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Intercultural Living Labs, Cognitive Sovereignty and Geoethics: artificial intelligence in cultural landscapes

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Abstract

This article examines intercultural Living Laboratories (Intercultural Living Labs) as situated devices for dialogue and co-production within the context of a long-term project working with communities in Portugal and Brazil. In these settings, the current dialogue phase with artificial intelligence, as part of the 'Agora – Cultural Landscape Community AI Hub' project based at the Instituto Terra e Memória and coordinated by the authors, is not taking place in a methodological vacuum or in contexts that are not mediated by technology. Rather, it builds upon well-established paths of co-creation, where Living Labs and Digital Humanities tools have long been utilised as instruments of dialogue with communities for purposes such as representation, cultural preservation, feedback, decision support, and institutional negotiation. Throughout this process, technologies have evolved, but the underlying principles have remained consistent: humanities contribution for community-based landscape management, anchored in knowledge building, ethics, participation, respect for local cultures, community empowerment and co-constructed foresight. The current phase involving AI introduces a new level of complexity, particularly in terms of scale, opacity, circulation and governance, without breaking from this normative framework.

In this context, the article introduces the concept of cognitive sovereignty, which describes a collective's historical and continuously evolving capacity to sustain its own

systems of memory, interpretation, classification, and future projection. This includes the incorporation, rejection, or reinterpretation of external influences. The article argues that Intercultural Living Labs do not create this sovereignty but rather make the broader processes through which communities are already reconfiguring their relationships with technologies and knowledge infrastructures more observable and negotiable. Adopting a transdisciplinary perspective, the discussion seeks to integrate scientific and situated knowledge in a robust methodological framework, without reducing these distinct knowledge systems to an arithmetic sum or dissolving the specificities of their production and validation regimes. Within this framework, the article contributes to geoethics by shifting the focus from the individual conduct of professionals to the ethics of situated socio-technical infrastructures that mediate relationships between communities, data, models, and cultural landscapes.

As the dialogue phase with AI, which began in 2025, is still in its early stages, this article focuses on concepts and methods rather than presenting established results. At this stage, the dialogue is primarily focused on experiments with generative AI for creating and reformulating narratives and forms of representation, territorial modelling for visualising and comparing scenarios, and prototyping data curation and exploration tools in secure test environments. These experiments are not considered ends in themselves, but rather as tools for supporting community reflection, decision-making and territorially-based forms of anticipatory governance. Thus, the article offers initial reflections on this dialogue and its ethical-political challenges and geoethical implications, as well as its emerging forms of mediation. This paves the way for future analyses of more established empirical developments in this process.

Keywords: Geoethics, Intercultural Living Labs, Cognitive Sovereignty, Artificial Intelligence in cultural landscapes, Co-creation, Transdisciplinarity.

1. Introduction

In the contexts that ground our work, communities play an active role in shaping the arrival, interpretation and adoption of artificial intelligence and other technologies in their territories. They have their own systems for remembering, interpreting,

classifying, transmitting and projecting the future, which shape their cosmologies, everyday practices, institutions, intergenerational relations and ways of inhabiting the territory. Therefore, when new technologies emerge in these contexts, they encounter ecosystems that are rich in meaning, dispute and experimentation. In light of this, the article addresses artificial intelligence as a specific episode in the broader history of technological interventions within specific cultural landscapes (Werlen, 1993; Ingold, 2000; Oosterbeek, 2017a, 2023).

Over the past few decades, the communities we have collaborated with in Mação (Portugal), the port region of Rio de Janeiro, and the Xingu Indigenous Park (Brazil) have experienced successive technological transformations. These range from the proliferation of digital media to the increased circulation of data in public services, corporate platforms, and everyday devices (Oosterbeek et al., 2011, 2013; Robrahn-González, 2015, 2022, 2025; Cura et al., 2018; Martins et al., 2024). In this trajectory, artificial intelligence emerges as a recent turning point. Rather than introducing the presence of technology, it reorients existing disputes, directing some of them towards algorithmic infrastructures, classification models and predictive devices (Gillespie, 2014; Kitchin, 2017; Couldry and Mejias, 2019).

In this article, we understand AI as socio-technical mediation in this light. We are interested in its operational capabilities and the way it alters regimes of visibility, narrative forms and decision-making criteria, but also its potential to provide effective access to humanities knowledge, including non-academic knowledge, within an integrated framework of operationalisation (Beimisheva et al., 2025). Beyond its potential to replace previous forms of knowledge, AI intensifies the role of technical infrastructures in organising memory, social intelligibility, and collective action (Latour, 2005; Beer, 2017; Kitchin, 2017). It also allows us to deal with massive volumes of unstructured data, integrating them, through clearly documented methodologies (e.g. deep learning), into the broader information-to-decision processes of agency and governance.

Over the past few years, our collaborative projects with these communities have focused on landscapes and their sustainable management. Here, we define sustainable management as the capacity to develop locally situated, culturally rooted and socially legitimate responses to environmental, heritage and institutional challenges. In our partnerships with these three communities, processes always begin with concrete problems formulated by the communities themselves through reflection exercises on territorial preservation, the circulation of memories, the protection of sacred sites, and the continuity of ways of life (Oosterbeek et al., 2016; UNESCO, 2019; Clark and Harley, 2020).

In all these cases, the communities themselves have repeatedly identified the future as a central concern. This stems from observations of environmental transformations

in the territories, perceptions of climate change and economic pressures, and uncertainties regarding the continuity of cultural practices, connections to sacred sites and ways of life. Over the years, we have used Digital Humanities tools to support the representation of traditional elements in these contexts, and to create spaces where people can discuss their expectations, fears, and visions for the future. These spaces are anchored in materialities (e.g. re-conceptualising objects from the past) but can take the form of maps, visual narratives, cultural circuits, and devices of shared memory. This highlights the role of images and materiality in negotiating between memory and plans for the future (Oosterbeek, 2022). The recent engagement with AI thus represents an intensification of existing methodologies and issues, operating under expanded conditions of modelling, inference, circulation, and governance (Münster et al., 2019; Trillo et al., 2021; Flanders and Muñoz, 2022).

Instead of applying external models, methodologies have been developed at the intersection of local knowledge, digital humanities, geosciences, historical ecology, philosophical reflections and territorial mediation. This approach requires humanities' scientists who can assume the roles of analyst, methodological mediator and translator between regimes of knowledge simultaneously, without compromising the rigour of scientific research. Instead of simply applying predefined protocols, they must make the frameworks they use explicit, explain how they interpret territorial contexts and provide reasoned justifications for their choices when articulating scientific and community knowledge (Oosterbeek et al., 2016; Haider et al., 2018; Clark and Harley, 2020).

Throughout these different technological generations, we have maintained stable guiding principles alongside these communities: ethics, participation, cultural respect, and community leadership. From analogue instruments to artificial intelligence, our fundamental commitments remain whilst the scale and complexity of the dialogue expand. In this context, we consider under what conditions AI can align with these agendas while preserving community authority over cultural landscapes, memories, and visions of the future (European Commission, 2019; Robrahn-González, 2021; UNESCO, 2022).

It is important to emphasise that these previous initiatives have already produced a variety of tangible results. These include management tools, landscape restoration programmes and cultural agendas in Mação, Portugal (Louro, 2019; Oosterbeek, 2024); memory circuits and platforms for Afro-descendants in Rio de Janeiro; and government-protected remappings of sacred sites near the Xingu Indigenous Park in Brazil. While these processes are not detailed in this article, it is important to note that the current dialogue with AI builds upon this prior accumulation of applications, co-production and situated use of technologies in community contexts.

At present, communities are explicitly addressing issues that link memory and the future within broader economic, urban and territorial contexts. While concerns about preserving their cultural heritage remain, themes such as creative economy initiatives, territorial branding, cultural tourism, smart cultural districts and forms of advocacy in public policy are gaining prominence. The rapid expansion of AI thus opens a new chapter in this process. The central question is no longer merely how to represent and integrate complex knowledge; it now includes how algorithmic systems reconfigure knowledge production, cultural mediation, memory, governance, and collective capacities for anticipation. Against this backdrop, the 'Agora – Cultural Landscape Community AI Hub' project, initiated in 2025, revives past collaborations centred on the Earth and Memory Institute (Mação, Portugal), the Pretos Novos Research and Memory Institute (Rio de Janeiro, Brazil), and the Matipu Indigenous Association (Xingu, Brazil). This project provides the empirical setting through which this article articulates its evolving issues, principles, and geoethical inquiries (European Commission, 2010, 2014; Trillo et al., 2021; UNESCO, 2021; Robrahn-González, 2022; UNCTAD, 2022).

Situated understanding and critical education come before any line of code. It is important to recognise not only how to program the machine, but also who decides what it should prioritise and whom it should be designed to serve. Building on this, we propose the concept of cognitive sovereignty to describe the historical capacity of communities to sustain their own modes of memory, interpretation, classification and projection of the future. This involves incorporating, rejecting or reframing external influences according to their own criteria. Understood in these terms, cognitive sovereignty refers to arrangements in which different forms of knowledge (academic, indigenous, local) interact without any one knowledge system automatically imposing itself as the sole measure of intelligibility, legitimacy or the future.

Consequently, the co-production of knowledge introduces new variables into scientific practice itself when applied to research problems designed in collaboration with each community. This means sharing decisions with communities that would traditionally remain solely in the hands of experts, such as which experiences are accepted as evidence, how memories are recorded or protected, which categories of observation are adopted and how the relevance and scope of a model in a given territory are judged. This arrangement requires ongoing attention to the limits and scope of the tools used, as well as the possibility of revising procedures as new questions arise during the research process.

