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ORIGINAL ARTICLE

Decentralised Agentic Governance: A Methodology for Community-Owned Linguistic Datasets and Knowledge Synthesis

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Abstract

The rapid expansion of Large Language Models (LLMs) has intensified concerns regarding centralised data extraction and the erosion of linguistic sovereignty. Current industrial paradigms largely treat language as a raw resource, harvested at scale with limited regard for cultural context or community agency. This paper proposes a methodological shift from passive data extraction to active knowledge co-creation through a triadic framework integrating human contributors, autonomous AI agents, and decentralised governance mechanisms. By combining Agentic Scaffolding — an AI-assisted interaction layer that guides rather than replaces human contributors — with DAO-based validation, the framework enables communities to collectively produce, validate, and govern high-fidelity linguistic data. The resulting system establishes the foundation for a community-owned Linguistic Commons designed to support future integration with advanced knowledge structures such as Knowledge Hypergraphs while preserving cultural integrity, transparency, and community sovereignty.

Keywords: Agentic governance; AI ethics; decentralized autonomous organizations (DAO); linguistic commons; knowledge hypergraphs.

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1. INTRODUCTION

The rapid advancement of Large Language Models (LLMs) has revealed a fundamental tension between automated data extraction and linguistic sovereignty. In prevailing industrial practices, language is frequently treated as a neutral raw material — scraped, normalized, and aggregated at scale — often stripped of its cultural nuance and social provenance.

This approach contributes to what we term data alienation: a condition in which communities retain little agency over how the linguistic knowledge they generate is formalised, reused, or monetised. In this sense, data alienation may be understood as a linguistic manifestation of what Couldry and Mejias describe as data colonialism (Couldry & Mejias, 2019). Such centralised data pipelines pose ethical and epistemic risks, potentially flattening linguistic diversity and reinforcing dominant cultural representations within AI systems (Bender et al., 2021).

In response, this paper proposes a shift from extractive data practices toward active knowledge co-creation, positioning communities not as passive data sources but as governing participants in the construction of machine-readable knowledge (Jobin et al., 2019).

At the core of this proposal lies a synthesis of Agentic Scaffolding and Decentralised Governance. Autonomous AI agents are employed not as decision-makers but as contextual mediators that assist contributors in structuring linguistic knowledge. Final authority over meaning, validity, and inclusion remains with the community through a Decentralised Autonomous Organisation (DAO). The overarching goal is the creation of a Linguistic Commons — a community-owned repository of knowledge governed by its contributors rather than centralised institutions (Ostrom, 1990).

1.1 Why a Triadic Approach?

Existing approaches to linguistic data creation tend to rely on one of three partial solutions, each insufficient in isolation.

Human-only curation — as practised in traditional lexicography and community documentation projects — produces culturally grounded knowledge but scales poorly and depends on centralised editorial authority, reintroducing the institutional control it seeks to avoid.

AI-only generation — as seen in large-scale web scraping and automated annotation pipelines — achieves scale but systematically strips cultural context, reproduces dominant-language biases, and offers no mechanism for community contestation or correction.

Governance-only frameworks — such as community wikis or open licensing schemes — distribute authority but lack structured knowledge representation and provide no scaffolding for non-expert contributors to produce machine-readable outputs.

The Triadic Synthesis Framework proposed here combines all three elements precisely because each compensates for the others' limitations: AI agents lower the cognitive barrier to structured contribution; DAO governance ensures community authority over meaning; and immutable ledger integration preserves provenance and enables downstream reuse. No two-element subset is sufficient — the triadic structure is the minimum viable configuration for community-owned linguistic knowledge synthesis.

1.2 Key Concepts

This section defines the core concepts underpinning the Triadic Synthesis Framework and explains their relevance to the proposed methodology.

Data Alienation refers to a condition in which communities and individuals lose agency over the data they generate and over how that data is formalised, reused, and monetised. In the context of Large Language Models, it manifests as the extraction of linguistic and cultural content without consent, transparency, or compensation — treating language as a raw resource for corporate AI systems. The concept builds on critical data studies and the literature on digital colonialism (Couldry & Mejias, 2019), which demonstrates how technology corporations extract value from human life on a logic analogous to historical colonialism. In our framework, data alienation is the core problem the triadic structure addresses: by transforming communities from passive data sources into active co-creators and governors of linguistic knowledge, the framework restores community control over meaning and use of their linguistic contributions.

