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Third-Party Interactions

Jorg J. M. Massen[1,2] and Alexander Mielke[3]
[1]Animal Behaviour and Cognition, Utrecht University, Utrecht, The Netherlands
[2]Austrian Research Center for Primatology, Landskron, Austria
[3]Primate Models for Behavioural Evolution Lab, Institute for Cognitive and Evolutionary Anthropology, Oxford, UK

Introduction

The evolution of intelligence in our own and other species remains a hotly debated topic. The social brain hypothesis, prominent in this debate, argues that one of the reasons animals have acquired increasingly complex cognition (i.e., intelligence) is to deal with increasingly complex social life (Dunbar 1992; Humphrey 1976). Studies have found a relationship between interspecific variation in primate neocortex size and group size (Dunbar 1992) and more generally in mammalian brain size and respective group sizes (Shultz and Dunbar 2010a). Moreover, studies show that gray matter density in particularly "social" parts of the brain correlates significantly with social network size in humans (reviewed in Adolphs 2009) and rhesus macaques (Noonan et al. 2014). Importantly, intraspecific variation in group size also predicts cognitive performance in several different taxa (Ashton et al. 2018).

However, the question remains: which challenges in social life necessitate increased cognitive capacity? Notably, the interspecific correlation between brain size and group size does not hold for all mammal species, nor does it hold for avian species (Shultz and Dunbar 2007, 2010b); thus, group size per se might be too simplistic to explain species differences. Consequently, many scholars have focused their attention on species' "social complexity," yet the term has remained relatively vague and it is currently undecided what actually constitutes social complexity (cf. Boucherie et al. 2019). In his seminal paper on social relationships, Robert Hinde (1976) identified three levels of increasing complexity in the social life of an individual, i.e., (1) interactions, (2) relationships (described by the content, quality, and patterning of interactions), and (3) the structure of a group, based on the patterning of relationships. More recently, this framework has been expanded by the spatiotemporal dynamics of a species, i.e., the degree to which the social environment of an individual varies across time and contexts (cf. fission-fusion dynamics, Aureli et al. 2008), lifetime changes to the social environment (Boucherie et al. 2019), and the role of interactions with conspecific outsiders (Ashton et al. 2020).

Social complexity, in all these conceptions, assumes that individuals have repeated interactions with group members as agents with their own interests, history, and relationships; and individuals have to compromise between competition

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for resources and the need to cooperate to survive. Accurately predicting conspecific behavior – by keeping track of others' social interactions and relationships – could give individuals an advantage but would dramatically increase individuals' information processing needs when navigating the social landscape (Dunbar 1992). Thus, one central aspect to the study of comparative social complexity has been a focus on third-party interactions. Third-party interactions are any situation where two group members interact, and a third individual influences the course, outcome, or aftermath of the interaction. These situations remind us that individuals in social groups are engaged actors that influence the lives of others. In terms of complexity, the possibility that other group members can get involved dramatically increases the number of social situations that can occur in a group; it forces animals to be vigilant about their surroundings, and it might allow them to strategically manipulate the interactions and relationships of others in a process of social niche construction (Flack et al. 2006). For researchers, third-party interactions open up a window into the mind of our study species: we can test what they know about the power relations and bonds between those in their group and which interactions they perceive as relevant (Bergman et al. 2003). Here, we will summarize evidence that many social animals are indeed able to classify the relationships between others in their group along multiple dimensions and will proceed to describe how they use this knowledge to intervene into aggressive and affiliative interactions. We provide seminal and clear examples but want to emphasize that the list of studies we refer to is far from exhaustive.

Understanding Third-Party Relationships

On their own, interactions between conspecifics do not need to involve complex cognition. An evaluation of the motivation, strength, sex, and age of your interaction partner may do the trick. Whenever these interactions occur more often with certain individuals, however, it may pay off to individually recognize and differentiate between individuals, leading to variation in relationship quality. This becomes particularly important when individuals repeatedly cooperate with group members in reciprocal exchanges. Various social species entertain such differentiated social relationships; recognize others as kin, friend, and/or dominant; and remember such relationships over time (Massen et al. 2010). However, do animals also recognize the patterning of social relationships among their conspecifics, i.e., do they also know who is related to whom and who outranks whom? This could allow them to predict behavior more accurately.