This text presents an exploration of this conceptual and methodological proposition, which is grounded in a long-standing collaborative trajectory that has recently entered a new phase with the explicit incorporation of AI. The text aims to highlight

the analytical framework, programmatic principles, emerging issues and geoethical concerns that now guide the ongoing work.

Thus, the article is organised around three main themes. The first analyses AI in terms of its function as an infrastructure for classification, memory and anticipatory governance, understood as an anthropological and socio-technical issue. The second theme proposes cognitive sovereignty as a concept through which to understand practices of collective control over regimes of knowledge, visibility and decision-making. The third theme examines Intercultural Living Labs as a specific methodological framework through which the local reconfigurations of these forms of sovereignty become more apparent in light of the recent advent of AI.

2. Conceptual framework

2.1. Knowledge, ontologies and territoriality

In the contexts in which we work, territory is not simply an area delineated on a map. It refers to a socio-spatial field constituted through material conditions, institutions, practices, affiliations, memories, power relations, political claims and ways of inhabiting. Territory therefore encompasses both the physical settings in which social relations unfold and the legal, political and institutional arrangements through which access, use, belonging and authority are negotiated (Werlen, 1993; Ingold, 2000; Escobar, 2008; Oosterbeek, 2025b).

In this article, landscape refers to the historically produced, culturally informed and materially grounded configurations through which different actors perceive, interpret, value and act upon a territory. Landscape is therefore neither a merely visual scene nor a subjective representation detached from material conditions. It emerges from the relationships between biophysical processes, built and archaeological features, social practices, memories, knowledge systems, institutions, power relations and expectations for the future. The same territory may consequently sustain multiple, partially overlapping or conflicting landscapes, as different actors engage with it through distinct histories, ontologies, interests and modes of dwelling (Werlen, 1993; Ingold, 2000; Oosterbeek, 2025b).

We use landscape as the principal operational concept because the article is concerned not only with territories as material and political fields, but also with the processes through which they become intelligible, meaningful and actionable. These are precisely the processes in which Digital Humanities tools, geoscientific instruments and AI systems intervene: they select categories, define scales, organise visibility, connect data and narratives, construct indicators and model possible futures.

The concept of landscape therefore enables us to examine both the materiality of territorial transformations and the plurality of interpretations, practices and aspirations through which communities and institutions engage with them. In the Brazilian contexts addressed in the article, the term territory frequently foregrounds belonging, memory, conflict, use and rights, whereas in European contexts it may more commonly evoke governance, planning and land-use regulation. Rather than erasing these differences, the concept of landscape enables us to analyse how these dimensions are interpreted, contested and brought together within specific cultural and historical configurations (Werlen, 1993; Escobar, 2008; Santos, 2014).
This ontological pluralism forms part of the analytical problem itself, directly influencing the way in which it is formulated. When algorithmic systems are designed based on categories that universalise certain ways of conceiving of space, time, causal nexus, risk or relevance, there is a risk of erasing, simplifying or distorting modes of existence that fall outside these conventions. Simply asking whether technology works in these contexts is insufficient. We must also ask for whom it works, on what assumptions it is based, through which operations of translation it functions, and what effects it has on pre-existing worldviews, the organisation of memory, authority, and decision-making. It is in this scenario that working with local ontologies and the concept of relational territoriality ceases to be a theoretical detail and becomes an ethical and epistemological criterion (Smith and Wobst, 2005; Mignolo, 2011; Santos, 2014).
This focus on ontological pluralism is based on ideas that have been developed in Amerindian anthropology, particularly the concepts of perspectivism and multinaturalism. These concepts shift the focus from cultural differences to differences in worlds, bodies and perspectives (Viveiros de Castro, 2002, 2015). When applied to territories, this shift means that technical categories are treated as decisions about which worlds and ontologies may or may not be made visible in data models and infrastructures.
However, this framework does not imply relativising the validation criteria inherent to scientific research, nor does it replace analysis with identity-based assertions. On the contrary, it requires a more rigorous articulation of the categories employed, the indicators selected, the scales of observation adopted and the interpretative limits of the models used. In pluriepistemic contexts, the analytical responsibility of researchers increases as they must now make the ontological and geoethical assumptions underpinning devices of territorial representation, classification systems, and instruments of anticipation visible in a methodologically explicit manner. The central issue is not just to produce good models, but also to understand how scientific and situated knowledge relate to one another and the effect this has on the production of territorial evidence (Haraway, 1988; Jasanoff, 2004; Oosterbeek, 2017a).

2.2. Artificial intelligence as an anthropological and socio-technical issue

Artificial intelligence now plays an increasingly prominent role in governance processes, planning, everyday mediation and knowledge production. In territorial contexts, AI intervenes through classification systems, predictive models, automated agents, visualisations, and decision support systems that reorganise information flows, prioritise relevance, and structure possibilities for action. This growing prominence makes AI a particularly fruitful subject for anthropological and socio-technical analysis, as it enables us to observe, on a larger scale, how categories, criteria of evidence, regimes of visibility and forms of anticipation operate in social life and the governance of territories (Latour, 2005; Gillespie, 2014; Beer, 2017).

In this way, AI systems play an increasingly active role in mediating how the world is rendered intelligible. They classify, correlate, filter, synthesise and project, thereby helping to shape what gains prominence, what is treated as a relevant signal, which patterns receive attention and which scenarios guide decisions. This role, however, is necessarily partial and conditioned by the data on which models are trained, the categories and objectives embedded in their design, and the institutional contexts in which their outputs are interpreted. AI systems cannot therefore be assumed to identify all relevant patterns, experiences or perspectives and may reproduce or amplify structural absences and biases unless these limitations are explicitly documented, critically assessed and addressed through plural data curation, participatory governance and human oversight. Through these operations, AI systems introduce mediations that touch upon central dimensions of social experience, such as memory, authority, judgement, prediction and collective coordination. Their analytical relevance stems from their capacity to influence the conversion of experiences into data, data into evidence and evidence into decisions (Boyd and Crawford, 2012; Beer, 2017; Couldry and Mejias, 2019).

This is why AI takes on a specific anthropological relevance in this article. Its presence intensifies the role of technical infrastructures in organising memory, social intelligibility and collective action. This makes the processes through which classifications, inferences and decision-making criteria become part of the daily lives of communities and institutions more visible. Rather than remaining confined to computation, AI now occupies the spaces where narratives, priorities, legitimisations and possible futures are defined. For anthropology, classic questions such as ‘who defines categories’, ‘who produces authority’, ‘how is memory organised’ and ‘how is the future imagined’ reappear today, intersected by algorithmic architectures and modelling systems (Jasanoff, 2016; Pink et al., 2018).

This interpretation has direct implications for the social geosciences and for geoethics. In processes of territorial, heritage and environmental management, AI is involved in tasks that are both technical and normative, such as constructing indicators, classifying risks, developing scenarios, visualising spatial dynamics, and setting priorities. Each of these operations involves assumptions about what should be measured, which scale matters, which relationships are made legible and which forms of vulnerability or collective permanence enter the analytical field of view. Therefore, the scientific evaluation of these systems benefits from a framework that considers technical performance, classifying assumptions, interpretative limits, and territorial effects simultaneously (Hartman, 2020; European Commission, 2019; UNESCO, 2022).

This framework is in line with recent anthropological and ethnographic approaches to AI. These approaches emphasise the importance of tracing the construction of models, data, and metrics within their specific contexts. This allows us to understand how technical categories become infrastructures of power and intelligibility (Sapignoli, 2021; Munk et al., 2022). These approaches treat algorithmic systems as socio-technical artefacts that encapsulate disputes between the market, science and ethics, while also reconfiguring what counts as evidence, objectivity and risk (D'Ignazio and Klein, 2020; Karczeski, 2022). Describing AI as an 'anthropological event' involves tracing its ethnographic processes of reorganising the categories of person, nature, and the future, rather than merely considering it as a technological innovation (Oliveira, 2018; Levin and Minyar-Beloruchev, 2024).

In this regard, geoethics can be defined as the study of the values that inform meanings, behaviours and practices when human activities interact with the Earth system. This includes the ethical, social and cultural implications of the knowledge and technical-scientific tools employed in these interactions. Therefore, geoethics is less a fixed code and more an attempt to articulate responsibilities within contexts characterised by specific materialities, different perception regimes, and diverse ethical traditions (Peppoloni and Di Capua, 2016, 2021; Sjursen and Oosterbeek, 2023).

The anthropological and socio-technical approach adds to the rigour of the analysis. Rather than viewing AI strictly from a technical perspective, it considers how the processes of modelling and representation reconfigure territorial realities in practice by influencing decisions, priorities, and what becomes visible or remains marginalised. The presence of AI in territorially situated contexts demands particular consideration of the connections between data, models, interpretations and social consequences (Jasanoff, 2016; Friberg, 2022).

