituals increase with the degree of male–male tolerance and cooperation. The variety of societies found in this genus, combined with its role as a model for human socioecological evolution, sheds light on the evolution of ritualized behavior in humans.

10.6.2 Sequence Organization

Mondada and Meguerditchian (2022) applied the idea of *sequence organization* to baboon social interactions, with greeting as a prime example. The concept of sequence organization was posited by students of human behavior as a key element in a larger hypothesis of social interaction. This approach considers an interaction to be more than just one action following another. It views each action as making the next one relevant, including alignment or "disalignment" with the prior action. The sequential order displays the way intelligible actions are produced; how they are progressively identified and recognized; and how they are responded to. It establishes and manifests the rights and obligations of the participants. Setting aside cultural meanings, this is a social process that can be observed in baboons.

Mondada and Meguerditchian (2022) performed an analysis that showed how the actions of baboons are finely coordinated and mutually shape each other. In the openings studied, and in particular in the greetings (constituted by the presentation of the hindquarters), baboons manifested a very precise sense of sequence organization. They displayed it by carefully formatting their courses of action, by scrutinizing them, and by expressing whether or not they conform social and normative expectations. This is particularly observable in the orientation to absence of responses in the other individual. While approaching each other, baboons establish and define their mutual positions. This indicates what the encounter is becoming—either an aligned and even affiliative unfolding of actions, or an interaction that is "disaligned" (simply put, trustful or suspicious). The researchers emphasized that this analytical approach from human studies can be readily applied to baboons. They inferred common factors that may derive from parallel evolutionary backgrounds.

10.6.3 Leave-Taking

Behaviors that mark the parting of two individuals are a common and possibly universal feature of human social life. Baehren and Carvalho (2022) studied leave-taking in wild baboons by testing a range of candidate behaviors on video footage. The behaviors that they addressed were (1) self-scratching, (2) eye gaze, and (3) orientation in the direction of parting. Their analysis controlled for interaction duration and individual variation. The results showed that orientation in the direction of parting occurs predominantly before social separation events. It was not associated with solo or proximity separations. This suggested to the researchers that the behavior plays a unique social role that could have evolved for a social function. It may assist in strengthening social bonds or in minimizing aggression, increasing the affiliative nature of interactions or mitigating risky endings.

This work was limited to one species in one locality. The absence of risk from predators or humans in that national park could have been significant. These baboons were more terrestrial than many other populations and this could increase opportunities for such short-term, recurrent social interactions. Such opportunities increase visual proximity, and as such, leave-taking may be a necessary adaptation to social life on the ground.

Terrestrial adaptations, of course, have crucial relevance to early hominins. Differences in aggressive behavior, social cohesion, and female-bondedness (for example) might also affect leave-taking, resulting in variation among species that has not been studied (Baehren and Carvalho 2022). Variation between forest and savanna species or populations might be significant.

10.7 Summary and Discussion

Nonlinguistic communication is any form of signaling between animals that does not involve language in the human sense of the term. It need not be deliberate on the part of the sender. Patterns of baboon communication suggest how early hominins might have communicated with each other and how effective their system might have been. Some features of baboon communication have nothing special to tell us about nonlinguistic signals in early hominins. This is because baboons are like most other primates in these behaviors; for example, mutual grooming and staring threats. However, some baboon patterns provide more specific analogies.

Vocal communication in baboons uses a call system comparable to that of other primates. It contains a limited number of call types that are characteristic of the genus and seem to be strongly constrained by the genes. Nevertheless, it is a flexible and versatile system because each call type has subtle variations and baboons derive information from integrating social context with the signal. Early hominins probably evolved such a system as they adapted to diverse and changing environments and to the advent of multilevel societies.

Two categories of baboon vocalization seem to be especially pertinent to early hominin adaptation: loud calls and grunts. Loud calls are essentially barks that are broadly analogous to human shouts in volume and at least some functions. Female barks vary from tonal calls (in response to separation) to harsher vocalizations (predator alarms). It seems that there is no intent behind the separation calls, so the cognitive basis for some parts of the system is relatively simple. Males have a distinctive two-phase loud call, the "wahoo." Some wahoos are predator alarms while others are emitted during dominance contests and may serve as a substitute for costly aggression. This vocalization is a good example of flexibility in baboon usage of innate signals. The wahoo is prominent among the aggressive chacmas, but rarely occurs in Guinea baboons where there is little dominance competition among males. On the other hand, "roars" seem to be similar among chacmas, Guinea baboons, and humans.

Grunts are acoustically similar between baboons and humans. Baboon grunts are deep rhythmic sounds that are harmonically rich and serve a variety of communicative functions. An evolutionary theory of grunting views it as a response to autonomic demand (e.g., physical effort) that occurs across all mammals, including humans, that has been coopted to be a social signal. In baboons, for example, grunts occur in the effort of beginning travel and have come to communicate in that context and others. The circumstances in which baboons communicate with grunts must have had many parallels in early hominins, given the similar demands of their physical and social environments. For example, a troop of baboons varied their grunts in relation to habitat usage (perhaps reflecting some level of awareness of their surroundings). They used longer grunts in forested areas, probably in response to reduced visibility and sound transmission.

Grunts signal "benign intent" among baboons, facilitating positive social interactions. The variety of these interactions gives rise to hypotheses about the underlying cognitive processes. Baboons seem to integrate the exact form of a grunt with the signaler's identity, its probable subsequent behavior, and the target of the signaler's attention. This may come close to an understanding of the other's mental process (often called "Theory of Mind"). Another study also made inferences about cognitive processes, suggesting that grunts represent the combination of an affiliative motivation with a "strategic" component (modulation with regard to relationship quality and context). Playbacks of grunts were also used to assess the ability of baboons to comprehend the relationships of others. In contrast to chacmas, male Guinea baboons showed little concern about indications that a female was changing partners. Presumably this was because they live in a society where such affiliations are chosen by females.

A captive study indicates that baboons have a substantial capacity for gestural communication in a broad sense that includes facial expressions and any other movement of the body or part of the body directed to a specific partner or audience. This supports inference from the *Pan* species that early hominins might have communicated extensively with gestures at close quarters. Longer range communication might have been encouraged by expansion into more open habitats with less vegetational cover.

Ritualized greetings between males are an important and somewhat specialized form of communication in baboon and human societies. In both taxa they convey trust and cooperativeness, and in both taxa some similar signals are used (the most dramatic being toleration of genital touching). Baboons also seem to recognize the conclusion of interactions. Recent research on one troop reports a consistent signal of leave-taking, but only when there is complete separation from a social situation. Baboon greeting behaviors may be an example of sequence organization, a theory of human interaction that posits a complex relationship between each behavior and the one that follows it.

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