

# Things and Patterns – from Pyramiden to Patagonia

Festschrift in honor of Professor  
Hein Bjartmann Bjerck

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Birgitte Skar, Heidi Breivik og Martin Callanan (red.)



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# Towards a “Flatter” Landscape Archaeology

On Relations between Digital Elevation Models and an  
Ethnolinguistic Dictionary from Tierra del Fuego

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*Jo Sindre P. Eidshaug*

## ABSTRACT

This paper draws on object-oriented ontologies to explore potential interfaces between digital elevation models (DEMs) based on light detection and ranging (LiDAR) from the northern coast of the Beagle Channel, Tierra del Fuego, Argentina, and entries in Reverend Thomas Bridges’ 19<sup>th</sup>-century Yagan–English dictionary. The DEMs and the dictionary both agree with archaeological and ethnographic records about the centrality of the shore and tidal zone for the Yagan—the marine foragers inhabiting the southernmost seascapes in the world. However, the two sources of information populate different axes. When tracing anomalies in LiDAR images, we mostly pursue coastlines lengthwise to identify distributions of shell middens. While the DEMs illustrate the monumentality of the shell middens in Fuegian seascapes, they rarely permit insights into what happened at a distance from the coastline—whether inland or at sea. By contrast, in the Yagan–English dictionary the chief territorial divisions lie on an axis from the sea to the top of the hill. These divisions, which run parallel with the coastline, are more richly described in the dictionary. Object-oriented ontologies provide vital ingredients for a “flatter” landscape archaeology and a *context* for combining sources of information as disparate as DEMs and ethnolinguistic dictionaries.

## Introduction

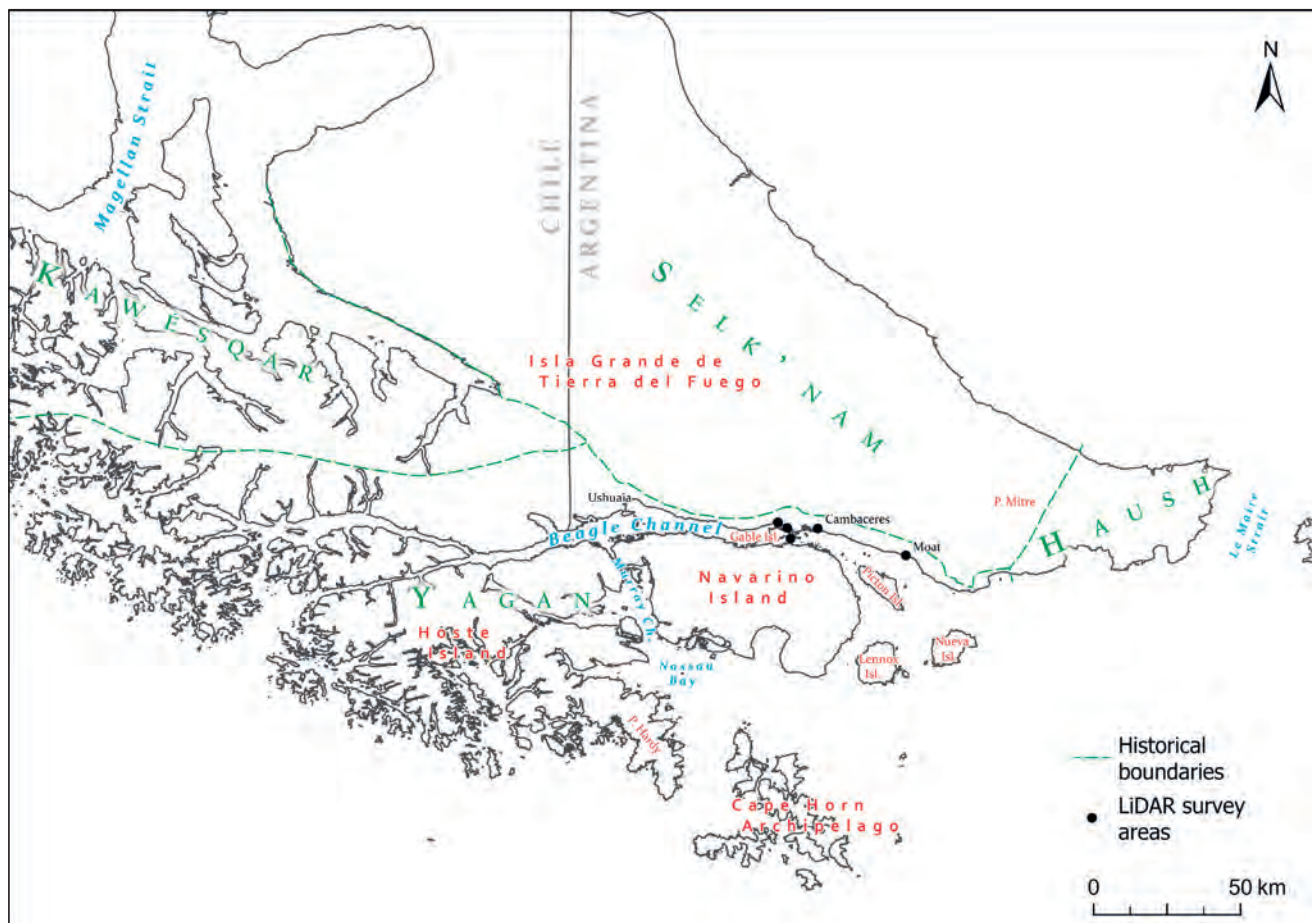
*kūsimōra* *A heap of shells such as are around wigwams* (The Yagan–English dictionary by Rev. Thomas Bridges)

Shell middens are prominent features on the shores of the Beagle Channel (Tierra del Fuego, Argentina and Chile) and remain the most important archaeological remnants left by the marine foragers who inhabited the Fuegian archipelago for more than seven millennia. The middens are often visible from afar and high up, and recently almost 1,900 were identified in digital elevation models (DEMs) covering some 12 km<sup>2</sup> of the channel’s northern coast (Fig. 1) (Risbøl et al. 2023, Eidshaug 2024:Appendix B, Eidshaug et al. 2025). The DEMs were generated from unmanned aerial vehicle (UAV) light detection and ranging (LiDAR) data collected in 2022 by the Norwegian–Argentinian research cooperation Marine Ventures. Comparisons of LiDAR and ground survey data from Cambaceres (3 km<sup>2</sup>)—recorded by Hein Bjerck and colleagues over the period 2009–13 (Bjerck et al. 2016)—show that

almost 70% of the ground survey record was identified in the DEMs (Risbøl et al. 2023).

