# Natural meaning, probabilistic meaning, and the interpretation of emotional signs

Constant Bonard

Published in *Synthese* (2023) 201:167 <https://doi.org/10.1007/s11229-023-04144-z>

Version: Author accepted manuscript.

[1. Introduction 1](#_Toc131515186)

[2. Natural meaning, probabilistic meaning, and emotions 3](#_Toc131515187)

[3. Three difficulties for probabilistic meaning 9](#_Toc131515188)

[3.1. First difficulty: All that a signal means 9](#_Toc131515189)

[3.2. Second difficulty: The extinct eagle scenario 13](#_Toc131515190)

[3.3. Third difficulty: Imperative pre-illocutionary force 17](#_Toc131515191)

[4. Conclusion 21](#_Toc131515192)

[Acknowledgments 22](#_Toc131515193)

[References 22](#_Toc131515194)

### Abstract

When we see or hear a spontaneous emotional expression, we usually immediately, effortlessly, and often correctly interpret it to mean happiness, sadness, or some other emotion as well as what this emotion is about. How do we do that? In this article, I evaluate how useful the concepts of natural meaning and probabilistic meaning are when it comes to explaining how we and other animals interpret emotional signs displayed without communicative intentions. I argue that Grice’s notion of natural meaning, because it is a factive relation, is too restrictive for this purpose. I then present the notion of probabilistic meaning. The latter seems adequate for analyzing our ability to interpret non-communicative emotional signs, but it faces several difficulties when it comes to analyzing how we and other animals interpret emotional *signals,* i.e.signs that have the function to communicate emotional information. I present three of these difficulties. En passant, I suggest that a teleosemantic notion may be better suited for these challenges.

## 1. Introduction

How do you know what emotions others feel and what these emotions are about? Sometimes, people simply tell you or overtly show you how they feel. These are cases where people *speaker-mean* (or non-naturally mean) what emotion they undergo (Grice, 1957). According to mainstream contemporary pragmatics, you interpret what people mean in such cases notably thanks to your recognizing their communicative intentions, making some assumptions about their rationality, and inferring the content of these intentions (for a review, see Green, 2007, Chapter 3). Other times, people display their emotions without communicative intentions, but you nevertheless understand what emotion they undergo and what it is about. Think about cases such as betraying one’s emotion, despite one’s will, through a frown, a trembling voice, tensed muscles, or a blush. Think also about infants or nonhuman animals instinctively and successfully communicating their emotions through screams and gestures.

These are examples of *emotional non-speaker meaning interpretation*. They are examples of *emotional meaning interpretation*, because, for instance, you (correctly) *interpret* Sam’s blush to *mean* that he is *embarrassed by Maria’s remark*. And they concern *non-speaker* *meaning* because they do not involve the communicative intentions required by speaker meaning (for a review of the literature on what these intentions amount to, see Bonard, 2021 Appendix). Signs produced without such communicative intentions are called *non-ostensive* signs. These signs include both *signals* – i.e. signs that have the communicative function to carry the information that they carry (Green, 2007, Chapter 1) – as well as non-communicative signs.

Our question in this article will be the following: What theoretical constructs best explain the ability to infer pieces of information about others’ emotional states (the psychological mode and its intentional content) by observing non-ostensive signs of these states? In other words: how does the audience interpret – and often successfully understand – emotional non-speaker meaning?

In the following, after a brief discussion of Grice’s notion of natural meaning and its relation to the interpretation of emotional signs, I will present the notion of probabilistic meaning (Millikan, 2004; Scarantino, 2015; Scarantino & Piccinini, 2010; Shea, 2007; Skyrms, 2010; Stegmann, 2015). We will see how it seems able to explain our ability to correctly interpret the meaning of at least some non-communicative emotional signs. However, in §3 we will then see that probabilistic meaning faces three problems with respect to the interpretation of emotional *signals*. We will also see, en passant, that these problems may constitute a prima facie argument for vindicating teleosemantic notions because the latter appear to have what it takes to overcome these problems.[[1]](#footnote-1)

Before, let me briefly comment on the expected contribution of this paper. Arguments against the idea that we can analyze the interpretation of signs only with factive and probabilistic notions have already been given by teleosemanticists, e.g. by Millikan (1989, 2004, 2013, 2017) (for reviews, see Scarantino, 2015, sec. 5; Shea, 2013, 2018, sec. 1.3; Shea et al., 2018, sec. 3.2). However, some probabilistic accounts of non-intentional information transmission seem able to avoid such objections – I’m thinking in particular about Scarantino’s work on information, animal communication, and emotional expression (Scarantino, 2013, 2015, 2017). Part of what is novel about this paper is that it presents objections against the idea that we can analyze the interpretation of signs in purely probabilistic terms thanks to such accounts – objections that are (at least partially) new, as far as I know. The other way in which this paper is novel is by focusing on the interpretation of emotional signs. Let me explain this focus.

The umbrella question with which this paper is concerned is how observers come to know unobserved facts from observing signs of those facts. Though I am confident that it is worth pursuing this question at a general level, I believe that discussing a particular range of cases in detail allows us to have a clearer idea of what is going on in these cases. Furthermore, it may be the case that a teleosemantic account works well for a range of signs, but not for all signs (this is the reason why some philosophers like Sterelny (1990), Nanay (2014), Shea, Godfrey-Smith, and Cao (2018), or Green (2019) put forward what Sterelny calls ‘modestteleosemantic proposals’ (1990, sec. 6.6)).

Now, I focus on emotional signs, as opposed to another limited range of cases, for several reasons. First, it is a domain where we possess extensive empirical studies. This will prove useful below. Secondly, many emotional signs are widely recognized as emotional signals. This will also play a role in the arguments below. Thirdly – and most significantly as far as I am concerned – our ability to understand emotions deserves a special focus because it bears on other important issues.

A first is the essential role that this ability plays in our social life – it could be useful to better understand what goes wrong when one misinterprets emotional signs, notably for therapeutic reasons (Wells et al., 2021). A second is that the interpretation of emotional signs – e.g. alarm calls – plausibly has played an important role in the evolution of human communication: explaining what cognitive mechanisms are at play there may even shed light on the origin of human linguistic abilities (Bar-On, 2013). A third related issue is whether emotional signs are interpreted through general cognitive mechanisms or rather by special mechanisms – cognitive modules – dedicated to this purpose (I will touch on this question below). A fourth concerns whether and how an AI could come to a human-level competence in interpreting emotions, which itself is a question that will become more and more important for theoretical and practical reasons as AIs improve and become more common. Hopefully, this paper can very modestly contribute to some small parts of these broad and important research programs.

That being said, versions of the arguments below may apply more broadly to our interpretation of signs and signals in general. However, because those can be of very different kinds, I prefer to leave this question for future work. In particular, I am not confident that explanations of how we and other animals interpret emotional signals (which will be my focus) may extend to the working of less complex signaling systems (e.g. bacteria signals) or more sophisticated ones (e.g. conventional signals).

## 2. Natural meaning, probabilistic meaning, and emotions

To explain our ability to interpret emotional non-speaker meaning, a natural place to start is with the concept of natural meaning. Grice (1957) himself incidentally suggested such an explanation when he wrote:

‘If I frown spontaneously, in the ordinary course of events, someone looking at me may well treat the frown as a natural sign of displeasure.’ (Grice, 1957, p. 383)

Grice’s goal in this article was different from the present project. His main aim was an analysis of two senses of the verb ‘to mean’. By contrast, my goal is to better explain how we interpret non-ostensive emotional signs. Nevertheless, natural meaning is relevant to my project because, as Grice’s remark suggests, the observer may exploit the fact that the frown means displeasure to gain knowledge about the frowner’s affective state.[[2]](#footnote-2) Dretske (1981) notably used a notion similar to Grice’s natural meaning – that of natural information – to analyze how observers can gain knowledge about unobserved facts from signs of these unobserved facts. And scholars such as Godfrey-Smith (1991), Millikan (2004), Skyrms (2010), and Scarantino (2015) have pursued projects similar to mine based on Dretske’s notion.

Grice’s natural meaning can be understood as factive indication: if a sign of type x naturally means an event or state of affairs of type p, then whenever a token of x is instantiated, a token of p is also instantiated.[[3]](#footnote-3) Only if this entailment holds may we say that x naturally means that p. Natural meaning thus has a very strict necessary condition (as does Dretske’s natural information, which is also factive). This strictness doesn’t threaten in any way the soundness of Grice’s notion (or Dretske’s) – a frown of a certain type may well naturally mean displeasure if the frowner is indeed displeased. However, it may pose a problem for the project of explaining how we interpret emotional signs – which, once again, wasn’t Grice’s.

