WHAT IS ANIMAL COMMUNICATION?

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It is a common intuition that nonhuman animals (hereafter, 'animals') communicate among themselves and even with us humans. But what is animal communication? Our intuition suggests that we can apply the same concept of communication to both animals and humans. But is there a theoretical account of communication that can vindicate this intuition? And if there is, what is the payoff of such an account?

I argue that vindicating the intuition that animals communicate like humans do is more challenging than one might initially think. I show that the dominant accounts of animal and human communication in the literature (i.e. biological, informational and Gricean) are neither designed nor able to vindicate this intuition. I then derive two basic constraints on what should count as a plausible Maximally Unified Account of animal and human communication (MUA), i.e. an account that is able to vindicate the intuition, discussing two accounts that meet these conditions: Millikan's theory of intentional signs (2004; 2017) and Green's theory of organic meaning (2019). Finally, I assess the utility of an MUA such as Millikan's and Green's in the studies of animal and human communication.

Keywords: animal communication; human communication; biological accounts; informational accounts; Gricean accounts; Green's organic meaning; Millikan's intentional signs; language evolution

1. Introduction

It is a common intuition that nonhuman animals (hereafter, 'animals') communicate among themselves and even with us humans. For example, we think of dogs' play bows as their way of communicating to each other that they want to play, and of cats' meows as their way of telling us that they want food. The basic intuition that animals communicate also guides theoretical and empirical research.

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There is a large body of literature on communicative behaviours across numerous animal species. And no biologist would deny that animals communicate.

But what is animal communication? Our intuition suggests that we can apply the *same* concept of communication to both animals and humans. We do not seem to be punning when we use 'communicate' in reference to both. When we humans speak of animal communication, we seem to actually recognise similarities between certain animal behaviours and our own communicative acts. But can we theoretically justify the intuition that there is something common between these behaviours? Is there a theoretical account of communication that can vindicate this intuition? And if there is, what is the payoff of such an account? These are the questions that I address in this paper.

In §§2–5, I argue that vindicating the intuition that animals communicate like humans do is more challenging than one might initially think. In §2 I show that in the literature on animal and human communication there are a variety of different, sometimes even inconsistent, accounts of communication. In particular, I identify three dominant accounts: the biological accounts of animal communication (e.g. Maynard-Smith & Harper 2003), the informational accounts of animal communication (e.g. Wheeler & Fischer 2012; Scarantino & Clay 2015), and Gricean accounts of human communication (e.g. Sperber & Wilson 1995; Scott-Phillips 2014).

Not only is each of these accounts designed to be applied either to animal (biological and informational) *or* human communication (Gricean), but, I argue, even if we were to extend them beyond their intended domains, none could adequately conceptualise a single domain of animal/human communication, to which our intuition seems to point. I develop this argument in §§3–5.

If the dominant accounts cannot vindicate the intuition, is it at all possible to bring the domains of animal and human communication into a unified conceptual framework? In §6 I identify two basic constraints on what should count as a plausible "Maximally Unified Account of animal and human communication" (MUA), i.e. an account that is able to vindicate the intuition. These are: Theoretical Adequacy and Empirical Plausibility. In §7, I discuss two accounts that satisfy these requirements: Millikan's (2004; 2017) theory of intentional signs (IS), and Green's (2019) theory of organic meaning (OM).

In §8, I turn to the question of the payoff of an MUA such as Millikan's and Green's in the studies of animal and human communication. I argue that IS and OM allow us to recognise animal and human communication as continuous phenomena. However, I argue that in the context of the study of language evolution the generality of an MUA is less useful, and that a narrower focus on (less widely shared) psychological continuities is more appropriate.

2. The Theoretical Fragmentation in the Literature on Animal and Human Communication

In the literature, animal and human communication are typically studied separately, through the lenses of different theoretical frameworks. This is partly because different fields of communication research have developed largely independently (Moore & Palazzolo 2024), guided by different motivations and different research questions. Another reason for the theoretical fragmentation is that it is generally assumed that animal and human communication are fundamentally distinct, and that different concepts of communication are to be used for animals and humans (e.g. Sperber & Wilson 1995; Tomasello 2008; Scott-Phillips 2014). The dominant accounts for animal communication are what I call the "biological" and the "informational accounts," while human communication is predominantly conceptualised according to Gricean accounts.

2.1. Biological Accounts of Animal Communication

The biological accounts frame animal communication through the lenses of biological evolution (as opposed to, e.g., cultural evolution; cf. §7) and stress the role of co-evolutionary mechanisms in the formation of signals and responses (e.g. Dawkins & Krebs 1978; Maynard-Smith & Harper 2003; Rendall, Owren, & Ryan 2009). The main question guiding biological accounts is *why* animals communicate despite potentially conflicting interests (see e.g. Zahavi 1975; Maynard-Smith & Harper 2003). This question is at the centre of their concern for the evolutionary mechanisms of signal stability.

In biological accounts, signals are typically defined as "Any act or structure which [i] alters the behaviour of other organisms, which [ii] evolved because of that effect, and which [iii] is effective because the receiver's response has also evolved" (Maynard-Smith & Harper 2003: 3). This definition highlights three important points about the biological concept of communication:

(i) Communication is a process where an individual influences the behaviour of another by means of a signal. Signals include vocalisations (e.g. alarm calls), gestures and morphological traits such as peacocks' colourful tails.

(ii) Signals are the product of biological evolution. In particular, they are naturally selected because the effects that they produce on receivers' behaviours provide an evolutionary advantage to the signallers. The biological function of signals (i.e. the reason for which they have evolved) is to manipulate the receivers' behaviours: Signals have evolved because they elicit responses in the receivers that increase the signallers' fitness.

