Overlapping Ontologies and Indigenous Knowledge

From Integration to Ontological Self-Determination

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Abstract Current controversies about knowledge integration reflect conflicting ideas of what it means to "take Indigenous knowledge seriously". While there is increased interest in integrating Indigenous and Western scientific knowledge in various disciplines such as anthropology and ethnobiology, integration projects are often accused of recognizing Indigenous knowledge only insofar as it is useful for Western scientists. The aim of this article is to use tools from philosophy of science to develop a model of both successful integration and integration failures. On the one hand, I argue that cross-cultural recognition of property clusters leads to an ontological overlap that makes knowledge integration often epistemically productive and socially useful. On the other hand, I argue that knowledge integration is limited by ontological divergence. Adequate models of Indigenous knowledge will therefore have to take integration failures seriously and I argue that integration efforts need to be complemented by a political notion of ontological self-determination.

1. Introduction

The integration of Indigenous and Western scientific knowledge has become a widely discussed topic in anthropology, ethnobiology, conservation biology, and related disciplines (e.g. Lynch et al. 2010; Bohensky and Maru 2011; Evering 2012; Gratani et al. 2014). While anthropologists and philosophers have often focussed on unbridgeable differences between knowledge systems, recent debates about knowledge integration shift attention towards complementarity. In part, this shift in perspective reflects a step from theory to practice. Philosophical debates about incommensurability and anthropological accounts of radical

alterity may be theoretically intriguing but they are of little help in the development of collaborative practices in areas such as the co-management of local environments. In addition to the practical necessity to find common ground, proponents of integration projects often argue for a shift in understanding of Indigenous knowledge.[1] Far from being just exotic and alien representations of reality, Indigenous knowledge reflects unique expertise in local environments. Integrating local Indigenous knowledge therefore promises "access [to] a large amount of information and experience that has been previously ignored, or treated as mysticism. This additional knowledge, with its empirically derived emphasis on the natural world, can provide us with scientifically testable insights into some of the most pressing problems facing humankind today" (Pierotti and Wildcat, 2000, p. 1339).

Despite these promises, there has also been growing skepticism about integration efforts. This skepticism is motivated both by epistemological and political concerns. On the epistemological side, integration projects seem to be either overly optimistic or narrow in scope. Even if it is true that Indigenous knowledge can be sometimes integrated with Western science, a focus on integration seems to neglect types of knowledge that resist integration efforts. Furthermore, this is not only an epistemological but also a political issue. Nadasdy (1999, 2005; Sillitoe and Marzano, 2009), for example, has argued that the project of integration tends to focus on convenient aspects of Indigenous knowledge that can be treated as just another type of data for scientific inquiry. Instead of empowering Indigenous

[1] The current literature uses a number of related concepts that include "Indigenous knowledge" (Agrawal 1995; McGregor 2005), "traditional ecological knowledge" (Berkes et al. 2000; Wyhte 2013), and "local knowledge" (Cooper 2007, Bicker et al. 2004). Not only do these concepts have slightly different connotations but each of them can also be defined in different ways. The aim of this article, however, is not to engage in definitional questions but address the epistemological and political dimension of integration projects. Most of my arguments could therefore be reformulated in a different terminology.

communities, knowledge integration therefore often reproduces existing hierarchies by disregarding knowledge that does not meet the needs of Western scientists and resource managers.

The aim of this article is to develop an account that takes both the prospects and limitations of knowledge integration seriously. In a first step, I argue that philosophical debates about natural kinds provide a helpful starting point for optimistic interpretations of knowledge integration. Empirical evidence of cross-cultural convergence in ethnobiological taxonomies can be interpreted as involving recognition of the same empirically discovered property clusters. Assuming that different knowledge systems involve recognition of different properties of the same property cluster, integration is not only possible but also epistemically productive. While a simple model based on property clusters appears to favor an optimistic outlook on knowledge integration, I argue that such an account also helps to uncover substantial limitations of integration efforts. Recognizing such limitations does not only raise theoretical questions but has important implications for normative debates about knowledge integration. While knowledge integration is often epistemically productive and socially desirable, an appropriate model also needs to incorporate integration limits that reflect ontological divergence. Projects that focus exclusively on integration reproduce social hierarchies by recognizing Indigenous knowledge only insofar as it is useful in Western scientific contexts. I conclude by arguing that adequate accounts of knowledge integration need to be complemented by a political notion of ontological self-determination.

2. Knowledge Integration and Property Clusters

The aim of this section is to show that philosophical work on natural kinds provides a simple but nonetheless effective model for many successful cases of knowledge integration.

Especially in the field of ethnobiology, researchers often stress the prevalence of cross-cultural taxonomic convergence. For example, Tzeltal Maya and Western zoologists may have very different knowledge about jaguars and use different terms (*Balam* or *Panthera onca*) but it seems uncontroversial that they both refer to jaguars. Given co-reference to the same species and different knowledge about this species, both the possibility and the epistemic benefits of knowledge integration appear straightforward. Indeed, the idea that co-reference to biological kinds allows epistemically beneficial knowledge integration can be further motivated by classic accounts of natural kinds such as Mill's famous suggestion that "real kinds" have an inexhaustible number of properties: "Knowledge of the properties of a Kind is never complete. We are always discovering, and expecting to discover, new ones" (Mill, 1858, p. 310). Assuming that a natural kind has an inexhaustible number of properties and that different knowledge systems involve co-reference to the same natural kind, knowledge integration will often provide access to different subsets of properties and therefore lead to a more comprehensive account of a natural kind.

Even if philosophical accounts of natural kinds provide a helpful approach to knowledge integration, one may worry they come at the price of controversial metaphysical baggage. Mill's idea of an inexhaustible number of properties is now often considered overly restrictive (Magnus, 2012, pp. 16-18; Khalidi, 2013, pp. 48-55) and recent debates about natural kinds seem to create at least as many metaphysical problems as they solve. Not only does the very concept of natural kind remain controversial (Hacking, 2007) but philosophers have proposed a large variety of accounts of natural kinds and there is no sign of an emerging consensus.[2]

[2] Examples include Brigandt (2009), Magnus (2012) Franklin-Hall (2014), Ereshefsky and Reydon (2015) Khalidi (2013); Slater (2015). While this article merely focuses on property clusters, many of these proposals could be employed in debates about knowledge integration. For a more detailed account of the relation between Indigenous and natural kinds, see Ludwig (2015a).

