Chapter 13
Social Cognition

13.1 Introduction

The concept of social cognition encompasses a broad range of processes underlying the ability to identify, mentally represent, and respond to other individuals and groups, their behaviors, intentions, and relations (Hopper et al. 2018). It covers many aspects of human cognition, most of which potentially have roots in early hominin evolution. These include generalized capabilities such as perception, memory, and attention, as well as more specific phenomena such as social categorization, imitation, and Theory of Mind. In a broad sense, social cognition also encompasses emotions. Despite a traditional division between cognitive and affective processes, they now can be seen as a set of closely connected and interdependent processes (Shkurko 2020).

Baboons have played an important role in the development of social cognition studies because the complexity of their societies was quickly apparent, even from limited field studies of savanna baboons in the early days of research on the genus. The multilevel societies of hamadryas baboons quickly followed in the literature. More recently, greater diversity in baboon societies has become known through studies of Guinea baboons and Kinda baboons. In the growing knowledge of baboon social variation, there are illustrations of basic concepts of social cognition as well as analogies for the evolution of particular features of social cognition in early hominins. Some aspects of social cognition in baboons were introduced in the preceding three chapters. Others are discussed below.

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13.2 Theories of Social Cognition

Social cognition has been conceptualized in several different ways that overlap with one another. With regard to comparison of baboons and early hominins, three hypotheses are especially pertinent: Machiavellian Intelligence (MIH), Social Brain (SBH), and Embodied Social Brain (ESBH). The first two share the basic premise that the evolution of cognition in hominins and other primates (as well as many other mammals) has been driven primarily or entirely by social complexity. The ESBH introduces a critical perspective that emphasizes brain–body interaction and is more open to ecological as well as social factors in cognition.

The main point to be made in the following discussion, aligned with the purpose of this book, is to demonstrate the importance of baboons in theorizing about social cognition. As usual here, the capabilities of baboons are taken to represent behavior that was possible for early hominins. Some of the examples alluded to in this section are treated in more detail later in the chapter.

13.2.1 The Machiavellian Intelligence Hypothesis

A crucial development in the study of social cognition was the publication of the book *Machiavellian Intelligence* (Byrne and Whiten 1988a, b). It has been called a "keystone" for the field (Hopper et al. 2018). The basic concept is that primate cognitive abilities have been shaped by complex social environments rather than technical or ecological problems. The term "Machiavellian" might seem to limit the hypothesis to competitive or agonistic interactions, but the intent was and is much broader.

The Machiavellian Intelligence Hypothesis (MIH) does encompass competition, and early research focused on *tactical deception* among baboons (Whiten and Byrne 1988). This is the ability to mislead others for personal gain by occasional false use of a normally honest behavior. It was considered "a particularly sensitive yardstick for the depth of Machiavellian intelligence a species can display." Field study of chacma baboons, for example, found several types of tactical deception that used devices such as screaming as if being attacked and exaggerated staring as if seeing a predator. These deceptive behaviors distracted others from food or diverted them from attacks.

Though the initially obvious cases of tactical deception involved agonistic and competitive behavior, the MIH is also concerned with cognition that underlies coordination and cooperation. A recent example (Hopper et al. 2018) is a study of baboon decisions about group movements that was described in the previous chapter. Investigation of the cognitive basis for coordination led to the conclusion that "democratic" collective action could be based on relatively simple behavioral rules (Strandburg-Peshkin et al. 2015). In this case, close examination of the phenomenon suggested a simpler cognitive foundation than others had envisioned.

On the other hand, the capacity for more complicated forms of cooperation seems to have been demonstrated by experiments with Guinea baboons. Pairs of the baboons were tested on side-by-side computers that yielded food rewards under varying conditions. Confronted with a partner who failed to cooperate to obtain a reward for both participants, the excluded individual tried to manipulate the other or went looking for another partner.

13.2.2 The Social Brain Hypothesis

The Social Brain Hypothesis (SBH) argues that the need to live in large social groups selected for increased brain size and, by extension, the cognitive capacities needed to ensure that these groups remain functional and cohesive (Dunbar and Shultz 2007; Shultz and Dunbar 2010). The SBH posits that primates solved the ecological problem of predation risk through the evolution of group-living, and then solved the problem of competition among individuals in social groups by evolving large brains and complex cognitive capacities. Evidence of the hypothesis is not necessarily tied directly to brains. Instead, the objective is to establish the existence of cognitive capacities that only a large brain can support (e.g., understanding of third-party relations). This is one example of extensive overlap in the topics of concern for the SBH and the MIH. In fact, the two hypotheses have been equated (Dunbar 1993, 2003). The difference is that the SBH emphasizes the relationship between social behavior and a more detailed view of the physical brain.

