What Do Animals and Plants Know, Predict and Transmit?

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Abstract: Taking stock of the research conducted in anthropology and related sciences in recent decades, this introduction examines the skills that are attributed to animals and plants by humans. On the one hand, the boundaries between Man and Nature have become more porous, and an increasing number of scientists are recognising the intelligence of these living beings. On the other hand, the categories used to measure this intelligence are inadequate and biased. A few ethnographic fragments taken from fieldwork carried out, in particular, among Indigenous people of the Philippines, Indonesia and Colombia are discussed, confirming this observation. Then, the contributions of the authors of this special issue are briefly presented. These authors call for a renewed reflection on animal and plant skills from the perspective of shared and interacting environments and worlds. Their aim is to deepen reflection on the anthropology of the living.

Keywords: anthropology of the living, ontology, skills, animals, plants

With the advent of modernity and its boundless faith in technological progress, humans granted themselves the privilege of knowing the world. In this naturalistic context, animals were long construed as beings moved by instinct and "mechanical" engagement in the world, and by a lack of complex thinking that drastically separated them from humanity (see Malebranche and Descartes). The use of perfectly mastered knowledge and the possession of superior cognitive abilities served as an ontological differentiator, marking a distinction in nature and essence between humans and the rest of the living world. From this perspective, animals – and plants even more so – knew nothing except to compete and reproduce. A few centuries later, studies from a wide range of disciplines are taking a different approach to the way humans relate to non-humans, and to plants and animals in particular.[1] Several authors have pointed to the deleterious effects – especially on an epistemological level – of former ways of understanding life. Jacob Von Uexkül, André-Georges Haudricourt and Jean-Marie Pelt are among the pioneers committed to understanding how plants and animals perceive the worlds in which they evolve, with a crucial question left unresolved: Can humans really put themselves in the shoes of other living beings such as ticks, cats, dogs or bats?

A decisive and diffuse turn has transformed how animals and, more generally, non-human life forms are viewed. Bridges have been built between disciplines, the boundaries between human and nature have become more porous, and animals (in particular) have been granted a myriad of qualities they were once thought to lack: the ability to communicate abstract and complex content and the capacity to feel emotions, to dream, to build and use tools, to carry out rituals, to imitate, to play, to scheme, and so on. The notion of "animal cultures" has thus come to include, particularly in the wake of some ethological perspectives, all the skills that were left in the shadows by a mutilating naturalism (Lestel 2001). At the same time, more and more scientific

studies recognise the intelligence[2] of animals, and work to document it and reintegrate it into cooperation strategies with other beings. In doing so, such studies point to our difficulties in fully grasping the consciousness and subjective experience of non-humans due to the inadequacy of the frameworks we use to assess them (Despret 2012; Despret and Larrère 2014). As a result, studies in behavioural ecology have been accompanied by social and political demands. In the age of the "Anthropocene," many have called for non-human entities to become subjects of law (Stone and Larrère 2017).

In the social sciences, it is clearly through what has been called the "ontological turn" that the desire to escape discriminatory categories – whereby nature and culture, along with all their variants, are diametrically opposed – has been the most explicit and has yielded the most fruitful findings. When performed in the wake of this turn, which has been busy denouncing and circumventing the naturalism constraining the way in which we view (social and natural) phenomena, studies have achieved their greatest theoretical power. Often presented as the leading figures of this revolution, authors like Bruno Latour (1991) and Philippe Descola (2005, 2011, 2014) have pointed to the fundamental epistemological dimension of dualisms, prompting a profound reflection on ways of doing science. Among the many works conducted as part of this process, we can cite the analyses of Florence Brunois (2005, 2008), who considers the "environment" not as a divisible entity from which humans can be excepted, but as a totality to be studied without extracting humans from it. More recently, the anthropologist Eduardo Kohn (2013) has put forward an equally novel thesis in a book tellingly entitled *How Forests Think*. This groundbreaking work seeks to integrate humans and non-humans into the same analysis and to bring about an approach that blurs human singularity. Kohn's book, which joins at the semiotic level what our ontologies have set apart, reflects an interdisciplinary concern to propose new models for thinking and understanding environments. Similarly, although in a different manner, the geographer Augustin Berque (2000) considers humans together with the environment in which they evolve as opposed to extracting them from it. He proposes to circumvent the anthropocentric vision by focusing on the deep connections, the very intertwining that – especially from a sensory and emotional point of view – characterises the embeddedness of individuals in the world.

