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Interaction and Ostension: The myth of 4th order Intentionality

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Abstract

Research in comparative cognition on allegedly uniquely human capacities considers the identification of these human capacities in other species as one of their main points of inquiry. Capacities are applied in their theoretical descriptions to promising empirical data. The conclusion then often is that even though, on a behavioural level, the human and nonhuman cases appear related, on a cognitive level there is no relation whatsoever because the underlying cognitive states diverge in quality. This result seems dissatisfying for two reasons: (1) there is ample empirical evidence that suggests the presence of the capacities in other species, and (2) the claim that the underlying states diverge often hinges on the reference to the theoretical definitions of these capacities only. This opinion piece focuses on the capacity of ostensive intentional communication to demonstrate that the original theoretical analyses often are not befitting a comparative endeavour and should therefore not be used as pivotal reference within comparative research. An outlook will be provided on more promising approaches to identifying ostensive communication, namely an interactive approach that will allow for ostension to not be perceived as a one-turn signalling behaviour, but as interactive, with the possibility of being established in a trial-and-error manner.

Keywords: Ostension, intentional communication, comparative cognition, interactional approaches, negotiation

1. Introduction

In theoretically oriented investigations on cognition and communication it is often assumed that ostensive intentional communication, shared intentionality and related capacities are uniquely human. It is the evolved human cognition allowing for these capacities and with that what is often labelled the human interaction engine to occur [1-3]. In a recent study though, Genty et al. [4] discuss convincing evidence on great apes displaying shared intentionality in interaction. In several observed instances, bonobo subjects engaged in joint activities such as grooming and play, until one of the partners seized to participate. Individuals then reengaged the partner through the use of gestures, vocalisations, gazing behaviour and body postures, demonstrating a sense of commitment, a requisite for shared intentionality to occur. In another investigation, researchers discuss comparable examples as being potential instances of interactive repair [5], an integral part of human joint action, in which communicative trouble is fixed through elaboration and modification by the communicator or a signalling of misunderstanding by the recipient. Furthermore, a growing number of studies provide evidence for intentional communication in nonhuman animals, including great apes, baboons, corvids and canids [6-12]. These species displayed goal-oriented (e.g., stopping when goal is achieved, elaboration and persistence until goal is achieved) and audience-directed signalling (e.g., gazing, signalling only in the presence of an audience, production of attention-getters towards the audience). Some empirical evidence even demonstrates the use [13-16] and comprehension [17, 18] of attention-getters by great ape subjects in communicative interactions. Attention-getters are necessary for ostension to occur. Additionally, complex social learning has been found in great apes [19], including potential learning and flexibility in the acquisition of communicative signals in ontogeny [20-22] hinting at a cultural, not evolutionarily hardwired, flexible use of communicative signals ([23], see also the great ape language studies in the 1960s and 1970s on the acquisition of arbitrary communicative signals through learning [24, 25]). Last but not least, research suggests that great apes do understand the minds of others, at least implicitly [26, 27], displaying expectations and anticipation of others actions, based on previous action. What do all these findings suggest? Perhaps other species, and in particular other great apes, do display allegedly uniquely human capacities such as shared intentionality and ostensive intentional communication? It is difficult to tackle these questions in a satisfying manner, because, when taking into account the theoretical descriptions of these capacities, the answers are clear: Other species do not display capacities such as ostensive intentional communication. The reason for this obvious answer is that the capacities, often originally defined in philosophy, linguistics and developmental psychology, rely solely on cognitive complexity to describe its occurrence on a proximate level. This leads to descriptions of these capacities to reach levels of cognitive complexity that most likely cannot be found in any other species, such as 4th-order intentionality and recursive mindreading [28, 29]. Given that the capacities' descriptions therefore exclude other species from displaying the capacities, it is difficult to even address the evidence

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mentioned above in any informative way, as it is excluded in an almost a priori-manner. As a consequence, discussions about the potential presence of these capacities in nonhuman animals remain stagnant with no consensus in sight, with two camps of opinions facing each other: Camp One insisting on the presence of the capacity in nonhuman animals based on suggestive empirical evidence (e.g.,[4, 30, 31]) and Camp Two denying animals the capacity by referring to the theoretical descriptions of the capacity (e.g.,[2, 32, 33]).

