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Systemic Relational Insights: A new hybrid intelligence approach to make sense of complex problems

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Systemic Relational Insights: A new hybrid intelligence approach to make sense of complex problems

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Designing in the complexity and timescale of the global effort around "unsolvable" problems means working at different scales.

While developing local projects, it is not easy to make evident the relationship with global trends and patterns to enable reproducibility in other communities potentially benefiting from the same approach. Two possible reasons behind this are the difficulty in systematising data, expertise, community wisdom and existing scientific knowledge and enabling the epistemic conditions to make this happen. The design research community has for years been aware of how a new epistemology of design is needed, a new approach to design at a systemic scale that can hold together communities, territories, and non-human life (towards a "pluriversal" dimension) and the systemic agentivity of infrastructures in which we interact with intelligent devices, through a decentralised and decolonised vision in both methods and technologies. While various models and methodological approaches have been conceptualised, the current difficulty in bringing them to the level of practice can partly rely on the lack of functioning tools. Various experiments with citizen science approaches and the harnessing of collective intelligence through digital technologies, together with the rapid progress made in the field of artificial intelligence, suggest that it is possible to combine these approaches in order to implement tools that can bridge this gap.

The presentation reports the advances of ongoing research based on the hypothesis that it is possible to bring out new types of insights, useful to design within systemic contexts, elaborating heterogeneous information and knowledge flows (scientific, indigenous, or coming from environmental data), through the joint work of the communities themselves with interactive infrastructures based on artificial intelligence models. “Systemic relational insights” are forms of information that emerge from a relational analysis between multiple points of view and perspectives on the problems of a territory, capable of linking the specificities of these relations at a local scale with patterns measured at a global scale.

KEYWORDS: knowledge integration, artificial intelligence, citizen science, more-than-human design

RSD TOPIC(S): Methods & Methodology, Sociotechnical Systems

Presentation summary

The scenario of the study is that of a society in which the challenges of the discipline of design have by necessity reached the scale of the complex and the planetary, as well as awareness of the great problems of humanity that impact the local in diverse ways, thus requiring answers that are never the same, even if converging. These responses must embrace an increasingly community and territory-centred approach to Responsible Innovation and Research (Smallman, 2018). While there is untapped potential for locally collected data to reveal global patterns of change, more work needs to be done to develop efficient ways to channel locally derived data to superordinate scales in order to accelerate our ability to understand complex problems (Danielsen et al., 2005). The challenge in relating different problem scales and making analyses conducted in different local contexts (even if from the perspective of the same type of systemic problems) interoperable is partly due to the difficulty of systemically combining heterogeneous information (data, community wisdom and existing scientific knowledge) and simultaneously creating the epistemic conditions to do so. What is needed in

practice is to enable a co-evolution of our cultural approach, which has already happened in part, together with the tools that make it tangible at the level of practice.

We must, however, seek to explore the scale of complex systems without limiting ourselves to anthropocentric models and by valuing insights that can escape the ideas on which there is already a collective consensus and little innovative value (Drew et al., 2020) in a vision that accepts complexity and seeks to combine the multiplicity of perspectives. The cultures of New Materialism philosophy (Coole & Frost, 2010) and the cybernetic tradition in dialogue with those of design (Dubberly & Pangaro, 2019) have shown us the need to look beyond the usual stakeholders by including not only non-human life (Fell et al., 2022) but also the agency of systems that include matter and computational devices (Bennett, 2010; Giaccardi, 2020). Nora Bateson, elaborating on her father's epistemological-ontological apparatus (see G. Bateson, 2000; G. Bateson 2002), has reactivated the discussion around how to bring perspectives, information, facts, phenomena, and experiences into dialogue through what she calls warm data (N. Bateson, 2017), trans-contextual information that enhances interdependencies in complex systems. The design research community has been aware for years that a new epistemology of design is needed, a new approach to design on a systemic scale through a decentralised and decolonised vision in both methods and technologies projected to a more pluriversal dimension (Escobar, 2018). Although various models and methodological approaches have been conceptualised, I believe the current difficulty in bringing them to the level of practice can be partly attributed to a lack of operational tools.