On the side of vegetal life, which long seemed to embody radical otherness, a "plant turn" has also taken place, although it is much more recent than the "animal turn." Indeed, in 2019, the journal *Anthropology Today* published without much fanfare a special issue edited by John Hartigan (2019) and entitled "Ethnography of Plants." Introducing new terms like "phytocommunicability" and "plant piety" (Schulthies 2019), but also "phytoethnography" (Daly and Shepard 2019), this issue turns plants into veritable "ethnographic subjects," while simultaneously exploiting and enacting the decompartmentalisation now happening in culture at large. It reflects a concern to produce a new understanding of animals and plants – this distinction being itself subject to controversy. The German forester Peter Wohlleben (2017) has recently had great public success by associating trees with "societies" and by highlighting trees' ability to communicate with each other. Although based on tangible facts, his thesis is not always convincing; nevertheless, it attests to a cross-cutting concern for non-humans and reflects an effort to get them out of the rut in which they have long been stuck.

Initiatives of this kind are multiplying, with calls for new methods to put an end to the modern conception of nature. In our opinion, these often highly philosophical discourses need to be supported with empirical and practical data lest they reach a dead end. In this regard, many researchers are worried that decompartmentalisation efforts will largely result in the use of terms once reserved for humans to refer to non-humans. Francis Hallé (2018) invites us instead to innovate and to invent a new vocabulary, one less marked by the anthropocentric grounding of reason. Like Stefano Mancuso (2019, 160), he questions the notion of the individual and its relevance in describing plants. He points out that the latter can be divided into several cuttings and that, consequently, their genetic and physiognomic complexity is poorly reflected in the terminologies normally employed to designate our objects of analysis. Recent advances have also highlighted the erroneous nature of certain taken-for-granted ideas. This is the case with the notion of plant immobility, which is challenged by the existence of several moving plants in equatorial forests: what is of interest here is the ability of plants to understand and manage their own occupation of time and space. This is also the case with the idea that plants have genomic stability, which is being undermined by epigenetic discoveries: it has been suggested that some plants possess several genomes and can even "invent" new ones when they are under significant threat. Plants, then, escape the categories to which they have long been confined.[3] These discoveries call for complexifying our understanding of the living world, but also suggest that if we are to escape anthropocentrism, we must be careful not to re-enter it through the back door.

The paths taken to carry out this work of complexification are indeed very diverse. For instance, following in Bateson's footsteps – and taking up theoretical concerns

dear to researchers like Edward Hall (1959, 1966) and Paul Watzlawick (1978) – Donna Haraway focuses on "non-linguistic embodied communication" (Haraway interviewed by Gane 2006; Haraway 2008, 27), opening up new paths for understanding plant and animal skills. These recent and older works highlight the role played by extra-verbal stimuli in behaviours and perceptions of the environment, while inviting us to extract humanity from the culturalist lens. Homo sapiens no longer have full control over their own communication, and it ceases to be their privilege (Gane 2006).

In this regard, biologists are currently examining bioelectric phenomena in plants and putting forward the notion of "plant neurobiology" (Mancuso and Viola 2018). Biological studies are focusing on the transmission of electrical signals over long distances, inquiring into systems of communication between cells, particularly eukaryotes. These studies also suggest that plants react very quickly to multiple environmental factors: acid rain, temperature variations, stress situations, or attacks by pathogens. As of now, several types of signals have been identified.[4] Moreover, it has been suggested that plants are able to predict and announce earthquakes, as illustrated by Yoshiharu Saito's research[5] on the bioelectric activity of trees. All these discoveries call for naturalism and modern thinking to open up to other perspectives and to engage with questions that they have frequently dismissed.

Meanwhile, the anthropology of viruses and bacteria (Sélosse 2017) shows that these continuously anticipate the unexpected.[6] This finding echoes recent developments in cognitive ethology that attest to the need for placing cognitive processes at the core of animal behaviour research. Similarly, recent advances in neurophysiology tend to construe anticipation as a driving principle that cuts across species. While anticipation is a mode of understanding things and organising behaviour that is absolutely central to human cognition, it is also more generally one of the most fundamental properties of the ordering of life. In making anticipation central to the embeddedness of (all kinds of) beings in the world, such advances somehow place all living organisms on a continuum of environmental understanding and hazard management (see in particular Berthoz 2003; Berthoz and Debru 2015). These studies take a new look at humans and animals, but also, more generally, at all forms of life whose *skills* were once confined to the boundaries of computing and adaptation.