(iii) Receivers' responses to signals are evolved, too. As Searcy and No-wicki (2005) note, among others, the evolved character of receivers' responses is a necessary condition for the very existence of communication. Since receivers are also subject to evolutionary mechanisms, if responding to signals was not beneficial, evolution would drive them to stop responding. Instead, the fact that they do respond to signals in communication suggests that they benefit from performing their responses.[1]

2.2. *Informational Accounts of Animal Communication*

While biological accounts focus on signal stability, informational accounts are often concerned with modelling animal communicative interactions in search for possible parallels with various aspects of human communication, such as reference or semantic content, more generally (e.g. Seyfarth et al. 2010; Wheeler & Fischer 2012; Scarantino & Clay 2015). In these accounts, animal communication is conceived of as a process of natural information transmission between a sender and a receiver.[2] Natural information consists in a modified version of Grice's (1957) notion of natural meaning (Scarantino 2015).

Natural meaning is the type of meaning that signs such as black clouds carry about rain, or that smoke carries about fire,[3] and is defined by Grice (1957: 377) as the property of an entailment relationship: a sign *p* naturally means *q iff p* entails *q*.

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1. Early biological theories didn't put much emphasis on the evolved character of receivers' responses, leaning towards a concept of communication as "manipulation" (see especially Dawkins & Krebs 1978). Scholars, including Krebs & Dawkins (1984), have since modified this initial view, on the grounds that that an interaction where only signallers derive benefit is not evolutionarily plausible, because receivers, too, are subject to selective pressures (see e.g. Searcy & Nowicki 2005).

2. With few exceptions (e.g. Rendall et al. 2009), natural information also plays a role in biological accounts. It is used by biological theorists to explain why receivers respond in certain ways to signals, i.e. why certain responses are adaptive (Carazo & Font 2010). However, whereas in biological accounts natural information always explains why, evolutionarily, certain responses have been selected for (i.e., the states of affairs that correlate with the signal explain why certain responses are adaptive; i.e. information as an "ultimate" explanatory construct); in informational accounts the information transmitted can also figure psychologically in receivers' real time decision-makings (i.e., it can also be mentally represented by receivers; i.e. information as a "proximate" explanatory construct). On the ultimate/proximate distinction see Kalkman (2017); see also Mayr (1961).

3. Grice's account of natural meaning is an analysis of one of two senses of the English word "means" as exemplified in sentences such as "those black clouds mean rain" and "that smoke means fire" (as opposed e.g., to the meaning of "mean" in sentences like "by this gesture I mean x," see §3).

On Scarantino's informational account, the conditions for information-transmission are looser than in Grice's original formulation: Natural information does not require a perfect correlation between the sign (p) and what it signifies (q). A sign p naturally means q *iff* it correlates statistically with q; and *iff* the occurrence of p changes the probability of q in the eyes of a recipient (Scarantino 2015). All that is required for a sign to transmit natural information is some relevant link between a sign and a specific event, such that the event can be inferred or predicted from the sign and lead to appropriate responses. This notion of information is also called "predictive" or "probabilistic" information.[4]

After all, as Wheeler & Fischer (2012) and Scarantino & Clay (2015) have noted, only few, if any, animal signals exhibit perfect statistical correlations with world states. Animals often produce the same types of signal in different contexts. And yet, animal signals do carry information, even if they do not entail what they signify. For example, putty-nosed monkeys produce their eagle alarm calls in response to falling trees and breaking branches, too (Arnold & Zuberbühler 2013). Although putty-nosed monkeys eagle alarm calls correlate with eagles, falling trees and breaking branches with a probability of less than 1, they still manage to convey information about these states of affairs to their receivers (see also Arnold & Bar-On 2020).[5]

One aspect of the information-transmission process that is often emphasised by informational theorists is the role of the context in signal interpretation. For example, Seyfarth and Cheney (2017: 340) describe animal communication in terms of "a rich pragmatic system." Contextual cues are used by animal receivers to disambiguate the informational contents of signals when these, being produced by animals in different situations, may be indicative of different things. As reported by Arnold & Zuberbühler (2013), if eagle alarm calls are accompanied by the sound of a falling tree, putty-nosed monkeys do not respond as they would in the case of a predatory risk.

2.3. Gricean Accounts of Human Communication

In contrast to the biological and the informational accounts, Gricean accounts focus on human communication. One of their goals is to make sense of certain linguistic phenomena, such as semantic underdetermination (see e.g. Moore 2018). Gricean accounts conceptualise human communication by focusing on

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4. See Scarantino & Clay (2015) for an evolutionary explanation of "predictive" or "probabilistic" information.

5. This interpretation turns on claims about the semantics of the eagle call that may turn out to be wrong. If the meaning of the call is "Terror from above," then it's less obvious that the correlation is imperfect.

the psychology of its users. They look, in particular, at the psychological infrastructure that supports the production and reception of communicative acts.

In Gricean accounts, communication is defined as a process of expression and recognition of communicative intentions. Communicative intentions are developed by drawing on Grice (1957)'s analysis of nonnatural meaning, which, for Grice, is the meaning proper to communicative acts.[6] According to Grice's analysis, an utterance *x* has nonnatural meaning *iff* by *x*:

(G.1) The utterer intends to induce an effect in some audience (this effect can be a belief, as in the case of descriptive sentences; or an action, as in the case of imperative sentences).

(G.2) The utterer intends that the audience recognises their intention in (G.1).

(G.3) The utterer intends that the audience fulfils (G.1) at least in part on the basis of (G.2).[7]

Taking Grice's own example of "Those three rings on the bell (of the bus) mean that 'the bus is full'", 'the bus is full' is an example of non-natural meaning *iff* by ringing the bus driver intends (G.1) to produce in the audience the belief that the bus is full, (G.2) that their audience recognise this intention, (G.3) that their audience forms the belief that the bus is full at least in part because of the recognition of this intention.