Although one may worry that any account of knowledge integration in terms of natural kinds will be hampered by metaphysical controversy, many problems can be sidestepped by focusing on a widely shared and largely uncontroversial assumption in the debate about natural kinds: Kind terms often refer to empirically discovered property clusters. Property clusters may not be necessary and sufficient for natural kinds (Ereshefsky and Matthen, 2005; Reydon, 2009; Magnus, 2014), but there can be no doubt that property clustering often grounds taxonomic practices both in Western science and Indigenous societies. For example, recall my earlier claim that Tzeltal Maya and Western zoologists use different kind terms *Balam* and *Panthera onca* but nonetheless both refer to jaguars. The recognition of the same species from different cultural perspectives is possible because jaguars share a distinct cluster of properties from bone structures and fur patterns to hunting behavior and ecological roles. Tzeltal Maya and Western zoologists may have different epistemic interests and cultural backgrounds but nonetheless recognize that members of the kind jaguar share a large variety of properties that distinguish them from other organisms.

Property clusters provide a simple but nonetheless effective account for explaining "ontological overlap" in the sense of shared commitments to the existence of jaguars. Furthermore, they are also of crucial importance for explaining the epistemic significance of kinds. While the presence of typical properties does not guarantee the presence of a kind (and vice versa), the connection is still stable enough to allow robust inferences. For example, if we know that an organism behaves in certain ways (or has a certain bone structure), we can predict that it is a jaguar. Furthermore, if we know that an organism is a jaguar, we can infer that it will probably have certain (e.g. behavioral or morphological) properties. Finally, probabilistic inferences are also possible from some properties to other properties. For example, knowledge about anatomical properties such as the structure of teeth and bones may allow us to predict types of hunting behavior.

The epistemic potentials of property clusters allow the formulation of a simple model of knowledge integration. For example, it is not only plausible that Tzeltal Maya and Western zoologists co-refer to jaguars but also that they have different knowledge about the properties of jaguars. Maybe only the Western zoologist knows about certain anatomical and genetic properties of jaguars while only the Tzeltal Maya knows the smell of jaguar excrement or the hunting habits of a local jaguar population. Integrating both knowledge systems will be epistemically productive by providing a more comprehensive account of the property cluster that is associated with jaguars and therefore also allowing a larger number of inferences. Most obviously, knowledge integration provides the sum of inferences that are unique to each knowledge system such as the inference from genetic properties to a jaguar in Western science and from excrement smell to a jaguar in an Indigenous knowledge system. Furthermore, integration can also lead to genuinely novel inferences in which properties that are uniquely known in different knowledge systems are only jointly sufficient to make robust inference.

More abstractly, we end up with a picture that is summarized by figure 1. Members of a kind K typically have a number of clustered properties P, Q, R, S, T, U, V, W, X. Some properties are known only in knowledge system S1 (stripes) or S2 (dots) while others are known in both S1 and S2 (stripes and dots).

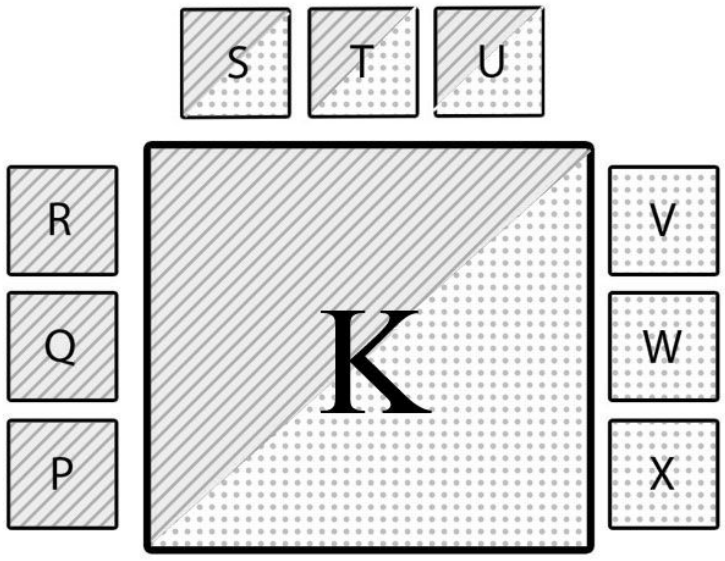

Figure 1: A kind K comes with properties P-X that are partly recognized by knowledge system S1 (stripes), partly by S2 (dots), and partly by both knowledge systems (stripes and dots).

Knowledge integration in this model is epistemically productive because it provides a more comprehensive account of the typical properties of members of K and therefore allows novel inferences. Clearly, this model is too simple to capture all aspects of current debates about knowledge integration and I will consider some of the limitations in section 4. Still, it works surprisingly well with a range of prominent case studies that can be understood in terms of partly overlapping ontologies.

Arctic Foxes (Gagnon and Berteaux, 2009) have a circumpolar distribution in tundra habitats of America, Asia, and Europe. As omnivores and opportunistic feeders that inhabit various regions, local populations rely on different strategies and scientific information regarding the

winter diet of Arctic foxes is highly incomplete. A consideration of local Inuit knowledge of the Mittimatalik community in Nunavut therefore expanded Western scientific knowledge in various areas. For example, Inuit informants identified two distinct strategies (marine vs terrestrial) of feeding in this region as well as differences in fur characteristics depending on the feeding strategy. Inuit of the Mittimatalik community clearly had diverse knowledge about arctic foxes that was previously undocumented by Western ecologists. Gagnon and Berteaux (2009) suggest that the case of arctic foxes contrasts with another case study of snow geese because knowledge about the former is highly scale relative. While snow geese are migratory birds, arctic foxes adapt locally in their behavior, ecological role, and even morphological properties. This makes the application of the integration projects promising and clearly fits the proposed model of property clusters. Inuit and Western biologists refer to the same biological kind (arctic foxes) but have knowledge of different properties of this kind. While Inuit have knowledge of properties with local markers such as unique feeding strategies and fur characteristics, Western biologist have primarily knowledge of (e.g. anatomical or phylogenetic) properties that generalize across the large circumpolar habitat of arctic foxes. Knowledge integration therefore proves epistemically fruitful and has the potential to contribute to the development of local conservation strategies.