Broadly speaking, the thesis is that the cognitive demands of social relationships within a large group select for a larger brain. More specifically, selection is for the executive functions centered in the neocortex. The relationship between neocortex volume and group size is particularly strong in primates. However, this is just a first approximation. It represents a deeper relationship with behavioral indices of social complexity such as coalition formation, tactical deception, and social play (Dunbar and Shultz 2007).

The group-size proxy can be used for inferences about early hominins. Aiello and Dunbar (1993, 2003) used established scaling relationships to calculate neocortex volume from the cranial capacity of fossil skulls. The group sizes derived from the neocortical estimates were “bracketed” by observed group sizes of extant chimpanzees and humans, which means roughly 10–200 individuals. This is virtually the same range of variation as among the troops of COKY baboons and bands of hamadryas baboons.

Baboons have smaller brains than chimpanzees or early hominins, but they have larger brains than most other monkeys. They have used these brains to survive in the same range of habitats as those occupied by early hominins and not matched by chimpanzees. The apparent similarity in group sizes suggests that baboons encountered social challenges similar to those of early hominins while they engaged in that expansion and perhaps solved the problems in similar ways.

13.2.3 The Embodied Social Brain

Barrett et al. (2021) have advocated an alternative interpretation of the social brain concept that is less concerned with the size of the brain and more focused on the question of whether regions of the primate brain were specialized for sensing and responding to particular kinds of bodily social stimuli—facial expression, eyes gaze, head and body orientation, and biological motion. This view of the social brain, introduced by researchers such as Lesley Brothers and David Perrett in the years around 1980, aimed to establish what particular circuits of the primate brain were doing, and whether these were dedicated to a specific category of objects—other animate beings—as distinct from the broader category of physical objects.

Barrett et al. (2021) gave three interrelated reasons for the revival of this approach:

1. *Group size and brain structures:* Recent comparative work has questioned the link between group size and neocortex size and has demonstrated the importance of non-cortical areas, particularly the cerebellum, in primate brain evolution.
2. *Brain–body relationship:* Recent theory holds that brains evolved first and foremost to control bodies. From this it is inferred that cognition is better conceived of as a set of processes that mediate the adaptive control of bodies in dynamic, unpredictable environments. This contrasts with the traditional "disembodied" view of cognition as a purely brain-based process involving mental representations of the outside world.
3. *Neural reuse:* This concept suggests that much local neural structure is evolutionarily (and developmentally) conserved, but combined and recombined in different ways to perform diverse functions.

Rather than looking for human-like cognitive representations in the neocortex of primates, ESB advocates a research program that would attempt to understand how both human and nonhuman cognition emerge from the reuse of systems that have evolved for embodied sensory-motor control.

Here again, baboons provided the illustrative example though this one is hypothetical. At the beginning of the day some baboons are on the sleeping cliffs grooming, others are already foraging, and a few are beginning the daily journey. A baboon must make decisions concerning hand and foot placement as she descends from the cliff. There are also decisions about which other baboons she can safely approach along the route. On the ground, there are decisions about where to forage and this means monitoring location and activities of nearby baboons. While foraging, the baboon must decide where to move as others approach or move further away. Simultaneously, she is coordinating her hand movements as she picks and processes food items. Like every other baboon, the exemplar is usually in action and responding in real time to a flow of social and environmental stimuli. Options like these are strongly influenced by biomechanical constraints and environmental factors. Therefore, they cannot be considered clean-cut abstractions that exist in an independent mental realm, as is supposedly implied by the SBH.

Embodied decisions respond to constant change in available actions and relevant variables (e.g., success probability, action cost). The baboon (or early hominin) continuously acquires sensory information about relevant affordances as part of ongoing activity, with no temporal distinction between choice and implementation. Such decisions do not require a central executive of any kind. They depend on which of the reciprocally connected sensorimotor networks are the first to "commit" to a given action strongly enough to pull in the rest. With regard to brain evolution, the implication is that more attention should be paid to parietal regions associated with the size and structure of social groups as well as demands of the foraging environment and the degree of terrestriality (Barrett et al. 2021). Neurological research on primates supports the view that various brain structures are involved in social behavior (Platt et al. 2016).