The evolution of the designer and his/her role in relation to digital tools (Lim & Jung, 2018) is taking place in the context of a world that is increasingly conforming to the skills and capabilities of algorithms (Floridi, 2019), crediting the vision of a multiple and complex reality in which cognitive flows of humans, animals and machines are intertwined (Hayles, 2006, p. 165). The proliferation of artificial intelligence (AI) applications is then posing new and important challenges for the discipline of design while offering opportunities to advance its operational and methodological practices (Yang et al., 2018), especially in situations where large amounts of data obtained over time and from heterogeneous sources become available (Holzinger et al., 2021; Imran et

al., 2020; Parr et al., 2021). It is in this dimension of possibilities and new paradigms that it is necessary to explore new ways of making sense of complexity through technology itself.

The ongoing research hereby presented attempts to open up a new path to prototype operational tools for the investigation of complexity that:

- combines heterogeneous knowledge: scientific research, local indigenous knowledge, data and metadata (Sosa, 2020; Danielsen, 2018)
- moves from the tradition of participatory approaches
- learns from citizen science (CS) practises the ability to engage communities in scientific research processes (Eitzel et al., 2017)
- responsibly leverages AI capabilities to bring out patterns, patterns and correlations that are not easily recognisable and interact with communities (Hee-jeong Choi et al., 2020; Hsu et al., 2022; Korsgaard et al., 2016)

This work is intended as a contribution to the development of a model of a broader, more structured design framework for the territorial scale, inclusive and community-driven, that is able to stand within the scientific paradigm, attempting to adapt to the conditions associated with a supra-ordinate scale of change, by leveraging (and appropriating) the new technologies that can be traced back to AI approaches (Figure 1). The central hypothesis is that it is possible to bring out a new type of research insight (and a new scientific assemblage), useful for planning in complex, multi-stakeholder contexts involving communities and territories, from heterogeneous information and knowledge flows, through the joint work of the communities themselves together with AI models.