Common Eider Ducks (Gilchrist et al., 2005) are large marine birds that are harvested by local Inuit in Nunavut, Hudson Bay. Eider duck populations are vulnerable as they do not migrate but rely on polynyas for wintering - pockets of open water that are surrounded by ice. After a report of declining populations in the 1990's, Western biologists and Inuit collaborated in a survey that crucially relied on local knowledge such as locations of important polynyas and wintering behavior of Eider ducks. While the example of arctic foxes shows that the scale-relativity of Indigenous knowledge often allows epistemically productive knowledge integration, the case of eider ducks also illustrates how such a knowledge integration can be

valuable in conservation efforts. As Gilchrist et al. (2005, 20) point out, local Inuit knowledge about wintering behavior and important polynyas was of crucial importance for documenting a "dramatic population decline [that] would have gone undetected by Western science". Following the proposed integration model, we can describe this case of successful knowledge integration as involving recognition of the same biological kind (eider ducks) as well as knowledge about different properties of this kind. Only the integration of both knowledge systems allowed an accurate estimate of the dramatic population decline of 75% and therefore proved crucial for conservation efforts.

Bowhead Whales (Huntington, 2000) in Alaska became regulated by a harvest quota after a successful political fight of Indigenous whalers against a general hunting ban in 1977. Establishing appropriate quota required a census that started with visual counts by Western scientists and led to an initial estimate of less than 3000 bowheads. The local hunters disputed this estimate and argued that the count missed bowheads that migrate under the ice when the lead (i.e. fracture of sea ice) is closed. A new census that incorporated this local knowledge about migration behavior produced a very different and more accurate estimate of a bowhead population of 6000-8000. Again, the example neatly fits the idea that integrating knowledge about the same kind can be epistemically productive. While Western scientists certainly have knowledge about bowheads that is not available to local whalers, the reverse turned out to be true in the case of local migration patterns. Only the integration of knowledge from both contexts allowed an accurate population estimate. The case of bowhead whales therefore complements the example of arctic foxes in showing that knowledge integration can be epistemically productive and the case of eider ducks in illustrating practical implications for conservation management. Furthermore, it also indicates that knowledge integration can be of direct benefit for Indigenous communities by allowing the development of sustainable hunting quota.

My examples of three different Arctic species illustrate epistemic potentials of knowledge integration along figure 1. Both Indigenous and Western biologists recognize these species as distinct kinds and have diverse knowledge about their properties. Local Indigenous communities had knowledge about the migration behavior of bowheads, import polynas for eider ducks, and fur patterns of Arctic foxes, while Western biologists didn't. Western biologists also had knowledge about these species that was not available to the local communities. While both Indigenous and Western biologists had different knowledge, integration turned out to be possible and epistemically beneficial because it involved co-reference to the same kinds. Furthermore, at least the last two examples suggest that knowledge integration is often not only epistemically but also socially beneficial.[3] This optimistic result is ontologically grounded in the sense that knowledge integration is made possible by overlapping existence assumptions regarding kinds.

3. Integration Failures and Ontological Divergence

[3] Of course, the benefits for different groups crucially depend on how exactly integration projects are organized. Research projects that integrate Indigenous knowledge as sources of additional data will often primarily benefit Western researchers. At the same time, integration can also go in the other direction and it has become more commonly recognized that "Indigenous peoples [...] incorporate methods from biology, ecology, climate science, among other fields into their own knowledge systems" (Whyte, et al. 2015, p. 25). Furthermore, there is also growing interest in collaborative research communities that do not integrate pieces of one knowledge system into another but rather aim to create novel research communities through reciprocal collaboration. For example, Wylie's (2015) discussion of collaborative practices in archeology provides helpful examples of this trend. A consideration of the benefits of knowledge integration beyond my simple examples would therefore requires engagement with the structure of specific integration projects.

In the last section, I proposed a property cluster model that is minimalistic in the sense that it avoids metaphysical controversies about natural kinds but still provides an account of knowledge integration on the basis of overlapping ontologies. In this section, I argue that such a property cluster model is not only useful for explaining successful knowledge integration but can also help to understand how knowledge integration is limited by ontological divergence.[4] More specifically, I will argue that the recognition of different property clusters is common in ethnobiology for at least two reasons. First, different epistemic and social goals lead to a focus on different properties and regularities. Second, there are actually different properties and regularities to be found in different domains of inquiry.

3.1 Sources of Ontological Divergence I: Goal Dependency It has become a truism in anthropology that Indigenous accounts of nature are often "holistic" in the sense that they focus on relations between plants, animals, humans, and the land and to a much lesser degree on internal (e.g. anatomical or genetic) properties.[5] As Atran (1998, p. 562) puts it in the context of the Itza' Maya of the lowlands of northern Guatemala: "Historically, the West's development of a worldwide scientific systematics explicitly involved disregard of ecological

[4] Of course, I do not want to claim that ontological divergence is the only source of integration failures. For example, Marlor's (2010) case study of Kwakwaka'wakw clam diggers illustrates methodological conflicts that do not seem to require ontological divergence. Furthermore, Koskinen and Mäki (2016) provide a very helpful framework that stresses numerous sources of integration failures.

[5] Examples include Davidson-Hunt et al. (2005), Rotarangi and Russell (2009), Fowler and Lepofsky (2011) Scott (2013). Of course, holism in the context of Indigenous knowledge includes more than the ontological focus on relations. For example, holism is often also interpreted as a normative notion that reflects the moral dimension of interrelatedness.

relationships, and of the colors, smells, sounds, tastes, and textures that constitute the most intimate channels of Maya recognition and access to the surrounding living world. For example, the smell of animal excrement so crucial to Maya hunters, or the texture of bark so important to their recognition of trees in the dark forest understory, simply have no place in a generalized and decontextualized scientific classification."