More specifically, we would face a problem if we accepted an explanation based on natural meaning that has some initial plausibility but that appears to be incorrect. Here it is: an observer would learn about the emotional state of the person observed in virtue of knowing that the token expression they observe belongs to a type that naturally means that the person displaying the expression is in a certain kind of emotional state (like anger, sadness, etc.). In other words, the explanation would be that a token sign S is taken by observer O to mean that someone is in an emotional state of type ET because S is taken by O to belong to the sign type ST and that signs of type ST naturally means that its bearer is in ET. The problem with this explanation is that, it seems, there are no sign types whose tokens naturally mean that someone is in a certain kind of emotional state. Let us see why by turning first to facial expressions.

For one thing, facial expressions may be faked. Secondly, the muscles of our face may, in certain situations, form a pattern that is normally associated with a certain emotion, even though we do not undergo this emotion. For example, Barrett, Mesquita, and Gendron (2011) present a photograph of Serena Williams displaying what is considered to be a prototypical ‘angry face’ in research on facial expressions of emotions (Young et al., 2002). However, she certainly is not angry in this photo, as she has just scored an important point (see Fig. 1).



**Fig. 1.** Serena Williams displaying a facial expression associated with anger according to research by Ekman and colleagues (from Barrett et al., 2011)

In fact, more recent findings suggest that none of the patterns of facial muscle contractions proposed in the relevant literature factively indicate an emotion kind (Barrett et al., 2019).

What about other emotional signs besides facial expressions? Are there other types of cues that can be considered to naturally mean emotional states? When we turn to the relevant literature, we find only one well-evidenced case: some types of physiological cues may naturally mean emotional arousal in ‘regular’ contexts. More precisely, in a context where the person has not been physically active (e.g. has not run in the last hour) and where we put aside extraordinary scenarios (e.g. the subject’s brain has been artificially manipulated, they are an alien), the following changes in physiology taken as a whole appear to naturally mean that the subject is emotionally aroused: blushing, sweat increase, pupil dilatation, heart rate modification, increase in respiratory rhythm, decrease in deepness of breath (panting), and exacerbated muscular tonus. Furthermore, each of these stimuli taken individually appears to naturally mean arousal if we restrict the context further – e.g. if we take pupil dilatation as a sign, we need to make sure that the context doesn’t involve a change in light intensity.[[4]](#footnote-4) Note that these types of cues in the relevant contexts naturally mean emotional *arousal* only, and not even positive or negative emotional valence nor types of emotional states such as anger, sadness, etc.

There don’t seem to be other examples where types of cues recognizable with the naked eye naturally mean types of emotional states.[[5]](#footnote-5) This suggests that, in general, an observer doesn’t learn about the kind of emotional state of the person observed by knowing that the cues they display belong to a type that naturally means an emotional state. (And I haven’t even mentioned yet the problem of explaining how one understands what is the intentional object of other’s emotions beyond what emotional kind is expressed.)

However, one may make the following suggestion: nevertheless, natural meaning may still be a relation we exploit when we correctly interpret emotional signs provided that we quantify the claim as follows: this type of sign (in a certain set of contexts) *usually* naturally means emotional state s (about a certain object).[[6]](#footnote-6) The observer may know this and thus form the belief that the person observed is *probably* undergoing such or such emotion (about such or such object). This suggestion leads us to consider another type of theoretical construct. Instead of using phrases like ‘x usually/often/occasionally naturally means p’, philosophers interested in our ability to acquire knowledge about facts from observing signs of these facts proposed definitions of what I will call ‘probabilistic meaning’.

Probabilistic meaning includes different notions that all make use of less-than-1 correlationsbetween a sign and what the sign is a sign of (Millikan, 2004; Scarantino, 2015; Scarantino & Piccinini, 2010; Shea, 2007; Skyrms, 2010; Stegmann, 2015). There are two main ways to define probabilistic meaning: using objective or subjective probabilities. I will present a preeminent example of each type, that of Shea (2007) and that of Scarantino (2015), which should be representative of the general notion.

Here is Shea’s definition of ‘correlational information’, a type of probabilistic meaning defined in terms of ‘chance’, or objective probability, i.e. an ontologically mind-independent kind of probability (with R and C referring to types of sign and conditions):

« R carries the correlational information that condition C obtains iff for a common natural reason within some spatio-temporal domain D: chance (C | R is tokened) > chance (C | R is not tokened). » (Shea, 2007, p. 421)

The restriction to ‘common natural reason within some spatio-temporal domain’ is meant to eliminate accidental correlations, i.e. eliminate ‘spurious correlations’ which are neither directly nor indirectly causally related (more on spurious correlations below).

If we put aside spurious correlations, the idea basically is that if some type of sign x (e.g. dark clouds approaching) raises the objective probability that a type of state of affairs p obtains (it will rain), then x gives a probabilistic indication that p. If ‘information’ is understood, as is usual, as what reduces uncertainty, then some information is indeed carried by the sign. Consequently, organisms may make beneficial use of such probabilistic indication even though it isn’t factive.

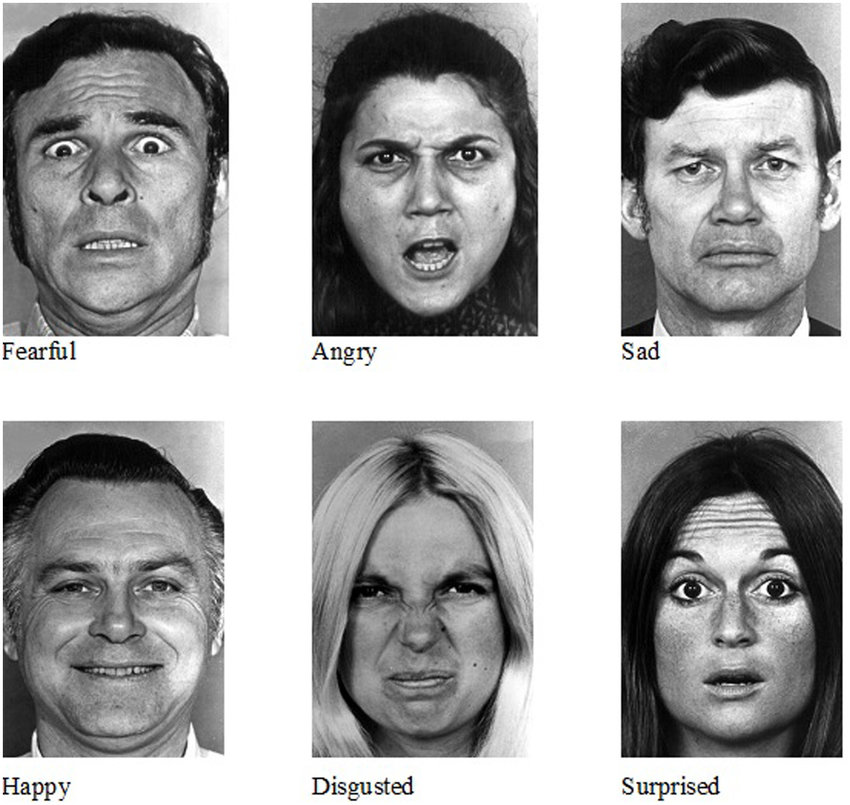
Another kind of probabilistic meaning is defined by Scarantino (2015), who uses Bayesian, ontologically mind-dependent probabilities (‘p(… | …)’ in the quote). In the following quote, ‘r’ stands for a token sign, i.e. an entity which can carry information, ‘s’ for the source of information in the world, i.e. that which we can learn about, and ‘G’ and ‘F’ for properties or states:

« Incremental Natural Information (INI): r’s being G carries incremental natural information about s’s being F, relative to background data d, if and only if p(s is F | r is G & d) ≠ p(s is F | d). » (Scarantino, 2015: 423; see also Scarantino & Piccinini, 2010)

Scarantino’s definition of INI is a way to formalize the Bayesian/Shannonian idea that the information carried by a cue corresponds to the number of hypotheses one can eliminate once one has become appropriately acquainted with the cue, given one’s initial hypotheses, i.e. prior credence or background data. Simplifying somewhat, we may say that if a token sign x probabilistically means that p, then observing x modifies one’s credence about p, given some background data. This modified credence can then be used as background data in further observations. For instance, if these black clouds over location L probabilistically mean that it is raining at L, then observing that there are these black clouds over L modifies one’s credence about whether it is raining at L – given relevant background data, such as that, when there are black clouds over some place, it often is raining there (a background data which we may have acquired from past observations that there often is rain when there are black clouds).[[7]](#footnote-7)

Coming back to emotional signs, probabilistic meaning seems perfectly fitted to explain at least some cases where we can gain knowledge about someone else’s emotions from observing changes in physiological cues. Among the latter are the physiological signs mentioned above that are used by affective scientists to measure affects: increased sweating, pupil dilatation, heart rate, breathing rate, and breathing deepness. Each of these signs, given a regular context, carries the correlational information (in Shea’s sense) that the person is affectively aroused. We can become acquainted with that correlation by observation and we can thus gain knowledge about other’s emotional states from observing these signs. To put this in terms used by Scarantino, even if we start with no background data about what these signs mean, repeated observations that they are present when others are affectively aroused strengthen the observer’s subjective probability that people are aroused when they display these signs. This suggests that the notion of probabilistic meaning may explain how we and other animals interpret emotional signs in everyday cases through the information we gain from observed correlated events. [[8]](#footnote-8)

A particularly promising candidate here concerns the famous Ekmanian facial expressions for ‘basic emotions’ (Fig. 2). A facial expression that belongs to one of these six types may well probabilistically mean that the person undergoes the corresponding emotion kind. It doesn’t matter that people sometimes fake them or that we may sometimes put on these faces while not undergoing the corresponding emotions (Serena Williams’ example above). There doesn’t need to be one-to-one correlations between these facial expression types and the emotions they express.