Drawing on Grice (1957), Gricean accounts define human acts as communicative insofar as by uttering *x* utterers intend (at least):

(GA.1) To produce an effect in their receivers (e.g. the formation of a belief, or the performance of an action).

(GA.2) That their receivers recognise their intention.

(GA.3) And act with no further intention that their receivers are deceived about their intentions (GA.1) and (GA.2).

The intention described in GA.1 is commonly referred to as "social" (e.g. Tomasello 2008) or "informative" (e.g. Sperber & Wilson 1995; Scott-Phillips 2014); the intention described in GA.2 "communicative" (e.g. Sperber & Wilson 1995; Tomasello 2008; Scott-Phillips 2014). The intention described in GA.3 replaces G.3, which is considered too restrictive for communication, and serves to protect Grice's analysis from counter-examples (Neale 1992; see §5 below).

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6. Grice's (1957) analysis of nonnatural meaning is an analysis of the English word "mean" as it is used in communicative contexts, as in "by this gesture I mean x" (cf. §2.2).

7. In this paper, I introduce Grice's notion of nonnatural meaning only as it is presented in his seminal publication (1957), thus in relation to clauses (G.1)–(G.3). For an examination of other clauses that were introduced later in Grice's writings, see Grice (1989), Avramides (1989), and Neale (1992).

Importantly, Gricean theorists widely take intention GA.2 (that the receiver recognises the sender's intention GA.1) to be the hallmark of human communication. In particular, in human communication, speakers characteristically manifest their receiver-directed goals to their receivers through "ostensive" signals, such as direct gaze, name calling and intonation patterns. Intentions combining GA.1 and GA.2 are thus commonly called Gricean communicative intentions.

2.4. The Biological, Informational and Gricean Accounts and a Unified Account of Animal and Human Communication

Not only do biological, informational and Gricean accounts conceptualise communication in different ways, but, it is important to note, their definitions are in some cases also incompatible with one another. Behaviours that are communicative within one account may not be communicative within another. As a result, the same behaviour may count as communicative or not communicative depending on the concept of communication that we use.

For example, if we take the case of an involuntary groan signalling pain, this counts as communicative in the informational definition: groans correlate with, hence raise the probability of, pain (in the eyes of a potential receiver), satisfying the prerequisites for natural-information transmission. However, it does not meet the criteria of the Gricean accounts, which conceive of communication as a form of intentional action. The groan is produced involuntarily. The groan might not count as an act of communication in the biological definition either, should it be established that it did not evolve to influence its receivers.

In addition, there are cases where the biological and informational definitions align but still conflict with the Gricean definition. For example, the roar of a red deer is communicative by both biological and informational accounts. According to standard interpretations, red deer roars are naturally selected to make receivers retreat and their formant dispersions carry natural information about the size of the sender (e.g. Maynard-Smith & Harper 2003). However, it would not be considered communicative under the Gricean framework, unless it is produced with Gricean communicative intentions (in §5.3 I show that there are problems with this). Conversely, behaviours that are not communicative by biological and informational standards may be communicative according to the Gricean accounts. An improvised gesture, if produced with Gricean communicative intentions, qualifies as a Gricean act of communication. Yet, an improvised gesture is not communicative from a biological point of view, since it is not naturally selected, nor from an informational point of view, as there is no pre-existing statistical association between the gesture and its meaning.

As it turns out, while our intuition suggests that animals and humans communicate in similar or at least comparable ways, in the literature animal and human communication are typically treated as separate phenomena. Furthermore, the dominant accounts define communication in radically different ways, to such an extent that their definitions are in certain cases even incompatible. A discrepancy exists between our intuition and this literature. Moreover, in §§3–5 I argue that the dominant accounts are unable to vindicate this intuition, even if we try to extend them beyond their intended scope. None of the biological, informational, and Gricean accounts can bring animal and human communication together within a unified theoretical framework.

3. Biological Accounts and the Domain of Animal/Human Communication

> *Biological definition of communication:* an interaction where signals are biologically adapted to influence the receivers, and the receivers are biologically adapted to be influenced by signals.

Many animal signals are largely the product of biological inheritance, rather than learned, and this is why biological accounts are so important in the study of animal communication. As argued by Fischer (2020), animal signals are largely biologically constrained both in their forms and in their functions. Most of them are produced by all individuals of the same species, independently of social experience, and there is often a tight relationship between signal types and contexts of use. Honeybees produce their dances to indicate the location of food. Vervet monkeys produce alarm calls in connection with danger. During play, Japanese macaques produce "coos," whereas Rhesus macaques produce "gruffs." Although both are able to produce both "coo" and "gruff" calls, they keep vocalising in their species-specific way even when raised in the other species' socio-ecological context (Owren et al. 1993). Chickens make distinctive "food calls" when they find food. The gestural forms of all four species of non-human great apes (chimpanzees, bonobos, gorillas, and orangutans) overlap extensively (Graham et al. 2019).

Although the fact that a signal is largely biologically fixed does not necessarily entail that it had evolved for a communicative function,[8] many biologi-

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8. In fact, evolutionary forces other than adaptation can determine behavioural similarities across species: biological traits, for example, can be spandrels resulting from selection on other traits (Gould & Lewontin 1979). A non-adaptationist interpretation has been recently proposed by Graham et al. (2024) for some great ape gestures. On this view, at least some great ape gestures are similar across great ape species not because they are naturally selected, but because of anatomical and cognitive constraints.

cally fixed animal signals satisfy the requirements of the biological definition: they have evolved to alter the behaviours of other organisms. This is the case, in particular, of those that result from either phylogenetic ritualisation or sensory manipulation (Scott-Phillips et al. 2012).