13.2.4 Proximate Factors in Brain Size

The theories cited above all assume that brain size (whether in whole or in part) evolved by natural section. Some baboon evidence suggests the involvement of proximal factors as well as direct selection. A study of captive olive baboons in groups ranging in size from 2 to 63 found that average brain volume was proportional to group size (Meguerditchian et al. 2021). Variation in the size of the enclosures had no such effect, removing one important confounding effect. Increased brain size was largely a function of white matter (although gray matter showed some effect). White matter plays an important role in connecting parts of the brain that are basic to social cognition. The researchers inferred that the connection between group size and brain size supports the evolutionary hypothesis of the social brain. They also noted that the context of their experiment requires explanation in terms of plasticity.

The implication for early hominins is that natural selection might have had a dual effect, favoring intrinsic brain size and also the capacity to increase brain size in response to group size. Consideration of the alternative (or complementary) baboon models (Chap. 7) suggests the following possibilities: (1) troop size might have increased with expansion into more open country in relation to predator pressure and/or other factors (such as the beginnings of cooperative hunting); (2) total community size might have increased with the development of increasingly complex multilevel societies; or (3) both.

13.2.5 Cultural Intelligence

Proponents of the Cultural Intelligence Hypothesis argued that there are two major problems with the Social Brain Hypothesis (van Shaik et al. 2012). The first problem attributed to the SBH is that it cannot account for grade shifts, where species or other taxa have significantly different brain sizes than predicted by social organization. For example, relatively small-brained spotted hyenas display cognitive abilities and social organization similar to that of baboons. Second, the SBH cannot account for the fact that species with high socio-cognitive abilities also excel in general cognition. For birds and mammals, van Shaik et al. (2012) proposed to integrate the social brain hypothesis into a broader framework that they called cultural intelligence. This hypothesis stresses the high costs of brain tissue, general behavioral flexibility, and the role of social learning in acquiring cognitive skills.

The phrase "cultural intelligence" implies a level of social learning beyond that of baboons and early hominins, probably at the level of *Homo erectus*. However, the behavioral flexibility and learning capabilities of baboons suggest that early hominins provided a fertile field for the evolution/development of cultural intelligence. Baboons display high levels of behavioral flexibility and learning capability, even when compared to closely related species such as rhesus macaques.

Anikayev et al. (2022) tested adult male hamadryas baboons and rhesus macaques for learning ability and exploratory behavior. One task required an individual with freedom of choice to learn that food was always in one of two consistently placed containers. The exploration experiment presented the subject with the novel stimulus of a multicolored plastic cube. The baboons learned the location of the food significantly more quickly than did the macaques. They exceeded the macaques in exploration of the novel object in terms of duration of contact and the diversity of investigative and manipulative behaviors.

These results agreed with a series of prior experiments that culminated with Anikayev et al. (2021). In that paper they explicitly compared the baboons to early hominins. They concluded that ecology was the main drive of cognitive adaptation in open country because of needs such as memory for the location of resources (see Chap. 12 here). However, they also acknowledged the significance of social complexity and accepted the proposition that ecology and social organization interacted with each other.

13.3 Cognition in Social Interactions

Students of the evolution of primate and hominin social cognition have examined a variety of specific behavioral patterns. They do not necessarily place them exclusively in any of the general theories described in the preceding section.

13.3.1 Tactical Deception

Tactical deception occurs when an individual is able to use an "honest" act from its normal repertoire in a different context to mislead familiar individuals. Most primate groups are so intimate that any deception is likely to be subtle and infrequent.

Whiten and Byrne (1988) gathered accounts of deceptive behavior in various primates and classified them in terms of the function they perform. For each class, they sketched the features of another individual's state of mind that an individual acting with deceptive intent must be able to represent, thus acting as a "natural psychologist." In an 18-month field study of chacma baboons, the authors and P. Henzi observed eight instances of apparent tactical deception, which they classified into four types.

Type 1. A juvenile screams, falsely representing an attack, which results in the diversion of others; this makes available to the juvenile the USOs that the others have been digging up.

Type 2. A juvenile engages in exaggerated "looking," usually indicative of a predator or another baboon troop, with the result that an adult male is distracted from an attack.

Type 3. An adult female uses unneeded aid solicitation gestures to manipulate an adult male. In one instance the male was distracted from attacking the female. In another, the male left a food patch that he had appropriated from the female.

