

Evidence and Interpretation in Great Ape Gestural Communication

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ABSTRACT

Tomasello and colleagues have offered various arguments to explain why apes find the comprehension of pointing difficult. They have argued that: (i) apes fail to understand communicative intentions; (ii) they fail to understand informative, cooperative communication, and (iii) they fail to track the common ground that pointing comprehension requires. In the course of a review of the literature on apes' production and comprehension of pointing, I reject (i) and (ii), and offer a qualified defence of (iii). Drawing on work on expressive communication, I sketch an account of a mechanism by which ape gestural communication may proceed: the showing of expressive and naturally meaningful embodied behaviours. Such gestures are easily interpretable because they present rich evidence for a speaker's message. By contrast, pointing typically provides poor evidence for a speaker's message, which must therefore be inferred from considerations in the interlocutors' common ground. This makes pointing comprehension comparatively difficult.

KEYWORDS: Non-human great apes, Gestural communication, Pointing, Communicative intentions, Expressive communication.

1. Introduction

In recent years, a large literature has been devoted to the finding that while pre-verbal children both produce and understand pointing, non-human great apes

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seem to produce points only for human caregivers, and only after extensive contact with them (for example, Tomasello, 2006, 2008); and captive apes, with experience of human interaction, typically remain poor at understanding pointing (e.g., Tomasello, Call & Gluckman, 1997) – at least in the absence of a more substantial enculturation (Lyn, Russell & Hopkins, 2010). The evidence that they find pointing comprehension difficult is important and intriguing because all great ape species engage in intentional communication similar to human communication (Tomasello & Call, 2007). They gesture to initiate grooming rituals, to request food, sex, or play, to threaten one, and to reconcile in the aftermath of fighting. These gestures are under intentional control (Leavens, Russell & Hopkins, 2005) and, like human language, are used flexibly – with the same gestures used for different communicative goals, and the same goals pursued through different gestures. These similarities have led some to argue that through studying ape gestural communication we can gain insight into the evolutionary origins of language (Tomasello, 2008; Corballis, 2011). At the same time, studying the limitations of apes' gestural communication tells us something about what makes humans cognitively unique.

The findings on apes' difficulty with pointing comprehension have been widely replicated. Consequently, they seem to shed light on a fundamental difference between human pre-verbal cognitive abilities and the cognitive abilities of our nearest living relatives. Partly in light of these findings, philosophers (e.g., Tallis, 2010) and psychologists (e.g., Tomasello, 2008) have argued that the ability to produce and comprehend pointing plays a foundational role in the ontogeny and phylogeny of human social life, language and cognition. Not least this is because, as a triadic and intentionally controlled communicative act, it improves the ability of groups of individuals to coordinate their activities with respect to features of their environment. This coordination facilitates a wide variety of activities, including language acquisition, pedagogy, building and hunting. An explanation of why apes are poor at understanding pointing might therefore contribute substantially to an explanation of why humankind has been able to recast the natural world in its own image, while chimpanzees, bonobos, gorillas and orang-utans are all threatened with extinction.

I divide the paper to come into a number of sections. In section (2) I survey studies of the production of pointing in great apes and young children; and in section (3) give a similar overview of studies of pointing comprehension, and

discuss explanations of why subjects may or may not succeed in different comprehension tasks. In sections (4) and (5), I sketch out a new explanation of why, despite their skill at gestural communication and their ability to produce points, apes may be poor at comprehending pointing. My hypothesis is that for the most part apes succeed in their gestural communication because their gestures are *evidence-rich*. That is, they contain a great deal of information about the messages they are seeking to communicate; and so are easy for conspecifics to interpret. For example, one way in which apes communicate is by showing to one another unintentional behaviours that naturally express the mental states they wish to communicate, and so provide direct evidence for how they should be interpreted. By contrast, the message underlying a point is typically under-determined by the point itself and can be inferred only through tracking of common ground – including previously shared experiences and assumptions of cultural knowledge. Pointing gestures are therefore *evidence-poor* – and so harder to interpret, particularly for individuals (or species) with limited inferential abilities. This difficulty affects comprehension but not production of pointing because while audiences must typically interpret the messages of interlocutors, communicators need not infer their own communicative goals.