Even more committed to this approach are the studies that evoke "the genius of animals," at the risk of sometimes reversing hierarchies and the order they sustain. The collected volume edited by Karine Lou Matignon (2016) is particularly relevant in this regard. Contributions include Ludovic Dickel's (2016) analysis of the tricks and ingenuity of the octopus; Franz de Waal's discussion of feelings of injustice and equity in monkeys; Barbara J. King's study of respect for the dead among baboons and elephants; and Bernd Heinrich's examination of the malice of corvidae. In the same vein, we can mention the more philosophical work of Vinciane Despret on the intelligence of dogs (2016) and birds (2019), or that of Jean-Baptiste Morizot (2016) on wolves. Again, these various approaches attest to a new way of considering animals and in particular their relationships with humans. They prompt us to rethink our conceptual tools and invite us to reinitiate multidisciplinary discussions. This invitation to dialogue concerns especially evolutionary psychology, biology, philosophy, the cognitive sciences, and the social sciences (most importantly social and biological anthropology).

As we can see, these approaches not only reflect a shift in the way we investigate living things, but also lead to innovative discoveries. The latter fuel the drive to complexify our understanding of humans' embeddedness in the world, paving the way for further reflection on their singularities. One of the most explicit ways of expressing this new awareness consists in highlighting the effectiveness with which other organisms integrate into their environment and manage to detect information useful for their survival. Interest in these organisms morphs into fascination, and non-humans become models of acclimatisation and adaptation. Biomimicry is a clear example of the fact that plants and animals have ceased to be mere resources and have become models of inspiration and archetypes of successful embeddedness in the world.

And the discoveries fuelled by our fascination with plants and animals in turn justify it. It has been established that certain plants and animals (categories that should themselves be questioned in terms of their encompassing effect) are endowed with sophisticated skills that make them hypersensitive to earthquakes and climatic variations. Behavioural adaptations have been observed in some plant species when they are faced with situations that are likely to threaten the equilibrium of their distribution in space. For instance, orchid species adjust their size to the trampling they perceive around them, and some trees produce more fruit to stimulate their own reproduction in the face of climate stress. This type of discovery reinforces the current fascination with non-humans, while being the product of research approaches that reflect this same fascination. In this context, complex communication systems are understood as facts of interspecific cooperation. It has been suggested that some trees can communicate underground (with their roots via fungi) or by air (through activating large networks). The

botanist and dendrologist Francis Hallé (2014, 2018) cites the example of cypress trees, which are able to "degas" when threatened with fire, thus signalling to other trees that a fire is in progress. More generally, Hallé highlights plants' abilities to anticipate and to adapt to their environments. He mentions, in particular, the case of acacia trees, which change the biochemical composition of their leaves when a predator approaches, and that of tendril vines, which are capable of moving on supports that they perceive.[7] Hallé concludes that plants are extremely resilient thanks to a fully decentralised system present in each of their cells: despite their lack of brains, vital organs or vocal cords, they are able to influence animal behaviour, to communicate, to memorise and to interact.[8]

By suggesting that humans no longer have the privilege of knowledge or intelligence, these advances and findings open up new avenues for reflection. They attest to a shift in the way we look at animals and plants, which materialises into the positions that constitute the many original themes explored in this special issue. The first theme is the recognition that animals and plants are endowed with cognitive and sensory skills. The second is a kind of reversal of the hierarchical relationship that places humans at the top of their environment: having escaped their subordinate position, non-human life forms become models of adaptation to the environment, and their "ways of doing things" inspire us to create a more meaningful mode of being in the world.

However, while these ideas have recently emerged in our latitudes, they are not exclusive to our own historical and cultural trajectory. These approaches that take plants and animals very seriously reflect an attitude and relationship to non-humans that has prevailed in other parts of the world for centuries. Indeed, many of the populations studied by anthropologists have long affirmed – either through similar or completely different routes – their proximity to certain animals or plants, while claiming to take inspiration from them in various domains. As keen observers of life, Indigenous peoples have long identified the "performances" of animals and plants. And while they often assign them important cosmogonic roles via myths, they also exploit their skills in order to make relevant decisions and to act adequately in many tasks. Thus, there is an interest today in documenting what humans say and do about non-human skills by starting from cases observed in a wide range of (modern and non-traditional) sociocultural contexts. Although the ethnographic literature provides many telling examples (scattered across a particularly dense corpus), here we present a few cases from our research on Indigenous knowledge conducted in the Philippines, Indonesia and Colombia.

On the mountainous island of Mindoro, the Alangan Mangyans live in close contact with the plants and animals around them. They note that some trees, like the *bangkal*, provide them with a lot of information on upcoming weather and on whether or not a storm is imminent: "If the *bangkal* bears a lot of fruit, it is a sign that the rainy season is coming, that the rains will be heavy. If the *bangkal* does not bear a lot of fruit, then there will be few storms . . . For us Indigenous people, it's a sign" (Artur 2019, field notes).

