

## Chapter 4

### Breaking the Silence: Green Mudras and the Faculty of Language in Plants

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There is a language older by far and deeper than words. It is the language of bodies, of body on body, wind on snow, rain on trees, wave on stone. It is the language of dream, gesture, symbol, memory. We have forgotten this language. We do not even remember that it exists.

--Derrick Jensen, *A Language Older Than Words*

Language is often said to be one of the hallmarks of being human and is thought to have emerged from the interactions of three adaptive systems, namely individual learning, cultural transmission, and biological evolution (Christiansen and Kirby 2003). The faculty of language has provided humans with an effective tool for classifying experiences, discriminating events and communicating what has been learned to others, thus steering adaptive adjustments to our way of being in (and relating to) the environment. There are many theories about the origins of language (Bolhuis et al. 2014) and while the truth is that we simply do not know where, when and how it did come about (Hauser et al. 2002), the evolution of language in humans is considered to be one of the most important events in the history of life on this planet (Maynard Smith and Szathmary 1995). There is, of course, no denying that language is essential to every aspect of our everyday lives. Through words, gestures and much more, we use language to inform others of a multitude of feelings, desires, worries, questions, insights we experience in relation to the world that surrounds us. The question is whether such use of language is truly an activity, a form of behavior, which makes us so unique and unlike other species.

The answer to this question clearly depends on how we define language and the criteria for its use. According to the Oxford English Dictionary, the formal definition of language includes:

- a.** The system of spoken or written communication used by a particular country, people, community, etc., typically consisting of words used within a regular grammatical and syntactic structure.
- b.** The vocal sounds by which mammals and birds communicate; (in extended use) any other signals used by animals to communicate.
- c.** A means of communicating other than by the use of words, as gesture, facial expression, etc.; non-verbal communication.

This definition readily acknowledges that non-human others share with our species a variety of cognitive and perceptual mechanisms that constitute ‘language’ in its broad sense (see in-depth discussion on faculty of language in the broad sense (FLB) and in the narrow sense (FLN) and their components by Hauser et al. 2002). This definition denotes what language enables an organism to *do*, including both verbal and non-verbal communication, and makes no specific reference to language as a uniquely human trait. Strangely, however, an internet search quickly reveals that it is a narrowly understood definition language (FLN) and its tendency to assume human uniqueness that continue being indoctrinated in schools and universities worldwide as established scientific facts. The exceptionality of the human language is conceived by virtue of the unique capacity of recursion--a concept proposed with no explicit definition by Hauser et al. 2002, and subsequently defined by Pinker and Jackendoff (2005) as a “a constituent that contains a constituent of the same kind”; in other words, a phrase of a certain type can be found inside a phrase of the same type like a linguistic equivalent of a set of Matryoshka dolls--and discrete infinity--the property by which a few finite elements produce an infinite number of expressions; see Chomsky (2000). The problem is that the empirical evidence does not support the theoretical assumption. For example, recursion may extend indefinitely *in principle*, but its actual usage is quite limited (e.g. Karlsson 2010; Laury and Ono 2010) and might even be absent in some human languages (Everett 2005). Additionally, recursive computations are not a unique feature of human language because they are found in other capacities, such as numerical and spatial cognition, which are more broadly distributed among non-human species (e.g. Gentner et al. 2006; see also Arsenijević, 2008; Arsenijević and Hinzen 2010). This discrepancy needs addressing because our narcissistic way of think about the world perpetuates an attitude of disregard for the non-human world and more generally, the natural environment.

To address the discrepancy, I make no attempt to be all-inclusive in my approach to this huge field of research on language. My inevitably selective treatment of the topic is primarily informed by emerging empirical evidence from the field of animal and plant

behavioral ecology rather than the wide variety of perspectives offered by linguistics and psychology. It is my goal, however, to engage the transdisciplinary dialogue between the psychological and ecological understanding of language--I approach this task by bridging the gap between the human and non-human world in two ways. On the one hand, I bring the human world closer to nature by showing that much of human language is instinctual and by virtue of its very 'materiality', closer than we think to the language of non-human others. On the other hand by showing the greater complexity of non-human communication and thus elevating it closer to human language, I attempt to bring nature closer to the human world via, ultimately, the medium of a more universal understanding of language.