2. Production of Pointing in Non-Human Great Apes

Around their first birthday human children can already point flexibly for their caregivers. They use this same gesture to request objects, to inform ignorant others of their location, and to share interest (Behne et al., 2012; Liskowski et al., 2004; 2006; Tomasello, Carpenter & Liskowski, 2007). They also point as a means of referring to absent objects (Liskowski et al., 2009). Moreover, they appear to do all of this spontaneously, without need of training (Matthews et al., 2012). Despite the facility of human children for pointing, there is little evidence that apes point for one another in their natural habitat, although there have been some documented exceptions – for example, when a young bonobo was observed pointing to a bush in which humans were hiding (Veà & Sabater-Pi, 1998). Recently Pika and Mitani (2006, 2009) have argued that chimpanzees of the Ngogo community in Uganda use a ‘directed scratch’ to show others where on their body they wish to be groomed; and that, post-gesture, grooming partners groom at the indicated site – implying the production and comprehension of a recognisably point-like action. However,

while this finding is intriguing and the existence of such referential gesturing by no means implausible, Pika's and Mitani's data is difficult to interpret.¹ Consequently, the question of whether or not apes point in the wild remains open.

Despite the provocative title of Tomasello's 2006 article 'Why don't apes point?', it has been well documented that apes living in captivity do acquire the ability to point for their human caregivers (Call & Tomasello, 1994; Leavens et al., 2004; Zimmermann et al., 2009). Although they do this without explicit training, since wild apes have only rarely been observed to point, the acquisition of pointing in captivity is most likely a consequence of regular encounters with human pointing. This exposure occurs when, for example, zookeepers point to ask apes to retrieve foreign objects from their enclosure, in exchange for food. Setting aside for now the question of whether, and to what extent, apes comprehend the precise referential content of their keepers' gestures, numerous apes have acquired the ability to produce points by directing their extended finger or arm at an object while looking communicatively towards a human interlocutor.

The most well documented cases of captive apes producing intentional pointing gestures are found in chimpanzees (the most studied of any ape species), who point for humans to request food (Leavens & Hopkins, 1998; Leavens et al., 1996, 2004). Bonobos and orang-utans have also been shown to point for food (Zimmermann et al., 2009). However, unlike pre-verbal human infants, adult chimpanzees do not point to request absent objects (Liszkowski, Schäfer, Carpenter & Tomasello, 2009) – suggesting that in comparison to children their ability to point to communicate referentially is somewhat limited.

A fairly common claim (e.g. Tomasello, 2008) has been that while children point for various motives, apes point only to request. While it may be true that apes don't often gesture spontaneously as a means of sharing information about

¹ In particular, Pika and Mitani (2006, 2009) argue that the directed scratch cannot be explained by any lower-level, non-communicative, account – for example, by the hypothesis that individuals are scratching a parasite, to which the other then attends – because the directed scratch is used primarily between high-ranking males. However, no explanation is given of why – if this scratch is communicative – it should occur predominantly in this type of dyad; and non-communicative explanations are consistent with this pattern. For example, it may be that ascension to a high rank is facilitated by skillful grooming, which is often used as a means of forging political allegiances, and that the most skilled groomers are those who are good at determining when their grooming partners are bothered by parasites.

the world, they do point to make indirect requests (which might sometimes be glossed as informative acts). For example, Call and Tomasello (1994) showed that human-reared orang-utans pointed to indicate the location of a tool that a human experimenter could then use to obtain food for them. Using the same paradigm, Zimmermann et al. (2009) showed that captive mother-reared orang-utans and bonobos pointed for the same reason. Pedersen et al. (2011) have reported that enculturated bonobos (including Kanzi and Panbanisha) point both to share interest in objects, and to inform their human interlocutors. While captive apes may sometimes point informatively, Kanzi and Panbanisha are extraordinary and unusual apes, having been human-reared and language-trained since birth. Consequently their behaviour may not generalise to other apes.

Despite Tomasello's recent claim that "there is not a single reliable observation, by any scientist anywhere, of one ape pointing for another" (Tomasello, 2006, p.507), such evidence has now emerged – from within his own group in Leipzig. Bimbo, an adult male orang-utan, was observed to point for other orang-utans in a token exchange task (Pelé, Dufour, Thierry & Call, 2009). In this task, individual orang-utans (and bonobos and chimpanzees) were trained to exchange different sets of tokens for food. Pairs of conspecifics were then each given a set of tokens containing some that were valuable to themselves, some that were valuable to a partner, and some that were valuable to neither. They were then given the opportunity to exchange tokens with one another. During exchanges, Bimbo regularly pointed to the tokens that he wished to receive. A follow-up study has confirmed that he points to request from conspecifics (Moore, Call & Tomasello, in preparation).²

Although Bimbo's pointing is impressive, its significance should not be overstated. In principle, at least, there's no strong reason why apes shouldn't learn to point: all ape species are known to beg for food, in which case extending a hand or finger in the direction of a distal item as a way of specifying a referent more carefully is not a cognitively complex feat. Indeed Tomasello (2008) argues that there's no *cognitive* reason why apes shouldn't point for conspecifics (assuming, for argument's sake that they could understand), since the cognition required for the *production* of pointing is not difficult. He argues

² While Pele et al., also found that Bimbo's points were understood by his conspecifics, preliminary data analysis suggests that we have failed to replicate this finding.

that the reason why apes don't point for one another is that they don't cooperate in ways that would make this worthwhile.