The shell middens’ high visibility in DEMs is, however, in sharp contrast to their almost complete absence in Reverend Thomas Bridges’ (1842–98) Yagan–English dictionary (Bridges 1987, Eidshaug et al. 2024). The dictionary, which contains about 22,800 entries, was compiled in the 1860s and 1870s, when the Yagan—the descendants of the Fuegian marine foragers—still maintained traditional marine lifestyles. Despite the lack of information regarding shell middens, the dictionary harbors fragments of the Yagan people’s intimate knowledge about the coastal environment and its countless animate and inanimate inhabitants. Strikingly, the word *canoe* appears in almost four percent of the English translations, testifying to the vessel’s undisputed centrality in Yagan marine lifestyles (Eidshaug et al. 2024).

Data diversity is beneficial for the study of marine lifestyles and coastal landscapes in Tierra del Fuego.



**Figure 1.** Map of Tierra del Fuego including study areas, locations mentioned in the text, and a rough division of the territories occupied by different ethnographic groups in the historical period (16<sup>th</sup>–20<sup>th</sup> century) (based on Lothrop 1928:Plate IV). Illustration: Jo Sindre P. Eidshaug

However, the disparate nature of certain sources creates an acute theoretical challenge: Whereas the lexicon compiled in Bridges' dictionary carries strands of Indigenous knowledge assembled over millennia, LiDAR-derived DEMs provide tidy, vegetation-free, geo-referenced, three-dimensional (3D) models ideal for visual inspection and manipulation, spatial analysis, and codified behavior. Assembling such contrasting sources of information in a coherent theoretical framework cannot be done at the stroke of the pen.

Landscape archaeology is, unfortunately, still haunted by a spectral divide between what—somewhat simplified—can be characterized as science-based and phenomenological approaches (Kluiving et al. 2021). A fundamental tension between the two prevailing models of landscape archaeology—to which we will apply the respective labels Cartesian and Correlationist (after Meillassoux 2008, see below)—resides in their differing ways of tackling the dualism between humans and landscape. And like most dualisms (subject vs. object, nature vs. culture, etc.), the poles are

extremely "entrapping." No matter how arbitrary they really are, they are so well organized that they can hardly be escaped (cf. Harris and Cipolla 2017:28–32). Thus, the *Cartesian model of landscape archaeology* lacks cohesiveness, because it keeps its analyses of landscape and humans separate (Meier 2012). Environmental archaeology and most forms of tech-driven landscape archaeology belong in this group. The *Correlationist model of landscape archaeology*, in contrast, lacks symmetry, because it delegates all analytical power to the relation between humans and landscape: It filters every interpretation of landscape through the human-world relation (cf. Harman 2011:118–119, 139–140). Phenomenological approaches to landscape archaeology belong to this spectrum. The unresolved tension between the Cartesian and Correlationist models calls for a renewal of landscape archaeology (see also Kluiving et al. 2021).

This paper explores an alternative approach to landscape archaeology. One that endeavors to do justice to all potential sources of knowledge. To do that,

I carefully draw on selected elements from the recent resurgence of realism in continental philosophy, with a certain skew towards Graham Harman’s object-oriented ontology and Levi Bryant’s machine-oriented ontology. Object-oriented ontologies provide a context for identifying and discussing interfaces and synergies between DEMs and ethnolinguistic dictionaries—two sources of information that appear to be worlds apart.

Over the last decade, the constellation of object-oriented ontologies (e.g., Harman 2011, Morton 2013, Bryant 2014, Harman 2016, 2018) has become more salient in the archaeological discourse (e.g., Olsen and Witmore 2015, Edgeworth 2016, Pétursdóttir and Olsen 2018, Bjerck 2021, Harman and Witmore 2023; see also papers in Crellin et al. 2021, Olsen et al. 2021, Rich and Campbell 2023). Authors who are sympathetic to these philosophies have stressed the crucial roles played by more-than-human participants in the world and embraced the notion of a non-hierarchical, flat ontology. Even though certain ideas, including Harman’s mantra of a “new theory of everything” (Harman 2018), are hard to swallow, I contend that these philosophies contain elements that are appealing for a landscape archaeology that endeavors to combine vastly different sources of information.

This paper has two interconnected objectives. First, to explore and establish useful relations between the archaeological information contained in Bridges’ Yagan–English dictionary and the DEMs from southern Tierra del Fuego. Second, to evaluate the potential contributions of Harman’s object-oriented ontology to landscape archaeology.

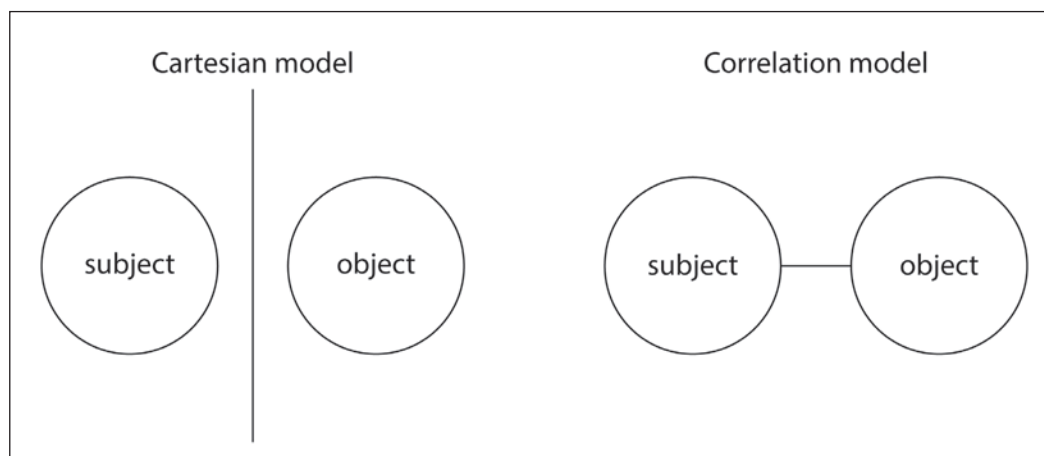
### The duel in landscape archaeology

The fierce debates between processual and post-processual archaeologists in the 1980s and 1990s left an enduring gap between those who model archaeology on the hard sciences and those who hold archaeology to be an interpretative enterprise closer to the humanities and social sciences (Kristiansen 2004, Sørensen 2017). Lately, however, archaeology has been reconciling its relationship with science through the incremental implementation of new scientific methods in an increasingly interdisciplinary research environment (Sørensen 2019, Kristiansen 2022, Lucas and Witmore 2022). This shift relates to what Kristian Kristiansen (2014) has described as the third science revolution in archaeology. In spite of warnings against shunning humanistic perspectives, the implicit neglect of theory, and the devaluation of qualitative research (e.g.

