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Encountering nature through fieldwork: expert knowledge, modes of reasoning, and local creativity

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The concept of 'relation' has been central to the anthropological reworking of the nature/culture and nature/society dichotomies. However, ecology is relational in a way that has often been ignored or dismissed in contemporary socio-cultural anthropology. This article shows that there is more to ethnoecology than an ethnocentric form of analysis representing other people's understandings of the natural world through the prejudiced lens of Western scientific classifications. Three 'fieldwork on fieldwork' experiments involving encounters between natural scientists and indigenous communities in Amazonian Ecuador and Southern Guyana are discussed to illustrate the heterogeneity of human knowledge, the role of expert knowledge in intercultural communication, and the need to differentiate ecological reasoning from moral reasoning.

It is fashionable today to argue that science must be dethroned 'by making it a specific chapter of a specific ontology that exists among a whole range of different ontologies that all have the same value' (Costa & Fausto 2010: 94). Modern science, the ontological critique goes, is founded on a unitary category of nature that objectivizes the world according to Western abstract categories and dualistic cosmology. Anthropologists who cling to the Western unitary concept of nature are bound to misrepresent other people's understandings of the natural world. For Philippe Descola (e.g. 2005*a*; 2011), Marilyn Strathern (e.g. 1980; 1995), and Tim Ingold (e.g. 2000; 2012), to take three prominent critics of the imposition of the Western double reification of 'nature' and 'culture' onto integrated local knowledge systems, a respectful analysis of *other* ecologies would need to attend to the ways in which modes of knowing may be organized and acted upon in ways that do not presuppose a natural order existing independently from and externally to a cultural order. When based on the prejudiced lens of our own understanding of nature, whose given attributes are defined by modern science, a largely outmoded way of ordering the world given the recent progress in theoretical biology (Descola 2012), anthropological analyses fail to engage with the relational and interactive nature of knowledge.

I wish to propose here that ecology is relational in a way often ignored or dismissed in contemporary socio-cultural anthropology. If we are to address fruitfully the continuing epistemological tensions at work in the anthropological reworking of such

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dichotomies as nature/culture or nature/society, we must, on the one hand, distinguish analytically the three entirely different meanings borne by the term 'relation', and, on the other hand, recognize the qualitative differences existing between ecological and moral reasoning. After exposing my reasons and arguments for establishing such analytical distinctions, I outline a new approach to reasoning, which sheds new light on the heterogeneity of human knowledge. I then show how such an approach illuminates key aspects of knowledge-sharing between indigenous communities and scientists. My first 'fieldwork on fieldwork' experiment involves scientists who, as part of a large biodiversity conservation project, created a botanical collection and surveyed 625 plant species named and used by the Huaorani of the Ecuadorian Amazon. The specifics of their research methodology and findings have been analysed elsewhere (Rival 2009*a*). The second such experiment relates to a period of field research I carried out amongst the Makushi of Rewa in southern Guyana with Marianne Elias, then a doctoral student in evolutionary biology with a special interest in plant genetics. This initial phase became part of a ten-year research project on manioc varietal diversity (Rival & McKey 2008). The third experiment deals with a more recent and shorter field trip, during which I accompanied a Mayan agroecologist to Toñampari, a Huaorani community, to co-design with the villagers a rotating polyculture system (Rival 2009*b*). Having looked at relations between living organisms as they are researched by different scientists through fieldwork with indigenous communities in three separate settings, I come back to the issue of 'relation'. I conclude by showing how we may avoid reproducing Western dichotomies without resorting to constructivist arguments. Undoing the epistemological void between the natural and the social sciences, product of our own intellectual history, need not imply that everything, everywhere, is socially constructed.

The intermingling of knowledge systems

The concept of 'relation' has become central to the anthropological reworking of the Western nature/culture dualism. In Marilyn Strathern's abstract semiotics, all relations are internal to a system of cultural ideas, understood to be independent from external causal relations (Strathern 1980: 177, 193, 195, 196; 1995: 16-17). The perceptible world consists mainly of sign-encoding appearances, and persons are constituted out of gendered exchange relations (Gell 1999). Relational complexity results from *other* relations (i.e. when two entirely different conceptual objects are mutually modified through juxtaposition), rather than from objectifying the relationship of self to *other* (Strathern 1980: 191, 215, 216; 1995: 18, 21, 25). For Tim Ingold, by contrast, social relations get dissolved within the experiential world of interactions between organisms. Organisms do not even relate to their environments, for relations form emergent properties within a relational system in which everything is in perpetual flux and movement (Ingold 2012: 8, 12, 72-4). Relations are conceptualized as trails of becoming along which life flows like a river, through which understanding grows, and down which enduring organisms enmesh their conjoined histories, endlessly (Ingold 2012: 13-14, 115, 120, 168, 221). Philippe Descola's apprehension of the relations existing between humans and other than humans lies equidistant from Strathern's mereological metaphysics and Ingold's sentient 'perceptionism'. Starting from the premise that the opposition nature/culture is both historically recent and unevenly distributed around the planet, Descola proposes to search for the basic principles that have led to instituted social realities in worlds where nature does not exist (Descola 2005*a*: 56-7; 2011: 72-4, 83). In all worlds, whether they are organized around a modern notion of nature or not, life is

experienced and understood through a cosmological duality between 'interiorities' and 'physicalities' (Descola 2005*a*: 121, 168; 2011: 94-5). Without such a duality, there would be no coherence to culture; persons could not be treated as potential subjects of social relations; and patterned discontinuities between humans and non-humans could not emerge or stabilize (Descola 2005*a*: 549, 551).

Although the richness and density of the work produced by these three authors over the last four decades requires a lengthier treatment than the one I am able to offer here, I wish to point to the fruitfulness of comparing and contrasting their engagements with indigenous modes of inhabiting a multiplicity of worlds, and their critiques of previous anthropological attempts at analysing systems of classification of nature. Descola and Ingold show greater interest in the material properties of the natural environment than does Strathern, whose questioning of anthropology as an almost exclusively Western project arises more from a reflection about human biology than from one about the biophysical properties of the world. Where Strathern and Descola share an interest in cultural structures, Ingold dissolves cultural meanings within 'skills', a concept at once biological and cultural. There is no place in Ingold's vision of relationship and commitment to direct perception for what may be unique to the human way of experiencing the world, or for the world of creative difference afforded by human languages. While both Strathern and Ingold reject the division of relations into either internal or external, Descola embraces it as a necessary universal fact without which cultural difference could not emerge or endure. And if Descola attends to cultural persistence and the stability of social institutions, without which events could not be turned into meaningful reality, Strathern and Ingold both stress the fluidity and incompleteness of transformational (Strathern) and developmental (Ingold) relational worlds, irrepressibly open to unforeseen possibilities. In sum, although there are significant differences between Strathernian, Ingoldian, and Descolian approaches, it is fair to say that they all end up 'disappearing' nature within relational fields built on the dissolution of boundaries between the social and the physical environment. This becomes clearer when one takes into account that 'relation' can refer to (I) the moral and variable link between individual persons or groups; (II) the connection or correlation between two abstract objects of thought; or (III) the interactions and interdependencies between a living being and its environment.[1]

Given the concreteness of the observable reality of biological relations, it is not surprising that the unique place occupied by living beings within the biophysical environment is universally recognized. Unlike Strathern or Descola, Ingold has written extensively on the third meaning of the word 'relation' (e.g. Ingold 2000: 166-8; 2012: 69-71, 85-6, 124, 160-1, 231-2). Using ecological psychology to reconceptualize living beings as persons/organisms, he famously wrote that 'there is no radical break between the domains of social and ecological relations' (Ingold 2000: 107). However, there is ground to argue that this approach has led him to dissolve Meaning (I) into Meaning (II), hence to reduce social relations to interactions. Moreover, given that what makes living beings be as they are and behave as they do remains partly beyond direct observation, theories of how Meaning (III) relates to Meaning (I) and even (II) have varied both historically and culturally. In order to capture Meaning (III) fully and to rediscover how it may relate to Meaning (I) and Meaning (II), I now propose that we pay attention to the set of relations called 'ecological relations' by natural scientists.