According to the informant Isagani Garong, birds also presage bad weather. Thus, "when the weather is wet and a storm with heavy rains approaches, it is at that moment that the *paypalis* comes out" (Isagani Garong 2019, field notes). Bats, and especially fruit bats, announce typhoons when they curl up. Sometimes it is insects that do so – for instance, the *balinganay*, which is a type of bee. As Anigo Balbas highlights, Alangans believe that "if one of them approaches a house or goes to strange places where there are many tall trees, it means that one of the people living near that place will get sick" (Anigo Balbas 2019, field notes). The Alangans also consider snakes to be able to count. Thus, one way to immobilise and get rid of snakes is to show them a cord with an odd number of knots: this presents them with a cognitive problem to solve, which gives humans enough time to escape (Isagani Garong 2018, field notes).

Among the Ibaloy in the central mountain range of Luzon, snakes convey messages from the deceased, whereas different bird species announce hurricane events or seasons. Lolo Melanio, an Ibaloy elder, cites the example of the death-portending *bokaw*:

> If the bird *bokaw* will shriek or screech above the sky, we know someone just died or someone will die soon. If the sound is strong, it is a male who will die but if the sound is soft, it is a female. If you hear the shriek of the *bokaw*, you will notice that someone among your relatives will die after three days. (Lolo Melanio, in Laugrand et al. 2019b)[9]

But, Lolo Melanio also cites the case of birds that presage typhoons:

> If the bird *jadjaran* appears, there will be a *powek*, a typhoon, that will last for a long period of time. When the *kiling* bird appears, there will be a typhoon that will take place for a short period of time, it will take place for only 24 hours but trees may fall down because it will be strong. (Lolo Melanio, in Laugrand et al. 2019b)[10]

Besides, the Ibaloys are upset by the fact that typhoons are now designated with human names as opposed to

bird names like before, for they are convinced that doing so inevitably increases the number of human deaths.

Among the Blaan of Mindanao, birds literally set the rhythm for humans, informing them of upcoming storms, diseases or deaths (Laugrand et al. 2018).

These few examples taken from the Philippines illustrate how populations scattered in different habitats and regions have long used animals and plants to anticipate climatic events that constrain their daily activities and even threaten their way of life. In this sense, their sophisticated knowledge reflects a widespread, cross-cultural propensity among Indigenous peoples to study the surrounding environment, its variations, and its inhabitants in order to establish an adequate relationship with it.

The Wayùu are no exception, as they attest to the geographical diversity of ways of looking at the activities of plants and animals, and more generally, at environmental variations (Simon 2019). Since they live in northern Colombia and Venezuela, they are subject to the capricious and sometimes hostile climate of the Guajira Peninsula. This semi-desert area is characterised by variable annual rainfall, constant sunshine, and the predominance of easterly winds (*jouktai*) that dry the soil and contribute to desertification. In order to adapt to this environment, which leaves no room for anticipation, the Wayùu practise different types of subsistence activities. Thus, as the year progresses, they engage in small market gardening, supplementary hunting, and then fishing. The latter is their main productive activity, whereas livestock farming is mainly practised for accumulative purposes. Livestock are used for major transactions, never for simple consumption. Each of these activities is subject to climatic variations in both its mode of implementation and its pace of deployment. The Wayùu's limited control over their conditions of existence – which stems from the constraining nature of the climate and the biotic properties of the peninsula – is reflected in their particular way of apprehending the events that they observe or experience.

Among the Wayùu, daily activities (the use of adequate tools, wild or crop plants, and livestock or prey animals) rely on thorough observation of the environment and its occasional variations. It is during fishing activities that reliance on animal behaviours is most explicit. Wayùu infer the presence of pelagic prey based on the presence of fishing birds above the waters, and adapt their fishing techniques accordingly. They also deduce from the behaviour of some rodents the imminent arrival of schools of small coastal fish, as these pass along the shoreline only occasionally, namely, during the period when rodents reinforce their nests.

