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Joint Action without Mutual Beliefs

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Abstract: Joint action among human beings is characterized by using elaborate cognitive feats, such as representing the mental states of others about a certain state of affairs. It is still debated how these capacities evolved in the hominid lineage. I suggest that the consolidation of a shared practice over time can foster the predictability of other's behavior. This might facilitate the evolutionary passage from inferring what others might know by simply seeing them and what they are viewing towards a mutual awareness of each other's beliefs. I will examine the case for cooperative hunting in one chimpanzee community and argue that it is evidence that they have the potential to achieve common ground, suggesting that the consolidation of a practice might have supported the evolution of higher social cognition in the hominid lineage.

Keywords: joint action, chimpanzees, cooperative hunting, common ground

1 Introduction

Cooperation and joint action are pervasive in everyday life. Human beings engage in daily cooperation, from modest cases such as walking together to much more complex practices: human communication, exceptional in the animal kingdom for the use of language, is a form of coordinated action. Joint action is generally considered to be made possible by advanced cognitive abilities that only humans have: Searle (1995), Bratman (1992, 2009) and Tomasello (Fahy et al. 2012; Tomasello 2014) share the belief that cooperation is enabled by collective intentionality, understood as the intention to perform an action φ knowing that other agents are taking part in φ. This capacity is either understood as a specific mental state (a "we-intention", as Searle (1995) puts it) or as a way to coordinate one's own intentions with the intention of other people (Bratman 1992, 2009).

Tomasello in particular (2014) argues that collective intentionality is a specifically human capacity, and that it constitutes an important divide between

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humans and other animals. In his view, human beings are capable of performing complex cooperative activities thanks to having collective intentionality. This means that while carrying out a cooperative action, not only must the individuals be aware of the shared collective goal and of the state of affairs wherein the action takes place, but they also need to mentally represent the intentions of others. This second-person representation of others' mental states is a complex cognitive ability that only human beings seem to have. Non-human primates are occasionally capable of cooperation, but for Tomasello they do not have the motivation to engage in cooperative abilities (they mostly do so in experimental conditions): on the contrary, non-human primates (especially chimpanzees) are much more competitive than cooperative. Furthermore, it would be unwise to assume that non-human primates are capable of something as cognitively complex as representing others' intentions and of second-person engagement. Therefore, the absence of 1) a shared motivation to act with others for anything other than merely instrumental goals; and 2) the mutual awareness among individuals that they are acting together would suggest that non-human primates do not engage in cooperative activities *strictu sensu* (Carpenter and Call 2013).

Tomasello's account of cooperation, which requires collective intentionality, is unsatisfying because whereas it is safe to assume that cognitively mature humans are well capable of collective intentionality, it does not answer the question of the evolution of cooperation. Specifically, there is somewhat of an explanatory gap between our hominid ancestors' (presumably) unsophisticated cognitive abilities and the complex capacity to represent others' intentions of human beings. This problem stands in the way of explaining the evolution of cooperation in general (Koren 2016) and especially the evolution of communication (Geurts 2019a, 2019b), which is extremely important for human beings and incomparable to other animals' when it comes to sophistication.

In this essay, I will suggest that the consolidation of a shared practice can explain the passage from the (probably) low cognitive abilities of early hominids to the sophisticated capacities of modern human beings to understand the mental states of others in the course of a joint action. Specifically, I will propose that the consolidation of a shared practice over time can help the individuals participating anticipate how others will behave, due to the constraints dictated by the procedures of the shared practice for it to be efficient. Over time, it will become easier for agents to predict each other's actions and understand their state of mind with the support of the mutually understood procedure of the practice itself.

In the next section, I will discuss the concept of common ground, both from a descriptive standpoint as a set of mutual assumptions about other agents and the action they are partaking in; and from a participative standpoint, as the assumptions an individual formulates about what the other is aware of. Next, I will review

and evaluate the case for cooperative hunting among one specific community of chimpanzees and compare it with collective hunting in other observation sites. Looking at this specific case, I will elaborate on the concept of "proto-common ground", as a pre-reflective, perceptually grounded prerequisite for common ground which can explain the cooperative status of hunting in this specific observation site. Finally, I will propose that the consolidation of a practice can favor the development of more complex cognitive abilities and can fill the explanatory gap in theories of the evolution of cooperation (and, among examples of cooperation, communication) that rely on the development of complex social cognition.

2 Joint Action and Common Ground

There is one aspect of joint action that, whereas acknowledged by some theorist of collective intentionality, is often not considered to be particularly problematic. For instance, Michael Bratman (1992, 2009) concludes the explanation of his theory of joint action (as mainly determined by interlocking intentions among the agents) by underlining the importance of common knowledge. If collective action is determined by a shared plan which each agent keeps in their mind and acts upon, and if the coordination of the agents is made possible by the interlocking intentions of each agent, then the common knowledge between them (about what the plan is, what the role of each member is and what each other's beliefs and intentions are) is key for a successful collective action. I believe it is useful to analyze the idea of common knowledge more thoroughly, and I will follow Herbert Clark's (1996) in-depth discussion of the concept.

Common knowledge belongs to a family of concepts (such as mutual beliefs, joint knowledge and mutual expectations) that points at the context shared by individual agents, and that some authors call *common ground*. This concept designates the information that is "out in the open" between a plurality of agents. For a number of agents to cooperate successfully, they both need to know what they have to do and how to do it – for instance, if they need to cook something, they both need to know what is the procedure for the recipe and what roles each of them can take. The common knowledge of the procedure of the practice and of the roles each agent has to take therefore plays a key role to efficiently carry out cooperative action. The same is also true for successful communication, as communicative practices themselves require coordination and a cooperative effort from both speakers. Common ground is generally intended as a set of mutual beliefs held by both agents about each other and about the practice they intend to carry out. This set of mutual beliefs is usually represented with a recursive structure:

Bap and *Bbp*,
BaBbp and *BbBap*,
BaBbBap and *BbBaBbp*,
Ad infinitum

Where *Bxp* stands for: "X beliefs that P", a's awareness of P is mirrored by b's awareness of P (that is what makes P a shared belief) and both *a* and *b* are aware of the other believing that P.