Atran's quote helps to understand two related causes of ontological divergence in ethnobiology. First, Indigenous communities often recognize different properties and regularities because they focus to a much larger degree on ecological relations and are less concerned with internal properties of organisms. Second, they often focus on properties such as texture of bark that are important in supporting local practices but may be considered negligible by Western scientists. The observation that attention to properties and regularities is socially mediated is ubiquitous in ethnobiology and other "ethnosciences". For example, consider ethnopedological research on the classification of soil types (Barrera-Bassols and Zinck, 2003; Araújo, 2013). Indigenous and Western classifications of soil types typically overlap in the recognition of some general (e.g. morphological) features of soil but also diverge in cases where accounts are shaped by the specifics of local (e.g. agricultural) practices. These socially mediated differences do not suggest that Indigenous accounts of soil types are oblivious to empirically determined properties of soil. Instead, divergence in accounts of soil types reflects different empirically determined properties and causal relations depending on the practices that these accounts support. For example, Yucatec Maya classifications reflect properties such as soil depth, stoniness, or drainage conditions that are of crucial importance for local agricultural practices but often ignored by Western soil taxonomies such as the World Reference Base for Soil Resources (Bautista and Zinck, 2010; Estrada-Medina et al., 2013).

These different perspectives cast doubt on the general applicability of the integration model of the last section. If Indigenous accounts of organisms or soil types are shaped by considerations

of different properties such as ecological relations and socially relevant regularities, we should expect them to recognize at least occasionally different kinds than Western scientists. For example, Yucatec Maya and Western pedologists focus on different properties of soil and therefore recognize different clusters of properties. More generally speaking, the significance of a property cluster cannot be evaluated independently of the epistemic and social goals that shape an ontology. Of course, the goal dependency of ontologies is not a new claim in philosophy of science but commonly defended in the context of ontological pluralism (e.g. Dupré, 1993; Chakravartty, 2011; Ruphy, 2011; Danks, 2015; Ludwig, 2015b). Furthermore, it is not difficult to see how such an ontological pluralism in philosophy of science supports the expectation of ontological divergence in ethnobiology. If diverging goals within Western science can lead to the use of different ontologies, we should *a fortiori* expect similar effects in Indigenous and Western scientific communities that have much more pronounced differences in epistemic and social goals (Dupré, 1999).

3.2 Sources of Ontological Divergence II: Local Clusters. While the goal dependency of biological ontologies provides one reason to expect limitations to knowledge integration, there are also different property clusters to be found in different domains of inquiry. Ludwig (2015a), for example, suggests that mycological knowledge of the Tzeltal Maya of Chiapas may provide examples of only locally stable property clusters. For example, the mushroom taxon *Tsa' wakax* seems to refer to a stable property cluster within the highlands of Chiapas: members are usually small, of brownish color, short-lived, inedible, having gills, well-developed stipes, thin stalks, they grow on grasslands, shrivel up in the sun, have no cultural use, are found between June and October, and so on. However, there is little reason to believe that this cluster of properties will be stable across a range of environments beyond Chiapas. In a different environment (e.g. Appalachian Mountains), mushrooms that are classified as *Tsa' wakax* may not grow primarily in grasslands and may also be found in a

different time of the year. Furthermore, typical features such as brownish color, short-lived, and gills may be just as common among mushrooms that do not fall under the taxon *Tsa' wakax.* In other words: *Tsa' wakax* may be a stable property cluster for Tzeltal mycology but not for Western mycology.

This local stability of a property cluster also implies that we should expect some inferences to be only locally reliable. In the last section, I suggested that an Indigenous knowledge system may allow probabilistic inferences. For example, knowledge that a mushroom is found on grassland in October, has a thin stalk, and a well developed stipe may allow the probabilistic inference that it is *Tsa' wakax.* Knowledge that a mushroom is found on grassland in October and has a thin stalk may also be sufficient to predict that it not edible. And so on. However, these predictions appear to be local in the sense that they are only reliable in a restricted domain. Knowledge about certain properties of a mushroom may be sufficient to infer that it is probably not edible in the highlands of Chiapas but knowledge about the same properties may not be sufficient to make the this inference in the Appalachian Mountains.

The example of *Tsa' wakax* illustrates that a kind can qualify as a stable property cluster under the boundary conditions of a domain of inquiry A (e.g. Tzeltal Maya) but not under the boundary conditions of another domain of inquiry B (e.g. Western mycology). Of course, there can also be property clusters that are stable for both domains of inquiry A and B. For example, recall the case of jaguars that are recognized in various Indigenous taxonomies including Tzeltal and in modern biology. However, a focus on local ecological relations will also lead to the recognition of property clusters that are not detectable given a focus on generalizable facts about genealogy, genetics, or morphology of organisms. Indeed, there are countless properties of populations that are stable within one environment but not in another. An animal may develop specific hunting strategies and have a unique fur pattern in one environment but not in another. A plant may prefer a specific soil and proximity to another species in one environment but not in another. A mushroom may be eaten by boars and only

grow in the forest in one environment but not in another. And so on. As a consequence, a group of organisms can form a highly relevant property cluster within an Indigenous knowledge system while being considered at best superficially unified by a Western taxonomist. This recognition of different property clusters provides a clear challenge to knowledge integration. In contrast with my examples from section 2, Indigenous knowledge does not provide novel information about a biological kind that is already part of a Western biological ontology. Instead, using Indigenous knowledge presupposes adopting at least parts of an Indigenous ontology by recognizing a different kind.

Locally stable property clusters can be grounded in the specific ecological conditions of a restricted environment but they can also be the product of other mechanisms such as local social practices. As Khalidi (2015) has convincingly argued, many social kinds satisfy standard criteria for natural kinds in the sense that they involve stable property clusters that are causally unified and can sometimes also exist independently of us recognizing them as kinds. These observations are often presented as a challenge of the common distinction between natural and social kinds (see Kincaid, 2000; Thomasson, 2003; Guala, 2014) but they also identify another mechanism that can lead to locally stable property clusters. While some social kinds such as *money* appear in vastly different societies, others reflect social dynamics that are unique to a specific cultural context. In this sense, both local ecological and social dynamics can ground locally stable property clustering. Again, we should expect an Indigenous society to employ an at least partly different ontology that acknowledges the existence of different kinds within its target domain.