Sørensen 2017, Ribeiro 2019, Crellin and Harris 2020), the new scientific revolution appears to have been warmly welcomed by most archaeologists. And while I agree that it is important to take the new scientific methods and results seriously (cf. Fredengren 2013), the generation-old post-processual critique of naïve reliance on science as an objective enterprise ought not to be swept under the carpet. Consequently, there is an urgent need for theory-building to keep pace with the impressive array of new scientific methods emerging in archaeology. This need is echoed in landscape archaeology.

Technological developments related to geographic information systems (GIS), UAVs, photogrammetry, LiDAR sensors, aerial and satellite imagery, including multi- and hyperspectral cameras, and geophysical prospection (to name a few)—combined with gradually falling operating costs—have created multiple new possibilities for digital landscape archaeology since the advent of the new millennium. Despite commendable efforts to make room for the new digital toolkit within a more humanistic and theoretical framework (e.g., Witcher 1999, Lock 2003, Wickstead 2009, Llobera 2012, Doneus and Kühteiber 2013, Richards-Rissetto 2017), the use of advanced technology and digital software has made landscape archaeology an ally in the recent resurgence of science. In parallel, environmental archaeology—a related field with close ties to shell midden research (Rick 2024), which has always been firmly rooted in science (e.g., Carleton and Collard 2020, Davis 2020)—has kept growing in popularity. Meanwhile, the phenomenological landscape archaeology that drew on Chris Tilley’s monumental *A phenomenology of landscape* (1994) has, in many respects, largely run out of steam (cf. Barrett and Ko 2009, Johnson 2012; see also critique in Fleming 2006). Had landscape archaeology taken another trajectory, perhaps we would not have needed to remind ourselves about the stubborn fact that both DEMs and ethnolinguistic dictionaries can be appealing and relevant sources of information for landscape archaeology.

It is widely accepted that there is a fault line between two intrinsically different approaches to landscape archaeology, which, at least partially, depends on opposing conceptions of the term landscape (e.g., Bender 1993, Ingold 1993, Knapp and Ashmore 1999, Layton and Ucko 1999, Thomas 2001, Johnson 2007, Kluiving and Guttman-Bond 2012). Bruno David and Julian Thomas (2008b) summarize the schism in the following way:



**Figure 2.** Schematic drawing of the relation between humans (subject) and environment (object) in the Cartesian and Correlationist models of landscape archaeology. Illustration: Jo Sindre P. Eidshaug

The tension between landscape as an entity to be viewed like a painting from afar, and either analyzed or aestheticized, and landscape as a context of dwelling or inhabitation is one that has haunted landscape studies, and that was bequeathed to archaeology once it began to be concerned with the concept (David and Thomas 2008:27)

The source of the disagreement touches upon a pivotal issue in landscape archaeology, namely the relation between humans and environment, which can alternatively be labeled landscape or world. The issue carries both ontological and epistemological flavors, as it pertains to how we address the fundamental relation between subjects and objects, and which component(s) of that relation we can access.

### The Cartesian model of landscape archaeology

The Cartesian model of landscape archaeology refers to David and Thomas' notion of "landscape as an entity to be viewed like a painting from afar" (2008:27). This model gives precedence to vision, particularly that of Western science, and depends upon the premise that a detached subject has the capacity to gaze disinterestedly upon the world of objects (Bender 1999, Thomas 2001:168, Ingold 2011:209). It is a model that conforms well with the notion of space within GIS, as "rectilinear, isotropic, gridded, and framed, creating the so-called 'scientific gaze' through distanced and dispassionate observation" (Huggett 2015:91, cf. Thomas 2004, but see Wickstead 2009).

As the Cartesian model locates the human mind outside the world of objects, it adheres to an ontology that situates subjects and the world of objects on different ontological planes of existence (Fig. 2). Con-

sequently, the model allows for objects and subjects to be accessed independently of one another. Such a model is variously referred to as Cartesian, Western, and modern. The model encompasses most forms of digital landscape archaeology (cf. Huggett 2015) and environmental archaeology, which explicitly relies on a dualism between humans and their environment (cf. Reitz and Shackley 2012).

### The Correlationist model of landscape archaeology

The second part of David and Thomas' tension in landscape archaeology is consistent with the Correlationist model of landscape archaeology, which conceives "landscape as a context of dwelling or inhabitation" (David and Thomas 2008:27). More explicitly stated, "landscapes are relational entities constituted by people in their engagement with the world" (Thomas 2001:176)—in other words humans and landscapes cannot be considered independently of one another. Phenomenological approaches to landscape archaeology belong to this model.

The Correlationist model is a reaction to some inherent, fundamental shortcomings of the Cartesian model, especially in relation to its dualism. The Cartesian model harbors an insoluble paradox, which is expressed in Tim Ingold's (2011:40–42) analysis of the anthropological axiom "nature is a cultural construction." According to this axiom, the different versions of nature encountered among different peoples are cultural constructs. However, since there is a real world out there, this can only be explained by understanding culture as a stratum of perception and a construct that sits atop real nature. This amounts to two versions of nature: "'really natural' nature (the object of study for natural scientists) and 'culturally perceived' nature (the

object of study for social and cultural anthropologists)” (Ingold 2011:41). The paradox resides in realizing that Western culture (including science) is also a construct, whereby it follows that the Western account of nature is also a construct. Inevitably, this leads to a conclusion that real nature out there can never be grasped, as there is no escape from the fact that it is always culture (subjects) that provides accounts of nature (objects). Thus, according to the Correlationist model, the Cartesian model’s analytical separation of nature from culture is flawed, because nature and culture can never be considered apart in the real world.

Quentin Meillassoux (2008:6) employs the term correlationism to refer to the epistemic, seemingly insoluble issue that human subjects and the world of objects cannot ever be accessed independently of one another (Fig. 2). Correlationism holds that we can only access the correlation or rapport between subjects and objects. Meillassoux (2008) argues that this notion of correlationism has pervaded continental philosophy since Kant, and that it has led to the questioning and occasional rejection of a world out there, existing without humans. Yet, puzzled by the empirical sciences’ ability to produce knowledge about an ancestral past from which humans are absent, Meillassoux attacks correlationism from the inside and finds a way to establish an absolutizing capacity for scientific claims (Bryant et al. 2011:8). In other words, “what is mathematizable cannot be reduced to a correlate of thought” (Meillassoux 2008:117).

The gap between how the Cartesian and Correlationist models conceive the relationship between subjects and objects amounts to the duel in landscape archaeology. Although both models sustain an ontological rift between subjects and objects, the ways they conceive of access to these two ontological entities are fundamentally different: The Cartesian model would never accept that a primordial relation between subjects and objects dictates the reality of the objective world. The Correlationist model, on the other hand, would never allow the poles in the dualism of the former to act as surrogates for reality, since their existence depends on the rapport between them. Consequently, it is not hard to understand why the duel impedes coherent attempts at bridging the gap between the scientific and phenomenological approaches to landscape studies. One cannot simply slip back and forth between the two models. Case studies that are deeply rooted in one of the models can always be rejected by reference to their most profound assumptions. In Thomas Kuhn’s (1970) terminology, they are incommensurable.

