

## TOWARDS A PROCESS EPISTEMOLOGY FOR THE ANALYSIS OF SOCIAL-ECOLOGICAL SYSTEMS

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### ABSTRACT

This paper proposes an epistemological approach to analyze social-ecological systems from a process perspective in order to better tackle the co-constitution of the social and the ecological and the dynamism of these systems. It highlights the usefulness of rethinking our conceptual tools taking processes and relations as the main constituents of reality instead of fundamental substances or essences. We introduce the concept of experience as understood in radical empiricism to critically revise our available

concepts through focusing on the concept of difference, exploring apparent contradictions and engaging in assemblage thinking.

## KEYWORDS

process philosophy; onto-epistemology; social-ecological; dynamism

## INTRODUCTION

Recent research has emphasized the need to explore relations and processes when trying to understand social-ecological systems in terms that (i) do not separate the social and the ecological and (ii) do justice to their changing character (Kaaronen 2018). Yet, whenever we try to account for these systems' characteristics, we often use concepts, such as 'nature', 'culture', 'social', etc, that convey neither dynamism nor intertwinedness. (Debaise 2017, Nicholson and Dupré 2018; Weinbaum 2015; Stengers 2005). Concepts are the tools we use to make sense of reality in general and of the problems we face in particular. They are historical constructs that constrain and orient our thinking. In other words, the available concepts determine the kinds of problems we can pose as well as defining the space for possible solutions to those problems. The vast majority of currently used concepts have inherited a separation of the social from the ecological that is typical of modernity, i.e. the period of thought that started roughly with Descartes (Debaise 2017). This has been deemed inadequate to explore the kind of wicked problems that characterize sustainability research (Roux et al. 2017). We follow Folke et al. in understanding sustainability science as a field that 'emerged to inform and facilitate a transition toward sustainability, improving society's capacity to govern the earth in ways that simultaneously meet the needs of a much larger but stabilizing human population and substantially reduce hunger and poverty, while sustaining the life-support systems of the planet' (2016 p. 41).

In particular, we focus on the study of social-ecological systems, which are characterized by the intertwinedness of people and nature and marked by continuous change (Levin et al. 2013). This means that transdisciplinary perspectives are needed if we are to understand their behaviour. Thinking about processes that cross several

domains also helps to account for the multiple connections that characterize the kind of problems social-ecological systems typically face (Kaaronen 2018).

In this paper we encourage a move toward a focus on processes, rather than on entities, as it offers a useful perspective in attempts to understand the centrality of change and the intertwinedness of the social and the ecological. We introduce onto-epistemo-logy and radical empiricism as approaches that allow us to make sense of the world from a process perspective. We then propose a way of evaluating the usefulness of concepts, and put forward three suggestions for developing novel concepts based on a process ontology: to think in terms of differences; to challenge well-established concepts in order to uncover hidden connections; and to start studies from the perspective of the ‘assemblage’, a sort of network that comes together for a purpose.

Acknowledging the need to better bridge the dichotomy between social and ecological, new approaches have emerged in sustainability science. Some of these – such as research adopting a practice-theory perspective (West 2016), focusing on stories as a key to transformation (Galafassi et al. 2018), and attempting to adopt a relational approach to resilience (Darnhofer et al. 2016) – are of particular interest here because, similarly to process ontology, they seek to expand our view of the connections that may matter. It is also worth noting that the analysis of co-evolution presents an important contribution to thinking on the interaction between the social and the ecological (Gual and Norgaard 2010), and could be seen as an approach for understanding intertwinedness. These perspectives however are not always explicit about the ontology they follow.

We propose here to consider processes as the departing point in the analysis of social-ecological systems (Kaaronen 2018). We will revise the ways in which we create concepts in order to overcome the limits posed by the available concepts when investigating change and the intertwinedness between the social and the ecological. The paper first explains why ontology matters, and then sets out – taking what is known as radical empiricism as an approach – to defend an onto-epistemo-logy that bridges the separation of the social and the ecological and that puts change and becoming at the core of analysis. In the second part, the paper presents a definition of ‘useful’ concepts, and answers the question ‘useful for what?’ Finally, the paper advances three compatible approaches to creating useful concepts grounded on radical empiricism:

focusing on difference, challenging existing concepts, and exploring the concept of 'assemblages'. This, we argue, paves the way for going beyond our currently available concepts to pose problems in terms that might lead us to better address the complex and intertwined character social-ecological systems.