While biological accounts work well as frameworks for several cases of animal communication, they could not adequately describe human communication and thus vindicate our intuition. Understanding communication only in terms of biological adaptations, biological accounts are especially unable to explain human natural languages, which are a paradigmatic example of a culturally transmitted communicative system involving non-adapted signals and responses. Additionally, biological accounts cannot accommodate improvised signals, which are also common in human communication and are similarly not adapted (see e.g., Sperber & Wilson 1995). This makes biological accounts inadequate to conceptualise the domain of animal and human communication. Leaving out large parts of human communication, biological accounts are too narrow to work as unified accounts.

4. Informational Accounts and the Domain of Animal/Human Communication

> *Informational definition of communication:* a process of natural information-transmission between a sender and a receiver in a context.

Like biological accounts, informational accounts are typically used to describe animal communication, but, unlike the former, they could be extended to human communication too. This is because virtually any sign that we would describe as communicative in animals and humans can satisfy the description of a sign that transmits natural information (Grice 1957; Scarantino 2015; §2.2). Both animal and human signals statistically correlate with states of affairs and, by occurring, increase the probability of these states of affairs in the eyes of a receiver.

A linguistic utterance such as "I'm hungry" carries natural information about the sender's hunger: There is a statistical correlation between people being hungry and uttering "I'm hungry," such that saying "I'm hungry" raises the likelihood that the utterer is hungry. The same can be said of animal distress signals: since they are statistically produced by animals who are in a state of distress, a receiver could probabilistically infer from a distress signal that the sender is in distress. Context-dependent signal interpretation, too, is a common feature between animal and human communication. As we saw in §2.2, animals respond differently to same types of signals in different contexts. Our linguistic communication is often similarly context dependent: interpreting indexical expressions

such as *I*, *you*, *today*, *this*, *that*, for example, requires considering contextual clues, such who the utterer is in the case of the indexical *I*. Given the importance of the context for both animal and human communicative interactions some scholars even see in contextual interpretation a point of evolutionary continuity between animal and human communication (e.g. Wheeler & Fischer 2012; Scarantino & Clay 2015; see Bar-On & Moore 2017; Bar-On 2021; and 2024 for a critique).

Although it is possible to frame both animal and human communication within informational accounts, these accounts are still unable to vindicate our intuition. While informational accounts identify a point of connection, this is not specific to communication. Beyond animal and human communicative interactions, many other phenomena also satisfy the informational definition of communication—that is, are equally context-dependent transfers of natural information. Informational accounts are neutral about what mechanisms should underpin the correlations, and this means that any physical correlation, if it is tracked by a receiver, can fulfil the informational criteria of communication.

For example, large sizes in animals statistically correlate with strength. Probabilistically inferring good fighting abilities from assessing the size of a competitor is not a case of communication, but it does meet the requirements of the informational definition: it is a transfer of natural information. Similarly, in a given context, environmental phenomena such as black clouds statistically correlate with atmospheric phenomena such as rain or snow. If in context C, with a temperature above 0°C, I predict rain from black clouds, this is not a case of communication, and yet this event fulfils the informational criteria. These are examples of what scholars usually refer to as "cues," namely, non-communicative information-bearing features of the world that can be used as a guide to future action (Hasson 1994). In Scarantino's account, a perception criterion, requiring that "X's presentations in context C reliably cause responses adaptive to Ys in the absence of Ys" (2013: 1014), potentially narrows down the subset of information-transmission processes that can count as communicative: for a sign to satisfy Scarantino's definition, it is not sufficient that it statistically correlates with a world state in a context, but it must also elicit adaptive responses. Nevertheless, as long as it elicits an adaptive response, any sign can "communicate" information on Scarantino's criteria.

When it comes to framing animal and human communication together, informational accounts are unable to distinguish cues from communication, levelling animal and human communicative interactions with a wide range of events that are not communicative. The informational concept of communication applies far beyond the domain of animal/human communication, as circumscribed by our intuition, which sees as communicative certain *animal* and *human* behaviours but not other phenomena such as black clouds. This makes informational accounts unable to vindicate our intuition. Including a wide range of events beyond ani-

mal and human communicative acts, the informational accounts are too broad to work as unified accounts of animal and human communication.

While informational accounts cannot distinguish cues from communication, they can however, by defining communication as a transfer of natural information, distinguish communication from coercion. Coercive acts "force" individuals to act, i.e. influence the behaviour of others by force (Maynard-Smith & Harper 2003). A paradigmatic example of an act of coercion is that of physical manipulations, like pushing. Whereas in pushing the effect on the receiver is the result of force alone, informational accounts require that receivers' responses in communication are at least partly explained by the information transfer, i.e. that they are at least in part mediated by an interpretive process.[9]

5. Gricean Accounts and the Domain of Animal/Human Communication

> *Gricean definition of communication:* communication is a process of expression and recognition of Gricean communicative intentions, i.e. intentions of the sender (GA.1) to produce an effect in the receiver by uttering, and that (GA.2) the receiver recognises this intention.

Gricean accounts may appear to be in a better position than other accounts to frame animal and human communication. In contrast to the biological accounts, Gricean accounts are able to include both biologically fixed and learned signals. Simultaneously, Gricean accounts are narrower than the informational accounts: they do not apply to many non-communicative interactions that are included by the informational definition of communication.