In a seminal study, Dorothy Cheney and colleagues (1995) investigated whether yellow baboons understand power relationships of others. In a cleverly designed experiment, they made use of the vocal cues accompanying dominance interactions among the baboons; that is, dominant individuals tend to grunt to subordinate individuals, who occasionally respond with fear barks. Importantly, this never happens in the other direction. Cheney and colleagues made recordings of grunts and barks and then edited them to create *expected* sequences of a dominant individual grunting and a subordinate individual fear barking, thus according to the dominance hierarchy. However, they also created *unexpected* sequences of a subordinate grunt followed by a fear bark from a dominant individual, thus inconsistent with the current dominance hierarchy. As such, this sequence could mimic a turnover in the group's dominance hierarchy. They then played back these sequences and monitored the reactions of third parties, i.e., individuals that were not part of the simulated interaction. The baboons reacted much stronger to unexpected sequences, suggesting that the baboons have certain expectations about third-party dominance interactions between group members (Cheney et al. 1995) and thus seem to have some sort of mental representation of these dominance relationships.

However, in principle, the baboons could also deduce the relationship between others by comparing their own relationship with each of them separately. For example, if individual A is dominant over our subject and individual B is subordinate to the subject, the subject can deduce that A is dominant over B. Such transitive inference in itself is already an interesting cognitive feature. It becomes more complicated if both are dominant over, or subordinate to, the subject, but then still the subject could deduce the relationship between A and B by comparing the rank distance or degree of dominance/subordinance with each of them and thus without requiring a mental representation of the relationship between those others. Nonetheless, since then, experiments using similar play-back setups have shown that chacma baboons differentiate third-party rank relationships within and between family groups and thus seem to classify their conspecifics simultaneously based on their individual rank and their kin relations (Bergman et al. 2003), which do not need to overlap with the subjects' kin relationships. Moreover, captive ravens showed that they not only have expectations about the rank relationships in their own group but that they also seem to understand the rank relations of a neighboring group (Massen et al. 2014a). They could observe that group but did not have any direct relationship with them, suggesting that these ravens do have some sort of mental representation of rank relations.

Third-Party Interactions

Having third-party knowledge becomes particularly adaptive if used strategically to outcompete your conspecifics. Specifically, animals may interfere in ongoing interactions between other individuals. These interactions allow individuals to affect the outcome of social interactions to their own benefit: presumably, the potential outcome could have negative consequences for a bystander (e.g., their offspring is injured; a competitor creates a new alliance), and they have the power to influence the outcome to their own benefit. Broadly, third-party interactions allow group members to maintain the status quo (by stabilizing group dynamics, enforcing existing alliances, and preventing new alliance formation) but can also be used to challenge existing power structures (by, for example, combining forces against higher-ranking competitors and gaining access to new cooperation partners).

The third party can interfere in aggressive conflict or in affiliative/cooperative interactions. Different terms have been used to describe third-party interactions, dividing them by the nature and direction of the third party's involvement. During aggressive interactions, individuals can provide *coalitionary support* (third-party aggression toward one of the opponents) or engage in *policing* (impartial third-party action to stop conflict). After conflict, they can provide *third-party post-conflict affiliation* ("third-party reconciliation" if they perform reconciliation for a friend or kin; "consolation" or "triadic post-conflict affiliation" if they direct affiliation toward the loser of the conflict). Also, *third-party interventions in affiliative interactions* (attempting to disrupt or participate in affiliative interactions) have been described in an increasing number of species. We will describe each of these categories in the remainder of this chapter.

Support in a Conflict

Possibly the best-described form of third-party interaction is support in a conflict (de Waal and Harcourt 1992). Coalitionary support has been described in a range of animal species (Bissonnette et al. 2015) and has been cited as one of the prime examples of nonhuman animal cooperation if individuals risk injury by interfering (van Schaik et al. 2004). However, whether this is a truly cooperative endeavor depends on the context and the opponents involved. Possibly the most common form of coalitionary support, for example, involves the opportunistic support of a high-ranking individual that is attacking an individual that is lower ranking than both the coalition partners ("all-down" coalitionary support), thereby enforcing the status quo. Consequently, the chances of losing the fight and/or the risk of injury are low (van Schaik et al. 2004). As the support of high-ranking group members is a strong factor in winning conflicts, most species who show coalitionary support also show targeted recruitment behavior (e.g., Range and Noë 2005).