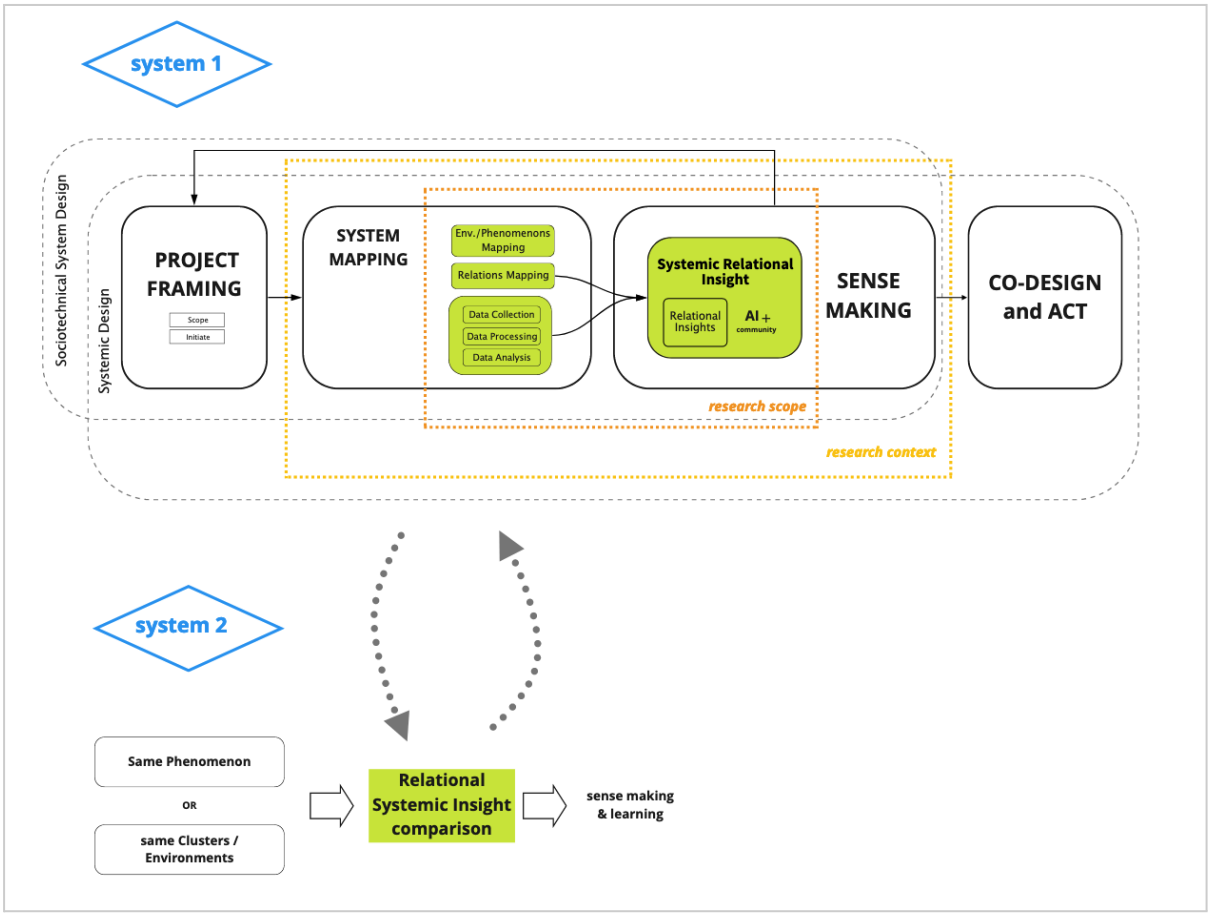

Figure 1. Long-term envisioned general framework where the research project is positioned.

Methods

The current research is the subject of my doctoral thesis and began with an exploratory approach. Then a hybrid methodology was constructed, combining sufficiently established knowledge from multiple technical domains and design approaches with a mix of desk research and validation through action research (field experiments with real data, real algorithms, and most important, real communities).

Systemic relational insight

This approach will lead to the prototyping of a processual model to which a system of tested operational tools will be tied in order to bring about the emergence of what has been pro-tempore called *systemic relational insight* (SRI): the minimum recognisable configuration of valid narratives and knowledge that enables comparison between two socio-technical-natural systems (Figure 2).

Relational insights

The goal is to come up with a first validated prototype of an analysis and sensemaking process (with associated methods and tools) that could be applied system-wide. The model introduces the idea of the SRI, which is to be seen as a new scientific device, a digital repository containing data, policies, and network configurations that enable new AI-processed research insights in a community-in-the-loop approach (Häußermann & Lütge, 2022). SRIs are generated through the aggregation of different *relational insights* (RI) with the data and scientific literature needed to explain in more absolute terms the specifics of the design context. Their purpose is to make two complex systems as comparable as possible and thus enable greater transferability of analyses, solutions and insights themselves (Figure 3).

For example, to study the relationship between a cohort of actors and another human/nonhuman/landscape actor in a system, a machine-learning approach can be used to detect correlations between interview texts, images, and GIS data. This information can then be used to derive relationships between the data and the nature of the relationship itself. The result is a digital container, readable by both humans and computers, that includes a dynamic and heterogeneous database, insights that emerge through correlations between phenomena, flows and subjects, and relationships between local systems and global instances validated by communities.