Type 4. A single instance in a transitional situation where male A had become dominant with respect to access to females, but male B continued to lead the troop. Male B led others, including A, away from a food patch and then circled around to occupy the patch by himself.

Hiding is another form of deceptive behavior. Whiten and Byrne (1988) cited the description by H. Kummer of an adult female hamadryas who gradually shifted her seated position over a distance of 2 m until she was hidden from the leader male by a large rock. There, she groomed a subadult male—behavior that the leader would not tolerate. Whiten and Byrne (1988) regarded such behavior as "sufficiently fine tuned" to require crediting the agent with mental representation of the target's attentional state.

Although baboon deceptive behavior played an important role in the development of social cognition studies, it now seems that they are matched by other monkeys and over-matched by great apes. Regarding this particular topic, baboon analogy demonstrates the lowest common denominator that might have existed in the earliest hominins living in troops (this assumes that the last common ancestor did not have the full range of cognitive capabilities found in extant chimpanzees).

13.3.2 Cooperation

Humans are "strategic cooperators" in the sense that they make decisions on the basis of costs and benefits in order to maintain high levels of cooperation. This capability may have played a key role in human evolution (Formaux et al. 2023). Wild baboons seem to cooperate in some ways, as when males respond as a group to predators or occasionally engage in simultaneous hunts. However, such behaviors can also be explained as independent but parallel responses of individuals. Guinea baboons seem to display the capability for more complex forms of cooperation, at least in experiments.

Formaux et al. (2023) tested Guinea baboons for their cognitive ability to engage in cooperative behavior under seminatural conditions. The subjects were a small troop with freedom to move around an enclosure. They were presented with a test apparatus that they could use voluntarily to gain small food rewards. Two adjacent computer screens allowed participants to obtain rewards for themselves and partners. Each individual could make choices based on the behavior of partners.

During experiment 1, eight individuals reached predefined criteria of at least 80% prosocial choice in one block of 50 trials when a partner was present. They displayed flexibility when the contingencies of the task were reversed. Unchanged response to the reversal during a ghost control phase confirmed that the presence of a partner was essential to their behavior. In the second experiment, the reward structure was changed so that an individual could no longer receive a direct reward. In this circumstance, individuals made the prosocial choice if the partner had previously made a prosocial choice.

During the first, less demanding experiment, the baboons only used partner choice: changing partners more frequently when the partner did not make the prosocial choice. In the more demanding second experiment, prosocial baboons developed two more strategies when paired with a previously non-prosocial partner: They more frequently chose the selfish stimulus, and they were more likely to not respond at all, interrupting the trial and leading to a partner change. In brief, they used direct reciprocity and partner choice to develop and maintain high levels of cooperation.

The researchers inferred that their subjects had the cognitive capacities to adjust their level of cooperation strategically, using a combination of partner choice and partner control strategies. They concluded that such capacities were probably present in our ancestors and would have provided the foundations for the evolution of typically human forms of cooperation (Formaux et al. 2023).

13.3.3 Pointing

A pointing gesture creates a referential triangle that incorporates a distant object into the relationship between the signaler and the gesture's recipient. Pointing, long assumed to be specific to the human species, emerges spontaneously in captive chimpanzees and can be learned by monkeys. Meunier et al. (2013) tested olive baboons for understanding and use of learned pointing behavior. Specifically, they asked whether the behavior was conditioned and dependent on reinforcement or whether the baboons understood it as a mechanism for manipulating the attention of a partner.

Nine subjects had been trained with operant conditioning to exhibit pointing. The experiment tested their ability to communicate intentionally about the location of an unreachable food reward in three different contexts, varying with regard to a human partner's attentional state. In each context, the experimenters quantified the frequency of communication signals, including gestures and gaze alternations between the distal food and the human partner. They found that the baboons were able to modulate their manual and visual communicative signals as a function of the experimenter's attentional state. They concluded that baboons can intentionally produce pointing gestures and understand that a human recipient must be looking at the pointing gesture for them to perform their attention-directing actions. Even at a rudimentary level, such capability would have enhanced early hominin cooperative behavior in important areas such as predator defense and hunting.