#### A WORD ON ONTOLOGY

Some of the research on social-ecological systems has engaged in epistemological discussion, but the underlying ontology – i.e. theories about what exists – for the study of such systems has received less attention (Becker 2012, Schoon and van der Leeuw 2015). Here, we would like to present two reasons why we believe it is important to specify one's ontology before embarking on epistemological developments. The first relates to the nature of research on social-ecological systems (SES), which by definition is inter- if not transdisciplinary. As numerous authors have argued (Lele 1991, Norgaard 2002, Eigenbrode et al. 2007, Hertz and Schlüter 2015), the practice of inter- and transdisciplinary research benefits from the disclosure of ontological differences: our hypothesis on what exists determines how we can study it. Said otherwise, what exists gives an indication of the appropriate ways to study it. For example, if we believe that all phenomena can be reduced to the interplay of matter, it makes little sense to study the narratives that people construct around those phenomena. Conversely, if one believes that people's construction of meaning around a specific place is key to understanding agricultural practices in that place, then it would make no sense to focus on the different chemical components of the land. Disclosing underlying ontological commitments is important in enabling interdisciplinary work, either by allowing the integration of knowledge or by allowing the development of several parallel approaches. This holds true even if one thinks that differences in ontological commitments are only of a semantic, and not ontological, nature.

Second, even if one does not engage in inter- or transdisciplinary research, epistemology without ontology – such as what is sometimes called radical constructivism (Livet 2014) – poses problems. It assumes that 'being' is a pure construction, an agreement between people, and accordingly that being is completely reducible to that agreement. Yet, many of the meanings a particular being carries are recurrently disputed and renegotiated. This would not be the case if meanings were

defined by and completely reducible to an agreement (Livet, 2014). The dispute over meaning seems to indicate that being may have the potential to be something different to its current description while at the same time maintaining its identity (otherwise we could not talk about it in a meaningful way). Of course, we could argue that meaning construction is a perpetually renewed agreement, akin to the Rousseauian social contract, which is not tied to the event of endorsing the contract, but rather perpetuated by the re-crafting of social rules. Yet, the case of social-ecological systems suggests that the identity of what exists cannot be considered as pure construction, since the 'ecological' constantly makes itself present. Imagine, for example, the case of a flood. Meaning can be constructed about a place, the place can be transformed by the flood and as a result, meaning can change, suggesting that construction is subject to empirical experience. Reducing ontology to epistemology makes it difficult to account for this because it cannot, by definition, grasp that which is apart from the description of being. For these reasons, we consider specifying one's ontology necessary for epistemological practice.

## RADICAL EMPIRICISM AS AN ONTO-EPISTEMOLOGICAL PERSPECTIVE

### **Processes and experience**

We ground this paper in process ontology – that is, we take the world to be a constant becoming, constituted of processes and relations instead of independent entities with well-defined boundaries – and develop our position from that perspective. It builds on the work of a group of process thinkers and brings together classical references, such as the work of Alfred North Whitehead (1925), William James (1904), Gilles Deleuze and Félix Guattari (2002; 2014). Our purpose is to use this work to provide several approaches to studying SES from a process perspective and to highlight the value of a process-oriented epistemology for sustainability science. Some have argued that process perspectives have not so far been more widely adopted in science because the classic works, such as those of Whitehead, are perceived as obscure (Dupré and Nicholson 2018) and difficult to access for non-philosophers. We aim to make these works more accessible to a broad readership by referring to commentators, such as Stengers (2005), Debaise (2017) and Zourabichvili (2012), who have themselves aimed to clarify some of the central concepts of process philosophy.

The concept of becoming is central to a process perspective. Becoming, as we understand it, is a process that exists. A process ontological perspective is a realist perspective in which processes constitute all that reality consists of. A process refers to a relation or a set of relations that are realized or actualized. The actualization of a process constitutes an experience. In this sense, processes are nothing more than experiences. Indeed, experience is the most fundamental or 'primary activity [operation] of all existence' (Debaise 2017: 53).