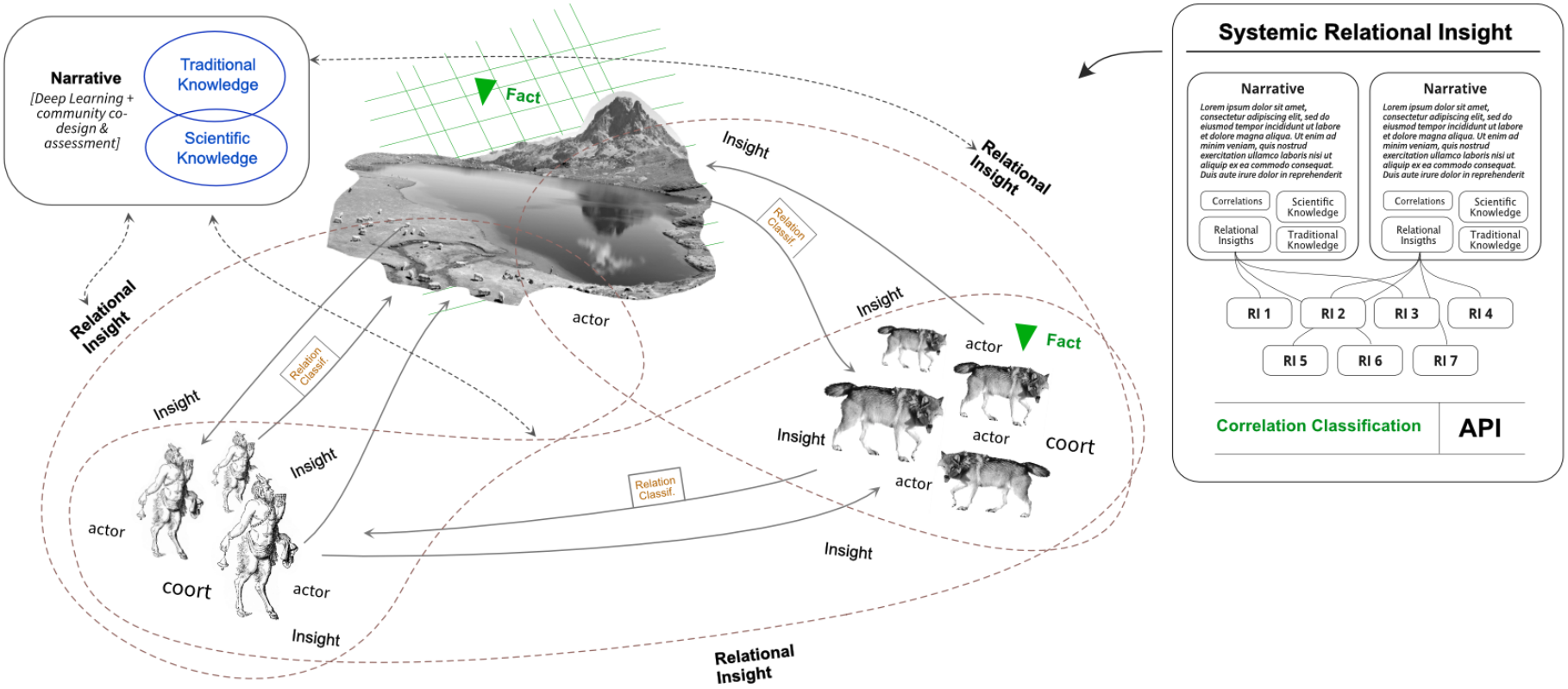

Figure 2. First conceptualisation of systemic relational insight (SRI).