13.3.4 Social Facilitation

Social facilitation, which occurs in a wide variety of animal species, is a phenomenon in which one or more individuals manifest certain behaviors in the presence of conspecifics regardless of relevance to any other circumstances. Huguet et al. (2014) tested baboons for the cognitive basis of such social facilitation. The subjects freely engaged in computer-based conflict response tasks that required cognitive control for successful performance. The results indicated that the social presence not only enhanced dominant responses, but also depleted resources for cognitive control. As a result, the baboons experienced greater cognitive conflicts, were less able to inhibit an older learned action in favor of a new one, and were also less able to take advantage of previous experience.

According to the researchers, these findings explain why inappropriate behaviors are not easily suppressed by primates when acting in social contexts. If these "inappropriate" behaviors are maladaptive, natural selection may favor greater cognitive control to overcome the facilitated responses. The researchers hypothesized that such a demand for greater cognitive control in social groups might have been a factor in the evolution of human intelligence (Huguet et al. 2014). A speculation: an evolved tendency to resist group influences on behavior might be one factor in cognitive dissonance in extant humans.

13.4 Self in Society

Baboon analogies suggest how early hominin individuals might have perceived themselves in relation to other individuals in society, both conceptually and emotionally. These analogies are reinforced by comparison with contemporary humans.

13.4.1 Possession and Ownership

Nancekivell et al. (2019) theorized that human understanding of ownership depends on a naïve concept of ownership that emerges early in development. They drew on research from multiple disciplines to suggest that the phenomenon emerges in childhood, develops across the lifespan, and may be universal despite variation across cultures and history. These researchers alluded to an experiment in which hamadryas baboons seemed to respect the rights of a possessor even if lower ranking than a potential poacher.

Sigg and Falett (1985) investigated the usefulness of concepts of possession and property in analyzing the relationship between hamadryas baboons and objects. Their subjects were placed in five experimental situations involving possession of fruits or a food container. Results with both desirable objects indicated that dominant males were controlled by an "inhibition" against taking food away from lower-ranking companions. Also, given the choice, males preferred neutral food cans over cans previously used by the partner. The significance of possession in these experiments was highlighted by the results of a different test, when food pieces were thrown between two partners. In these tests, the dominant never allowed the subordinate to take a piece.

Nancekivell et al. (2019) expressed reservations about the significance of this case and others: "… further work is needed to test whether any of these examples reflect possession of a naïve theory of ownership and to test alternative accounts. For example, many of these findings could be explained by animals showing respect for temporary physical possession of objects, and cost–benefit analyses of whether attempts to take others' possessions are likely to be worthwhile."

Advancing knowledge of baboons suggests another qualification, based on additional results reported by Sigg and Falett (1985). The inhibition they described appeared only in male–male dyads. In male–female and female–female dyads, the extent of "respect" was contingent on rank difference and the type of food. This can be compared to the "respect" that wild male hamadryas baboons display toward one another regarding their respective female associates (Chap. 8). Recognition of possession may be an adaptation to the hamadryas system of one-male units that are nested within larger social groupings, and may be an analogy for social evolution in hominins (Evans et al. 2022). The study by Sigg and Falett hints at the possibility that respect for possession of objects might have been generalized from respect for possession of females, at least in males. Recognition of possession among females could have a completely different origin and set of cognitive correlates.

If the hamadryas analogy is correct, it suggests that the concept of ownership (or right of possession) evolved in male early hominins to minimize conflicts over females. However, we now know that Guinea baboons live in a similar multilevel system based on unimale groups in which males are tolerant of one another and females choose their male associates (Chaps. 7 and 8). Early hominins in such a system would not have had the same pressure to evolve a system of possession rights with regard to females and would have taken a different (not yet explicated) path to concepts of possession and ownership.

13.4.2 Personality

Personalities, variable cognitive/behavioral tendencies across individuals, have been demonstrated in a wide range of primates and other animals. Baboons are no exception. The significance of personality in baboons suggests that this was a factor in the social behavior of early hominins. In the previous chapter, it was suggested that behaviors such as innovation and exploration might have been affected by variable tendencies toward leadership and/or readiness to learn from others.

A chacma baboon project was devoted to personality. In a 7-year study of 45 females, Seyfarth et al. (2012) identified "three relatively stable personality dimensions, each characterized by a distinct suite of behaviors." These were labeled Nice, Aloof, and Loner. Nice females were friendly to all other females, often grunted to subordinates, and had strong social bonds and stable preferences for top partners. Aloof females were more aggressive and grunted mainly to superiors. Loner females were often alone and relatively unfriendly. The baboons seemed to have some recognition of these variations. They approached Nice females at high rates and approached the others at much lower rates. The different personality types varied somewhat in their responses to social challenges: male immigration and the danger of infanticide; and the death of a close relative.