Contemporary ecology, or the branch of biology dealing with the relations of organisms to one another and to their physical surroundings, includes the study of human

interactions with animal and plant species. Ecologists today work with a wide range of theoretical frameworks, none of which treat humans exceptionally: that is, apart from or above the rest of nature (Schaeffer 2007). In other words, rather than seeing nature as something external, ecologists now tend to treat it as relational. Their focus is straightforwardly on interacting organisms, in particular on how each plant and animal affects every other plant and animal in a particular ecosystem, as well as how humans interact with plant and animal communities. This is particularly clear in the work of natural scientists interested in the evolutionary ecology of domestication, who do not posit any radical separation between people and the environment, or between 'wild' and 'cultivated' nature (Rindos 1984). On the contrary, they take cultivators as the most important part of the biotic environment of crop plants (Van der Meer 2011). When they say that ecology – the interactions among cultivators, plants, and environments – has shaped the process of domestication, they mean that cultivators, with their knowledge, decisions, preferences, and actions, represent the most important 'mutualists' of the biological populations under domestication.

Before examining the extent to which knowing about ecological relations motivates knowledge-sharing between expert knowers, whether these are natural scientists, indigenous forest-dwellers, or indigenous practitioners, and before exploring some of the ways in which reasoning about ecological relations differs, but is not entirely divorced, from moral reasoning, I wish to show how the theoretical insights of Barth (2002), Flyvbjerg (2001), and Atran and Medin (2008) may be combined to illuminate further the dynamic interactions between the three different meanings of the term 'relation'.

In a seminal paper, Barth (2002) indicates how anthropology may approach the three faces of human knowledge comparatively. It is in recognition that different domains of cultural knowledge and different ways of knowing coexist that Barth invites us to 'unravel more of the processes and dynamics of the human varieties in knowledge' (2002: 17) and to undertake comparative ethnographies of knowledge. For Flyvbjerg (2001), social science inquiry should aim to offer reflexive analyses of goals, values, and interests as a precondition for enlightened development in any society. Taking inspiration from his study of Aristotelian intellectual virtues, he argues that the most important task for social and political studies is 'to develop society's value-rationality vis-à-vis its scientific and technical rationality' (Flyvbjerg 2001: 53). No matter how 'objective' the knowledge sought or offered is – that is, no matter how 'epistemic' or 'technical' – it always implies some kind of 'phronetic' engagement with underlying values (Flyvbjerg 2001: 55-60). *Phronesis*, or practical wisdom, is neither about producing things according to instrumental rationality (*techne*), nor concerned with the universal production of knowledge, the domain of analytical rationality (*episteme*).[2] Rather, the concern of *phronesis* is the analysis of values and the value judgements that inform human action. Whereas many commentators have attempted to reduce *phronesis* to either *techne* or *episteme*, Flyvbjerg maintains that *phronesis* is not a higher form of know-how, nor is it anything but a practical ethics based on judgement and experience. Finally, like Foucault and Bourdieu's readings of Aristotle on *phronesis*, Flyvbjerg's emphasizes power relations, conflict, and contested meanings in social life.

Cognitive studies that highlight the uneven distribution of knowledge within and between communities, and point to the unique characteristics of expert knowledge (Atran & Medin 2008), well complement Barth's and Flyvbjerg's theorizations of the various types of rationality that orientate human behaviour. As Barth admits, if the ritual and social forms examined in his paper can be powerfully accounted for through

the three-pronged approach he proposes, forms of knowledge on which 'nature impinges in a much more determinate way' (2002: 17) may require a type of analysis that does not focus so single-mindedly on the interplay between erratic innovation and the disciplined cultivation of sacred knowledge. Issues of validity and performance play out differently in environmental decision-making. Atran and Medin, who, like Barth and Flyvbjerg, see a direct relation between how people understand nature and act *in* it, combine socio-cultural anthropology and cognitive psychology to research the patterned distribution of knowledge and belief both across and within cultures. Instead of taking individual variation as a deviation from the norms or rules of a given cultural tradition, they treat it as a core object of study. Their theoretical approach, which allows not only for an appreciation of the variable distribution of knowledge within and between human groups, but also for a better understanding of expert knowledge, illuminates the characteristics of the ecological relations presented in this article.

For over ten years, Atran and Medin's research team worked on the cultural knowledge and biological expertise of two different regional populations to test their hypothesis regarding the innate modularity of folkbiology as a conceptual domain driving categorization and inductive reasoning. The first study population was located in lowland Guatemala, and comprised three ethnic communities: native Itza' Maya, Q'eqchi' displaced Maya, and Spanish-speaking immigrants locally known as Ladinos. The second was in the US's Midwest, and included Native American Menominee children, adults, and fishing experts; various sub-groups of majority-culture adults and children living in Wisconsin; university undergraduates; and diverse groups of 'biology experts' such as park-maintenance workers, landscape architects, professional taxonomists, bird-watchers, and fishermen. The researchers found commonalities in conceptual organization across the board, as well as unexpected patterns of co-variation between ecological reasoning, culture, and expertise, thus confirming Barth's insights on internal processes of differently constituted traditions of knowledge. For example, both majority-culture and Menominee fishermen knew as much about fish, and, as expert knowers, they knew more about fish life and about fishing than people in their families and communities who did not fish. However, the Menominee on the whole tended to be more knowledgeable about fish than were members of the majority culture, and intracultural differences in knowledge and reasoning were greater within members of the majority culture than they were among the Menominee. The reasoning about fish of majority-culture fishermen tended to involve only the adult life of the fish, while the Menominee would reason ecologically on the basis of its full life-cycle.

Medin, Atran, and their co-researchers similarly found notable knowledge differences between various types of tree experts (landscapers, park-maintenance workers, and professional taxonomists) within North American culture. Whereas the three kinds of experts provided broadly similar tree classifications (and justifications for them), thus pointing to the salience of folk generics (especially the genus level), differences between them revealed that expertise affected the categorization of, and reasoning about, biological kinds. For instance, whereas the maintenance workers classed trees according to morphological and taxonomic criteria very similar to those used by the scientists, the sortings of landscapers conformed least well with scientific taxonomy. Landscapers tended to be primarily concerned with utilitarian and aesthetic aspects (such as the optimal placing of trees in relation to each other, or to other features), while maintenance workers tended to reason about trees as living beings that require care: they have to be planted, pruned, treated, or removed if damaged or diseased. In

other words, the justifications offered for sorting trees in a particular way differed as a function of type of expertise (Medin, Lynch, Coley & Atran 1997).