The assumption of local social dynamics that ground locally stable social kinds is not surprising in the light of the vast anthropological research on the cultural variability of social organization. However, local social dynamics are also of crucial importance for another and rarely considered class of "hybrid" kinds that involve mixed clusters of properties from different (e.g. biological and social) domains. In the case of ethnobiology, the relevance of

biological properties is often mediated by social practices that confer a range of novel social properties (e.g. aesthetic, agricultural, culinary, economic, medical, spiritual, symbolic...). For example, an Indigenous community may distinguish between two varieties of a mushroom because they are used in different medical contexts and therefore also have different economic, spiritual, and symbolic significance. While the two varieties have different chemical properties (the difference in chemical composition that allows different medical uses) and morphological properties (the markers that are used by the community to distinguish the varieties), they become recognized as distinct kinds in a local taxonomy only because this chemical/biological property cluster is enriched by social properties. Without social embedding, the varieties would appear as only superficially distinct members of the same taxonomically relevant kind. Indeed, this is a common scenario in the case of mushrooms. Indigenous societies strongly differ in their social (e.g. medical, nutritional, or spiritual) use of mushrooms and therefore also employ radically different mycological taxonomies (e.g. Ellen, 2008).

The examples of local biological, hybrid, and social kinds all illustrate that properties and regularities are not always geographically evenly distributed. It is therefore far from surprising that societies will often employ different ontologies that reflect their local biological and social environments. Note that this source of ontological divergence differs from goal-dependency: two societies could have the same goals but still employ different ontologies because they engage with different environments (and vice versa).

3.3 Explaining Integration Failures: In this section, I have argued that we should expect divergence between Indigenous and Western ontologies because of both different goals as well as the occurrence of different property clusters in distinct domains of inquiry. More abstractly, we can summarize this result by extending the model of the last section in the sense of figure 2. My examples of successful knowledge integration are represented by the case (1)

where a kind K is recognized by both knowledge systems S1 (stripes) and S2 (dots). A prototypical case of ontological divergence would be the case (2) where a kind K' is only recognized by S2 and only S2 involves knowledge about properties that are shared by the members of K'. A related scenario is (3) where at least some properties are recognized by both knowledge systems but only one of them recognizes K'' as a relevant kind. For example, recall the case "hybrid kinds" such as culturally significant varieties within a single species. While salient morphological properties P''-R'' of the variety K'' may be known in both S1 and S2, only S2 recognizes medical uses, economic value, spiritual significance etc. and therefore includes K'' as a distinct taxon.

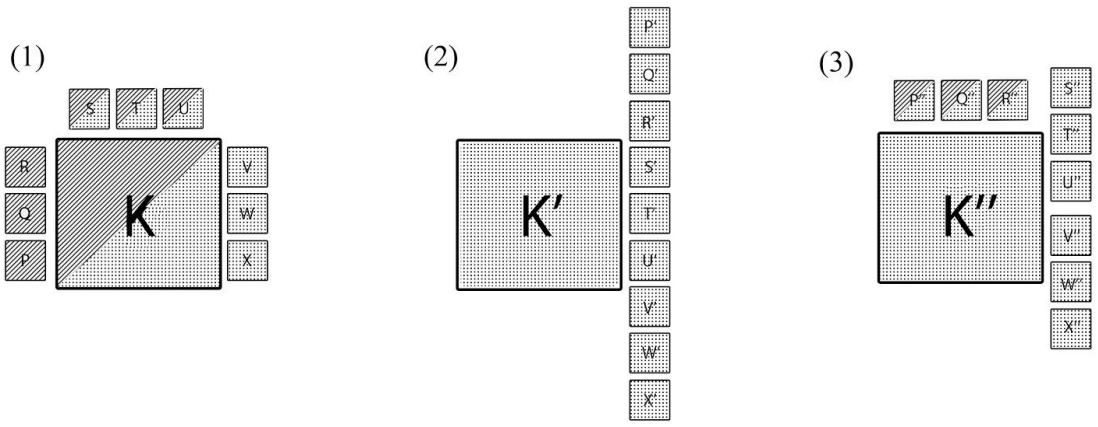

Figure 2: (1) illustrates a case of successful knowledge integration. Both knowledge systems S1 (stripes) and S2 (dots) recognize the same kind K but have knowledge about different the properties of K. Integrating this knowledge leads to a more detailed account of K. (2) and (3) illustrate cases of failed knowledge integration in which only S2 (dots) recognizes K' or K''. In (2), only S2 recognizes any of the shared properties [P' - X'] while S1 has no reasons to consider the members of K' to be unified at all. (3) may be the empirically more common case. S2 recognizes a rich property cluster [P'' - X''] and therefore also recognizes K'' as a relevant kind in its ontology. S1 only recognizes some properties [P'' - R''] and does therefore not recognize K'' as a relevant kind.

Ontological divergence in the sense of figure 2 can lead to metaphysical worries about issues such as the status of locally recognized kinds as natural kinds. Apart from general skepticism about the notion of natural kinds (Hacking, 2007), one may also argue that locally stable kinds satisfy criteria of natural kinds in terms of property clusters (Slater, 2015) or epistemic usefulness (Love, 2009). However, friends of more ambitious notions of natural kinds may still wonder whether all kinds in the sense of figure 2 should be considered "natural" in the sense of the large variety of proposals in contemporary philosophy of science. For example, one may debate to what degree Indigenous kinds are grounded by homeostatic mechanisms (Boyd 1999, 2010) or more generally in appropriate causal relations among properties (Craver, 2009).

The aim of this article, however, is not to defend a position in these metaphysical debates or to provide a general account of the relation between Indigenous and natural kinds.[6] Instead, my goal is epistemic and normative insofar as I want to address controversies about knowledge integration on the basis of the proposed model of partially overlapping ontologies. While shared reference to the same property clusters clearly facilitates knowledge integration, ontological divergence provides challenges to integration efforts. For example, knowledge about *Tsa' Wakax* cannot be integrated into Western biology in the same way as knowledge about *Balam* (i.e. jaguars) because only the latter appears in Western biological taxonomies. Indigenous knowledge about kinds that are not even remotely similar to any Western scientific kinds will often be missed entirely or not taken seriously.

Although one may describe cases of ontological divergence such as *Tsa' Wakax* or different soil types in terms of "taxonomic incommensurability" (Sankey 1998), they clearly do not imply that Western scientists are entirely incapable of making sense of alternative ontologies.

[6] See Ludwig (2015) for a more detailed treatment of these issues.

By taking the goals of Indigenous communities and their domains of inquiry seriously, a Western scientist may recognize a kind that is unique to an Indigenous ontology and its relevance for local practices. This would indeed require at least in parts adopting the ontological perspective of an Indigenous community but there seems to be no reason to think that this is empirically or even logically impossible.