This representation of common knowledge should not be understood as an infinite set of beliefs held by an agent, but as a set of implications the agent is (theoretically) able to conceive (Lewis 1969). Importantly, this description of common ground is given from a third-person, descriptive point of view.

However, this level of description may not be the most accurate when common ground is considered from a first-person perspective. As Clark notices, for the individual agent taking part in the cooperative action the mutuality of the shared belief(s) has to be taken for granted. From the perspective of an individual, the shared belief can be either explicitly agreed upon or simply assumed to be shared among the agents involved. If two people are baking a cake, they can, on the one hand, explicitly agree upon what each of them has to do ("I will whisk the eggs while you mix the flour") or, on the other hand, they can already know and assume what each of them is supposed to do. If, for instance, they would already have baked together many times in the past, assuming that each one knows what has to be done can be reasonably assumed. To use another example, if Abel and Betty are about to go out of a building and the former asks the other whether she has an umbrella, he not only is aware that it is raining but also assumes that Betty is aware that it is raining – that is after all the reason why Abel wants to know whether Betty has an umbrella. From a third-person perspective, the iterative chain of beliefs I described above applies in this case as well. However, considering only Abel's perspective, that iterative structure can be better described as follows: Abel knows that it is raining; Abel knows either that 1) Betty knows that it is raining *or* that 2) Betty does not know it is raining; Abel will act accordingly based on Betty's perceived awareness of the relevant state of affairs – that is, Abel will act accordingly to what he believes Betty is aware of. This could be formalized as follows from Abel's point of view:

1. *Bap*
2. *BaBbp* and *Ba non-Bbp*
3. *a* (*φ1*) iff (*BaBbp*) and *a*(*φ2*) iff (*Ba non-Bbp*)

Taking the example of Abel and Betty above, the description following this formalization would be:

1. Abel believes that it is raining;

2. Abel believes that Betty believes that it is raining or Abel believes that Betty doesn't believe that it is raining;
3. Abel will act in a certain way if and only if Abel believes that Betty believes that it is raining; or Abel will act in another way if and only if Abel believes that Betty believes that it is raining.

Whereas this is not common ground *strictu sensu*, it is an important prerequisite for achieving it from an individual's standpoint. There might not be shared awareness of the situation in which the action is taking place, nor of the beliefs and intentions of the other agent, but there are ways to assess whether the other sees what you are seeing. Abel can infer that Betty knows it is raining from certain behavioral cues, e.g. whether she is looking outside the window. Again, the fact that it is raining does not constitute common ground between them – for instance, Betty might be thinking about something else and not paying attention to the weather while looking out of the window. From a first-person perspective, the achievement of common ground is never achieved beyond absolute doubt, as an agent might in theory always be wrong. Whereas this is no reason for excessive skepticism, it shows that, from an individual's standpoint, achieving common ground presupposes a set of assumptions about the state of affairs and about what the other perceives and understands of such state of affairs.

In other words, if we put ourselves in the shoes of an individual agent performing a joint action, common ground is established by a set of assumptions about how to perform the action and about the other's awareness of her role in the action. Furthermore, depending on whether the belief P is actually common ground among the agents or not – that is, depending on whether B knows what A knows – A will of course act differently, usually trying to clarify P to B (to *make it* common ground) in order to achieve the joint action's goal. From an individual agent's perspective, the shared belief(s) that constitutes common knowledge is a set of more or less justified assumptions about common knowledge that direct her action. Therefore, common ground is not just an information pool shared among agents, but also a normative construct that allows agents to expect how others will behave in the joint action (Geurts 2019b). This is in line with recent theories of social cognition that underline how the understanding of other minds relies on normative structures directing how agents ought to behave in certain situations and during certain practices (see e.g. Fernandez Castro 2017; McGeer 2015; Zawidzki 2013).

The first-person standpoint on common ground, as opposed to a third-person description, will be useful in Section 4, wherein I will argue that the consolidation of a practice – and therefore, the standardization of a procedure for a joint action – can be considered a favorable candidate for the evolution of cooperation. Most

importantly, I will note that the first-person perception of common ground, for which an agent needs to be aware of (P) and of the other's awareness of (P) can be sufficient to carry out complex practices. In this way, the consolidation of a complex practice can justify the evolution of hominid intelligence from fairly simple abilities to a deeper complexity.

3 Hunting Among Chimpanzees: Cooperative Versus Impact Hunters

The emergence of meat eating has long been seen as a key element for the evolution of the hominid lineage (Stanford 1996), due to both the observation of contemporary hunter-gatherer societies and the difference in meat consumption between those societies and non-human primates. Chimpanzees (*Pan troglodytes*) are known to hunt a variety of small prey, and especially colobus monkeys (Newton-Fisher 2007). It has been observed that the way chimpanzees hunt for colobus monkeys varies in different observation sites.

In this section, I will first focus on the occurrence of hunts among the chimpanzees of the Taï forest, in Côte d'Ivoire, where hunting seems to be an exceptionally complex activity, requiring a great deal of coordination between hunters. I will secondly confront the behavior of Taï hunters with how chimpanzees in other sites hunt, and propose that Taï chimps' capacity for partaking into highly complex activities relies heavily on the individual's skills and knowledge of the others' actions and their surroundings.