[I]f the social environment of apes suddenly became more cooperative, they could point imperatively to request help from one another with no additional cognitive machinery. (Tomasello, 2008, p.37)

Leavens, Hopkins and Bard (2005) also give a compelling argument for concluding that ecological reasons alone suffice to explain why apes don't point to request from one another. For pointing to be worthwhile, a pointer's environment must be (1) structured in a way that places required objects outside an individual's reach, but (2) populated by cooperative individuals who would reliably pass objects if asked to do so. Great apes' natural habitats lack both features – (1) because they lack the unnatural barriers of human environments, and (2) because apes are generally unwilling to share high-value items.

3. Comprehension of Pointing in Non-Human Great Apes

A standard paradigm used to test communication comprehension is the object choice task. An experimenter hides a prize in one of two or three opaque containers, before engaging the attention of the subject and indicating (e.g., by pointing and gazing) where the prize was hidden. Understanding of the point is measured by the subject's ability to retrieve the prize.

Even very young children find this task straightforward. Following an experimenter's point, children of 12 months find a hidden toy above chance (Behne et al., 2012). Dogs (Hare & Tomasello, 1999) and even domestic goats (Kaminski et al., 2005) also reliably use human points to locate hidden food. However, despite being motivated to retrieve hidden food, chimpanzees succeed in this task only at chance (Tomasello, Call & Gluckman, 1997; Hare & Tomasello, 2004; Herrmann & Tomasello, 2006). This is not because apes cannot tell which object is the target of the point. All species follow an experimenter's gaze to a distal target (Bräuer, Call & Tomasello, 2005), and they typically do attend to the correct location. They also excel at using non-communicative cues to identify the location of the desired food. For example, chimpanzees perform above chance in a similar task in which an experimenter *reaches* for the container containing the food (Hare & Tomasello, 2004). The

act of reaching visually resembles pointing, but differs from it in not being communicative.

Why chimpanzees should struggle with pointing comprehension is not obvious and in recent years, Tomasello and colleagues have ventured various explanations for this failure. In a relatively early paper, Tomasello, Call and Hare concluded that “in contrast to human children, chimpanzees may not understand in behaviour such things as ... communicative intentions” (Tomasello et al., 2003, p.156). However, since all species of great ape gesture for one another, this explanation is surely implausible. Gestures that were not in some sense understood would not be produced. A more plausible elaboration of this argument might come in Tomasello’s later claim that “with respect to Gricean communicative intentions – involving the embedding of one intention within another ... - apes are simply, in my view, not capable of either understanding or reproducing these” (2006, p.516). The idea here is that if apes do understand communicative intentions, they don’t do so in the ways that humans do - since, on Tomasello’s account, human communication has a Gricean intentional structure; and since Gricean communication requires socio-cognitive and meta-representational abilities that apes lack. This claim is supported by Tomasello’s (2008, p.99) contention that while apes’ dyadic communication may have a non-Gricean intentional structure, pointing – because triadic – is necessarily Gricean; and so implicates more demanding social cognition. Against this claim, though, it may be that the socio-cognitive prerequisites of Gricean communication have traditionally been overstated; and that, properly stated, apes are Gricean communicators. Juan Carlos Gómez (1994) and I (Moore, submitted; forthcoming) have both argued in favour of a functionalist reading of Grice that substantially reduces its socio-cognitive pre-requisites, and makes it less controversial to count apes as Gricean communicators. In this case, the difficulty of Gricean communication may also be a poor candidate for explaining why apes struggle with pointing comprehension.³

A further explanation proffered by Tomasello and colleagues (Tomasello 2006, 2008; Herrmann & Tomasello, 2006) is that unlike humans, non-human great apes do not cooperate for unselfish motives; and that pointing comprehension requires such cooperation. On this account, apes’ failure on

³ It’s also worth noting that Tomasello’s equation of Gricean communication with triadic, ‘referential’ communication is idiosyncratic: Grice never made this claim, and his own examples included dyadic interactions. See Moore (forthcoming, footnote 2).

object choice tasks is explained by their lacking an expectation that others would point to share the location of food. This is because ape habitats are naturally competitive (Hare, 2001), and conspecifics in the wild wouldn't share valuable resources – making the standard object choice task an ecologically unsatisfying way of testing their competence.