Yet however operational they may be, these associations also reflect a specific way of understanding the world and its dynamics. Indeed, in this ethnographic context, each occurrence is considered through the lens of an intentional-relational scheme that assigns a voluntary origin to phenomena. Contra the notion that there exist arbitrary contingencies, mechanical laws or unmotivated facts, each event is viewed as the manifestation of a will (Simon 2018, 2019). And since nothing is ever unmotivated, the concomitance of different events is itself interpreted in relational terms: it is thought to reflect ties of attachment, familiarity or alliance. For instance, bees (*ko'oi*) are described as messengers by the Wayùu when they appear offshore and harass fishermen in their activities. Their arrival is said to precede that of the northeasterly wind (*Jepirachi*), which is favourable for sailing. This prompts the Wayùu to turn off their engines and to adapt their navigation to the wind conditions they know are coming. As argued elsewhere (Simon 2017), the Wayùu's conception of bees as messengers is not insignificant in this fishing context. It reflects a general disposition to refute contingency (nothing is unmotivated and no mechanical law can serve as an explanation) and to interpret events by assigning intentional and relational origins to them. Far from being a mere convenience of language, the Wayùu's use of the Spanish term *mensajeras* – and the reference to the intentional act of "announcing" in wayùunaïki (*aapiraa*) – betrays a propensity for detecting associations likely to bring heterogeneous phenomena closer together, and for attributing these phenomena's properties to the will of the beings involved. It is not surprising, then, that the Wayùu consider that the presence of insects reflects a deliberate intent – namely, the intent to announce – or that Wayùu terminology translates the anteriority of one manifestation (the arrival of the bees) to another (the coming of the northeasterly wind) into intentional terms. This case merely illustrates a particular way of understanding the world, its dynamics, and its inhabitants. It exemplifies the logic by which the Wayùu approach a phenomenon and operationalise its alleged causes. The elements that we Westerners would be tempted to relegate to the landscape (that is, to the surrounding setting) occupy a central place here. The behaviour of fauna and flora and, more generally, variations in the environment provide support for the interpretation of the world and become the moving force behind human action. This intentional-relational scheme highlights each element of the "scenery" as a being driven by will and caught in networks of relationships. In this sense, plants and animals are viewed as precious witnesses to the dynamics that animate the world and orchestrate its different inhabitants together.

Likewise, the Mentawai living in the rainforest of Siberut – an island located 150 kilometres off Sumatra – give pride of place to animals and plants. Here, however, the major role granted to non-humans takes a completely different form. Whereas the Wayùu's attentive posture entails observing the environment to adjust modes of action, the Mentawai demonstrate a more controlled attitude toward events (Simon 2020). To achieve a peaceful life, the Mentawai endow certain agents with qualities that go beyond their most obvious formal properties. Specific beings are attributed skills (a term that suggests intentionality more than the term "quality") and are involved in dense ritual sequences. This is the case with animals like chickens and pigs, which are assigned predictive skills and the ability to influence the trajectories of individuals. To make these animals participate in targeted tasks, the Mentawai express wishes and invite them to focus their attention on the wish recipients. They then sacrifice the chickens and pigs, believing that the killing will transform the victims into beings capable of fulfilling the formulated aspirations. It is because of the sacrificed animals' alleged capacity to accomplish human projects that one can tell whether or not the future will be happy. After the sacrifice, the Mentawai grab the pigs' hearts or the chickens' stomachs, which they read in order to determine whether the animals intended to do what they were asked. When the omen is bad, a new sacrifice must be performed, because the realisation of human projects depends entirely on the support of non-humans. For the Mentawai, then, a peaceful journey through the world is unthinkable without recourse to animals. Similarly, Mentawai ritual devices are always composed of leaves of different plant species. By endowing plants with specific powers, the Mentawai make them play a major role in the success of their efforts. Indeed, the leaves they use are meant to compensate for the failings of the human condition. Plants play roles that humans, with their limited capacities, are not able to take on. They have the capacity, for instance, to bring together beings normally separated into bounded (and ontologically distinct) species groups, to influence the behaviour of prey animals, to brighten spirits, to encourage the cooperation of the Master of the Forest, and so on.

All these understandings – which have been summarily sketched here – may seem fanciful to the Cartesian naturalist, but they take on their full meaning in animist and analogical cosmologies. They draw their coherence and plausibility from systems in which humans are thought of only in relation to other living beings. In many societies where knowledge has been built through long-term observation and continuous experimentation, these logical connections reflect a concern to link, to bond, and to unite people. Of course, these particular cases merely illustrate how groups distributed in all regions of the globe map out their place in the world in relation to fauna and flora. But given the interest in animal and plant skills that has recently developed in our latitudes, an idea has emerged that cuts across cultures: humans do not have the privilege of the faculties that modernity had reserved for them.