3.1 Cooperative Hunting in Taï Chimpanzees

Group hunting in chimpanzees has been studied across different areas and is characterized by many differences depending on the sites where it has been observed. There is one example of group hunting that some believe to be an example of cooperative action: hunting among chimpanzees in the Taï forest in Côte d'Ivoire. I will now describe how group hunting in this forest occurs, based on observations by Boesch (1994, 2002).

The hunt of colobus monkeys is described as extremely complex. Different to other observation sites, the canopy forest cover in Taï is characterized by much higher trees, up to 50 m tall, in contrast with the usual 15 as it is the case for other sites. This environmental difference makes hunting much more difficult, as trees that tall afford many more escape routes for the colobus monkeys and the taller

tree branches may be too thin to hold the much heavier chimpanzees. The author thinks this is a crucial characteristic of the practice of hunting in Tai with regards to other observation sites.

Boesch and his team observed that hunts occurred mostly in groups of at least four males, and that the hunters seemingly take very specific roles. *Drivers* are those which get close to the pack of colobus monkeys and drive them in a specific direction: they do not try to catch up with their prey, but simply follow them and lead them off in some direction. *Chasers* are those chimps which not only follow the prey but actually try to catch up with them and snatch them. *Ambushers* have a much more complex part in the hunt: their role is to anticipate the direction of the colobus pack and wait for them on a tree that would be on their way. They need to anticipate the direction and speed of the prey and the tree height the chased pack will try to reach while escaping in order to snatch them. Finally, *blockers* perform the same action as the ambushers but instead of snatching the prey they surprise them by blocking the colobus monkeys' escape route, disarranging their ranks and separating the pack in the confusion.

Boesch defined this hunting practice as collaborative because the hunters perform different but complementary roles during the act. It also seems that the chimpanzees involved understand that, for the hunt to be successful, different roles need to be filled. One could simplify the roles taken by the chimpanzees by seeing that chasers and drivers simply follow the prey, whereas blockers and ambushers have to predict the escape-route and wait with the right timing and position (one could even claim that blockers are just ambushers who failed to snatch the prey). Even with this simplification, however, the collaborative aspect of this activity stands. The role of ambushers and blockers is meaningful and successful because the colobus monkeys are either driven or chased in some direction where the hunters wait to surprise them. Therefore, one could not explain the behavior of blockers and ambushers without keeping in mind the actions of drivers and chasers.

Hunting among Taï chimpanzees has two further aspects that suggest it being a cooperative activity. The first regards the individuals partaking in the hunt. In all the 248 hunts which occurred in the time of observation (between 1987 and 1995), 11 out of 13 of the male chimpanzees involved in hunts assumed all the described roles at least once. Some individuals performed roles more often and more efficiently than others. Furthermore, the way spoils are shared among hunters is noteworthy. When the prey is finally caught, the chimp responsible for the snatch yells and attracts the attention of the other males close by. However, the males that did not hunt receive a significantly lesser share of meat, even if they were alpha males (Fahy et al. 2012). Larger shares are given to those hunters that performed the more effortful roles – the ambushers and blockers. In other words, the most skilled

hunters received a larger share of the meat, even when they were not directly responsible for the final capture, as if they were recognized by the other hunters as more deserving of the larger share because of their finer skills. Overall, the success of the cooperative hunt is ultimately determined by the individuals being skilled enough to perform their role, and it seems that the chimpanzees themselves reward skillfulness with a larger share.

The second aspect to be underlined is the long way to learn how to hunt among Taï chimpanzees. By taking part in the hunts and observing the behavior of fellow hunters and their prey, chimpanzees learn the different roles involved in hunting and how to perform them by taking part in the hunts throughout their lifetime, to the point that they learn to hunt efficiently after circa 20 years. Hunting being a predominantly male activity in the case of Taï chimps in particular, the chimpanzee's mother does not teach nor react directly to how her male children learn to hunt. Young chimps are not explicitly taught how to hunt and the respective roles, but simply imitate and hone their skills throughout a lifetime: they have to rely almost entirely on their own participatory and observational skills to learn how to hunt. The necessity to learn a relatively complex strategy on their own, on the one hand, explains the long time to learn to hunt efficiently. On the other hand, the learning process relies entirely on what seems to be a consolidated practice, whose successfulness relies on the coordination of all hunting roles and the efficiency of which relies on a relatively complex role-taking and proper coordination.

3.2 Impact Hunters in Kasekela and Kanyawara

In sites other than Tai collective hunts of colobus monkeys may not necessarily represent a case of genuine cooperation. Instead, they might be a case of by-product mutualism: hunts may appear cooperative, whereas they are simply the result of selfishly acting individuals happening to be present when the hunt is initiated. Considering this possibility, Gilby, Eberly, and Wrangham (2008) and Gilby et al. (2015) proposed what they call the "impact hunter" hypothesis to describe collective hunting in most chimpanzee observation sites. The authors hypothesize that hunts are initiated by some male individuals, who, by approaching a group of red colobus monkeys, draw out adult males from the predated group, disarranging their defensive ranks and possibly causing some of the monkeys to flee. In this situation, a bystander chimpanzee may have a higher probability to catch a fleeing red colobus monkey by merely being there. The authors hypothesize that hunts most likely occur when these impact hunters approach a group of colobus monkeys and eventually favor the opportunistic intervention of bystanders from the mayhem caused.

The authors predicted, firstly, that impact hunters would initiate hunts more often than expected by chance and be therefore generally more prone to hunt than average, and secondly, that after the death of an impact hunter in a community hunting rates would significantly decrease, as the absence of the more enterprising individual would cause less hunts to occur. In the sites of Kasekela (Gombe National Park, Tanzania) and Kanyawara (Kibale National Park, Uganda) these two hypotheses were confirmed. When individuals identified as impact hunters were present at encounters with colobus monkeys, the chance of initiating a hunt increased significantly. Furthermore, contrary to previous expectations, a number of impact hunters were often not the ones who actually caught the chased monkey: by approaching the group of colobus monkeys and disarranging their ranks, impact hunters change the payoff structure for all other potential hunters, making it easier for nearby chimps to snatch escaping prey.