In the following, I will first examine the issues arising from the application of the traditional descriptions of the capacities and then focus on the capacity of ostensive intentional communication (i.e., the overt communication of one's intentions to a particular audience) to analyse whether these issues are resulting from the way the capacity was originally analysed in the theoretical sciences. I will then suggest ways in which the original analyses are not befitting for the current comparative endeavour and therefore cannot move the discussions at hand forward: they relied on cases that are unique to a certain westernised human environment and are dogmatic with regards to the kind of proximate mechanisms that should be involved. In the last part, I will provide an outlook on a more promising approach to identifying ostensive intentional communication in nonhuman animals, namely an interactive approach: It is the above-mentioned interaction engine that allows for ostension to not be perceived as an all or nothing capacity, but as one that can be displayed in a trial-and-error manner.

2. The a- priori exclusion of evidence and the problem of the paradigm of cognitive complexity

Research in comparative cognition and related investigations into the evolution of the emergence of allegedly uniquely human capacities considers the identification of these human capacities in other species as one of their main points of inquiry. Capacities such as ostensive intentional communication or shared intentionality are applied in their full-blown traditional theoretical definitions and descriptions to promising empirical data, predominantly in other primate species. The conclusion then ever so often is that even though, on a behavioural level the human and nonhuman primate cases may appear related, on a cognitive level there is no relation whatsoever. This conclusion is reached, because the discussions often rely on the following reasoning when facing potential novel empirical evidence for the capacity in a species:

1.) Capacity X (e.g., intentional communication) is theoretically defined (e.g., the original elaborations of Grice [34] and Sperber and Wilson [3]) with reference to cognitively complex mechanism/state A (e.g., for intentional communication: ostension in the form of 4th order intentionality, i.e., meta-intentions), in order to explain the behaviourally complex output I (e.g., a typical instance of intentional communication in human interaction);
2.) Research has shown that other species cannot display the cognitive complexity A in question as defined in theoretical investigations,

3.) Therefore, other species do not have capacity X.

Note that 3.) follows independently of the empirical evidence provided, if the evidence is no direct evidence for the necessary mechanism or state A to be present. For instance, intentional communication in humans is behaviourally characterised as a multimodal, flexible and dynamic back-and-forth interaction, with speech being accompanied by signals of other modalities such as gaze and gestures. The latter highlight the concrete communicative intentions of the producer (i.e., they are ostensive signals), while the former provides the information to be communicated. When investigating intentional communication in nonhuman great apes though, no matter how behaviourally complex, i.e., multimodal and flexible an action is discovered, this complex interaction is no evidence for intentional communication in the human, ostensive sense. The reason being that it is commonly established that the species cannot display recursive mindreading up to 4th order intentionality. Issues of such nature are not new to comparative cognition as a closer analysis of the investigations into great ape pointing behaviour by Leavens and colleagues [35] showed. In this line of research declarative-informative gesturing (i.e., pointing) is taken to be the behaviour that necessarily and sufficiently provides evidence for an individual to have a theory of mind. Given that most research indicates that pointing gestures are not understood by great apes, it is argued that great apes do not have a theory of mind. No matter what other evidence one could find about the potential appreciation of great apes of other minds, given that they lack the capacity to understand pointing, for a very long time it was argued that great apes simply do not understand the minds of others. As Leavens and colleagues [35] rightly point out, the connection between pointing and complex mental states are described as one of necessary and sufficient conditions, namely in the shape of a biconditional: p ⇔ q: p is the case if and only if q is the case. We can only label great apes as mind readers if and only if they display and understand pointing behaviour. The same biconditional reasoning holds for ostensive intentional communication, as I will discuss in the next section.

3. Ostensive intentional communication

The capacity of communicating ostensively and intentionally is being treated with the reasoning described above. The focus though lies on the notion of *ostension*. It is generally accepted that a number of species produce signals intentionally (e.g., for great apes [12, 36-38], for baboons [11], for corvids [9]; for canids [6, 10]) but it is not this quality that makes human communication special. It is rather the overt, i.e., ostensive, nature that, so goes the traditional claim, makes it unique [33, 39]. We openly share particular information with a particular recipient. We, in fact, *show them* that we intend to inform *them* about something particular. This overt showing of our informative intention is necessary, according to Sperber and Wilson [3] with reference to Grice [34], because otherwise recipients would not focus in on the speaker in a world full of information. Ostension described in such a manner presents one way of directing and drawing in a recipient's attention. Given this rather

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simple, straightforward function of ostension, the traditional analysis of what cognitively is necessary and sufficient for ostension to occur, appears at the very least questionable [40, 41]: For a speaker to overtly communicate, 4th order intentionality needs to be present on a representational level. The speaker wants the recipient to know that the speaker wants the recipient to know that x, whereas x is any given information to be communicated. On a behavioural level this meta-intention triggers the display of ostensive signals, such as gestures and establishing eye-contact, which make recipients focus on relevant elements in the environment and on the speaker. That is, while vocal utterances may deliver the information the communicator intends to share, other signal modalities direct and grab the audience's attention.