There is another aspect of Atran and Medin's empirical work which opens new avenues for the study of inter- and intracultural communication of environmental and ecological knowledge, including its moral, social, and political significance. By looking for the channels that allow intergroup communication, as well as for possible reasons explaining why some groups fail to communicate, Atran and Medin demonstrate that human groups can learn ecologically sound practices from each other without necessarily sharing the same language, or, for that matter, the same understanding of the non-human entities that dwell in the 'commons'. Their study of the municipality of San José, El Petén, Guatemala, suggests that it is because they have developed social networks and channels of communication to learn from the native Itza' that the Ladinos have adapted to their new environment in a more sustainable way than the Q'eqchi' have. Conversely, in Wisconsin, stereotyping, prejudice, and a lack of communication between members of the majority culture and the Menominee have resulted in interethnic resource conflicts, which, in turn, have strengthened the two groups' 'differing mental models and associated values and practices' (Atran & Medin 2008: 236).

Atran and Medin's discussion of dynamic and dialectically interrelated differences in cultural commitment to, and affective valuation of, particular landscapes offers a solid standpoint from which to push the reflection on *phronesis* and on the relationship between empirical knowledge, utilitarian rationality, and value-rationality (see in particular Atran 2001: 169-71; Medin, Ross & Cox 2006). The Itza', who believe that disrespect for the forest causes the suffering of all, have not designed social institutions to support collective decisions and forms of co-operation for the maintenance of forested commons. Therefore, the Itza' have no means to get the displaced Highland Mayas (Q'eqchi') to perceive their lowland spiritual landscape, which the latter now occupy, as anything else than mere agricultural land to be developed according to governmental planning. As the Q'eqchi' continue to invest their mountains with sacred value and to maintain ancestral ties to the homeland they were forced to abandon, they have very few incentives to engage phronetically with the Itza'. The Ladinos, by contrast, have learned to experience the forest landscape ecologically and interactively under the guidance of Itza' experts, thus adapting cognitively, aesthetically, and emotionally to Itza' cultural persistence. In Wisconsin, white conservation values derive from the experience of sport fishing (i.e. catching and releasing the fish) and a view of nature as external to human society. Rooted in Menominee unity with the natural world and a subsistence economy organized around seasons, Amerindian values, by contrast, centre on the notion of thrift (Gudeman 2012). Few whites are aware of – let alone know or understand – the Menominee's ecological orientation. This explains why powerful majority-culture organizations successfully campaign for the revocation of Menominee fishing and hunting rights, seen as the source of fish and game depletion. What these detailed studies show is that: (1) ecological relations are implicated in *techne* in a way not envisaged by Flyvbjerg; (2) cultural meaning may, quite independently from power, shape the way in which *techne* informs *phronesis*; and (3) *phronesis* is too often understood to involve value judgements based on 'human exceptionalism' (Schaeffer 2007).

Let us now turn to the ethnography to see how the analytical tools delineated above help us answer questions such as: How do Meaning (I), (II), and (III) of the term 'relation' relate to the diversity of systems of objectivization of the world? Is the

distinction between ecological and moral reasoning analytically useful, and what does it tell us about the heterogeneity of human knowledge? What does the qualitative difference between ecological and moral reasoning tell us about the intuitive ontologies studied through experimental methods or the scientific ontologies underpinning ecological studies?

Fieldwork and experimentation

Whether we think of fieldwork as 'doing our philosophy outdoors' (Ingold 2012: 238), or whether we consider fieldwork as the place and time when 'the universal working of intersubjectivity' can produce 'a kind of knowledge that everyone can master' (Descola 2005*b*: 73), there is no doubt that fieldwork facilitates the gaining of new understanding of other perspectives and different practices within and beyond anthropology. Fieldwork, an inherently iterative process with obvious dialogical and relational implications, constitutes a fertile ground for intercultural encounters. Fieldworkers and the people with whom they study have multiple opportunities over extended periods of time to correct misconceptions and misunderstandings. Fieldworking, or the situated performance of finding something out for oneself by being there, as opposed to a lab experiment or a philosophical speculation pursued at the writing desk, influences the ways in which the researcher comes to know what she or he knows, and this quite independently of her or his own disciplinary background. Doing fieldwork on fieldwork thus promises to be a good way of finding out what social and natural scientists really do. It also has the potential to shed light on the precise ways in which ethnographic data differ from experimental data, and, in particular, the ways in which intersubjective exchanges condition a field researcher's grasp of a particular situation, especially when researching cultural understandings of the biophysical reality, where so much 'goes without saying' (Bloch 1991), and where there may be no one-to-one correspondence between classificatory concepts and lexemes (Atran & Medin 2008: 33-5).

The three scientific fieldwork experiments presented here (labelled for convenience 'Huaorani plant naming', 'Makushi manioc diversity', and 'indigenous agroecologies') are approached as a kind of meta-fieldwork that was neither designed nor planned as such. I did not participate in or observe directly all the interactions under discussion. I was nevertheless able to reconstruct interactions between natural scientists and native participants by comparing what I observed and witnessed with what I learned through informal conversations, interviews, gossip, and subsequent research on published and unpublished materials over a long period of time (from 1993 to 2011). The ethnography would not have been qualitatively and quantitatively richer had I designed the research around such meta-fieldwork from the start. Comparing these three cases has highlighted that rapport played an important role in constituting the necessary context for knowledge exchange, and that local participants showed great enthusiasm for experimentation.

It is not surprising to a social anthropologist that fieldworking is a highly social affair. Knowledge production depends not only on good working relations between research participants, but also on personal identities and circumstances. There are many sides to the simple truth that fieldwork is an intensely social activity that requires acceptance, co-operation, and trust, or that there can be no sharing of knowledge, let alone knowledge co-production, without rapport. Each of the three projects was made possible through a mix of previous experience and serendipity. The Ecuadorian

biologists who collected Huaorani plant names used the knowledge they had gained through previous ethnobotanical surveys with other indigenous groups to generate research questions that allowed them to move away from a narrow focus on biodiversity mapping. QuehueireOno participants had become familiar with fieldworkers, having hosted me for a number of years, and worked with Flora Lu (1999). Like many anthropological projects, the Makushi manioc diversity research design followed on from, rather than preceded, the 'being there' in the field. Doyle McKey, who had become fascinated with the evolution of anti-herbivore chemical defences in a major tropical crop, manioc (McKey & Beckerman 1993), was looking for a South American site where indigenous communities were cultivating it as their main crop, and where wild manioc was known to abound. Marianne, who had a passion for genetics and evolutionary biology, as well as for human cultures and music, was looking for a funded doctoral research position. Having done my doctoral research with hunter-gatherers with only a minimal interest in crops, I was interested in working with great cultivators, hopefully of bitter manioc. The indigenous agroecologies project would not have come off the ground if I had not met Armando,[3] a Mayan agroecologist visiting seed saving projects throughout Ecuador, or if he had not accepted an invitation from Toñampari villagers to demonstrate his cultivation techniques.