These results seem to confirm that collective hunts, at least in some observed sites, are merely cases of emergent cooperation, a result from selfishly acting individuals who do not act in view of how others hunters move but simply take advantage of the circumstances they find themselves in. Collective hunting among chimpanzees, here, would be nothing more than an individualistic enterprise, wherein each chimp undeservedly takes advantage of what others did.

3.3 Between Individuals and Environment: The Consolidation of a Social Schema

At this point, it may seem difficult to explain what continuity exists in a single practice among communities of chimpanzees. On the one hand, Gilby et al. (2015) describe hunting among most Eastern African chimpanzee communities as an individualistic enterprise, whose success is partially favored by the undertaking of others but is ultimately determined by the readiness and aggressiveness of opportunistic individuals. On the other hand, Boesch describes hunting in Taï as a highly cooperative ability, whose success depends on somewhat specific role-taking by each hunter. I will now spell out the differences between these two cases, and point out two very important characteristics present both in Tai and in other sites: the role of skilled individuals for successful hunts and the presence of a similar coordination game underlying them.

The most evident and important difference between Taï and sites such as Kanyawara and Kasekela is the configuration of the forest. The canopy forest in most observed chimpanzee communities is generally 15 m tall; instead, the trees of the Taï forest can be as tall as 50. This ecological difference changes the dynamics of the hunt significantly. In Kasekela, for instance, observed cases of hunting for

colobus monkeys occur when the forest cover is irregular or interrupted, or where there are not many trees and, as a consequence, colobus monkeys do not have many escape routes. It is not surprising, then, that in sites where the forest cover is not very thick or tall individual hunts are more frequently successful (Gilby and Wrangham 2007). In Taï, it is much more difficult for chimpanzees to hunt by themselves, because colobus monkeys have more escape routes in the taller canopy forest: it is easier to jump from tree to tree, and many branches can hold adult colobus monkeys but not the much heavier predators. For Boesch, then, a collective effort seems necessary in Tai to hunt successfully.

Furthermore, keeping in mind the different hunting dynamics between Gombe and Taï chimpanzees – that is, between sites wherein hunts are initiated by impact hunters and the site where hunting is almost always resulting from a collective effort – one could see a schematic continuity between an opportunistic, individual strategy and a complex, socially embedded one. In Kasekela and Kanyawara the impact hunters were not found to be above average when it comes to actually catching the prey. Instead, impact hunters disarray the ranks of the colobus monkeys' group and allow for nearby chimpanzees to snatch a fleeing or an unprotected monkey. As Gilby et al. (2015) acknowledge, this dynamic somewhat resembles the more complex hunting practice described by Boesch in Tai. However, in Kasekela and Kanyawara the impact hunters approach the colobus monkeys out of boldness and create a payoff dynamic favoring reactive nearby chimps. The ready bystander can successfully snatch the prey only because of the impact hunter's actions. In this case, the collective hunt is clearly a result of a by-product mutualism: even if the bystander is able to snatch the prey only because of the impact hunter's initiative, he (theoretically) needs not to be aware of the impact hunter's actions.

The same cannot be said of hunting in the Taï forest. The actions of blockers and ambushers would be meaningless without the roles of drivers and chasers, in the same way that a lucky bystander could not catch a fleeing colobus monkey without the impact hunter attacking the monkeys first. However, the behavior of blockers and ambushers cannot be fully explained bearing in mind only the behavior of the other hunters: for the hunt to be successful, the ambushers/blockers themselves need to bear in mind that the colobus monkeys are being driven by the other hunters in certain directions. Furthermore, they need to know the forest configuration in order to block the escape routes and to snatch the colobus monkeys successfully. Therefore, ambushers and blockers in the Tai forest play a far more cognitively demanding role than reactive bystanders in Kanyawara and Kasekela.

Another significant difference between the two cases regards the initiation of chimpanzees into hunting as such. Chimpanzees in Taï need about 20 years to

become successful hunters. Whereas calling it a sort of apprenticeship would be improper, it is nevertheless striking that, to become efficient hunters, young chimps need to get acquainted with the prey and to observe and partake in hunting for a long time, often assuming the easier roles of drivers and chasers while learning to hunt efficiently. No analogous behavior has been observed among Kasekela and Kanyawara chimpanzees.

Another differentiating characteristic between the two cases is the way the meat of the caught prey is shared among chimpanzees. Among Taï hunters, the meat of the prey is shared quite specifically: ambushers and blockers – that is, hunters with more demanding roles – receive a larger amount of meat than drivers and chasers. When the prey is caught, the one hunter responsible for snatching it emits a call that attracts all nearby chimps to the site wherein the monkey was killed, including both hunters and bystanders. Most interestingly, dominant males who did not take part in the hunt received a smaller share of meat than ambushers and blockers (Fahy et al. 2012; Samuni et al. 2018). This might be a sign that hunters recognize who of the partakers of the hunt is more deserving of a larger share. In contrast, in other sites the division of the prey is seemingly determined by more circumstantial factors, such as the strengthening of already present social bonds, avoidance of harassment, kin selection, altruistic behavior and others (Newton-Fisher et al., 2007; Silk et al. 2013).

Finally, the last noteworthy difference between cooperative and "impact" hunting is the way hunts are initiated. Chimpanzees are known to patrol their territory in groups, to contrast potential invaders from adjacent communities and occasionally make incursions into their territory (Alberti, Sugden, and Tsutsui 2012). In Taï, chimpanzees seem to patrol their territory and systematically hunt during those patrols (Samuni et al. 2018), which is not the case in other sites. As the hunters depart together during those patrols, they are aware and can keep track of each other's presence when the hunt is initiated.