It is this link then, between ostension, the display of ostensive signals and 4th order intentionality that causes issues for the evaluation of nonhuman animal communication. Discussions concerning the evaluation of in particular great ape communication divide researchers in two camps, with Camp One pointing out the shared multimodal nature of ostensive communication at least on a behavioural level between human and nonhuman great apes (e.g., [17, 42]), including the importance of eye gaze in communicative interactions [43, 44]. Given these behavioural similarities between human and nonhuman great apes, it seems not a far-fetched suggestion that the latter may count as ostensive communicators, particularly in light of research demonstrating the intentionally flexible nature of their gestural and vocal communication [45, 46] and great apes' possession of at least basic insights into the minds of others [27].

Camp 2 strongly opposes such a sentiment. Researchers such as Scott-Phillips [2, 32] argue against the interpretation of great ape multimodal, flexible and intentional signal use as indicators for the presence of ostensive signals and with that an overt nature of the communicative interaction. Camp 2 emphasises that even though the gestures and eye gaze behaviours found in great apes can be and are used to express ostension in humans, no matter how extensively we were to investigate the uses of these signals, "it will remain the case that eye gaze, pointing, and related behaviours are, formally, neither necessary nor sufficient" ([47], p. 235) for ostensive intentional communication, because all these signals are also used in non-ostensive ways. What is necessary and sufficient for ostensive communication, instead, is the presence of the 4th order intention of the form "S wants R to know that S wants R to know that x." Scott-Phillips perceives this 4th order intentionality requirement as a biconditional relationship, just as Leavens et al. [35] discussed for the case of pointing behaviour: An instance of communicative interaction is only an instance of ostensive communication (p) if and only if 4th order intentionality (q) is in place: $p \Leftrightarrow q$. Following from that, if 4th order intentionality is absent in great apes, so are ostensive signals. But therefore, also, just as Leavens and colleagues pointed out, progress with regards to discussing the empirical findings cannot be made, because it is difficult if not impossible to falsify the 4th order intentionality within this biconditional relation. I will discuss this important point in the next section, under 4b.

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Note that at this point, proponents of Camp One may propose two diverging reasonings to respond to Camp Two: either they could argue that given the behavioural evidence for ostension in other species, they also display 4th order intentionality cognition, or proponents could claim that the cognitive requirements for ostensive intentional communication in humans are cognitively inflated by theoreticians not just for other species but also for pre-verbal human babies and everyday adult communication. I take it that evidence for 4th order intentionality in other species is non-existent and therefore the majority of Camp One may ascribe to the latter response.

4. Provision of necessary and sufficient descriptions of involved cognitive mechanisms vs. a comparative approach

One issue with the identification of capacities such as ostensive intentional communication in nonhuman animals lies with the methodological proceeding of such an investigation and more concretely, is deeply rooted in the capacities' theoretical descriptions. The description of intentional communication was originally stipulated in the field of the philosophy of language and is often applied to empirical investigations as a checklist of criteria for the identification in other animals (e.g., [37, 48]). The original descriptions themselves though are the result of theoretical analyses of a very different research endeavour. That is, the capacities were analysed for a very different purpose than a comparative investigation, which in turn makes these descriptions problematic for the later investigation. In what follows, I will discuss the two main inadequacies of the original theoretical investigation of intentional communication when being applied to comparative cognition and what lessons can be learned from it for the endeavour of identifying ostensive intentional communication and other capacities in nonhuman animals.

a) Ecological validity and general relevance of the original theoretical analysis

For anyone daring to go back to the first analysis of intentional communication, namely Grice's seminal article called *Meaning* [34], but also to what is probably its most influential follow-up, Sperber and Wilson's Relevance Theory [3], the character of theoretical investigation becomes apparent right away even to the non-philosopher. Through examples of human utterances and everyday interactions, in a step-by-step manner, necessary and sufficient conditions are developed to exclude so-called covert communication (i.e., non-overt) and identify clear-cut cases of ostensive communication.