There cannot be fieldwork without personal relationships, no matter how different the interests or the social values of those who collaborate, especially when field research is designed to last as long as an average ethnographic fieldwork. Literate and savvy participants in regional markets and national politics, the Makushi were welcoming and friendly from the start. Fieldwork started with a particular focus on toxicity, and Marianne and I soon began to collect manioc varieties. In these first weeks of collaborative fieldwork, there was much knowledge exchange between the evolutionary biologist in training and the anthropologist. By helping Marianne weigh the tubers and calculate their cyanogenic content, I learned a few lab techniques, while Marianne, curious by nature, learned the open-minded participant observation way of knowing by 'being there'. The number of stories and anecdotes we exchanged at night about what we had seen and done during the day grew, along with our familiarity with the community, and no doubt the same iterative process was taking place amongst our hosts. Marianne, who already knew Portuguese, was quickly acquiring the colourful English spoken in Rewa. Soon we had visited most kitchens; helped in peeling, grating, squeezing, and toasting manioc; lent a hand in preparing fields for the next planting season; sung Makushi, French, and Latin American songs along with our hosts; written down myths and oral histories; assembled a collection of manioc varieties, learning their names and their phenotypic characteristics; and mapped a few gardens. Far from stopping with our ethnobotanical research, Makushi eagerness to collaborate in projects documenting their natural environment has continued to attract researchers (Daly 2012). By contrast, the research contract between scientists and local participants was more tenuous both in QuehueireOno and in Toñampari. The Huaorani plant naming project was entirely dependent on local goodwill, motivation, and availability, none of which could be established once and for all. Individual men and women hired for the botanical survey only worked when they felt like it, regardless of whether they had been paid or formally contracted. Better results were obtained from consultants with whom a relation of mutual appreciation had developed, which often implied material exchanges and social interactions that went far beyond the contractual relation. Demands exerted on the Ecuadorian scientists were even greater than the ones to which

I had been subjected, as if a mutual recognition of differentiated citizenship added an extra layer of constraint or obligation in the gaming of intercultural transactions. Motivation and availability were also determinant factors in the success of the indigenous agroecologies project, with the difference that the intense curiosity with which Armando's exotic presence was met ensured that many villagers participated, without asking anything in return.

It is in the systematic use of controlled experiments that natural science fieldwork departs from focused or holistic ethnographic fieldwork. Yet this is also the aspect that local research participants seemed to have enjoyed the most. QuehueireOno villagers were keen on the sampling and experimental plots and transects. The enthusiasm of adults and children for the plant trail and the free listing exercise I organized as part of a pilot project aimed at testing aspects of transgenerational transmission of biological information, which I was asked to repeat on successive days, made me aware of the fact that, over the years, some of my inquiries had been much easier than others. While I often struggled to get someone to help me collect stories about shamanism or to transcribe myths and chants, I had no difficulty in finding people willing to show me how to prepare a banana plantation, or to explain the specific uses of a particular plant. Similarly, the 'action research' experiment[4] conducted in Toñampari led to animated conversations among villagers about soil colour and texture, mulching, number of harvests, and cultivation techniques. Marianne's scientific attention to cultivated fields and varietal diversity was of great interest to the Makushi, who were at least as curious about her experimental research as she was about their cultural practices.

In addition to systematic recording and quantified observations, Marianne's project also included an experimental field containing representatives of all the manioc varieties existing in Rewa. The Makushi perfectly understood that Marianne was involved in a controlled experiment, and although they did not fully know what she was looking for, the experiment mattered to them. Their curiosity and interest were such that they became directly involved in preparing the experimental field, which grew to be a joint project. I could multiply the examples, and mention the numerous occasions I and other colleagues have witnessed the keenness with which indigenous collaborators involved in biodiversity conservation research use the visualizing and recording equipment of natural scientists, either to enrich their perception and experience of animal and plant species, or to satisfy their curiosity regarding Westerners' ways of knowing.[5]

This section has illustrated some of the similarities and differences between anthropological fieldwork and fieldwork practised by natural scientists interested in ethnoecological knowledge. I have shown that when carried out over extended periods of time, field activities produce knowledge rooted in intercultural social contexts, regardless of the discipline framing the research questions. When natural scientists stay long enough in the field, part of their experience necessarily acquires some of the characteristics of anthropological fieldwork; they become ethnographers of a sort. Moreover, indigenous collaborators treat researchers who come to them in ways that show indifference to the latter's disciplinary background. In the three examples presented, local participants showed a marked preference for the concrete and focused research methodologies used by field botanists, zoologists, and biodiversity conservationists over the more discourse-probing methods favoured by anthropologists.

Ecological knowledge and expertise

In one way or another, each of the three research programmes sheds new light on indigenous understandings and uses of ecological relations. Rather than being originally motivated by a genuine interest in Huaorani ways of knowing nature, the plant name study was designed to survey rigorously and measure quantitatively species richness in a particular Andean foothill region (Cerón & Montalvo 1998). Huaorani consultants were initially asked to name plant species that the scientists had already inventoried, so that the latter could quantify how much of the rainforest the Huaorani use. Despite obvious methodological shortcomings, the study was based on data collected while walking in the forest. And although their initial purpose had not been to study the specificities of an indigenous ethnoclassificatory system, Cerón, Montalvo, and their team became increasingly interested in the Huaorani way of identifying plants (Rival 2009*a*: 56-7). The data they collected showed that phenological states and ecological relations are actively used to locate flowering and fruiting trees, particularly in hunting, which largely depends on knowing the location of trees and shrubs that are sources of food for animals. Rather than treating a plant as an abstract representative of a particular species, it is named according to the state of growth and maturation in which it is encountered. Moreover, plant species are named slightly differently in relation to the state of re-growth of the part of the forest where they are found. Little of this transpires in the final written product, which bears the unmistakable marks of modern scientific knowledge production. Although the ethnobotanical study does little more than list Huaorani names for 625 plants, matching these with scientific names and cataloguing their use, it nevertheless records the fact that name variation is high. Whereas ethnobotanists would have eliminated the 'noise', the botanists kept all synonyms and alternative spellings for the same plant name, recording the different orthographies used.[6] They did so, they told me, to prevent errors in the scientific identification of tree species – proof, if there is one, of how much they relied on Huaorani knowledge. Unable to establish whether morphospecies were being lumped together or whether some species were known under different names because of an inherent difficulty in differentiating species on the basis of visual cues, or, even, because of unevenness in use or knowledge distribution, they simply recorded all the names as spelled by Huaorani collaborators. Another reason they gave me for this practice is that their Huaorani field assistants had explained that different spellings reflect differences in pronunciation,[7] as well as dialectal differences.[8] Finally, all variations were kept because it was decided that Huaorani fieldworkers should be allowed to write the names down as they wished, as, perhaps, a source of scientific data for future research on interpersonal variation. To me, this is a clear example of how this botanical study, despite its being cast in an epistemology remote from Huaorani ways of knowing, nevertheless bears traces of Huaorani knowledge practices, in particular the lexical encoding of ecological and phenological relations.

