

Communication before communicative intentions

Josh Armstrong

Department of Philosophy, University of California at Los Angeles, 390 Portola Plaza, Los Angeles, CA 90095, USA

Correspondence

Josh Armstrong, Department of Philosophy, University of California at Los Angeles, 390 Portola Plaza, Los Angeles, CA 90095, USA.

Email: jarmstrong@humnet.ucla.edu

Abstract

This paper explores the significance of intelligent social behavior among non-human animals for philosophical theories of communication. Using the alarm call system of vervet monkeys as a case study, I argue that interpersonal communication (or what I call “minded communication”) can and does take place in the absence of the production and recognition of communicative intentions. More generally, I argue that evolutionary theory provides good reasons for maintaining that minded communication is both temporally and explanatorily prior to the use of communicative intentions. After developing these negative points about the place of communicative intentions in detail, I provide a novel alternative account according to which minded communication is characterized in terms of patterns of action and response that function to coordinate the representational mental states of agents. I show that an account which centers on patterns of representational coordination of this sort is well suited to capture the theoretical roles associated with minded communication and that it does so in a way that provides a good fit with comparative facts about the presence of minded communication among non-human animals.

KEYWORDS

Animal Minds, Communication, Intention, Social Coordination

1 | INTRODUCTION

The comparative study of behavior has revealed a remarkable degree of psychological complexity in the communicative abilities of non-human animals. From bats and baboons to chickens and cuttlefish, a wide range of non-human animals have been shown to perform intelligent actions that are exquisitely designed to update their audience members' states of minds in characteristic sorts of ways.¹ How should these empirical facts about non-human animals inform our philosophical theories of communication? Why, if at all, should philosophers care about the communicative abilities of other animals?

This paper elaborates upon and defends answers to these questions. My primary focus will be on the implications of the behavior of animals for familiar ways of understanding the nature of interpersonal communication. Since in a discussion of non-human animals it is best not to prejudge the question of whether communication in this familiar sense is a relation that necessarily holds between persons as opposed to other kinds of psychological agents, I will utilize the theoretically more neutral term *minded communication* (or *m-communication*, for short).² I argue that facts about non-human animal communication motivate a broader understanding of minded communication than the one that has become standard in philosophical discussions of communication since the influential work of H.P. Grice (1957) and those following in his wake (e.g. Schiffer (1972), Bennett (1976), Sperber and Wilson (1986/1995), Stalnaker (2014), among many others). According to this account, communication is taken to be a process whereby a communicator intentionally brings about a change in audience members' states of mind (in their beliefs, desires, expectations and etc.) and for that change to be mediated, at least in part, by audience members' recognition of the communicator's intention. According to views of this kind, minded communication minimally requires the production and successful recognition of a specific kind of *communicative intention*.

My aim is not to show that communicative intentions have no role to play in any instances of minded communication but, rather, to show that minded communication can and does occur in the absence of communicative intentions. In Section 3, I make this case by focusing on what is known about the behavior of non-human primates. I show that there are good reasons to believe that non-human primates engage in psychologically rich forms of communication but that these creatures are not capable of producing or recognizing communicative intentions and, hence, that communicative intentions are not required for minded communication as such. Even apart from counterexamples concerning specific cases of animal communication, I show in detail that there are quite general evolutionary reasons for maintaining that minded communication is both temporally and explanatorily prior to communicative intentions—in particular, that communicative intentions evolved to facilitate already existing practices of minded communication, rather than the other way around.

Building on these evolutionary considerations, in Section 4, I propose an alternative model of minded communication that centers on a socio-cognitive relation I call *representational coordination*. To a first approximation: representational coordination consists in situations in which communicators perform the actions they do because of the specific effects those actions function to bring about on audience members' states of minds, audience members respond to those actions in the specific way that they do (at least in part) because of the way those mental responses function to guide their own subsequent actions, and neither communicators nor audience members would benefit from unilaterally changing their manner of action and response. While representational coordination does involve non-trivial capacities for mental representation, it does not

require more demanding meta-representational capacities. Nor, for that matter, does it require agents to form intentions of the sort highlighted by Grice concerning the manner in which communicative actions manage to achieve their cognitive effects.

My proposed model of minded communication shares with other broadly teleosemantic accounts of meaning and communication a focus on the selective stabilization of behaviors, and, more specifically, on the co-evolution of sign production and sign response (Millikan (1984), Skyrms (1996), Planer and Godfrey-Smith (2020)). However, in Section 5, I argue that, if construed wholly in biological terms that apply widely within the living world, standard teleosemantic models fail to capture central facts about the patterns of sign production and sign response displayed by many animals in addition to humans. The mental states of an animal (human or otherwise) can make a difference to the way that animal engages in communication with others. Accordingly, I argue that there is good reason to follow a long philosophical tradition in distinguishing purely natural forms of communication from distinctively minded forms of communication. In the terms of the framework that I shall develop, there is real and theoretically important distinction to be made between forms of communication that merely serve to coordinate the behavior of organisms (or their parts) and forms of communication that serve to coordinate the behavior of organisms by way of coordinating their mental states. The importance of this distinction between different kinds of communication should not be obscured in an effort to correct the overly intellectualized picture of minded communication that has routinely been invoked within philosophical discussions.

One final preliminary remark before turning to the central issues of the paper. Much of the discussion to follow will turn on questions about the place of *mental (or psychological) states and processes*—specifically, *representational* or *cognitive* aspects of mental states and processes—in explaining animal behavior.³ How best to demarcate mental states and processes from non-mental ones is, quite obviously, a complex issue that is the subject of extensive philosophical debate. Since I cannot discuss the issue in detail, I will proceed by more or less assuming a particular account of the mind that I find plausible, assessing questions about minded communication from the point of view of that account. The account in question locates the distinctive character of mind in terms of a distinctive kind of *agency*—specifically, in terms of the integration of distinctive capacities for *tracking the world* and for *guiding action*.

In brief, the claim is that organisms equipped with mental capacities have internal states that do not merely co-vary with the states of the world and serve to mediate behavior but have capacities that do these things in highly particular ways. At the level of tracking, creatures with mental states have sensory systems displaying constancy mechanisms and the ability to integrate multiple sensory cues together to form a unified perspective on a complex environmental scene—that is to say, mental capacities enable organisms to identify (and re-identify) complex distal environmental conditions despite significant variations in the proximal stimulation to which they are exposed. In these respects, minded organisms have internal states with bona fide representational content.⁴ At the level of guiding action, the claim is that organisms equipped with mental states do not merely use their environmentally sensitive internal states to guide their behavior but do so in *flexible* ways.⁵ In other words, there is a kind of response breadth in the behavioral repertoire of minded organisms: these organisms are capable of varying their behavior on the basis of their expectations of the benefits and costs of their actions. Accordingly, even after an agent of this sort has come to represent the world as being one way rather than another, they can decide to act in multiple different ways or not at all.

Although much of what I say below is compatible with other ways of attempting to demarcate the mind, I believe this account is both theoretically plausible and empirically tractable and so

will treat it as a working hypothesis. The connection between this account of mental states and processes and my account of communication will emerge throughout the paper.

2 | GRICE'S PROBLEM

In his highly influential paper, Grice (1957) distinguishes between what he calls *natural meaning* and what he calls *non-natural meaning*: a distinction between a form of meaning that is grounded in purely statistical patterns of co-variation found widely in nature and a form of meaning that is more specifically grounded in psychologically-mediated actions on the part of individual agents. And, famously, Grice offers an analysis of non-natural meaning in terms of a specific sort of communicative intention on the part of individual agents. One of the central aims of this paper is to argue that Grice's analysis is insufficiently general: that there are instances of non-natural meaning that do not involve specific communicative intentions on the part of the individual agents that figure in Grice's discussion. However, in what follows I will frame my discussion in terms of questions about communication rather than in terms of questions about meaning per se.

Meaning and communication are, of course, intimately related: communication involves states or acts that have meaning, in some sense or other. Nevertheless, the difference between meaning and communication is not inconsequential. Communication is essentially a social affair, centering on relations that hold between *communicators* (or *senders*) that act and *audience members* (or *receivers*) that respond. In contrast, an agent may well mean something (in either of Grice's senses of the term) by an observable action without successfully procuring a response on the part of audience members or even if there happen to be no audience members present at all. By focusing on communication directly we make the reciprocal dependence at play between communicators who perform actions and audience members that respond explicit rather than merely incidental.⁶

Still, Grice's distinction is not without a point. Communication abounds widely in nature. There are many systems of communication—for example, those present in the chemical interactions among the cells in our body or among bacteria—that do not in any interesting sense require psychologically mediated actions and responses on the part of individual agents. Call these systems of **natural communication**. But there are also systems of communication which do require psychologically mediated actions and responses on the part of individual agents; in Grice's term, there are systems of communication which are grounded in acts of non-natural meaning on the part of communicators and the identification of non-natural meaning on the part of audience members. These latter systems of communication are standardly called systems of 'interpersonal communication'; however, as I have already noted, I will use the term **minded communication** to denote these systems of communication.

Grice highlighted the question of what it is for an agent to successfully perform an action with non-natural meaning. I want to highlight a related but distinct question: What is it for two or more agents to successfully engage in minded communication? What, in other words, do interacting agents each need to do in order to successfully communicate in a psychologically distinctive way with one another?

Given what I have already said about what makes a mind a mind, I will take it to be uncontroversial that paradigm instances of minded communication are at least *representationally mediated* and *flexibly controlled* whereas paradigm instances of natural communication are not. Although these conditions are not sufficient for minded communication, for reasons that I shall shortly detail, they are plausible necessary conditions that can fruitfully be used to probe for the presence

of minded communication even before we have arrived at an informative characterization of its underlying nature.