### On the human superiority complex

Based on the common view portrayed by a narrow definition of the faculty of language (FLN), human language is creative and unpredictable, while the non-human (generally restricted to some animal species) communication is believed to be stereotyped, instinctive and predictable. But are we even sure that our use of language is truly unpredictable and creative? Based on linguistic evidence, Lakoff and Johnson (1980) showed that most of what we do every day and how we experience and describe the world around us is, in fact, instinctive; we think, act and communicate with each other using a stereotyped language that is defined by our culture through a conceptual system of metaphors which we are normally not even aware of. Perhaps it is because this system of metaphors is unavoidable and typically unconscious (Lakoff 2010) that we come to conceive of our language as spontaneous, free, unpredictable and creative, and, by logical extension, attribute each of these characteristics to our species as a whole, leading us into a trap of idolatry. Further, though there are many apparent differences between human and non-human language, it is sensible to question our long-standing practice of defining the essence of our humanness through the things that non-human others lack (Baker 2012). When we do so, we inevitably use the qualities and conditions of being non-human as oppositional foils. At best we fail to arrive at certain conclusions about our distinctiveness and at worst, we engender distorted beliefs about our own nature as well as that of non-human others--beliefs that then prove disastrous for our relationship both with our own natures and with those of others.

Because of its traditional foundation in human psychology and linguistics, the study of language assumes, to a greater or lesser extent, that human linguistic behavior constitutes the standard template for theorizing the issue. Clearly, taking human language as the diagnostic reference point to investigate what linguistic abilities are present in non-human others is inescapably anthropocentric and confines the interpretation of the communicative capacities of non-human others to the domain of human values and perception. To solve these problems, we need to envision an empirically tractable and phylogenetically neutral account of language (see examples from the evolution of signals and communication literature, such as Maynard Smith and Harper 2003; Jablonka and Lamb 2005; Skeyrms 2010) that resists the temptation of looking for evidence of signaling systems in the non-human world that exhibit the various forms of signaling and communication that jointly make up human language. And even then, such a strategy is still anthropocentrically tinted, being inevitably bounded (as previously mentioned) to our conceptual system of metaphors, which by virtue of being a bundle of incomplete representations, favors one way of seeing while obscuring others (Lakoff and Johnson 1980).

In this chapter, I will propose a slightly different approach, one that deliberately embraces the human ‘filter’ by employing the very same concepts such as language, meaning, symbols and culture (whose problematic character we have noted above), to then view language from a wider biological perspective in terms of what it lets us or any organism *do* (i.e. an embodied view of language; see review by Kelly et al. 2002; Clark 2006). By treating language as a real and perceivable feature of the whole organism-environment system, where linguistic information is used and come to have meaning in the same basic way as in perceptual-action situations (see Wilson and Golonka 2013), we are able to consider language as a meaning-making *activity* at the core of every form of life, whether human or not.

Here, I offer an overview of the most recent empirically grounded advances in our understanding of the actual ‘gestures’ and ‘utterances’ of others, and particularly plants, which may assist in opening up a fresh dialogue about and with these non-human others. Ultimately, the overall aim is to encourage the emergence of new ways of understanding our experience of the world; and in so doing, breathing life into a new narrative, where language is unbridled from human incarceration and its power is re-focused towards a more integrated perception of the world.