The cases used as examples to derive necessary and sufficient cognitive conditions from, are either examples situated in a very specific kind of human environment, socially complex relations, urban and westernized, and full of human specific artefacts (e.g., photographs, paintings). Take for instance the

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following example from Grice [34], in which he aims to line out the difference between covert and overt communication:

(1) "I show Mr. X a photograph of Mr. Y displaying undue familiarity to Mrs. X."

Vs.

"I draw a picture of Mr. Y behaving in this manner and show it to Mr. X."

These example cases that are presented as instances of covert or overt intentional communication are as already mentioned, specific to a certain kind of human, western, industrialized environment. The presence of human artifacts that are used to communicate messages complicates scenarios by adding a number of possibilities on how an individual can hide one's intentions (i.e., not communicating overtly), and in turn adds up layers of cognitive complexity to exclude these cases from being interpreted as overt. Those layers of complexity may not be necessary in communities with a lack of such artifacts and social complexity. In an environment not part of a certain kind of human cultural reality, complex social scenarios as described above may lack at the very least ecological validity and may therefore not be observable. Following from that, it will be difficult to find a level of comparability for these examples and adequate cases in other species, not because the capacity may or may not be present in the subjects, but because of a lack of common ground with regards to the reality of the species. This leads to an inadequacy of contexts to be compared [35] and to researchers having to come up with creative experiments to even remotely match the human scenarios.

Furthermore, very many cases only arise from the presence and use of human language. That is, metaphors, implicatures and written language broaden the possibilities of communicating covert and overt, and with that again complicate possible cognition to be in place to display overt communication:

(2) Peter: «What do you intend to do today?»

Mary: «I have a terrible headache.»

This example discussed by Sperber and Wilson [3], is an example of an implicature, in which Mary means to communicate more than what is actually said. It is up to Peter to infer the full meaning of Mary's utterance. Implicatures, given that they are used regularly in human communication, are counted as instances of overt communication, if to both communicators all necessary background information is available in order to understand the implicature. That is, Mary and Peter need to be aware of the common ground, i.e., Peter needs to know that Mary intends to stay home, but does not want to hurt his feelings, and Peter also needs to know that Mary knows that he knows that she does not want to hurt his feelings but that she does not want to go out today and so on. Implicatures require a complex amount of awareness of the other's mind and background. But it is because of the implicature that this complex awareness is necessary. It is because of the complexity of human language that overtness in the example above requires such metacognitive capacities. While for this example again there is a clear lack of ecological validity, the implications go further than that: in a

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community without complex signal systems, ostension may be cognitively easier to achieve, and with that some steps in the original analysis of ostensive communication are just not necessary to take.

b) The discrepancy between an endeavour aiming for necessary and sufficient conditions of capacities vs. an endeavour of identifying core representational cases of capacities

The endeavour of identifying capacities in nonhuman animals is a comparative endeavour, and therefore requires examples designed in a comparative, ecologically valid manner. It also aims to identify core examples for the capacities independently of the types of mechanisms involved. That is, whether the mechanisms that foster a capacity's emergence and occurrence are proximate (e.g., cognitive), ultimate or historical is only to an extent of having to identify and specify these mechanisms in the species of relevance. The emphasis of the investigation rather lies with finding cases that are representative examples of the capacities, not identifying the culmination of cognitive complexity within these capacities. As opposed to that the original conceptual analyses of intentional communication were endeavours of identifying the capacity's necessary and sufficient conditions with regards to the *cognition* that needs to be in place. Given that, the analyses were conducted within the methodological paradigm of cognitive complexity, i.e., describing complex behaviour and situations with complex cognition. In itself that is not a problematic methodological premise. Issues arise though, when one aims to find necessary and sufficient conditions within this paradigm of cognitive complexity and interprets the identified set of necessary and sufficient conditions for a capacity to occur as the only potential set of conditions: Necessary and sufficient conditions can only be identified within a certain paradigm or theory (i.e., within certain assumptions). That is, necessary and sufficient conditions cannot exclude counterfactuals, in the sense of excluding other potential options outside of the paradigm [49, 50]. If for instance 4th order intentionality is sufficient for ostensive intentional communication to occur, if 4th order intentionality was not present, ostensive intentional communication could have still occurred in other ways, with other mechanisms and states in place, such as for instance emotional (see next sections) or attentional states. We cannot falsify the sufficiency of 4th order intentionality within a paradigm of cognitive complexity, because it is within this paradigm that this sufficiency was established. Indeed, the assumption of providing the only possible set of necessary and sufficient conditions for ostensive intentional communication leads to a whole group of investigations generating evidence against 4th order intentionality involved in ostension being broadly ignored. These investigations question the validity of studies seemingly underlining the complex nature of comprehension of ostension, by providing a different experimental set-up for human infant subjects, demonstrating the potentiality that ostensive signals in humans do not have any special, additional social meaning and do not amount to more than attention-getting of the hearer. For instance, in two recent studies [51, 52], researchers provided an experimental set-up to address the claim that human infants follow their caretakers' gaze, if this gaze presents an ostensive signal, i.e., the caretakers display communicative intentions with them. Gazing is generally described