Large Language Model (LLM) is an AI system trained on large collections of text to generate, interpret, and transform natural language. LLMs learn statistical patterns from vast text corpora, enabling them to produce coherent and contextually relevant outputs. In our framework, LLMs are not used for autonomous generation or decision-making; rather, they serve as the underlying engine for the Agentic Scaffolding layer, where they assist contributors by suggesting schema-conformant structures, highlighting relationships, and identifying ambiguities — always under human oversight.

Decentralised Autonomous Organisation (DAO) is a member-governed organisation whose decision rules are encoded and executed through blockchain-based mechanisms. DAOs enable collective decision-making without centralised intermediaries; members vote on proposals, and outcomes are automatically executed via smart contracts (Buterin et al., 2019). In our framework, the DAO operationalises the Governance of Meaning (defined below): community members collectively review, validate, and approve proposed knowledge entries through transparent, auditable voting mechanisms. The DAO ensures that semantic validity is determined by the affected community rather than by external authorities.

Agentic Scaffolding is introduced in this paper as a methodological concept referring to AI-assisted guidance during semantic knowledge-structuring tasks. The term extends the educational notion of "scaffolding" (Wood et al., 1976; Vygotsky, 1978) — where a more knowledgeable other provides temporary support that fades as competence grows — to the human-AI collaboration context. In our framework, the AI agent (built on the ElizaOS architecture) offers schema suggestions, highlights semantic relationships, and flags ambiguities, but does not autonomously approve or finalise any entry. This ensures that human judgment remains authoritative while the cognitive burden of formal representation is lowered. Unlike fully autonomous AI generation, Agentic Scaffolding is thus a supportive, not substitutive, layer.

Input Bottleneck (also known as the *knowledge acquisition bottleneck*) is a fundamental constraint in knowledge engineering, where the creation of high-quality structured data depends on a narrow pool of expert annotators, severely limiting the scale and diversity of datasets (Feigenbaum, 1977). In traditional knowledge engineering, a knowledge engineer mediates between domain experts and the system, extracting knowledge from human experience and translating it into machine-readable formats — a process that is labour-intensive, expensive, and poorly scalable. In our framework, Agentic Scaffolding directly addresses this bottleneck by allowing non-expert contributors to produce structured semantic data with AI support, radically expanding the pool of potential knowledge creators and increasing both the scale and cultural diversity of the collected data.

Immutable Ledger is a blockchain-based record in which approved entries and governance decisions are permanently recorded and auditable. Once a validated knowledge entry is written to the ledger, it cannot be altered or deleted, creating a tamper-evident audit trail. In our framework, the immutable ledger stores each approved semantic triple together with its contributor attribution, governance outcome (DAO decision ID), and versioned schema. This provenance metadata ensures accountability, enables verification, and supports downstream reuse — allowing any future user to trace the origin and validation history of each piece of knowledge.

Linguistic Commons is a collectively owned and governed repository of linguistic knowledge maintained by the communities that create it. The concept draws on Elinor Ostrom's foundational work on the governance of common-pool resources (Ostrom, 1990), which demonstrates that communities can sustainably manage shared resources through self-governance without relying on state control or privatisation. In our framework, the Linguistic Commons is the final output of the Triadic Synthesis Framework: a community-

owned dataset with transparent governance, ethical alignment, and long-term interoperability — designed to support integration with advanced knowledge structures such as Knowledge Hypergraphs while preserving cultural integrity and community sovereignty.

Governance of Meaning is an authorial term introduced in this paper to denote the collective determination of semantic validity, contextual appropriateness, and cultural accuracy by the affected community. It is the process by which community members jointly evaluate and approve proposed knowledge entries before they become part of the shared dataset. In our framework, Governance of Meaning is operationalised through the Decentralised Validation layer (Phase 2), where peer review, community discussion, and Quadratic Voting mechanisms enable the community to serve as the final arbiter of meaning. This ensures that meaning is not imposed externally (by corporations or framework developers) but is determined by the community for whom that meaning is significant.

Quadratic Voting (QV) is a collective decision-making mechanism in which the cost of casting `n` votes for an option is proportional to n^2 (Buterin et al., 2019; Lalley & Weyl, 2018). This allows participants to express the intensity of their preferences rather than just their direction, while the quadratic cost structure prevents any single actor from dominating outcomes. In our framework, QV is used in Phase 2 (Decentralised Validation) as a safeguard against majority domination and to amplify minority voices. A contributor with strong conviction about the correctness or incorrectness of a fact can cast more votes (paying a higher cost) than someone who is indifferent. Combined with reputation earned through proven contribution (Proof-of-Contribution), QV creates a governance system that is resistant to capture by well-resourced actors.