## The making of meaning

Humans use language to make sense of everything that surrounds them and to share their perceptions with others in order to reduce uncertainty about the world and possibly improve their capacity for survival. While our drive for language acquisition may be innate (Chomsky 1965; but see Tomasello 2003), its competent use in relation to a given cultural background is a meaning-making activity that is acquired through learning and inevitably bound to the context of its use (i.e. language is ‘meaning in use’ a la Wittgenstein; see Baker 2012). In this sense, our language is about information, certainty, and survival, but, most profoundly, language serves us in our attempt to grasp the essence of what it is like to experience being human. As a vibrating link encoded with all the memories of our species and all the life forms we descended from, the making of meaning is our gateway to experience our deep history of connection to all others, humans and non-humans. It is within this common milieu that humans and others use a language to represent events and things in their own environment, giving meaning to their individual experiences of being in the world. It is, then, accurate to say that (our) language is one of the hallmarks of being human; yet in its deeper connotation, such declaration is even more profound because it is equally true for all others.

As humans, bound as we are to our dwelling-world (see the notion of ‘Umwelt’; von Uexküll 2010), is it even possible to conceive the making of meanings by others--perceive the language of a humpback whale, a songbird, an ant, a sunflower or a bacterium? Doing so could be a matter of attunement to the enormous vocabulary of bodily postures, elusive gestures, loud colorful displays, fleeting acoustic and chemical utterances, and barely palpable electro-magnetic embraces used by all living forms, including us. Of course, this is no easy task. To start with, because of our innate anthropocentric bias (see discussion by Gagliano 2015), we are likely to recognize more readily (if at all) the existence of a language, when this is primarily made of sounds (i.e. speech as the defining ability of using language to engage in dialogue and its absence used to denote the ‘silence’ of nature; Vogel 2006). Yet this could be just the place where we start considering the language of non-humans from a wider biological perspective based on available empirical evidences. Birds, for example, have a considerable repertoire of sounds, which develops into articulate and complex ‘songs’ constituting part of their language, and exists alongside their innate call system (equivalent to

our human innate call system of screams, grunts, sighs, laughter). The avian language arises through learning earlier in life and it is fully developed by experience within the context of its use, so that birds know when to use certain vocalizations (e.g. a flight whistle is used only while the birds are flying; Rothstein and Fleischer 1987). The exquisite range of vocalizations including a variety of distinct regional dialects that makes up the avian language is motivated by a need to communicate and imbued with meanings, such as declaring ownership of a territory, attracting the attention of a potential mate, or repelling an intruder, all of which are examples of interactive exchanges between two or more individuals (i.e. conversations). Moreover, a recent study by Flower et al. (2014) found that a species of African bird is in fact rather talented at using language, especially that of other species, to ‘cry wolf’ in a bid to scare other animals away and steal their food. As true tacticians, these birds change their calls in response to the feedback they receive from their dupes, so that when one false alarm no longer works, the birds switch to another species’ warning cry (Flower et al. 2014). Whether or not these birds are actually intuiting what others are thinking or adapting their behavior by reflecting upon their meaning-making activity, the fact remains that their mastery of language is, like our own, a demonstration of a very accomplished capacity for creating sounds that acquire meaning because of how the information is used (i.e. to direct and regulate the behaviors of themselves or others), which ultimately enhances their survival.

Exactly how, though, do we approach others whose languages we fail to notice because they appear silent to us? Plants seem to fall into this particular category because theirs is primarily (as currently understood) a silent language of shapes, colors and scents (but see recent findings on the ability of plants to produce, detect and respond to sound; Gagliano et al. 2012; Gagliano 2013; Appel and Cocroft 2014). Indeed, one of the primary ways through which plants interact and communicate within their environment is by a rich and complex bouquet of several thousand volatile chemicals (see Raguso 2008). Through their crafty use of this chemical language, plants are able to breathe out their message by encoding it with a single scented word that nonetheless conveys multiple meanings depending on the intended recipients. By adding just a bitter whisper (literally, only tiny amounts), of nicotine to their bouquet of nectar volatiles, for example, plants are able to discourage unwanted visitors such as florivores and nectar thieves; yet, this same nectar constituent is simultaneously used by the plant to manipulate the behavior of desirable floral visitors, such as hummingbirds, causing them to visit more flowers and ultimately increasing the plant’s