The Makushi manioc diversity project, based on evolutionary ecology premises, was sufficiently broad and interdisciplinary to provide a holistic examination of many of the factors at play in crop domestication, particularly the interplay between environmental pressures and cultivators' preferences for certain cultivars, and that between clonal propagation and sexual reproduction.[9] Findings established that Makushi cultivators create garden environments that protect and maintain the disturbance-adapted regeneration niche of the wild ancestor of manioc, its disturbance-adapted dispersal ecology involving seed burial by ants, and its plant germination ecology, all facts that

play a significant role in enhancing the variability of cultivated forms (Elias, Rival & McKey 2000). Working alongside Marianne, who had become intrigued by the number of self-seeded plants present in Makushi manioc fields, I was captivated by anything I could construct as different, cultural, or magical, such as the use of *bina* plants[10] in manioc plantations to promote their growth and reproduction, or the fact that manioc clones were planted facing east in all the fields I had visited. Still, as I learned from Marianne the co-evolutionary significance of *tepuru pîye* (seed-grown plants), I began to focus my attention on exchanges of plant materials between cultivators, as well as on local understandings of growth, reproduction, and organic life (Rival 2001).

What makes my third example so interesting is the spontaneous decision on the part of Toñampari villagers to appoint Paa as a counterpart to Armando for the agroecological experiment. I had known Paa for a long time. To me, he was one of the last great warriors who had participated in the raid against the missionaries in 1956 (Rival 1994). My conversations with him over the years had always been about warfare and hunting; I had no idea that he was regarded by his community as an elder with special gardening knowledge. Paa had many garden plots scattered around Toñampari, in which he used a simple form of crop rotation. Unlike common Huaorani practice, he divided his plots into two halves, planting bananas and plantain in one half, and manioc in the other. Paa told us that he had learned this technique from Nemo[11] and her *guiri* (literally relatives, i.e. other foreigners who had visited her in Toñampari). 'She would sit in the evenings with us', he said one day, turning to Armando, 'lecturing us on how to live better, how to live well with our families, how to grow our own food, and how to pray to God the Creator'. Armando, who had never been in the Amazon region before, had gained much experience over the years with documenting plant associations. He had become savvy at comparing various Meso-American agricultural practices, and at experimenting with different traditions to see which one produces the best results for a particular community. For both Paa and Armando, cultivating plants involved knowing relations between different crops, and between plants, birds, insects, and other animals, as well as the ecological interface between cultivated plots, the village, and the forest. Whereas experimentation had brought Paa to shift his knowledge of ecological relations from hunting to sedentary subsistence agriculture, Armando had used experimentation as a means to apply what he had learned while at university. When I visited him in his hometown after the Toñampari trip, he showed me what he called his first 'ecological design', a re-created ancient Mayan *milpa*.[12] The patch of luxurious vegetation with its system of beds and plant associations had allowed him to acquire a range of agroecological skills and tools through trial and error, which he subsequently applied to other projects in other places.

In one way or another, each of these three research programmes probes into indigenous ecological knowledge, a particular kind of expert knowledge which offers many opportunities to study the relationship between thinking about and acting on nature, as well as to consider implicit bodies of practical and experiential knowledge that are memorized in forms other than linguistic. As Sillitoe (1998; 2002; 2007; Sillitoe & Marzano 2009) has argued, debates about 'indigenous knowledge' (IK) have allowed anthropologists to question knowledge practices that separate Science from applied science, or 'knowing how' (skill-based) from 'knowing that' (conceptual). His insightful discussion of why IK has become a liminal trope between the instrumentalized and the subaltern stresses that it is often representative of dynamic procedures and skills that have been generated or appropriated by local people in the course of

history, thus continuously reproduced through a rationality driven by the daily requirements of persisting. Sillitoe (2010: 21) further shows that knowledge that can only be learned through doing is most meaningfully discussed through the co-performance of embodied skills with other practitioners. As I have shown in this section, indigenous people are to a greater or lesser extent expert knowers, who enjoy interacting with other experts through field experiments. This is why I argue that there is more in common between the way natural scientists and indigenous peoples think about ecological relations than is commonly recognized. This, of course, does not mean, as I discuss in the next section, that the concepts, categories, and practices brought to bear by a people in organizing and interpreting their relations with the natural world, which I call here ecological reasoning, exist in isolation from moral reasoning.

Anthropologists as social experts

Surely, reasoning ecologically about observable relations between biological organisms does not occur in a social vacuum; 'moral reasoning' gets inevitably embroiled in 'ecological reasoning', as all fieldworkers experience, whether they are anthropologists or not. The intermingling of social and moral reasoning in the Makushi manioc diversity project was quite straightforward. It involved a central concern with avoiding resource waste through use and exchange, not unlike what Douglas Medin and his collaborators have reported for the Menominee (Medin *et al.* 2006: 142-5). As mentioned earlier, Marianne lived her time in the field as a welcomed apprentice, listening to people's advice, correcting her mistakes, and preparing and eating the produce of her work with the village's families. Not only were the villagers subjecting her to endless questioning, but they were also commenting to each other on her activities, or on the way she was choosing and combining varieties, wondering, for instance, why she was planting variety 'X' near variety 'Y'. It was through such critical commentary, guidance, and interest that Marianne came to make the scientific discoveries contained in her doctoral thesis. She recalls in a recent interview:

> I know, I have a tendency to be too Cartesian ... but I had to adjust to what they were telling me, and I had to justify my choices to them. For instance, they told me, 'no way you can do the plantation like this, it is far too big, you will not use up all what will be produced. The manioc is going to waste ...' I had to make sure that all the tubers were going to be used up. The size of the field was based on my experimental needs, but they were cultivating it with me, and looking after it when I was not there. I managed to eat and give away all of the tubers. Nothing got wasted ... I based myself on their own perception of what they told me. My thesis is very descriptive, I made a big effort on the side of the human sciences.

The first Huaorani case does not exhibit any obvious moral concern, apart from the Huaorani's keenness to educate the Ecuadorian scientists about the right way to name trees and plants: that is, to identify them as changing living beings caught in ecological webs, rather than as speciated abstractions. However, when compared with the second Huaorani case, a pattern emerges. In many ways, the Ecuadorians were treated not so much as tropical rainforest experts, which they were to a large extent, but as experts in the world of objects coveted by the Huaorani: that is, not unlike the oil engineers who had become part of the Huaorani social universe. The difference was that QuehueireOno villagers had decided not to harass the former with the same requests they continuously put to the latter, but, rather, to educate them about ecological

relations. In many ways, this is also how they treated me, with the caveat that the natural scientists, their experimental tools, and interesting calculations were seen as particularly entertaining and fun to work with.

By contrast, the encounter with Armando was perceived to be of an entirely different sort. Not only was he ecologically knowledgeable, but he also knew the implications of his knowledge, hence the appointment of Paa as an expert counterpart to ensure a balanced exchange of information between two equally powerful cultivators. Paa and Armando became friends,[13] and the pair led all the activities that we undertook throughout the project, walking in front of us when visiting plantations and forest groves, and facing each other when talking to us in the demonstration plot. Their relationship contrasted with the rather distant one Armando exhibited with the owner of the house where we had been asked to stay. Our host, half-Huaorani and half-Quichua, was the school caretaker. Each morning during our stay, he would busy himself around the school compound in his impeccable white overalls, a cylinder of herbicide latched on his back, meticulously applying the land management techniques he had seen used around oil camps and North American housing estates. The caretaker's son, a part-time teacher in the school, had volunteered to translate between Spanish and Huaorani during the group visits, leaving me to tag along as a participating learner and witness. Every evening after dinner, villagers would crowd into the caretaker's vast stilted house to see Armando, hear his stories, and watch DVDs.