Evidence for this cooperative communication hypothesis comes from a study by Herrmann and Tomasello (2006). Here, chimpanzees and bonobos who performed at chance in a condition in which a cooperative experimenter pointed to show them where food was hidden, performed above chance when a competitive experimenter extended her hand and arm in an obstructive posture to communicate that she did not want them to look in one location. That is, while they could not infer the location of the food in an informative communication condition, they were able to do so in a prohibitive communication condition – suggesting that what apes fail to grasp is not communicative intent, but only communicative acts performed with cooperative, informative intentions (Herrmann & Tomasello, 2006). A wealth of evidence supports the claim that apes do not act cooperatively in the ways that humans do (e.g., Hamann et al., 2011). However, several studies have recently emerged that undermine the cooperative communication hypothesis. They suggest that some deeper factor, still consistent with the hypothesis that apes are less cooperative than humans, would better explain their poor comprehension.

A recent study by Kirchofer et al. (2012) used a non-standard object choice paradigm to investigate whether chimpanzees and dogs comprehend imperative, requestive pointing. Here the experimenter pointed to request one of two tools. The dogs but not the chimpanzees retrieved the requested tool above chance. A possible interpretation of this finding is that chimpanzees struggled because the experimenter was asking them to be cooperative, and again failed for ecological reasons. However, even though they were poor at returning the correct object, chimpanzees often did return an object. This suggests that unwillingness to cooperate would not explain their performance. Rather, what they struggled to understand was which object the experimenter wanted. Another recent study (Tempelmann, Kaminski & Liebal, 2013) found that even in competitive scenarios chimpanzees, bonobos and orang-utans failed to understand requestive pointing. In this study, pairs of conspecifics competed in a task in which an experimenter rewarded them for pointing to request a piece of hidden food. One partner could always see where the food

had been hidden, and had previously been trained to point to request it. What was measured was whether apes not trained to point and unable to see the food could use the trained ape's point to infer its location. In fact, no participants of any species did this. Since failure here cannot be explained by failure to understand cooperative motives, it suggests that some deeper problem explains apes' performance: they are simply poor at comprehending referential gestural communication.

While these studies suggest that an understanding of cooperation is not the cause of apes' difficulty with pointing comprehension, evidence from enculturated apes and from modified object choice paradigms further complicates the explanation of this performance – by showing that there are circumstances in which apes can be brought to grasp even informative pointing.

Lyn, Russell and Hopkins (2010) tested the comprehension of informative pointing in an object choice trial in groups of bonobos and chimpanzees “raised in a complex social-communicative environment” (*ibid.*, p.363), and also in a group of captive but un-enculturated chimpanzees. They found that whereas most of the tested bonobos (including Kanzi and Panbanisha) and all enculturated chimpanzees were able to use the experimenter's points to find the food well above chance, only one of the un-enculturated captive chimpanzees did so. Similarly, an early study on an enculturated orang-utan, Chantek, found that while he was moderately (i.e., significantly but unspectacularly) successful at comprehending the points of an experimenter in an object choice task, an un-enculturated orang-utan tested in the same paradigm was not (Call & Tomasello, 1994). These results suggest that with an upbringing not typical of zoo apes, characteristically involving being hand-reared by or in close contact with humans, apes can be brought to understand human pointing. Consequently, their difficulty with pointing comprehension cannot be the result of an insurmountable cognitive limitation.

Another study suggests that simple environmental factors may also dramatically affect the performance of apes. In standard object choice tasks, the hiding containers are close to one another – typically less than 100cm apart. However, this has the potential to lead to ambiguity in the production of an experimenter's points, and to allow interference from low-level effects like the failure of apes to inhibit their urges to select boxes that they know not to have been indicated, but which nonetheless remain in their line of sight. Mulcahy and Call (2009) note that whereas in ape tasks the containers are typically

hidden close together, in studies on other animal species, distal targets were typically used, potentially leading to confounds in comparisons of performance. They tested bonobos, chimpanzees and orang-utans and found that where containers used to hide food were placed 250cm from one another, 2 out of 3 bonobos and 6 out of 10 chimpanzees (although 0 out of 3 orang-utans) who found the food only at chance when containers were placed 60cm apart now did so above chance. Nonetheless, the significance of this study is difficult to assess. For a start, a similar distal paradigm was also used in both Herrmann & Tomasello (2006) and Kirchofer et al. (2012) without improving apes' performance. Why this should be is not yet understood.

4. Evidence and Interpretation in Ape Gestural Communication

Evidence from current empirical data suggests, then, that while captive apes acquire the ability to point fairly easily, comprehension remains more difficult; and that while it isn't outside their ken, it emerges systematically only as a result of substantial enculturation. This reflects, I suggest, not just something about apes, but about pointing: namely that its comprehension is more difficult than production. Consequently, contrary to Tomasello (2008) and Leavens, Hopkins and Bard (2005), there may be cognitive reasons – unrelated to cooperation – for why apes don't point for one another.