In the form of a set of diagnostic tests, we can ask whether a system of communication is natural or minded by asking the following set of questions.⁷ First, are the messages produced and received in the system of communication capable of genuinely misrepresenting the states of the world, over and above being non-factive or out of sync with the current state of the environment? Second, are the acts of producing and receiving the messages in the system flexibly controlled by agents' expectations and preferences, over and above being controlled by those agents' more basic reflexes or instinctual behavioral profile? If the answer to both of these questions is 'yes,' we have a prima facie reason to take the system of communication to be minded. In contrast, negative answers to both these questions gives us a prima facie reason to take the system of communication to be purely natural.⁸

So understood, the basic phenomenon at work in minded communication is quite familiar: it concerns situations in which agents "devise some external perceptible signs which let one another know of those invisible ideas of which their thoughts are made up," to quote Locke's famous description.⁹ Minded communication, in other words, centers on situations in which two or more agents exchange the representational contents of their states of mind through some medium of signs or observable actions that are produced and responded to by the flexible actions of those agents. In such situations, not only can there be a kind of diffusion (or "transmission") of mental states among a population of agents in which one agent's representations of the world comes to be adopted by other agents in the population but this process of diffusion is constrained by those agents' expectations of the costs and benefits of their actions. This latter feature serves to make the probability that one agent's representations of the world will spread to other members of the populations sensitive to specific features of the unfolding context of social interaction—for example, the agents' history of prior interactions and their current estimations of the benefits of subsequent social interaction. In short, while the term 'minded communication' is new, the basic phenomenon that the term is being used to pick out has long been the focus of extensive discussion.

Minded communication gives rise to a rather straightforward empirical problem: namely, the problem of providing a complete or even approximate description of the specific mechanisms that enable agents to flexibly exchange the contents of their states of mind with one another. But minded communication also gives rise to a more conceptual or philosophical problem—one that might well be called *Grice's problem*, because it was Grice that so forcefully brought the problem to general philosophical awareness.¹⁰

There are many situations in which a psychologically mediated action on the part of one agent causes a change to another agent's state of mind, but not all such situations constitute instances of minded communication. For instance, if you walk up to me and deliberately poke your finger in my eye, that would bring about certain changes to my state of mind. But it would seem wrong to suggest that your finger poke communicated that you were trying to hurt me, even if trying to hurt me was indeed the reason behind your action. Similar, you might well be able to infer from my nervous twitches and the presence of your broken cup that I am the one that broke your cup. But there seems to be a theoretically important difference between your coming to accept that I broke your cup from observing my nervous twitches together with your broken cup and your coming to accept that I broke your cup from my having told you that I broke your cup.

Examples like these make it clear that not all situations in which agents flexibly act in ways that *cause changes* to others' states of mind are situations in which those agents have *genuinely communicated* with one another in psychologically distinctive ways. But what exactly is this

further factor that serves to demarcate communicative interactions from other representationally mediated and flexibly controlled forms of social interaction?

Grice (1957) and (1969) famously suggested—and many subsequent authors have agreed—that this problem should be solved by an appeal to a distinctive kind of intention (or plan) on the part of communicating agents and their recognition on the part of audience members. To be a bit more exact, we can say that an action U is guided by a **communicative intention** iff the communicator produced U intending that:

- (i) audience members would come to entertain some particular representational content P by forming or activating a belief or intention on the basis of observing U ;
- (ii) audience members would recognize that the communicator produced U in order to generate the psychological response in (i); and,
- (iii) audience members' psychological response in (i) would go, at least in part, by way of the recognition in (ii).¹¹

We can then let the INTENTION-COMMUNICATION THESIS or, more simply, INTENTIONALISM be the thesis that the representational content expressed by a communicator's action is determined by that communicator's communicative intention and, further, that successful minded communication requires audience members to identify the representational content expressed by the communicative intention guiding that communicator's action. More simply, INTENTIONALISM is the thesis that minded communication consists in the production and successful recognition of actions guided by a specific communicative intention. According to proponents of this thesis, minded communication differs from other psychologically mediated forms of social interaction in virtue of the fact that minded communication requires the use of communicative intentions in a way that other forms of social interaction do not.

It should be noted that communicative intentions need not be brought to the level of explicit awareness—or accessible to conscious reporting to oneself and others—in order to be produced or recognized by agents. Communicative intentions can arise within agents tacitly, through the exercise of fluent social-cognitive competences (cf. Railton (2009)). For all that, communicative intentions do require a significant amount of psychological complexity from the agents that have them. In order to generate or recognize communicative intentions, agents must possess the capacity to mentally represent the representational states of themselves and other agents and the capacity to form goals about the manner in which their actions can bring out changes in the representational states of other agents. In other words, in order for an agent to produce or recognize a communicative intention at some time t that agent must, at t , have the capacity to engage in both *meta-representation* as well as *means-to-end causal reasoning* about the relation between the communicator's act and audience members' psychological response.^{12, 13}

In what follows, I will argue that INTENTIONALISM is mistaken and I will develop an alternative account of minded communication in its place. But before turning to that task, let me state explicitly once again that my arguments against INTENTIONALISM are not intended to show that communicative intentions are altogether otiose in our understanding of systems of communication or that there might not be forms of minded communication that do require the presence of communicative intentions. For example, nothing I will say is inconsistent with the claim that communicative intentions are required to explain specifically human forms of minded communication—say, in the use of richly structured natural languages, or poetry, or political persuasion.¹⁴

The fact of the matter is that philosophers have routinely conflated questions about the specific character of minded communication with questions about what makes human systems of minded communication unique (or, better: uniquely unique) in the natural order of things.¹⁵ But questions about what minded communication consists in are distinct from questions about the distinctive way humans engage in minded communication—only confusion comes from conflating these separate questions. Consequently, it may well be that some authors who have made a central appeal to communicative intentions are not really committed to INTENTIONALISM as defined here, but are instead attempting to develop a thesis about distinctively human forms of communication. I do not wish (here, at least) to debate specific questions of exegesis, although I do believe that there is at least a quite natural reading of Grice (1957) and many others (e.g. Schiffer (1972) and (1982), McDowell (1980), Sperber and Wilson (1986/1995), Scott-Phillips (2014)) according to which these authors claim that communicative intentions are implicated in the nature of psychologically distinctive, minded forms of communication quite generally. In any case, it will be useful to explore the prospects of INTENTIONALISM even if few authors have explicitly endorsed that thesis in the general form stated here.

3 | ANIMALS AND THE EVOLUTIONARY CHALLENGE

INTENTIONALISM is false: minded communication does not require the production and recognition of complex communicative intentions. At the most basic level, my argument for this claim takes the form of a counterexample: there are creatures capable of engaging in minded communication that are nonetheless not capable of producing and recognizing communicative intentions. Hence, minded communication does not require the presence of communicative intentions and INTENTIONALISM is mistaken.

While objections of this kind have been developed in the case of human children (Breheny (2006)), human adults with autism spectrum disorders (Glüer and Pagin (2003), De Villiers et al (2007)), and even neurotypical adult language users (Keysar (2000), Gauker (2008)), I will focus the case on non-human animals. This focus on non-human animals will bring out features of explanatory practice within evolutionary theory that serve to deepen the force of the basic problem with INTENTIONALISM.

3.1 | The distribution problem

Many contemporary philosophers treat animal communication systems as complicated instances of natural communication systems. This is generally not because they hold that animals are thoughtless brutes, incapable of any kind of mental representation. Instead, the rationale typically centers on the claim that animal communication systems lack the kind of *flexibility* required for minded systems of communication. According to this picture, animals communicate using a fixed set of genetically specified elements that operate in a wholly pre-arranged, code-like manner.¹⁶ Thus even if the senders and receivers of animal communication systems have psychological capacities, the claim is that their communicative behavior is not guided by those psychological capacities in the way required for minded communication.

This common view of animal communication turns on a conflation between inflexibility in the number and type of elements in a communication system and inflexibility in what the elements of that communication system can be used to express across different occasions of use.

A communication system with a fixed set of genetically specified elements may well serve to flexibly express occasion-specific messages. In the useful terminology of David Kaplan (1989a), inflexibility with respects to the *characters* (or standing “rules of use”) of a system of communication does not imply inflexibility with respects to the *contents* (or occasion-specific “messages”) that those characters are used to express across various contexts of use.

The difference between these two types of flexibility is especially important in understanding the behavior of animals, for the simple reason that *mobility* is a characteristic feature of animals.¹⁷ Animals move their bodies in ways that brings about significant changes in their spatial locations and they must keep track of these changes in addition to responding to whatever other changes their environments may be undergoing. So even if the set of elements comprising the communicative repertoire of a given species of animal were completely fixed, animals of that species could still use that repertoire to say a good deal about the states of their environment. More specifically, the fact that an animal is biologically endowed with a set of “codes” for producing or responding to acts of communication does not itself show that this animal does not use its states of mind to produce or process the specific contents generated through the use of those codes. Consequently, flexibility with respect to the set characters comprising a communicative repertoire or flexibility with respect to the contents expressed on occasions of use by those characters is relevant for assessing the psychological status of a communication system.

Consider the much-discussed alarm call system of vervet monkeys.¹⁸ These monkeys produce acoustically distinct calls in response to distinct kinds of predators: one for aerial predators such as eagles, one for terrestrial predators such as leopards (or domestic dogs), and another for low-lying terrestrial predators such as snakes. Each of these acoustically distinct calls is associated with a characteristic response by audience members: looking up and seeking cover in a bush in the case of eagles, running up a tree in the case of leopards, and looking down at the ground while jumping in the case of snakes. Although vervets do refine the production and processing of these alarm calls over the course of individual development, and although the calls themselves do show some regional variation across populations of vervets, this basic repertoire of calls appears to be fairly inflexible and highly developmentally canalized. Still, the particular contents conveyed by the use of these alarm calls is context-dependent in that the calls serve to indicate the presence of a particular type of predator at the time of utterance.¹⁹

Is this basic communication system an instance of minded communication? By the lights of the diagnostic tests with which we started, there is good reason to answer in the affirmative.²⁰ Vervet communicators track their predators in psychologically distinctive ways; the same is true for the way vervet audience members track the calls of other vervets. Moreover, as Cheney and Seyfarth (1990) document at length and as subsequent work by Ducheminsky et al (2014) has confirmed, neither the production of the calls nor the response to the calls operate in a simple, automatic, manner. It is not an inevitable consequence of receiving an aerial alarm call that other vervets will look up and seek the cover of a bush; if previous eagle calls by the communicator have proven to be unreliable, for example, audience members barely look up or forgo a response altogether. Similarly, it is not an inevitable consequence of detecting a predator that vervets produce alarm calls, as might be the case if the calls were simply an automatic fear response. In fact, upon detecting a predator, vervets do not issue alarm calls unless they take it that audience members are within earshot.²¹

Vervet alarm calls thus provide a variable but still reliable means of making vervets’ mental representations accessible to others, serving to align group members’ states of mind with one another and with the world each group member inhabits. In sum, we have good reason to believe vervet monkeys engage in minded communication.