It is within this framework that the need for situated and intercultural AI becomes clearer. When algorithmic systems enter environments shaped by histories of

colonisation, inequality, repression and resistance, their analysis must consider how categories, evidence and criteria of relevance are conceived, implemented, adopted, negotiated and disputed. The contemporary centrality of AI makes it a particularly productive field for observing how regimes of power and knowledge are reorganised within concrete cultural landscapes. When supported by plural datasets, critical interpretation and participatory governance, AI-assisted analysis may also help reveal how individuals and groups are positioned across multiple, overlapping and sometimes contradictory affiliations. However, such systems may equally reproduce reductive (Sen, 2006) or ethnocentric and anachronistic (Ginzburg, 1980) classifications when their underlying data and categories are insufficiently examined. Avoiding the reduction of persons and collectives to single labels therefore depends not on AI alone, but on the methodological, interpretative and governance arrangements through which it is designed and used. This discussion introduces cognitive sovereignty as an analytical problem aimed at understanding how different groups define the uses, limits and meanings of AI. These decisions simultaneously constitute geoethical choices regarding what is counted, protected and projected in each territory.

The redefinition of these boundaries forms part of a broader anthropological debate concerning the redefinition of 'human' in relation to animals, spirits and machines. The ecological crisis and the development of AI have exposed the limitations of modern ontologies, creating an opportunity for alternative forms of cosmopolitanism to emerge (Viveiros de Castro, 2002, 2015).

In this context, AI can play a major role in bridging different knowledge avenues and, particularly, in rendering accessible the vast amount of humanistic documentation, from historical and archaeological reconstructions (LaMonica and Foka, 2026), to literary narratives, philosophical considerations (Maurya and Singh, 2026) or individual testimonies through time. It helps structure dialogues across all these contributions and between them and natural and social sciences, within a common framework encompassing several time and space scales.

2.3. Anticipatory governance, participation and cognitive sovereignty

The increasing use of AI in public policy, territorial management and planning mechanisms is closely linked to a concept known as 'anticipatory governance'. This refers to a set of practices through which models, scenarios, simulations and classification systems aim to predict and manage future risks, trends and potential interventions (Miller and Bennett, 2008; Guston, 2014; Jasanoff and Kim, 2015).

In contexts characterised by climate crisis, urban pressure, land conflicts or socio-environmental vulnerabilities (such as those affecting the territories with which we work), the use of algorithmic systems to identify threats, prioritise issues and inform decision-making is becoming increasingly prevalent. At different scales, these modelled futures condense interests, historical experiences, spatial categories and specific ontologies, which are often associated with technocratic frameworks that are presented as universal. In the contexts in which we work, the central analytical question is to understand how these mechanisms define risk, the forms of territorial continuity they render visible and the futures they marginalise (Goldsmith and Crawford, 2014; Guston, 2014; Anderson et al., 2022).

At this stage, participation becomes a constitutive dimension of both the research and the modelling process. In co-production arrangements, such as the one described in this article, the focus is on defining the problems to be addressed, the knowledge to be used as input, the relevant indicators and the criteria by which risk, success and sustainability are formulated in each territory. It also establishes the conditions under which results may be accepted, contested or revised. In this way, co-production broadens the analytical scope of the research. From the initial formulation of the problem onwards, it introduces alternative criteria, forms of evidence and ways of defining risk, success and sustainability in each territory. This means that methodological decisions are no longer made exclusively within the scientific community but instead negotiated within shared arrangements of anticipatory governance (Stilgoe et al., 2013; Smith et al., 2018; Shrivastava et al., 2020).

This formulation aligns with wider discussions on data and cognitive sovereignty, emphasising the importance of safeguarding individuals' and communities' ability to control how their data, narratives and mental processes are captured, inferred and redirected by digital infrastructures (Kukutai and Taylor, 2016; Carroll et al., 2020; Fast Company Brasil, 2025). Without reducing the discussion to individual privacy, these approaches emphasise the defence of autonomous regimes of attention, memory and interpretation in the face of the expansion of AI systems that standardise how we perceive the world (Silva, 2025; Almeida, 2026).

It is here that the notion of cognitive sovereignty takes centre stage. As previously defined, it constitutes the historical and continually reconfigured capacity of a collective to maintain authority over how memory, experience, classification, evidence and the future are organised within contexts of intense technical mediation. This relational and contested capacity is traversed by internal conflicts, institutional pressures, asymmetries and constant negotiations. The emphasis lies in the concrete practices through which collectives select, curate, translate, restrict, reinterpret or reject mediations that present themselves as inevitable or epistemically superior (Jasanoff, 2004; Visvanathan, 2009; Santos, 2014).

In this sense, cognitive sovereignty helps organise a field of relationships in which different forms of knowledge are co-produced and retain the ability to influence the definition of intelligibility, legitimacy, and the future. For scientific research, this implies re-evaluating the criteria used to formulate problems, select categories and indicators, qualify evidence and define the scales at which models operate. This allows the arrangements of authority and dispute that structure each territory to be explicitly incorporated. It is precisely here that the argument touches on geoethics in the strongest sense: decisions about what to measure, how to represent things, which risks to prioritise, which scenarios to model, and which things to make visible cease to be merely technical options and become geoethical decisions embedded in socio-technical infrastructures of territorial knowledge.

This interpretation is consistent with the international literature, which identifies responsibility as a key aspect of geoethics. Responsibility is not only understood as a professional code of conduct for the geosciences, but also as a means of making prudent, context-sensitive, and socially justifiable decisions in situations where technical knowledge, the environment, and the collective future are intertwined (Bobrowsky et al., 2017; Lucchesi, 2017; Peppoloni and Di Capua, 2021).

Consequently, the future emerges as a relational dimension of territorial life. It is linked to a collective's capacity to sustain continuities, anticipate threats, envisage desirable changes and negotiate paths in the face of environmental, economic and political changes. For this reason, cognitive sovereignty also encompasses the authority to shape expectations, interpret signs of change and define the terms through which possible futures can be represented, debated and monitored in collective decision-making processes (Jasanoff and Kim, 2015; Zheng et al., 2021; Notarstefano, 2022).

These disputes become most visible in arrangements such as Intercultural Living Labs. Controversies surrounding categories, indicators, regimes of visibility and criteria of relevance in these spaces make it clear that anticipatory governance involves technical, cognitive and political dimensions simultaneously. Throughout the process outlined in this article, digital humanities tools such as symbolic maps, territorial simulators and multimedia narratives had already been used to highlight traditional features of territories and ground discussions about the future in shared representations. As the projects became more complex, practices linked to cultural diplomacy, intergovernmental relations and multilevel governance were also incorporated, thereby expanding the capacity for translation between communities, institutions, decision-making levels and languages of intervention. The current phase, supported by AI systems, further expands this potential for modelling and comparing scenarios whilst preserving community leadership in assessment and decision-making and the analytical responsibility of researchers.

In our experience, these issues have converged to form a number of programmatic guidelines, which stem from both accumulated fieldwork experience and dialogue with international forums, including discussions held within the framework of UNESCO. The following stand out in particular: ethical and critical education in AI; the construction of governance frameworks sensitive to cultural plurality; and the use of AI as a potential mediator of social cohesion when co-created in line with heritage education initiatives and territorial citizenship training developed over the past few decades (Oosterbeek, 2017b). Rather than being fixed, this list of principles is continually readjusted by concrete experiences, the limitations of technological systems and local forms of negotiation regarding memory, territory and the future (UNESCO, 2017; European Commission, 2019; Morisano et al., 2024).

In this context, regulatory sandboxes can be understood as a contemporary institutional manifestation of anticipatory governance. They create controlled, temporary environments for experimentation and combine oversight, regulatory learning, and evidence generation to refine regulations. The recent landscape in the European Union also shows that such mechanisms have been introduced to reduce regulatory uncertainty, identify regulatory gaps, facilitate the transition from research to application and enable more agile, forward-looking policy-making. However, the European experience indicates that the effectiveness of these arrangements depends on institutional coordination, clarity of objectives, communication between stakeholders and strong links with other forms of experimentation, such as living labs, testbeds and innovation hubs. In this light, regulatory sandboxes cease to appear merely as an administrative tool for regulation. Instead, they become part of a broader field of socio-technical mediations, in which the terms of the legitimisation, testing, containment, and eventual incorporation of innovations in socially situated contexts are negotiated in advance (European Commission, 2026).

3. Research architecture: Intercultural Living Labs and co-creation arrangements

3.1. Intercultural Living Labs as social formations and mediation devices

Throughout this study, we use the term ‘Intercultural Living Labs’ to refer to collaborative working arrangements that bring together various experimental environments, including Fab Labs, Makerspaces, community meeting spaces and digital devices for representation and simulation, to address challenges defined

by the communities themselves. These formats have specific functions ranging from technical prototyping and collective listening to the production of shared representations and deliberation on the uses of data, images, and narratives. Here, the analytical interest lies less in rigidly distinguishing each format and more in understanding the ecosystem formed when they begin to operate in an integrated manner within processes of territorial co-production (Robrahn-González, 2015; Oosterbeek, 2017a; Gould, 2018).

From this perspective, Intercultural Living Labs are specific social formations that mediate between different regimes of knowledge, institutional scales, and temporalities. They bring together the expectations, conflicts, alliances, asymmetries and forms of translation of communities, researchers, public institutions and technical infrastructures. Consequently, these Living Labs provide a valuable opportunity to observe how territorial experiences become visible, negotiable and open to discussion through maps, simulators, repositories, digital narratives and, more recently, AI systems. Their methodological relevance stems from the ability to track, in a situated manner, how categories, evidence, priorities and criteria of legitimacy circulate among different actors and achieve provisional forms of stabilisation. Such stabilisations are integral to the historical dynamics of societies.