**Fig. 2.** Ekmanian facial expressions (from Young et al., 2002)

However, in the next section, we will see reasons to doubt that this application works as well as it first seems. It appears that we need something else than the information we gain from observed correlated events to explain the interpretation of emotional signals.

Let me highlight already that the arguments below will not concern emotional non-communicative signs. As far as this paper is concerned, the way we interpret the latter may be captured perfectly well by purely probabilistic accounts. For this reason, the following arguments may suggest a division of labor between accounts of the interpretation of emotional non-communicative signs vs. signals – even if the latter is restricted to non-speaker meaning.

## 3. Three difficulties for probabilistic meaning

### 3.1. First difficulty: All that a signal means

In his work, Ekman remarks in several places that tokening a facial expression of emotion may allow us to infer information not only about the kind of emotion that is expressed but also about plenty of other, related, pieces of information. He takes as an example the photograph of a woman with an apparent facial expression of anger (we can think of that in Fig. 2) and writes:

« Consider the diverse information that someone who observes this expression, totally out of context, just as it appears on the page, might obtain.

* Someone insulted/offended/provoked her.
* She is planning to attack that person.
* She is remembering the last time someone insulted her.
* She is feeling very tense.
* She is boiling.
* She is about to hit someone.
* She wants the person who provoked her to stop what he/she is doing.
* She is angry. » (Ekman, 1997: 316)

To evaluate how probabilistic meaning can deal with the ability to interpret emotional signals, we will focus on a simpler, less controversial, but well-studied case: the vervet monkey alarm call for eagles (‘eagle call’ for short). However, let us keep in mind that the discussion also applies to what Ekman hypothesizes and we will come back to it.

Vervet monkeys, like many species, use alarm calls in situations of imminent danger that are highly charged emotionally. However, contrary to what was generally thought until the seminal field work of Seyfarth and Cheney (1980), these calls don’t only convey the information that the monkeys are afraid but also what they are afraid of. Eagle calls in particular communicate the fear *of an eagle,* one of their main predators. Vervet monkeys also have alarm calls for leopards and snakes but that is not important for my argument. I could have taken as an example a generic alarm call that expresses fear of all types of threats and replace in the following ‘eagle’ with ‘threat’ *mutatis mutandis*. Focusing on the eagle call however makes the discussion more convenient.[[9]](#footnote-9)

Echoing somewhat Ekman’s remarks, I will assume that token eagle calls are interpreted by other monkeys to mean, among other things, the following:

1. I’m so afraid!
2. An eagle (a threat) is present.
3. Get down from the canopy!

Let us start with (i). Given that an eagle call is tokened, there is more probability, objective or subjective, that (i); so, the eagle call does probabilistically mean that (i).

A first difficulty for a purely probabilistic account of what the eagle call is interpreted to mean is that there are many other states of affairs whose probability is greater given that the eagle call is tokened: for this reason, the call probabilistically means lots of things which neither the vervet monkeys nor we interpret it to mean.[[10]](#footnote-10)

To see why let us first take the objective definition of probabilistic meaning from above.[[11]](#footnote-11) Here are some of the states of affairs that have a greater (non-accidental, objective) chance of being the case given the fact that the eagle call has been tokened compared to a scenario where the eagle call has not been tokened:

1. The sky is green.
2. The speed of sound in air is about 343 meters per second.

(iv) is made more probable because a tokening of the call raises the probability that a monkey has seen an eagle, and so raises the probability that the sky is any color other than brown since there is a greater probability that an eagle is seen by a monkey if the sky is any color other than brown. The fact that (iv) is false is irrelevant since probabilistic meaning is non-factive.

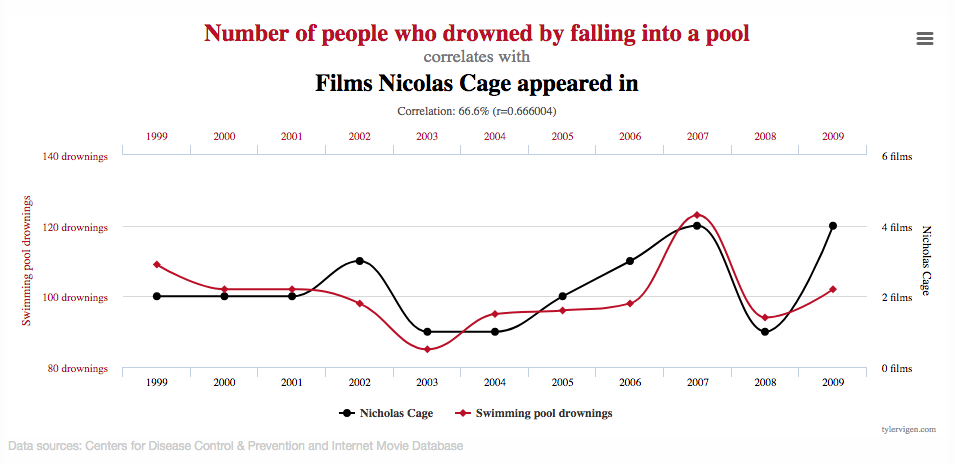
(v) is made more probable given that the eagle call is tokened because the probability that the speed of sound in air is 343 m/s is made greater every time a sound is tokened that travels in air at this speed.

We may indefinitely multiply examples of this kind.

The difficulty here seems to come from the fact that the eagle call is not only a sign, but it is a communicative sign: a *signal*. We don’t want to say that the meaning of the eagle call, understood as a signal, is that the caller is afraid *and* that the sky is green, *and* a whole bunch of other non-relevant and potentially absurd pieces of information. Similarly, we don’t want to say that the meaning of the angry-looking expression in Ekman’s photo is that someone insulted/offended/provoked her *and* a whole bunch of absurd pieces of information that are (non-accidentally) correlated with it. Nevertheless, this is what is implied by the objective definition of probabilistic meaning when we apply it to such cases.

Roughly, the same remarks can be made concerning Scarantino’s subjective definition except that we should always relativize to whom the sign means something. According to his account, the eagle call probabilistically means (i)–(v) for those who have the background knowledge which allows them to modify the strength of their credences about (i)–(v). For instance, the call means (v) to sound physicists (not to monkeys), and so on.[[12]](#footnote-12)

Another difference is that Scarantino’s definition does not require that there is any non-accidental link between the call and what it means. This implies that the call carries much absurd information given certain background data. Indeed, absurd correlations are legion. To illustrate, consider the following graph:



**Fig. 3.** A spurious, accidental correlation: In a given year, the number of people who drowned by falling into a pool (red) correlates with the number of films Nicolas Cage appeared in (black). Correlation: r=0.666004.[[13]](#footnote-13)

Now that you have seen this graph (and learned about the 0.666 correlation) between the number of films Cage appears in and the number of people who drown by falling into a pool, you possess sufficient background knowledge for the following to hold according to Scarantino’s definition: to you, if 100 people have drowned in a pool in 2022, it means (/carries the information) that Nicolas Cage featured in two movies in 2022.