5.1. Gricean Accounts and the Biological Accounts

By defining communication in terms of a set of mental states entertained by the utterer, Gricean accounts are able to capture communicative interactions independently of the origin of their signals. What matters for a signal to be part of a Gricean act of communication is not its origin, but the intentions with which it is

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9. Biological accounts' adaptationist definition distinguishes communication from both cues and coercion. In contrast to cues, signals are selected for the effects they produce. Unlike coercion, in communication receivers' responses are designed to be influenced by signals (Scott-Phillips 2008). However, the biological solution to the distinction between cues, coercion and communication can only apply to a limited subset of communicative interactions, and, especially, does not apply to linguistic communication (see §3).

used. Unlike biological accounts, Gricean accounts can work with both learned (e.g. linguistic devices) and biologically fixed signals, whether or not they are adapted for communication.

Intentionally produced learned and biologically fixed signals can be classified as Gricean *iff* they are produced with Gricean communicative intentions. Note that signals that are products of our biological inheritance (see e.g. Byrne et al. 2017 on great ape gestures) may be produced intentionally, and thus be part of a Gricean act of communication in the same way as learned signals (see fn 8): If the reason for signal overlap is that species are constrained in their articulatory movements or cognitive operations, there is no reason why these signals could not be under voluntary control.

It is worth noting that certain Gricean accounts—those that reject G.3 (see Neale 1992; Wharton 2003; Moore 2017a)[10]—can even apply to biologically fixed signals that are produced involuntarily *iff* these signals are *used* with Gricean communicative intentions.[11] While an utterer may not have control over the production of certain signs, they may still have control over their use. For example, they may have control over whether to show them to someone else. *Iff* the showing is done with communicative intentions (i.e. with an overt intention to produce an effect in the receiver), the whole act (i.e. both the showing and what is shown) can be conceptualised as communication by Gricean standards (Wharton 2003; Moore 2017a). I might show an involuntary skin rash to someone to communicate to them that I am having an allergic reaction. *Iff* my (intentional) showing of the (involuntary) skin rash is done with Gricean communicative intentions, then this act can be communicative by the Gricean framework, despite involving an involuntarily produced sign.

5.2. *Gricean Accounts and the Informational Accounts*

Gricean accounts are able to exclude many processes of information-transmission that are communicative by the informational accounts and fall outside the domain of animal/human communication circumscribed by our intuition. First of all, by construing communication as a form of intentional action with a receiver-

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10. As originally formulated in Grice's account of nonnatural meaning, G3 is incompatible with involuntary signals: G3 requires that that the hearer's response follows from the utterer's intention to produce that effect by their utterance *x*. Contrary to this requirement, the meaning of involuntary signals can be inferred independently of the signaller's intention to communicate it. This is because involuntary signals are already evidence of the state that elicits them. However, G.3 has been excluded from the majority of Gricean accounts for a number of reasons (e.g. Schiffer 1972; Neale 1992; Sperber & Wilson 1995; Wharton 2003; and Moore 2017a), and does not feature in standard accounts of Gricean communication (see §2.3).

11. On the repertoire/use distinction see Bar-On (2021; 2024).

directed goal (GA.1), Gricean accounts can effectively distinguish communication from various instances of mere cue-reading, examples of which include (cf. §4):

(i) Predicting rain from black clouds, measles from spots, fire from smoke, etc.
(ii) A mosquito predicts that there is a mammal from detecting CO_2; predicting good fighting abilities from the size of a rival.
(iii) Seeing someone reactively screaming out of fear at the sight of a frightening object.
(iv) A vervet monkey infers the presence of an eagle from hearing an (intentional) eagle shriek produced to scare away a competitor; I infer that my friend is back home from hearing them talking on the phone.

Signals of groups (i–iii) are not intentionally produced, and signals of group (i) are not even produced by biological entities. Group (iv) signals are produced intentionally, but they are intended to affect someone other than the receiver of the information transmission process.

Moreover, by characterising communication as an overt, ostensive, intentional action (GA.2) Gricean accounts are able to rule out a further range of cues:

(v) Covert intentional actions: e.g. I leave an electricity bill on the table for my housemate to see it; a mouse deliberately pushes a bar because they have learned that if they do it, the experimenter will give them some food; to have its empty cup refilled, the customer places it where the waiter is likely to see it.
(vi) Cases of intentional deception: e.g. the one described by Grice (1957: 382) of a murderer leaving B's handkerchief near the scene of the crime "in order to make the detective believe that B was the murderer."

These acts (v, vi) are intended to produce an effect in the receiver (thus satisfying GA.1), but these intentions are not made manifest to them, and in (vi) they are even concealed for deceptive purposes, thus failing GA.2.

5.3. The Empirical Implausibility of Gricean Accounts

However, Gricean accounts are unable to vindicate our intuition. Standard interpretations suggest that animals are not capable of Gricean communication because it is too cognitively demanding (e.g. Sperber & Wilson 2002; Scott-Phillips 2014; Scott-Phillips & Heintz 2023; see Gomez 1992 and Moore 2017a, b for a different view). According to Grice (1986: 85) himself, the intentions

required for Gricean communication are "plainly too sophisticated to be found in a language-destitute creature."

According to standard Gricean accounts, animals lack three fundamental capacities that are necessary for Gricean communication: (1) the capacity to attribute beliefs, (2) the capacity to entertain complex meta-representations, and (3) the capacity to draw complex inferences (see Moore 2018 for a critical discussion of the cognitive prerequisites of Gricean communication). Call and Tomasello (2008) argue that non-human primates are able to track goals and perceptual states, and perhaps entertain first-order representations, but are unable to understand beliefs and engage in high-order meta-representational reasoning. Complex inferences are thought to be beyond the reach of animals, who, for example, struggle to understand pointing gestures, which are a paradigmatic case of semantic underdeterminacy (Tomasello 2008; but see Lyn et al. 2010; Yamamoto et al. 2012).[12] This makes standard Gricean accounts inadequate to conceptualise the domain of animal and human communication. Leaving out animal communicative behaviours, the standard Gricean accounts are too narrow to work as unified accounts.