Within these dynamics, interpretative and decision-making frameworks may persist for a time, guiding action while remaining open to readjustment, displacement or abandonment. Living Labs facilitate the observation of these processes because they bring them together in concentrated frameworks of mediation, experimentation and deliberation situated in specific territories. In these contexts, categories, scales of analysis, forms of representation, and decision-making criteria directly impact cultural landscapes and their potential futures (Gregory, 2018; Chevalier and Buckles, 2019; Grcheva and Vehbi, 2021).

The trajectory of these Intercultural Living Labs predates the adoption of the term in our projects. For decades, these partnerships have been organising in-person meetings, utilising Digital Humanities tools, conducting public feedback sessions, establishing representation agreements and making shared decisions regarding the use and circulation of data. This has been done in dialogue with examples of social innovation and territorial management in which co-creation labs were deployed as mediation tools (Carbone et al., 2013, 2020). Being designated as Intercultural Living Labs enhances the analytical clarity of this working framework as a situated methodological arrangement capable of articulating mediation, experimentation, and territorial deliberation. It also clarifies the transition from the previous phase, which focused more on representation, memory and preservation, to the current phase in which AI systems integrate modelling processes, scenario comparisons and reflection on the future (Robrahn-González, 2015; Oosterbeek, 2017a; Gregory, 2018).

Throughout this process, various concrete mediation ecosystems have been designed, adopted and adapted in close dialogue and consultation with the communities. These ecosystems include social territory simulators, participatory control rooms, narrative interfaces, multimedia repositories and digital environments with differentiated access. In addition to the technical dimension, the curation of these ecosystems encompasses decisions regarding visibility, restriction, circulation, safeguarding and the duration of use. The Intercultural Living Labs provide a particularly fertile methodological field in which to examine how processes of territorial mediation integrate geoscientific categories, historical narratives, community protocols, digital modelling and geoethical criteria within a single research framework (Münster et al., 2019; Filgueiras et al., 2020; Longo et al., 2020). In this sense, Living Labs can be understood as spaces for the situated application of geoethics, as they reveal the processes through which different stakeholders negotiate values, responsibilities, the limits of intervention, and legitimate ways of linking specialised knowledge, situated knowledge and local conditions (Peppoloni and Di Capua, 2016; Di Capua et al., 2021).
As previously mentioned, within these frameworks, scientific work plays an active role in constructing and articulating frameworks, translating between languages and scales, formalising categories and evaluating the interpretative limitations of models. Living Labs are therefore of interest as they intertwine co-production, modelling, mediation and analytical accountability in a particularly visible way (Bray et al., 2000; McNiff, 2013; Clark and Harley, 2020).

3.2. Interculturality, translation and the co-production of knowledge in AI within Intercultural Living Labs

In Intercultural Living Labs, interculturality emerges as an ongoing process of translation and negotiation of meanings, as well as the construction of partial equivalences – that is to say, provisional approximations – between distinct reference universes. Across the three community contexts currently integrated into the project (a rural community in Mação, Portugal; the Matipu Indigenous community in the Xingu region of the Brazilian Amazon; and an urban Afro-descendant community in Rio de Janeiro, Brazil), local participants engage with researchers, technical specialists and institutional actors around AI systems. The issue at stake extends beyond access to a new technology. Central to these interactions is the possibility of incorporating territorial experiences, forms of memory, locally defined criteria of relevance and distinct worldviews into systems that typically operate through standardised classifications, technical terminology and universalising assumptions (Stockhammer, 2012; Ingold, 2017; Samanani, 2022).

In this context, terms such as 'data', 'model', 'risk', 'indicator', 'evidence' and 'future' take on political and epistemic depth. Rather than functioning as transparent categories, they become the subject of dispute, retranslation, semantic adjustment and, in certain situations, explicit rejection. It is precisely in this process that interculturality becomes methodologically relevant: it enables us to observe how different communities render AI systems intelligible through their own repertoires, thereby influencing the framing of problems, the criteria of relevance, and the validation methods employed by the research. Translation is thus integral to the process of producing knowledge in multi-epistemic contexts (Curry et al., 2010; Tamaro et al., 2019; Flanders and Muñoz, 2022).

Living Labs facilitate the observation of this process because they provide a structured environment for experimentation, conceptual clarification, the comparison of perspectives, and deliberation on potential applications. Exercises such as symbolic mapping, joint indicator construction, scenario formulation and digital tool or algorithmic prototype use allow us to track how technical categories are appropriated, rejected, displaced or re-inscribed within local grammars of care, memory, territory and protection. The co-production of knowledge in AI thus takes on a precise meaning: it involves opening up the framing of problems, devices, and evaluation criteria to effective dialogue with forms of knowledge that organise relationships with territory, the future, and interpretative authority in their own ways (Smith and Wobst, 2005; Atalay, 2012; Roberts et al., 2020).

It is important to emphasise that Living Labs are one context in which this translation work becomes particularly observable, building on negotiations that communities carry out through other channels. By proposing exercises in symbolic mapping, the joint construction of indicators or scenario simulation using digital tools, we create another arrangement in which these negotiations become partially visible within the scope of our work and under agreed conditions. The co-production of knowledge in AI refers to the explicit opening up of system and device design to perspectives that, through their own channels, are already reconfiguring what counts as data, risk, evidence and memory in specific territorial contexts (Smith and Wobst, 2005; Atalay, 2012; Roberts et al., 2020).

This architecture highlights the difference between co-production and the aggregation of contributions more clearly. The process creates conditions in which different forms of knowledge influence the definition of what merits modelling and what counts as evidence. It also influences the parameters by which a system may be considered relevant (or not) in a given territory. Consequently, researchers' roles become more precise: they must make assumptions explicit, render distinct languages comparable, identify areas of incommensurability, formalise analytical criteria and describe rigorously what becomes translatable, contestable or unresolved at each stage.

Content curation – deciding what to include or exclude, and under what conditions – is an integral part of this process. In different contexts, communities define what can be recorded, in what format, for what purpose, with what degree of openness and under what protection, review or removal protocols. These decisions are integral to the architecture of the resulting knowledge, as they influence what is included as input, what remains restricted, what can circulate and what requires specific frameworks and modes of interpretation. In this sense, ethics emerges as a practice of governing what is visible and shareable. It is closely linked to the intercultural conditions of knowledge production and the ways in which different territories regulate the relationship between memory, exposure, protection, and the future (Curry et al., 2010; Tamaro et al., 2019; Lombardo et al., 2020).

It is in this context that the methodological and geoethical problems of intercultural AI become apparent. Systems deployed in these contexts depend on the quality of translations, the robustness of curatorial protocols, the clarity of representation criteria and arrangements that allow for joint monitoring of how categories and inferences stabilise throughout the process. For researchers, this means acknowledging that seemingly technical decisions (e.g. how to train a model, the dataset used, or the type of interface offered) directly affect memory, visibility, and opportunities for action in each territory. Interculturality therefore ceases to be an additional framework and becomes a prerequisite for the use of AI in complex territorial contexts (European Commission, 2019; UNESCO, 2022; Loveridge et al., 2024).

3.3. Cognitive sovereignty: dimensions and disputes in Intercultural Living Labs

In Intercultural Living Labs, cognitive sovereignty is particularly evident because decisions regarding knowledge, mediation and the circulation of content are discussed, formalised and tested within specific working arrangements. This enables us to observe in real time how different groups define criteria of relevance, visibility and use in territorial modelling processes and engagement with digital technologies and AI systems (Haraway, 1988; Visvanathan, 2009; Santos, 2014).

From this perspective, we propose analysing cognitive sovereignty across three interconnected dimensions: the epistemic, infrastructural and political. The epistemic dimension refers to the capacity to define which knowledge, categories, indicators and forms of evidence are considered relevant when describing and modelling territories. This involves decisions about including oral narratives, memories of conflict, local classifications, cosmologies, and situated forms of environmental perception in Digital Humanities ecosystems and AI systems. The infrastructural dimension concerns

control over the means of mediation that organise attention, circulation, storage and access, such as platforms, simulators, repositories, interfaces, agents and digital environments with varying degrees of openness. The political dimension focuses on the ability to effectively challenge, reorient, condition or refuse technological uses affecting memory, visibility, territory and ways of life (Kitchin, 2017; Couldry and Mejias, 2019; UNESCO, 2022).

In practice, these dimensions are reflected in decisions relating to access protocols, visibility levels, recording priorities, validation methods, circulation timeframes and content review or removal criteria. Some of these decisions are debated in co-creation committees in our partnerships and incorporated into the governance arrangements of the repositories and devices used. Analysing these instances allows us to observe how disputes surrounding evidence, authority, confidentiality, preservation, public utility and territorial future become integral to the methodological design of the research itself (Carroll et al., 2019; UNESCO, 2022; Morisano et al., 2024).

One particularly concrete element of this arrangement is the 'Co-creation Partnership Agreement' signed by the Terra e Memoria Institute and community organisations. This formalises principles such as FAIR/CARE, free prior and informed consent, and privacy safeguards, as well as community authority to control the use, circulation and review of sensitive content made available or produced by the communities within the scope of the partnership, and the decision not to disclose such content if necessary. Rather than being merely an administrative document, the Agreement functions as a methodological and geoethical framework, translating aspects that often remain implicit in academic projects into explicit rules. This makes the limits of access, the conditions of use of materials, and the distribution of authority over data, narratives, copyright, and community-sourced representations produced within the scope of the research verifiable. In this sense, it gives concrete form to cognitive sovereignty in the investigation and governance of territorial knowledge procedures.