Such results may seem risible, but defenders of probabilistic meaning can bite the bullet. After all, it is far from unreasonable to make inferences based on statistical correlations. Of course, sometimes such correlations are trivial (e.g. (v)) and sometimes they are spurious (Cage’s example), but, overall, correlations *are* informative. So, even though we find examples where the common use of the word ‘meaning’ seems not to apply, defenders of probabilistic meaning may say that their purpose was not to find a definition that reflects the common use of this word (contrary to what Grice was doing) but to define a useful theoretical construct, a technical notion, and so it is fine that it is odd to use the word ‘meaning’ in certain cases (the remarks from this paragraph applies *mutatis mutandis* for the phrase ‘carries the information’ instead of the word ‘meaning’).[[14]](#footnote-14)

I actually agree with this response and don’t think that (iv)–(v) or spurious correlations should lead us to abandon the notion of probabilistic meaning. Nevertheless, I find it reasonable to consider the present difficulty to be a genuine objection to using a definition of probabilistic meaning to analyze how we or other animals interpret the meaning of emotional signals, especially if there is a better technical concept around. The fact is that teleosemantic notions do seem to do a better job at predicting what is the information conveyed by signals to their receivers (see e.g. Green, 2019; Shea et al., 2018).

In a nutshell, the main advantage of teleosemantic notions over probabilistic meaning when it comes to analyzing the interpretation of emotional signals, as opposed to that of non-communicative signs, is that teleosemantic notions do take into account the *function* that signals have. For instance, it is not the function of the eagle call to transmit spurious correlations, nor is it to transmit (iv) and (v). Thus, they are not part of the teleosemantics of the signal. By contrast, it is very plausible that it is part of the evolutionary function of the eagle call to communicate (i)–(iii), and so part of its teleosemantics.

This hypothesis is also in line with the fact that vervet monkey alarm calls seem to be inherited genetically and that species that are phylogenetically close to vervet monkeys possess calls with similar acoustic features and apparently identical communicative functions (Price et al., 2014). Vervet monkeys may indeed genetically inherit dedicated cognitive mechanisms (perhaps modules) whose biological functions are to interpret alarm calls (and to produce them). And these communicative functions shaped by evolution would be what teleosemantic accounts postulate.

The interpretation we make of other people’s emotional expressions is also plausibly tightly connected with what is the communicative function of these expressions, whether they are genetically inherited or not. Indeed, most and perhaps all non-ostensive emotional expressions possess a communicative function that they have been given by natural selection, cultural selection, convention, or an individual’s intention (Green, 2007, Chapter 2). For instance, the angry-looking expression discussed by Ekman plausibly has the function of communicating (something like) the pieces of information listed by Ekman and quoted above. Just like monkeys’ interpretations of eagle calls, we do not interpret others’ emotional expressions to mean all that they are correlated with. But, perhaps, we normally interpret them to mean what they have the function to communicate. And, if Ekman is correct, some of these functions may be inherited genetically and shared across all human cultures through cognitive mechanisms (modules) dedicated to the production and interpretation of prototypical facial and vocal expressions of ‘basic emotions’.

The remarks of the last two paragraphs are mere hypotheses. Evaluating their plausibility cannot be done here. My point was only to suggest that a teleosemantic account that is not based solely on the observation of correlated events but further postulates communicative functions (which may be partly inherited genetically) promise an account that corresponds better to how we interpret certain emotional signals – though this may not hold for non-communicative signs.

### 3.2. Second difficulty: The extinct eagle scenario

Certain emotions, such as fear and disgust, often are ‘false alarms’, in the sense that we are often afraid of something that is not dangerous or disgusted by something that is not contaminated. From an evolutionary perspective, at least for certain species and certain stimuli, this makes sense because the cost of false alarms – i.e. of undergoing these emotions when there is nothing to be afraid of or to be disgusted by – is significantly less than the cost of ‘misses’ – i.e. of not undergoing these emotions even though there actually is something to be afraid of or to be disgusted by (Godfrey-Smith, 1991).

Now, take the following imaginary but realistic scenario. Imagine a group of vervet monkeys that happens to live in an area where eagles have recently gone extinct. Assume furthermore that vervet monkeys are quite faint-hearted creatures, whose fear episodes often are false alarms. Although there no longer are any eagles around, they often are afraid that there is one, for instance when another type of big bird flies around, even if it’s not a predator – e.g. a goose. As a result, the monkeys use their eagle call more often than not when a large non-eagle bird is around and no eagle is around. Nevertheless, the monkeys still understand the call as being eagle-related (as per (ii) above) and they react with the same behavior as before: they gaze up and anxiously get down from the canopy as quickly as possible, to find cover, and wait there terrified. This is so even for monkeys that were born during this ‘extinct eagles’ era and so have never experienced any correlation between eagle calls and eagle attacks. Nevertheless, even for these youngsters, what the call is interpreted to mean seems not to have changed at all: everyone reacts as though an eagle – a threat – was present every time.[[15]](#footnote-15)

The present difficulty for purely probabilistic accounts is that, it seems, we cannot explain why this call is still interpreted as being eagle-related by all members of the group solely with the probabilistic notions from above and the evidence provided by observed correlated events.[[16]](#footnote-16)

Let us start with the objective probabilistic notion. Here it is, as a reminder:

« R carries the correlational information that condition C obtains iff for a common natural reason within some spatio-temporal domain D: chance (C | R is tokened) > chance (C | R is not tokened). » (Shea, 2007, p. 421)

In the extinct eagle scenario, it is not true anymore that the call carries the correlational information that there is an eagle around because if ‘C’ = ‘there is an eagle around’ and ‘R’ = ‘the eagle call’, then it is not true that chance (C | R is tokened) > chance (C | R is not tokened) since both chances are null. So, this objective probabilistic account cannot by itself explain that the vervet monkeys still interpret the call to mean (ii).[[17]](#footnote-17)

Let us now turn to the subjective probabilistic account. As a reminder, here is Scarantino’s definition:

« r’s being G carries incremental natural information about s’s being F, relative to background data d, if and only if p(s is F | r is G & d) ≠ p(s is F | d). » (Scarantino, 2015: 423)

Given my assumptions, it is not the case that the eagle call carries incremental natural information about there being an eagle around to the young monkeys insofar as these youngsters have never experienced a correlation between the eagle call and the presence of eagles and, so, haven’t acquired the required background data.

To see why let us fill in the variables as follows:

* r’s being G = the eagle call being heard by the young monkeys
* s’s being F = there being a non-eagle large bird (and no eagle) around
* d = the background data of young monkeys acquired through experience

Given my assumptions, Scarantino’s definition predicts that the eagle call probabilistically means ‘there is a non-eagle large bird (and no eagle) around’ to the young monkeys because the subjective probabilities p(s is F | r is G & d)) and p(s is F | d) are not equal. They are not because, given their acquired background data, young monkeys have a higher credence that there is a non-eagle large bird (and no eagle) around when they hear the call compared to when they don’t hear it since they have experienced more often there being a non-eagle large birds (and no eagles) being around when they heard the eagle call compared to when they didn’t. Indeed, as mentioned in the description of the scenario, the monkeys are faint-hearted and use the call more often than not when a non-eagle large bird (and no eagle) is around. However, once again, the problem is that even the young monkeys interpret the call to be eagle-related.

There is a possible fix for someone who would nevertheless want to use Scarantino’s notion here. One could appeal to genetically inherited background data: an innate prior credence that the eagle call is positively correlated with the presence of an eagle. This innate credence would imply that the call does carry incremental natural information about there being an eagle around and so this notion could be used to explain how the young monkeys interpret the call.

However, this move would seem to transform a purely probabilistic account into a hybrid probabilistic-teleosemantic account insofar as this prior credence could only be explained, it seems, by a mental mechanism that is inherited genetically to fulfill an evolutionary function: the function of taking the sound of a call as an input and yielding a credence about an eagle being present as an output. In other words, what protects Scarantino’s account from the present difficulty seems to be a teleosemantic (or teleosemantic-like) element – i.e. a communicative function shaped by evolution. This move would be fair enough and it is not in contradiction with Scarantino’s general framework as far as I know. But my present concern is to evaluate non-teleosemantic, purely probabilistic accounts. As mentioned in section 2, my aim is to evaluate explanations of the interpretation of emotional signs that are based on the information that observers get from observed correlated events – that is what I mean by ‘purely probabilistic account’. Such accounts, in contrast to mixed probabilistic-teleosemantic accounts, wouldn’t appeal to innate cognitive mechanisms whose function is to link the sign observed to its interpreted meaning irrespectively of observed correlated events. Furthermore, once we postulate an innate mechanism that takes the call as an input and yields a credence about an eagle being around as an output, it seems that probabilistic notions become superfluous in the sense that this mechanism explains by itself how monkeys interpret the call and so that we don’t need in addition an account appealing to observed correlated events.[[18]](#footnote-18)

Another line of response for the defender of probabilistic meaning is the ‘add a belief’ strategy. The idea is the following: (ii) is just a shortcut for the following, more primitive, interpretation:

(ii\*) The user of the call believes that an eagle is present

Even in the extinct eagle scenario, there is an objective correlation between the eagle call and (ii\*). And the explanatory role of the hypothesis that the call is interpreted to mean (ii) can also be played by the hypothesis that it is interpreted to mean (ii\*). For instance, the fact that the other monkeys look up to the sky when they hear the eagle call and get down from the canopy is due to their inferring (ii) (‘An eagle is present’) from (ii\*) (‘The user of the call believes an eagle is present’).