With that said, and despite intensive empirical and theoretical investigation, there is no compelling reason to believe that vervet monkeys are capable of generating or recognizing communicative intentions: they do not seem capable of meta-representation, and they do not appear to formulate reflexive intentions about the manner in which their vocalizations influence audience members' states of mind.²² Like all primates, vervet monkeys do engage in robust, and highly sophisticated, forms of social cognition—a point I have developed elsewhere (Armstrong (2019); see also Andrews (2012)). But vervet monkeys do not show any evidence of engaging in the specific kind of social cognition at work in the production or recognition of communicative intentions. It therefore follows that the category of minded communication is not demarcated by the presence or absence of communicative intentions or, indeed, by any other kind of meta-representational state.

I'll call this the *distribution problem* because it alleges that the distribution of systems of minded communication is incompatible with the core claim of INTENTIONALISM. It is worth emphasizing that the vast literature on primate communication provides countless other cases illustrating the points I have been making about vervet alarm calls.²³ Indeed, the problem is not unique to primate communication systems. It just as well could have been illustrated by patterns of behavior observed among a wide variety of other species both within the mammalian lineage and outside of it.²⁴

There are interesting and important questions to ask about *exactly* how widely distributed minded communication is among animals—for instance, about whether minded communication is found among reptiles such as frogs or among insects such as bees. I will return to these questions in Section 5. For now, it suffices to say that comparative facts about minded communication provide a serious objection to INTENTIONALISM. And the problems run deeper still.

3.2 | The evolutionary problem(s)

Evolutionary theory is fundamentally concerned with understanding the way in which organisms undergo change over time. Foundational accounts of the nature of communication should not merely cohere with comparative facts about the distribution of communication systems but should also cohere with our understanding of the underlying processes that *generate* the relevant distributions.

It is useful here to distinguish between two distinct but complementary ways that evolutionary theorists explain change over time. The first can roughly be described as providing an answer to the question of why it is that the frequency of some given trait (or class of traits) varies over time among a population of organisms, and providing that answer in a way that appeals to known evolutionary processes such as natural selection, drift, migration, etc. The second can roughly be described as providing an answer to the question of how it is that there came to be a causal mechanism producing a given trait T such that this causal mechanism stands at the endpoint of a continuous sequence of mechanisms such that each mechanism in the sequence produces a trait increasingly similar to T and differing from its predecessor in only marginal respects.²⁵ For instance, one might explain the evolution of feathers either by (i) elucidating the contribution that heritable variations in feathers make to the ability of organisms in a population to survive and produce viable offspring or by (ii) elucidating a gradual sequence of mechanisms which begins with the production of feather-like follicles in individual organisms and which culminates in a specification of the mechanisms that produce full-blown feathers.²⁶ We can call the former an

adaptive explanation of a trait and the former, following Calcott (2009), a *lineage explanation* of a trait.

We are still a good deal away from being able to provide anything like comprehensive adaptive or lineage explanations of minded communication. Nevertheless, I maintain that profound problems surround any serious attempt to provide either type of explanation in a way that is consistent with INTENTIONALISM. The problem is that explaining the origins of communicative intentions in either of the two relevant ways seems to presuppose the prior presence of minded communication. In making this point I will focus on the case of adaptive explanations, although similar remarks could also be made in the case of lineage explanations.²⁷

To provide an adaptive explanation is, as I have said, to characterize a path through which known evolutionary forces such as natural selection or drift could give rise to the emergence and perpetuation of some given trait. Very few theorists have considered questions of the origin of communicative intentions in this sense, or about the kinds of selective scenarios that might serve to generate the capacities supporting communicative intentions.²⁸ There is, however, a large literature on the selective scenarios that might explain why the ability to engage in meta-representation might have come to initially emerge and subsequently persist over time. I will use the literature concerning the adaptive origins of meta-representation as something of a rough proxy for the adaptive origins of communicative intentions, working under the conditional assumption that the origins of each of these types of psychological states can be explained in adaptive terms.

A variety of selective scenarios for the emergence and stabilization of meta-representation have been proposed. Some have emphasized the importance of meta-representation for engaging in complex social coordination, particularly the kind of complex social coordination involved in collective foraging, big game hunting and the division of communal labor.²⁹ Others have focused on the importance of meta-representation for building long-term social contracts, and, in particular, for detecting cheaters that would reap the benefits of social coordination without paying its costs. More generally, a capacity for meta-representation might facilitate a kind of “Machiavellian intelligence” that allows agents more effectively to navigate the complex dynamics of life within a social hierarchy.³⁰ Still others have highlighted the developmental role of meta-representation in facilitating extended social networks, teaching, and rich forms of cultural learning.³¹ A number of other possible selective scenarios have been proposed and discussed.

Thankfully, my goal here is not to attempt to identify which (if any) of these accounts is to be preferred or to show how they might fruitfully combined. Rather, I want to abstract over the differences between these accounts and focus on a common core.

It is striking that each of these leading accounts of the origin of meta-representation presuppose that the underlying populations of agents are already capable of linking up their representational states of mind through patterns of observable action and response—that is, of engaging in minded communication. In particular, these accounts of the adaptive value of meta-representation do not themselves serve to explain why agents would come to have representational states of mind or why such agents would perform actions that would allow their representational states of mind to be accessible to others. Rather, what these various accounts seek to explain is the role that meta-representation would play in overcoming various *limitations* or *constraints* imposed on already existing systems of minded communication.³²

Why kinds of limitations might these be? One central kind of limitation concerns the expressive power of a system of communication. A group of agents may well find themselves facing a specific kind of communicative bottleneck in which they have a rich array of mental states—for example, in having thoughts about objects distant in space or time or about subject matters not accessible solely by perceptual means—but an expressively poor system of communication to convey the

representational content of those mental states. Another kind of limitation concerns the reliability or fidelity with which agents are able to infer the representational content associated with other agents' actions—as, for example, when you are trying to teach me how to perform a complex and labor intensive manual skill but in which I struggle to follow the fine-grained details of the actions you display.

In their separate ways, the foregoing accounts of the adaptive significance of meta-representation all aim to provide explanations for what a capacity for meta-representation might help agents overcome both these kinds of limitations and why overcoming these limitations would aid in the ability of those agents to survive and reproduce. But it makes little sense to talk about the adaptive value of expanded abilities to engage in an activity that one cannot already engage in. Consequently, if agents were not already engaging in psychologically distinctive forms of minded communication there could be no selection for the relevant meta-representational abilities

We thus have another reason to reject INTENTIONALISM. That thesis identifies minded communication with the ability to produce and recognize specific kinds of meta-representations. And yet, leading attempts to provide an adaptive explanation of meta-representation presuppose the prior existence of minded communication. Meta-representation is not therefore a necessary condition on minded communication as such. More generally, there is an important sense in which minded communication is both temporally and explanatorily prior to communicative intention.

It is perhaps worth making clear that I do not take any of this to provide a kind of transcendental deduction of the falsity of INTENTIONALISM. In particular, I do not claim that there are no possible selective scenarios for the emergence of meta-representation among a population of agents who are not engaged in some kind of minded communication. For example, it seems metaphysically possible that a lineage of solitary, asexually reproducing animals could develop a capacity for meta-representation thanks to its role in facilitating completely asocial psychological processes of reasoning and reflection; say, as a means of critically evaluating their own epistemic policies or past mistakes.³³

My discussion of adaptive explanations above does not concern what is metaphysically possible but rather what is biologically and evolutionarily plausible given what is known about the actual world. A good deal of work strongly suggests important—though likely contingent—connections between the ability to engage in sophisticated forms of social cognition (of which, meta-representation and communicative intention would be special cases) and the demands of living in stable social groups. In particular, animals with greater capacities for social cognition have been found to come from lineages whose members live in groups that require individuals to interact repeatedly with the same individual or the same group of individuals over time in psychologically demanding episodes of coordination and conflict.³⁴ The stability of these specific kinds of social arrangements crucially depend upon the ability of its members to communicate with one another in psychologically distinctive ways. Minded communication provides a glue or “common tie” that allows the members of these groups to remain a unit over time.

In considering the processes that lead to the emergence of meta-representation within our own hominid lineage, current evidence suggests that we came to possess an ability to engage in meta-representation only provided that we were able to interact and exchange our representations of the world with others.³⁵ This is the case if for no other reason that a solitary primate of our body size and dependence on others would be far too vulnerable to predation and would lack the right kind of structured learning environment to develop a capacity for meta-representation outside the context of minded communication. These facts about our history provide good reason to believe that even if meta-representation evolved in our lineage because of the role it played in purely asocial processes of reasoning and reflection, minded communication would have had to be present

in our lineage beforehand. In other terms: all the nearby, evolutionarily plausible scenarios in which our ancestors evolve the capacity to engage in meta-representation are also scenarios in which our ancestors (or their ancestors) had already evolved the ability to engage in minded communication. A focus on asocial processes of reasoning and reflection does not provide of a way of avoiding the foregoing problem with INTENTIONALISM.

4 | MINDED COMMUNICATION AS REPRESENTATIONAL COORDINATION

How, then, should we understand the character of interpersonal or minded communication? In particular, how do we draw a principled distinction between situations in which agents act in ways that cause changes to each other's states of mind and situations in which agents genuinely communicate with one another? Along with a number of other philosophers—notably Dorit Bar-On ((2013a); (2013b)))—I believe that we can provide answers to these questions without “going Gricean” or making any essential appeal to communicative intentions. In this section, I will develop a specific proposal that bears this out.