Knowledge Hypergraph is a knowledge representation structure capable of modelling complex contextual relationships involving multiple interconnected entities simultaneously. While traditional knowledge graphs represent relationships through binary connections (subject–predicate–object triples), hypergraphs allow multiple entities, contexts, and governance relationships to be represented within a single hyperedge. In our framework, validated semantic triples produced by the community serve as proto-relations that can later be aggregated into hypergraph structures (see Section 3.3 and Figure 3). This enables the representation of higher-order, context-rich knowledge that preserves the complexity and nuance of community-generated cultural content.

1.3 Technical Foundations for Interdisciplinary Readers

Before describing the Triadic Synthesis Framework in detail, we briefly introduce the core technologies it relies upon. This section is intended for readers who may not have a technical background in knowledge engineering, blockchain, or AI systems; specialists may proceed directly to Section 2.

Knowledge Graphs are networks of interconnected facts, typically represented as triples of the form subject–predicate–object. For example, the statement "Marie Curie discovered Radium" can be represented as a triple: (`Marie Curie` – `discovered` – `Radium`). Knowledge graphs allow machines to store and query complex relationships using dedicated query languages such as SPARQL. In our framework, knowledge graphs serve as the target structure into which community-validated linguistic knowledge is formalised and stored. The contribution of our work is not to build a new knowledge graph, but to provide a methodology by which communities can collectively populate and govern one.

LLM Agents are AI systems that can interpret natural language and generate structured outputs. Unlike generic chatbots, our agents are constrained to work within predefined schemas and are explicitly prohibited from making autonomous decisions. In our framework, the agent functions as a scaffolding tool: it suggests possible structures, highlights relationships, and flags ambiguities, but it does not approve, reject, or finalise any entry. The agent thus lowers the cognitive barrier to structured contribution while keeping human judgment authoritative.

DAOs (Decentralised Autonomous Organisations) are digital entities governed by rules encoded as smart contracts on a blockchain. Members of a DAO vote on proposals, and the outcome is automatically executed by the code. In our framework, DAOs are used not for financial speculation but as a transparent and community-controlled mechanism for validating knowledge entries. A proposed linguistic fact is submitted to the DAO; community members review it, discuss it, and vote on whether to accept or reject it; and the decision is automatically recorded on an immutable ledger. This ensures that knowledge validation is governed by the community, not by a centralised authority.

Blockchain is a distributed, tamper-evident record-keeping system. In our framework, blockchain is used primarily as an **immutable audit trail**: once a knowledge entry is approved by the DAO, its content, provenance (who contributed it and how they are credited), and governance history (which validation round, which DAO decision ID, which schema version) are permanently recorded. This transparency ensures that any future user of the dataset can verify the origin and validation process of each piece of knowledge, enabling accountability, trust, and long-term reuse.

Together, these technologies enable a workflow in which non-expert contributors can produce machine-readable knowledge under community oversight, without ceding control to centralised intermediaries. The framework thus combines the cultural grounding of human contributors, the efficiency of AI assistance, and the transparency of decentralised governance — offering

a practical path toward community-owned linguistic datasets.

1.4 Illustrative Use Case: Documenting an Endangered Dialect

Consider a small speech community whose dialect is largely absent from contemporary AI systems.

Under conventional approaches, fragments of the dialect may be collected through web scraping, detached from cultural context, and incorporated into proprietary datasets without community involvement.

Under the proposed framework:

(i) A community member interacts with an AI agent that guides them in documenting a proverb, phrase, or cultural expression.

(ii) The contribution is structured into a machine-readable semantic format.

(iii) Community members review and validate the submission through DAO governance mechanisms.

(iv) Approved knowledge is permanently recorded together with provenance metadata.

(v) The community retains authority over future access, licensing, and use of the resulting dataset.

This process transforms language communities from passive data sources into active co-creators and governors of linguistic knowledge.