A different project explored the following hypotheses with negative results: (1) that human observers become a "neutral" stimulus and (2) that this habituation process is "equal" across group members (Allan et al. 2020). Based on flight initiation distance, the baboons viewed the observers as a high-ranking social threat rather than a neutral stimulus. Habituation was not equal across group members. There were repeated individual differences that were more important than contextual factors (such as habitat) in determining the distance at which baboons reacted to the observers by visually orienting and/or moving away. A strong correlation between visual and displacement tolerance indicated that this was a personality trait.

Bracken et al. (2022) used high resolution GPS data to investigate personality and plasticity in the movement of chacma baboons across natural and urban environments in a South African city. With regard to personality, the baboons displayed individual differences in movement metrics. Individuals that traveled straighter paths on average, traveled even straighter paths in urban space. Those that increased their step length and decreased their residency times the most in urban space were high-ranking individuals.

A study of olive baboons explored individual differences in coping style and stress reactivity. As in many other primatological studies, these researchers used a "personality-like framework" derived from the human personality literature (Pritchard and Palombit 2022). Coping style and stress reactivity were quantified using observer ratings in individually targeted field experiments. Three personality trait factors emerged: Neuroticism, Assertiveness, and Friendliness. Personality trait differences showed little association with coping style, but Neuroticism was predicted by stress reactivity.

Taken together, the baboon personality research suggests that any of the larger early hominin groups contained a variety of personalities with differing responses to social situations. Interactions of these individuals may have affected the adaptive behavior of all concerned. The extent to which these personalities are heritable is not clear. In one study of baboons, close female kin did not have personalities that were more alike than those of nonrelatives (Platt et al. 2016).

13.4.3 Emotions

The research on personality in baboons seems to imply that emotions are important in shaping social behavior, for example, friendliness, aggressiveness, anxiety, and fear. Delgado et al. (2023) noted that studies showed stress-relieving affiliative behaviors among wild female baboons are linked to decreased cortisol responses and relatively long life. They took this to be an evolutionary perspective on how human individuals form and maintain strong social networks, which has become a significant public health priority. Delgado and colleagues reviewed psychological and neural mechanisms that enable people to connect with each other to alleviate the consequences of stress and isolation. Central to this process is the experience of rewards derived from positive social interactions, which encourage the sharing of perspectives and affective states.

One of the neurological mechanisms underlying emotion in humans is hemispheric specialization. This is manifested in asymmetries of facial expressions that mainly indicate right hemisphere dominance. Wallez and Vauclair (2011) extended this research to olive baboons with recordings of two affiliative behaviors (lipsmack and copulation call) and two agonistic ones (screeching and eyebrow raising). This study provided evidence for right hemisphere specialization in the production of some baboon vocal and facial expressions of emotion. There was no indication that dominance status or sex had any influence on the results. The researchers considered the results as indicative of "neurophysiological and neuroanatomical homologies between baboons and humans in the cortical control of emotional vocal and facial expressions." Of course, analogy is the alternative possibility.

13.5 Social Information

Social information includes information about others and information from others. The topic of grunts (Chap. 10) was one of many topics that led to some discussion of social information. This section provides further comparison of social information in baboons and humans, with implications for early hominins.

13.5.1 Social Comparison

Comparison of self to others is an important characteristic of human social life and may have been a component of social organization in early hominins. Dumas et al. (2017) used a computerized task presented in a social context to explore the psychological mechanisms of social comparison in humans and baboons. They found that the effects of social comparison on a subject's performance were guided both by similarity (same versus different sex) and by task complexity. Comparing oneself with a better-off other (upward comparison) increased performance when the other was similar rather than dissimilar, and a reverse effect was obtained when the self was better (downward comparison). Furthermore, when the other was similar, upward comparison led to a better performance than downward comparison. The beneficial effect of upward comparison on baboons' performance was only observed during the simple task. Humans and baboons responded in comparable ways, depending on whether the other in the experiment was similar or dissimilar to the subject and whether the other was better or worse off. The researchers inferred that humans and baboons shared cognitive mechanisms for social comparison.