reproductive success (Kessler and Baldwin 2006; Kessler et al. 2008). Together with olfactory signals, visual displays including species-specific shapes, colors and colour patterns (see Raguso 2004), are the other prominent and well-known medium through which plants interact and communicate. More than 450 species of plants, for example, are able to change their colour, position and shape to advertise their trading hours and even promote further business deals if inadequately pollinated. Research by Willmer et al. (2009) describes the legume *Desmodium setigerum* as one such master shape-shifter, who will show off attractive lilac flowers at the start of the day to then turn them into a less eye-catching white and turquoise colour as the flowers get pollinated over the course of the day. The colour change is accompanied by a slower change in the shape of the flower as the upper petal folds downwards over the reproductive parts, where the pollen is produced (i.e. anthers) and germinates (i.e. stigma). By rapidly changing the shape and colour of its pollinated flowers and thus reducing their attractiveness, this plant directs pollinators to the unvisited flowers to be pollinated. If they received insufficient pollen, however, the flowers of this plant are unique in their ability to (literally) re-advertise themselves as ‘open for business’ by changing their shape to expose the stigma once again as well as shifting from the white and turquoise back to the attention-grabbing lilac colour.

Like all language, these are gestures enriched with meaning, which plants use to invite, for example, the pollinators’ behavior that is most beneficial at a specific time. Plants and pollinators, in particular, seem to have reached a mutual understanding of this interactive language, a kind of covenant where the meaning of colors, shapes and scents together with the rules that govern these meanings are constantly negotiated, agreed upon and embodied by the plant and its pollinators as part of their co-evolutionary dialogue. In this sense, they do not differ considerably from any human gestures, including our spoken words; these, too, are perceptible material symbols ‘representing’ the real things (or referents) of the world and to which a meaning is assigned and collectively agreed upon for a message to be shared amongst individuals. At this point, some may concede that plants display the faculty of language, but nonetheless argue for human exceptionalism--our language is unique and distinctive because of the arbitrariness of the relationship between its signifiers and their referents (i.e. Saussure’s theory of arbitrariness; Harris 1987), an arbitrariness that implies freedom and creativity. In other words, human language is special because of its power of abstraction, thanks to which the symbols we use are, in fact, not directly tied down to the physical things they symbolize. Yet once again, how sure are we that our language truly is as

subjective and not intrinsically connected to what it represents as we perceive? Even excluding the case of onomatopoeia and ideographic languages (discussion on this topic by Cuddon 2013), linguistic evidence shows that our words were originally much more rooted in a material connection to the things they referred to than we think, and abstraction of the symbol from the symbolized only developed over time (see Abram 1996 and notes therein; pp. 99-102/284).

Interestingly, even if we were to consider abstraction as an intrinsic and ‘required’ property of human language, which allows a speaker to refer to something that is not present (as proposed by Vogel 2006), our exceptionalism remains illusionary. After all, if the case of human hunters mimicking partridge calls to lure the birds out of the bush is an example of abstraction (Vogel 2006), then the case mentioned above of the African bird that cries wolf using other species’ warning calls is too. And so it is for orchids that dupe wasps into becoming unsuspecting pollinators by releasing a spectrum of chemicals very similar to what other plants emit when ‘crying for help’ to summon predatory insects to feast on caterpillars (Brodmann et al. 2008) or even mimicking animal alarm (pheromone) calls such as those of honey bees, which are frequently captured by wasps to feed on their larvae (Brodmann et al. 2009). In other words, human language is not more exceptional than the very evolutionary process that shapes it--a natural dance by which the symbolic, yet material, gestures of all living species are perpetually moved into new and evolving habits of rendering meaning in the world.