## Object-oriented ontology

Object-oriented ontology (OOO) is a realist philosophy associated with the US philosopher Graham Harman (e.g., 2002, 2011, 2016, 2018). In tandem with posthumanism, it is part of a broader movement against anthropocentrism and a reappraisal of the more-than-human world. And like his many peers involved in this movement, Harman is highly critical of correlationism—although he pursues a path that diverges from the one carved out by Meillassoux. Despite a lack of unity, the new realism converges around the opinion that the world is wholly independent from experience, and that the version that appears to experience is highly impoverished (DeLanda 2013:vii).

Drawing on Heidegger, Harman (2002, 2011) develops the notions of autonomous objects and impoverishment through a distinction between an object’s visible exterior and hidden interior. Almost a century ago, Heidegger (2010) noted that things rarely appear to the conscious mind. Only on a few occasions, such as when they break, do we become aware of things as visible, discrete objects—before they once again slip and recede into the background. According to Heidegger, it is when using things we encounter them as they really are. Heidegger exemplifies this with a hammer: “the less we just stare at the thing called hammer, the more we take hold of it and use it, the more original our relation to it becomes and the more undisguisedly it is encountered as what it is, as a useful thing” (Heidegger 2010:69). Harman contends that this distinction—between presence-to-hand (*Vorhandenheit*) and readiness-to-hand (*Zuhandenheit*)—designates a key ontological feature of all things (Harman 2002:35–44). To describe these features, Harman applies the terms *sensual* for the visible and accessible exteriors of objects, and *real* for their withdrawn and inaccessible interiors.

A central concept in Harman’s writings is *withdrawal*. It means that things always keep something back, conserving a surplus or excess: “no matter how many times we turn over a coin, we never see the other side *as* the other side—it will have to flip onto ‘this’ side for us to see it, immediately producing another underside” (Morton 2011:165).

Harman argues that objects also withdraw from practice: “using a thing distorts its reality no less than making theories about it does” (Harman 2011:42). Additionally, the prominent dualism between the real and sensual is not restricted to how human relations work: “*all* relations translate or distort that to which they relate: even inanimate relations” (Harman

2011:44). Accordingly, the ways in which objects encounter one another follow the same pattern as human encounters with them. Even in causal relations, objects encounter one another as specific effects, only displaying limited sets of properties:

When one billiard ball strikes another, it treats its victim as a simple mobile mass, and remains unattuned to its other concealed treasures—the richness of its imperfect plastic texture, its suddenly irrelevant color or its vague synthetic fragrance. No object ever unlocks the entirety of a second object, ever translates it completely literally into its own native tongue (Harman 2002:223)

Thus, we can easily see how the term object, in Harman's vocabulary, far exceeds that of the useful thing in the Heideggerian sense: It covers anything that amounts to an autonomous reality—something that differs both from its constituent pieces and its relations—whether human or nonhuman, material or immaterial (Harman 2011:19, 2018:51).

Based on this brief introduction to object-oriented ontology and the notions of impoverishment, autonomy, and withdrawal, I will concentrate on three potential contributions of the philosophy to landscape archaeology: flat ontology, methodological flexibility, and landscapes of objects.

### Flat ontology, methodological flexibility, and landscapes of objects

Flat ontology is not a new concept, but it offers a point of departure. Much like the actor–network theory's principle of symmetry (Latour 2005:76), it is applied to describe an ontology with no a priori hierarchical relations between its parts (DeLanda 2013:51). Its flatness always refers to ontological flatness: while "*all things equally exist, yet they do not exist equally*" (Bogost 2012:11). This means that belonging to the same ontological realm does not imply egalitarianism among things: all sorts of differences play out in the sensual realm of relations, where things interact (Harman and Witmore 2023). Thus, the notion of flat ontology simply encourages us to initially treat all objects on an equal footing (Harman 2018:54) and serves as a guideline or attitude in the same vein as the principle of symmetry for symmetrical archaeology (cf. Shanks 2008, Olsen and Witmore 2015).

However, flat ontology also acts as a reminder that the data and methodologies we use are never exhaustive (cf. Harman 2018)—they only amount to impover-

ished versions of reality. At the same time, the notion of flat ontology enables us to establish a context for combining and seriously discussing objects that are ostensibly distant as DEMs and dictionaries, without having to conduct complex transformations of the information in advance (such as translating, converting, filtering or adapting the data). This is not to say that human intentionality and material causation yield equally predictable outcomes, only that their difference is a matter of degree rather than kind (Harman 2011:44–47, Bryant 2014:50–51).

Situating all objects, including DEMs and dictionaries, in the same realm (i.e., the sensual realm) opens for a more flexible and plural methodology. This kind of leveling is essential because objects withdraw from whatever method(s) we apply, revealing only a limited number of properties, and always keeping something in reserve. To use a method is thus to induce a bias—to distort data by means of pulling out and amplifying certain properties or certain versions of things at the expense of others. Hence, methods can only reveal impoverished versions of things, and although using multiple methods can enrich our understanding of things (even in the past), it can never exhaust them. While it may be common sense that different methods reveal different properties of objects, it is not at all easy to avoid projecting a primordial hierarchy based on the status the applied methodologies enjoy in the research community (and among funding bodies).

One key aspect of object-oriented ontology is that objects differ from their parts (Harman 2018): Maya blue pigments should not be confused with mural paintings, genes are not humans, mussels differ from shell middens, and shell middens from dwellings. Methods rarely target the same things, and even when they do, they encounter different surface features of these things. Thus, methodological flexibility can enable landscape archaeology to escape the poverty of isolated methods and to paint more complex and vivid pictures of the areas and objects that are being investigated.

Another valuable element for landscape archaeology is the unapologetic focus of object-oriented ontologies on things, which gives us landscapes with countless things operating at different levels (pigments, shipworms, pottery sherds, ancient DNA, <sup>18</sup>O and <sup>16</sup>O isotopes, shells, shell middens, pinnipeds, cormorants, humans, trees, canoes, islands, mountains, winds, etc.). Initially, we are encouraged to take all of them as seriously as humans, no matter how tiny or monstrous they at first appear (Olsen 2010, Olsen



**Figure 3.** A cluster of ring-shaped shell middens (*Wikirrh* site, Cambaceres Bay) with human scales. These circular depressions are interpreted as the remnants of dwelling huts and were repeatedly reused for erecting new dwellings (e.g., Piana and Orquera 2010, Zangrando 2018). They owe their shape to the tradition of arranging midden materials around the dwellings. Domes, by contrast, lack visible depressions adjacent to the middens (i.e., on the ground surface). Photo: Jo Sindre P. Eidshaug

et al. 2012, Bryant 2014, Harman 2016, 2018). This perspective can promote a recognition of the myriads of co-working objects and their engagements in the world—independently of, and in addition to, those perpetually colonized by human perception, experience, and contextualization (cf. Knapp and Ashmore 1999). In this context, Bridges’ dictionary serves as a reminder that landscapes not only comprise immovable features (i.e., mountain, islands, beaches, etc.) but also a myriad of working and co-working objects of diverse sizes, whether or not they have been noticed by their human co-habitants (Eidshaug et al. 2024).