These choices link the concept of Intercultural Living Labs to a broader agenda of data sovereignty. In this context, the openness and reuse of scientific information must be balanced with the autonomy of communities and institutions to determine how their data is aggregated, recontextualised and utilised by AI systems (Kukutai and Taylor, 2016; Carroll et al., 2020; Silva, 2025). In open science and territorial modelling contexts, cognitive and data sovereignty converge to ensure that the increased circulation of data does not undermine local forms of authority, secrecy, evidence, or the future through technical means (Carroll et al., 2020; Walter et al., 2021).

Analysing these disputes also makes the internal heterogeneity of the collectives involved more visible. Cognitive sovereignty reveals its full analytical scope when viewed as a field of negotiation between generations, political positions, institutional experiences, expectations regarding technology and different approaches to memory

and territory. Rather than assuming a homogeneous communal will, the concept enables us to describe how priorities, sensitivities, and criteria for protection or openness are discussed, adjusted, and sometimes put under strain internally. Living Labs make these distinctions more explicit by bringing together actors who occupy diverse positions within the collectives themselves and in the institutions with which they interact, around concrete mechanisms and decisions (Aldridge, 2016; Samanani, 2022; Loveridge et al., 2024).

This heterogeneity also broadens the analytical scope of cognitive sovereignty. The concept describes a historical process of composition, contestation and repositioning in relation to knowledge infrastructures and mediation devices. Its utility lies in enabling analysis of the gradations, tensions, interruptions and rearrangements in how collectives maintain authority over memory, classification, evidence and the future. In territorial contexts characterised by historical asymmetries, this approach reveals how seemingly technical decisions (e.g. those relating to indicators, scales of analysis, open data or interface design) can significantly impact the collective ability to influence the continuity of cultural landscapes and ways of life.

For researchers, tracking these three dimensions of cognitive sovereignty is a demanding analytical task. This involves describing how categories are produced and negotiated, how infrastructures encode power relations and how protocols of visibility and technical decisions incorporate geoethical consequences. It also requires integrating these elements into scientific criteria for problem formulation, evidence assessment, scenario modelling, and methodological evaluation.

The "Agora – Cultural Landscape Community AI Hub" project contributes in this area. Communities are already discussing ways to defend their territories and ways of life in a variety of forums. The scientific partnership provides analytical frameworks, research tools and modelling instruments to link this knowledge with academic practices and practical solutions to the specific challenges facing cultural landscapes. In this context, cognitive sovereignty no longer merely functions as an organising concept for the argument, but also as a methodological principle for integrating scientific and situated knowledge into robust, academically sound and territorially relevant research processes.

4. Methodological design

4.1. Communities involved

This article is based on three partnerships between the research team and territorially situated collectives. These collectives are considered here as relational

contexts of co-production, which entered a new phase of explicit dialogue with artificial intelligence in 2025 (Smith and Wobst, 2005; Robrahn-González, 2015; Oosterbeek, 2017a).

The first partnership is with a rural community in the Médio Tejo region of Portugal, Mação, where we collaborate on initiatives in education, applied archaeology, and the reconstruction of territories of memory. This community combines strong local roots with dispersed family networks and challenges of generational continuity. Here, issues related to land use and the severe impact of environmental disasters, such as forest fires or large-scale flooding, coexist with places of devotion, memories of labour, and population decline. This makes discussions on visibility, representation, and generational continuity particularly sensitive, as efforts are made to reinterpret heritage as a living resource (Oosterbeek et al., 2016; Nocca, 2017; Oosterbeek, 2017a).

The second context is located in the port area of Rio de Janeiro, Brazil. It is centred on the Instituto de Pesquisa e Memória Pretos Novos, which is located in an area of Afro-Brazilian heritage that has been deeply affected by historical violence, silencing, and the struggle for recognition. Processes of urban archaeology, the creation of memory circuits, digital platforms and geospatial visualisations have helped to change perceptions of the area. These processes bring together archaeological heritage, the memory of enslavement, and contemporary struggles for the valorisation and preservation of cultural landscapes associated with the history of slavery and the Afro-Brazilian community living there today. In this context, debates about who can access what content, under what terms, and within what institutional frameworks, permeate decisions regarding content accessibility and current discussions on the use of AI in education, cultural mediation, and urban governance processes (Little and Shackel, 2014; Robrahn-González, 2015, 2022).

The third context is that of the Matipu indigenous community in Brazil. Situated within the broader history of the peoples inhabiting the Xingu Indigenous Park, the community has been affected by land conflicts, pressure on natural resources, and disputes over the recognition of ancestral territories. Over the years, we have conducted cultural mapping exercises, provided training in digital tools and secured federal recognition of sacred sites located beyond the boundaries of the Indigenous Park (including assisting in the creation of 3D replicas of sites that have been vandalised), all in accordance with our protocols for safeguarding and collective decision-making. In this context, issues of cognitive sovereignty are linked to concerns regarding the protection of sensitive knowledge, intergenerational continuity and the relationship between territories officially recognised by the Brazilian government as Indigenous Lands, and spaces of ritual circulation that transcend administrative boundaries (Smith and Wobst, 2005; Atalay, 2012; Morisano et al., 2024).

These three contexts are not used to make an abstract comparison between different realities; rather, they allow us to observe how issues of memory, territory, representation, visibility and the future are articulated within concrete cultural landscapes, on different scales and in different configurations. In each case, the recent introduction of AI intersects with previous trajectories of digital mediation, methodological experimentation and institutional negotiation, which are dense enough to render the ongoing reconfigurations intelligible. The "Agora Cultural Landscape Community AI Hub" project therefore observes the incorporation of technology into social and territorial ecosystems that were already devising responses to problems of preservation, recognition, development, continuity and transformation through their own means.

In all these contexts, 'community' does not refer to a homogeneous group, but rather to sets of individuals who differ in terms of generation, activity, beliefs, gender, political stance, institutional affiliation, and relationship with technology. In Mação, for instance, there are older farmers alongside young people who move between rural areas and urban centres, as well as municipal technicians and cultural agents, all of whom have different expectations regarding heritage and the future. In indigenous territories, traditional leaders, women, young people, and representatives of external organisations do not always share the same priorities regarding the digitisation of knowledge or the visibility of cultural landscapes. In the port area of Rio de Janeiro, long-standing residents, newcomers, public officials and visitors contest narratives concerning memory, tourism and urban regeneration.

Embracing this heterogeneity is integral to the study's methodological design. Rather than speaking 'on behalf' of communities, we observe how different internal groups negotiate, challenge or adapt the digital mediations and AI proposals involved in managing and shaping the future of these territories. We also contribute to addressing their priorities and requests, particularly through capacity building and the development of tools for anticipatory governance grounded in long-term data series and landscape-scale analysis.

4.2. A history of collaboration

The trajectory underlying this article began over fifteen years ago, before artificial intelligence was explicitly introduced into the partnerships. The common theme throughout has been the co-production of knowledge relating to cultural landscapes, applied archaeology, heritage management, socio-cultural inclusion, and experimentation with digital technologies. Throughout this process, various tools have been developed, tested and adopted, including spaces of memory and innovation,

social territory simulators, narrative landscapes platforms, multimedia repositories, cultural digital twins, participatory control rooms, cultural circuits and virtual museums. These tools have been created in dialogue with the challenges raised by the communities themselves. The phase launched in 2025 with the 'Agora – Cultural Landscape Community AI Hub' project builds directly on this body of work, reorienting it towards new issues related to AI modelling, anticipation, and the governance of territorial futures (Robrahn-González, 2015; Oosterbeek, 2017a; Gould, 2018).

This long duration is not merely a historical antecedent of the project. It is integral to its methodological design. It is this duration that enables us to view the current phase as an extension of prior processes of translation, experimentation and negotiation rather than as the sudden imposition of an external technological agenda. It also lends consistency to the identification of programmatic principles, points of attention, and emerging issues in the new phase involving AI. Therefore, these reflections are not based on isolated observations from recent workshops. Rather, they are anchored in working relationships that have been built up over time, within which the current phase with AI can be interpreted.

For instance, in Mação, following a severe fire hazard back in 2003 that affected over 90% of the territory, a series of permanent initiatives were deployed, based on a partnership involving the municipality, the Polytechnic University of Tomar, NGOs and several communities. Spaces of memory, structured around objects and their memories, were the first tools to engage conversations about local problems and means to assess them. This was then combined with the building of several datasets (environment, heritage and beyond), also engaging hands-on experiments and regular conversation across clusters of concern (the management of the forest and the land; education, social care amidst population decrease and ageing, inclusion, etc.), building of time series approaches to the past of the territory and digital tools (from GIS to augmented reality). Over more than twenty years, this long-term collaboration has combined sustained local trust-building with participation in international knowledge networks. Global networking has functioned as a means of addressing locally defined challenges rather than as an end in itself. Mação's participation in five UNESCO networks (Oosterbeek, 2024) has supported exchanges, institutional learning and access to broader frameworks, while local communities have continued to develop site-based strategies through sustained engagement and perseverance. This trajectory also helped to inform wider approaches to integrated landscape management, including the national policy framework adopted in Portugal in 2020 (Portugal, 2020) and subsequently supported through the European Union's Recovery and Resilience Programme.