Contributions to This Issue

Far from adopting an animalist perspective, this special issue focuses on the knowledge and skills attributed by humans to non-humans, from the smallest beasts to the largest mammals, from poisonous berries to large forest trees. This issue is part of a trend that has prompted the emergence, over the past decade, of new research themes, along with an ethno-ethological approach (Brunois et al. 2006; Lescureux 2006) that privileges interspecific relations (Haraway 2008; Despret 2012; Jaclin 2013). In 2000, the journal *Terrain* (see Lenclud 2000) published an issue entitled "Do Animals Think?" The present project was designed to revisit this question. Moreover, contributors were prompted to answer other original questions concerning animals: What are they presumed to foresee? What do they transmit to humans? What sensory equipment do their skills require?

While this special issue was initially designed to privilege a multidisciplinary approach, it has become mostly anthropological. Nevertheless, it opens up new avenues for rethinking living things beyond the great ethno- and anthropocentric divides. It contains rich illustrations of situations in which non-humans are construed as privileged witnesses of upcoming phenomena, or as models for a more informed relationship to the environment. The various contributions explore the shared worlds that have been emerging based on the cognitive, perceptual and projective skills attributed to animals by humans. However, this thematic issue leaves the question of plants largely open. In view of this, the present introduction suggests the fruitfulness of future studies that would give pride of place to vegetal life.

The texts compiled here explore three intrinsically connected themes: the skills attributed to animals, the use of animals and plants as models of inspiration, and the emergence of new shared worlds (or other possible ways of sharing the world).

The Cognitive and Sensory Skills Attributed to Animals

Populations around the globe consider non-human life forms to have a particularly enlightened view of the environment and its dynamics that allows them to anticipate

phenomena that humans cannot perceive (let alone foresee). They consequently treat animal and plant behaviour as an important source of information for appropriate action.

This attribution to living beings of a capacity for anticipation can be observed in many contexts and for a wide range of animals. Examples include turtles in China (see Vandermeersh 2013), caribou among the Canadian Innu (Tanner 1979), and birds and pigs in several Austronesian societies (Le Roux and Sellato 2006; Scott 2015a, 2015b; Laugrand 2015; Laugrand et al. 2015, 2018). We could cite many other examples: the use of insects, marine animals, reptiles, and mammals, as well as plants (bark, branches, roots, etc.), in different parts of the world. From the smallest to the largest animals, from crop plants to wild flora, non-human life forms are attributed a wide range of skills in terms of apprehending the world in general and future events in particular. Four contributions to this issue address this theme.

The historian Éric Baratay – who is well known for his work on the animal's viewpoint (Baratay 2012) and who, like others (see Mougenot and Strivay 2011), aims to write history *with* animals – begins by discussing the case of horses teaching miners in France in the nineteenth and twentieth centuries. He shows that, in a dangerous and unpredictable world where adaptation is a required skill, horses excel because they are often able to anticipate. Miners trust them and delegate a multitude of tasks to them. Baratay revisits testimonies from miners, but also from veterinarians and engineers, bringing to light the talents of horses that, in the mines as in the battlefields, played a fundamental role that has been underestimated by a still-naturalist history. This equine example illustrates a relationship of cooperation and delegation in which Equidae are endowed with particular skills and made to extend human capacities.

On a completely different continent, the anthropologist Michèle Cros examines how, among the Lobi of Burkina Faso, bats are accused of transmitting the Ebola virus. She notes that bats are assigned qualities and skills by two opposing perspectives. She then shows how properties attributed to different beings reflect themselves in the events to which they are linked, and how they determine both the mode of apprehension of these beings and the means of action they generate, drive or encourage. Bats, then, simultaneously appear as protective and rebellious, occupying an in-between position.

Frédéric Laugrand and Antoine Laugrand also focus on the perceptions of bats, this time in four Indigenous groups in the Philippines. They explore the ethnographic contrast wherein the Alangan Mangyans and Ayta view bats as having the ability to live long and resist viruses, whereas Western scientists and other public health specialists worry about these strange beings whom they construe as veritable reservoirs of pathogens. They conclude that bats are assigned skills depending on how they are perceived.

Through the notion of master entity developed by the Kaingang shamans of Brazil, Robert Crépeau and Rogerio Rosa recall that animals appear in several Kaingang stories on the origins of technical and ritual knowledge. In addition to being endowed with real power of action, animals are presented as the first organisers and officiants of the Kikikoi, a great funeral ritual that is considered to be the most important expression of Kaingang culture and identity.