### Tierra del Fuego, DEMs, and a dictionary

Tierra del Fuego is home to myriad fjords and channels, bays and coves, sounds, straits, and inlets alternating with headlands, islands, islets, and rocks (Fig. 1). The archipelagic coastal configuration creates calm, sheltered waters between the mainland and the open sea with rich and diverse marine ecosystems (Bjerck 2009, Bjerck and Zangrando 2013). The southern Fuegian seascape has been inhabited by marine foragers

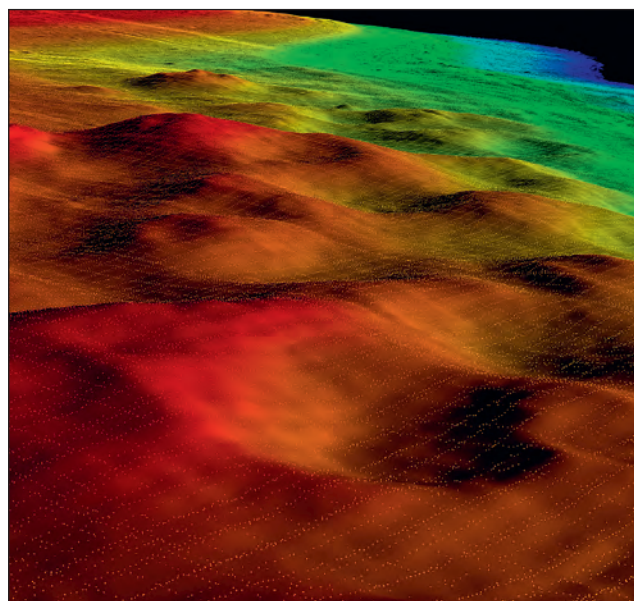
for at least 7,200 years and possibly continuously for as long as 8,600 years (Zangrando et al. 2022)—until the traditional marine lifeways eroded shortly after the severe outbreaks of infectious diseases in the 1880s, tragically causing the death of almost 90% of the Yagan population (Orquera and Piana 2015:86–91).

Shell middens remain the most ubiquitous testimonies to the marine foragers who resided on the coasts of the Fuegian archipelagos. Most of them can be characterized as *ring-shaped*, meaning middens arranged around dwellings (structures made of saplings and branches with a base diameter of 3–4 m) (Fig. 3), or *dome-shaped*, referring to middens without any such visible traces of dwellings. Ring-shaped middens usually appear in clusters and were repeatedly reused for erecting new dwellings—after short or long hiatuses (Piana and Orquera 2010, Zangrando 2018). The middens’ zooarchaeological assemblages are principally composed of shells but contain varied proportions of faunal remains, including marine mammals, sea birds, fish, and guanacos (Orquera and Piana 1999, Estévez et al. 2001, Tivoli and Zangrando 2011). The artifact assemblages typically include tools made of lithics (especially knapped artifacts like side-scrapers, end-scrapers, flakes,

and points but also pecked or polished implements, like sinkers and mallets) and bone (detachable and fixed harpoon points, awls, punches, pressure flakers, spatulas, chisels, wedges, and others), and ornaments made of shells, bones, and teeth. Middens also contain sediments, charcoal, and ashes, in addition to features such as dwelling floors, hearths, and burial places (Orquera and Piana 1999, Piana and Orquera 2010).

As shell middens modify the local ground conditions, including topography, most of them can be identified and mapped using remote sensing techniques such as LiDAR (Risbøl et al. 2023, Eidshaug et al. 2025)—a widely used method that has proved highly useful for archaeology across the globe (e.g., Chase et al. 2012, Opitz and Cowley 2013, Vinci et al. 2025). LiDAR is used to acquire 3D coordinates of the Earth's surface through measurements of backscatter from laser pulses emitted by a sensor. The laser can penetrate vegetation and for each return signal (depending on the sensor), a point coordinate is recorded. These coordinates can be assembled in geo-referenced point clouds and used to generate digital surface models (DSMs). Applying filtering algorithms and automated (plus manual) point cloud classification, vegetation and other off-ground points can be removed to generate bare-earth models—digital elevation models (DEMs)—that are highly suitable for identifying archaeological features (Fig. 4). The ability of LiDAR to penetrate vegetation, its accuracy in terms of 3D modeling, and the potential to reveal subtle archaeological features based on minor changes in the relief (using various visualization techniques) has made it a powerful tool for landscape studies (e.g., Chase et al. 2012, Risbøl 2013, Doneus et al. 2022). This is also the case for shell middens in Tierra del Fuego, where 69% of 1,240 features (all except three were recorded as shell middens, see Bjerck et al. 2016) from the ground record were identified in DEMs generated from UAV LiDAR data in Marine Ventures' recent study from Cambaceres (Risbøl et al. 2023).

However, given that traditional lifeways were sustained until the beginning of the 20<sup>th</sup> century in Tierra del Fuego, extremely diverse sources are available. Written sources from the 17<sup>th</sup>–20<sup>th</sup> centuries offer completely different opportunities for studying marine lifeways and landscape use, even though they remain colored by European perspectives. In this context, Reverend Thomas Bridges' Yagan–English dictionary (1987) is a rather unique contribution—bearing in mind that the ethnographic content in dictionaries usually differs from traditional accounts, and is often overlooked (Roper 2020, Hopkin and Roper 2023).



**Figure 4.** High-resolution digital elevation models (DEMs) can be interpolated from 3D point clouds. The example shows a cluster of ring-shaped shell middens recorded with UAV-based LiDAR survey in Cambaceres (*Manakatush* site). Illustration: Jo Sindre P. Eidshaug

The dictionary, which was compiled in the 1860s and 1870s, contains English translations of about 22,800 Yagan words and is a rich source of information about the Yagan peoples' marine lifeways, environmental knowledge, and the Fuegian seascape (Eidshaug et al. 2024). However, in the longstanding absence of a searchable digital version, its tremendous ethnographic value has remained largely unattainable for research. It is therefore not surprising that it has been little studied from an archaeological perspective (cf. Swensen 2014, Husøy and Swensen 2016, Eidshaug et al. 2024).