There is a factor that is shared between the practice of hunting between the Taï forest and observation sites in Eastern Africa. In both cases, the successfulness of hunts is especially determined by specific individuals among the hunters. In Kanyawara and Kasekela, impact hunters determine the initiation of hunts, and their death was observed to be followed by an evident decrease in hunting rates in those communities. The presence of impact hunters was found to significantly determine the occurrence of hunts in general. Likewise, successful hunting in Taï is mainly determined by skilled individuals, specifically the blockers and ambushers, who are capable of anticipating speed and direction of the hunted monkeys. In the two cases, even if the decisive individuals carry out different functions between Taï and other sites, it is those very individuals who seem to determine whether a collective practice is successful.

Ultimately, it seems that the reliability of hunting among chimpanzees is assured by reliable individuals. Whereas this is trivial in sites wherein the impact hunter hypothesis applies, I believe it is also important for Taï chimpanzees. One can assume, along with Tomasello, that chimpanzees are not capable of collective intentionality and to consider the collective practice as such: however, not only the success, but even the mere meaningfulness of ambushers and blockers' actions can be understood only in reference to the actions of drivers and chasers. What each hunter needs (at least ambushers and blockers) to be efficient is the awareness of their surroundings and of the movements of the prey: despite hunting involving a group of chimpanzees coordinating with each other, its efficiency is determined by individuals.

To conclude this section, I want to recap three factors to keep in mind concerning the similarities and differences between cooperative hunting in Taï and hunting in other sites. Firstly, the different characterization of the forest cover has a definite influence on how the hunters act in order to catch their prey. Secondly, the successfulness of hunts relies on the readiness and skillfulness of individual hunters, both in Taï and in other sites, with the important difference that more skilled individuals assume the role of ambushers and blockers in Taï and in site such as Kanyawara and Kasekela the individuals with initiative are the ones causing the colobus monkeys to move. Thirdly, Taï chimpanzees learn to become efficient hunters in the arc of about 20 years, becoming accustomed to hunt in a relatively long time, while chimps in other sites start hunting earlier and more spontaneously. Finally, collective hunting, regardless of whether it is cooperative as in Taï or casual as in other sites, seems to occur as a stag-hunt kind of coordination game, wherein for the hunt to be successful there must be at least one individual causing the prey to move and another capable of snatching it in an opportune moment.

4 Defining Proto-Common Ground: Consolidation of Shared Practices and Evolution of Common Ground

In this section, I will argue that the consolidation of a practice is an important step in the evolution of cooperative action that precedes (and possibly favors) the development of complex abilities like collective intentionality. I have described in the previous section the case of cooperative hunting among chimpanzees in the Taï forest and compared it to non-cooperative hunting in other sites, and I will now link cooperative hunting to the issue of common ground I described in Section 2.

Engelmann and Tomasello (2017) are aware of the specific hunting dynamics that occur among Taï chimpanzees. However, they are skeptical about it being an actual cooperative activity. Firstly, they note that in general hunting among chimpanzees is an uncoordinated and individualistic enterprise – which is true for the cases of Kanyawara and Kasekela described by Gilby et al. (2015). Secondly, they mention that the meat procured during these hunts does not seem to constitute an important part in their overall diet. In most observed sites, not only are hunted animals only an occasional part of the chimpanzee diet, but hunts also counterintuitively occur, not when fruits and vegetation are scarce, but in the seasons they are more abundant (Gilby and Wrangham 2007), suggesting that colobus monkeys are not an essential dietary factor to the chimps' survival, constituting instead somewhat of a luxury meal. If occurrences of cooperative hunting are so sporadic, the argument goes, one ought to be reluctant in attributing to chimpanzees the ability to engage in cooperative actions *strictu sensu*.

I believe that Tomasello's and Engelmann's worries are not warranted. Firstly, it is true that hunting among Taï chimpanzees is an exceptional cultural variance. However, one aspect differentiating the hunting in Taï populations from hunting in other sites is a factor that Tomasello acknowledges as fundamental for the evolution of cooperation in the hominid lineage: the environmental pressure, which is probably extremely influential in prompting the development of consistent hunting roles in that site, as uncoordinated hunting would otherwise have a much lower success rate.

The second concern of Tomasello and Engelmann can be answered with a finding by Fahy et al. (2012), who found evidence that, on the contrary to other observation sites, colobus monkeys in Taï are a stable source of nutrition for chimpanzees. This constitutes evidence that humans are not the only primates for whom meat is an important dietary staple. More importantly, the fact that meat is a stable dietary source for chimps in Taï is even more evident in the fact that their complex cooperative behavior is motivated by these more nutrient meals, and that the successfulness of cooperative hunting in turn favors a more stable consumption of meat.

If we sum up the factors analyzed in Section 3.3, it seems justified to define hunting among Taï chimpanzees as a cooperative practice. The behavior of individual chimpanzees cannot be explained in individualistic terms, because their hunting actions can only be understood by referring to the behavior of the whole group. There is, however, the problem of the mental capacities of chimpanzees to consider the role and intentions of others: it could be unwarranted to believe that chimpanzees are able of second-person thought or consideration of the intentions of others. This would hinder the cooperative status of hunting, because there would not be common ground between the actors involved – the hunters are not

able to form mutual beliefs about the hunt's practicalities, nor about each other's intentions. The iterative structure of common ground would not apply here, and the practice might not be considered a genuine joint action.

I would now like to recall the discussion of common ground in Section 2 in order to solve this issue. Following Herbert Clark's analysis, common ground can be understood as two-fold: either in a third-person perspective, as a set of mutual beliefs that agents can have about each other and the joint action; or in a first-person perspective, as a set of assumptions about the other based on the agent's awareness about the state of affairs and about how the other perceives the state of affairs. Chimpanzees may not be capable of mutual second-person intentional attribution, but I believe that they are capable of understanding what the other is perceiving, and therefore of acting upon the other's perceptual states.