#### The faculty of language: learning, culture and evolution in plants

The versatility in the linguistic behavior of plants, like in other organisms, arises as a result of experience and, in turn, underpins the adaptive changes necessary to cope with novel and unpredictable challenges to ensure the survival and flourishing of individuals within their specific ecological, as well as social, settings. We now know that plant chemical language, for example, is endowed with true semantic flexibility, so that new meanings may be assigned to old chemical words and used in novel interactions and new contexts (see review by Holopainen 2004). Evolutionarily speaking, it is precisely through use and experience under different circumstances that this inventory of gestures and utterances is enriched with



meaning and, most importantly, shared with others and across generations. From this perspective, the language of plants seem to emerge from the interactions of individual learning, cultural transmission, and biological evolution--the same three adaptive systems thought to be at the root of human language. Let's briefly consider how these three systems are expressed in the life of plants.

Even though, in the broadest sense, the evolution of language occurs at a species level over hundreds of thousands of years, the fundamental process of adaptation by which a linguistic behavior is acquired in the first place, performed by a number of individuals over time, and then passed from one generation to the next (i.e. on a cultural timescale of thousands of years), is driven by the individual's ability to learn during its lifetime (see discussion by Christiansen and Kirby 2003). In this regard, we have recently discovered that plants, like animals, can learn rapidly by acquiring novel behavioral features and change their behavior as a result of their individual experience (Gagliano et al. 2014); these learned behaviors can later become innate and potentially enhance evolutionary learning at the species level through the fundamental mechanism of genetic assimilation (i.e. the 'Baldwin Effect'). Based on what we currently know, it is in the context of plant defensive behavior against enemies that the linguistic ability of a plant to swiftly learn appears to be particularly significant. The volatile words plants whisper, for example, appear to be rather specific in what they convey (e.g. expressing useful and reliable information to the predators of their attackers). Moreover, by remembering past attacks, individual plants learn to adjust their volatile responses to be better prepared for future battles. And, as in humans, plants eavesdrop on the affairs of their neighbors and are able to use this vicariously acquired knowledge to mount a tactical defensive response even before they are attacked or damaged themselves (e.g. Paré and Tumlinson 1999; Karban et al. 2000; Heil and Ton 2008). Additionally, we know that the scented utterances of plants are more meaningful and effectively received amongst kin (i.e. genetically identical or related) than strangers (e.g. Karban and Shiojiri 2009; Karban et al. 2013). This finding together with the recent discovery that recognition of relatives also involves specific leaf gestures and the perception of particular light signals (e.g. Crespi and Casal 2015), have demonstrated the occurrence of cooperative rather than competitive interactions among kin in plants (e.g. Dudley and File 2007; Murphy and Dudley 2009; File et al. 2012) as observed in a wide range of taxa. And, in general, this seems analogous to the process by which a group of individuals learns and

passes on information to others, hence giving rise to what we call cultural transmission in humans and some animals.

Ultimately (and evolutionarily), being able to communicate with each other, form bonds of various kinds, and engage in teamwork are what makes language so important to us all, human and non-human alike. Consequently, I would like to invite the reader one last time in this chapter to interrogate the cultural validation of human linguistic uniqueness, in which humans strike us as ‘special’ or ‘exceptional’ when compared with non-human others. Whether human or not, the linguistic code of gestures and utterances unique to each species is designed as it is because those (and not any others) are the specific design features that have evolved to make for a useful communication system in the cultural context. Here, the term ‘culture’ relates to the suite of behaviors and ways of living for that species or group of species. For example, the cultural background of plants refers to the interactions and relationships amongst plants as well as between plants, other organisms and the environment. Therefore, the interpretation of these linguistic features is contingent on the knowledge of the appropriate cultural background in which the code is used. As such knowledge is understood and shared by members of a specific group (whether human or non-human), the code concurrently defines the communication system within that group and constructs the identity of those that use it. In humans, we can readily appreciate the extent to which speaking a language with a particular accent, for example, can easily give away one’s geographical area of origin or even social status. And we appreciate that this is the case in other species too. The song patterns of humpback whales, for a well-known example, depend on where they live; populations inhabiting different ocean basins are known to sing distinctly different songs and all males in a given population sing the same mating song until a catchier tune emerges as they encounter a migrating population and, then, all males start singing the latest song (Noad et al. 2000; Garland et al. 2011). The degree of creativity associated with the composition of these songs and their sharing, as part of a cultural exchange amongst populations, is undeniable even if we still do not understand exactly how they are composed or what they communicate. To understand this ‘whale-specific’ knowledge, there is no need to break into the ‘whale code’ by translating it into human standards; it is essential, however, to appreciate the cultural background within which such ‘whale code’ is used by whales. Somehow, we intuitively know that what whales are sharing using their language is solidly reposed within the nature of being a whale. And I believe this is exactly where the crux of the matter is rooted. The answer to my earlier question of whether it is possible for humans to