6. Two Basic Constraints on a Maximally Unified Account of Animal and Human Communication

In the previous section I showed that none of the biological, informational and Gricean accounts are able to vindicate the intuition that animals and humans communicate. With respect to the domain of animal and human communication circumscribed by our intuition, the biological and Gricean accounts are too narrow, while the informational accounts are too broad: The biological accounts exclude large parts of human communication (e.g. linguistic communication); the Gricean accounts, in their standard formulation, exclude all animal communication; while informational accounts do apply to cases of animal and human communication, they also indiscriminately include a wide range of other events that are not intuitively communicative.

If the dominant accounts cannot vindicate the intuition, is it at all possible to bring the domains of animal and human communication into a unified concep-

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12. Interestingly, the possession of the capacities for Gricean communication has also been questioned in the case of young children. While the standard view is that the capacities for Gricean communication are rooted in an evolutionarily adapted, uniquely human cognitive package (e.g. Sperber 2000; Csibra & Gergely 2009; Scott-Phillips 2014), experimental evidence suggests that these capacities develop gradually over time (e.g. Wellman et al. 2001; Liddle & Nettle 2006), perhaps influenced by language mastery (Heyes & Frith 2014; Moore 2021). If this is true, then not only do Gricean accounts fail to apply to animal communication, but also to a significant portion of human communication (i.e. communication by young children).

tual framework? In this section, I derive two basic constraints on what should count as a plausible "Maximally Unified Account of animal and human communication" (MUA), i.e. an account that is able to vindicate the intuition: Theoretical Adequacy and Empirical Plausibility.

> *The Theoretical Adequacy criterion:* an MUA should descriptively capture *many* instances of animal and human communication, while excluding *many* non-instances.

This is required to theoretically justify our intuition that certain behaviours in animals and humans are communicative, and that these communicative behaviours are different from other phenomena. In contrast to biological accounts, an MUA should descriptively capture paradigmatic instances of animal and/or human communication (e.g. linguistic communication). In contrast to informational accounts, it should descriptively capture some important distinctions (e.g. between communicative and non-communicative information-transmission).

The Theoretical Adequacy criterion should not be understood in terms of necessary and sufficient conditions. It states *many*, and not *all*, instances, because I take it to be plausible that communication is a category with a family resemblance structure in the sense of Wittgenstein (1953). Studies of human cognitive categorisation show that we do not classify things rigorously on the basis of the presence or absence of a univocal set of properties (Rosch & Mervis 1975). Moreover, studies in experimental philosophy indicate that our intuitive categorisation judgements can vary across demographic groups, and even depend on how cases are presented (Machery 2017). This suggests that what we as individuals may intuitively judge as an instance of communication may not be the same for everybody at all times. Hence, a definitive set of necessary and sufficient conditions for communication is unlikely to exist. This undermines the possibility that an MUA can really apply to all and only cases of animal and human communication. While an all-encompassing definition of communication might not be possible, there is still room for an MUA, one that is able to capture a wide range of instances that we consider to be communicative in animals and humans, while distinguishing them from many other non-instances.

> *The Empirical Plausibility criterion:* an MUA should not assume cognitive capacities that are empirically proven to be lacking in either animals or humans.

For a justification of our intuition to be theoretically sound there shouldn't be empirical reasons against attributing the descriptive terms mentioned by the account to both animals and humans. Take the example of Gricean ostension.

On most views, an important marker of Gricean ostension is making eye contact (§2.3), which has also been observed in animal communicative interactions, such as in great apes (Moore 2016). Since making eye contact is interpreted as a sign of ostension in preverbal infants (e.g. Csibra & Gergely 2009), one might think that observing eye contact in animal communicative interactions could also justify describing these acts as ostensive. However, using ostension to describe animal communication would not be empirically plausible at least according to standard interpretations of Gricean communication, which require, among other things, third- or even fourth-order meta-representations for ostension (see e.g., Sperber 2000 and Scott-Phillips 2014; see §5.3). Then, an MUA should do more than just offering a description of many cases of animal and human communication. It is also required that the description be empirically plausible for both animals and humans, i.e., neither should lack the capacities implied in its descriptive terms.[13]

7. Two Versions of an MUA: Intentional Signs and Organic Meaning

Two accounts in the literature, I suggest, meet the conditions for an MUA. These are: Millikan's theory of intentional signs (1984; 2004; 2017), and Green's theory of organic meaning (2017; 2019). The notion of intentional signs is central to Millikan's biosemantic approach, that seeks to provide a naturalistic account of representation. In Millikan's account, representations are "intentional signs." As intentional signs, they are characterized by having the purpose or "proper function" of representing states of affairs to their receivers—where a thing's proper function is the effect that accounts historically for its existence and reproduction (1984: 28). By the notion of organic meaning, Green aims to bring together all instances of meaning in biological communication.

Millikan defines intentional signs as purposefully produced by biological systems in response to states of affairs, with the purpose (or proper function) of providing cooperative interpreters with natural information about those states of affairs (i.e. representing those states of affairs). Intentional signs "will always stand midway between two systems that have been designed to cooperate with one another" (2004: 73), meaning both systems benefit from the interaction. In contrast, in Green's (2017; 2019) account, organic meaning is a designed transfer of information between systems that are not necessarily cooperative.

Given the constraints on an MUA that I have outlined, Millikan's account of intentional signs (henceforth IS) and Green's account of organic meaning

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13. There may be competing accounts of the requirements for a particular feature. See, for example, Moore 2017b for an alternative view on the cognitive requirements for Gricean ostension.