I see two main problems with this response. The first is that it is not clear that vervet monkeys can attribute beliefs (or belief-like states) to each other and infer the relevant conclusions as is required by the inference from (ii\*) to (ii): they may well lack the cognitive capacities to attribute beliefs and make inferences on this basis. Furthermore, even if they can, such inferences may still be a cognitively challenging task, which may take some time, attention, and energy to achieve, and which they may fail to perform with a high success rate. Such cognitive difficulties are far from ideal in situations of emergency such as when predators attack. Thus, it would be much more efficient to have a call that means (ii) rather than (ii\*). But then, why would natural selection lead them to interpret the call to mean (ii\*) instead of (ii) directly, a message which appears to be more fit to the function of the signal?

These remarks apply beyond the eagle call to many emotional signals. Such signals are present in creatures that seem not to have the cognitive ability to attribute beliefs or belief-like states to others. This includes many nonhuman species and human infants. Nevertheless, emotional signals seem to be correctly interpreted by these creatures to carry information about how the world is (Bar-On, 2013) and most paradigmatically about the presence or absence of a threat. As far as human infants are concerned, this is nicely shown by emotional signaling in the visual cliff paradigm: parents usually successfully signal to their one-year-olds that crossing a transparent plexiglass structure is safe/not safe by displaying a joyful/fearful facial expression (Sorce et al., 1985).

The second, related, problem of the ‘add-a-belief’ response is that at least some emotional signals have the function to inform about the external *world* as opposed to inform aboutbeliefs or other mental (or internal) states of the communicator. From evolutionary and developmental points of view, it seems rather clear that the point of many emotional signals – paradigmatically alarm calls – is not to instill in others beliefs about the signaler’s beliefs, but rather to inform about a threat. This constraint cannot be respected by the move from (ii) to (ii\*).

Before we move on, observe that we can come up with scenarios similar to the extinct eagle scenario for many other emotional signals. For instance, we can imagine a human culture where fearful ‘alarm screams’ are only used in contexts where there is no threat (e.g. they are only used by actors, horror-movie watchers, roller-coaster riders, etc.) but where, nevertheless, the scream is still interpreted as signaling a threat – if someone screamed on the street, people would instinctively think the person is in danger. This is not implausible insofar as humans may well have an innate disposition to interpret certain screams as alarms for threats (Arnal et al., 2015). In this scenario, the scream has preserved its communicative function despite the absence of correlations between the scream and the presence of threats. As with the extinct eagle scenario, I don’t see how this could be adequately explained solely with a purely probabilistic account.

More generally, it seems that scenarios similar to the extinct eagle scenario could be designed for all emotional expressions whose communicative functions endure irrespectively of changes in probability, in particular when their production and interpretation are genetically inherited. Though the extent of genetically inherited emotional expression and interpretation is debated (see e.g. Barrett et al., 2019), its existence is certainly not to be excluded. If Ekman is correct that communication through the six facial expressions from Fig. 2 is genetically based, the difficulty from this section may apply to such cases and so, for instance, to our ability to infer various information from the photograph mentioned above of the woman with an angry-looking face (Ekman, 1997).

For all these reasons, it seems to me that cases like the extinct eagle scenario present a difficulty for the idea that the interpretation of emotional signals can be accounted for through purely probabilistic accounts. More particularly, these scenarios present a difficulty for the idea that we can learn about the intentional objects of others’ emotional states solely with the evidence provided by observed correlated events. By contrast, teleosemantic notions seem safe from such scenarios. A main advantage that teleosemantics has over probabilistic meaning here is that it allows signals to have, and preserve, their communicative function irrespectively of changes in probabilities – typically for functions that are inherited genetically.

Note once again that the present difficulty doesn’t apply to the interpretation of non-communicative signs.

### 3.3. Third difficulty: Imperative pre-illocutionary force

In the insightful article ‘How to do things with emotional expressions: The theory of affective pragmatics’ (2017), Scarantino discusses Ekman’s photograph of the angry-looking woman that I mentioned above. He agrees with Ekman that this facial expression allows an observer to infer the pieces of information mentioned in Ekman’s quote. Drawing on the speech act tradition, Scarantino argues that this invites us to analyze what the facial expression communicates through analogs of different illocutionary forces. It is analyzed as having an assertive (or indicative) force in virtue of indicating that ‘Someone insulted/offended/provoked her’. It has a directive (or imperative) force in virtue of communicating how the woman wants others to act (‘She wants the person who provoked her to stop what he/she is doing’). It has an expressive force in virtue of conveying how she feels (‘She is boiling’). And it has a commissive force (i.e. that of promises) in virtue of carrying information about how she plans to act (‘She is planning to attack that person’).

My third and last difficulty for a purely probabilistic account of how we interpret emotional signals is that it is hard to see how probabilistic meaning can have an imperative force, but it is at least plausible that human and nonhuman emotional expressions do send signals with an imperative force.[[19]](#footnote-19)

I’m not assuming that emotional expressions devoid of speaker-meaning possess the same illocutionary forces as genuine speech acts. Rather, the idea is that they may possess features analogous to illocutionary forces. I will reserve the expression ‘illocutionary force’ for genuine speech acts since the latter have many relevant properties that may be absent from signals devoid of speaker-meaning (e.g. illocutionary intents, common knowledge of speech act norms, clearly defined conventions, linguistic meanings, etc.). For the cases of non-speaker meaning where it nevertheless makes sense to distinguish analogs to illocutionary forces, I use the expression ‘pre-illocutionary force’.

There are reasons to be skeptical about the existence of pre-illocutionary force in emotional and affective signals.[[20]](#footnote-20) Nevertheless, if probabilistic accounts cannot make room for the possibility that pre-illocutionary forces exist, this constitutes a difficulty for them. We don’t want to exclude the possibility of their existence a priori – even if we are skeptical about it – in light of the important philosophical literature on this subject (see e.g. Huttegger, 2007; Martínez & Klein, 2016; Millikan, 1995; Scarantino, 2017) and the empirical evidence suggesting that pre-illocutionary forces play a role in emotional communication among human infants and nonhuman primates (Hopkins et al., 2013; Rivas, 2005; Van der Goot et al., 2014) (I come back to this below). Going back to the vervet monkey eagle call, remember that we assumed that this call sends the following messages:

1. I am so afraid!
2. An eagle is present.
3. Get down from the canopy!

Let us accept, at least for the sake of the argument, that (ii) has an indicative pre-illocutionary force with the content that an eagle is present and that (iii) has an imperative pre-illocutionary force with the content that the other group members get down from the canopy.[[21]](#footnote-21)

We have seen how the notion of probabilistic meaning is supposed to explain that the eagle call means (i) and (ii). How does it deal with (iii)? One strategy, briefly addressed above, would be to pursue the so-called ‘flattening scheme’ (García-Carpintero, 2015): to flatten all (pre-) illocutionary forces to only one – the indicative force (this move was made notably by Lewis, 1970).

In our case, this would amount to claiming that the meaning of (iii), even though it appears to have a different force than that of (ii), is actually re-describable through, and reducible to, a message with an indicative force, one that can be accounted for in probabilistic terms. So, (iii) may be analyzed as ‘Other monkeys will get down from the canopy (as a result of hearing this call)’[[22]](#footnote-22) or perhaps as ‘The call user desires that other monkeys get down from the canopy (as a result of this call)’. Vervet monkeys can communicate about the presence of an eagle (indicative force) as well as how they feel about it, and how others will, or are desired to, react to the presence of an eagle, thanks to a probabilistic co-variation between these three states of affairs and the uttering of the call. This allows us to ‘flatten’ the expressive and imperative forces to the indication of feelings and (future/desired) behaviors.

I am not convinced by this ‘flattening scheme’. To see why let us first concentrate on the following flattening interpretation of (iii): ‘Other monkeys will get down from the canopy (as a result of hearing this call)’. Sure, there is a correlation between a monkey making an eagle call and the members who heard the call getting down from the canopy. We can thus establish that the probabilistic meaning of the call involves this information about the future behavior of the other monkeys. However, a message carrying this information has an indicative function: it fulfills its communicative point just in case it is accurate, just in case it represents the world as possessing certain features, as being such that other monkeys will get down from the canopy after hearing the call. But this is not the (pre-) illocutionary function of imperatives. This is the (pre-) illocutionary function of a prediction. Imperatives do not have the function of representing the world as it is or as it will be, their function is to *get others* to do things and to do them as specified by the content of the imperative.