4.1 | Coordinating states of mind

In its most basic form, my claim is that minded communication consists in patterns of actions and response that *function to coordinate the mental states of agents*.³⁶ It is the function of communicative actions and responses to coordinate the mental states of agents in the sense that coordinating the mental states of agents is why these patterns are produced and why they are perpetuated over time: communicators perform the specific actions that they do (at least in part) *because* of the effects of those actions on the mental states of audience members and, conversely, audience members respond to those actions in the specific way that they do (at in part) *because* of facts about the role those mental states play in guiding action.³⁷ Crucially, while these functional relations *may* be mediated by the production and recognition of communicative intentions they need not be: a pattern of action and response can function to coordinate agents' states of mind without being explicitly intended as such.

The foregoing provides a straightforward way to distinguish communication from merely causing changes to agents' states of mind. Your nervous twitches may well cause me to come to believe that you broke my cup but, crucially, those twitches are not produced because of the way they function to coordinate our states of mind and so do not constitute an instance of minded communication. Similarly, my wearing of a tuxedo is likely to generate an expectation in others that I am going to a formal event of some kind. However, unless I wear a tuxedo because it functions to generate that expectation in others, my wearing of a tuxedo would not count as an instance of minded communication.³⁸ In genuine cases of minded communication, the patterns of action and response (rather than some alternative pattern, or no action or response) are produced and perpetuated because of their role in linking the states of minds of agents rather than as an accidental by-product or downstream consequence of other things the agents are doing.³⁹

The basic idea takes us some ways toward addressing Grice's problem, but it does not go far enough. In particular, we need to provide a more careful characterization of what is involved in coordinating the mental states of agents. This is especially important for understanding the difference between *successful* and *unsuccessful* episodes of minded communication. After all, the

conspicuous waving of my hand in your direction may well function to link up our states of mind in definite ways. But if you took me to be offering you a friendly greeting, whereas I was warning you of a bug near your face, there is a clear failure at work in our communicative exchange: you *misconstrued* or *misunderstood* my communicative act. If minded communication is to be understood in terms of patterns that function to coordinate the mental states of agents, then coordination must involve more than mere a reciprocal dependence in agents' states of mind.

To address this fact, I will make use of a variant of the game-theoretic model of coordination introduced by David Lewis (1969). In Lewis' original set up, a sender and a receiver are engaged in a game of coordination. The sender has access to information about the world that the receiver lacks and can act so as to produce an observable *sign* or an action type that functions to inform. The receiver, in turn, can observe the sender's choice of sign and perform an action which has payoff consequences for both agents. If there is an appropriate match between the state of the world observed by the sender and the choice of action selected by the receiver, then both players get a positive payoff but get no pay-off otherwise.

Instead of focusing directly on the match between the external state of the world and a receiver's subsequent external behavior, I suggest that we focus on that match indirectly as mediated by a set of intervening variables: namely, the representational states of mind of the agents doing the sending and receiving of the observable signs. In the form of a diagram—modified from the now standard depiction of Lewis' model (Godfrey-Smith (2014a), p. 79)—the central idea can be modeled as in Figure 1.

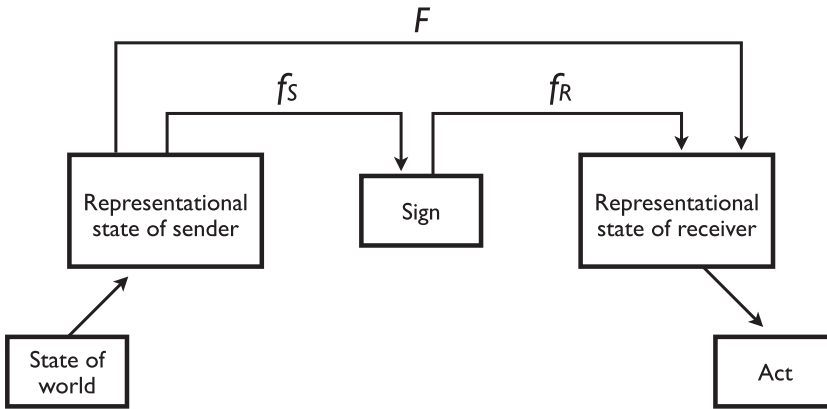


FIGURE 1 Representational coordination: f_S , maps representational states of mind of the sender to signs; f_R , maps signs to representational states of mind of the receiver; F , the resulting mapping from states of mind to states of mind

In terms of this model, we can characterize an *m-communication problem* as a situation in which there are multiple possible policies (or “protocols”) for sending and receiving representational content available to both the sender and receiver but in which both sender and receiver have an interest in adopting policies that are appropriately related to each other's. An instance of coordination that results in minded communication is a solution to an m-communication problem—i.e. a set of ordered pairs $\{f_S, f_R\}$ —which meet three core conditions: (i) *the pair of policies, rather than some alternative pair of policies which could have been used by the agents, is adopted by the sender and receiver in the course of their social interaction with one another*; (ii) *the representational content of each of the pair of policies is anchored to the same aspects of the world in the sense of having overlapping or co-extensive semantic conditions of satisfaction* (e.g. overlapping

accuracy, fulfilment, or truth conditions); and, lastly, (iii) *neither sender nor receiver would benefit from unilaterally deviating from their choice of policy*. When two or more agents manage to settle on an m-communication system that meets these conditions, we can say that they are engaging in a form of **representational coordination**.⁴⁰

With these points in place, my proposal can be reformulated as the claim that minded communication consists in patterns of actions and response that function to result in representational coordination. Unsuccessful cases of minded communication—cases in which agents are communicating but doing so poorly—consist in patterns of actions and response that function to connect the mental states of agents but do so in way that fail to result in representational coordination.

4.2 | Putting intentions in their place

Representational coordination makes clear how agents could engage in minded communication without having, or being so much as capable of having, a special kind of communicative intention. Let me illustrate this point by returning to the case of vervet monkeys.

Vervet monkeys face m-communication problems. In the specific case of alarm calls, this problem concerns the connection between vervet monkeys' mental representations of predators and their policies of producing and responding to vocalizations. There is, after all, no intrinsic connection between the acoustic properties of alarm call and the states of affairs in the world those alarm calls serve to represent. And as we have seen, there is no automatic (reflex-like) connection between a vervet coming to represent the presence of a predator and that vervet coming to produce an alarm call; nor is there an automatic (reflex-like) connection between a vervet hearing the alarm call of another and that vervet coming to represent the presence of a predator. Yet, vervet monkeys do clearly benefit from having access to a system that functions to coordinate their representations of predators with the mental representations of others.⁴¹

On a given occasion of social interaction, a vervet sender will have successfully engaged in minded communication with one or more receivers to the extent that the representational content of the state of mind that guides the sender's act is coordinated with the representational content of the receivers' state of mind upon hearing the sender's call. Conversely, there will be a failure of communication if the representational content that guided the vervet's production of the call fails to be considered by receivers—i.e. if the production was guided by a representation of an aerial predator, but the receiver comes to generate a representation of a ground predator or merely comes to represent the fact that the sender emitted a call of a certain type. No appeal to higher-order or meta-representational states of mind is required.⁴²

Of course, agents engaging in representational coordination could reasonably be said to be guided by first-order intentions: specifically, by what David Kaplan (1989b) dubs a *directing intention* or a plan for a bodily movement anchored in an entity that a communicator has in mind. However, the present point is that no appeal to a distinctive kind of *communicative* or *reflexive intentions* is required to understand what it is for an agent to perform a communicative act. Similarly, there need not be any recognition of such communicative or reflexive intentions on the part of audience members in order for successful communication to occur. In short, the present point is that we can solve Grice's problem in a way that does not capitulate to anything like Grice's solution.

Still, it is worth emphasizing that communication by way of the production and recognition of communicative intentions satisfies the conditions required for representational coordination. In particular, communication by way of the use of communicative intentions can be

straightforwardly understood as a special case of representational coordination; namely a special case in which agents' policies of sign production and sign response are being selected in a way that is sensitive to the special way each agent represents the mental states of themselves and others and also represents the causal potential of their actions to bring out changes to one another's states of mind. For reasons that I discussed in the last section, coming to engage in minded communication by way of the use of communicative intentions can have important consequences for agents: it can free them from various kind of communicative bottlenecks and allow them to communicate more efficiently and reliably. But coming to engage in minded communication by way of the use of communicative intentions doesn't fundamentally change the kind of activity that agents are engaged in; namely, coming to coordinate their representational states of mind through their own flexible actions and responses. While all cases of communication that center on the use of communicative intentions are cases of representational coordination, there are many cases of representational coordination that do not in any way involve the use of communicative intention. Acknowledging that some agents—for example, many adult humans—might utilize communicative intentions in quite exceptional ways does not undermine the central fact that communicative intentions are not required for minded communication as such.

5 | AGAINST REDUCTION

Let me close my discussion by considering an objection. It is natural to wonder whether the foregoing leads us down a rather slippery slope. It may seem, in particular, that I have simply assimilated the category of minded communication to the category of natural communication, or else have undermined the existence of a theoretically interesting division between systems of communication of this kind. Does representational coordination really carve out a distinctive area of communicative behavior—one that is different in kind from the communicative behavior displayed between bacteria or within the cells of our bodies?

Representational coordination does carve out a distinctive area of communicative behavior, one that relates minded communication to natural communication in straightforward ways without thereby reducing one to the other. As a rough analogy: minded communication stands to natural communication as cultural inheritance stands to genetic inheritance. And just as cultural inheritance is psychologically mediated in a way that genetic inheritance is not, so too, minded communication involves patterns of sender-receiver coordination that are psychologically mediated in a way that natural communication does not.⁴³ The distinction between natural communication and minded communication is—like the more general distinction between genes and culture— theoretically principled, even if it allows for gradations and lots of borderline cases. Let me explain.