conceive and appreciate the making of meanings by others may also be found here. What if language is a fundamentally natural and inevitable consequence of being that emerges as an organism makes meaning of its surroundings and, in turn, engraves the very identity of that organism and its physical embodiment in its world?

If we are to understand the language of plants, for example, the detecting, dissecting and deciphering of their ‘code’ (e.g. the identity of the chemicals a plant produces) need not be the main priority of our scientific endeavors. For example, how many more chemical compounds or light wavelengths do we need to detect and analyze before we can truly access, understand and appreciate plant language? Much of the research in plant science is primarily focused on dissecting plants and deciphering their internal codes. However, the greatest advances in our understanding of plant language have been ingeniously delivered by a relatively small number of scientists who have adopted ecologically driven approaches, where the ‘cultural background’ is taken into account. This is because meaning emerges during interactions amongst organisms; hence language is not a fixed property of that organism (e.g. a specific chemical compound) but rather a truly ecological, dynamic process of relationships by which meaning emerges to shape the production of behaviors that, in turn, shape new interactions for new meaning to emerge (e.g. a biology of language à la Maturana; see discussion on the topic by Kravchenko 2011). In practice, reducing such an active and ecologically vibrant process to a fixed and Petri dish-like property has resulted in substituting the subjective material plant with an abstraction, the scientific idea of what an objectified plant is, does and knows. Far from being trivial, the cultural construction of plants as *objects* of scientific exploration not only contradicts the emerging and expanded understanding of plant behavior including matters of plant intelligence, agency and intersubjectivity, but is also of ethical significance in the context of human-plant relations (Marder 2013). I suggest that an embodied conception of language could offer a valuable step towards the de-objectification of plants and the recognition of their subjectivity and inherent worth and dignity, renewing a sense of ecological intimacy and kinship with these non-human living *others* and thus, promoting human care for nature (see Clayton and Meyer 2015).

Additionally, the task of redefining language through an embodied analysis could also be valuable to address the abstraction of our own species from nature. In fact, the same power of abstraction that has reduced living plants into lifeless objects, over time has (literally) uprooted our own species from the physical connection we have to what we refer to. Because the symbols we use have become themselves separate from (and only arbitrarily related to)

what those symbols symbolize, the idea that *H. sapiens* is separate from and dominating over all other species (hence special) is incarnated within the medium of communication itself, but nevertheless groundless. From this perspective, our abstractive power has resulted in the silencing (rather than the revealing) of the expression and faculties of ourselves as well as others, such as plants. Breaking this silence call for a truly ‘cross-cultural’ dialogue – a full immersion into the ecological context and beingness of humans, plants as well as other non-human organisms with whom we share a common world. Such approach demands a new and enlarged sense of ‘cultural awareness’ that appreciates both humans and plants (and any other organism) as embodied agents and recognizes that language always is contingent on the encounter of individual and subjective perceptual worlds and emerges at those points of contact and interaction in a truly ecological sense.

In today’s globalized world, we are increasingly dwelling in highly cross-cultural environments and an attitude of tolerance, respect and appreciation for diversity is clearly fundamental for human societies to flourish in co-existence with all *others* (and sadly, we know too well what happens when such attitude is not adopted). From this perspective, language is that open and tangible invitation to (literally) stop and smell the roses – as those plant volatile chemicals enter your nose, the cross-cultural dialogue is opened.

### Note

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