It is through experiencing particular processes that one creates abstractions, i.e. concepts that allow us to refer to particular experiences. The process of abstraction should be understood as a critical reflection on what constitutes the/an experience, and on whether available concepts help us to convey the elements that 'matter' in an experience (Deleuze 1988). But then, what matters? In the case of social-ecological systems analysis, what matters is what manages to expose change and becoming in SES as phenomena that can be studied.

If epistemological practice refers to the practice of making useful abstractions on the basis of our experience, and if reality itself is constituted out of experience, then we are in a situation where 'experience' has both an epistemological and an ontological dimension. From a process ontological perspective, epistemology and ontology are inextricably linked. We follow Karen Barad in her challenge to the separation between epistemology and ontology:

We do not obtain knowledge by standing outside of the world; we know because 'we' are of the world. [...] The separation of epistemology from ontology is a reverberation of a metaphysics that assumes an inherent difference between human and nonhuman, subject and object, mind and body, matter and discourse (2007 p. 185).

'Experience' is not exclusively human. Human conscious experience is one *manner* of experiencing, among other, non-conscious ones, which are human and non-human (Mesle 2008). According to process thinkers, the human subject is not an entity that first exists and then experiences. Joan Scott argues, for example, that the human subject should not be taken as given, but instead thought of as constituted through experience (1992). A human subject is not a fixed substance that experiences an exterior world. Hence, a human subject, or rather, a subjectivity, refers to the activity of experiencing.

This, according to Whitehead, applies to micro-organisms as much as it does to human subjects, the two differing only in *how* they can experience, not *that* they experience. Debaise notes that 'it is as if the universe ceaselessly contracts into a multiplicity of points that are so many centres of experience, perspectives of all that exists. It is important to note that these perspectives are not perspectives *on* the universe but perspectives *of* the universe, immanent to it' (2017 p. 51).

The apparent incoherence between a conscious experience (epistemological) and experience as constituent of reality (ontological) thus vanishes because *all is experience*, that is to say, experience is the primary activity of *all* existence. But how can we do justice to these various manners of experience? What permits us to think them in ways that give equal consideration to, and do not discriminate between, one form (manner) of experience and another? To elaborate on this, we introduce radical empiricism.

### **Beyond the bifurcations of modernity: radical empiricism as an evolving possibility space**

*To be a radical empiricist is therefore to pay closer attention to the grain of actual experience while bracketing the comprehensiveness of the categories through which it is so often approached.* (Duvernoy 2016 p. 433)

We have argued that experience has an ontological and epistemological dimension or, as Barad calls it, an onto-epistemo-logical dimension (2003). Therefore, we must give experience an appropriate position and not restrict it according to different types (e.g. sensory or mental) in our approach to knowledge generation. For this purpose, we turn to radical empiricism as understood by the philosopher William James (1904). Radical empiricism emerged at the beginning of the twentieth century and can be understood as a reaction against the orthodox epistemologies, such as empiricism or rationalism, that were dominant at the time. Radical empiricism seeks to disclose the potential of experience as something immanent, that is, as something that evolves from within a world in constant flow, as opposed to it being a tool that gives access to a world beyond our experience, as earlier empiricist approaches would suggest. Aside from this immanence, James also emphasizes the importance of giving room to all dimensions of experience:

To be radical, an empiricism must neither admit into its constructions any element that is not directly experienced, nor exclude from them any element that is directly experienced. For such a philosophy, the relations that connect experiences must themselves be experienced relations, and any kind of relation experienced must be accounted as real as anything else in the system (1904 p. 534).

This does not mean that we are able to account for every aspect of our experiences, or that we should do so, but rather that we should not exclude any aspect as a result of a theoretical commitment or principle. In this respect, James's empiricism is radically different to other epistemological approaches. For example, it diverges from classical approaches to empiricism, in which our senses are the key to discovering what exists, or rationalism, which emphasizes our logic as the key to identifying universal rules such as the priority of the whole in respect to its parts. It is also different from critical realism<sup>1</sup> in as much as the latter maintains a strict separation between ontology and epistemology. These approaches to knowledge generation are based on an underlying ontology that refers to what is already there, and are disjoined from and only a derivative of that underlying ontology.