I take the category of natural communication to be fruitfully understood in terms of patterns of behavioral coordination that make use of *biological signaling*. A biological signal is an act or structure produced by one organism (a sender) that effects the behavior of other organisms (receivers); that evolved because of the effects the act or structure has on other organisms; and that is effective because the response to the act or structure by other organisms has also evolved (Maynard Smith and Harper (2003), Scott-Phillips (2008)). As a number of authors have emphasized, biological signaling centers on situations in which organisms (or their parts) engage in the exchange of information with one another in a biologically robust sense of the term (c.f. Millikan (1984) and (2004), Skyrms (1996) and (2010), Shea et al (2017), Planer and Godfrey-Smith (2020)).

Examples of biological signaling abound in nature. As I have mentioned, this includes the between-organism communication that arises among bacteria and plants and the within-organism communication that makes multicellular life possible. But it also includes many instances of communication among animals: for example, situations in which animals signal their danger to others through the use of permanent bodily coloration or marks (so-called *aposematic signaling*) or the temporal stage of their mensural cycles through the visible swelling of their genitalia (a form of *sexual signaling* common among many primate species).

However, it is a mistake to take every instance of communication among animals (much less among human animals) to be exhausted by the features at work in biological signaling. There are, in particular, a range of cases in which purely biological construals of communication will leave core facts about the interactions that take place between senders and receivers underspecified and unexplained. To take just one concrete example, recall the fact many animals display an audience effect in the production of their calls: even upon detecting a predator, they do not produce alarm calls unless they take there to be the right kind of audience member within earshot. There is nothing in the generic description of biological signaling that explains this effect, and for good reason. The effect depends on the ability of these animals to integrate their mental representations of predators with their mental representations of audience members, and to condition the production of their calls accordingly.

It is thus one thing to conclude that a system of communication is not mediated by higher-order mental states such as meta-representation or common knowledge, but it is quite another thing to conclude that a system of communication is not mediated by mental states at all. The lack of higher-order mental states—be it among humans or among vervet monkeys—simply does not provide any evidence for the lack of first-order states of mind.⁴⁴ After all, the observable pattern of sender-receiver interaction may well be sensitive to the presence of *intervening psychological variables*. In paradigm cases of minded communication, these intervening psychological variables are relevant for explaining at least two sets of features. First, whether the behavior of senders and receivers is *representationally mediated*—i.e. whether sign production and response depend upon an integrated perspective that allows senders and receivers to robustly track the distal states of the world despite significant variation in the proximal stimulation to which they are exposed. Second, whether the behavior of senders and receivers is *flexibly controlled*—i.e. whether senders and receivers can vary their policies of sign production and response across different occasions of use and do so in ways guided by their expectations of the benefits and costs of their actions.

In paradigm cases of natural communication, by contrast, the pattern of sender-receiver interaction is neither representationally mediated nor flexibly controlled. No intervening psychological variables are needed in such cases, and representational coordination is, in contrast to other kinds of biologically significant sender-receiver coordination relations, quite beside the point. Of course, intervening psychological variables could be exogenously introduced into standard models of biological signaling.⁴⁵ But to do so would simply be to introduce a version of representational coordination of exactly the sort I described in the last section and to tacitly recognize a theoretically important difference between systems of communication that are mediated by the mental states of senders and receivers and systems of communication that are not.

There is thus a principled distinction to be drawn between minded communication and natural communication, and representational coordination helps us to understand the basis of this division. As I have already mentioned, to say that the distinction here is principled is not to say that it is sharp or exhaustive: there will be many *marginal* or *partial* cases of minded communication.

Marginal cases of minded communication will be instances of sender-receiver interaction that are either representationally mediated or flexibly controlled, but not both or not both for each the

sender and the receiver. For example, screaming in response to a surprising event or blushing in response to an embarrassing faux pas can each be representationally mediated without being flexibly controlled. And the processes that allow a predator on a particular occasion to detect a fake aposematic signal (or an instance of “Batesian mimicry”) may be representationally mediated and flexibly controlled even if the signal was produced by the prey in a way that was neither representationally mediated nor flexibly controlled. As these cases serve to bring out, even in marginal cases of minded communication there is a need to move beyond the generic features at work in biological signaling: we need to consider the specific ways the relevant organisms mentally represent their worlds and the manner in which their mental representations guide their subsequent actions.

The existence of marginal cases of minded communication highlights the fact that representational coordination is not a trivial matter. Not only are there living creatures that do not engage in minded communication, but minded communication is far from ubiquitous even among those animals that possess the requisite kind of psychological capacities.

It is ultimately an empirical matter to determine which creatures on which particular occasions of interaction engage in representational coordination. Still, there is no doubt that the present framework implies that paradigm instances of minded communication can likely be found among a wide range of animals.

Consider a concrete example. There is suggestive (though inconclusive) evidence that the celebrated waggle dance of honeybees meets the conditions I have proposed for representational coordination, and hence, for minded communication. For example, honeybees have been shown to construct and continually update rich cognitive maps which allow them to identify (and re-identify) valuable resources in their environments (Menzel et al (2005)), and they appear to use these cognitive maps in producing their waggle dances. Moreover, honeybees have been shown to flexibly alter or suppress the production of their dance depending on a variety of factors—for example, the relative danger that a foraging route poses for audience members.⁴⁶ Likewise, honeybee receivers must integrate both tactile and visual sensory cues to access the occasion specific content of a waggle dance and, further, appear to vary their response to the dance in accordance with both their own prior expectations of food sources and the relative costs associated with inaccurate or misleading dances.⁴⁷ All of this seems to suggest that honeybees display the distinctive kind of *agency* required for minded communication in the production and response to their waggle dance—a form of agency that is not present in the communicative behavior of bacteria or the brightly colored skin patterns of the poison dart frog.

Of course, future empirical evidence could paint a very different picture of honeybee communication and one may well dispute the details of the data currently available. But no matter how the details of this particular case shake out, it is clear that representational coordination occurs in a broad range of animals—not in every living creature or even among every species of animal—but a quite diverse lot all the same.

The claim that representational coordination, and hence minded communication, can be found among such a diverse range of animals may well fly in the face of hardened philosophical intuitions. However, I take this result to be a feature of the account I have provided rather than a bug. Minded communication grows out of a general need that psychological agents have to relate their states of minds to the states of minds of others and to do so in ways that are responsive to the expected costs and benefits of their actions. If satisfying this need serves as a fuel for both individual and communal success, as has long been supposed, then we should not be surprised to discover that systems of minded communication evolved among a vast array of different lineages of animals.⁴⁸

NOTES

- ¹ Here and throughout I use the term “animal” in a loose and something colloquial sense of the term. Scientific practice provides a variety of different ways of precisifying the category of animals, none of which agree perfectly with colloquial usage. For the purposes of the discussion, I primarily use the term ‘animal’ to denote *an individual organism with a centralized nervous system and a highly mobile form of life*; see Godfrey-Smith (2016) pp. 15-42 for a useful recent review of various concepts of animals.
- ² “Intentional communication” is another term that is frequently used to describe this form of communication. However, this label is unhelpfully tendentious in the present context insofar as it bakes the notion of intention into subject matter of study at the outset of inquiry. In my view, the appeal to intention should instead be seen as one way of explicating or explaining the basic phenomena rather than an uncontroversial part of the phenomena itself.
- ³ For the purposes of my discussion, I will remain neutral on the question of whether a creature could (implausibly, in my view) have representational mental states without also having some form of phenomenal consciousness. Accordingly, I will proceed to use the terms ‘mental,’ ‘psychological,’ and even ‘cognitive’ as stylistic variants of one another. While this is standard in comparative psychology and ethology, it departs from other uses of the terms. For instance, in philosophy of mind and computational psychology the term ‘cognitive’ is often reserved for representational states of a system that are conceptually-based or have sentence-like structure. Nothing essential in my argument will turn on this particular set of terminological conventions.
- ⁴ This point has been elaborated in detail by many others; in particular, see Burge (2010) for a rich and empirically informed discussion of the role of constancy mechanisms and sensory-integration in establishing the lower bounds of representational content. See also Sterelny (1995) and especially (2003) for an illuminating discussion of the evolutionary pressures that may drive the emergence of creatures with these distinctive means of tracking the world.
- ⁵ This feature of the mental is emphasized in Godfrey-Smith (1996) and especially in Sterelny (2003).
- ⁶ See Godfrey-Smith (2017) and Moran (2018) for two recent developments and elaborations of this important point.
- ⁷ These diagnostic questions are closely related to two of the core diagnostic tests for non-natural meaning that Grice proposed in (1957) and especially those diagnostics that he reiterated in (1982). As noted, these tests are not designed to provide sufficient conditions for the presence of non-natural meaning or minded communication. Rather, the tests are designed to provide a theoretically neutral way of characterizing the target phenomena under discussion, one which stands to be further elucidated by a more complete positive account. Thanks to an anonymous referee for very helpful discussion on this point.
- ⁸ In Section 5 below, I consider cases with split verdicts on these questions or what I call “marginal” cases of minded communication.
- ⁹ Locke (1689/1979), III. 2.1.
- ¹⁰ Although I will reject Grice’s proposed solution to this problem, I believe that Grice’s work should be praised for its emphasis on the importance of mentalistic vocabulary and of mental phenomena more generally in the study of human social interaction. This psychological approach to human social interaction had largely fallen out of philosophical favor at the time of Grice’s early essays. While I disagree with the details of Grice’s account, nothing I say in what follows is intended to undermine the psychological turn that he helped to (re)establish within philosophical discussions of the social—indeed, I will be emphasizing the importance of this psychological approach to cases of social interaction that do not center on humans or their use of language.
- ¹¹ The use of the term ‘communicative intention’ to explicitly denote distinctive kinds of psychological states of agents or instances of what Grice himself calls SPEAKER MEANING came into common use following the influential discussions of Sperber and Wilson (1986/1995) and Recanati (1986), although Sperber and Wilson used the term specifically to refer to instances of clause (ii) in Grice’s analysis. As Neale (1992) discusses at length, there has been some debate about whether clause (iii) should be included in the explication of the relevant intentions or whether clauses (i) and (ii) should be taken to suffice. Although the arguments that I develop in this paper apply even to those that take communicative intentions to merely require (i) and (ii), I will adopt the textbook characterization that requires all three of Grice’s clauses for both ease of presentation and because I think that the third clause helps give a rationale for the second clause that would otherwise be lacking; see Moran (2018) and Harris (2021) for relevant discussion.