A defender of probabilistic meaning may agree with this and defend that it is the second flattening option which is the good one, i.e. ‘The call user desires that other monkeys get down from the canopy (as a result of this call)’. Imperatives plausibly express desires and desires themselves have an imperative force – this would be how imperatives inherit their (pre-) illocutionary force. So, in the monkey case, the imperative force of ‘Get down from the canopy!’ actually derives from the indication of the monkey’s desire that others get down from the canopy. The desire has the function of representing the world in such a way that it must change to fit its content. In this case, the content of the desire is that the other monkeys get down from the canopy. And probabilistic meaning can easily account for how this desire is conveyed: through a correlation between a monkey using the eagle call and this monkey desiring that the others get down from the canopy. The call inherits the force and the content of the desire, which is how it becomes an imperative, as opposed to a descriptive (such as the prediction that other monkeys will get down from the canopy).

This is the option suggested by Scarantino in his ‘theory of affective pragmatics’ (Scarantino, 2017), based notably on the remarks made by Ekman (1997) that I quoted above. As mentioned, Ekman remarks that a facial expression of emotion may not only carry information about what is felt by the person but also, among other things, about how the expresser desires that others behave. Scarantino argues that the information about this desire should be analyzed as having an imperative force.

This answer makes very interesting points, but it involves a move that is critical and about which I am skeptical: moving from the claim that a signal informs about a mental state – in particular, a desire – to the claim that the signal thus inherits the force of the mental state – the imperative force. The reason is that there can be signals which inform about desires that are not thereby imperatives. Here is an example: I inform you that I desire to finish this paragraph and eat lunch. Through this sentence, I thereby convey information about a world-to-mind mental state, a mental state with an imperative function. Does this suffice to give the sentence itself an imperative force? Clearly not. Even if I inform you about a desire which concerns your own actions, for instance in the sentence ‘I hereby inform you that I desire that you behave more ecologically’, this is not sufficient to give this sentence an imperative force.

In such cases, I have made assertions about my desire. I have produced a signal with an indicative force, even if its content is a desire, i.e. a mental state with an imperative force. The force of the content does not determine the (pre-) illocutionary force of the signal. That is why even though I conveyed my desire as part of the content of my speech act, I have not produced an imperative. But then, why would it be the case for the monkey using the eagle call or the woman displaying a facial expression of anger? Why wouldn’t they convey a desire but not an imperative? How can this be captured by the probabilistic theory of meaning? I don’t know how the defender can respond to these questions.

Another direction in which the defender of the probabilistic account may go is to refuse the starting point of this section and to deny that there is such a thing as pre-illocutionary imperatives. The defender of this strategy may argue that the way the eagle call works is that the probabilistic, indicative information about the eagle is plugged into some kind of consumer system of the receiver (such a move is made by e.g. Rescorla, 2012), which turns something non-imperative into action. ‘Get down from the canopy!’ is not part of the meaning of the signal, but monkeys infer that they ought to get down from the canopy from the fact that there is an eagle around, just like they would if they had seen an eagle instead of having heard the call.

This solution may work for the vervet monkey case (though see Huttegger (2007) for considerations suggesting that vervet monkeys use both indicatives and imperatives). However, it has the disadvantage of giving up on explaining the existence of pre-imperatives (and other pre-illocutionary forces). This is problematic insofar as empirical evidence from primatology and developmental psychology seem to show that apes and human infants do perform communicative acts with an imperative pre-illocutionary force through ‘request gestures’, something that can be observed independently of how the addressee reacts (Hopkins et al., 2013; Van der Goot et al., 2014). In other words, there is not only a downstream, pre-perlocutionary effect of the request gestures, but we can observe the pre-illocutionary intent to request something.

In fact, many researchers discussing attempts to teach sign language to apes (gorillas such as Koko or chimps such as Nim Chimpsky) note that they seem able to learn mostly, and perhaps only, imperative signals. In a review of a wide corpus of videos of chimpanzees who were taught sign language, 3,448 chimp signs were analyzed and the authors concluded that ‘Requests for objects and actions were the predominant communicative intentions of the sign utterances, though naming and answering also occurred.’ (Rivas, 2005, p. 404). Outside the realm of animal communication, but in relation to affects, imperative pre-illocutionary force is a construct that serves to explain what information pain signals carry (see e.g. Martínez & Klein, 2016). In these examples and others, denying the existence of pre-imperatives or giving up on an explanation of their nature would seem unfortunate.

However, we are not forced to go in this direction because, instead of trying to account for all non-speaker meanings through probabilistic meaning, we may account for the meaning of signals such as pre-imperatives through a teleosemantic notion. Indeed, it is entirely reasonable that the evolutionary function of certain signals is to convey contents with different forces (Huttegger, 2007). So, for instance, if we go back to Ekman’s photograph of the angry-looking woman, we may well hypothesize that this emotional signal has the functions of carrying information with an indicative force and of carrying information with an imperative force. What information an Ekmanian angry face has the function to carry will determine its pre-illocutionary force, according to a teleosemantic account. Let me note by the way that a teleosemantic account can allow this function to be acquired through natural evolution (as Ekman and, before him, Darwin hypothesized) but also through cultural selection or for other reasons (see e.g. Nanay, 2014). Teleosemantics requires that there is a semantic function, but this function may come from different sources, depending on the teleosemantic notion at hand.

Again, note that the third difficulty presented in this section doesn’t apply to non-communicative signs.

## 4. Conclusion

In this article, after having seen that the notion of natural meaning is too restrictive to explain how we and other animals interpret non-ostensive emotional signs, we saw that the notion of probabilistic meaning seems adequate for analyzing our ability to interpret at least some non-communicative signs, but that it faces several difficulties when it comes to signals. I have also mentioned that teleosemantic notions may overcome these difficulties.

Let me end with a tentative remark for potential future research. Since the difficulties concerned signals and not non-communicative signs, this suggests a possible division of labor between probabilistic and teleosemantic notions of meaning. Further inquiry on this may shed light on important issues related to emotional communication. In particular, as mentioned above, the arguments presented here may suggest that special-purpose cognitive mechanisms (cognitive modules, perhaps) possess the function to interpret certain emotional signals – a function that may be genetically inherited and that teleosemantic accounts aim to analyze. If so, this may be relevant to issues related to the evolution of human communication, therapeutic practices, or human-AI interaction, as mentioned in the introduction.

## Acknowledgments

Many thanks to Julien Deonna, Bence Nanay, Nick Wiltsher, and to two anonymous reviewers for their insightful written comments on previous versions of this paper. This research was funded by the Swiss National Science Foundation grants P2GEP1\_200057 and P500PH\_210771. A CC-BY public copyright license has been applied by the author to the present document and will be applied to all subsequent versions up to the Author Accepted Manuscript arising from this submission, in accordance with the grant’s open access conditions.

## References

Arnal, L. H., Flinker, A., Kleinschmidt, A., Giraud, A.-L., & Poeppel, D. (2015). Human Screams Occupy a Privileged Niche in the Communication Soundscape. *Current Biology*, *25*(15), 2051–2056. https://doi.org/10.1016/j.cub.2015.06.043

Bar-On, D. (2013). Origins of meaning: Must we ‘go Gricean’? *Mind & Language*, *28*(3), 342–375.

Barrett, L. F., Adolphs, R., Marsella, S., Martinez, A. M., & Pollak, S. D. (2019). Emotional expressions reconsidered: Challenges to inferring emotion from human facial movements. *Psychological Science in the Public Interest*. https://doi.org/10.1177/1529100619832930

Barrett, L. F., Mesquita, B., & Gendron, M. (2011). Context in emotion perception. *Current Directions in Psychological Science*, *20*(5), 286–290.

Bonard, C. (2021). *Meaning and emotion: The extended Gricean model and what emotional signs mean* [Doctoral dissertation, University of Geneva and University of Antwerp]. https://doi.org/10.13097/archive-ouverte/unige:150524

Bonard, C. (2022). Beyond ostension: Introducing the expressive principle of relevance. *Journal of Pragmatics*, *187*, 13–23. https://doi.org/10.1016/j.pragma.2021.10.024

Bonard, C. (under review). *Underdeterminacy without ostension*.

Bonard, C., & Deonna, J. (2023). Emotion and language in philosophy. In G. L. Schiewer, J. Altarriba, & B. C. Ng (Eds.), *Language and emotion: An international handbook*. de Gruyter. https://doi.org/10.1515/9783110347524-003

Cacioppo, J. T., Tassinary, L. G., & Berntson, G. (2017). *Handbook of psychophysiology* (4th ed.). Cambridge University Press.