One of the conceptual legacies of modernity is the splitting of reality into two domains of existence. This bifurcation (Debaise 2017) came about through the creation of various dichotomies – such as the division between mind and matter or subject and object – which ultimately led to the world being divided into subjective and objective realms. We would argue that this type of thinking is also behind the separation of the 'natural' from all that is social, including subjective interpretations of such nature. Epistemological approaches such as classical empiricism and rationalism operate out of such bifurcations and discredit one type of experience in favour of another; for example, preferring sensory experience over mental experience, such as logical reasoning, or vice versa. In what follows, we use two examples to explain this further.

### *Thinking in terms of experienced processes*

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<sup>1</sup> Critical realism encompasses a large variety of approaches and is not a coherent whole (Archer et al. 2016). It is beyond the scope of this article to engage in a discussion of those differences. To the best of our knowledge, however, critical realists maintain the distinction between ontology and epistemology.

Let us take a concrete example to illustrate the ways in which thinking in terms of experiences helps us grasp the irreversibility of certain SES processes. We will explore the ways in which amaranths ‘adapt’ to glyphosate in soy fields in terms of processes and experiences to highlight how some of the so-called ‘components’<sup>2</sup> of the system adapt to their changing environment in ways that make it difficult to separate them from their environment. Our exploration of the process of ‘adaptation’ starts with farmers adding glyphosate to their modified soy crops to get rid of the amaranths that invade their fields. The herbicide does indeed kill the amaranths and not the soy plants. Yet, the amaranths seem to ‘adapt’ to the glyphosate; they seem to overcome the problem that glyphosate poses to their reproduction and regrow (Powles 2008). These amaranths are no longer called ‘weeds’, but ‘superweeds’ (Bain et al. 2017). As we have seen, substance approaches consider substance to be unchangeable, thus the need to change name from ‘weed’ to ‘superweed’ in order to create two different self-contained categories. Radical empiricism encourages us to think about connections between, or hidden in, the categories we use in order to make sense of the various dimensions of experience. This can be used to extend the realm of experience beyond purely human experience. For example, the amaranths can be conceived as centres of experience that appear to be key in understanding the processes at play in the soy fields. The point that radical empiricism helps us make is that processes that we might have excluded as relevant to the question we are studying, might happen to be key, and that we should try and examine possible connections. This does not mean that we need to systematically include all possible elements of each case, but rather that we should not exclude any in principle, and that we should try to determine which ones matter by considering what is key for the unfolding of certain processes, such as, in this case, the processes that the amaranths, the herbicide and the soil engage in. A process perspective would lead us to ask: what relations exist? Which are changed? What processes continue? Which are interrupted? And to try and think about these questions from different centres of experience. In this case: if new herbicides are brought in, which processes will experience them? This opens up the possibility of thinking about

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<sup>2</sup> One of the inherent difficulties in trying to formulate a process-based perspective is that to convey meaning we have at our disposal words that might entail the existence of self-contained substances, such as ‘component’. We try to navigate this difficulty in this paper by allowing what might seem like contradictions, hopefully only momentarily.

social-ecological processes from different perspectives and becoming aware of the categories we might be uncritically embracing.

*Accounting for diverse types of experience through local objectivities*

Adhering to different ontological commitments, will lead to discrimination between different types of experiences. For instance, if we believe that all phenomena can be reduced to the interplays of matter, we are likely to make an ontological distinction between mind and matter, giving priority to those experiences that can be expressed in terms of matter – for example sensory experiences relating to the behaviour or composition of matter (e.g. the chemical composition of the soil, etc.). These types of experience are often associated with strong notions of objectivity, given that they can be represented or measured in standardized ways. Conversely, if one believes that people's construction of meaning on a specific place is key to understanding agricultural practices in that place, then it would make no sense to focus on the different material components of the land. Here, while maintaining a distinction between mind and matter, priority is given to experiences of a more subjective nature, such as aesthetic and cultural experiences, some of which are purely mental experiences – for instance, experiences interpreted in terms of cultural values. Radical empiricism, however, does not discriminate between these different types of experience. Giving experience an onto-epistemo-logical status has the potential to go beyond the mind/matter and subject/object bifurcations. Consider an experience that goes beyond such bifurcations in the sense of that it conveys a different worldview, implying, for example, a different categorization than that suggested by the dominant ontologies of modernity (Whitehead 1925). It could convey a worldview where farmer and land form a unit and cannot be understood independently from one another (De la Cadena 2015). In such an account, the experience of the farmer *and* the experience of the land would matter. Experiences about the composition of the soil, cultural meanings, aesthetic experiences, as well as the practices these beings engage in, all culminate in an observer's *perspective explaining the emergence of agricultural practices* of that particular place (see quote by Debaise above).