The abstract possibility of adopting Indigenous ontological perspectives, however, often contrasts with the reality of scientific practice. On the epistemic side, Western scientists will often fail to recognize Indigenous knowledge that is expressed in diverging ontologies because its recognition would require intimate familiarity with the epistemic and social goals of a community and the unique features of a local environment. On the normative side, Western scientists also tend to be interested in knowledge that fits in their own frameworks and does not require a shift in ontological perspective. Integration projects that only focus on knowledge that is expressed in terms of ontological overlap, however, create a range of normative problems and the question of knowledge integration therefore often becomes a deeply political issue.

4. From Integration to Ontological Self-Determination

So far, I have discussed ontological divergence and limitations of knowledge integration only as theoretical problems. However, there is clearly a political issue looming here. If the prospects of knowledge integration are limited by ontological divergence, an exclusive focus on integration will lead to a biased account of Indigenous knowledge. This observation is at the core of many political challenges of knowledge integration. For example, consider the widely discussed case of the *Maya International Cooperative Biodiversity Group* (ICBG) that aimed at gathering Indigenous knowledge about biodiversity and ethnopharmacology in Chiapas (Berlin and Berlin 2004; Lucas et al. 2013). The project followed Berlin's famous

arguments "that the ethnobiological knowledge of traditional peoples conforms in many respects to basic scientific principles" (Berlin and Berlin 1996, 3) and therefore seemed to leave little room for uniquely local knowledge that resists integration efforts. Aside from complex questions about informed consent in sharing this knowledge, critics accused the Maya ICBG more broadly of doing "violence to Indigenous meanings of nature, medicine, and property" and objectifying "part of their culture to conform to the consumption desires of outsiders" (Nigh 2004, 466).

Assuming that ontological divergence limits knowledge integration, we can indeed not always expect that Indigenous knowledge "can be disentangled from its local cosmology and appropriated instrumentally elsewhere" (McGonigle 2015, 14). The political implications are straightforward. An exclusive focus on integration can turn into a form of subjugation by recognizing a knowledge system S1 only insofar as it contributes something useful in the context of another knowledge system S2. This type of integration does not empower Indigenous communities but reinforces hierarchies. As Nadasdy (1999, 1) puts it in his influential critique of integration projects: the idea of integration often "conforms to Western conceptions of 'knowledge.' It takes for granted the power relations between aboriginal people and the state by assuming that traditional knowledge is simply a new form of 'data' to be incorporated into existing management bureaucracies and acted upon by scientists and resource managers."

But what is the alternative? My discussion of the previous sections suggests that we should not react to these problems by endorsing a cultural relativism of incommensurable worldviews. Knowledge integration may be limited but is still often enabled by overlapping ontologies and co-reference to the same empirically discovered property clusters. Furthermore, knowledge integration is often clearly desirable as illustrated by the cases of bowhead whales and common eider ducks in section 2. In both cases, knowledge integration was of crucial relevance for developing adequate conservation measures that also contributed

to protecting species that are important for local communities. Instead of contrasting an overly optimistic model of seamless knowledge integration with an overly pessimistic picture of incommensurable worldviews, we need a more nuanced account that leaves room for both integration and integration failures. In this section, I propose to adopt two theoretical tools in working towards such an account. First, standpoint theories in feminist philosophy of science provide a helpful framework that takes marginalized forms of knowledge epistemically seriously without endorsing a cultural relativism of incommensurable worldviews. Second, I suggest to account for integration limits by incorporating a notion of ontological self-determination into the framework of standpoint theory.

4.1 Standpoint Theory. In the previous sections, I argued for a partial overlap between Indigenous and Western scientific ontologies and for an account that leaves room for both successful knowledge integration and integration failures. Projects that exclusively focus on integration fail to reflect this complexity and an adequate account will have to take the particularity of Indigenous standpoints seriously. In philosophy of science, feminist standpoint theory (e.g. Wylie 2003; Crasnow 2008; Intemann 2010) is best suited to provide a framework that reflects the particularity of Indigenous standpoints. Although philosophers of science have largely ignored debates about Indigenous knowledge in ethnobiology and related disciplines, standpoint theory engages with related problems regarding marginalized groups within Western science. Prominent case studies from primatology and virology to archeology and linguistics clearly show that standpoints matter and are epistemologically relevant for issues such as identifying undetected variables or exposing biased samples (Harding 2015, chapter 2). Intemann (2010, 788), for example, illustrates this argument with an assessment of the effectiveness of a vaccine by a female biomedical researcher who grew up in sub-Saharan Africa. While the biomedical researcher agrees with her colleagues from the U.S. on a lot of criteria for assessing effectiveness, she may be aware of variables that allow her to recognize

that a vaccine will not work for many affected populations. “She may know that vaccine technology favored among U.S. molecular biologists requires refrigeration that will be expensive and practically difficult in many contexts in rural Africa” (Intemann 2010, 788). In this case, a standpoint does not threaten the objectivity of scientific reasoning but rather contributes to an adequate assessment.

Prominent case studies in standpoint theory resemble my examples of Indigenous knowledge in the sense that they involve epistemic contributions beyond the institutionalized center science. One benefit of discussing Indigenous knowledge in analogy to these cases is that standpoint theory provides an attractive response to worries about incommensurability and relativism. Instead of endorsing cultural relativism, standpoint theorists argue that marginalized knowledge can be of crucial importance in detecting biases in scientific practice and therefore strengthen the objectivity of research. Such an appeal to “strong objectivity” (Harding 1995) provides an attractive framework for my discussions of Indigenous knowledge. Both my examples of successful knowledge integration (e.g. bowhead whales and eider ducks) and integration failures (e.g. Yucatec soil types and Tzeltal mushroom kinds) do not appeal to cultural relativism but reflect “objective knowledge” about patterns in the natural world in an intuitive sense. Standpoint theory helps to unpack these intuitions about objectivity while acknowledging that the discovery of specific property clusters has to be understood in relation to the standpoint of an Indigenous community.

Furthermore, standpoint theory does not only provide an attractive theoretical but also political framework for debates about Indigenous knowledge. By presenting the recognition of marginalized perspectives as a question of social justice, standpoint theorists have been highly influential in turning mechanisms of social exclusion into a widely discussed problem in philosophy of science. It is therefore by no means surprising that standpoint theorists have been more recently pioneering discussions about Indigenous knowledge in philosophy of science by extending their focus beyond marginalized groups within Western societies (Wylie

2015, Harding 2015). Framing debates about ethnobiological knowledge integration in terms of standpoint theory therefore does not only help to understand the epistemological and metaphysical issues but also shifts the focus to the political dimension of marginalizing local standpoints.