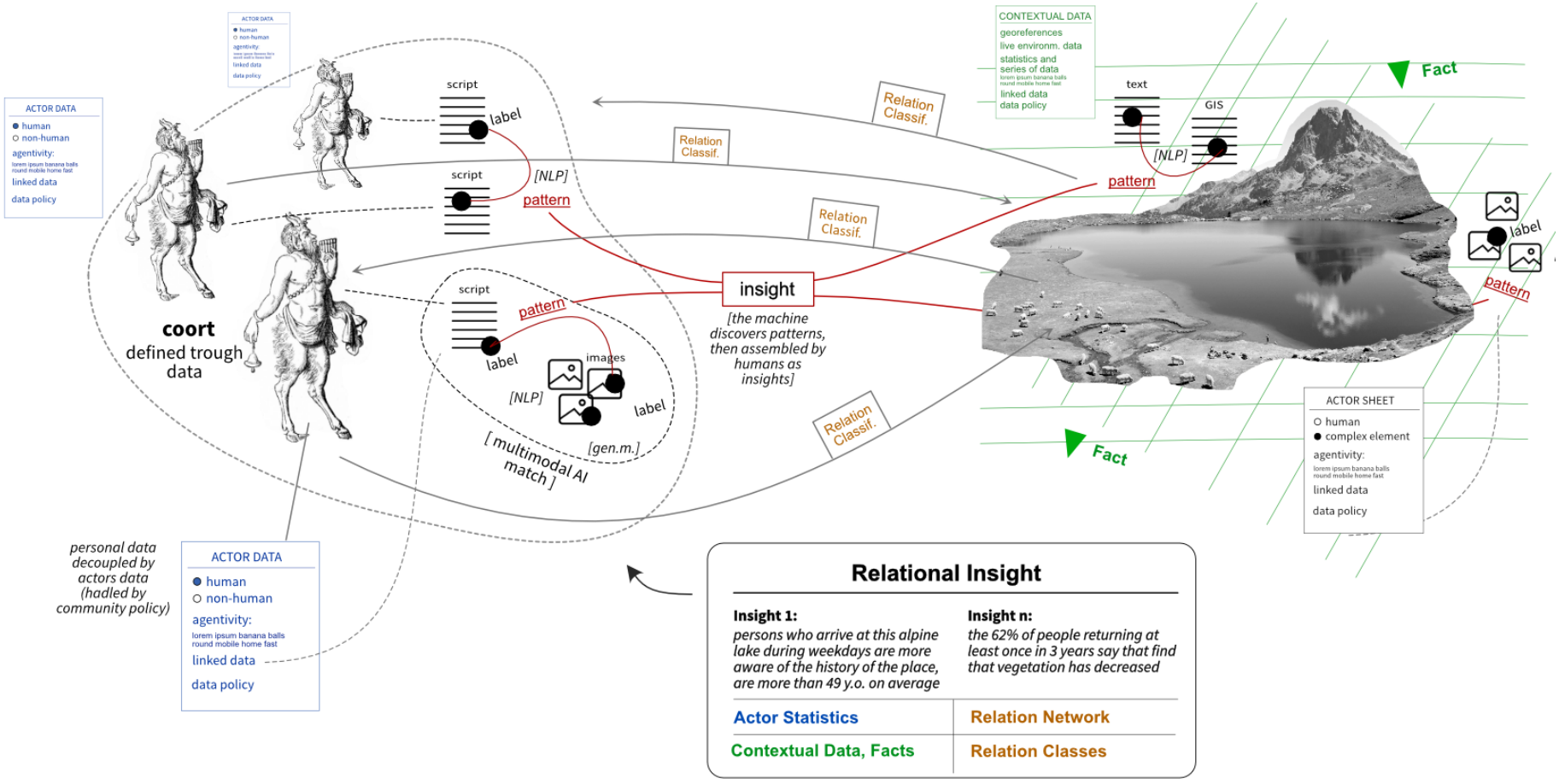

Figure 3. First conceptualisation of relational insight (RI).

The approach aspires to make configurations of systems on different territories more easily recognisable in relation to potential problem-solving patterns (Figure 4). One of the most significant features is that it employs a relational ethnographic approach, in which there are no predetermined categories, but it is the AI that groups actors into cohorts based on the type of relationships that characterise them.

The heart of the research concerns the detailed definition of three basic parts:

- The logical and processual components of "relational insights" (understood as platforms of insight data from various sources and the design methods to generate them).
- The socio-technical subsystem with participatory and citizen science methods that validates the data, oversees the work of the algorithms, and makes the system interoperable.
- The minimal technological infrastructure needed and – possibly – based on open source and already available technology components on which to build the first prototype of a usable toolkit.