This is clearly not a traditional understanding of objectivity, which supposes the existence of a neutral standpoint, free from any perspective. It resonates with Deleuze's

perspectivism, which encourages us to think and examine the conditions for a certain experience to emerge. Deleuze attributes this position to Leibniz and others after him:

For Leibniz, for Nietzsche, for William and Henry James, and for Whitehead as well, perspectivism amounts to a relativism, but not the relativism we take for granted. It is not a variation of truth according to the subject, but the condition in which the truth of a variation appears to the subject (Deleuze 1993 p. 20).

This is proper to a perspective, but it does not lead to a subjective or (orthodox) relativism. In order to describe this approach, Duvernoy (2016) has coined the term 'objective relativism'. Duvernoy (2016) provides an example by referring to DeLanda's discussion about the properties of glass. The conditions that enable experience will determine whether glass appears to have the property of being solid or fluid – when it is actually neither one nor the other, but rather 'an amorphous solid', a state somewhere in between the solid and the fluid (Curtin 2007). So then, what do we refer to when we speak of conditions that enable experience? One relevant condition here is timescale: the glass might appear to be melting – even at low temperatures – but at timescales of no relevance for human experience. The point here is that there are many other properties being defined by what we can loosely call epistemological practices tied to the tools, such as a microscope, which allow us to have particular experiences. In this sense, a property can be said to be objective relative to the constitutive relations that enable an experience, which also resonates with Barad's relational re-interpretation of the 'condition for the possibility of objectivity' (Barad 2003: 815). In sustainability science, innovative perspectives such as the Multiple Evidence Based approach have recognized that there is no such a thing as a neutral objective standpoint and take the position that each knowledge system should be accepted with its own logics of validation (Tengö et al. 2014, 2017).

Thus far we have discussed the central position of experience and introduced radical empiricism as an overall perspective that 'frees' us from the standard bifurcations that structure our thinking. But how do we concretely 'do' that? What concrete approaches lead us to actively transgress our current understandings? How can we allow experiences to culminate in corresponding useful and novel concepts? In what follows,

we will argue that thinking in terms of difference and challenging existing concepts are approaches that help us build a critical perspective on the concepts we currently use. By critical perspective, we mean a perspective that leads us to question the concepts used and to examine the ontological positions embedded in such concepts. In addition, we propose to explore the concept of 'assemblage', which will help us create useful concepts on the basis of experience. First, we tackle the question of what useful concepts are.

#### WHAT ARE USEFUL CONCEPTS?

Process philosophers challenge the idea that concepts are representations of something that exists out there – i.e. of a truth independent of us – that we aim to discover. Deleuze contends that we can craft a truth that is not about discovering what exists but about accepting that we engage in the creation of concepts (Deleuze and Guattari 2014). We contend here that a concept is useful if it allows us to make explicit the conditions and the links between elements that allowed a particular process to arise. What matters is whether the concepts we use serve our dealings with the world. Concepts become useful when they highlight connections that were not previously acknowledged and that help us deal with our problems.

Donna Haraway's concept of cyborg is a useful example. In her famous essay 'A Cyborg Manifesto', Haraway addressed some of the critics of feminism by proposing a new concept – the cyborg (1991). This was of course not a new concept per se, but was a new concept in the field of feminism. The feminist perspective had been criticized for focusing on identity within gender boundaries. So Haraway instead offered porous boundaries as a tool for rethinking subjectivity. She argued that what matters is not to determine how 'humans' can be distinguished from 'animals' and from 'machines', but the possibilities offered by the connections that bring together human-animal-machine in affinity.