Throughout this journey, the priorities set by the communities have evolved. In the early years of the partnerships, the work focused on protecting sacred sites,

historic structures, archaeological sites and sites of historical violence, as well as endangered cultural practices, against a backdrop of intense territorial pressure and attempts to silence them. Over time, these concerns evolved to encompass questions about how cultural landscapes could support the creative economy, strengthen territorial identities, reinforce cultural tourism circuits with an ethnic and historical focus, and influence public policy. At this stage, the Intercultural Living Labs record memories and become spaces where communities experiment with ways of linking preservation, income generation, institutional recognition, and intervention in urban and rural agendas. The arrival of AI in 2025 coincides with this shift, fitting into an agenda that combines memory and the future, and offering new means of modelling scenarios, comparing alternatives, and providing analytical support for claims regarding territorial visibility and sustainability.

4.3. Methodological procedures and community contexts

Methodologically, the research combines ethnographic procedures, co-design tools and digital experimentation, as well as protocols for the shared governance of the produced materials. The heterogeneous methodological framework comprises participant observation, interviews, records of formal and informal meetings, and the production of symbolic maps, visual narratives, panels, digital prototypes, simulators and test environments with AI tools. This framework was developed in dialogue with the communities and is subject to varying degrees of openness, restriction and review. The Intercultural Living Labs occupy a central place within this framework in the production and observation of these materials by concentrating processes of negotiation, curation and problematisation, which are also distributed across other spaces (Whyte, 1991; McNiff, 2013; Aldridge, 2016).

The procedures also incorporate actions situated within the territories themselves, carried out by the communities as part of their regular activities, as well as activities accompanied or shared with the research team. These include walking through areas of cultural and environmental significance; recording on-site reflections; identifying sensitive landscape features; evoking situated memories; monitoring socio-environmental sustainability challenges defined by the communities themselves; and participating in existing practices, such as cultural tours, rites, ceremonies, celebrations, and other forms of territorial engagement. This presence enables us to integrate the intangible dimensions of the landscape (connections, perceptions, embodied memories, rhythms of use and modes of engagement with the territory) into the research, which are not always captured by recording methods detached from the situated experience.

Each work cycle is prepared in conjunction with local partners and is based on the definition of priority themes, meeting formats, participants, recording methods, and expectations regarding the use of generated materials. This includes decisions on what can be documented, the medium to be used, the purpose, the levels of access and the scope for subsequent revision or editing. Currently, this arrangement operates within the framework set out in the Co-creation Partnership Agreement. This agreement serves as a methodological reference for governing the materials, recording mechanisms and jointly defined limits on circulation. The ongoing tests with generative AI and territorial modelling are also situated within this framework. These tests are always developed in protected environments and are subject to community decision-making regarding their scope, their uses, and the possible future release of the results (UNESCO, 2017; European Commission, 2019; Morisano et al., 2024).

Currently, when we refer to 'AI', we are more specifically referring to a limited set of applications under development within the project, including generative AI for experimentation with languages, narratives, and forms of representation; territorial modelling for visualisation, scenario comparison, and reflection on memory, risk, and the future; and AI agent and device prototypes for organising, curating, and exploring heterogeneous materials produced within the scope of the partnerships. Methodologically, the article focuses on these specific families of AI applications insofar as they engage with concrete problems formulated by the communities. All of these applications are developed in isolated and secure test environments (community sandboxes) which are designed as restricted and reversible spaces for experimentation.

Although our community sandboxes do not correspond to state regulatory sandboxes in the strict sense, they share the same logic of bounded, reversible, learning-oriented experimentation. The key difference is that the focus of oversight and validation here is organised primarily around the community's authority over uses, visibility, risk, and the circulation of results, rather than merely around regulatory compliance (European Commission, 2026).

The corpus referred to in this article is derived directly from this arrangement. This includes field notes, simple minutes, agreed audiovisual records, locally produced materials, outputs from digital tools in protected test environments and documentation generated during the monitoring of territorial activities. In accordance with the Co-creation Partnership Agreement, the communities retain the authority to decide which tools and datasets may be used and what type of information is permitted. These materials are stored in shared repositories with differentiated levels of access, which are defined jointly. They remain subject to correction, further restriction or removal in accordance with the established agreements. The analysis presented

in the article focuses less on measuring the immediate impacts of this phase, and more on identifying emerging patterns of problematisation, translation, curation, categorical negotiation, and dispute surrounding memory, risk, evidence, visibility, and the future (Whyte, 1991; Chevalier and Buckles, 2019; Morisano et al., 2024).

The explicit incorporation of AI has also led the project to systematise and articulate large volumes of heterogeneous data derived from academic research, community-produced materials and official documents, organised according to the issues identified within each partnership. In the academic sphere, this process brings together contributions from different disciplines concerned with territorial challenges, focusing less on the accumulation of individual specialisms than on the intersections between them that may generate insights, inspire responses and identify promising areas for further investigation. In the community contexts, it involves organising materials already produced or circulating within the territories so that they can enter into dialogue with this broader body of knowledge, under the access, curation and governance conditions established by each partnership. Building on this ongoing work, a subsequent methodological phase is being planned to involve academic specialists in topics identified as particularly relevant, integrating their contributions into collaborative working sessions, collective reflection and other formats of joint development (Rocha and Gouveia, 2018; Filgueiras et al., 2020; Flanders and Muñoz, 2022).

The analysis considers both the thematic content of the materials and the socio-technical conditions of their production and circulation. This includes examining who proposes categories, how certain indicators become relevant, how content is regarded as evidence and the conditions under which particular representations are accepted, revised or rejected. The methodology seeks to integrate elements emerging from Living Labs and territorial actions with the research's scientific criteria, incorporating them into problem formulation, scenario modelling, mechanism evaluation, and articulating the study's interpretative limits. The specific contribution of the 'Agora – Cultural Landscape Community AI Hub' project lies precisely in this integration: articulating scientific and situated knowledge into robust methodological responses to the concrete challenges of cultural landscapes without supplanting community agency already exercised in other forums (Jasanoff, 2004; Couldry and Mejias, 2019; Hartman, 2020).

As previously mentioned, the AI phase is still in its infancy, having only begun in 2025. Consequently, the scope of this article's empirical findings is intentionally preliminary. It does not present any established findings on system performance, changes in governance, or consolidated effects on the territory. Instead, it focuses on outlining the methodological arrangements, operational principles, emerging issues, and analytical criteria that will guide this new phase of research.

At the same time, these methodological choices are not set in stone. In a programme of work based on co-production and adaptive management, mechanisms, protocols, tools and modes of analysis are expected to be continually refined, expanded or replaced as new issues arise, communities reorient their priorities and the AI experiments themselves reveal unforeseen limits and possibilities. This openness is integral to the research design, embodying the geoethical and intercultural principles that underpin the project.

4.4. Transdisciplinarity and citizen science

The 'Agora – Cultural Landscape Community AI Hub' project is based on a transdisciplinary premise of co-production between scientific disciplines, professional expertise, and the local knowledge of communities. This approach is geared towards addressing complex sustainability challenges in specific territorial contexts. From this perspective, transdisciplinarity is a method of problem formulation, evidence integration and response development, rather than merely a heterogeneous team composition. The methodological value of transdisciplinarity lies in its ability to construct working languages, comparable categories and shared frameworks that can articulate different forms of knowledge concerning specific territorial issues.

In this context, the concept of the citizen scientist becomes very concrete. Representatives nominated by the communities themselves participate in the research, acting as intermediaries in the definition of priorities, the monitoring of mechanisms, the interpretation of materials and the discussion of criteria of relevance. This participation enhances the analytical relevance of the research because, from the formulation of the problem onwards, it introduces situated knowledge regarding memory, territory, risk, visibility and the future. For researchers, this means working alongside these interlocutors, making methodological choices transparent, and creating space for discussion, adjustment and challenge throughout the process. This approach reinforces the public and shared dimension of research in multi-epistemic contexts.

The collective construction of knowledge by human societies is thus understood as a practice of methodological integration. The central focus is on creating conditions in which the differences between academic science and other knowledge systems can be meaningfully integrated, enabling the definition of problems, evidence and desirable futures to be distributed amongst different forms of knowledge in dialogue. In this dynamic, transdisciplinarity brings distinct fields closer together and broadens the range of solutions, alternatives and ways of addressing sustainable development

problems defined by communities. This is because it draws upon different cognitive systems, diverse accumulated experiences, and plural repertoires of ideas and worldviews.

Transdisciplinarity is thus linked to cognitive sovereignty in that it seeks to create conditions in which the integration of scientific and situated knowledge strengthens the collective capacity to guide decisions regarding territories and cultural landscapes while preserving the analytical rigour necessary for academic research. More broadly, this combination of transdisciplinarity and public participation resembles approaches that treat citizen science as a means of merging various areas of expertise and connecting professional science with society (Bonney et al., 2009; Haklay, 2013; Oosterbeek, 2025a).

In the current era of AI, the relevance of this transdisciplinary architecture is increasing. The ongoing systematisation of large volumes of academic and community data requires precisely the kind of mediation that this scientific approach aims to provide: translation between languages and scales; identification of points of intersection between disciplines; construction of relevant indicators; curation of sensitive materials; and clarification of the assumptions that underpin modelling and interpretation. In this context, AI acts less as an autonomous solution and more as a means of organising, relating and exploring heterogeneous sets of knowledge in response to the challenges defined by each community.