- ¹² As I will understand the term here, “meta-representations” denote a class of representations with both a distinctive kind of *content* and a distinctive kind of *structure*. At the level of content, meta-representations are representational states of an agent that are directed toward or about the representational features of their own and others’ mental states—i.e. representational states that feature attributions of non-factive representational properties such as error/accuracy, truth/falsity, or aspectual perspective. At the level of structure, meta-representations have semantic contents that are embedded under mental states (such as *believing*, *desiring*, *considering*, etc.) which themselves have independently specified semantic contents.
- ¹³ Juan Carlos Gómez (1994) and, more recently, Richard Moore (2017) and (2018) have each suggested ways of using the terms ‘communicative intention’ and ‘Gricean communication’ that would not require much psychological complexity on the part of agents. While I am highly sympathetic to the motivations that animate these discussions, their proposed terminology serves to eliminate all the distinctive elements of Grice’s account that cannot be found in the discussions of earlier authors (for example, in Augustine’s (426/2008) discussion of conventional signs or in Hume’s (1739/1975) discussion of promise making). Furthermore, these ways of using the terms “communicative intention” and “Gricean communication” leave us without labels to describe the difference between creatures that can engage in meta-representation and means-to-end causal reasoning on those meta-representational states and creatures that cannot. I take my term ‘minded communication’ to provide a less anachronistic label for the subject matter that Gómez’s and Moore’s important proposals serve to illuminate.
- ¹⁴ See Moore (2018) for useful discussion of this point. In Armstrong (Forthcoming) I argue that communicative intentions are favored in specific social environments in which agents need to communicate with a demographically diverse group of interlocutors about a wide range of spatially and temporally displaced subject-matters. I argue that such social environments have long been characteristic of human populations and, as such, that there is good reason to believe that communicative intentions are important for understanding distinctively human forms of minded communication even if they are not required for minded communication or even linguistic communication as such.
- ¹⁵ The parenthetical “uniquely unique” is needed for the simple reason that every system of communication—like every individual and every species of organism—has unique features. The interesting question is not whether human communication is unique but whether the unique ways that humans communicate is or is not exceptional from the point of view of the comparative-evolutionary study of communication.
- ¹⁶ This line is suggested strongly suggested by Sperber and Wilson (1986/1995) and explicitly taken in Scott-Phillips (2014).
- ¹⁷ An appreciation of the significance of the connection between animal movement and animal minds goes back at least to Aristotle, as has been emphasized by Nussbaum (1984). Merker (2005), Godfrey-Smith (2017), Ginsburg and Jablonka (2019) provide more recent discussions of the connection between mind and mobility.
- ¹⁸ This system was first discussed by Struhsaker (1967) and was confirmed under careful experimental conditions by Seyfarth, Cheney and Marler (1980). See Cheney and Seyfarth (1990) for an elegant presentation of this work, and Ducheminsky et al (2014) for a recent replication of the initial results.
- ¹⁹ See Schlenker et al. (2016a) and Schlenker et al (2016b) for discussion of the particular semantic features of these and other primate alarm calls system. While the context dependence at work in the vervet alarm call system seems purely automatic or indexical, I argue in Armstrong (2019) that there is evidence that many monkeys and great apes also utilize non-automatic or supplemental context dependent signals in their communicative exchanges—particularly in their use of “social calls” prior to social interaction with one another or following violent conflict.
- ²⁰ It is also worth noting that vervet alarm calls pass Grice’s own diagnostic tests for non-natural meaning: it is perfectly felicitous to report “that vervet call meant that there is a snake nearby, but there is no snake nearby” or, more generally, to attribute the act of communication to the individual vervet monkey that produced the call.
- ²¹ This so-called “Audience Effect” has also been documented in the alarm calls of a species of ground squirrels (Sherman (1977)), in domestic chickens (Karakashian et al (1988)), and in many other primate species (Zuberbuehler (2009)).
- ²² See Cheney and Seyfarth (1990) and (2007) for extended discussion; see also Tomasello and Call (1997), Rosati et al (2009), Andrews (2012), Fischer and Price (2016), and Burge (2018) for more recent reviews of the status of meta-representation among non-human primates.
- ²³ For discussion see Tomasello and Call (1997), Cartmill and Byrne (2007) Kalan and Boesch (2015), Moore (2016), Crockford et al (2017), and Townsend et al (2017).

- ²⁴ See Blumstein (2007) and Kappeler et al (2013) for discussion of more general features of mammalian communication systems; see Pepperberg (1999) and (2004) for discussion of grey parrots and corvids.
- ²⁵ Calcott (2013). As Calcott emphasizes, this is a similar but not quite identical distinction to the ultimate explanation/proximate explanation distinction developed by Mayr (1961).
- ²⁶ This example is discussed in Calcott (2009), building on the discussion in Prum (1999).
- ²⁷ The lineage version of the argument helps to bring out the fact that the distinction between natural communication (or, relatedly natural meaning) and the category of communicative intention cannot be exhaustive or sharp. For a sharp division of this kind would involve an abrupt transition from the mechanisms that enable organisms to track and respond to co-variations in their environment to the mechanisms that enable organisms to generate meta-representations and reflexive meaning intentions. The trouble for INTENTIONALISM is that an abrupt transition in mechanisms of this kind would violate the continuity requirement on lineage explanations. I will set this problem aside for the purposes of my discussion since it could well be maintained, following Grice's own remarks (1957), p. 215 on the issue, that there are cases of communication that do not neatly fit into either the category of natural communication or the category of minded communication.
- ²⁸ In his (1982) discussion, Grice provides a brief discussion of the origins of communicative intention or SPEAKER MEANING (in his technical use of this phrase). But Grice himself takes his discussion to be a *mythic* origin story, rather than a serious historical or evolutionary reconstruction. Even as myth—or what Bar-On (1995) insightfully describes in terms of a *rational* reconstruction of the origins of SPEAKER MEANING—the trouble with Grice's tale is that it does not provide an account of the *population level* processes that serve to explain why the psychological capacities supporting SPEAKER MEANING would need to come on the scene in the first place. My present point is that plausible population level accounts presuppose that the members of the underlying population are already engaging in minded communication.
- ²⁹ See Tomasello (2014), and more cautiously, Sterelny (2012) for a recent statement of this view.
- ³⁰ See Cosmides and Tooby (1992), and the papers in Byrne and Whiten (1989).
- ³¹ See Hrdy (2009), Sterelny (2012) and Gergely and Csibra (2011).
- ³² See Dunbar (1996) for a particularly clear development of this basic point.
- ³³ The proviso about “asocial” psychological processes of reasoning and reflection is important because—as Mercier and Sperber (2017) have recently argued—psychological processes of reasoning and reflection could have evolved for social purposes such as discursive engagement and social persuasion.
- ³⁴ For relevant reviews, see Dunbar and Shultz (2007), Emery et al (2007), and especially Muthukrishna et al (2018).
- ³⁵ A similar claim has been made concerning the developmental origins of meta-representation in contemporary humans; see Garfield et al (2001), de Villiers and de Villiers (2014), Hayes (2018), and Moore (2020) for discussion. However, this (controversial) claim about human ontogeny is independent from the claim I am making in the paper about human phylogeny.
- ³⁶ Here and throughout I assume a broadly etiological account of functions of the sort suggested by Wright (1973), and subsequently elaborated and refined by many others.
- ³⁷ Of course, the relevant actions also function to *coordinate overt behavioral responses*. The present point is that acts of minded communicative function to coordinate over behavioral responses by way of functioning to bring about changes to audience members' representational states of mind.
- ³⁸ In a range of other cases discussed by Grice (1957), the same considerations lead to the same verdict. For instance, Grice suggested that cases like Herod presenting the severed head of John the Baptist on a platter or that of one agent showing a photograph of a painful event to another agent were not genuine cases of non-natural meaning or communication because at least one of the three conditions on communicative intention failed to be satisfied. However, these cases are all ruled to be instances of minded communication by the lights of the present account. I take these verdicts to be advantages of the present account rather than liabilities.
- ³⁹ This point highlights a contrast between the current approach to communication and the ‘expressivist’ approach to communication recently developed by Dorit Bar-On ((2013a) and (2013b)). Bar-On's account of communication centers on the important fact that that many paradigm cases of so-called expressive behaviors (e.g. a grimaced face or a hurried gait) are both mediated by the mental states of agents and can reveal those mental states to suitably informed audience members. One issue here concerns how to provide a clear and informative demarcation of the category of expressive behavior. But even if we just focus on paradigm cases of expressive behavior, the trouble is that there is nothing essentially communicative about the category of expressive behavior: many expressive behaviors are not produced because of the effects they have on others' states of mind and

are just as likely to be produced outside the context of social interaction as they are while interacting with others. In this sense, expressive behaviors can often serve as *cues* to agents' states of mind without functioning as genuine *communicative signals* of agents' states of mind. In my view, expressive behaviors are indeed relevant for the study of minded communication but only after those behaviors have been selected because of their role producing and perpetuating representational coordination.