Concepts have an onto-epistemo-logical dimension in that it is only via the act of abstraction that we can make sense of continuity and extension in the world. Thus, thinking in terms of hybrids, or cyborgs, and what they can do is a way of abstracting that allows us to pose different questions and understand different effects. But there are, in principle, many different ways of abstracting in order to make sense of continuity

and extension in the world, which means that there is no one, 'right', context-independent type of abstraction to use. What is 'right' is defined by what is necessary and sufficient for a particular purpose of understanding.

Readers in the field of sustainability research are also familiar with the mushrooming of terms that seek to convey very slim differences that might not matter for the purposes of highlighting relevant connections and understanding change. An example is the multiplicity of terms to convey the idea of 'joint management'. We find, for example, concepts and frameworks such as: governance, collaborative governance, co-management, adaptive co-management, adaptive governance, interactive governance, stakeholder engagement, civic participation, effective participation, deliberative democratic management, etc. While we don't intend to encourage the creation of concepts for every single case studied, we believe that what is to be encouraged is a critical approach to the available concepts, in the hope of highlighting their limitations. This can be done with existing words, but provocative concepts that call for unheard of associations, such as the idea of 'earth-being' put forward by anthropologist Marisol de la Cadena to convey the special relationship some communities in the Andes perform with mountains, might also be a way to advance science as the endeavour to pose new problems.

#### APPROACHES TO CRITICALLY ASSESSING OUR CONCEPTS AND CREATING NEW USEFUL ONES

In this section we provide tools for adopting a critical perspective on the concepts we use to analyse a specific case. First, we will explore what it would mean to emphasize difference when understanding experiences. Second, we will challenge the concept of the subject from a process perspective. Third, we will present assemblage thinking as a way of operationalizing radical empiricism. Through assemblage thinking, the importance of the context as a set of active elements that create differences in experience is highlighted. This enables the creation of novel abstractions and discloses their potential of becoming.

### **Prioritizing ‘difference’ over ‘identity’ in view of understanding experience**

The empirical differences that exist in the world between different experiences run the risk of being negated by the necessity to make such experiences fit our concepts. By definition, no experience is identical to another, or – as Heraclitus put it – ‘On those stepping into rivers staying the same, other and other waters flow’ (Graham 2015). This ontological position is coherent with radical empiricism since it allows us to understand change through the differences in experience, and frees us from trying to make change fit into pre-existent categories. Here we must be careful to understand the concept of difference as ontologically prior to identity, which means that difference is not something that emerges as a result of pre-existing entities.

Difference is what makes it possible to separate one experience from another, put otherwise, it is what explains the specificity of the phenomena at play. This ‘experience’ can be the actualization of a set of characteristics in an entity that will entail its identity – by being different to all other possible characteristics. The example that Deleuze takes is that of language, in which the phonemes exist as different from each other: b is different from p, from t. Dialect pronunciation differences are also an example of differentiation shifts within a language (2004). We will challenge the key concept of subjectivity in the section below, in an effort to put forward approaches that might help us avoid cancelling difference, which has far reaching consequences.

The field of development studies offers several well-known examples of attempts to cancel difference (Escobar n.d., Mitchell 2002). A paradigmatic example is the case of Balinese water management temples, described in detail by Lansing (1987; 2012). These temples and the rituals around them are organized into a highly complex crop-management system in which crop rotation not only allows efficient shared irrigation practices but also pest control management. Development interventions put forward in the 1970s constituted a threat to the system, as the complex arrangements that composed it were not acknowledged by the holders of technical knowledge, in this case, the promoters of the Green Revolution. ‘In the 1970s a national campaign of ‘massive guidance’ in agriculture required Balinese farmers to give up the right to set their own irrigation schedules, and practice continuous cultivation of Green Revolution rice’ (Lansing and de Vet 2012 p. 453). These actors reasoned with an outcome-oriented vision, in which the objective was to increase crop production. Thus, the Green

Revolution imposed an abstract vision of agriculture, valid regardless of context, a vision of agriculture in which social and spiritual relations did not matter. This imposition of technical and dis-embedded knowledge on Bali's highly complex crop-management systems is an example of the power of certain concepts to cover the differences that matter. All the elements of difference that are erased in trying to make experience fit a supposedly existent essence, prevent us from connecting experiences in novel ways or recognizing the rich processes of adaptation intrinsic to local knowledges.<sup>3</sup> It is by trying to understand the approaches of local communities that anthropologists get to disentangle the multiple processes that make up the complex social-ecological system – which in this example included the fields, the temples, water and pest management, harvesting, and organizing religious activities – in ways that cannot be kept separate. By focusing on difference, the specific relations between people, their lands, the management of their crops and the religious meaning of these processes appear as defintory of the phenomena at play.