### Leveling DEMs and the Yagan–English dictionary

As noted, Harman's notion of withdrawal refers both to what is withdrawn from human perception and nonhuman encounters: LiDAR sensors are obviously indifferent to the distinction between archaeological and non-archaeological anomalies that is all-important to a human interpreter of DEMs. And while point clouds store multiple attributes, they remain mute about artifact assemblages buried in the soil, let alone their object biographies. Withdrawal implies a dispersed but omni-present impoverishment of reality, in which each object largely collapses into its own private reality. Thus, various reductions of reality are distributed across archaeological assemblages, DEMs,

and dictionaries. Yet, according to a flat ontology, the reductions of reality do not make any one of these sources less real than the others (cf. Latour 1999, Bryant 2014, Harman 2016)—regardless of their diverging biographies. Indeed, maps are no less real than the situations they seek to visualize (Wickstead 2009, Mlekuž 2013, cf. Latour 1999).

Visualizations—DEMs—are particularly interesting because technology is generally extremely effective in obscuring inherent reductions of reality, and hence obliteration of complexity in the past (Rączkowski 2020). Naturally, many other factors affect what can potentially be identified in DEMs, including vegetation, topography, decision-making related to data processing (especially point cloud processing and visualization methods), and the interpreter’s personal experience (e.g., Bollandas et al. 2012, Fernandez-Diaz et al. 2014, Doneus et al. 2020, Štular et al. 2021, Doneus et al. 2022). However, due to the immense power vested in visualizations, they resemble the truth—no matter how distorted they are (Rączkowski 2020). As with metal detecting, geophysical prospection, and other types of technology, remote sensing tends to reproduce and reinforce known patterns—in other words you “[see] what you want to see” (Brophy and Cowley 2005:18)—so that discovery of new sites (of known categories) per se becomes the goal, in what has been dubbed the stamp-collection approach (Mills 2005, Rączkowski 2020). Without proper reflection upon what can be achieved with remote sensing techniques and GIS applications, and how they actually work and disseminate knowledge, there is a real danger of getting blinded by technological efficiency and losing sight of the complexity of both the archaeological past and the research practice (Witcher 1999, Rączkowski 2020).

As to a dictionary, the personal agenda of the lexicographer and the context in which it was compiled may be quite visible in its content (e.g., Fishman 1995, Winer 2020, DuBois 2023)—for instance, in what entries are included and excluded, and what information about the words is provided in the metalanguage (including folkloristic/ethnographic information). Reflecting upon the ethnographic content of the Dictionary of Newfoundland English (DNE), Philip Hiscock writes:

Doing ethnography through the dictionary is possible, like getting your hit of nicotine from O. P. B. [other people’s butts], but it is difficult, often impossible, to see the ethnographic reality from which the dictionary draws (Hiscock 2020:209–210).

Smoking others’ butts is useful. It’s cheap, often stronger than the fresh tobacco it came from because it filtered what was inhaled by the original smokers. But of course, it is just what they have left behind, now decontextualised from the originals, and heavily perfumed by the process of their having smoked it. So too with relying on the citations served up by the DNE (Hiscock 2020:223).

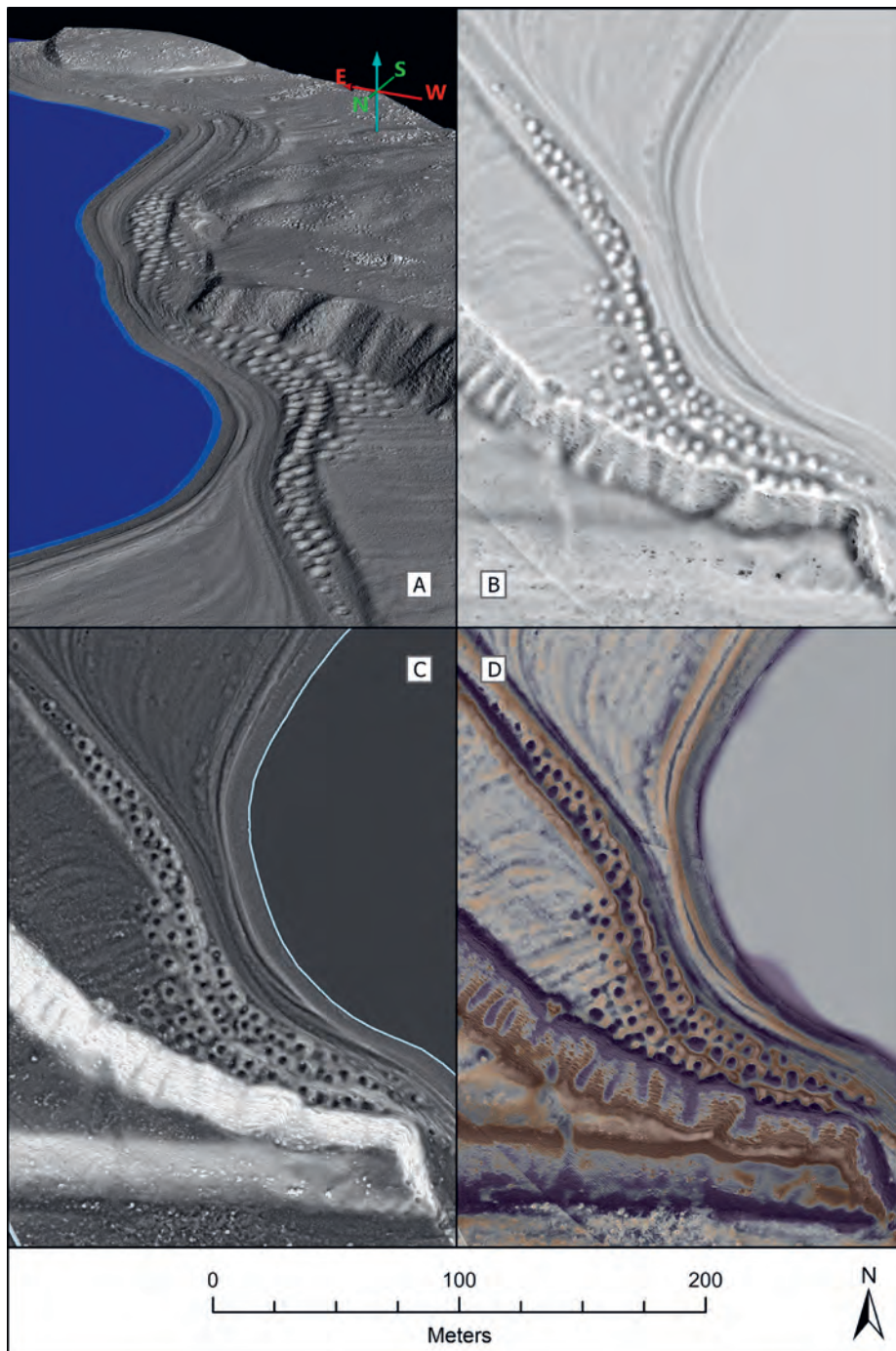
Archaeology always relies on “what they have left behind”—on accounts that are secondary and fragmentary. There are always mixtures of contextual and non-contextual elements (cf. Eidshaug et al. 2024:728). Likewise, vocabularies and explanations of words in dictionaries merely offer fragmentary glimpses of ethnographic realities. And there is usually little information about the number of permutations in lexicographical entries (Roper 2020). Thus, the resolution of landscape as captured through a dictionary like the Yagan–English one will always be patchy and coarse-grained (Eidshaug et al. 2024).