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as an ostensive signal, involving communicative intentions in the signaller, if it occurs in combination with for instance infant-directed speech [53]. In the two studies (the latter replicated the results of the former), infants followed the adult's gaze equally reliably independently of whether the adult produced ostensive or non-ostensive gaze (i.e., an attention-getter not involving communicative intentions). This result implies that firstly, young children interpret attention-getters and ostensive signals in the same way, and secondly, independently of high-level meta-intentions involved, humans (and perhaps other species), use signals such as gazing as a source of information.

Issues applying the theoretical analyses of ostensive intentional communication to empirical investigations already arose in the 1970s and 1980s. Developmental research during that time (in particular [54, 55]) investigated the cognitive and social development necessary for the occurrence of full-blown intentional communication in pre-verbal children. When, researchers asked, do children begin to actively seek out adults to fulfil their own goals and desires, and with that start to understand their communicative signals as instruments to affect the adult's intentions? The investigations focused on gestures, gazing, pre-verbal vocalisations and the child's interactions with objects of interest in correlation with the adult's behaviour. While Bates [54, 56] focused on declarative and imperative gestures, and therefore later on became the source of inspiration for one of the first lists of criteria to identify intentional communication in great ape gesturing by Leavens and colleagues [8], it was in particular Golinkoff [55] who pursued other ways than the scenarios described in the theoretical analyses to identify intentional communication in the preverbal children by emphasising the importance of *elaboration* behaviour (or *negotiation* as Golinkoff coined it). Elaboration plays a central role in pre-verbal children to grab the audience's attention and direct this attention, it was argued. Indeed, this described function of elaboration very much equals the function of ostension described in the theoretical analyses discussed above. Golinkoff furthermore claimed that children are capable to reach a common outcome, such as playing with an adult, through several trial-and-error attempts of communicating, an important observation I will discuss in section 5.

It seems then highly problematic to go on feeding into discussions that are only founded in the reference to the traditional theoretical descriptions. Even though Grice provided a very influential analysis of ostensive intentional communication, the conclusions of the theoretical investigations are not truths put in stone, but rather endeavours that require constant adaptation to novel empirical findings [57]. This is only possible though if the descriptions do not presuppose certain cognitive requirements that cannot be falsified. This goes as much for intentional communication as it goes for other capacities. Papadopoulos [58], for instance, demonstrates that Tomasello's Roleplaying Model of shared intentionality [59], from which it is followed that a level of abstraction is required, is in no way the only possible paradigm under which joint actions could arise (see also [4]). Papadopoulos argues for a normative approach to shared intentionality instead. Following Andrews' [60] analysis of

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minimal criteria for social norms, he claims that other species may display shared intentionality by following implicit social norms that amount to implicit behavioural obligations.

In contrast, Tomasello relies on Bratman's [61] view that shared intentions are intentions to execute a plan with partners: A commitment to mutual support is in place. Tomasello argues [39] that this commitment implies that the cooperative partners participate in shared intentionality by trying to achieve a concrete common goal. The common goal can be achieved with a *plan of action*. This plan of action can only be understood by all partners through what Tomasello calls "third-personal perspective taking" ([39], p. 55). What he means by that is that the involved individuals are required to abstract away from each partners' perspective towards a general objective. With this abstraction in place, participants can take on different roles to achieve the shared goal. In fact, they could, in theory, take on any of the roles based on the abstraction. For the abstraction to be cognitively manifested, individuals have to take a bird's eye perspective of the task, i.e., a level of abstraction that most likely cannot be reached by any other species than humans. Taking such a stance would imply that chimpanzee hunting [62] is only a case of shared intentionality if the data is interpreted as chimpanzees taking on different roles to successfully hunt the prey, i.e., one individual being the chaser, another one being the catcher etc. It is again here, that because of the absence of the required mental complexity that chimpanzee hunting cannot be interpreted as a joint action. The planning and birds-eye perspective character clearly may make collaborative actions with shared goals more efficient and in a complex environment with very many potential roles and possible actions, it may even be necessary for success, but all of this is not a given in a less complex social set-up.