This ongoing initiative also opens up new possibilities for transdisciplinary exploration. As the systematisation of materials highlights certain issues and areas of interest, it becomes possible to plan the involvement of academic specialists in promising areas for future integration into collaborative working sessions, brainstorming, and other formats of joint development. The value of this future stage does not lie in adding expertise in a peripheral manner, but in strengthening the programme's capacity to link specific disciplinary contributions to territorial agendas already formulated by communities and developed in partnership with the research team. Therefore, the programme's contribution does not lie in introducing reflection where it did not previously exist. Communities already develop problems, priorities and ways of defending their territories and ways of life through multiple channels. The transdisciplinary architecture of the 'Agora – Cultural Landscape Community AI Hub' project offers something else: integration of these developments with scientific research procedures, modelling, controlled experimentation and applied responses to produce knowledge that is both academically robust and relevant to the territory. It is at this point that citizen science, transdisciplinarity and cognitive sovereignty converge as constitutive elements of scientific practice focused on complex cultural landscapes, rather than merely general principles of participation.

5. Analysis: practices of cognitive sovereignty in Intercultural Living Labs

As discussed in Section 3, Intercultural Living Labs are understood here as situated social and methodological arrangements in which communities, researchers, institutional actors and technical infrastructures engage in processes of experimentation, translation and deliberation around territorially defined challenges. At this stage of the argument, the concept is briefly recalled in order to frame the analysis that follows. Rather than constituting isolated workshops or fixed physical spaces, these Living Labs comprise broader ecosystems of interaction that connect community activities, digital tools, formal co-creation agreements, governance protocols and collective decision-making – building on practices that long precede the recent engagement with AI. Their analytical relevance lies in making more observable how categories, forms of evidence, representations, access conditions and criteria of relevance are negotiated, contested and provisionally stabilised. It is within these arrangements that the practices and disputes associated with cognitive sovereignty can be examined most directly.

5.1. How communities problematise and redefine AI

As previously highlighted, artificial intelligence does not emerge as a novelty in our working contexts, which are already characterised by technical mediation. In the Intercultural Living Labs, AI enters the scene less as a novel technology to be presented, and more as a presence to be situated, interrogated, and compared with previous experiences of using digital tools and technical infrastructures, which already impact territories and ways of life. The current phase makes the ways in which these previous experiences are revisited, explicitly articulated and reorganised in light of AI more observable.

Initially, AI is situated by analogy with familiar mediations: a potential memory aid, a mechanism for undue exposure, a form of external monitoring, a useful resource for making content visible or a device capable of reinforcing existing asymmetries. As discussions progress, these initial formulations gain greater precision and differentiation. Rather than a simple opposition between acceptance and rejection, more specific questions emerge concerning what can be experimented with, under what conditions, within what limits, in which protected environments and with what safeguards regarding the circulation and use of content. Thus, the problematisation of AI appears as a process of reinscribing the technology within local frameworks of care, territorial protection, memory and the future.

This movement is of particular analytical interest because it demonstrates that engaging with AI involves more than just translating technical concepts; it also encompasses the re-formulation of problems, the shifting of categories, and the re-inscribing of technology within local frameworks of care, territorial protection, memory, and the future. Issues such as utility, risk, relevance, protection, visibility and interpretative authority are discussed in relation to historical experiences of territorial defence, memory management and negotiation with external institutions. The Living Labs provide a context in which this process becomes visible to researchers, as these negotiations take shape around prototypes, scenarios, simulations and curatorial exercises.

One of the Living Labs provides an example that helps to make this movement more concrete. In the initial experiments with generative AI and territorial modelling, conducted within protected community sandboxes, the tools were used primarily to reformulate existing content in different languages or narrative formats – for instance, to explore how AI would express an already established account differently.

The movement towards problem reformulation emerged through an iterative process of comparison, discussion and revision. Participants examined the generated outputs against their own memories, territorial experiences, categories of relevance and expectations regarding representation. In doing so, they identified omissions, semantic displacements, inappropriate classifications and assumptions derived from external interpretative frameworks. These observations led not only to the revision of prompts, sources and representational formats, but also to reconsideration of the categories through which the initial problem had been formulated.

The focus therefore began to shift from asking how AI could reformulate an existing account to asking which experiences, relationships and forms of knowledge should structure the account in the first place. In this process, AI did not autonomously redefine the problem. Rather, the provisional outputs generated by the system functioned as objects of collective scrutiny, enabling participants and researchers to make implicit assumptions more visible and to reformulate questions, categories and modelling priorities in territorially situated terms.

This remains an emerging process rather than a consolidated result. Nevertheless, it provides an initial indication of how engagement with AI may move from linguistic or technical reformulation towards a deeper problematisation of the languages, classifications and regimes of visibility involved. In doing so, it brings the experiments closer to challenges of territorial representation as defined and revised by the communities themselves. It is precisely at this point that the issue takes on a geoethical dimension. When dialogue with AI shifts the focus from discursive reformulation to disputes over how territories, memories and experiences should

be represented, classified and made visible, criteria of responsibility come into play. These criteria relate to the modelling, circulation and use of systems that could either reinforce or reduce historical asymmetries.

At this initial stage, it is important to recognise that more articulate ways of identifying problems, distinguishing applications, expressing reservations and exploring possibilities are emerging in dialogue with the research team. The analytical interest of the item lies in these emerging problematisation processes, through which cognitive sovereignty manifests as the capacity to shape, influence, evaluate and reinterpret technologies in line with territorially defined priorities.

5.2. Disputes over categories: territory, memory, future, risk

As dialogue with AI evolves within the Intercultural Living Labs, disputes surrounding the categories that organise scientific work and the territorial experience of communities become more evident. Territory, memory, the future and risk manifest in different ways among participants, institutions and interacting knowledge systems. The introduction of AI makes these negotiations particularly relevant, since systems of modelling, classification, visualisation and decision support depend on the precise definition, translation and operationalisation of these categories.

In the case of territory, differences in framing become particularly clear. As defined in Section 2.1, territory and landscape are analytically distinct but inseparable. Territory refers to the material, institutional and political field in which relationships, practices and claims unfold, whereas landscape refers to the historically situated and culturally informed configurations through which that field is perceived, interpreted, valued and acted upon. A single territory may therefore sustain multiple, overlapping or conflicting landscapes.

In some contexts, landscape is constituted through networks of relationships involving people, workplaces, memory, devotion, circulation and land use. In others, it encompasses relationships with spiritual entities, ritual pathways and intergenerational continuities. In still others, it is shaped by experiences of historical violence, denied recognition and ongoing struggles for permanence. When maps, models, simulators or AI systems are introduced, these different landscape configurations interact with the categories stabilised in databases, technical protocols and management tools. From an analytical perspective, what becomes particularly significant is the work of translation, friction and adjustment required to make different understandings comparable without erasing the historical, relational and ontological depth that gives them meaning.

A similar process occurs with memory. In environments of experimentation and deliberation, memory manifests as oral traditions, celebrations, life paths and emotions that cannot be fully captured by databases. This has a direct impact on what can be recorded, modelled, synthesised or communicated by AI and Digital Humanities systems. The dispute extends beyond the selection of content to be preserved, challenging the very definition of legitimate memory itself.

The future emerges in these processes as a relational dimension of territorial life. It is linked to the capacity to sustain continuities, anticipate threats, imagine desirable transformations and negotiate forms of permanence in the face of environmental, economic and institutional changes. Experiments in anticipatory governance supported by AI and anchored in the Digital Humanities seek to make community expectations, fears and plans visible, preserving the plurality of contested futures and the community's capacity to debate them. Here, cognitive sovereignty also encompasses interpreting signs of change and establishing criteria by which possible futures can be monitored and debated. As such, these methodologies also contribute to the UNESCO agenda on literacy futures and on Global Anticipatory Policy.

Perhaps most explicitly, the category of risk encapsulates the difference between what appears in technical frameworks and what is experienced on the ground. Often, the risks that communities identify as priorities do not align with statistical probabilities or administrative classifications, but rather with issues such as the loss of young people, the exposure of sensitive knowledge, the erosion of territorial ties, symbolic violence, the erasure of memories, and the improper capture of information. The Living Labs only offer a snapshot of this broader dynamic, enabling us to observe how cognitive sovereignty is exercised. Rather than eliminating differences, this dialogue enables us to analyse which risks take centre stage, why, and the consequences for forms of representation and territorial action.

The scientific interest in these disputes lies in demonstrating that such categories function as operators of intelligibility and intervention. They guide what is accepted as evidence, what is monitored, what is protected and what remains outside the field of vision of these mechanisms. Rather than merely describing reality, they organise modes of intelligibility and intervention. In this sense, analysing disputes surrounding territory, memory, the future and risk enables us to track how cognitive sovereignty is exercised in defining the terms by which cultural landscapes become scientifically treatable and politically negotiable. Once again, the issue has clear geoethical implications: choices regarding categories, indicators, regimes of visibility, and modelling methods cease to be merely technical operations and involve decisions on how to represent territories without reducing their historical, cultural, and relational complexity.

5.3. AI literacy, community agency and governance: emerging signs and ongoing reconfigurations

At this initial stage, some signs are already becoming apparent. As the Intercultural Living Labs establish themselves as spaces for situated discussions about AI, participants are able to formulate more precise questions about how systems function, how information flows are controlled, what criteria determine relevance, what visibility regimes exist, and what possibilities there are for revision, restriction or refusal. These questions arise in relation to both generative tools and territorial modelling and prototypes of AI agents and devices aimed at organising and curating materials produced within the scope of the partnerships.