1.5 Positioning against Prior Work

Several existing initiatives address aspects of community-centred linguistic data production, and the proposed framework is informed by — and builds upon — their contributions. Mozilla Common Voice (Mozilla Foundation, 2019) has demonstrated that crowdsourcing can produce large-scale, open speech datasets with broad community participation; however, it does not address semantic knowledge structuring or community governance over meaning, nor does it provide provenance tracing at the level of individual contributions. The Masakhane research community (Nekoto et al., 2020) has advanced participatory NLP for African languages, establishing that community involvement improves data quality and cultural relevance; yet it operates as a research collective rather than as a formalised governance architecture capable of producing machine-readable, provenance-aware knowledge artefacts. The CARE Principles for Indigenous Data Governance (Carroll et al., 2020) articulate a normative framework for collective benefit, authority, responsibility, and ethics in data stewardship, offering foundational ethical principles that the proposed framework seeks to operationalise technically. Data-trust and data-DAO initiatives have explored decentralised structures for collective data ownership (Delacroix & Lawrence, 2019), but have not been applied to the specific challenge of structured linguistic knowledge synthesis.

Unlike these approaches taken individually, the Triadic Synthesis Framework proposed here integrates AI-assisted semantic structuring, community governance, and immutable provenance recording into a single methodological architecture. Its distinctive contribution is not to replace existing participatory or ethical frameworks, but to provide a technical and governance infrastructure through which their principles can be operationalised in practice for structured linguistic knowledge production. Rather than competing with these initiatives, the proposed framework provides an interoperable governance methodology that could complement them by enabling community-owned semantic knowledge production with transparent provenance and decentralised validation.

2. METHODOLOGY: THE TRIADIC SYNTHESIS FRAMEWORK

The proposed methodology operates through a triadic interaction model involving Human Contributors (H), an Agentic Scaffolding Layer (A), and a Governance Layer (G). Together, these components form the Triadic Synthesis Framework.

The objective is to overcome the traditional input bottleneck of knowledge engineering — the dependency on expert annotators that constrains the scale and diversity of structured dataset creation, whereby the creation of high-quality structured data typically requires expert annotation and centralised control.

2.1 Phase 1: Agentic Scaffolding (Interaction Layer)

In this paper, Agentic Scaffolding is introduced as a methodological concept that refers to AI-assisted guidance during semantic knowledge-structuring tasks — distinct from fully autonomous AI generation, in which human judgment remains authoritative throughout.

Rather than presenting contributors with a purely technical interface, the framework employs an autonomous AI agent based on the ElizaOS architecture.

The agent functions as a contextual mediator by:

- suggesting schema-conformant structures,
- highlighting semantic relationships,
- identifying ambiguities and missing context.

The agent does not autonomously approve, reject, or finalise entries. Its role is supportive rather than authoritative.

Outputs are represented as structured semantic units, including subject–predicate–object triples augmented with contextual metadata.

The agent operates within predefined schemas and does not independently determine semantic validity or introduce authoritative content.

2.2 Phase 2: Decentralised Validation (Governance Layer)

Structured entries generated through the interaction layer are submitted to a DAO for validation.

This phase operationalizes what we term Governance of Meaning. Governance of Meaning refers to the collective determination of semantic validity, contextual appropriateness, and cultural accuracy by the affected community. Through this process, community members collectively evaluate and approve proposed knowledge entries before they are added to the shared dataset.

Validation combines:

- peer review,
- community discussion,
- Quadratic Voting mechanisms.

2.3 Phase 3: Immutable Integration (Storage Layer)

Following community approval, validated entries are recorded on an immutable blockchain-based ledger.

Each record is linked to:

- contributors,
- governance outcomes,
- versioned semantic schemas.

This creates a transparent audit trail supporting accountability, provenance tracking, and downstream reuse. Together, these three phases form an end-to-end pipeline for community-governed knowledge synthesis (see Figure 2).

The community remains the final arbiter of meaning.