13.5.2 Information About Others

Chacma baboons display sophisticated knowledge about relationships in their troops (Cheney and Seyfarth 2007). Various studies show that they behave in accord with relationships in the social hierarchy; track the consortship status of mating pairs; and respond to conflicts by selectively aiding unrelated individuals who have been grooming partners (summarized by Fischer et al. 2019). Playback experiments with wild chacma troops have demonstrated how such social traits influence the attention structure of individuals. They respond strongly to vocalizations of apparent intruders represented by the playbacks. In relation to other troop members, they respond strongly to rank reversal consortship break-ups that are simulated by playbacks.

Guinea baboons differ, apparently on the basis of greater gregariousness and spatial tolerance with little or no concern for dominance. They show more interest in the vocalizations of other group members than those of outsiders, treating them as sources of information about current associations. Researchers inferred from such variations that the "value" of types of social information may differ from one species to another (Faraut and Fischer 2019; Fischer et al. 2019). Thus, any choice of analogies for hominin relationships must follow from the choice of the likely social structure. These results have potential implications for the evolution of social cognition in hominins, since hominins probably lived in troops and in multilevel societies at various stages.

13.5.3 Information from Others

Informativeness—defined as reduction of uncertainty—is central to human communication (Reboul et al. 2022). It allows the rapid dissemination of novel information among individuals (Carter et al. 2016). Reboul et al. (2022) investigated the sensitivity of baboons to informativeness in a series of experiments. On a computer screen, they manipulated the informativity of a cue relative to a response display. The baboons were allowed to anticipate answers or wait varying amounts of time for a revealed answer. Anticipations increased with informativity, while response times to revealed trials decreased. Further experiments reduced rewards for anticipation responses (to 70%) with the result that the link between anticipations and informativeness disappeared. However, the link between informativeness and decreased response times for revealed trials persisted. Additionally, in all experiments, the number of correct answers in revealed trials with fast reaction times increased with informativeness. The researchers concluded that baboons are sensitive to informativeness as an ecologically sound means to tracking reward.

Carter et al. (2016) considered the limitations on informativeness in baboons in a social setting. An individual's ability to use information is likely to be dependent on phenotypic constraints operating at three successive steps: acquisition, application, and exploitation. They identified phenotypic constraints at each step: peripheral individuals in the proximity network were less likely to acquire and apply social information, while subordinate females were less likely to exploit it successfully. Social bonds and personality also played a limiting role along the sequence. As a result of these constraints, the average individual acquired social information on less than 25% of occasions and exploited it on less than 5 percent of occasions. This study highlighted the sequential nature of information use and the fundamental importance of phenotypic constraints on this sequence. Early hominins may have gained some benefit from sensitivity to informativeness, but were probably subject to limitations like those of baboons.

13.5.4 Culture?

One of the most important aspects of information transfer in humans is cultural traditions, transmission of behavior patterns from one generation to the next. The manufacture of stone tools has often been taken as evidence of culture in early hominins. However, there is now some doubt that the earliest efforts represent culture. Snyder et al. (2022) performed an experiment with 25 humans who were naïve with regard to stone knapping techniques. All of them learned the techniques individually, producing and using core and flake tools. If the earliest stone tools do not represent culture in hominins, this leaves an open question as to what the earliest forms of culture might have been. Beyond material culture, there is the question of what social patterns were likely to become cultural in early hominins. Chimpanzees provide an abundance of evidence, but baboons display at least one instance that differs from those of the apes.

Perhaps the best documented case of baboon culture is that of the peaceful chacmas, because the evidence for transmission is clear. Sapolsky and Share (2004) reported a case in which half of the males in a troop succumbed to tuberculosis under circumstances which dictated that the more aggressive males died and atypically unaggressive individuals survived. A decade later, males in that troop were still unaggressive. Due to dispersal, none of the males who survived the epidemic remained in the troop; therefore, new males joining the troop must have adopted the unique social pattern. Features of this male culture included high rates of grooming and affiliation with females, a relaxed dominance hierarchy, and physiological measures suggesting less stress among low-ranking males. All of this occurred among members of the species reputed to be the most aggressive baboons. Models that explained transmission of this cultural pattern centered on the treatment of incoming males by resident females.

Olive baboons at Kekopey in Kenya, over the course of two studies, displayed the development of hunting traditions (Strum 1975). Hunting males spent more time away from the troop, traveled farther (up to 3.2 km from the troop periphery), and spent up to 2 h hunting whether successful or not. Relay chases by the hunters began as accidents but were quickly adopted as strategy, resulting in greater success.