Animals and Plants as Models of Inspiration

Ethnographies are filled with descriptions that shed light on humans' observation and imitation of animal techniques. For instance, the Inuit claim to copy the hunting techniques of polar bears (Laugrand and Oosten 2014), while the Batooro of Uganda acknowledge observing primates to find needed medicinal plants (Krief and Brunois 2017). In our latitudes, Michael Branstetter and his team (2017) have been exploring the sophisticated forms of agriculture developed by fungus-growing ants. One could give many more examples: the tool manufacturing skills of New Guinea crows, the sophisticated hunting skills of certain predatory animals (spiders, killer whales, bears), the engineering skills of building animals (beavers, bees, ants, etc.), the navigation skills of aquatic and/or migratory animals (in particular dolphins, donkeys and birds), and so on.

Diviners, shamans and witches, but also scientists and ordinary people, draw inspiration from these capacities and skills, using them to enhance their practices and knowledge. The same applies to plants, which are mobilised as agents and partners in several shamanic traditions. It should be recalled that some of the innovations we owe to people like Leonardo da Vinci or the Wright Brothers were based on the thorough observation of birds and other animals. Significant advances are now being made in the field of biomimicry (see Benyus 2017; Boeuf 2016; Thiéry and Reton 2017). This movement is not new, but in the age of the Anthropocene it is being revived by new issues and awareness. This is attested to by the publication of the book *Insectopedia*, in which the anthropologist Hugh Raffles (2010) shows that insects have much to teach humans in terms of resistance strategies. Indeed, they constitute an almost unimaginable source of inspiration.

The anthropologist Scott Simon uses an eco-semiotic and phenomenological approach to examine the knowledge and practices of the *sisil*, a bird so inspiring that it

has become emblematic for several Indigenous peoples in Taiwan. Passionate about ornithology, Simon analyses several narratives he has gathered from hunters. He identifies the skills attributed to this bird, such as prediction, communication and divination, as leading to different modes of interacting with it. Through these intersubjective relationships, humans learn about the forest and about hunting, but also about ways of communicating with ancestors in a context marked by colonialism, industrialisation and urbanisation. Thus, the text delves into a situation torn apart by the drastic reduction in forest area.

Séverine Lagneaux and Jean Nizet explore the topic of anticipation in the European livestock sector, highlighting the complex coexistence of different actors: animals, milking robots, and livestock farmers. They show that in addition to mobilising new technologies, livestock farmers recognise an increasing number of abilities in their animals and make use of these abilities to improve their domestic life. Thus, the modes of use recommended by technicians and agronomists are hybridised with other usages, in a sort of unprecedented and especially illuminating reconfiguration. This essay is about "routines" and about the integration of various actors and relationships into ordinary technical processes.

Jean Foyer, Julie Hermesse and Corentin Hecquet explore how humans relate to plants by studying cases of companionship, care and communication with plants that "fuel action." Based on a fieldwork study of viticulture and biodynamics in France, the authors (sociologists and anthropologists) call for a decentring and an endorsement of the plant turn. At the same time, they argue in favour of a recentring, thereby stressing an important point: relations with plants, including on the "spiritual" level, must not be overly exoticised. They note that it would be wrong to view interspecific relationships as specific to distant societies. Indeed, arrangements with plants are also observed in our part of the world, at the heart of ordinary practices.

The Emergence of New Shared Worlds (or Other Possible Sharings of the World)

If the oppositions nature/culture and human/animal must be revisited, it is partly because we are no longer interested only in the specific identities of different life forms, but also in their shared capacities, in the interactions and symbioses that drive them in concert. The cunning intelligence of animals can be understood in terms of the relational modes that such activity implies. The aim here is to reflect on the coexistence of humans, animals and plants, knowing that survival of the human species will be short-lived without that of other living things. At a time when the planet is facing a major environmental crisis, these issues seem essential because all lives are closely intertwined. Five articles deal more specifically with the question of knowledge and interactions.

Dorothée Denayer and Charlotte Bréda examine the problems posed by the presence of wolves on territories that have been appropriated by humans in the Wallon region. In doing so, they address the question of the sharing of territories by humans and animals. The authors highlight the wide range of actors involved, focusing on the tensions between different postures and approaches to this issue. Suspecting the presence of wolves in its area of jurisdiction, the Wallon Region administration created a vast observers' network that brings together hunting representatives and nature conservation associations. This partnership accompanies and prepares for the return of the great predator, with one objective: the lasting establishment of a "becoming together" of humans and wolves. However, the anticipation of human–wolf coexistence as a risk management issue has given rise to tensions. The two researchers, one a biologist and the other an anthropologist, examine the modes of knowledge and organisation that may accompany this phenomenon so as to better understand the skills that are attributed to wolves. In doing so, they highlight an entanglement whereby wolves affect humans and humans affect them in turn.