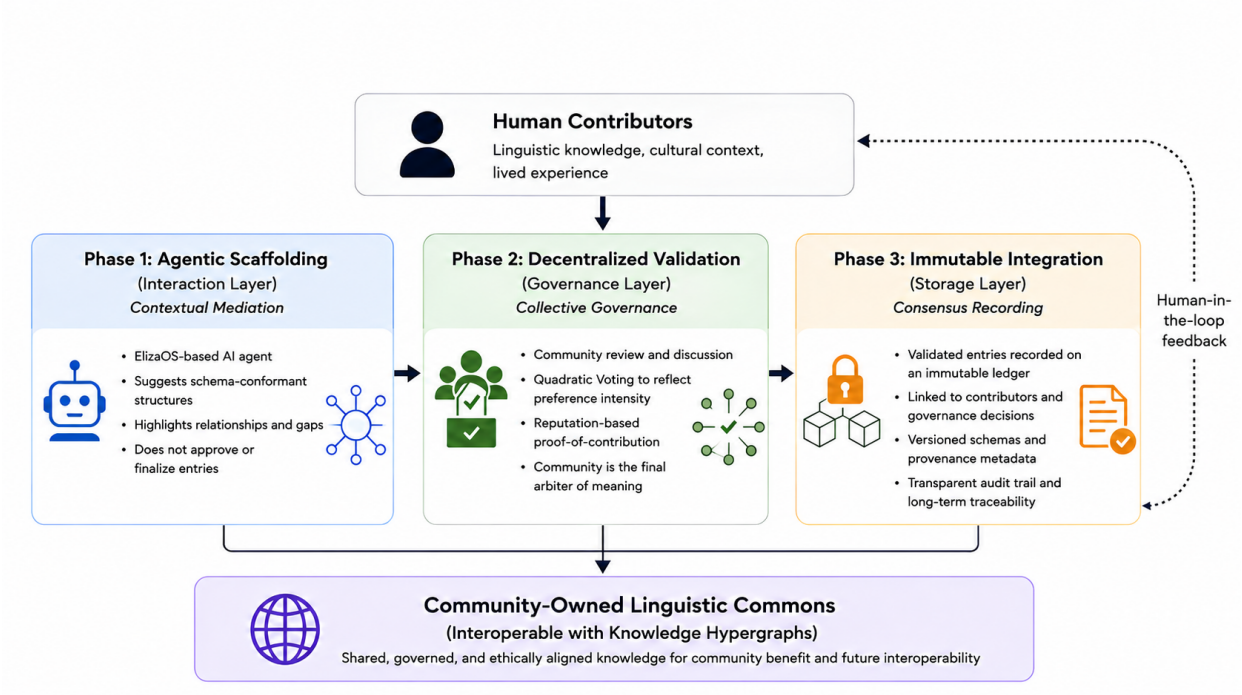

Fig. 1. The Triadic Synthesis Framework. Process-level overview illustrating the transformation of human linguistic input into community-validated semantic knowledge through Agentic Scaffolding, Decentralised Governance, and Immutable Ledger layers.