- ⁴⁰ Cumming (2013a) and (2013b) discusses an analogue of this notion under what he calls *alignment*. For reasons Cumming emphasizes, it should be noted that representational coordination does not require that senders and receivers enter into numerically identical representational states of mind—in particular, representational coordination can be achieved among states of mind that have *relevantly similar* representational contents.
- ⁴¹ See Zuberbühler (2009) for a discussion of the different kinds of benefits that are at work in the use of alarm calls.
- ⁴² Similarly, patterns of action and response centering on representational coordination can come to be stably reproduced or perpetuated over time between two or more agents by a variety of psychological resources—for example, by *operant conditioning* or by *observational learning*—that are far less demanding than the patterns of common knowledge involved by Lewis himself; see Burge (1975), Gilbert (1989) and (1990), Skyrms (1996) and (2010), Millikan (1998), and Moore (2013) for discussion of this point.
- ⁴³ The analogy should not be pushed too far. Many cases of natural communication are under only very limited or partial genetic control, and cultural transmission can occur in the absence of representational coordination via a kind of cultural eavesdropping in which members of an out-group acquire valuable attitudes and skills by covertly observing the actions of those in some in-group.
- ⁴⁴ In his important and otherwise insightful discussion, Skyrms (1996), pp. 93-94 quite explicitly makes the inference from (i) the fact that vervets have no need for higher-order mental states to stabilize their use of alarm calls to (ii) vervets have no need for mental states at all to stabilize their use of alarm calls. A similar pattern of inference may be behind his more recent assertion that “all meaning is natural meaning.” (2010), p. 1.
- ⁴⁵ Intervening variables could also be *endogenously* introduced as a function of more complex and, in particular, more modular forms of biological signaling. This appears to be Millikan's general strategy and it is deftly pursued in Barrett and Skyrms (2017). Although nothing I say is inconsistent with this strategy, I'm skeptical that all talk of mental representation or of psychological processes can be explained in terms of interactions between discrete entities playing the roles of senders and receivers; see Shea (2018) for useful discussion of this point.
- ⁴⁶ See, for example, Menzel (2011), Abbott and Dukas (2009), and Chatterjee et al (2019). As Rescorla (2013) highlights, there is a need to interpret these results cautiously.
- ⁴⁷ See Grüter and Ratnieks (2011) and Wray et al (2012).
- ⁴⁸ Versions of this paper were presented to audiences at the Institute of Philosophy in London, at the Institut Jean-Nicod, at the Philosophy of Biology at Dolphin Beach Workshop, at the University of Queensland, at the 2nd California Philosophy Workshop, at the LPS Program at UC Irvine, and at the University of Connecticut. I thank those present at these talks for their insightful questions and comments. I have benefited from extensive conversations and feedback from my colleagues and students at UCLA, particularly Tyler Burge, John Carriero, Sam Cumming, Daniela Dover, Gabe Dupre, Gabe Greenberg, Mark Greenberg, Pamela Hieronymi, Gabby Johnson, A.J. Julius, Bill Kowalsky, Gavin Laurence, Savannah Leon, Michael Rescorla, Sherri Roush, and Seana Shiffrin. I am also greatly indebted to conversations and encouragement from Dorit Bar-On, Peter Godfrey-Smith, Grace Helton, Eliot Michelson, Ruth Millikan, Richard Moore, Alex Morgan, Michael Nelson, Wai San Ng, Lucy O'Brien, Cailin O'Connor, Carlotta Pavese, Matthew Stone, Ron Planer, Stephen Schiffer, Robert Seyfarth, and Will Starr. Finally, I would like to thank two anonymous referees provide by *Nous* for their helpful and judicious comments on the paper.

REFERENCES

- Abbott, K., & Dukas, R. (2009). Honeybees consider follower danger in their waggle dance. *Animal Behavior*, 78, 633–635.
- Andrews, K. (2012). *Do ape read minds? Toward a new folk psychology*. MIT Press.
- Armstrong, J. (2019). Provincialism in pragmatics. *Philosophical Perspectives*, 32, 5–40. <https://doi.org/10.1111/phpe.12114>

- Armstrong, J. (Forthcoming). Communicative intention as luck reduction. In A. Fairweather & C. Montemayor, (Eds.), *Linguistic luck*. Oxford: Oxford University Press.
- Augustine, St. (426/2008). *On Christian Teaching*, edited and translated by R. Green. Oxford University Press.
- Avramides, A. (1989). *Meaning and mind: an examination of a gricean account of language*. Cambridge, MA: MIT Press.
- Barrett, J., & Skyrms, B. (2017). Self-assembling games. *The British Journal for the Philosophy of Science*, 68(2), 329–353.
- Bar-On, D. (1995). Reconstructing ‘Meaning’: Grice and the Naturalization of Semantics. *Pacific Philosophical Quarterly*, 76, 83–116.
- Bar-On, D. (2013a). Origins of meaning: Must we ‘go gricean.’? *Mind and Language*, 29(3), 342–375
- Bar-On, D. (2013b). Expressive communication and continuity skepticism. *Journal of Philosophy*, 110(6), 293–330.
- Bennett, J. (1976). *Linguistic behavior*. Cambridge: Cambridge University Press.
- Blumstein, D. (2007). The evolution, function, and meaning of marmot alarm communication. *Advances in the Study of Behavior*, 37, 371–400.
- Breheny, R. (2006). Communication and Folk Psychology. *Mind and Language*, 21(1), 74–107.
- Burge, T. (1975). On Knowledge and Convention. *Philosophical Review*, 84(2), 249–255.
- Burge, T. (2010). *Origins of Objectivity*, Oxford: Oxford University Press.
- Burge, T. (2018). Do infants and nonhuman animals attribute mental states? *Psychological Review*, 125(3), 409–434.
- Byrne, R. & Whiten, A. (1989). *Machiavellian Intelligence: Social Expertise and the Evolution of Intellect in Monkeys, Apes, and Humans*. New York: Oxford University Press.
- Calcott, B. (2009). Lineage Explanations: explaining how biological mechanisms change. *The British Journal for the Philosophy of Science*, 60(1), 51–78.
- Calcott, B. (2013). Why how and why aren’t enough: more problems with Mayr’s proximate-ultimate distinction. *Biology & Philosophy*, 28(5), 767–780.
- Carmill, E., & Byrne, R. (2007). Orangutans Modify Their Gestural Signaling According to Their Audience’s Comprehension. *Current Biology*, 17(15), 1345–1348.
- Chatterjee, A., et al (2019). Honey Bees Flexibly Use Two Navigational Memories When Updating Dance Distance Information. *Journal of Experimental Biology*, 222, <https://doi.org/10.1242/jeb.195099>
- Cheney, D. & Seyfarth, R. (1990). *How Monkeys See the World: Inside the Mind of Another Species*. The University of Chicago Press.
- Cheney, D. & Seyfarth, R. (2007). *Baboon metaphysics: The evolution of a social mind*. University Of Chicago Press..
- Cosmides, L., & Tooby, J. (1992). Adaptations for reasoning about social exchange. in H. Barkow, L. Cosmides and J. Tooby (eds.), *The adapted mind*, New York: Oxford University Press
- Crockford, C., Wittig, R., Zuberbühler, K. (2017). Vocalizing in chimpanzees is influenced by social-cognitive processes. *Science Advances*, 3(11).
- Csibra, G., & Gergely, G. (2011). Natural pedagogy as evolutionary adaptation. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 366, 1149–1157.
- Cumming, S. (2003a). Creatures of Darkness. *Analytic Phil*, 54(4), 379–400.
- Cumming, S. (2013b). From Coordination to Content. *Phil. Imprint*, 13(4), 1–16.
- de Villiers, J. G., & de Villiers, P. A. (2014). « The role of language in theory of mind development. *Topics in Language Disorders*, 34(4), 313–328.
- de Villiers, J., Stainton, R., & Szatmari, P. (2007). Pragmatic abilities in autism spectrum disorder: A case study in philosophy and the empirical. *Midwest Studies in Philosophy*, 31(1), 292–317.
- Ducheminsky, N., Henzi, P., & Barrett, L. (2014). Responses of vervet monkeys in large troops to terrestrial and aerial predator alarm calls. *Behavioral Ecology*, 25(6), 1474–1484
- Dunbar, R. (1996). *Grooming, Gossip, and the Evolution of Language*, Cambridge, MA: Harvard University Press.
- Dunbar, R. & Shultz, S. (2007). Understanding Primate Brain Evolution. *Philosophical Transactions of The Royal Society B Biological Sciences*, 362(1480), 649–658.
- Emery, N., Seed, A., von Bayern, M., & Clayton, N. (2007). Cognitive adaptations of social bonding in birds. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, 362(1480), 489–505.
- Fischer, J., & Price, T. (2016). Meaning, intention, and inference in primate vocal communication. *Neuroscience & Biobehavioral Reviews*, 82, 22–31.