Despite these advantages of combining discussions of Indigenous knowledge with standpoint theory, there also remain problems. Most importantly, standpoint theory has been developed in contexts where the goal of knowledge integration is largely uncontroversial. For example, an adequate response to the marginalization of women in scientific practice is not a "female knowledge system" that is separated from Western science but an adequate integration and representation of women in science. Following this focus on integration, standpoint theorists have more recently stressed that scientists who incorporate Indigenous perspectives find "that collaborative practice enriches their research practice in any number of ways, not only adding useful detail but generating new questions and forms of knowledge" (Wylie 2015, 192; see also Harding 2015, 96-103; Koskinen 2015). While these discussions about bringing Indigenous standpoints into a pluralistic community of researchers are clearly valuable, one may worry that they leave the question open how we should understand knowledge that resists integration into Western science because it is shaped by the goals and domains of local communities.

4.2 Ontological Self-Determination. In order to provide an adequate account of integration limits, I want to propose to incorporate the notion of ontological self-determination into the framework of standpoint theory. The term "ontological self-determination" (*autodétermination ontologique*) has been proposed by Viveiros de Castro (2009) in the

context of the hotly contested "ontological turn" in anthropology.[7] Abstracting from these anthropological debates for a moment, it is not difficult to see how my discussion of overlapping ontologies can motivate a notion of ontological self-determination. While shared ontological commitments in ethnobiology make knowledge integration often possible, diverging ontologies set limits to integration efforts. Furthermore, I have argued that ontological divergence is often motivated by different goals and domains of inquiry. Given the priorities of a Yucatec Maya community and a domain that is restricted to the Yucatán peninsula, for example, there are good reasons to employ an ontology of soil types that diverges from the World Reference Base for Soil Resources (WRB). Divergent ontologies therefore do not indicate that Indigenous communities fail to grasp the structure of the natural realm but rather reflect how different cultural and explanatory practices come with different ontological requirements.

These arguments suggest that the political self-determination of a community to pursue its own goals and to engage with a local domain requires ontological self-determination to employ different ontologies. Ontological self-determination in this sense implies, for example, that collaboration in conservation projects should not require that Indigenous communities articulate their knowledge in terms of Western scientific ontologies. While standpoint theorists correctly point out that Indigenous knowledge can enrich pluralist research communities, ontological self-determination complements such arguments by acknowledging that Indigenous knowledge cannot be understood primarily (or even exclusively) in its relation to Western science.

[7] For examples, see Paleček and Risjord (2013); Latour (2014); Holbraad et al. (2014). Whyte (forthcoming) proposes a wider notion of "collective self-determination" that is largely independent of this anthropological debate.

Ontological self-determination in this sense can be put in a wider context of "collective self-determination" as it has been recently proposed by Whyte (forthcoming). Whyte distinguishes between a "supplemental value" and a "governance value" of Indigenous knowledge. "Supplemental value" means that Indigenous knowledge provides "inputs for adding (i.e. supplementing) data that scientific methods do not normally track." An exclusive focus on supplemental value would be tantamount to the criticized limitation to knowledge integration that recognizes Indigenous knowledge only insofar as it is useful for Western scientists. However, Whyte insists that we also have ask what Indigenous knowledges do for Indigenous people and introduces governance value as "the sphere where we discuss community-based institutional means, strategies and processes that are needed for Indigenous peoples to make plans for the future about what to do in response to metascale forces such as climate destabilization and the dominance of settler states." The governance value of Indigenous knowledges requires collective self-determination of Indigenous communities to maintain and develop practices that provide adequate responses to these metascale forces. Clearly, collective self-determination in this sense is broader than ontological self-determination as it encompasses a wide range of governance-related practices. At the same time, the arguments of this article suggest that collective self-determination often presupposes ontological self-determination as these practices will often require knowledge that relies on divergent ontologies.

It is helpful to compare this interpretation of "ontological self-determination" with common debates in the context of the "ontological turn" in cultural anthropology. Claims of an ontological turn in anthropology are contentious and often criticized as oscillating between the theoretically modest project of describing various ontologies and the ambitious project of making ontological claims (Heywood, 2012; see also Laidlaw and Heywood, 2012; Bessire and Bond, 2014; Aspers, 2014; Graeber, 2015). On the one hand, cultural anthropologists can engage in a methodologically largely unproblematic project of "ontological cartography" that

documents the ontological commitments of various societies.[8] While such a project may be methodologically modest, a mere cartography of different ontologies is not sufficient given the theoretical ambitions of many proponents of the ontological turn. For example, the very point of Kohn's (2013) influential *How Forests think* is to develop an account of how forests think and not only to describe that the Runa of Ecuador's Upper Amazon are ontologically committed to thinking forests. More generally, proponents of the "ontological turn" have been eager to stress that their approach is not concerned with a "mere" diversity of worldviews but a diversity of worlds (Henare et al., 2007). It is difficult to see how this statement can be understood if it does not express the aim to move beyond cartography of different ontological views. Finally, the notion of "ontological self-determination" also indicates a project that is more ambitious than mere ontological cartography. Insofar as "ontological self-determination" is a political notion with practical relevance, it has to go beyond simply documenting difference.

This ambition to go beyond a mere cartography of ontological commitments has led to the objection that the project of an "ontological turn" in anthropology collapses into unfounded speculation about a "bloated universe" (Heywood 2012) in which the ontological claims of various societies are not only documented but presented as metaphysical truths. Such an ambitious reading of the ontological turn seems to turn anthropology into amateur metaphysics that populates the universe with all kinds of implausible entities. Ontologically oriented anthropologists have become increasingly aware of this dilemma between a weak cartographic and a strong metaphysical interpretation of the ontological turn and proposed various responses (e.g. Pedersen, 2012; Holbraad, 2013; Salmond, 2014) .

[8] The term of "ontological cartography" is used by Descola (2005) as well as Costa and Fausto (2010) and Salmond (2014). However, these authors sometimes seem to use the term in a theoretically more ambitious way than my suggestion of "merely" describing the ontological commitments of different societies.