Although data diversity may be more of a palliative treatment than a proper remedy for the ramifications of the concept of withdrawal, by using multiple sources it may be easier to identify whenever certain sources remain mute. Thus, any notion of a hierarchy between data derived from airborne sensors and dictionary entries should be treated with skepticism and scrutiny: They can both shed light on various properties of objects, various aspects of reality. And indeed, they are both enriching for coastal archaeology in Tierra del Fuego.

### Interfaces between DEMs and the Yagan–English dictionary

The DEMs from the Beagle Channel and Bridges’ Yagan–English dictionary can be conceived as more or less contemporary sources. While the DEMs display a tidied version of the topography encountered in March 2022, it is easy to imagine that it resembles the situation in the 1860s and 1870s—when Bridges compiled the dictionary. Relatively little modern disturbance is found in most parts outside the urbanized areas along the Beagle Channel. Of course, dwellings, people, canoes, artifacts, and other things are missing, while roads, tourist boats, fences, farms, prefectures, and other things have been added. By contrast, using the DEMs to imagine how the topography may have looked before the last 50% of the shell middens formed is a far more arduous exercise (Włoddek Rączkowski,





**Figure 6.** When searching for archaeological features along the coast, and for variations in use of different coastal landscapes, DEMs may be more efficient tools than the dictionary. Various visualization techniques may be used to manipulate LiDAR data for the purpose of identifying archaeological features, including (A) Applied Imagery’s Quick Terrain Modeler, (B) negative openness, ArcGIS Pro, (C) local dominance with 30% slope overlay, ArcGIS Pro, and (D) local relief model with 50% sky-view factor, 30% hillshade, and 30% slope overlay, ArcGIS Pro. Negative openness, local dominance, and sky-view factor models were generated using the Relief Visualization Toolbox (v.2.2.1) (Zakšek et al. 2011, Kokalj and Somrak 2019), while the others were created in ArcGIS Pro. The local relief model was based on Hesse (2010). Illustration: Kristoffer R. Rantala

(Eidshaug et al. 2024)—especially seabirds, shellfish, and marine mammals, whose bones or shells are often encountered in shell midden assemblages (e.g., Orquera and Piana 1999, Tivoli 2010, Zangrando et al. 2016). Nouns like canoe, water, fish, shore, and sea are far more frequent than mountain, forest, lake, and valley in explanations of Yagan words (Fig. 5). Even the lexicon pertaining to the hinterland is deeply entangled with knowledge, skills, and resources tied to a marine lifestyle, testifying to the messy webs of relations between sea, coast, and hinterland (Eidshaug et al. 2024).

Additionally, the Yagan–English dictionary gives name to: objects that leave fewer traces, such as the degradable structural components of bark canoes (bark, sticks, seed stalks of wild celery, soil used for sealing seams, turfs used as hearths, etc.) and dwellings (posts, sticks, branches, etc.), internal body parts of whales, mussels, and limpets, and freshwater contained in the moss-like *šāna*; elusive things in the intertidal zone, including the multi-temporality encapsulated in bird breeding and the life cycles of Darwin’s fungi, the bark of the evergreen southern beech *šöšči*, and crabs; and ephemeral things, like feathery ripples and

sunrays flickering on the water, the nuances in the ubiquitous winds, and other weather phenomena, including *auiyella*, “a certain state of the air in which distant objects are much distorted and when there is a peculiar lightness, caused by refraction, betokening in winter more snow” (Bridges 1987:65). Certain marine assemblages—like the intertidal zone, canoes, shallow waters, and kelp beds—appear densely settled by named inhabitants, revealing multiple well-developed, long-term relationships with these corners of the environment (Eidshaug et al. 2024).

Yet the dictionary rarely differentiates between geographical segments and places along the coastline, apart from naming diverse types of coastal environments, including some of their qualitative markers (e.g., steep coast, kelp beds, sandy, stony, or muddy beaches, etc.). DEMs are particularly useful for large-scale studies of archaeological landscapes and settlement patterns—even though they provide highly distorted versions of reality (Fig. 6).

Moreover, DEMs materialize the monumentality of the shell middens: a grand investment in landscape, partly made possible by entrapping symbioses between humans and micro-environmental agents. The gradual accumulation of midden materials through repeated reuse of the same places has made agglomerations of shell middens—especially of the ring-shaped type—conspicuous features in the Fuegian seascape. And the monumentality is not only a sensual artifact of the DEMs: the middens work as attractors in the landscape (Piana and Orquera 2010). As such, they possess potential entrapping effects: In periods of relative dormancy, when the middens were temporarily unoccupied (hiatuses in the archaeological record), these sleeping giants were always ready to unleash their powers (cf. Harman 2016:7)—to resume their function as ready-made sites for dwellings or take on new forms of being.

In addition to tradition and reuse, multiple other relations in the micro-environment surrounding the shell middens enable them to take on this function (Piana and Orquera 2010, Fretheim et al. 2016, Zangrando 2018; see also Rick 2024:333–335 on landscape legacies, and discussion in Eidshaug et al. 2025:964–965). Shell middens deteriorate slowly and because they produce high concentrations of calcium carbonate ( $\text{CaCO}_3$ ), they create favorable preservation conditions for osteological material (Orquera and Piana 2009). High  $\text{CaCO}_3$  concentrations also modify the local ground vegetation, furnishing grass growing on middens with a distinctive green tone that is visible

from far away (Piana and Orquera 2010, Zangrando 2018). The Yagan called this grass *ökaržšuka* (Bridges, 1987:48), the literal meaning of which is “house-grass.” Their visibility is further reinforced because the dominant tree species—*hanis* (*Nothofagus pumilio*) and *šöšči* (*Nothofagus betuloides*)—tend to avoid the middens, as they prefer soils with a low pH value (Romanyà et al. 2005), whereas shell middens have neutral or slightly alkaline pH values (Orquera and Piana 2001). This phenomenon can be observed in landscape models including vegetation points (DSMs). As noted by Zangrando (2018:12), the distinctive visibility of the shell middens even attracted the attention of Charles Darwin. Over the years, many other travelers, including archaeologists like Samuel Lothrop and Junius Bird, have been attracted by the middens dotting the shores of Tierra del Fuego. And after Luis Orquera and Ernesto Piana initiated systematic investigations of the Fuegian shell middens and developed a refined excavation methodology (see Orquera and Piana 1992), the middens unveiled ever greater elements of their capacities, yielding rich information about their inventories and about past marine lifestyles.