- Garfield, J. L., Peterson, C. C., & Perry, T. (2001). Social cognition, language acquisition and the development of the theory of mind. *Mind and Language*, 16(5), 494–541.
- Gauker, C. (2008). Zero Tolerance for Pragmatics. *Synthese*, 165, 359–371.
- Gentry, E., Breuer, T., Hobaiter, C., & Byrne, R. W. (2009). Gestural communication of the gorilla (*Gorilla gorilla*): Repertoire, intentionality and possible origins. *Animal Cognition*, 12, 527–547.
- Gilbert, M. (1989). *On social facts*. New York: Routledge.
- Gilbert, M. (1990). Rationality, coordination, and convention. *Synthese*, 84, 1–21.
- Glüer, K., & Pagin, P. (2003). Meaning theory and autistic speakers. *Mind & Language*, 18(1), 23–51.
- Godfrey-Smith, P. (1996). *Complexity and the function of mind in nature*. Cambridge: Cambridge University Press.
- Godfrey-Smith, P. (2014a). Signs and Symbolic Behavior. *Biological Theory*, 9, 78–88.
- Godfrey-Smith, P. (2014b). Sender-Receiver Systems Within and Between Organisms. *Philosophy of Science*, 81, 866–878.
- Godfrey-Smith, P. (2016). *Other Minds: The Octopus, the Sea, and the Deep Origins of Consciousness*. William Collins.
- Godfrey-Smith, P. (2017). Senders, receivers, and symbolic artifacts. *Biological Theory*, 12(4), 275–286.
- Grice, H. P. (1957). Meaning. *Philosophical Review*, 66(3), 377–388; reprinted in Grice (1991).
- Grice, H. P. (1969). Utterer's Meaning and Intentions. *The Philosophical Review*, 68, 147–77; reprinted in Grice (1991).
- Grice, H. P. (1982). Meaning Revisited. In N.V. Smith (Ed.), *Mutual knowledge*, pp. 223–243. New York: Academic Press.
- Grice, H. P. (1991). *Studies in the way of words*. Cambridge: Harvard University Press.
- Ginsburg, G., & Jablonka, E. (2019). *The evolution of the sensitive soul: learning and the origins of consciousness*. MIT Press.
- Gómez, J. C. (1994). Mutual awareness in primate communication: A Gricean approach. In (S. T. Parker, R. W. Mitchell, & M. L. Boccia Eds.), *Self-awareness in animals and humans: Developmental perspectives* (pp. 61–80). Cambridge University Press.
- Grüter, C., & Ratnieks, F. (2011). Honeybee foragers increase the use of waggle dance information when private information becomes unrewarding. in *Animal Behaviour*, 81(5), 949–95.
- Harris, D. (2021). Imperative inference and practical rationality. *Philosophical Studies*, <https://doi.org/10.1007/s11098-021-01687-0>
- Heyes, C. (2018). *Cognitive gadgets: The cultural evolution of thinking*. Cambridge, MA: Harvard University Press
- Hrdy, S. (2009). *Mothers and others: The evolutionary origins of mutual understanding*. Cambridge: Harvard University Press.
- Hume, D. (1739/1975). *A Treatise of Human Nature*, edited by L. A. Selby-Bigge, 2nd ed. revised by P. H. Nidditch. Oxford: Clarendon Press.
- Kalan, A., & Boesch, B. (2015). Audience effects in chimpanzee food calls and their potential for recruiting others. *Behavioral Ecology and Sociobiology*, 69, 1701–1712.
- Kaplan, D. (1989). Demonstratives. in *Themes from Kaplan*, Almog, J., Perry, J., and Wettstein, H. (eds.), Oxford: Oxford University Press, 481–563.
- Kaplan, D. (1989b). Afterthoughts. in *Themes from Kaplan*, Almog, J., Perry, J., and Wettstein, H. (eds.), Oxford: Oxford University Press, pp.565–614.
- Kappeler, P., Barrett, L., Blumstein, D., & Clutton-Brock, T. (2013). Flexibility and constraint in the evolution of mammalian social behavior. *Philosophical Transactions of the Royal Society Series B*, 368.
- Karakashian, S., Gyger, M., & Marler, P. (1988). Audience effects on alarm calling in chickens (*Gallus gallus*). *Journal of Comparative Psychology*, 102(2), 129–135.
- Keysar, B. (2000). The illusory transparency of intention: Does June understand what Mark means because he means it? *Discourse Processes*, 29(2), 161–172.
- Lewis, D. (1969). *Convention*, Cambridge: Harvard University Press.
- Liebal, K., Waller, B., Burrows, A., & Slocombe, K. (2013). *Primate communication: A multimodal approach*, Cambridge: Cambridge University Press.
- Maynard Smith, J., & Harper, D. (2003). *Animal Signals*, Oxford: Oxford University Press.
- Mayr, E. (1961). Cause and effect in biology. *Science*, 134(3489), 1501–1506.
- McDowell, J. (1980). Meaning, communication, and knowledge. in Z. Van Straaten (ed.), *Philosophical subjects*. Oxford University Press.

- Menzel, R. et al (2005). Honey Bees Navigate According to a Map-Like Spatial Memory. *Proceedings of the National Academy of Sciences of the United States of America*, 102(8), 3040–5.
- Menzel, R. (2011). A common frame of reference for learned and communicated vectors in honeybee navigation. *Current Biology*, (8), 645–50.
- Mercier, H., & Sperber, D. (2017). *The Enigma of Reason*, Cambridge, MA: Harvard University Press
- Merker, B. (2005). The liabilities of mobility: A selection pressure for the transition to consciousness in animal evolution. *Consciousness and Cognition*, 14(1), 89–114.
- Millikan, R. (1984). *Language, Thought and Other Biological Categories*. Cambridge, Mass.: MIT Press.
- Millikan, R. (1998). Language Conventions made simple. *Journal of Philosophy*, 95(4), 161–180.
- Millikan, R. (2004). *Varieties of Meaning: The 2002 Jean-Nicod Lectures*. Cambridge, Mass.: MIT Press.
- Moore, R. (2013). Imitation and conventional communication. *Biology & Philosophy*, 28(3), 481–500.
- Moore, R. (2016). Meaning and ostension in great ape gestural communication. *Animal Cognition*, 19(1), 223–231.
- Moore, R. (2020). The cultural evolution of mind-modelling. *Synthese*, <https://doi.org/10.1007/s11229-020-02853-3>.
- Moran, R. (2018). *The Exchange of Words: Speech, Testimony, and Intersubjectivity*. Oxford: Oxford University Press.
- Muthukrishna, M., Doebeli, M., Chudek, M., & Henrich, J. (2018). The Cultural Brain Hypothesis: How culture drives brain expansion, sociality, and life history. *PLoS computational biology*, 14(11), e1006504. <https://doi.org/10.1371/journal.pcbi.1006504>
- Neale, S. (1992). Paul Grice and the philosophy of language. *Linguistics and Philosophy*, 15, 509–559.
- Nussbaum, M. (1986). *Aristotle's De Motu Animalium*. Princeton University Press
- Pepperberg, I. (1999). *The Alex Studies: Cognitive and Communicative Abilities of Grey Parrots*. Cambridge MA: Harvard University Press
- Planer, R., & Godfrey-Smith, P.(2020). Communication and representation understood as sender–receiver coordination. *Mind & Language*, 1–21. <https://doi.org/10.1111/mila.12293>
- Prum, R. (1999). Development and Evolutionary Origin of Feathers. *Journal of Experimental Zoology*, 285, 291–306.
- Railton, P. (2001). Practical competence and fluent agency. In David Sobel & Steven Wall (eds.), *Reasons for Action*. Cambridge University Press. pp. 81–115.
- Recanati, F. (1986). On Defining Communicative Intentions. *Mind and Language*, 1(3), 213–241.
- Rescorla, M. (2013). Millikan on Honeybee Navigation and Communication. in *Millikan and Her Critics*, eds. D. Ryder, J. Kingsbury, and K. Williford. Wiley-Blackwell: pp. 87-102.
- Rosati, A., Hare, B. A., & Santos, L. R. (2009). Primate social cognition: Thirty years after Premack and Woodruff. In (M. Platt & A. A. Ghazanfar Eds.) *Primate Neuroethology*. Cambridge: MIT Press. 117-143.
- Schiffer, S. (1972). *Meaning*, Oxford: Oxford University Press.
- Schiffer, S. (1982). Intention-Based Semantics. *Notre Dame Journal of Formal Logic*, 23(2), 119–156.
- Schlenker, P., et al (2016a). Formal monkey linguistics. *Theoretical Linguistics*, 42(1-2), 1–90.
- Schlenker, P., Chemla, E., Zuberbühler, K. (2016b). What Do Monkey Calls Mean? *Trends in Cognitive Sciences*, (12), 894-904. <https://doi.org/10.1016/j.tics.2016.10.004>.
- Scott-Phillips, T. (2008). Defining Biological Communication. *Journal of Evolutionary Biology*, 21(2), 387–95.
- Scott-Phillips, T. (2014). *Speaking our minds: Why human communication is different, and how language evolved to make it special*. Palgrave Macmillan.
- Seyfarth, R., & Cheney, D. (2015). Social cognition. *Animal Behavior*, 103, 191–202.
- Seyfarth, C. D., & Marler, P. (1980). Vervet monkey alarm calls: Semantic communication in a free-ranging primate. *Animal Behavior*, 28, 1070–1094.
- Shea, N.(2018). *Representation in Cognitive Science*. Oxford University Press.
- Shea, N., Godfrey-Smith, P., & Cao, R.(2018). “Content in Simple Signalling Systems”. *The British Journal for the Philosophy of Science*, 69(4), 1009–1035.
- Sherman, P. (1977). Nepotism and the Evolution of Alarm Calls. *Science*, 197(4310), 1246–1253
- Skyrms, B. (1996). *Evolution of the social contract*. Cambridge: Cambridge University Press.
- Skyrms, B. (2010). *Signals: Evolution, learning, and communication*, Oxford: Oxford University Press
- Sperber, D., & Wilson, D. (1986). *Relevance: Communication and cognition*. Cambridge: Harvard University Press.
- Sterelny, K. (1995). Basic minds. *Philosophical Perspectives*, v.9, 251–270.
- Sterelny, K. (2003). *Thought in a hostile world*, Oxford: Blackwell.
- Sterelny, K. (2012). *The evolved apprentice: How evolution made humans unique*, Cambridge, MA: MIT Press.

- Struhsaker, T. T. (1967). Auditory Communication Among Vervet Monkeys. In S. A. Altmann (ed.), *Social Communication among Primates*. Chicago: University of Chicago Press. 281–324.
- Tomasello, M. (2014). *A natural history of human thinking*. Cambridge: Harvard University Press.
- Tomasello, M., & Call, J. (1997). *Primate cognition*. Oxford: Oxford University Press.
- Tomasello, M., Call, J., & Hare, B. (2003). Chimpanzees understand psychological states—the question is which ones and to what extent. *Trends in Cognitive Science*, 7, 153–156.
- Townsend et al (2017). Exorcising Grice's ghost: an empirical approach to studying intentional communication in animals. *Biological Reviews*, 92(3), 1427–1433
- Wray, M., Klein, B., & Seeley, T. (2012). Honey bees use social information in waggle dances more fully when foraging errors are more costly." *Behavioral Ecology*, 23(1), 125–131.
- Wright, L. (1973). Functions. *Philosophical Review*, 82, 139–168.
- Zuberbühler, K. (2009). Survivor signals: the biology and psychology of animal alarm calling. *Advances in the Study of Behavior*, 40, 277–322.

How to cite this article: Armstrong J. Communication before communicative intentions. *Noûs*. 2021;1–25. <https://doi.org/10.1111/nous.12396>