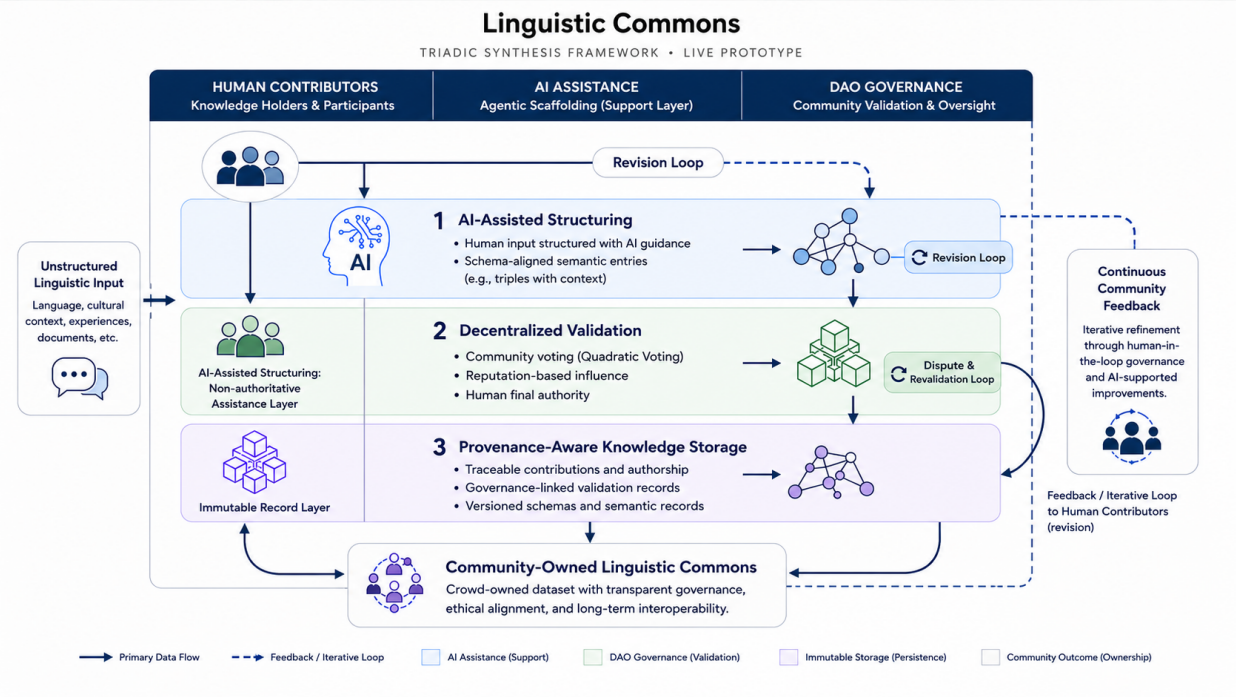

Fig. 2. End-to-End Knowledge Synthesis Pipeline. Operational flow showing AI-assisted structuring, community validation, governance review, and immutable storage of approved semantic knowledge.

3. DISCUSSION: RESILIENCE AND STRUCTURAL ALIGNMENT

3.1 Safeguarding Minority Voices through Quadratic Voting

To mitigate the risk of majority domination, the framework incorporates Quadratic Voting (QV) (Buterin et al., 2019; Lalley & Weyl, 2018). Governance influence is determined through a combination of Quadratic Voting participation and reputation earned through validated contributions.

This approach enables contributors to express preference intensity while reducing the ability of any single actor to dominate outcomes.

3.2 Preventing Governance Capture and Automation Bias

Governance influence is linked to Reputation-based Proof-of-Contribution rather than token accumulation alone.

Authority is earned through validated participation rather than financial resources.

Additionally, all AI-generated suggestions require explicit human verification, mitigating automation bias and preserving cultural context.

3.3 Alignment with Knowledge Hypergraphs

Traditional knowledge graphs represent relationships through binary connections.

Knowledge Hypergraphs extend this capability by allowing multiple entities, contexts, and governance relationships to be represented within a single hyperedge, enabling higher-order relational structures that cannot be adequately captured through pairwise links alone (Berge, 1989).

This structural transition from validated triples to grouped relations is illustrated in Figure 3. Validated semantic triples produced by the framework may therefore serve as proto-relations that can be aggregated into hypergraph structures.