Hare et al. (2000) and Hare, Call, and Tomasello (2001) provide evidence that chimpanzees can act upon what others see. Experimenters had a dominant and a subordinate chimpanzee compete over food: specifically, some pieces of food were visible to both the dominant and the subordinate, whereas others were visible only to the subordinate. It was observed (as expected) that subordinates would not pursue the food when the dominant would be aware of its location, but would pursue it when the dominant would not know of its location. This seems to indicate that the subordinate is capable of inferring what the dominant will do depending on whether the latter can see where the food is.

On the one hand, this is a pretty basic cognitive ability and the activity in the experimental condition is not cooperative but competitive, in line with Tomasello's argument that chimps are generally not motivated to cooperate. On the other hand, however, these experiments show that chimpanzees can act upon what others are aware of. They are not capable of conceiving common ground *strictu sensu*, but they are capable of acting upon the more rudimentary, first-person conception of common ground I discussed in Section 2. The understanding of what others are aware of is less demanding than understanding intentions, but can determine the actions of individuals within a dyad or a group. In Hare et al.'s experiments, if one takes the perspective of the subordinate, this first-personal understanding of the situation can be described as follows:

1. S sees the food
2. S sees that D (a) has seen/(b)not seen the food;
3. S (a) approaches/(b) does not approach the food for herself

Whereas this is not enough to achieve common ground, it can allow for coordinated action. In the case of hunting among Taï chimpanzees, the chain of assumptions an individual hunter has to make would be describable as follows:

1. A chases/drives prey in direction X

2. B knows A is present and vigilant
3. B sees the prey being chased in X
4. B expects the prey in X to ambush/block it

It makes sense to think that the mere awareness of the presence of other hunters (more than their exact position and direction) may suffice for an individual hunter to act in order to catch the prey. This is not the same as achieving common ground, because the hunters are not capable of conceiving the intentions and beliefs of others, nor of conceiving the entirety of the practice of hunting as such. However, just knowing that there are other reliable individuals ready to engage in the hunt will determine the behavior of individual hunters, especially the ones partaking in more complex roles. Understanding whether the other is seeing the same as you is a necessary (albeit not sufficient) presupposition for achieving common ground. As the chimpanzees leave for hunting patrols together, they probably know who and how many of them are hunting and can generally count on this knowledge when they decide what hunting roles to take and which direction to go. On the one hand, in cases where hunting among chimps is not cooperative, there might not be the need for awareness of what the other is aware of in order to conduct the hunt successfully. On the other hand, in the case of hunting among Taï chimpanzees, this capacity seems enough to carry out a much more specialized practice.

Chimpanzees might not achieve common ground *strictu sensu*, but can understand what others are aware of, which is a theoretical prerequisite for achieving mutual awareness. In this sense, chimpanzees are not able to achieve common ground, but they can see what others are seeing, therefore acquiring a prototypical understanding of how others might behave – and, most importantly, whether they will be able to act upon the perceptions and behavior of others. One might call this "proto-common ground", a shared awareness of a circumstance that implies the possibility to act together without the mutual understanding of the actual intentions and beliefs of the other.

I believe there is room to propose a fundamental step in the evolution of joint action and specifically between the role of environmental pressure and the development of complex mind-reading skills. Despite the difference of complexity in hunting between Taï and sites such as Kasekela and Kanyawara, I have noted above that the structure of the hunts are similar, with at least one chimpanzee approaching the prey and another ready to grab it. This coordination game is very basic and does not require much effort in sites such as Kasekela, wherein the hunters with more initiative are the ones approaching the prey and the more reactive individuals are the ones snatching it, even if they are mere bystanders who did not intend to hunt to begin with.

In Taï the coordination game is more complex and the hunters partake in more specific roles due to the different environmental conditions; however, the dynamic of the hunt is very similar, with chasers and drivers taking the initiative to get the preys moving and ambushers and blockers expecting them and reacting promptly to capture them. Furthermore, the payoff structure is somewhat similar when it comes to the sharing of the meat. On the one hand, in sites where Gilby et al.'s impact hunter hypothesis applies, the hunters capturing the prey are able to monopolize the meat and decide how and to whom distribute it arbitrarily. On the other hand, ambushers and blockers in Taï are the ones who gain the largest amount of meat in comparison with other hunters, suggesting that they are considered more deserving of it. Seemingly confirming this, hunted meat is mainly shared among hunters, and even dominant chimps who did not partake into it gain less access to it than ambushers and blockers.

5 From Valence to Salience: Unreflective Coordination and the Normativity of Proto-Common Ground

Previously, I referred to colobus hunting in sites such as Kanyawara and Kasekela on the one hand and in Taï on the other as a development of an opportunistic dynamic into a fully-fledged coordination game: the scheme that characterizes "impact hunting" (one chimp approaching the prey, another one snatching it) can be seen as a precursor to the cooperative mechanics of chimps in the Taï forest. The understanding of the latter as a coordination game and how it is perceived by the Taï hunters can provide some insight on the notion and application of what I have called "proto-common ground" and its evolutionary significance.