### **Challenging pre-existing concepts**

Following Deleuze, we can associate apparently disconnected entities or ideas as part of the same process in order to make new meanings emerge. We can explore the concept of the subject through process-oriented lenses. The subject is a particularly important concept in social-ecological systems research because the recognition of the presence of human subjects and their 'intent' in social-ecological systems leads to a focus on social aspects, as opposed to treating humans as one more component of ecosystems (Challies et al. 2014). As modern philosophy would have it, the subject is the human conscious subject who can say 'I think, therefore I am'. The subject, thus, is what 'is', here presented as a condition for the process of thinking. The subject is revealed through the process of thinking, but the process of thinking supposes the existence of the subject. If the subject is the one who can say 'I think', it follows that those who cannot say 'I think' are not subjects. If we extend this logic, the agent is the one who can say 'I act' and those who cannot say 'I act' are not agents. So, in other words, a subject or an agent is a pre-existing entity that can express self-awareness. Therefore, a mountain is not a subject or an agent.

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<sup>3</sup> It is beyond the scope of this paper to engage in an analysis of the power imbalances inherent in the practices that seek to cancel differences.

Yet, anthropologist Marisol de la Cadena, among other specialists of the Andes, reports that Quechua people in the Andes speak of mountains acting. We will use this example to further explore how thinking about different centres of experience can help us challenge the concepts that we use and, in this case, the concept of 'subject' or 'agent'. The types of acts that mountains perform, as presented in the narratives De la Cadena reports, include political acts such as interventions to change the law. In standard logic, the concept of mountain as used in this case would be considered a faulty concept: mountains do not act. Defining mountains as subjects goes against common sense; the very concept of a mountain *as understood in the West* excludes the possibility of action. Said otherwise, indigenous Quechua people from the Andes would be regarded as 'believing' that mountains act, but that belief would be dismissed as wrong or irrational. If we take instead the viewpoint of indigenous peoples in the Andes, the contradiction is overcome by dismissing the idea that humans are the only subjects, or that subjectivity is determined by the existence of a conscience capable of expressing itself. Furthermore, some beings are more powerful than others and, as such, have greater capacity to act than others. Mountains have greater capacity to act than humans and are thus seen as more important subjects than humans.

A third option – leaving aside the modern perspective as well as indigenous' worldviews – is to question the very concept of human subjectivity: human subjectivity is not held by humans but is instead a relation that humans take part in. Said otherwise, it is not about saying that both humans and mountains are subjects, but that humans are not subjects, or rather that they are incomplete subjects. It is in this light that we can re-examine the concept of 'earth-beings' put forward by De la Cadena. This concept departs significantly from what we usually understand when we refer to a subject. De la Cadena explains that both humans and non-humans are 'in-ayllu'. *Ayllu* is typically translated as a form of community organization, common in the Andes, especially among Aymara and Quechua communities. Yet, defining ayllu in those terms constitutes an attempt to translate it into a Western understanding of organization and government. De la Cadena, by contrast, offers us a different understanding of the concept, in which ayllu is the description of a state that brings together different beings. What we would call 'community members', their organization of harvesting and breeding tasks, the political organization of the community, and the link to the territory, together constitute the ayllu. As De la Cadena explains, these different beings are 'in-

ayllu', i.e. they exist in relation to each other. This relationship becomes visible in certain acts, such as the practice in which community members establish communication with the mountain and ask it for assistance. This practice entails blowing on coca leaves, which is a way of materializing the relationship, and which in turn leads the entities in that relationship to specific actions, such as political mobilization. Thus, a closer expression of what it means to be in-ayllu would be to say that the beings come to act through a relationship.