Although various sources of information have spatial and temporal limitations, a flatter landscape archaeology allows us to conceive archaeological data, DEMs, and the dictionary as complementary rather than competitive. Thus, it fits into a pattern observed in previous studies from the region comparing different records: photographic, written, and archaeological records (Fiore et al. 2014, Fiore et al. 2021); and the dictionary, and ethnographic and archaeological records (Swensen 2014, Husøy and Swensen 2016, Eidshaug et al. 2024). Rather than canceling one another out in a competitive race for a paramount truth, these records diversify, nuance, and expand our understanding of the complex lifeworld of the Yagan and their ancestors. However, there are other aspects of object-oriented ontology that require further discussion.

### Discussion: Object-oriented ontology and landscape archaeology

With the loss of humanistic perspectives in landscape archaeology, drawing on object-oriented ontology, machine-oriented ontology, and affiliated schools of thought may seem counterintuitive due to their cheerful rallying call against anthropocentrism in the humanities. Unsurprisingly, the most pervasive critique against object-oriented ontology-inspired archaeologies is precisely the absurdity of bracketing

off humans from the archaeological project (e.g., Barrett 2016, Ion 2018, Van Dyke 2021). Crucially, this is a critique that very much concerns ethics and politics, including what Alexandra Ion dubs “a fetishization of things, an abandoning of responsibility, and an alienation of humans” (2018:192). Severin Fowles (2016) has attributed the interest in things to the widespread criticism following the crisis of representation in anthropology and other social sciences in the 1980s. According to this line of reasoning, object-oriented and post-humanistic approaches offered an opportunity to bracket ethics, since representing objects instead of subjects does not involve the same pitfalls (Fowles 2016).

Alternative ontologies about relations between humans, animals, and the broader nonhuman world are deeply embedded in Indigenous knowledge (e.g., see Vanessa Watts [2013] on Indigenous place-thought and Eduardo Viveiros de Castro [1998, 2017] on Amerindian perspectivism and multinaturalism). However, according to Beatriz Marín-Aguilera (2021), ontology-related archaeologies are engaging in a new form of colonialism—one that, due to the extractive nature of its knowledge acquisition, contributes to the erasure of Indigenous knowledge (see also Todd 2016, Mendoza 2018). Thus, the literature in the field is characterized by a repeated failure to acknowledge Indigenous thinkers and publications (citations are remarkably absent in object-related archaeologies), a marginalization of Indigenous voices, and an ignorance of the vast diversity in Indigenous ontologies (Marín-Aguilera 2021).

Excluding humans and scorning ethics are potentially devastating consequences of applying an object-oriented framework. However, I contend that they are more likely to occur if the goals of object-oriented ontology are conflated with those of archaeology. Even then, they are certainly not necessarily entailed by the framework. Indeed, both Harman’s (2016) theory of symbiosis and Bryant’s (2014) onto-cartography aim at contributing to social theory, with the latter being deeply engaged in politics and ethics. Moreover, defending symmetrical archaeology, Bjørnar Olsen and Chris Witmore argue that such claims are usually based on a “misconception where readers conflate the rejection of *the rift between humans and the world* as a move where humans, life and interpretation become merely incidental” (Olsen and Witmore 2015:190, italics in original). Accordingly, a symmetrical approach is about opening archaeology to wider horizons than those of humans and their relations.

The Yagan–English dictionary serves as a worthy reminder of what we stand to lose if we attempt to bypass the great edifice of Indigenous knowledge in a pursuit of a world without humans (Eidshaug et al. 2024, cf. Harrison 2007). Although Bridges’ informants were absent in the dictionary, Jemmy Button, Okokko, Camilenna, Lucca, Yecife, Sisoïens, and others can be identified as contributors in various letters published in the *Voice of Pity, A Voice for South America*, and the *South American Missionary Magazine* (for specific references, see Eidshaug 2024:65–67). The world that emerges from the dictionary is not primarily that of Bridges—though neither is it a magical gateway to Yagan mindsets. The bottom line is that simply because archaeological puzzles are usually so fragmented, we cannot begin our analyses by eschewing human experience. Consequently, we should not conflate the goals of object-oriented ontology with those of (landscape) archaeology but rather choose and consider carefully which elements that can be useful. Flat ontology, if treated as a guideline, methodological flexibility, and landscapes of objects appear to be some of the more valuable contributions made by object-oriented ontologies.

## Conclusion

If we were to pursue the Cartesian model of landscape archaeology, it is only a slight exaggeration to say we might conclude that DEMs and the dictionary should always be analyzed apart, since cultural constructs contained in the dictionary may be based upon evidence that potentially can be discovered in DEMs (i.e., which, accordingly, more accurately represent real nature). Conversely, if we were to be true to the Correlationist model, DEMs would be inferior to the dictionary and possibly even irrelevant, as they do not provide insights into the human experience of landscape. The building blocks of a Correlationist model of landscape archaeology—albeit never truly emic, as it always involves translation—can only be encountered in humans, for which reason the lexicon is superior to digital reconstruction.

While object-oriented ontologies do not mend fences between the Cartesian and Correlationist models of landscape archaeology, they harbor vital ingredients for a flatter landscape archaeology, including flat ontology, methodological flexibility, and landscapes of objects. The core argument for drawing carefully on these theories is that they relieve the tension between a landscape archaeology that cares about humans’

sensory experiences and knowledge of the world and another one which celebrates the progress of scientific methods in restoring empirical data. As an alternative to the Cartesian and Correlationist models of landscape archaeology, a somewhat flatter landscape archaeology neither requires an analytical divide between humans and landscape, nor shrinks it epistemologically to a single, primordial relation between humans and the world. Rather than anchoring theories in hierarchical ontologies, we should shelter our analytical points of departure from all kinds of domineering domains. Consequently, we should refrain from choosing in advance whether a DEM or a dictionary is the better source for landscape studies. A flatter landscape archaeology sees these sources as complementary, and even when they seemingly compete, they are still enriching, yielding not only what might be labeled superficial phenomena but also other forms of knowledge, welcoming—hopefully—knowledge and wisdom lodged in Indigenous ontologies (with proper accreditation). Methodologically, landscape archaeologies inspired by object-oriented ontologies invite us to conceive of landscapes as consisting of individual objects whose identities differ both from their parts and from their relations, thus populating landscapes with countless organic and inorganic inhabitants. Most importantly, they support a methodical flexibility that is most welcome for archaeology.

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