No matter what we think of the state of these anthropological debates, however, my proposed reading of ontological self-determination in ethnobiology provides a clear answer to this dilemma. On the one hand, my goal has been not only to document ontological divergence but to show how divergent ontologies can refer to property clusters that are often of crucial relevance for Indigenous communities. Far from just describing ontological differences, I have therefore argued that diverging ontologies can be *epistemically* useful in local practices, *metaphysically* grounded in empirically discoveries, and *socially* relevant for the self-determination of local communities. On the other hand, this interpretation does not mean that we simply adopt ontologies without asking about their justification. On the contrary, ontological commitments of Indigenous (as well as Western) communities are justified only insofar they come with the epistemic, metaphysical, and social virtues that matter in their respective target domains. Instead of proposing an implausible metaphysical picture that adopts Heywood's "bloated universe" wholesale, I have employed a more restricted strategy that asks about the justification of ontological commitments by investigating their roles in local practices.[9]

[9] Heywood contrasts the "bloated universe" with Quine's famous 'taste for desert landscapes'. However, the arguments from section 3 suggest that different goals and target domains require different ontologies and that we should not always expect ontological unification across cultural contexts. An adequate account of ontologies will therefore often resemble a jungle rather than a desert landscape. This has also become widely recognized in contemporary philosophy of science independently from debates about Indigenous knowledge. Different research projects from particle physics to social psychology require vastly different ontologies and successful scientific practice requires what Ross and Ladyman (2007) call (in explicit contrast to Quine) a "rainforest realism" of ontological commitments. In this sense, contemporary philosophy of science largely departs from a "taste for desert landscapes' and there is little reason to adopt an overly restrictive ideal of ontology in debates about Indigenous knowledge.

Even if such a strategy avoids the dilemma of merely describing ontologies and implausible metaphysical speculation, it obviously comes at the price of limited application. While I have focused on fine-grained ontological differences in ethnobiology, ontologically oriented anthropologists typically start with the most salient cases of "radical alterity" such as thinking forests (Kohn, 2013) or shamanic transformations (Viveros de Castro, 2009). Many of these examples of radical alterity clearly illustrate my earlier claim that a model of property clusters has a limited scope. Furthermore, it is not difficult to see why property clusters will be of limited applicability in many cases of "radical alterity". Property clusters are of outstanding importance for understanding why unique ontological commitments of Indigenous communities are often of epistemic value in various local practices such as agriculture, hunting, or conservation management. However, real-life ontologies are not sterile epistemic tools and most ontological differences that are discussed under the label of radical alterity certainly transcend questions of epistemology.

Recognizing limitations in the case of "radical alterity", however, does not devalue discussions of more restricted cases of ontological divergence. On the contrary, there are often good reasons to start debates about the relation between ontologies "bottom up" with examples of smaller differences instead of "top down" with the most staggering cases of ontological divergence. First, starting with simple cases increases chances for understanding why different cultures employ different ontologies. For example, my ethnobiological case studies did not simply document ontological differences but provided reasons for taking alternative ontologies both metaphysically and epistemologically seriously. Even if an Indigenous biological ontology diverges from Western science, it still often refers to empirically discovered property clusters that are of outstanding epistemic importance for a community. Such a strategy does not only provide a direct response to the dilemma of describing ontologies and implausible metaphysics but also leads to an account that takes practices of other cultures seriously. Approaching ontological divergence top-down with cases

of radical alterity will often be less helpful for understanding why different cultures employ different ontologies and can reinforce a picture of exotic incommensurability without any prospects of mutual understanding.

Second, benefits of an account that starts with smaller ontological differences are not only theoretical but also political. Understanding why a diverging ontology is of crucial importance for the practices of an Indigenous community turns the status of such an ontology also into a political issue. If we start with the cases of ontological divergence that we understand the least, however, we can easily impede the goal of a normative account of ontological self-determination. Some proponents of the ontological turn in anthropology seem to accept his consequence by endorsing a "non- or anti-normative stance" (Holbraad et al., 2014) that does not evaluate ontological commitments at all. However, such a retreat from normativity threatens to make engagement with Indigenous ontologies a purely intellectual enterprise without any practical significance. Any meaningful engagement with integration projects in ethnobiology and "ontological conflicts" in other areas anthropology (e.g. Blaser, 2013; Nadasdy, 2005), however, requires a robustly normative stance. Starting bottom-up with comparably simple cases does therefore not only help to clarify the epistemic potentials of Indigenous ontologies but is also of crucial importance for understanding the political dimension of marginalizing diverging ontological assumptions.

5. Conclusion

Debates about knowledge integration often reflect conflicting ideas of what it means to "take Indigenous knowledge seriously". On the one hand, proponents of integration projects stress similarities between Indigenous and scientific knowledge systems and insist on the emancipatory potential of recognizing the rational foundations of Indigenous understandings of nature (e.g. Berlin and Berlin, 1996; Berkes et al., 2000; Gorelick, 2014). On the other

hand, critics of integration projects typically argue that an adequate engagement with Indigenous knowledge will need to recognize its fundamentally different structure. And of course, it is all too easy to further solidify this contrast with accusations of narrow-minded rationalism in one direction and of mysticism and "ontological turn's fetishization of otherness" (Vigh and Sausdal, 2014, 56) in the other.

The aim of this article has been to develop an account of overlapping ontologies in ethnobiology that takes both the prospects and limitations of knowledge integration seriously. Integrating Indigenous and Western scientific knowledge is often not only possible but also clearly desirable. For example, integration in conservation biology is often not only necessary for appropriate conservation practices but also in the interest of Indigenous communities. A closer consideration of diverging ontologies in ethnobiology, however, indicates that this is an incomplete picture. Both the goals and domains of inquiry of Indigenous communities often justify the employment of different ontologies that limit the prospects of knowledge integration.

An account of partly overlapping ontologies that leaves room for both successful integration and integration failures not only provides a more adequate picture of ethnobiological practice but also makes also first steps towards a serious "philosophy of ethnobiology". On the broader level it contributes to a recently developing (Harding, 2015; Koskinen, 2015; Whyte, forthcoming; Wylie 2015) but long overdue reflection of Indigenous knowledge in philosophy of science that creates space for serious engagement with cross-cultural research beyond common caricatures of cultural relativism and Eurocentric universalism.

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