Dretske, F. (1981). *Knowledge and the flow of information*. MIT Press.

Ekman, P. (1997). Expression or communication about emotion. In N. L. Segal, G. E. Weisfeld, & C. C. Weisfeld (Eds.), *Uniting psychology and biology: Integrative perspectives on human development.* (pp. 315–338). American Psychological Association. https://doi.org/10.1037/10242-008

García-Carpintero, M. (2015). Contexts as shared commitments. *Frontiers in Psychology*, *6*(1932). https://doi.org/10.3389/fpsyg.2015.01932

Godfrey-Smith, P. (1991). Signal, decision, action. *The Journal of Philosophy*, *88*(12), 709–722.

Green, M. (2007). *Self-expression*. Oxford University Press.

Green, M. (2019). Organic meaning: An approach to communication with minimal appeal to minds. In A. Capone, M. Carapezza, & F. Lo Piparo (Eds.), *Further advances in pragmatics and philosophy* (pp. 211–228). Springer. https://doi.org/10.1007/978-3-030-00973-1\_12

Grice, H. P. (1957). Meaning. *The Philosophical Review*, *66*(3), 377–388.

Grice, H. P. (1982). Meaning revisited. In N. V. Smith (Ed.), *Mutual knowledge* (pp. 222–243). Academic Press.

Hopkins, W. D., Russell, J., McIntyre, J., & Leavens, D. A. (2013). Are chimpanzees really so poor at understanding imperative pointing? Some new data and an alternative view of canine and ape social cognition. *PLoS One*, *8*(11), e79338.

Huttegger, S. M. (2007). Evolutionary explanations of indicatives and imperatives. *Erkenntnis*, *66*(3), 409–436.

Lewis, D. (1970). General semantics. *Synthese*, *22*, 18–67.

Martínez, M., & Klein, C. (2016). Pain signals are predominantly imperative. *Biology & Philosophy*, *31*(2), 283–298.

Millikan, R. G. (1989). Biosemantics. *The Journal of Philosophy*, *86*(6), 281–297.

Millikan, R. G. (1995). Pushmi-pullyu representations. *Philosophical Perspectives*, *9*, 185–200.

Millikan, R. G. (2004). *Varieties of meaning: The 2002 Jean Nicod Lectures*. MIT press.

Millikan, R. G. (2013). Natural information, intentional signs and animal communication. In U. Stegmann (Ed.), *Animal communication theory: Information and influence* (pp. 133–146). Cambridge University Press.

Millikan, R. G. (2017). *Beyond concepts unicepts, Language and natural information*. Oxford University Press.

Nanay, B. (2014). Teleosemantics without etiology. *Philosophy of Science*, *81*(5), 798–810.

Price, T., Ndiaye, O., Hammerschmidt, K., & Fischer, J. (2014). Limited geographic variation in the acoustic structure of and responses to adult male alarm barks of African green monkeys. *Behavioral Ecology and Sociobiology*, *68*(5), 815–825. https://doi.org/10.1007/s00265-014-1694-y

Rescorla, M. (2012). Millikan on honeybee navigation and communication. In D. Ryder, J. Kingsbury, & K. Williford (Eds.), *Millikan and Her Critics* (pp. 87–106). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118328118.ch4

Rivas, E. (2005). Recent use of signs by chimpanzees (Pan troglodytes) in interactions with humans. *Journal of Comparative Psychology*, *119*(4), 404–417. https://doi.org/10.1037/0735-7036.119.4.404

Scarantino, A. (2013). Animal communication as information-mediated influence. In U. Stegmann (Ed.), *Animal communication theory: Information and influence* (pp. 63–88). Cambridge University Press.

Scarantino, A. (2015). Information as a probabilistic difference maker. *Australasian Journal of Philosophy*, *93*(3), 419–443.

Scarantino, A. (2017). How to do things with emotional expressions: The theory of affective pragmatics. *Psychological Inquiry*, *28*(2–3), 165–185.

Scarantino, A., & Piccinini, G. (2010). Information without truth. *Metaphilosophy*, *41*(3), 313–330.

Seyfarth, R. M., & Cheney, D. L. (2003). Meaning and emotion in animal vocalizations. *Annals of the New York Academy of Sciences*, *1000*(1), 32–55.

Seyfarth, R. M., Cheney, D. L., & Marler, P. (1980). Monkey responses to three different alarm calls: Evidence of predator classification and semantic communication. *Science*, *210*(4471), 801–803.

Shea, N. (2007). Consumers need information: Supplementing teleosemantics with an input condition. *Philosophy and Phenomenological Research*, *75*(2), 404–435.

Shea, N. (2013). Naturalising representational content. *Philosophy Compass*, *8*(5), 496–509.

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. https://doi.org/10.1093/bjps/axw036

Skyrms, B. (2010). *Signals: Evolution, learning, and information*. Oxford University Press.

Sorce, J. F., Emde, R. N., Campos, J. J., & Klinnert, M. D. (1985). Maternal emotional signaling: Its effect on the visual cliff behavior of 1-year-olds. *Developmental Psychology*, *21*(1), 195.

Stegmann, U. (2015). Prospects for probabilistic theories of natural information. *Erkenntnis*, *80*(4), 869–893.

Sterelny, K. (1990). *The representational theory of mind: An introduction* (1st ed.). Wiley-Blackwell.

Van der Goot, M. H., Tomasello, M., & Liszkowski, U. (2014). Differences in the nonverbal requests of great apes and human infants. *Child Development*, *85*(2), 444–455.

Wells, A. E., Hunnikin, L. M., Ash, D. P., & van Goozen, S. H. M. (2021). Improving emotion recognition is associated with subsequent mental health and well-being in children with severe behavioural problems. *European Child & Adolescent Psychiatry*, *30*(11), 1769–1777. https://doi.org/10.1007/s00787-020-01652-y

Wharton, T., Bonard, C., Dukes, D., Sander, D., & Oswald, S. (2021). Relevance and emotion. *Journal of Pragmatics*, *181*, 259–269.

Witte, R. S., & Witte, J. S. (2017). *Statistics*. John Wiley & Sons.

Young, A., Perrett, D., Calder, A., Sprengelmeyer, R., & Ekman, P. (2002). Facial expressions of emotion: Stimuli and tests (FEEST). *Thames Valley Test Company (TVTC)*.