Nevertheless, coalitionary support may also occur between an individual that is higher in rank than the opponent and one that is lower in rank than the opponent ("bridging coalition"), or both coalition partners are outranked by the opponent ("all-up coalition"). Support might result in rank changes or levelling of access; that is, they provide temporary access to resources otherwise restricted by the higher-ranking individual target. In some species, coalitionary support against high-ranking individuals is central in the attainment of dominance rank (de Waal 1982). Whether animals engage in such coalitions depends not only on the species and potential cognitive constraints but also on the context (van Schaik et al. 2004). The decision to support one side in a fight is probably based on an evaluation of the feasibility (i.e., the potential to win), the costs for both participants (likelihood of injury), the benefits it will provide for both participants, and the relationship with the potential coalition partner, where friends are more likely to support each other (Schino 2007).

Policing

While ample evidence exists that individuals in a variety of species intervene in aggression to support one side, few descriptions of neutral or impartial interventions ("policing") exist, and published studies so far are generally in primates. Policing interventions (first described by de Waal 1982) do not target either contestant but terminate the aggression itself and prevent opponents from restarting the conflict. Policing is used by individuals to manage conflict in their community, stabilize the group, and prevent drawn-out fights or injuries that would hurt the group as a whole (Flack et al. 2006).

The scarcity of information on policing might be a reflection of its rarity or a result of the difficulty of deciding whether an intervention had a specific target or not. Policing behaviors have been described as such mainly in different species of macaque (Beisner and McCowan 2013; Flack et al. 2006) and chimpanzees (von Rohr et al. 2012). Usually, higher-ranking group members will attack both the opponents and/or position themselves between them, thereby disrupting conflict, even though (usually lower-ranking) female chimpanzees are sometimes also involved in impartial interventions (von Rohr et al. 2012). Policing seems to occur when the costs for the policer are low, for example, when they outrank the opponents, but they also do not seem to confer directly measurable benefits (Beisner and McCowan 2013). This has led to theorizing that policing mainly functions to stabilize the group – experimentally removing frequent "conflict managers" from a group increased the number of aggressions and reduced grooming and reconciliation rates within the group (Flack et al. 2006).

Post-conflict Affiliation

Originally dubbed consolation (de Waal and van Roosmalen 1979), triadic post-conflict affiliation describes affiliative approaches of a third party directed toward a former conflict participant. Among great apes, this may be reflected in an embrace, much like we humans console others. The definition of post-conflict affiliation by bystanders has since been extended to encompass multiple functions: to reduce stress in the victim ("true" consolation and sometimes considered an expression of empathy); to reduce the likelihood that aggression escalates and the bystander becomes a victim themselves; or to reconcile the opponents indirectly if the bystander is bonded or kin with either.

Third-party post-conflict affiliation has been described for a range of primate (reviewed in Watts et al. 2000) and non-primate species (see Fraser and Bugnyar 2010). Its function seems context specific and to vary both between and within species (Fraser et al. 2009). For example, in chimpanzees, former conflict victims show reduced behavioral markers of stress after triadic post-conflict affiliation (i.e., according to the definition: consolation; Fraser et al. 2008), whereas another study found that chimpanzees show this behavior to protect themselves from redirected aggression of that former victim (Koski and Sterck 2007).

The function of triadic post-conflict affiliation seems highly dependent on the quality of the relation between the former conflicting individuals and the third party. High relationship quality between the third party and the victim may lead to actual consolation; the victim outranking the third party may lead to protection against redirected aggression; and finally kinship or friendship between the former opponent and the third party may lead to third-party reconciliation (Fraser et al. 2009). Triadic reconciliation (Judge 1991) can happen when a third party that is a relative of one of the opponents in a conflict approaches and affiliates with that other former opponent in the conflict and is suggested to aid in the repair of the relationship between the former opponents and in stress alleviation, much like reconciliation between the two former opponents.

Affiliation Interventions

An increasing number of studies has shown that affiliative or cooperative interactions can also be subject to outside interference (first reported in de Waal 1982). Affiliative interactions are ubiquitous in many animal species, especially those with repeated interactions between conspecifics in more or less stable associations as we see in many mammals and birds (Massen et al. 2010). Social relationships are negotiated through a number of low-cost cooperative exchanges ("affiliations"), such as grooming, allo-preening, play, huddling against cold, vocal exchanges, and so on (Massen et al. 2010). Each individual usually only has a small number of close partners as the time for affiliation and resources individuals can provide in return are limited, leading to competition over access (Seyfarth 1977). Thus, affiliative interactions between two individuals have at least three potential, immediate consequences for a bystander:

(A) The affiliation limits the amount of time these individuals have available.
(B) The affiliation might threaten the bystander's social bonds with either partner because they might indicate a shift in bonding effort.
(C) The affiliation might indicate a change in power dynamics in the group if high-ranking individuals provide aggression support to immediate competitors of the bystander.