The claim that I will develop now is that the comprehension (but not production) of pointing requires the ability to make inferences about others' communicative goals on the basis of only limited direct evidence for what these goals could be. Inferring a communicative goal requires considering what a communicator intends to get her audience to think or do by communicating. Such reasoning can be difficult (Bar-On, 2013; Moore, forthcoming). While apes may sometimes be capable of making such inferences – particularly after enculturation, or where other forms of evidence support the required inferences – they typically find this difficult. This is because, at least in comparison to humans, they are not good at tracking and reasoning in light of the common ground (including shared experience) that enables humans to excel at inferring communicative goals even on the basis of thin evidence. This explanation of why apes find pointing comprehension difficult roughly corresponds to a third one given by Tomasello (2006, 2008).

4.1. The Art of Intentional Communication: Constructing and Interpreting Utterances

Communicative acts are unlike non-communicative acts in that their fulfilment is dependent upon their being grasped by an intended audience (Grice, 1957). This occurs only when an audience understands the communicator's communicative goal (or 'message') – that is, what it is that she wants her audience to think or do. The process of inferring this message is not always easy. For example, one can understand *that* someone is trying to communicate without understanding *what* they have said – as happens when one interacts with speakers of a foreign language. One can also understand what a communicator has said, without understanding what, in communicating, she was trying to communicate. This happens when one fails to grasp the subtext (or 'implicature') of an utterance (Grice, 1989). For example, if I tell you that "John is a cowboy" in order to intimate that he isn't trustworthy, and you infer only that John grew up on a cattle ranch, my communicative goal will remain unfulfilled.

In order to guard against such breakdowns, skilful communicators (perhaps without being aware of doing so) craft their utterances so as to maximise their chances of being understood. One can think of enacting communicative intent as the practice of assembling and presenting evidence for an audience to enable them to best grasp one's messages. The art of performing an utterance consists, then, in knowing how to craft an utterance in a particular situation, so as to best ensure comprehension. Understanding communicative intent is the art of inferring a communicator's message on the basis of the evidence that she presents for it; where this evidence consists in her performance of a particular utterance in a particular situation.

In interacting with others, communicators improve their chances of being understood by producing utterances that contain a greater degree of evidence for their communicative goals. The evidential support for the interpretation of an utterance can be increased in a number of ways. For example, one might combine uttered words with a cast of complementary behaviours like gaze-alternation, postural changes, gestures, intonations and emotionally expressive facial expressions. These are the sorts of phenomena to which Wittgenstein referred when he spoke of the "common behaviour of mankind" that is "the system of reference by means of which we interpret an unknown language" (Wittgenstein, 1953, §206). In such circumstances the vehicle of a speaker's

message may be distributed across a number of complementary actions. Alternatively, if utterers are lazy, confident of being understood, or if they want their message to be opaque to eavesdroppers, they can produce utterances containing less evidence for their intended goal. This is possible because skilful communicators are good at interpreting utterances even when evidence presented for the speaker's message is indirect. Such communicative acts might be classed, respectively, as *evidence-rich* and *evidence-poor*. The former include utterances that present direct evidence for a speaker's message; the latter exploit sources of evidence that are more indirect. Not all utterances are either evidence-rich or -poor: some may lie in between. However, getting clear about some paradigmatic cases will help to explicate the distinction and show why non-human great apes are better at some kinds of gesture comprehension than others.

In the following two sub-sections I discuss evidence rich and poor communicative acts with reference to two paradigmatic cases: the showing of expressive, embodied behavioural states, which is *evidence-rich*, and pointing, which is *evidence-poor*.

4.2. Evidence-Rich Utterances: Shown Expressive Behaviours

4.2.1. Expressive Communication

In a series of recent works, Mitchell Green (2007) and Dorit Bar-On (2013) have developed the idea that low-level communication can often take place through the production and comprehension of what they call expressive behaviour, which exhibits both the mental states of individuals and the features of the environment to which these mental states are directed. Expressive behaviours include emotional expression, gaze, and attention. For example, if I stare at a particular object with a visibly fearful expression and piloerect fur, then it will be apparent to knowledgeable onlookers that I am afraid of that object. Observers able to read the behaviour of others can learn much about mental life of their producers – for example, whether they desire the object of their attention, or are afraid of it, or curious – and so can respond appropriately to the cognitive states of observed individuals.