Gaspard Renault employs an ethnographic approach to analysing the dynamics taking place in a centre for the reintroduction of wild animals in Bolivia. He explores anthropo-zoological interactions between the volunteers and Capuchin monkeys present in the centre. His analysis sheds light on the details of interspecific relationships in a particular environment, while pointing out the constraints inherent to the process of reintroducing and rehabilitating animals. It also offers a stimulating reflection on the notion of "interspecific trajectory."

David Jaclin focuses on transgenic cancer mice produced by pharmaceutical companies and intended for a wide range of biomedical research centres. Programmed to die and condemned to be manipulated, these experimental animals raise questions about the separation and hybridisation of living things. However, they also raise the question of the détournement of non-human intelligences, as well as the question of the nature of interacting bodies. This nice example of ontological and interspecific blurring brings to light the heterogeneity of ethical postures made possible by relations to living things.

Julien Bondaz takes us to West Africa. He provides a stimulating text that compares mouse divination – myomania – in Burkina Faso to rodent control practices

in Mali. In doing so, he identifies a tracking logic common to both practices, which is to explain human afflictions and the disorder of things. Bondaz highlights the homology between the evidentiary paradigm and the scientific approach, productively revisiting rodent classification, forms of commensality, trapping techniques, and the interpretation of the traces left by these animals.

Dominique Lestel's article concludes this special issue with a philosophical and programmatic reflection on zoo-futurism. He acknowledges that in the modern world, humans seem increasingly willing to animalise themselves, which opens the door to surprising mixtures. Fiction, art and technology allow us to explore these unprecedented changes and to seriously reflect on what animals might bring to humans.

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Notes

1 There is a vast literature on these issues. For a synthesis, see Proust (1997), Birnbaum (2010) and Michalon (2018). See also Dalla Bernardina (2006).

2 The notion of intelligence itself should be questioned in its conceptual scope, particularly with regard to the competencies it designates. Several books have dealt with this issue for animals (Lodé 2013; Mougenot and Strivay 2011; Pouydebat 2017) or for plants (Coccia 2016; Daugey 2018; Hallé 2014; Lenne 2014).

3 For an edifying synthesis of these discoveries that are transforming our categories, see in particular https://www.franceculture.fr/emissions/science-publique/les-plantes-possedent-elles-une-veritable-intelligence.

4 See François Bouteau and Patrick Laurenti, "La neurobiologie végétale, une idée folle?" *Pour la Science*, 10 October 2018, https://www.pourlascience.fr/sd/biologie/la-neurobiologie-vegetale-une-idee-folle-14831.php.

5 See NPO Japan Earthquake Precursor Comprehensive Observation Center (JEPCOC), http://www.jepcoc.jp/ (accessed 6 February 2020).

6 Some bacteria have developed very effective coping strategies. Like *Pseudomonas fluorescens*, they organise their own genetic mutation and distribute the risks according to a strategy that researchers refer to as bet hedging. See Jean-Jacques Perrier, "Comment les bactéries anticipent l'imprévu," *Pour la Science*, 25 November 2009, https://www.pourlascience.fr/sd/evolution/comment-les-bacteries-anticipent-limprevu-10419.php.

7 See Fondation Maisons du Monde, "L'intelligence des arbres vue par Francis Hallé," 12 July 2018, YouTube video, 11:57, https://www.youtube.com/watch?v=EKkh_G751AQ.

8 Hallé states, "Humans are very proud of their large brain and of the technological prowess it allows, but they destroy their environment while plants improve theirs. Might plants be much smarter than us?" (2018).

9 Original version in Nabaloy: "Sota bokaw wa manpepkiw, no etadkiyeng e esel to ket daki e pan ekowan na shanshanin metey ngem no singa ebaray ket be-e. No epigsa ket daki, no kapsot ket be-e. No sota manpepkiw a ja bokaw a. Nontan na akow wa inpekiw ni bokaw ket pan bilang ka ni teddon akow et waray shemagen mon metey ya partidos mod ma nayki- nan, no aliben nayki-nan ket kaaskang mo" (Laugrand et al. 2019a, 67). English version published in Laugrand et al. 2019b, 71.

10 Original version in Nabaloy: "No onmotok e jadjaran ket waray powek ja onshokey. No kiling e ali minmotok ket wara mowan ali powek ngem ontikey, saman sota pigsa jen showen polo tan eppat ta oras ja mangketo- dang e kiyow, haman e kowanshay nan gowasay ya powek" (Laugrand et al. 2019a, 70). English version published in Laugrand et al. 2019b, 74.

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