Cooperative hunting in Taï can be characterized as a "stag-hunt" coordination game (Skyrms 2003), wherein the best outcome for every individual involved requires a cooperative effort.[1] In this coordination game, the best possible outcome for the individual player would rely on the intention of the other, making such game a representative example for joint action as understood by Tomasello and Bratman and as explained in the first section of this paper: the most reliable

1 It is relevant to know that the stag-hunt coordination game as elaborated by Skyrms assumes that players can either cooperate for a larger reward for everyone (to hunt stag) or defect for a smaller, but more safe to acquire individual reward (to hunt hare). It is not clear what "hare-hunting" would be in the case of cooperative hunting among chimpanzees in Taï, but it could be constituted by any distraction that might occur during their hunt patrols.

strategy for the players would be to understand and represent the intentions of the other, creating the conditions for fully-blown common ground (or common knowledge, as defined by Bratman). Following David K. Lewis (1969), Skyrms notes that common ground provides the resources for the creation and maintenance of a convention, an equilibrium in a coordination game – in our case, the coordination of individual chimpanzees by hunting roles. There are three possible factors that can constitute the kind of common ground necessary for the establishment of an equilibrium (a convention): prior agreement between the agents; occurrence of a precedent; and salience. A salient equilibrium (what Thomas Schelling (1960) calls a focal equilibrium) is one that "stands out" to the agent, being more prominent to their perception of the world for a reason or another.

In the context of this paper, salience plays a special role in understanding hunting among Taï chimpanzees as a form of joint action with a status of convention. Prior agreement not being a feasible candidate for establishing proto-common ground, what enables the regularities of chimpanzee hunting behavior must be the existence of a precedent (the occurrence of the same phenomenon in the past) and salience, the relevance for the agents involved in the joint action of an entity in their environment that triggers the coordination. Salience is a psychological property (it is experienced by the organism) and can be caused by a wide variety of methods, including prior agreement, precedent, common experiences and cultural repertoires shared among players. Gruinesen, Wyman, and Tomasello (2015) found that 8-years old children, when incapable of communicating with one another (and therefore being incapable of making a prior agreement) used visual salience to solve a coordination game. Specifically, they needed to place a ball into one of four containers, one of which had a different image than the others, and coordinate with their partner to place it in the same one: children in the experimental condition managed to coordinate by placing in the container with the different image, the most visually salient of the four. These results can be useful in understanding the coordination of chimpanzees in their hunts, as they are not capable of communicating flexibly and reliably as human children can do. Their hunt is triggered by the presence of the prey, which fulfills the role of focal point, or salient aspect that triggers the coordination game. That being said, however, there seems to be a missing step for the consideration of this coordination game as an instance of joint action. It is not clear, specifically, how salience alone would enable the development of a stag-hunt coordination game, where reliance on other players is crucial for a successful outcome. This reliance, in the case of mentally developed human beings (such as the children in Gruinesen et al.'s experiment) would entail the ability to take the perspective of the other player, or of representing their mental states, which chimpanzees most probably do not have.

What is missing is an understanding of how agents incapable of reflective, complex mental abilities are capable of coordinating from visual salience alone – that is, by seeing the prey and by being aware of the other hunters' presence. This theoretical and practical link from visual salience to coordination without complex mental abilities can be provided by looking at the chimpanzees' behavior as an instance of skillful unreflective action, as understood by Rietveld (2008a, 2008b).

Rietveld notes how in everyday life situations, humans act unreflectively but adequately in reference to certain sociocultural practices. In his understanding, this kind of unreflective action needs to be understood as a form of embodied intelligence motivated by the situation. But how do human agents manage to select the relevant elements of the environment they adequately act to? Rietveld uses an example from Wittgenstein (1978) of an architect who instinctively feels compelled to change the design of a door because of discontent with its original configuration as an example of unreflective normative action. The architect's appreciation of the original design and her desire to improve it are enabled by her possession of a skill, her being an expert architect. The acquisition of such skill is the result of years of training, making it socioculturally grounded, and enables not only the craftsman's unreflective, "gut-felt" appreciation of an object as appropriate or inappropriate, but also the equally instinctive capacity to detect precisely what aspects or particulars of such object move him to its improvement.

For Rietveld, this skill and the appreciation of the object as needing to be improved are embodied: the possession of a skill allows for a specific relationship between body and world that would not be possible in its absence, and the discontent directed to the object to be improved entails the felt need to modify this body-environment relation on the craftsman's part. Due to its embodied character, the skill enables the craftsman to individuate and act upon the relevant aspects of the object to be improved. The appreciation of the object moving the architect to improve it has a normative character, as its improvement is also a way of making it adequate for the craftsman's socially embedded skill. The skilled individual's appreciation of an object can be therefore be considered normative, but not explicitly guided by rules: the individual will act upon the object to be improved following her own criteria of appropriateness, which are determined by the sociocultural practice she learned and refers to in her appreciation but not explicitly articulated. The object's appreciation is an embodied concern compelling the skilled individual, as the indicators of perceived normative adequacy are present in the body-environment system. However, this embodied concern is rooted in a social practice: the craftsman's feeling compelled to improve the object is the result of the learning process and refinement of the expertise, which takes place amidst cooperative individuals adhering to established patterns of behavior.

In the case of Taï chimpanzees, Rietveld's reflections can explain two different sides of the problem at hand, of how a complex coordination game develops with relatively unsophisticated cognitive abilities. The first side of the solution regards the development of the skill as such. Recall that in those sites where hunting of red colobus is not a joint practice, the hunt has a schematic similarity, where one of the chimps (the impact hunter) causes the prey to move and the other opportunistically snatches it. This basic coordination game has the red colobus as a focal point, as the salient element in the environment triggering the action of both hunters. A similar behavioral schema could have taken place in Taï, with initial lack of success: however, with repeated instances of the same activities, and with an increasing awareness of the surrounding forest configuration, the coordination game might have become more and more complex. The establishment of the chase-ambush behavioral pattern can be considered, from the individual's standpoint, as the consolidation of a socially grounded skill, consisting in either the capacity to attack the prey (originally, to simply approach it) or the capacity to anticipate its position (originally, the casual snatching of the monkey). Given the available evidence, what seems to determine the refinement of the individual hunter's specific skill (besides the forest configuration) is the awareness of other hunters and their identities in the surroundings. Then not only the prey, but also the other agents act as focal points of the coordination game.