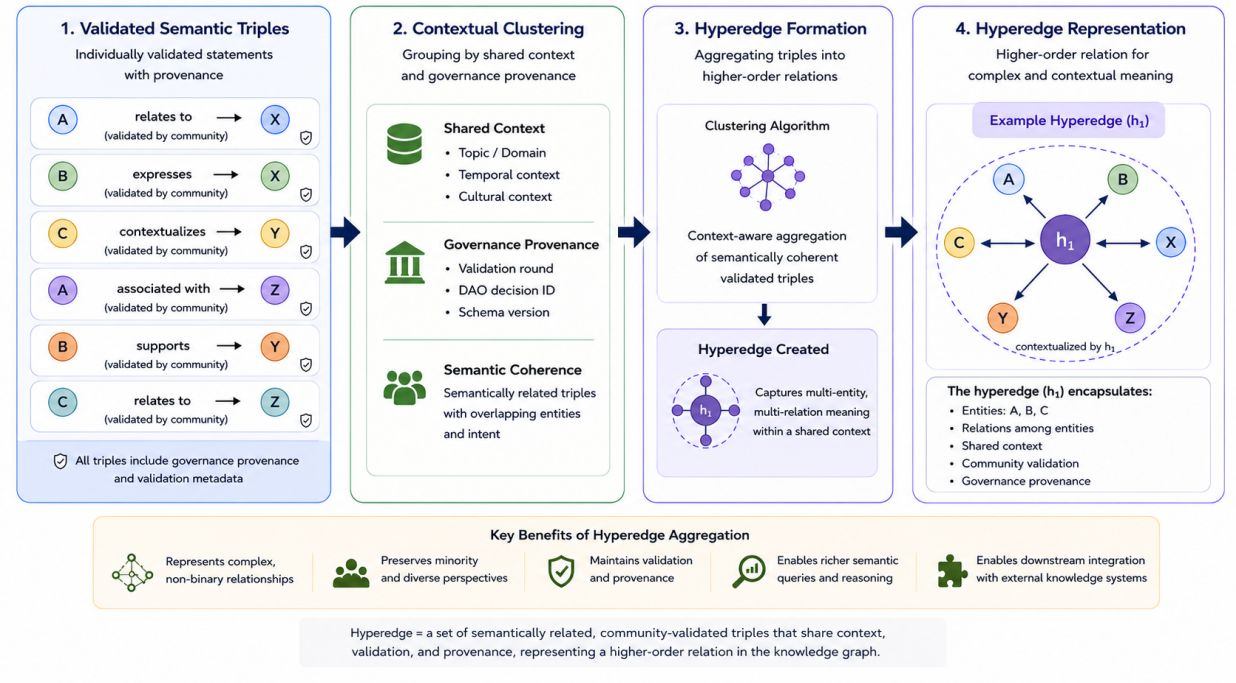

Fig. 3. From Community-Validated Triples to Hyperedges. Illustration of how validated semantic triples may be aggregated through shared context and governance provenance into higher-order hypergraph structures.

3.4 PRELIMINARY IMPLEMENTATION AND GOVERNANCE ROADMAP

To illustrate the practical implementation of the proposed framework, a proof-of-concept was developed and demonstrated during an international hackathon focused on agentic AI and decentralised systems. Building on the conceptual and technical insights obtained from this demonstration, a separate illustrative interface prototype was subsequently developed specifically for this paper to visualise the complete workflow of the Triadic Synthesis Framework.

The illustrative prototype shows how the three phases of the Triadic Synthesis Framework can be instantiated using currently available technologies: an ElizaOS-based AI agent for contributor-facing scaffolding (Phase 1); a DAO-based voting mechanism incorporating weighted preference expression consistent with Quadratic Voting principles (Phase 2); and on-chain provenance recording linking contributor identity, governance outcome, and versioned schema (Phase 3). While not intended as an empirical evaluation, the proof-of-concept is presented solely to illustrate that the proposed architecture can be instantiated using currently available technologies.

Future Governance Model

The framework is intended to be deployed as open-source public-good infrastructure. Governance authority is intended to remain with participating communities rather than with framework developers or infrastructure providers. Potential operators include cultural institutions, educational organisations, language preservation initiatives, and community-governed digital trusts. Future implementations will prioritise accessibility through mobile-first interfaces, simplified onboarding, and abstraction of blockchain complexity.

3.5 Governance Limitations and Open Problems

The governance mechanisms proposed in this framework are subject to known failure modes that are acknowledged here as open research problems requiring empirical investigation in future deployments. First, Quadratic Voting is vulnerable to Sybil attacks, whereby a single actor creates multiple identities to amplify voting power at reduced cost; mitigating this requires robust identity verification, which may itself create barriers to participation. Second, collusion among coordinated participants can undermine the preference-revelation properties of QV, particularly in small or tightly-knit communities. Third, reputation systems based on contribution history risk entrenchment effects, whereby early participants accumulate disproportionate influence that becomes structurally difficult to challenge. Fourth, the use of an immutable ledger creates a tension with data

subjects' right to erasure under frameworks such as the GDPR: once a knowledge entry is recorded on-chain, technical deletion is not possible, raising unresolved questions about compliance and consent management.

These limitations do not invalidate the proposed architecture but delineate its current boundaries and constitute a necessary agenda for future work.