(henceforth OM) are both theoretically adequate and empirically plausible. They satisfy the Theoretical Adequacy criterion in that they capture many instances of animal and human communication, while simultaneously excluding many phenomena that fall outside the domain of animal/human communication circumscribed by our intuition.

It is possible to argue that many signals in animal and human communication satisfy IS. For example, a hen's food call serves the purpose of representing the presence of food to her chicks, just as the English utterance "It is raining" has the purpose of informing interlocutors about rain. Hen and chicks, as well as the English speakers, can be regarded as cooperative systems according to Millikan: the chicks eating and surviving benefits both the hen and the chicks, and coordinating with one another is advantageous for the English speakers. Similarly, many animal and human signals satisfy OM. For example, an eagle alarm call is designed to provide receivers with information about eagles, just as the sentence "There's an eagle" is designed to provide receivers with information about eagles.[14]

In particular, I want to suggest, what makes IS and OM maximally applicable to cases of animal and human communication is that they are both based on a functional notion of design. This includes not just natural design (i.e. biological evolution), but also learning mechanisms (i.e. cultural evolution) and intentional design (Millikan 2004; Green 2007). This makes IS's and OM's notion of design different from, and broader than, the notion of design at the centre of biological accounts, which is limited to natural design.

In Millikan's (2004) view, the use of a broader notion of design is ontologically supported by the fact that, from a naturalistic perspective, natural design, learning mechanisms and intentional design are continuous phenomena: they all have biological roots. Moreover, these three types of design are fundamentally interconnected. This fundamental connection is well captured by Millikan's (1984) early characterisation of design: for a trait x to be designed to do y, y must account for the existence and reproduction of x. The definition of design provided by Millikan brings out an important point of continuity between natural design, learning mechanisms and intentional design: in all these cases a structure x exists in light of its effect or outcome y. Suppose, for example, that the roar of a deer is naturally designed to provide receivers with information about the size of the sender and that the English utterance "There's an eagle" is intentionally designed by a speaker to inform a receiver about the presence of an eagle. In both cases (i.e. natural design and intelligent design) the effect (i.e. providing the

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14. An anonymous reviewer thinks Green's view should be treated as a development of Millikan's view, rather than an independent account. I take no stand on this issue of lineage but acknowledge the similarity of the views. Additionally, for this reason, I treat them as separate in this paper.

receiver with information about the size and the eagle) explains the occurrence of the signal (i.e. the roar and the utterance).

Viewing natural design, learning mechanisms and intentional design as possible sources of design, IS and OM can apply to both genetically transmitted items and to culturally transmitted items. More precisely, in the case of communication they can apply to both biologically fixed signals (whether or not they are adapted for communication) and to learned signals (cf. biological accounts). Encompassing both biologically fixed (adapted and not adapted) and learned signals (e.g. natural languages), IS and OM descriptively capture many instances of animal and human communication. (As I mentioned in §3, human communication is predominantly achieved through learned natural languages; in contrast, the signals involved in animal communication tend to have a strong biological component, even in primates). Note that, including intentional design, IS and OM can also encompass improvised signals (cf. §3).

Furthermore, IS and OM exclude many non-instances of animal and human communication. By viewing communication as a (designed) transfer of information, both accounts distinguish communication from coercion, in a similar way to informational accounts (see §4). In both IS and OM, the effect on the receiver is the result of a process of information-transmission, rather than mere force. However, unlike informational accounts, IS and OM are also able to exclude many non-communicative processes of information transmission. Functional design places an important constraint on signal production: Instead of applying to any correlation between a sign and a state of affairs, IS and OM apply only to those correlations that occur in order to provide information to receivers. This constraint automatically excludes non-communicative processes of information transmission of groups (i), (ii) and (iv) of §4:

(i) Predicting rain from black clouds, measles from spots, fire from smoke, etc.

(ii) A mosquito predicts that there is a mammal from detecting CO_2; predicting good fighting abilities from the size of a rival.

(iv) A vervet monkey infers the presence of an eagle from hearing an (intentional) eagle shriek produced to scare away a competitor; I infer that my friend is back home from hearing them talking on the phone.

Black clouds, CO_2, the shriek, etc. all transmit information to the receivers, but they exist for reasons that are independent of this effect (i.e. the fact that they inform those receivers does not explain why they are produced in correlation with, e.g., rain and mammals).

IS and OM also satisfy the Empirical Plausibility criterion. Unlike Gricean accounts, they do not require cognitively complex capacities: the only require-

ment for design is, in principle, to be a reproducing type of entity that is subject to some kind of selective pressure, such that what the sender does (e.g. producing or displaying the signal) is subject to (natural, cultural, or intentional) selection for its effect on the receiver. This requirement (i.e. being subject to natural, cultural *or* intentional selective pressures) can easily be met by animals and humans—and even other biological entities. Because they are part of evolutionary histories, biological entities such as plants, bacteria and cells can also produce signals that are "designed" to convey information to their receivers.

In summary, IS and OM satisfy both the Theoretical Adequacy and the Empirical Plausibility criteria and prove to be able to serve as MUA and to vindicate our intuition that certain animal and human behaviours are similarly communicative.

8. Are Millikan's and Green's Versions of a Maximally Unified Account Useful?

The examples of IS and OM show that it is possible to theoretically justify our intuition that animals and humans communicate. Now, the question that I want to address is: what is the payoff of an MUA such as Millikan's and Green's in the studies of animal and human communication?

IS and OM have at least two main advantages, which stem from their generality. First, in capturing many instances of animal and human communication, they bring animal and human communicative behaviours under a unitary theoretical framework, thus allowing us to interpret them as continuous phenomena. This not only vindicates our intuition but also allows us to study animal communicative behaviours as a species of communication together with human communicative behaviours.