The second facet that Rietveld's theory of unreflective action can highlight is the way a perceptual state can constitute a constraint for normative action. Rietveld understands the craftsman's unreflective discontent directed to the object closely to what Varela and Depraz (2005) call valence. Valence is understood as the individual's immediate responsiveness to a relevant event in the environment. It is a basic discriminative ability, relative to an organism's ability to determine quickly whether it should move towards or away from something in its environment. In everyday experience, everything can be value laden for the organism, and the valence of things and events in its environment can be characterized by tension, attraction or repulsion on the agent's side. This perceptual, immediate and pre-reflective relation between agent and environment can guide the agent to an appropriate or inappropriate course of action, and is therefore instrumentally normative. We can understand, then, the perceptual awareness of the prey and of the other hunters – that is, what is entailed in this instance of what I called porto-common ground – as intrinsically normative, and capable of guiding coordinated action without requiring particularly complex mental abilities on the agents' part. The valence of the prey and the other hunters in the individual's visual field can be considered as the salience around which the coordination game can develop. Through this embodied understanding of this stag-hunt kind of coordination

game, we can accept that chimpanzees are capable of complex, coordinated action without attributing intentions and beliefs to each other.

6 Implications for the Evolution of Cooperation in the Hominid Lineage

In the light of the analysis of the previous sections, where the normativity of proto-common ground is enabled by the embodied, unreflective character of the chimpanzees' skill, it seems reasonable to conclude that hunting among chimpanzees in Taï represents a relevant exception to Tomasello's argument that non-human primates are not naturally motivated to cooperate. However, the differences and continuities between hunts in Taï and other sites also suggest a further aspect that can play an unexpected role in the evolution of cooperation and joint action. The differences between the two cases are mainly related to the practice itself.

One might argue that due to the environmental pressure the practice of hunting evolved, and along with it, the chimpanzees' cooperative abilities, even if they are not capable of forming mutual beliefs or reciprocally attributing intentions – therefore, even if they are not capable of creating common ground. The standardization of the practice, which is influenced by the environmental conditions wherein it occurs, might instead favor the development of the cognitive abilities of individuals: for instance, and importantly, the regularities of the practice will promote certain behavioral expectations in favor of others. If from a first-person perspective the acquainting with the common ground of a joint practice is favored by the standard procedures underlying the practice, the reiteration of the joint practice in a community can help stabilize and reinforce the individual's expectations about how others will act. In other words, the standardization of a practice can enhance the creation of common ground. It would not be the development of complex mental abilities to enable the establishment of a normatively charged cooperative practice, but the other way around, so that the adequacy to a consolidated, normatively charged practice can favor the development of mental abilities (Zawidzki 2013).

The evolutionary implications of this idea can be very significant. On the one hand, there is no reason to assume that chimps from other communities (were they theoretically moved to a site such as Taï) would not be able to learn cooperative hunting within the timeline of a generation or two. On the other hand, the fact that a simple coordination game can grow in complexity and stability of structure and payoff with the simple influence of a different environment could be considered of interest in the study of how cooperation evolved in early hominids. Our hominid

ancestors could have been well capable of partaking in a simple coordination game capable of consolidating into a more complex practice, similarly to hunting among chimpanzees. Favoring the development of reciprocal expectations about how the agents involved will act may contribute in the long run to the development of the necessary cognitive abilities necessary to achieving fully-realized common ground. The consolidation of the joint practice might be a fitting candidate to justify the evolution of the mental faculties of the hominid lineage into the high-level cognitive capacities of mature human agents.

One could argue that the difference in sophistication in hunting among chimps may not warrant the belief that hunting in the hominid lineage evolved similarly, because more sophisticated hunting might not be the decisive factor that characterized the evolution of cooperation among hominids. It is debatable whether hunting or scavenging were the primary dietary sources of early hominids (Stanford 1996). Furthermore, the environmental changes that occurred during the Oldowan era (~2.5–1.6 million years ago), which is thought to be the period wherein early hominids started cooperating more substantially, were mostly deforestation and the expansion of savannas (Peter Gärdenfors 2013). Therefore, the role played by the forest cover in cooperative hunting among Taï chimpanzees would most probably not apply in the case of early hominin collective practices.

These objections are not too threatening for my general argument. Adapting to different environmental conditions than the ones of Taï chimpanzees would still favor the development of the cognitive abilities necessary to achieve common ground from the consolidation of the practice. In principle, the consolidation of a coordination game underlying a shared practice and its progressive specialization due to environmental pressure could nonetheless stand as an evolutionary factor regardless of what the exact practice is. What matters would be that the expectations of the individuals involved in the joint action towards what the others are going to do would be grounded in the perceptually shared focal points of the practice. The very evidence that chimpanzees can create a stable practice and adapt themselves to assuming specified roles to carry the practice out efficiently suggests that our hominid ancestors would be able to do so as well, regardless of the specific environmental or dietary changes that prompted them to adapt and evolve.

7 Conclusion

In this paper, I described how what I called “proto-common ground”, a theoretical prerequisite of common ground, based on the perceived awareness of others, can be found in cooperative hunting among the chimpanzees of the Taï forest.

I suggested that this activity, which relies on the individual chimpanzees' embodied, pre-reflective skills, can be considered pointing to the possibility that the consolidation of a practice can enhance the predictability of others' behavior over time. If chimpanzees are able to understand what others are aware of and act upon this awareness in complex settings, a theoretical prerequisite can be considered as an evolutionary precursor of common ground already achievable for early hominids. The possibility that the consolidation of a shared practice might strengthen the individual's capacity for social cognition and mutual awareness could be considered an important step in the evolution of joint practices, from basic coordination games all the way up to communication, that is often overlooked by theories of joint action that focus on complex mental states such as shared intentionality.

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