When Toñampari villagers showed how they broadcast maize seeds on mulch, Armando, bemused by the fact that these lowlanders would not even select the seeds for replanting after harvest, made his questions increasingly more precise. He would ask: Are you cultivating the corn for the length and colour of its leaves? What about the corn itself? Don't you care about the size of the ear? The colour of the grain? While talking, he would demonstrate how to line up the cultivated soil with leaves, how to enrich the mulch, and how to plant seeds in small holes instead of broadcasting them, a practice which, he insisted, produces smaller cobs and plants of uneven sizes. Then he distributed to those who wanted them the seeds he had carefully selected in various market towns on his way to the Huaorani community. He had brought different varieties of beans, soya, lowland corn, peanuts, and other food crops he was as unfamiliar with as the Huaorani were, such as *chochos*, an Andean lupine that grows at 3000 metres above sea level. Villagers crowded round, curious and intrigued. Celia, who was as mischievous in her forties as she had been in her late teens, when I was living with her, laughed and said in her mother tongue that Huaorani people do not like beans 'like you foreigners seem to do'. She would take the seeds being offered, she added, not to plant them, but to make a big stew that, with a bit of hope, her dogs might find edible. Everyone laughed, and jokes fused in typical Huaorani style. Later on, Armando demonstrated the plant association and crop rotation system he was proposing to use. This is when an animated conversation broke out about the best way to cultivate maize and peanuts. When Armando explained his planting design in the shape of a spiral, curled like a snake to reduce labour while maximizing soil and water conservation, a middle-aged man approached him, took the digging stick from his hand, and patiently demonstrated why peanuts would not grow well in such a spiral. For a start, peanuts have to be soaked a whole day and a whole night before being planted; then they need to be planted along river banks, where the soil is moist and more fertile; finally, they need to be planted very close to the surface of the soil, and the digging stick must be

inserted horizontally, not vertically as Armando was doing. 'This is our way of growing peanuts', he continued. 'We have two varieties; both grow where the forest lines the river banks'. He handed the digging stick back to Armando, returning to his place on the outer circle. Armando acknowledged with a smile that he was not so familiar with peanuts, but he urged villagers to give his design a try anyway, and to observe carefully the results.

As the agroecology demonstration plot turned into a tournament between maize and bean growers, on the one hand, and peanut growers, on the other, I became vividly aware of the moralization of ecological relationality; cultivating crops involves forms of experimentation that are never fully divorced from identity politics. However, the point I wish to stress here is that knowing the specific conditions that make cultivation possible allows the anthropologist to recognize the social constructedness of knowledge, which inevitably implicates moral reasoning, without letting the habits of the mind attached to socio-centric expertise overwrite ecological relations. Anthropologists are not trained to see the implicit properties of the biophysical environment, which indigenous knowers acquire through direct and prolonged immersion, and which form an integral part of their world. Such tacit knowledge can be revealed as skilled reasoning through field experiments that facilitate verbal communication between members of different epistemic communities. In this way, documenting the making of biodiversity science through field encounters, providing that time in the field is long enough for mutual relationships to develop, facilitates the anthropologist's biological education, while tempering the biases of her or his social expert knowledge.

Rediscovering the concreteness of relations

With the discipline increasingly bent on showing that if everything is 'cultural' and 'social', especially ideas about 'nature', what natural scientists take to be 'natural' or 'universal' cannot be the concern of anthropology, or, for that matter, of any social science endeavour other than the deconstruction of scientific discourse and practice, one is left to wonder what place should be accorded to the rich ethnographic data gathered in botanical, ecological, and ethnoecological studies, such as those presented in this article. Ethnoecology, in particular, has been deemed a body of work which subverts the 'ecology of others', either because it neglects ecology as experienced through direct engagement with the world (Ingold 2000: 60, 107, 172-3), or because it analyses ecology according to an objectification of nature which is profoundly modernist (Descola 2011: 33-5), or because it relies on a dualist ontology that necessarily obfuscates native categories (Strathern 1980: 181, 187, 189-90, 202, 214-15, 219). Are these studies so tainted by Western constructions of nature that they can tell us nothing about the modes of knowing of non-modernized or other-than-modern people? Should they remain external to anthropology, or can they be used to navigate different conceptions of what the discipline is or could become?

My argument has been that anthropology can fruitfully renew its theoretical engagement with the fraught concepts of nature and life by looking at ecological relations as a special kind of expert knowledge used to categorize the biophysical environment *and* to reason about it. Ethnoecology was first proposed in 1954 and 1957 by Harold Conklin, and further theorized by Charles Frake in 1962 (Fowler 2000: 13-14).[14] The term 'ethnobotany' was coined in 1896 by J.M. Harshberger, a botanist from the University of Pennsylvania, who, in addition to recording native plant uses,

also gathered information on native beliefs about plants and ecological relationships.[15] Moreover, it would be erroneous to associate the systematic study of the natural world in general and of botany in particular exclusively with the West.[16] Furthermore, there has been much debate in both ethnoecology and ecology over the last few decades about adaptation and evolutionary processes, and much criticism of earlier theories based on marginalist notions of resource scarcity, yield optimization, and other economistic calculations, along with numerous efforts to understand the historical formation of landscapes through dynamic interactions between biophysical and socio-cultural processes involving both ecology and culture. This has opened a range of possibilities for multi-disciplinary field endeavours focusing on how different expert and cultural communities come to know about ecological systems and biological diversity. The three examples I presented illustrate how ecology as a kind of expert knowledge enabled natural scientists and indigenous communities to communicate and learn from each other, despite obvious differences in worldview and scale of understanding. In the three cases, indigenous knowers actively sought to educate scientists about how certain plants and animals relate to each other, and grow together. There was the same indigenous desire to share with knowledgeable others what has been learned from immersed observation and focused attention on growth and maturation processes, as well as the same keenness to learn new ways of doing things or thinking about them.

The three fieldwork experiments presented in this article show that ecological relations are used to reason about interactions between species in a way that does not necessarily merge the social and the biophysical environment into one single relational field. I have therefore suggested that ecological reasoning should be analytically differentiated from moral reasoning, even if the two are closely interrelated in practice. Ecological knowledge is situated, contextual, and relational, yet flowing between indigenous knowers and Western scientists with more fluidity than some have suggested (e.g. Blaser 2009). When fieldwork does not last long enough for repeated interactions and informal exchanges to create the rapport necessary for continuous genuine dialogue, as in my third ethnographic example, or when prejudice and moral judgement block channels for intergroup communication, as in some of the examples discussed by Medin *et al.* (2006), moral reasoning may overshadow ecological reasoning.