There is increasing evidence that all three of these reasons might trigger bystanders to influence the course and outcome of affiliative interactions of group members. How interventions play out and what bystanders can do to intervene differ between species: individuals might disrupt the affiliation completely; they might supplant one of the partners and take over their role; or they might become part of the affiliation (e.g., by joining a play bout).

The effects of competition over attractive partners (A) have been studied indirectly in many species, by studying the distribution patterns of aggregated cooperation rates in relation to dominance rank (following Seyfarth 1977). Recently, more direct evidence for competition for cooperation partners has been added: For example, grooming interventions in several primate species are driven by individuals that outrank at least one groomer and subsequently gain access to the higher-ranking groomer, thus establishing their own priority of access and potentially preventing revolutionary alliances (e.g., Range and Noë 2005). Importantly, in these interventions, the intervener ultimately gains access to one of the groomers – their motivation could therefore simply be driven by their own desire to groom an attractive partner.

In contrast, animals may also intervene in affiliative interactions that threaten their own existing relationships (B). Many social animals rely heavily on social bonds for survival and competition (Massen et al. 2010). It is therefore not surprising that interventions are used to protect these bonds from outside interference. For example, in feral horses, female bystanders challenge individuals who are affiliating with the bystander's close social partners. This is facilitated if the bystander is of higher rank than the competitor, but the motivation seems to be to prevent bond partner defection, because the intervener does not subsequently groom the partner (Schneider and Krueger 2012). Similar patterns have been observed in some primate species. In sooty mangabeys, Western chimpanzees, and rhesus macaques, bystanders are more likely to intervene into a grooming bout when they have a strong social bond with either groomer (Mielke et al. 2017, 2021). Domestic dogs display interventions in experimental situations where their owner affiliates with a dog-like toy, a result that has been likened to jealous behavior in humans (Harris and Prouvost 2014). Similarly, captive chimpanzees, just like their wild counterparts, intervene into affiliations when new group members target existing bond partners and show a strong negative emotional response that would indicate feelings of jealousy (Webb et al. 2020). Affiliation interventions are therefore not only a useful tool for the study of animal decision-making but also potentially of the evolution of emotions.

Finally, besides disrupting bond formation of their own friends, individuals can use affiliation interventions strategically to disrupt competitors from using alliances to shift power balances (C). Interventions of affiliative interactions can be highly effective in sabotaging ongoing affiliation (Mondragón-Ceballos 2001). In common ravens, pair-bonded individuals prevent the formation of new pair bonds, as the resulting pair would potentially lead to changes in the dominance hierarchy that could be detrimental to the intervener (Massen et al. 2014b). Similarly, sooty mangabeys, chimpanzees, and rhesus macaques show interventions at higher rates when the lower ranking of the two groomers is close to them in rank (after controlling for kinship and social bonds), indicating that they prevent competitors from accessing high-ranking partners (Mielke et al. 2017, 2021). Thus, like policing, affiliation interventions enable animals to preserve the status quo in their social groups.

To summarize, evidence of third-party understanding and the use of this knowledge in third-party interactions is accumulating for a variety of species, giving us a glimpse of the complexity of life in a social group and the cognitive abilities of many animal species. The function of these behaviors varies depending on the interaction, species, and context and generally depends a lot on the relationship quality of the three parties involved. Moreover, some third-party interactions can be flexibly applied to different context. Consequently, it has been hypothesized that the need for such flexible and strategic cognition in social groups with increasing complexity has been a significant selection pressure in the evolution of intelligence. While the focus of third-party interactions has long been on conflicts and post-hoc conflict management, it now seems clear that third parties can influence all manner of social interactions in a group (aggression, affiliation, play, sex, etc.). This creates a rich tapestry of interactions giving individuals the opportunity to influence their social environment, and we are very much looking forward to how further results from a wider variety of species and contexts will shed more light on individual animals as social agents.

Cross-References

- ▶ Dorothy Cheney
- ▶ Frans de Waal
- ▶ Machiavellian Intelligence
- ▶ Post-conflict Affiliation
- ▶ Post-conflict Resolution
- ▶ Reconciliation
- ▶ Robert Hinde
- ▶ Robert Seyfarth
- ▶ Social Grooming
- ▶ Social Intelligence Hypothesis
- ▶ Transitive Inference

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