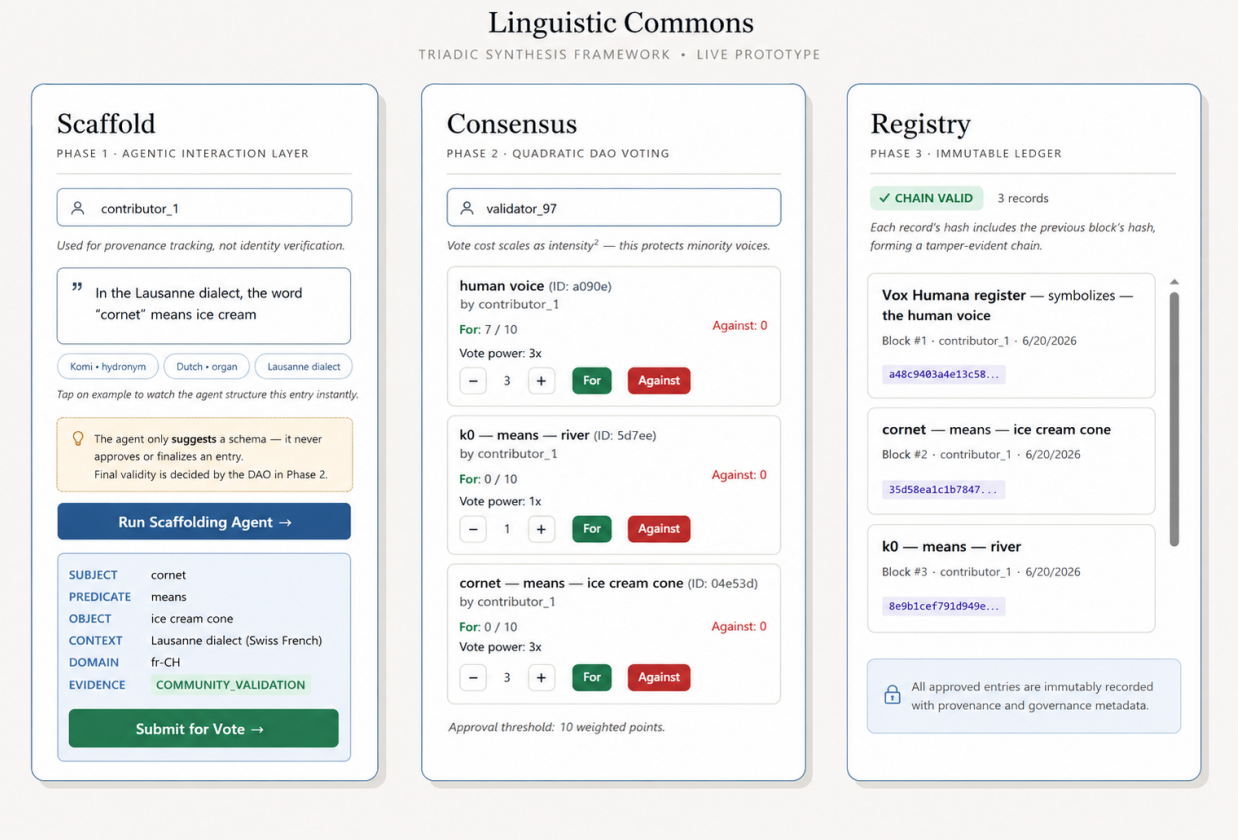

Fig. 4. Demonstrative prototype of the Triadic Synthesis Framework. Illustrative interface prototype developed to visualise the complete workflow of the Triadic Synthesis Framework presented in this paper. Panel Scaffold (left) illustrates Phase 1 — Agentic Scaffolding, where contributors receive AI-assisted support for semantic knowledge structuring through schema guidance, contextual prompts, and semantic relationship suggestions. Panel Consensus (centre) illustrates Phase 2 — Decentralised Validation, where community members review, discuss, and evaluate proposed entries through governance mechanisms designed to support collective determination of semantic validity and cultural appropriateness. Panel Registry (right) illustrates Phase 3 — Immutable Registry, where validated knowledge entries are recorded together with governance provenance, contributor attribution, and audit metadata. The interface demonstrates a representative example from a community-generated linguistic dataset and is intended solely to illustrate the interaction between the three phases of the proposed framework.

4. CONCLUSION AND FUTURE WORK

This paper argues that the transition from centralised data extraction to decentralised knowledge co-creation represents a necessary step toward digital and linguistic sovereignty.

The proposed Triadic Synthesis Framework integrates:

- human contributors,
- AI-assisted knowledge structuring,
- decentralised governance.

Together, these components enable communities to actively shape, validate, and govern the linguistic knowledge used by AI systems.

Future work will focus on:

(i) Deployment with specific marginalized language communities.
(ii) Evaluation of long-term governance dynamics.
(iii) Accessibility improvements.
(iv) Formal integration with Knowledge Hypergraphs.
(v) Interoperability with Industry Commons infrastructures.

Future work will also include empirical evaluation of contributor experience, governance participation, and data quality outcomes across diverse linguistic communities. More broadly, the proposed framework illustrates how AI-assisted knowledge production can be governed as a community-owned process rather than an extractive pipeline, providing a foundation for future participatory AI infrastructures.

AI DISCLOSURE

In accordance with current academic integrity standards, the author discloses that generative AI tools were used during manuscript preparation. AI assistance was limited to structural organisation, language refinement, and bibliographic synthesis. All conceptual frameworks, methodological decisions, figure verification, and final editorial judgments were made and verified by the author.

CONFLICT OF INTEREST

None to declare.

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