Other cases are only candidates for culture because they are unusual patterns shared within a group or population and absent from the rest of the species. Two of these have been described earlier in different contexts (Chaps. 4 and 5). The most distinctive is the fishing behavior of chacma baboons in a desert canyon (Hamilton and Tilson 1985). They obtained fish from drying pools by various means that included wading into the water to grope for live fish under boulders, and slapping the water at the edges of pools to stun nearby fish. Consumption of particular plant foods, including certain toxic plants, might be local cultural traditions; however, intergenerational transmission has not been verified and availability has not been eliminated as the determining factor.

13.6 Summary and Discussion

In a broad sense, social cognition encompasses all mental processes involved in an individual's reaction to other members of its social group and interaction with them. Cognitive processes may simply be inferred from behavior, but many attempts have been made to relate these processes to the structure and function of the brain. Social cognition in humans and primates has been the subject of several theories with many overlaps and a few crucial differences.

The Machiavellian Intelligence Hypothesis (MIH) and the Social Brain Hypothesis (SIH) have a great deal in common and are sometimes equated with one another. Both postulate that primate cognitive evolution has been driven mostly or entirely by the requirements of living in complex societies, rather than ecological pressures. Both connect primate cognitive evolution with relatively large brains and especially with the size of the neocortex. The Embodied Social Brain Hypothesis (ESBH) criticizes the MIH and SIH for separating mental processes from the actions of the body: mental processes are constantly adjusting to movement of the body in relation to varied substrates and to changes in the immediate physical and social environments. The ESBH is more open to ecological effects on cognition and argues that brain structures other than the neocortex, for example, the cerebellum, should receive more attention. All three of these hypotheses have used baboon examples to illustrate key points, which suggests that the roots of much human social cognition go back to the evolution of early hominins.

The Cultural Intelligence Hypothesis argues that the other theories of cognitive evolution fall short in failing to account for two facts. First, species with very different brain sizes can have very similar social organization (e.g., spotted hyenas and baboons). Second, species with high levels of social cognition also have high levels of general cognition. The CIH proposes a broader perspective on cognitive evolution that emphasizes the costs of brain tissue, behavioral flexibility, and the role of learning in the acquisition of cognitive skills. The degree of behavioral flexibility and social learning in baboons suggests that this view of cognitive evolution can also be rooted in early hominins.

There has been no attempt here to resolve differences among these hypotheses. In accord with the theme of this book, the point was to demonstrate the significance of baboons in the development of the theories. This, of course, suggests that the theories apply to early hominins as well as to extant humans.

This view is supported by a variety of specific hominin–baboon analogies. Some have been presented in the preceding chapters because the level of communication in baboon societies entails social cognition. Some were noted as examples of the precepts of the social cognition theories. Some were treated in more detail in the latter parts of this chapter: tactical deception, pointing, cooperation, social facilitation, social comparison, possession and ownership, personality, and emotions.

Social information is important to baboons, as it is to humans. Examples vary somewhat with species. Chacmas show that they are aware of the dominance hierarchy, mating pairs, and conflicts. They respond strongly to intruders simulated by vocal playbacks. Guinea baboons have little or no concern for signs of dominance relationships. They are more interested in vocalizations from within their own group rather than from outsiders, treating the former as knowledge about affiliations. Whether the emphasis is on dominance or affiliation, all baboons attend to information about their own position in the group. In experiments, baboons react much like humans to comparisons with others who are similar or dissimilar and better-off or worse-off. Researchers inferred similar cognitive mechanisms for social comparison.

Informativeness, defined as reduction of uncertainty in communication, allows rapid dissemination of novel information. This is a key factor in social and behavioral flexibility. In experiments, baboons displayed sensitivity to informativeness, but within social limits. Sensitivity to informativeness would have facilitated hominin adaptation to changing environmental and social conditions. Baboon studies also suggest the limits on such sensitivity in early hominins, perhaps prior to the major behavioral changes after 2 mya.

Culture entails the acceptance of novel information and its transmission from one generation to the next. The evidence for culture in baboons is small compared to what has been reported for some other monkeys and for apes. Nevertheless, there is enough to show that culture is compatible with the baboon way of life and that culture could have arisen among early hominins with many similarities to baboons. Outstanding examples are the unique peace culture in a troop of chacma baboons and the fluctuating predatory patterns of a troop of olive baboons. Consumption of unusual plant products by certain troops or populations might also be examples.

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