From a theoretical perspective then capacities such as ostensive intentional communication and shared intentionality require re-analysis given the purpose at hand, namely a comparative investigation, with examples used for the analysis that are relevant for very many different species and paradigmatically open with regard to the cognitive mechanisms involved. In the current absence of such a re-analysis, it is on an empirical level that in particular interactional research paradigms can move the discussions about the presence of the capacities in other species forward.

5. Ways to move forward: interactional paradigms and letting go of describing ostension as a one-turn success story

As argued in the previous section, it is central for the discussions surrounding the capacities to reconsider the traditional descriptions of the capacities. That does not mean to discard these descriptions altogether, but to re-analyse and re-formulate the descriptions not just with regards to the examples used in the theoretical analysis but also with regards to novel empirical findings. The later point is particularly important as research has again and again highlighted the central role of other proximate mechanisms, next to cognitive complex ones, such as emotional states in communicative

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interactions and learning [63-65]. Luckily, in particular with regards to a non-dogmatic approach to the cognitive mechanisms involved, there is no lack of alternative routes of investigation. One such alternative is the realm of interactional approaches. Interactional approaches, such as discourse analysis, may offer ways of explaining the production and understanding of ostension in communication outside of the paradigm of cognitive complexity, because they tend to be agnostic about the potential cognitive complexity at the outset of the investigation [66]. That is, they do not stipulate complexity of cognition, and while cognitive complexity can be inferred from the observed complexity and flexibility of behaviour, it is not this cognitive complexity that presents an a priori exclusion criterion within an investigation. The value of applying interactional paradigms to investigating animal communication in a comparative framework has been discussed in the past, most prominently in Shanker & King's proposal on interaction as "dynamic dance" between communicators [67, 68]. Two major issues, though, were brought forward by critiques: The first issue concerned the lack of methodological clarity, the second issue the almost biased focus on great apes [69]: Shanker and King discussed anecdotes of great ape communication only, without providing suggestions on how to statistically measure the interactions. Regarding the first issue, recent applications of interactional paradigms to animal interactions have proofed successful in providing potential blueprints for the statistical measurability of the interactions (e.g. [5]). Regarding the second issue, it is and should be essential for any comparative investigation into communicative interactions to consider a broad spectrum of species to gain insights into the correlation between interaction, ostension, cognition and lifestyle of a species. For instance, see discussion below on wolf interactions, ostension may require tolerance in communicative partners and tolerance in turn may only come about within certain social realities such as a cooperative lifestyle. This correlation can only be studied by taking into account a number of species with different social realities.

I argue that within an interactional paradigm, ostension, i.e., the open showing of one's intention to inform about something in particular, can be identified as an interactional achievement. Within such an approach one may first identify relevant behaviour in relevant contexts, and then, afterwards stipulate what cognition is required to be in place. Going back to the original analyses of intentional communication, it is interesting to see the absence of examples including more complex back-and-forth interactions, even though Grice [70] himself stated: "Our talk exchanges do not normally consist of a succession of disconnected remarks and would not be rational if they did." (p. 45). Ostensive intentional communication implies rationally interconnected back-and-forths, i.e., based on the signaller's actions the recipient reacts in a certain, appropriate way. That is, the very presence of ostensive intentional communication means the presence of interaction.

How come then that ostension is generally treated as a one-turn communicative act, with a signaller producing ostensive signals that are successfully understood by the recipient? In experimental set-ups aiming to investigate whether other great apes understand ostensive signals such as pointing,

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experimenters very often produce ostensive signals in a non-interactional manner, i.e., with great apes merely observing the experimenter (e.g., [71]) and very little opportunities to create a common ground and understanding for the experimenter's intentions. This though may be the key to investigating ostension in nonhuman animals that do not share a long history with human communicators.