Second, Millikan's and Green's MUAs do so by showing how cases of animal and human communication, which may seem very different, actually "hang together." In *Empiricism and the Philosophy of Mind*, Wilfrid Sellars (1963: 369) suggests that the aim of philosophy is "to understand how things in the broadest possible sense of the term hang together in the broadest possible sense of the term." IS and OM do achieve such a philosophical aim with respect to animal and human communication. They show that cases of animal and human communicative behaviours, in spite of their differences, are united in one fundamental respect: they are both designed transfers of information. Furthermore, unlike informational accounts, Millikan's and Green's MUAs do so without blurring instances and non-instances of animal and human communicative behaviours (cf. §4).

Moreover, there are significant common patterns in the cases of animal and human communication brough together by IS and OM. In other words, the many instances captured by Millikan's and Green's MUAs are homogeneous to a relevant degree.[15] Common patterns and plausible general explanations for these patterns have been discerned even between apparently dissimilar communicative phenomena. Here are three examples. As argued by Green (2007), problems of stability can shed light both on animal communication and on certain aspects of human communication, including speech acts norms. Furthermore, a number of studies show that certain features of signals in animals and humans can be explained in a similar way by appealing to a trade-off between efficiency and informativity (e.g. Ferrer-i-Cancho & Solé 2003 and Martínez 2019). Finally, forms of functional reference have been discovered in a wide range of animal species. Studies show that animals from chickens to monkeys, from great apes to humans, produce signals that provide receivers with information about objects (e.g. alarm calls that provide information about predators; see Palazzolo 2024 for a discussion).

Looking at common patterns across many instances of animal and human communication can illuminate important aspects of their evolution. Common features between the communicative capacities of humans and those of distantly related species, such as birds and cetaceans, can shed light on the potentially phylogenetically ancient foundations of human communication. They can also shed light on the ways in which similar environmental conditions can support the independent emergence of similar (i.e., analogous) traits. This latter phenomenon is commonly called convergent evolution. In convergent evolution, similar traits arise independently in distantly related lineages, perhaps as a result of similar selective pressures. Some traits that are shared between octopuses and humans are likely the result of convergent evolution: in the words of Godfrey-Smith (2016: 9), our last common ancestor with octopuses was so simple and remote that octopuses are basically "an independent experiment in the evolution of large brains and complex behaviour". Complex traits we may share with octopuses are unlikely to be a product of a common ancestry. That's because these species are only distantly related, and because functionally similar traits have not been identified in species more similar to our last common ancestor. Studying the environments in which these traits have emerged can offer valuable insights into their selective advantages.

However, if we pursue certain explanatory goals the generality of IS and OM would not be the most appropriate. For example, if our goal is to make progress in explaining language evolution a narrower focus would be more useful. To

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15. In their framework for concept utility, Egré & O'Magadain (2019), refer to this property (i.e. the extent to which objects in a given category share characteristics) as "homogeneity."

answer the question "How did human language evolve?", we need to under-stand what capacities relevant to the evolution of language are already present in animal communication systems, and what had to change instead for linguistic communication to come into the picture. Rather than an MUA, which focuses on those features that are maximally shared between animal and human communi-cative behaviours, we need a narrower focus on those features that are distinc-tive to human language and whose presence in animal communication systems can help us to understand its evolution.

According to Bar-On & Moore (2017), psychological features are crucially important in the study of language evolution. Because human communication is distinctively psychological, plausible precursors of psychological human com-munication in animal communicative behaviours are traits that are psychologi-cally similar (see also Bar-On 2021; 2024). Along similar lines, Scott-Phillips & Heintz (2023) have recently emphasised the relevance of psychological continuity for homology claims—that is, for identifying communicative traits that are shared between humans and other species because they were present in our last common ancestor with those species. In contrast, note that neither IS nor OM are able to track psychological properties: They group together signals that have a similar effect in providing information to recipients, without saying how and by what psychological mechanisms these signals achieve their effect.

If psychological features are crucially important for the study of language evolution, then an account that tracks the psychological properties of communi-cation would be more adequate for that goal. Such an account would be less gen-eral than IS and OM, excluding non-psychologically mediated communicative interactions. For example, it would rule out candidate communicative behaviors of all those species that are not capable of some form of informational integra-tion (Burge 2010), i.e. that cannot be said to have mental states because they do not have a unified point of view on the world. But it will have the capacity to sift through communicative interactions that are more relevant for understanding language evolution.

In that case, whether or not an inclusive account like Millikan's or Green's is useful to us will depend upon the purposes for which we are recruiting it. Such an account may therefore be highly desirable in some contexts, but undesirable in others.

9. Conclusion

In this paper, I have started from our intuition that animals communicate like humans do. As I hope to have shown, vindicating this intuition is not straightfor-ward. In the literature, animal and human communication are typically studied

separately, through the lenses of different, sometimes even inconsistent, accounts of communication. Moreover, I have argued, none of the prominent accounts are able to vindicate the intuition that there is something common between animal and human communicative behaviours. With respect to the domain of animal and human communication circumscribed by our intuition, the biological and Gricean accounts are too narrow, while the informational accounts are too broad. I then derived two basic constraints on what should count as a plausible "Maximally Unified Account of animal and human communication" (MUA), i.e. an account that is able to vindicate the intuition. I have showed that Millikan's theory of intentional signs (IS) and Green's theory of organic meaning (OM) do meet these two constraints. Finally, I have argued that while IS and OM have significant theoretical advantages, they are not useful for all explanatory goals. For example, if our goal is to explain language evolution, narrower accounts are more appropriate.

Acknowledgments

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