In conclusion, I have proposed that thinking about environmental and ecological knowledge in terms of distributed expert and cultural knowledge sheds a new light on the issue of anthropological competence and professional bias. Social anthropologists, who, by and large, live modern urban existences, are trained to look for social processes, cultural differences, and apparently irrational practices or utterances. It is not surprising, therefore, that they are more likely than not to find ethnobiological studies lacking in proper attention to socio-cultural understandings of relationships, the variability of cultural orders and systems of meanings, or even the structure of society. It is through working with indigenous gatherers, hunters, and cultivators, as well as through observing and participating in their encounters with other biological experts – whether field biologists, plant scientists, or ecologists – that I have come to appreciate my limited knowledge of biological diversity, and my own professional bias. It is of course a good thing that we are trained to observe how people interpret their social and moral world. However, our predisposed sensibility to moral and social reasoning should not come at the expense of recognizing the central importance of ecological reasoning, especially

in communities that live in close contact with their biophysical environment. As powerfully demonstrated by Atran and Medin (2008), where biological expertise has not devolved for lack of institutional support, people act in the world on the basis of knowledge that is deeply informed by interspecies relational dependence. Finally, paying attention to shared ecological knowledge invites us to rediscover the intuitive, sensory-based logic of the concrete (Lévi-Strauss 1962), not as a speculative tool enabling the anthropologist to show how 'cold societies' preserve ecosystems by ensuring the continuity of their cultures, but, rather, as a practical way of knowing the living world in all its materiality (Lemonnier 2011).

NOTES

This research is based on long-term field engagements with Huaorani and Makushi communities, and with a range of scientists and practitioners, to whom I am deeply indebted. Warmest thanks to Dr G.N. Appell, whose commitment and vision have helped so many research projects deemed non-fundable by other funding bodies. I wish to thank colleagues who made useful comments and suggestions at various research seminars at which this article was presented (especially L. Baer, M. Bloch, S. Feuchtwang, J. Piña Cabral and R. Puri). Many thanks as well to Gisli Pálsson for his useful comments on previous versions of this article, and to the three anonymous reviewers. I take full responsibility – it goes without saying – for the final product.

[1] I am referring here to the definition found in the *Petit Robert*. The third sense is: 'tout ce qui, dans l'activité d'un être vivant, implique une interdépendence, une interaction avec un milieu' ('all that involves, in the activity of a living being, interdependency and interaction with the being's surroundings').

[2] For interpretations of *techne* or *mètis* that differ from Flyvbjerg's, see Marglin (1990) and Scott (1998: 311-16).

[3] This is a pseudonym. Armando is a Ka'kchikel Maya from Guatemala with a BA in communication studies and anthropology and an MA in archaeology, both from a North American university.

[4] This type of research is common within farmer-to-farmer networks (e.g. Holt-Giménez 2006). It seeks to break down the divisions between 'cultivator', 'expert', and 'scientist'. Knowledge 'co-produced' through collaborative approaches is used to create change in both agricultural techniques and outlook on what agriculture entails.

[5] This is not to deny that expensive instruments used in 'MRV' (monitoring, recording, and verifying) controls or the new 'biodiversity technologies' may be experienced as deeply alienating (Cepek 2011).

[6] The team of botanists let the Huaorani write the names down as they wished (and I did the same). The latter used different orthographies, for instance either /hu/ or /w/, /c/ or /k/ or /qu/, /v/ or /b/, /u/ or /o/.

[7] For instance, *acöhue*, *acuwe*, or *acowe* for Cedrelinga sp. [Fabaceae-Mimosoideae].

[8] I was told by several Huaorani who had collaborated in the survey that differences could also simply be '*ononqui*' (literally 'for nothing'), an expression often used when someone wishes to express the fact that there is no cause for explanation, whether because the event has occurred 'naturally' (as opposed to having been provoked by, or signalling the intervention of, a spiritual force), or because individual variation is normal, therefore not requiring any explanation.

[9] Whereas field ethnobotany seeks to understand the perceptions and practices of communities of cultivators, field ecology seeks to characterize the environments in which plants grow and reproduce. As for genetics, practised in the lab, it seeks to characterize diversity and explain its dynamism. Many questions regarding the connections between these different levels of reality remained unexamined. It would therefore be very useful also to have an ethnographic account of Marianne's experimental research with genetic markers in the lab. The story of the interactions and relationships between plants and people over time and space, like that of biodiversity, has been overwhelmingly framed in terms of genetic change and its phenotypic expression, as traced through genomic research, using machines to 'extract information that can be read only by other machines' (Boero 2010: 119). But to what extent is molecular biology a reliable tool to document the 'science of the concrete'? In addition to the kind of issues raised by science and technology studies researchers (e.g. Pickering 1992) regarding the making of science, a number of conceptual issues regarding the kind of diversity identified in the lab and in the field require ethnographic scrutiny. As a variety means something different for a geneticist, an agronomist, a plant breeder, or a cultivator, we need to examine how scientists constitute crop diversity at the genetic, genotypic, and phenotypic levels.

[10] *Bina* plants do not form a homogeneous category, or appear to perform any functional role as promoters of growth; they are 'charms' with ritual significance.

[11] Huaorani name given to the missionary Rachel Saint, who is buried in Toñampari, where she lived until her death.

[12] From a Nahuatl word literally meaning 'to the field'. A *milpa* is a type of polyculture or agroecosystem used throughout Central America. For a discussion of similar experiments in ecological engineering, see Renard *et al.* (2012).

[13] Armando, who always addressed Paa with much respect and deference, referred to him as 'el pastor' (the priest) in conversations with me; the nickname signalled his gentle ironic take on the Huaorani's evangelization by the Summer Institute of Linguistics, and his perception of Paa as both a traditional and a modern spiritual leader.

[14] Building on Conklin's insights, Frake attempted to define what an ethnographic description of a cultural ecological system should entail:

> An ethnographer cannot be satisfied with a mere cataloguing of the components of a cultural ecosystem according to the categories of Western science. He must also describe the environment as the people themselves construe it according to the categories of their ethnoscience ... By discovering what one must know in order to classify plants and other ecological components in Hanunóo fashion, one learns what the Hanunóo consider worth attending to when making decisions and how to behave within their ecosystem (1962: 55).

[15] Other North American scholars working in other parts of North America at the same time as Harshberger called their studies 'aboriginal botany'.

[16] Whereas both the Incas and the Aztecs maintained botanical gardens, ancient Egyptians, Chinese, and South Asians are known to have organized ethnobotanical expeditions, and to have written lengthy treatises about their discoveries (Minnis 2000: 6).

REFERENCES

Atran, S. 2001. The vanishing landscape of the Petén Maya Lowlands: people, plants, animals, places, words, and spirits. In *On biological diversity: linking language, knowledge, and the environment* (ed.) L. Maffi, 157-74. Washington, D.C.: Smithsonian Institution Press.

——— & D. Medin 2008. *The native mind and the cultural construction of nature*. Cambridge, Mass.: MIT Press.

Barth, F. 2002. An anthropology of knowledge. *Current Anthropology* **43**, 1-17.

Blaser, M. 2009. The threat of the Yrmo: the political ontology of a sustainable hunting program. *American Anthropologist* **111**, 10-20.

Bloch, M. 1991. Language, anthropology and cognitive science. *Man* (N.S.) **26**, 183-98.

Boero, F. 2010. The study of species in the era of biodiversity: a tale of stupidity. *Diversity* **2**, 115-26.

Cepek, M. 2011. Foucault in the forest: questioning environmentality in Amazonia. *American Ethnologist* **38**, 501-15.

Cerón, C.E. & C.G. Montalvo 1998. *Ethnobotánica de los Huaorani de Quehueiri-Ono, Napo, Ecuador*. Quito: Abya Yala.

Costa, L. & C. Fausto 2010. The return of the animists: recent studies in Amazonian ontologies. *Religion and Society: Advances in Research* **1**, 89-109.