One proposal of a befitting context for the investigation of ostension in the realm of interactions are contexts of conflict negotiation, i.e., communicative negotiation of goals and intentions in order to avoid conflicts from escalating [72]: When a disagreement between two or more individuals is on the brink of entering a conflict, it is essential to avoid misunderstandings, by precisely and openly showing what one's intentions are and with that what one intends to communicate. This holds true for all participants in the interaction. An open negotiation takes place [73, 74]. Defined as such, we argued that conflict negotiations are paradigmatic cases of overt communication, in which the ostensive character of a communicative behaviour can be acquired through several back-and-forth interactions. If an individual fails to communicate their intentions openly in the first place and/or the recipient fails to grasp the intentions, individuals may be successful in establishing the overtness of their intentions in several turns, by elaboration through employment of different communicative means, based on the recipient's reaction. A communicator could fail to communicate openly for two main, not mutually exclusive reasons: Firstly, the communicator cannot communicate their intentions openly, because of dominance relations and with that a lack of tolerance. Secondly, the communicator cannot communicate openly due to cognitive limitations and/or limitations of the signalling repertoire to express their intentions clearly, directly and openly. Importantly, it is this description of ostension as a trial-and-error endeavour that diverges from the traditional treatment of ostension in experimental and observational set-ups in comparative investigations. Human animals, due to the efficient, semantic character of human language, may be trained and capable to communicate their intentions and information successfully and understandably in one utterance [23], but this is no necessity for ostension to be present. Following from this, the important shift for future investigations is to move away from the expectation that producing ostensive signals always is required to be well-directed and successful. In a non-semantically determined signal system, more space for misunderstandings is a given, and displays of communicative precision may be rare with regards to ostension.

As an experiment conducted by Cartmill & Byrne [75, 76] illustrates, a trial-and-error display of ostension may then imply primarily elaboration behaviour of the communicators. In the study, captive orangutans were tested on their communicative strategies. Desirable and undesirable food was displayed in front of the individuals, with the expectation that they would request the desirable food by using a gesture. The experimenter then either gave the subjects the desirable, half of the desirable or the undesirable food. In cases where they received only half of the desirable food, subjects repeated the gesture they initially used, but in cases where they merely received the undesirable food, subjects changed gestures, i.e., they elaborated their communicative strategies. Therefore, it appears that the

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subjects evaluated their level of success regarding the goal intended to achieve by producing the signal, and modified their communicative behaviour flexibly, depending on the experimenter's reactions. That is, it is not merely displayed persistence by the subject after failing to achieve their goal by repeating a signal, but a flexible response depending on the recipient's behaviour by using different signals [40]. The signallers adapted their strategy to inform the experimenter about the kind of food they want through several trials of directing the experimenter's attention towards the object (i.e., the desirable food) they intend the experimenter to focus on.

This trial-and-error perception of ostension goes in line with empirical and theoretical research (e.g., [18, 77, 78]) demonstrating the partial understanding of ostension in great apes [79]: chimpanzees appear to form communicative expectations on the basis of ostensive signals such as gazing, but unlike human infants and dogs, they do not use the experimenter's ostensive gazing behaviour to infer an intended referent (but see [80]). Furthermore, subjects that had richer experiences with human interactions in the past, paid more attention to the object pointed out by the caregiver's ostensive cues, than less experienced subjects [18, 81, 82]. Additionally, encultured great apes appear to use pointing gestures as ostensive signals, i.e., with social intentions [83]. This suggests that, firstly, exposure and with that learning may lead to great apes better understanding ostensive signals and secondly, understanding ostensive signals is not an all or nothing capacity, in particular in non-domesticated nonhuman animal species.

The obvious shortcomings of Cartmill and Byrne's experiment for the research question at hand is the non-natural set-up, with a human communicator as an audience, which may allow for only limited insights into the interactional capacities of other species. Conflict negotiation, as opposed to that, allows for ecologically more valid scenarios. Promising situations for negotiations are contexts in which subjects may display diverging goals but intend to avoid a conflict from occurring or escalating, such as food related contexts or joint actions such as joint travels or playing. Within, for instance, feeding contexts in which two or more individuals intend to eat the remaining food, two interactional ways can lead to conflict avoidance: One can either covertly interact with the other individual that aims to take the food, by not openly communicating that one is having the same intentions, avoiding the conflict, but perhaps also failing to achieve one's goals; or one communicates one's intention to eat the food overtly, and, in order to avoid conflict, also overtly communicates one's affiliative intentions.

Another promising context are consortship scenarios in wild chimpanzees. In these scenarios, male chimpanzees escort females in oestrous away from the group [84]. Research has shown that chimpanzee males produce an impressive number of different gestures in a flexible manner to communicate their goals to the female in order to not be detected by other members of the group, but also to display a cooperative intention towards the female to prevent her from screaming and again, in turn, to prevent detection by other group members [85]. It may be in such a cooperative set-up that

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precise and open communication of one's intentions (affiliative intentions, intentions to travel, intentions to share food) is necessary to keep the consortship going.