On Green's and Bar-On's accounts, the ability to understand expressive behavior is hardwired, or learned through processes of ritualisation. This makes expressive communication cognitively undemanding, and so available

even to pre-verbal infants and animals. Indeed, expressive communicators need not even be capable of communicating intentionally. In Bar-On's words:

[W]hat begins its life as an expressive gesture produced *without an intention to communicate* (or affect another's state of mind) ... *can* achieve (through various forms of ritualization, for example) distinctively intersubjective communicative purposes without the intrusion of communicative intentions or rational inferences. (Bar-On, 2013, section 4.5)

Expressive behaviour can therefore explain how individuals not capable of Gricean intentional communication can nonetheless enjoy rich social interactions with others.⁴

The idea that we can learn much through the unintentionally produced behavior of others is a deep and important one. However, it's also important to recognize that individuals who are capable of intentional communication can exploit the existence of expressive behaviours by incorporating them into their intentional communicative repertoire as a way of providing evidence about their communicative goals. One way they can do this is by intentionally showing their bodily expressed states to interlocutors.⁵

4.2.2. Showing and Gricean Communication

In his characterisation of the communicative act, Grice (1957) distinguished between 'natural' and 'non-natural' meaning. He thought the latter alone a property of communicative acts. That is, non-naturally meaningful actions are those performed intentionally by agents, with the goal of communicating some message to an interlocutor. Non-natural meaning is exemplified in statements of the form: "When I said that John is a cowboy, I meant that he is untrustworthy". In contrast, natural meaning is not, at least

⁴ Unlike Juan Carlos Gómez (1994) and I (submitted; forthcoming), both Green and Bar-On hold that Gricean communication is socio-cognitively demanding in a way that may preclude human children and animals from engaging in it.

⁵ In several places, Bar-On writes that expressive behaviours "show" the mental states of the individuals whose behaviours they are. Context makes it clear that she is not referring to acts of intentional communication, but to acts of behaviour through which an individual reveals its mental states to others *without intending to do so*. Nonetheless, I restrict use of the term 'show' to describe only acts of intentional communication.

primarily, a feature of purposive activity. Rather, a state of affairs is naturally meaningful if its holding entails or reliably predicts the holding of a second state of affairs, which can be inferred from the holding of the former. Natural meaning is exemplified in statements of the form *Those dark clouds mean that it's going to rain*, or *His piloerect fur means that he's excited*. Although Grice distinguished between natural meaning and the meaning that is characteristic of communicative acts, what he missed, and what others (Neale, 1992; Wharton, 2003) have subsequently pointed out, is that naturally meaningful behaviours can be and often are incorporated into communicative acts – by virtue of being shown.⁶ For example, I might choose to show you my black eye, as a way of telling you that the debt collectors have visited. Or, were I female chimpanzee in estrous, I might choose to show you my swelling, as a means of indicating to you my sexual availability.⁷ To the extent that expressive acts are also reliable indicators of the states of affairs with which they are associated, they too can be considered naturally meaningful.

From a producer's point of view, showing naturally meaningful behaviours is a very effective way to communicate. First of all, a communicator can thereby present robust evidence for her message, making it easily interpretable. For example, if I intentionally show you my tears in order to bring you to see that I am upset, then you are able to grasp my communicative goal without the intervention of potentially difficult inferences: you can literally see the pain in my expression. Second, showing allows unintentionally produced behaviours to be recruited into a repertoire of intentional communication. This is valuable because where individuals lack the ability to construct messages out of intentional behaviour, they can nonetheless avail themselves of the means to communicate. This is important because an act of intentional communication calls for a very different response from a case in which the mental state of another is merely expressed in observed behaviour. In the act of intentional showing a speaker or gesturer indicates to her intended audience not only that

⁶ Recognising that showing can be Gricean requires dropping the third clause of Grice's original analysis. There are good grounds for doing this: see Neale (1992), section (5).

⁷ On the account of the communicative act that I have defended elsewhere (Moore, submitted; forthcoming), I claim that it is sufficient for intentional communication that one produce a combination of two actions: an act of ostension, as a means of soliciting the attention of an interlocutor, and a vehicle of content, that encodes the message that a speaker or gesturer wants to communicate. The cases of showing described here are ones in which an act of ostension is produced in order to draw the intended audience's attention to a vehicle that has not been produced intentionally.

the she is in a certain state, but also that she is soliciting a response – and a response *from them*. For example, if I show you my tearful face, I am letting you know that I want you to respond to that in a way that is not true if you just see me crying. Similarly, if a female chimpanzee ostensibly presents her estrous to a male conspecific, this act puts him in a position to know not only that the female is fertile, but that she wants to copulate *with him*. This is very different from a state of affairs in which a male merely notices the female's swollen genitalia. This feature of intentional communication – namely, the producer's intention to solicit a response from a targeted audience – is not well captured on the existing accounts of expressive communication.