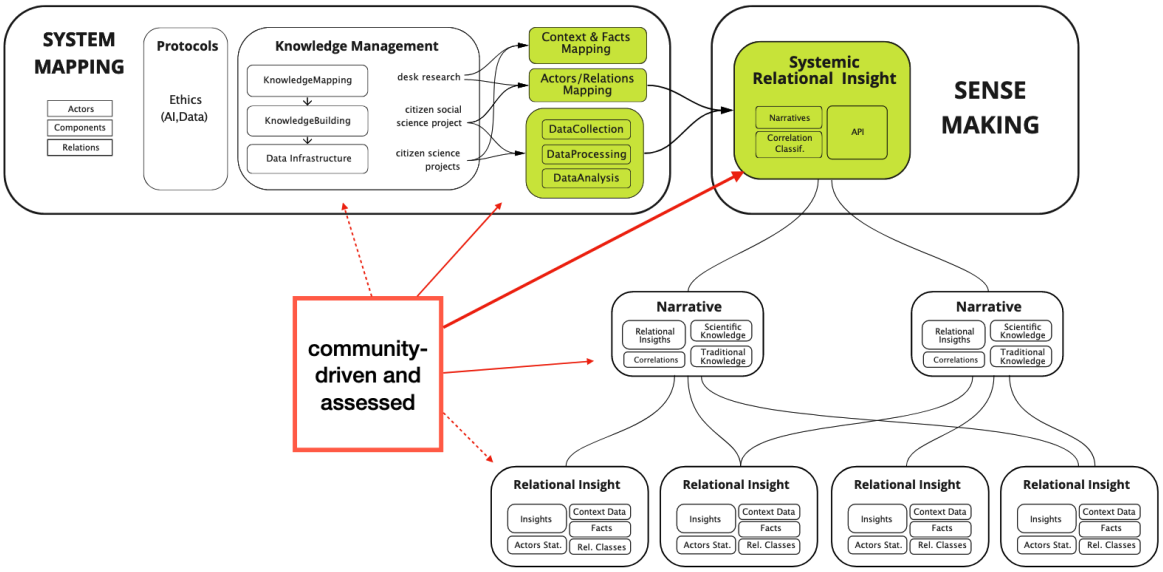

Figure 4. Nesting relational insights into systemic relational insight.

Expectations and criticalities

I expect the ability to build a design and methodological approach based on data and artificial intelligence, which capitalises in a new way on the relationship between multiple stakeholders, local communities, and environmental ecosystems involving the non-human. This approach includes the exploration of new methods and "devices" through which we produce, share and re-combine knowledge (scientific, indigenous, more-than-human, situated, relational, real-time, data-driven) to decipher the emergent. For this reason, SRIs are envisioned as a new format of knowledge, including a dynamic and heterogeneous database containing system actor's classification and ontologies, insights emerging through correlations between phenomena, flows, and subjects, and relationships between the local systems and global instances validated by communities. An approach that aspires to make configurations of systems on different territories more easily recognisable in relation to potential problem-solving patterns.

Systemic relational insights

SRI, which is currently the object in which research is instrumentally materialised, I believe will be useful to adapt in the future even product-service platforms of all kinds and parametric policy systems to the specificities of territories in relation to global adaptation patterns. Possible applications range from defining the identity of places, commons management (e.g., community forest management), circular economy, ontological mapping of value chains, optimising agrifood production and diets on territorial resources, generating territorial metaverses, gamification, simulation, and anticipation of interconnected scenarios.

Critical issue areas

At the current state, the research project has three main potential critical issues areas: ethical, technological and processual.

Ethical issues include power imbalances between different communities or stakeholders, such as technology companies and the general public. Additionally, data policies and privacy concerns may be challenging to navigate. It is also important to consider how the research may be received and understood by different cultures and communities and to be sensitive to these differences in order to avoid any unintentional harm.

Technological issues include the difficulty of working with multimodal AI systems, which can be complex and require a high level of expertise. Moreover, it will be important to be aware of the potential for "AI lock-in," where a particular AI system becomes entrenched and difficult to change or update, and to consider ways to avoid this. Bias in AI systems is another concern, and developing interpretability approaches to help understand and mitigate bias can be resource-intensive.

Processual issues include the overall complexity of the project and the need for expertise in both research and design. The complexity of protocols and frameworks used in the research may also be a challenge, and it may be necessary to simplify these in order to make the research more practical and applicable. Finally, the expendability of individual tools and approaches involved should be considered, as these may become outdated or replaced over time.

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