Consortship and feeding contexts have in common the overarching goal of conflict avoidance, in particular by the lower ranking individuals. Additionally, in consortship scenarios male chimpanzees want to avoid conflict, even though they are higher ranking than females. Given that a conflict is at stake, strategies and success to openly show one's intentions will vary from case to case and even from turn to turn, depending on how likely the conflict is to occur. Within a trial-and-error treatment of ostension, individuals may fail to communicate overtly to avoid aggression. Interestingly, the alternation between covert and overt communication is in itself an acknowledged measure for the presence of ostension in a species [47]. In negotiation scenarios investigators should therefore focus on the following questions for each observed interactive turn: How openly, i.e., how attentive are individuals to the communicative partner? Do they face the partner (more overt), or do they turn away when communicating (more covert)? Do they communicate at all (more overt) or do they display waiting behaviour (more covert)? What signals do they use, when communicating? Do the signals have a clear, informative meaning (more overt) or are the signals mere attention getters (more covert). Given the overall goal of conflict avoidance, individuals will pursuit different sub-goals when interacting, such as aiming to demonstrate affiliative intentions or trying to intimidate the conspecific. For each interactive turn, elaboration of multimodal signals is essential for the communication to count as overt, with signals with an informative meaning in line with the subgoals (e.g., food calls in primates, begging in dogs, leaf clipping gestures in chimpanzees) being produced in combination with signals that serve as attention getters and directors (e.g., gazing behaviour; certain facial expressions etc.).

Relevant examples can also be found in other species. For instance, research in wolves has shown that within feeding contexts related to food sharing, interactions are openly directed to the conspecific, with flexible uses of multiple vocal and bodily signals [86]: Dale and colleagues conducted experiments in which captive wolves and dogs faced two different food sharing paradigms: a group carcass feeding situation, in which a carcass was placed in the enclosure and individuals had to negotiate access to the carcass amongst each other, and a dyadic set-up, in which food in a plastic bowl was presented to the individuals. Interestingly, in both paradigms, wolves displayed more persistence behaviour than dogs, with longer interactions amongst individuals. Particularly interesting is the fact that in the dyadic set-ups, high dominance rank distance between the individuals resulted in peaceful interactions in the wolves, even though lower ranking wolf individuals displayed significantly more persistence than low-ranking dogs in the same set-ups. In contrast it is generally assumed that persistence requires high-level tolerance in the communicative partner and therefore should be less present in partners with rank difference [87]. Following from that wolves may display

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high-level tolerance in communicative interactions. Furthermore, wolves seem to be more insisting and with that informative about their goals than dogs. All these points provide evidence for the cooperative and open (and with that potentially ostensive) nature of these interactions. Important to note is that Dale et al. did not analyse all produced communicative behaviours in detail and did not code for the presence elaboration behaviour, but for persistence only. Therefore, more definite conclusions about the presence of the overt character of the interactions cannot be drawn. What the study shows, though, is a promising correlation between tolerance and flexible, potentially ostensive interactions worthy of further investigation.

It is examples like this then that illustrate how interactional approaches that are agnostic towards cognitive processes may generate interesting new data that can fuel the stagnant discussions regarding the identification of capacities such as ostensive intentional communication to move forward. Interactional approaches avoid the usual a priori exclusion arguments as described in this article and are befitting of a comparative research endeavour as they allow for the set-up of paradigmatic situations that are ecologically valid for very many species and focus on multimodality as opposed to language use.

6. Conclusion

I have argued that the traditional descriptions of capacities such as ostensive intentional communication require both a re-analysis on a theoretical level with regards to the examples used in the analysis, with regards to an openness concerning the cognitive states involved and with regards to novel empirical findings suggesting simpler mechanisms such as emotional and attentional states to be present. In the absence of such re-analyses to this date, I argued that empirical investigations for the capacity of ostensive intentional communication should focus on interactional approaches. Within such an interactional approach, and in particular within paradigmatic cases of conflict negotiation, ostension can be established between the communicators on a trial-and-error basis, as opposed to traditional descriptions of ostension as a successful signal production and comprehension within one communicative turn. In signal systems that lack the precision and efficiency of human language, overt communication of one's intentions may present itself more often in the described interactional shape. With this shift towards an interactional approach to ostensive communication and adequate re-analysis of the capacity for comparative purposes, stagnant discussions surrounding the identification of ostension in other species may finally move forward towards a consensus.

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