4.3. Common Ground

Intentionally shown expressive states are easily interpretable because evidence-rich. However, not all communicative acts are like this. While pointing can be produced in conjunction with expressive behaviours, it is often evidence-poor. Pointers produce the same vehicle of meaning for a wide range of reasons: to share interest, to make requests, or as a means of teaching or sharing information. The semantic content of the point – best glossed as something like “[Look at] that!” – consequently underdetermines substantially the pointer's message. Indeed, a point merely specifies the referent of a communicative act: it says nothing about why the pointer thinks that referent worthy of attention. If the referent is particularly salient – for example, if it's a predator – this message may be obvious. But in other cases, the interest of a referent may be less evident, and interpretation will be more difficult.

As Tomasello has observed (2006, 2008), the supplementary evidence that we typically exploit in the production and interpretation of pointing is *common ground*. This term (introduced in Clark, 1996) refers to the shared network of beliefs and assumptions that forms the background against which interlocutors make and interpret utterances. It includes both experiences shared between individuals, and also items of knowledge assumed to be known by members of a particular group. Some items of knowledge may be common ground not only within a species but also between different species. For example, in a community of humans and apes it might be common ground even between strangers that snakes are dangerous.

In many interactions, assumptions about what is in common ground informs the way interlocutors communicate, by allowing certain bits of information to

be alluded to or taken for granted in communicative interaction. If we're visiting a friend's house together and I point to a green bike parked outside it my reason for doing so might be mysterious to a stranger. However, if it's common ground between us that the bike belongs to your recent ex-girlfriend (and if we've discussed your desire to avoid her), then against this background, the message communicated through my pointing becomes interpretable.

Knowledge of common ground enables us to interpret the messages of others' communicative acts even when these are substantially under-determined by what they utter. However, the ability to exploit common ground in this way is cognitively expensive: it requires tracking the knowledge states of others, and the extent to which these overlap with our own (which makes demands on memory, among other things), not to mention a grasp of the sorts of communicative motives with which individuals might act. For example, for you to grasp my message that we should avoid our friend's party, it would need to be common ground between us that your ex is the owner of this bike, and that you don't want to see her, and that I am supportive of this desire. If I thought you were looking for the opportunity to reconcile with her, or that you should see her even though you don't want to, then the message underlying my point might be different. Knowing how to interpret my point will therefore turn on your ability to recall what we've shared about your life and my attitude towards these details, and to bring this to bear in your reasoning about my communicative goals. Of course, other cases of pointing will likely be easier. For example, for you to interpret my point as revealing the location of hidden food, you might need only to know that I know where the food is, and am often willing to help you find food. However, inferring what I want you to do or know here may still be more difficult than a case in which I intentionally show you my tears to inform you that I'm upset.

While young children are very good at using common ground – in the form of both shared experience (Liebal et al., 2009) and cultural common ground (Liebal et al., 2013) – to interpret an experimenter's points, apes' inability to track common ground may contribute to their difficulty with understanding pointing. This claim is supported because it is consistent with existing studies of great ape gestural communication that the greater part of it consists in either the intentional showing of naturally meaningful behaviours, or of gestures that have rich, ritualised semantic content by virtue of being related to naturally meaningful action schemas. In other words, it may be that ape gestural

communication works well because ape gestures are typically *evidence-rich*. In the next section, I develop this claim.

5. The Gestural Repertoire of Non-Human Great Apes

The classical view of ape gestural communication, first formulated by Tomasello and colleagues (Tomasello et al., 1985, 1989, 1994, 1997), was informed by observational studies of the gestural repertoire of captive chimpanzees. According to this view, which draws on Tinbergen's account of ritualised communication (1951), there are two classes of ape gesture: 'intention-movement signals' and 'attention-getters'. Intention-movement signals are derived from actions that are, over an extended period of time, performed regularly (although non-communicatively) between pairs of individuals. When an individual A performs an action x , B responds by performing y . Over time, partners become very good at anticipating what the other will do – such that, for example, B might start to perform y before A has finished performing x . Since performing only the first step of x is now sufficient to bring B to do y , A might now gesture only the first part of x when wanting to solicit B to do y . Actions in which such processes of ritualisation occur might include those that figure in feeding rituals, and nurturing interactions between mothers and their offspring, or in grooming or affiliative interactions between related and unrelated peers.

Such ritualisation processes can be illustrated with a number of examples. When young chimpanzees want to share the food being eaten by older peers, they sit by them and hold their hands up to the mouths of the older apes. This enables them to catch any dropped crumbs, and even to take food from the mouths of the eating apes (who usually tolerate some theft from infants and young juveniles), while also making it easy for the eating apes to push food out of their mouths and into the outstretched hands. Tomasello has argued that over time this act might have been ritualised into an upturned palm begging gesture. Halina, Rossano and Tomasello (2013) have recently documented a series of compelling further examples, grounded in observations drawn from hundreds of hours of footage of bonobo mother-infant interactions.