1. Besides teleosemantics, a Gricean-like pragmatic account whose scope extends beyond communicative intentions may also provide alternative explanations of the cases with which this paper is concerned – i.e. cases where probabilistic accounts fail to fully explain emotional non-speaker meaning interpretation – as I discuss elsewhere (Bonard, 2021, Chapters 1–4, 2022, under review; Wharton et al., 2021). However, the pragmatic account in question may well require social cognitive abilities that are absent from at least some of the cases below. [↑](#footnote-ref-1)
2. In ‘Meaning revisited’, Grice also suggested that an observer could learn that a creature is in pain because its behavior would naturally mean that it is in pain (Grice, 1982, sec. II). [↑](#footnote-ref-2)
3. As a reviewer noted, some may interpret natural meaning differently than I do and restrict it to a relation between individual tokens (as opposed to types or sets of tokens). If so, this and the following paragraphs would need to be reformulated. Nevertheless, my main point would remain the same, i.e. that the notion of natural meaning without probabilistic quantifying is too strict to explain how we interpret emotional signs. [↑](#footnote-ref-3)
4. Based on my review of the handbook considered the ‘bible’ of psycho-physiology (Cacioppo et al., 2017) and confirmed in personal communication by a psycho-physiologist specialized in emotions, Prof. Sylvain Desplanques (April 2020). [↑](#footnote-ref-4)
5. Note that psycho-physiologists may infer more from signs that are not observable with the naked eye – but I won’t discuss such cases because they cannot explain the everyday ability to interpret emotional non-speaker meaning. [↑](#footnote-ref-5)
6. Thanks to a reviewer for this formulation. [↑](#footnote-ref-6)
7. Scarantino suggests that the notion of (positive) incremental natural information fits a certain use of the phrase ‘x means y (to S)’ or of the phrase ‘x carries the information y (to S)’ – as in, e.g., ‘John’s frown means (/carries the information) that he is angry (to John’s wife)’ or ‘The eagle call means (/carries the information) that an eagle is present (to the other monkeys)’. He argues that this is a use that Grice’s or Dretske’s factive notions cannot capture (2015, p. 430-431). As a reviewer pointed out, this may be due to the fact that Scarantino’s notion captures a different sense of ‘meaning/carries information’: one that is epistemic as opposed to metaphysical. It concerns the *interpretation* of natural meaning/natural information where the latter refers to the metaphysical relation that Grice and Dretske would have been after. So, to avoid conflating two notions of meaning, one may want to rephrase sentences such as ‘To me, the black clouds mean (/carry the information) that it will rain’ as such: ‘I interpret the black clouds as meaning that it will rain.’ In what follows, I will sometimes use the first expression (as Scarantino does) but I agree that we shouldn’t conflate the epistemic and the metaphysical relations. I am interested in the epistemic one: in our *interpretation*, what signs mean *to observers*, what *we take* emotional signs to mean. [↑](#footnote-ref-7)
8. By ‘observed correlated events’ I mean either events with an objective positive probabilistic correlation that have been observed to be correlated or events to which the observer attributes a positive subjective probabilistic correlation in virtue of their observation of these events. [↑](#footnote-ref-8)
9. It is well known that alarm calls function to refer to threats, but let me highlight that considering them as emotional signals is also widely accepted among ethologists and other specialists. Tellingly, Seyfarth and Cheney write that ‘the emotional nature of animal vocalizations has never been in doubt’ (2003, p. 34). They add: ‘Given the obvious fact that animal vocalizations both communicate emotions and elicit them in others, contemporary scientists have directed their attention to the more complex question: do they communicate anything else?’ (2003, p. 34). Seyfarth and Cheney’s field work on vervet monkeys have famously provided evidence for a positive answer. After reviewing ethological literature on alarm calls among different species (including vervet monkeys), the two scientists remark that ‘[a]t present, the most reasonable hypothesis is that vocal production is caused by both the caller’s emotions and his assessment of […] other factors [such as what kind of predator is present, whether the caller is alone, or whether the call has already been produced]’ (2003, p. 43). They conclude that ‘emotion and reference are inextricably entwined, both in the production of calls by signalers and in the perception of calls by recipients’ (2003, p. 45). This is why I interpret the eagle call to express a fear whose intentional object is an eagle. [↑](#footnote-ref-9)
10. This difficulty is similar to the problem of finding an appropriate reference class for correlations, a problem addressed notably by Millikan (2004, Chapter 3, 2017, Chapter 11). However, the latter problem is broader than the difficulty I’m concerned with here and doesn’t concern signals specifically. Consequently, Millikan’s solution doesn’t resolve our difficulty because it doesn’t isolate how we interpret the information carried by signals understood as signals as opposed to non-communicative signs (for instance, it doesn’t explain why we don’t interpret mirthful laughter, understood as a signal, to mean (v)). Also, whether or not similar difficulties can be found in the teleosemantics literature, I don’t know that any of them focuses on emotional signs, which is the central goal of this article. [↑](#footnote-ref-10)
11. Let me highlight that Shea himself would probably agree with (at least some of) my criticisms and with my suggestion that a teleosemantic (or more specifically a ‘varitel semantic’) theory of signal content is needed (see Shea, 2007, 2018). My arguments thus are not directed at his general picture, but at the hypothesis that an objective definition of probabilistic meaning such as the one he defines would be enough to explain how we interpret non-ostensive emotional signals. Thanks to a reviewer for highlighting this. [↑](#footnote-ref-11)
12. To come back to the remark made in footnote 6, we could say instead that the call is *interpreted to* *mean* (v) by sound physicists, and so on. [↑](#footnote-ref-12)
13. Retrieved from <https://www.tylervigen.com/spurious-correlations> on July 4, 2022. The correlation r refers to the Pearson correlation coefficient (see Witte & Witte, 2017, Chapter 6). [↑](#footnote-ref-13)
14. Furthermore, they may add that, even though it sounds strange to say ‘The call means that the sky is green’, it is much less strange to say ‘The call means lots of things, just some of which are salient to other monkeys/explain why it evolved’. Thanks to a reviewer for this point. [↑](#footnote-ref-14)
15. This argument resembles the ‘better safe than sorry’ argument for teleosemantics as it can be found e.g. in Millikan (1989) and especially in Godfrey-Smith (1991), i.e. the idea that the meaning of signals cannot be accounted for by Grice’s natural meaning or Dretske’s natural information because certain signals, especially those signaling danger, can successfully convey what they mean despite often being false alarms. However, my argument diverges from those and targets probabilistic accounts that would use more recent notions, such as Shea’s and Scarantino’s. Shea’s notion (correlational information) can deal with scenarios where at least some calls are not false alarms because, in such scenarios, the call does change the objective probability that the relevant condition obtains, however frequent the calls are false alarms (thanks to a reviewer for highlighting that). However, as I will argue, it can’t deal by itself with my ‘extinct eagle’ scenario. Scarantino’s notion (incremental natural information) can also deal with the false alarm cases presented by Millikan and Godfrey-Smith (see Scarantino, 2015, sec. 5) because in these cases, the receivers have repeatedly experienced a correlation (however low it is) between the sign and what the sign informs them of. My scenario is different because the youngsters haven’t had this repeated experience of correlations so that, I argue, Scarantino’s notion cannot fully explain how they interpret the signal given their acquired background data. I discuss below a response that one could give to this based on genetically inherited data. [↑](#footnote-ref-15)
16. Note that there is a sense in which the probabilistic notions I discuss are perfectly correct in what I take to be their predictions: in a sense, the call does mean that there are no eagles around in this scenario and we can infer from the call that there probably are no eagles around (but rather another bird). But the monkeys do not make this inference, since they react to the call exactly as they did when eagles were frequent predators. My point is not that Shea or Scarantino’s notions are faulty, but rather that purely probabilistic accounts can’t explain how the monkeys in my scenario interpret the call. [↑](#footnote-ref-16)
17. As mentioned in a footnote above, Shea may well agree with this point since he believes that a teleosemantic or teleosemantic-like theory of signal content (a ‘varitel semantics’) is needed in addition to a merely probabilistic account. Once again, my goal is to argue against a purely probabilistic account and I use Shea’s correlational information because it is a good exemplar of probabilistic meaning based on objective probability. [↑](#footnote-ref-17)
18. Given how young monkeys react to hearing the call, the call plausibly increases their credence that an eagle is around. Doesn’t that suggest that there must be an account based on subjective probability that predicts that the call is interpreted to mean that there is an eagle around? It depends on how we interpret this question. My argument here is that it appears that this increase in subjective probability is plausibly explained by an account that appeals to something like the innate communicative mechanism mentioned. So, we can accept that the monkeys’ behavior is explained by an increase in their subjective probabilities while insisting that this increase itself must appeal to an element – the innate mechanism – that is not probabilistic. My general claim is not that there are no subjective probabilities involved, but that an account based solely on the evidence provided by observed correlated events can’t explain how monkeys interpret the call. [↑](#footnote-ref-18)
19. As far as I know, this argument is new. [↑](#footnote-ref-19)
20. See next footnote. [↑](#footnote-ref-20)
21. There are at least three reasons to be skeptical about the assumption that infant and nonhuman signals can send messages with an imperative pre-illocutionary force, contrary to what is assumed or argued for by the philosophers, primatologists, and developmental psychologists mentioned in the preceding paragraph (thanks to a reviewer for pressing me on this point). First, these cases (e.g. the eagle alarm call or infants and apes pointing) seem not to involve a genuine position of command but the latter may be a necessary criterion for imperatives. Second, relatedly, an imperative may need consequences if ignored but, plausibly, no consequences ensue if the receiver doesn’t comply in these cases (e.g. when an eagle call is ignored, the monkeys ignoring it aren’t punished by other monkeys). Third, these cases may not possess a determinable precise content though this may also be a necessary criterion (e.g. does the eagle call mean ‘Avoid aerial death!’, ‘Seek cover!’, or ‘Get down from the canopy!’?). I recognize the force of this skepticism, but I will nevertheless assume for the sake of the argument that the philosophers, primatologists, and developmental psychologists mentioned in question are targeting an existing phenomenon and that the eagle call sends message (iii) with an imperative pre-illocutionary force. Another way to think about this is to say that the three reasons to be skeptical about the existence of imperatives with a pre-illocutionary force (or ‘pre-imperatives’) actually point to traits that distinguish the pre-illocutionary imperative force from imperatives with the full-blown illocutionary force (or ‘full-blown imperatives’) – e.g. only full-blown imperatives require consequences if ignored, by contrast with pre-imperatives. I won’t discuss here whether and how the (pre-)illocutionary force of (i) is different from that of (ii) and (iii), but see Bonard and Deonna (2023). [↑](#footnote-ref-21)
22. It may be more intuitive to use ‘should’ or ‘ought’ instead of ‘will’ here, but I don’t see how we can quantify the probability of ‘should’ or ‘ought’ as opposed to that of ‘will’ and thus cannot see how probabilistic meaning can account for a ‘should’ or an ‘ought’, other than, perhaps, through desires. Hence my two ‘flattening’ interpretations. [↑](#footnote-ref-22)