Daly, L. 2012. The symbiosis of people and plants: ethnoecology among the Makushi of Southern Guyana. M.Phil. thesis, University of Oxford.

Descola, P. 2005*a*. *Par-delá nature et culture*. Paris: Gallimard.

——— 2005*b*. On anthropological knowledge. *Social Anthropology* **13**, 65-73.

——— 2011. *L' écologie des autres: l'anthropologie et la question de la nature*. Versailles: Éditions Quae.

——— 2012. La domestication de la pensée sauvage. Colloquium Hommage à la Pensée Sauvage: Nature, apports et rapports des savoirs autochtones. Collège de France, 14-15 May.

Elias, M., L. Rival & D. McKey 2000. Perception and management of cassava (*Manihot esculenta* Crantz) diversity among Makushi Amerindians of Guyana (South America). *Journal of Ethnobiology* **20**, 239-65.

Flyvbjerg, B. 2001. *Making social science matter*. Cambridge: University Press.

Fowler, C. 2000. Ethnoecology: an introduction. In *Ethnobotany: a reader* (ed.) P.E. Minnis, 13-16. Norman: University of Oklahoma Press.

Frake, C.O. 1962. Cultural ecology and ethnography. *American Anthropologist* **64: 1**, 53-9.

Gell, A. 1999. Strathernograms, or, the semiotics of mixed metaphors. In *The art of anthropology, essays and diagrams*, 29-75. London: Athlone.

Gudeman, S. 2012. Vital energy: the current of relations. *Social Analysis* **56**, 57-73.

Holt-Giménez, E. 2006. *Campesino a campesino: voices from Latin America's farmer to farmer movement for sustainable agriculture*. Oakland, Calif.: Food First Books.

Ingold, T. 2000. *The perception of the environment: essays in livelihood, dwelling and skill*. London: Routledge.

——— 2012. *Being alive*. London: Routledge.

Lemonnier, P. 2011. Fallait-il en passer par là? In *Penser le concret* (eds) N. Barbe & J.-F. Bert, 81-98. Paris: Creaphis Eds.

Lévi-Strauss, C. 1962. *La pensée sauvage*. Paris: Plon.

Lu, F. 1999. Changes in subsistence patterns and resource use of the Huaorani Indians in the Ecuadorian Amazon. Ph.D. dissertation, University of North Carolina at Chapel Hill.

McKey, D. & S. Beckerman 1993. Chemical ecology, plant evolution and traditional manioc cultivation systems. In *Tropical forests, people and food* (eds) C.M. Hladik, A. Hladik, H. Pagezy, O. Linares, G.F.A. Koppert & A. Froment, 83-112. Paris: UNESCO.

Marglin, S. 1990. Losing touch: the cultural conditions of worker accommodation and resistance. In *Dominating knowledge: development, culture, and resistance* (eds) F. Apffel-Marglin & S.A. Marglin, 217-52. Oxford: Clarendon.

Medin, D., E. Lynch, J. Coley & S. Atran 1997. Categorization and reasoning among tree experts: do all roads lead to Rome? *Cognitive Psychology* **31**, 49-96.

———, N. Ross & D. Cox 2006. *Culture and resource conflict: why meanings matter*. New York: Russell Sage Foundation.

Minnis, P.E. 2000. Introduction. In *Ethnobotany: a reader* (ed.) P.E. Minnis, 3-10. Norman: University of Oklahoma Press.

Pickering, A. 1992. *Science as practice and culture*. Chicago: University Press.

Renard, D., J. Iriarte, J.J. Birk, S. Rostain, B. Glaser & D. McKey 2012. Ecological engineers ahead of their time: the functioning of pre-Columbian raised-field agriculture and its potential contributions to sustainability today. *Ecological Engineering* **45**, 30-44.

Rindos, D. 1984. *The origins of agriculture: an evolutionary perspective*. Orlando: Academic Press.

Rival, L. 1994. The Huaorani in the Ecuadorian consciousness: otherness represented and signified. In *Imagines y imagineros: representaciones de los Indígenas Ecuatorianos – siglo XIX y XX* (ed.) B. Muratorio, 253-92. Quito: FLACSO.

——— 2001. Seed and clone: a preliminary note on manioc domestication, and its implication for symbolic and social analysis. In *Beyond the visible and the material: the Amerindianization of society in the work of Peter Rivière* (eds) L. Rival & N. Whitehead, 57-80. Oxford: University Press.

——— 2009*a*. Huaorani ways of naming trees. In *The ethnobiology of mobility, displacement and migration in indigenous lowland South America* (ed.) M. Alexiades, 47-68. Oxford: Berghahn.

——— 2009*b*. Report to the Firebird Foundation for Anthropological Research on sharing agroecological knowledge and ideas about indigenous education. Unpublished manuscript.

——— & D. McKey 2008. Domestication and diversity in manioc (*Manihot esculenta* Crantz ssp. *esculenta*, Euphorbiaceae). *Current Anthropology* **49**, 1119-28.

Schaeffer, J.-M. 2007. *La fin de l'exception humaine*. Paris: Gallimard.

Scott, J. 1998. *Seeing like a state: how certain schemes to improve the human condition have failed*. New Haven: Yale University Press.

Sillitoe, P. 1998. The development of indigenous knowledge: a new applied anthropology. *Current Anthropology* **39**, 223-52.

——— 2002. Contested knowledge, contingent classification: animals in the highlands of Papua New Guinea. *American Anthropologist* **104**, 1162-71.

——— (ed.) 2007. *Local science vs global science: approaches to indigenous knowledge in international development*. Oxford: Berg.

——— 2010. Trust in development: some implications of knowing in indigenous knowledge. *Journal of the Royal Anthropological Institute* (N.S.) **16**, 12-30.

——— & M. Marzano 2009. Future of indigenous knowledge research in development. *Futures* **41**, 13-23.

Strathern, M. 1980. No nature, no culture: the Hagen case. In *Nature, culture and gender* (eds) C. MacCormack & M. Strathern, 174-222. Cambridge: University Press.

——— 1995. *The relation: issues in complexity and scale*. Cambridge: Prickly Pear Pamphlet No. 6.

Van der Meer, J. 2011. *The ecology of agrosystems*. Boston: Jones & Bartlett.

Rencontrer la nature à travers le terrain : connaissances des experts, modes de raisonnement et créativité locale

Résumé

Le terme « relation » a joué un rôle clé dans la remise en cause épistémologique des formules dualistes nature/culture et nature/société. Pourtant, il existe un type de relation, ignoré ou négligé dans la plupart des travaux anthropologiques, qu'il est nécessaire de différencier des relations sociales : les relations écologiques. Le présent article montre que l'ethnoécologie ne peut être assimilée à une forme d'analyse ethnocentrique qui forcerait les façons multiples de comprendre la nature dans un cadre classificatoire occidental et scientifique. Trois expériences de « travail de terrain sur le travail de terrain », portant sur des rencontres entre naturalistes et communautés autochtones dans l'Amazonie équatorienne et le sud de la Guyane, sont utilisées pour discuter du caractère hétérogène des connaissances humaines, du rôle joué par l'expertise dans la communication interculturelle et de la nécessité de distinguer le raisonnement écologique du raisonnement moral.

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