In contrast to intention-movement signals, the second class of ape gestures described by the classical view – attention-getters – are not ritualised action schemas. Rather, they tend to be noisy or visually salient actions that apes perform in order to draw attention to unintentionally produced expressive

behaviours they want others to see. For example, a male chimpanzee engaging in a threat display might stamp on the ground or clap repeatedly while swaying from foot to foot and rolling his shoulders, in order to draw the attention of his intended audience to his aggressive posture, replete with piloerect fur and an agitated expression, to indicate his preparedness to fight. Another well-documented gesture is the use of leaf-clipping to draw attention to states of sexual arousal (Boesch, 2012). In the Tai National Park in the west of the Ivory Coast, aroused males repeatedly drag leafy branches between their teeth in order to make a distinctive rustling sound, which alerts females to their presence, and in turn to their erect genitalia.

On the classical account of ape gestural communication, both varieties of ape gesture are arguably evidence rich. In the case of attention-getters, they function by presenting naturally meaningful behaviours that are not under intentional control. Intention-movement signals are also naturally meaningful, because through a process of ontogenetic ritualisation the performance of part of an action sequence has come to be a reliable indicator of the action with which it is associated.⁸

The hypothesis defended here is, then, that apes perform poorly on object choice tasks because passing such tasks requires reasoning about the communicative goals of their interlocutor, which they find difficult. By contrast, the messages that apes typically communicate are more closely tied to the vehicles with which they express their communicative intentions. This claim is an empirical one and so would benefit from further empirical support. This could come in the form of a systematic analysis of all ape gesture types and their relation to naturally meaningful bodily states. This would constitute an ambitious but valuable undertaking, not least because the hypothesis ventured here would be falsified if, for example, ape gestures were found not to consist in the showing of expressive behaviours, or the communicative performance of parts of action schemas. Additionally, and complementarily, future studies could test whether apes' performance in object choice tasks improves when

⁸. The 'classical' account of ape gestures has recently been disputed (Genty et al., 2009; Cartmill & Byrne, 2010; Hobaiter & Byrne, 2011). Its opponents argue that ape gestures are not ritualised but part of a universal biological inheritance. The extent to which this work challenges the hypothesis that apes' gestural repertoire is evidence-rich requires more discussion than can be attempted here. However, the accounts may be consistent. One possibility is that ape gestures are universal precisely because they correspond closely to actions schemas that are common to all apes. A repertoire of embodied gestural acts might thereby constitute a rich source of evidence for indicating communicative goals.

their points are accompanied by expressive behaviours – perhaps in the form of relevant vocalisations and facial expressions. Here it's worth noting that two paradigms in which apes performed well – namely the reaching paradigm (used in Hare & Tomasello, 2004) and the competitive prohibition paradigm (used by Herrmann & Tomasello, 2006) – might naturally have been accompanied by expressive behaviours. In the 'cooperative' condition used by Herrmann and Tomasello (2006), analogous behaviours may have been absent.

I finish by considering the environmental conditions that might explain enculturated apes' learning to understand pointing.

6. What Explains Enculturated Apes' Success in Pointing Comprehension?

Enculturated apes come to understand pointing because the process of enculturation itself provides evidence about the ways in which points should be interpreted. It does this by giving apes exposure to shared experiences of particular interactions with human caregivers, and of the general sorts of reasons for which humans communicate. In the process, this enculturation creates a body of common ground between apes and their human caregivers that provides heuristics that apes are able to exploit in pointing comprehension. For example, suppose that during a period of rearing, a human caregiver often points for an ape to show it where to find food that was not hidden, but which the ape had nonetheless not seen. Such points will be easily understood, since upon alighting on the target of the point, the ape will both see the food and be placed in a position to grasp that the human was pointing to show it the food. Across a history of such interactions, the ape may come to grasp that humans point to show the location of food; such that when a human points to a concealed location after food has been hidden, it will grasp that she's indicating its location.

Worth emphasising here is that common ground is fluid: it can be acquired through a history of interaction, in the form of a gradual accretion of wisdom about the world and how its inhabitants act. I have not claimed that apes are unable to track common ground; only that in comparison to humans they are relatively poor at doing so. Indeed, even if they pick up heuristics that would help them to grasp why humans are pointing, and so infer their goals in a range of cases, they might still comprehend inflexibly in comparison to humans. Cases where the interpretation of a point requires intimate knowledge of facts

about individuals might therefore remain too difficult even for enculturated apes.

The gradual accretion of common ground, in the form of heuristics about why humans point, would also explain the success of some domesticated species of animal at comprehending human pointing. If common ground can be acquired in ontogeny, then – as others have argued to explain the ability of domestic dogs to understand human pointing (e.g., Hare & Tomasello, 2005) – it could also be built up over the course of a shared evolutionary history.

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