The emerging AI literacy in these contexts is less concerned with the ability to 'know how to use' tools, and more with the capacity to situate them within relations of power, mediation, and territorial decision-making. This process is also beginning to impact forms of collective agency. Notable here are the mediating figures who can navigate between technical languages, community concerns and institutional requirements, such as young people who can articulate digital uses, leaders who can engage with indicators without relinquishing their own narratives, and local agents who can demand content review or access restrictions based on previously agreed protocols. These developments already suggest significant realignments in the distribution of authority, knowledge and deliberation surrounding experimental devices.

At the same time, certain conflicts are becoming more explicit. Decisions that were previously vague or confined to closed institutional circles are now being debated based on shared perceptions. While this does not eliminate asymmetries or guarantee internal agreements, it does broaden the conditions for controversies regarding memory, visibility, confidentiality, territorial protection and the future to be embedded within broader processes. This is achieved through reconfigurations in the modes of participation, contestation and monitoring of systems, data and forms of representation.

Including AI in protected community sandboxes adds an important methodological element: it creates space to make mistakes, test ideas and backtrack before irreversible decisions are made. By enabling safe experimentation, these environments allow communities to explore different tools, compare languages, evaluate potential applications and consider the limitations without having to make immediate decisions. This regime of experimentation fosters the development of AI literacy in close connection with situated judgement, methodological prudence, and community authority over data and representations. This reinforces the capacity to adapt technology to challenges defined by territory.

From a geoethical and methodological perspective, these indications demonstrate the analytical value of showing that the advent of AI is shifting the focus of the discussion from the mere adoption or rejection of tools to defining the conditions under which they can be integrated, tested, restricted, evaluated, and ultimately applied to specific challenges within cultural landscapes. It is precisely in this shift that literacy, agency, governance and cognitive sovereignty intersect. It is not merely an increase in information about AI that becomes observable, but also the emergence of situated practices of judgement, curation and decision-making that are beginning to frame the technology in territorially relevant and scientifically tractable terms. For researchers, this means incorporating these emerging reconfigurations into the criteria used for analysis and validation. This demonstrates how communities and researchers together define the conditions under which AI systems can participate in legitimate processes of representation, modelling and decision-making regarding cultural landscapes in the past, present and future.

6. Discussion

The ongoing experience of the 'Agora – Cultural Landscape Community AI Hub' project demonstrates that incorporating artificial intelligence into cultural landscapes broadens the scope of 'advanced tools'. On a different scale, it reopens questions that were already present in the relationships between communities, memory, territory, representation and the future. This trajectory's analytical interest lies in observing, in concrete contexts, how AI makes processes of translation, curation, negotiation of categories, and deliberation on legitimate uses of technology more visible. The article's contribution is to clarify the conditions under which a convergent and plural science can engage in dialogue with territorially specific challenges (Jasanoff, 2016; Couldry and Mejias, 2019; UNESCO, 2022).

Intercultural Living Labs are particularly relevant in this process as they provide a methodological framework through which disputes concerning memory, risk, visibility, territorial representation and the future can be observed and analysed. In these spaces, prototypes, sandboxes, modelling and curatorial devices function as means of making the criteria, limits and possibilities for the use of AI explicit. They are valuable because they create conditions that allow processes of reflection and negotiation, which the communities themselves are already developing through other channels within their territories and forums of deliberation, to be integrated in an academically rigorous manner (Robrahn-González, 2015; Oosterbeek, 2017a; Roberts et al., 2020).

In this context, cognitive sovereignty proves to be a particularly useful concept. It enables us to examine disputes surrounding classification, the circulation of content, modelling techniques, evidence-based practices and interpretative authority within a single analytical framework. As well as describing the reaction to external technologies, the concept enables us to understand how communities and researchers begin to engage in explicit dialogue about the conditions under which AI systems can be tested, restricted, adjusted or incorporated into specific cultural issues.

The analysis also highlights a central aspect of scientific practice. Elements that emerge in these processes, such as category disputes, curatorial decisions, visibility protocols, situated forms of evidence, and expectations for the future, cease to be merely 'context' and become integral to the design of research, modelling, and validation. The programme seeks to act precisely at this juncture, articulating existing community capacities with scientific tools for systematisation, comparison, experimentation and conceptual elaboration. The project's contribution is evident in its ability to transform questions formulated at a local level into shared research problems capable of mobilising different disciplines and forms of knowledge around applied responses.

This experience also highlights the important roles of the academic team in this process. These include systematising heterogeneous materials, explicitly articulating modelling assumptions, integrating disciplinary contributions, constructing comparable mediations between distinct languages and translating these operations into consistent research procedures. The specificity of this scientific mediation does not replace collective decision-making. Rather, it aims to articulate territorially situated agendas with the capacity to organise data, model scenarios, test hypotheses and make the analytical criteria that guide each choice explicit.

It is at this point that the article's most specific contribution to geoethics becomes clear. The text shifts the focus from the individual conduct of professionals to socio-technical infrastructures, sociocultural matrices and networks of trust, categories of representation, indicators, risk criteria, and modelling devices that intervene in specific territories. In projects that accompany or may result in environmental, territorial or heritage changes, decisions regarding what to map, preserve, make visible, model or prioritise directly impact the relationships between communities, knowledge, the environment and the future. Geoethics thus broadens its scope of application when it participates in the processes of producing data, scenarios and decision-making tools, rather than being limited to an external set of norms. This expansion aligns with recent formulations that view geoethics as an ethics of responsibility towards the Earth, understood not only as a system but also through materially grounded and culturally informed configurations

of perceptions, practices and meanings – that is, landscapes. This ethics depends on spatial and temporal context and is open to participatory and inclusive processes, particularly when technical and scientific interventions affect specific communities and territories (Di Capua et al., 2021; Peppoloni and Di Capua, 2021).

At the same time, the analysed experience reinforces the need for methodological prudence. The rapid transformation of algorithmic infrastructures, generative capabilities, and interface forms continually expands the range of possibilities and risks that research must address. In this context, reversible, territorially-situated approaches conducted in protected experimental environments are particularly relevant. Rather than standardising tools or applications prematurely, the challenge lies in establishing the methodological and geoethical conditions necessary for critically monitoring these transformations without losing sight of the issues raised by communities.

7. Conclusions

This article argues that artificial intelligence must be understood as a territorially situated socio-technical mediation within cultural landscapes, rather than as a set of technical tools. The examined experiences show that AI enters ecosystems that are already rich in memory, technological experimentation, institutional negotiation and community problem formulation. It is this condition that renders it analytically significant: rather than generating novel disputes, it reconfigures existing controversies concerning classification, visibility, risk, representation and the future on a different scale (Jasanoff, 2016; Couldry and Mejias, 2019; UNESCO, 2022).

In this context, cognitive sovereignty has proved to be a useful conceptual framework for understanding communities' capacity to participate in the definition of the terms by which memory, evidence, classification and future projections are organised in contexts of intense technical mediation. The Intercultural Living Labs, in turn, have revealed methodological approaches that are particularly important for making these disputes visible and linking them directly to the territorial issues identified by the communities themselves. Together, these two elements provide an integrated analysis of issues relating to knowledge, power and the future within specific cultural landscapes.

In terms of the article's contribution, the main outcome of this stage is the development of an analytical and methodological framework for tracking how communities and researchers negotiate categories, translate between knowledge systems, curate and govern data, test representational and modelling devices, and collectively evaluate AI-supported outputs within protected experimental

environments. Rather than external variables, these processes constitute the empirical substance through which categories, models and representations acquire – or lose – legitimacy within each partnership. In this vein, the article contributes to geoethics by emphasising that decisions regarding data, models, indicators, regimes of visibility and forms of territorial representation also concern the continuity, protection and future of cultural landscapes (Oosterbeek et al., 2016; UNESCO, 2017; Clark and Harley, 2020).

The three contexts examined – Mação, the port region of Rio de Janeiro, and the Xingu – differ in terms of their histories, institutional frameworks, forms of conflict, and regimes of visibility. Nevertheless, they reveal an important convergence: in all of them, the introduction of AI reopens discussions about who defines categories, which memories can circulate, which risks take centre stage and how possible futures can be represented and debated. It is this convergence, rather than any uniformity between the cases, that lends strength to the argument.

At the same time, the scope of this study is deliberately limited. As it is in the initial phase, which began in 2025, there is not yet enough material to assess the medium-term effects on territorial governance, community appropriation of technologies, institutional transformation or the consolidated impacts of applications currently under development. The focus is on articulating the emerging problems, methodological frameworks, and conceptual criteria that currently define the programme. Overall, building on the humanities and encompassing the full range of sciences and knowledge systems, the 'Agora – Cultural Landscape Community AI Hub' project and its methodologies contribute to the resilience of communities and places and support anticipatory global governance.

The future direction of the research hinges on the empirical monitoring of these ongoing experiments. Points deserving closer attention include the evolution of protected community sandboxes, the stabilisation or tension of curatorial and governance practices, the consolidation of AI literacy in specific territories, and the capacity of communities and researchers to sustain legitimate arrangements for representation, modelling and decision-making over time. Throughout this process, the programme engages in an ongoing dialogue with broader regulatory developments, including European discussions on regulatory sandboxes and frameworks for anticipatory governance, to continually assess the design of community sandboxes against evolving standards of prudence, transparency, and institutional accountability. It is within this framework that the extent to which AI contributes to, or hinders, strengthening collective forms of life, knowledge and decision-making within complex cultural landscapes can be assessed with greater precision (Stilgoe et al., 2013; European Commission, 2019, 2026; UNESCO, 2022).

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