Besides anthropologists, others have engaged in a revision of subjectivity, as exemplified by the publication of a recent special issue in *Human Geography* on the subject. It is particularly interesting to note the point that Ruddick (2017) makes when she argues that the task at hand is not to enlarge the category of the subject to include others. It is not about saying that the mountain is a subject, it is about saying that the subject goes beyond humanity. The purpose of rethinking subjectivity is not to give human-like agency to non-human subjects, such as animals or collective beings. Instead, she suggests we redefine all subjectivity to include relational concepts such as empathy or care. Or, as Deleuze and Guattari put it, 'To reach, not the point where one no longer says I, but the point where it is no longer of any importance whether one says I' (Deleuze and Guattari 2002 p. 3). Deleuze invites us to use thinking as the act that puts our subjectivity into crisis (Zourabichvili 2012). This perspective conceives of subjectivity as a changing relational process. We have, thus, challenged a pre-formatted concept – the concept of the subject. Such challenges might lead to the creation of new concepts and to the formulation of different problems. Indeed, by challenging pre-formatted concepts we might create discontinuities in ideas and break the processes that present those ideas as obvious.

### **Assemblage thinking**

The third approach to the abstraction and creation of useful concepts is assemblage thinking, or rather, thinking in terms of assemblages (an idea originally put forward by Deleuze and Guattari (2002) and later developed by philosopher Manuel DeLanda (2006) and geographers Anderson and McFarlane (Anderson and McFarlane 2011, Anderson et al. 2012)). An assemblage is a collection of elements that come together to

affect, and this capacity to affect could not be realized without the assemblage. Said otherwise, the assemblage has an emergent capacity. Assemblage thinking based on radical empiricism helps us disclose those elements that are necessary for a capacity to emerge.

To continue our discussion on subjectivity, the assemblage perspective suggests that there is no relevant 'I' since everything that acts is embedded in assemblages. Such assemblages can be more or less complex. The harvesting of vineyards, for example, involves human cooperation, ecological worldviews, use of machines, adaptation to weather variability, negotiation with pests, etc. and thus constitutes quite a complex assemblage, composed of many other 'smaller' assemblages. On the opposite side of the spectrum, making a phone call might involve quite a simple assemblage, between one person and a phone. In both cases, agency – defined as the capacity to act – cannot be separated from the assemblage.

Of course, the classical objection to this thinking is that what matters in the assemblage is *the decision* to act, i.e. the so-called 'intentional agency'. But to what extent is that so? Wouldn't human agents incorporate the expectations of others – including non-human others, such as pests or pets (Haraway 2008, McCrea 2016) – when they act? Is the decision to act not triggered by the rest of the elements in the assemblage? By this, we don't mean to dismiss the importance of human action and human experiences, but we intend to put it within the network of the assemblage. The affect generated by assemblages allows us to go beyond established categories in view of creating new concepts. Epistemological activity thus allows the network that constitutes such an assemblage to be made known. And this helps us identify the different connections in the assemblage, which can then be strengthened or destroyed in order to create more sustainable outcomes. Assemblages thus transcend categories such as 'social' and 'ecological', and are dynamic since they can include new 'entities' that are redefined by the becoming of the assemblage.

## CONCLUSION

Through this article we have tried to argue for the need to critically interrogate our available concepts and to create novel ones in order to address the complex and wicked problems that we face when dealing with social-ecological systems. This is important as

we seek to craft solutions to problems that were created in scientific paradigms that place an emphasis on stability and deny the intertwinedness of the social and the ecological. The task of the researcher is to think *with* constantly evolving social-ecological systems instead of trying to represent them, which goes beyond acknowledging that, as researchers, we are ‘in’ this world. To fulfil this task then, we propose to investigate differences, challenge well-established concepts and explore different assemblages as tools that might help us overcome the artificial separation of the social and the ecological and begin thinking in dynamic terms. By prioritizing difference, challenging existing concepts and putting forward hybrid concepts, we have proposed epistemological tools that allow us to make the transition from a substance, object-based approach to an approach coherent with a process ontology. This process is still incipient, and we are inevitably subject to using words and concepts inherited from the dominant substance-oriented perspective, but exploring process approaches and the possibilities they offer constitutes a promising opportunity to craft concepts that disclose change and becoming as fundamental constituents of intertwined social-ecological systems.

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