



“Retrieval-Augmented Generation Systems and Virtual Reality for the History of Religions: Methodological Foundations and Future Perspectives”

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Citation: Monaca, M., & Morante, S. (2025). “Retrieval-Augmented Generation Systems and Virtual Reality for the History of Religions: Methodological Foundations and Future Perspectives”. *Preliminary Reports and Negative Results in Life Science and Humanities* 2(2). DOI: <https://doi.org/10.13129/3035-062X/pmr-5327>

Abstract

This paper presents preliminary results from an innovative research project integrating Retrieval-Augmented Generation (RAG) systems with the historical-comparative method applied to the History of Religions, proposing an extension toward Virtual Reality (VR) environments for immersive analysis of religious phenomena.

The project's first phase has demonstrated methodological compatibility between the Bianchian historical-comparative approach and artificial intelligence technologies, with particular reference to managing complex documentary corpora and preserving philological rigor.

The proposed future development envisions implementing VR interfaces that enable three-dimensional exploration of historical-religious contexts while maintaining source traceability and spatial-temporal contextualization of studied phenomena.

The integration of RAG and VR offers unprecedented prospects for comparative visualization of sacred architectures, ritual practices, and iconographic systems belonging to different traditions, opening new possibilities for university teaching and international collaborative research.

Keywords: History of Religions, Retrieval-Augmented Generation, Virtual Reality, Historical-comparative method, Digital Humanities, Immersive environments, Artificial Intelligence.



1. Introduction: From Traditional Research to Immersive Digital Environments

The History of Religions, as a discipline founded on the historical-comparative method, has undergone progressive epistemological maturation throughout the twentieth century. From the Pettazzoni era to Bianchian systematization, it has defined rigorous criteria for analyzing religious phenomena in their historical and cultural dimensions. The methodological approach developed by the Italian school, characterized by constant dialectic between idiographic investigation and comparative analysis, configures itself as a hermeneutic instrument particularly suited for dialogue with emerging digital technologies, provided such integration preserves the epistemological specificity of the discipline and its anchoring to verifiable historical documentation.

This contribution is situated within the contemporary debate on Digital Humanities, proposing a model of technological integration that avoids both quantitative reductionism and uncritical enthusiasm toward instrumental innovation. The proposal articulates itself in two moments: the presentation of preliminary results obtained through implementation of RAG (*Retrieval-Augmented Generation*) systems specifically configured for historical-religious research, and the elaboration of future perspectives contemplating the use of Virtual Reality environments for the analysis and teaching of religious phenomena in reconstructed spatial and temporal contexts.^[1]

This proposal responds to the necessity of exploring the potentialities offered by immersive technologies without compromising the methodological rigor characterizing the Italian tradition of historical-religious studies, configuring itself as a preliminary contribution for future implementations in the humanities and comparative research.

2. Methodological Foundations: The Historical-Comparative Method and Computational Technologies

2.1 The Bianchian Historical-Comparative Method

The historical-comparative method, systematized by Ugo Bianchi and the Messina school of the History of Religions, is founded on epistemological principles guaranteeing scientific rigor of inquiry. Three concepts prove fundamental: *historical typology*, which enables identification of recurrent configurations in religious phenomena while maintaining awareness of their historical and contextual specificities; *analogy*, understood in Aristotelian-scholastic sense as a classification instrument preserving both similarities and differences between independent traditions; the *concrete universal*, a category recognizing the universal dimension of religious phenomena in their always historically determined and culturally differentiated manifestation.^[2]



Application of this method implies a double hermeneutic movement: on one hand, idiographic research imposes in-depth analysis of each religious context in its historical, geographical, linguistic, and cultural singularity; on the other, the comparative perspective enables identification of analogous structures, parallel developments, and historical connections between apparently distant but analogous religious traditions in terms of processes and developments.

This methodological dialectic proves particularly significant in the digital age, where computational technologies offer unprecedented instruments for analyzing vast documentary repertoires and visualizing complex relationships between historical phenomena.

2.2 Convergences Between Historical-Comparative Method and RAG Architectures

Retrieval-Augmented Generation systems present structural characteristics manifesting significant convergences with principles of the historical-comparative method. RAG architecture essentially comprises three elements: a vector database containing semantic representations of verifiable historical documents; a retrieval system identifying pertinent sources based on semantic queries; a linguistic generator elaborating interpretive syntheses while maintaining traceability of utilized sources.

The principal methodological convergence lies in the system's capacity to preserve the link between produced statements and original documents, a fundamental requirement for philological rigor proper to the historical-religious discipline. Unlike linguistic models trained through fine-tuning, which incorporate information into model parameters rendering them opaque and unverifiable, the RAG approach maintains explicit separation between documentary base and generative capacity, enabling empirical verification of every statement through return to primary and secondary sources from which it derives.

3. Preliminary Results: Implementation of a RAG System for the History of Religions

3.1 Methodological Configuration of the System

The system's implementation phase required rigorous configuration respecting the discipline's epistemological principles. The process articulated itself according to the following phases:

- **Supervised training of the Agent:** the system was configured through fine-tuning techniques to function as a “historian of religions,” utilizing a selected *corpus* including foundational works of the discipline and recent methodological contributions, guaranteeing acquisition of comparative competencies without interpretive predeterminations.



- **Creation of the vector database:** implementation of a semantic indexing system optimized for the religious and mythological language of ancient sources, with particular attention to management of technical terms, linguistic variants, and differentiated cultural contexts.
- **Iterative validation protocols:** systematic series of verification questions and corrections to refine the artificial intelligence's understanding regarding the complex methodological reflection characteristic of the Bianchian tradition.
- **Implementation of uncertainty management mechanisms:** system configuration to make interpretive limits explicit, signal ambiguities in sources, and distinguish between verifiable factual information and hypotheses.

A detailed technical architecture of the system is provided in *Appendix 1*, documenting the computational infrastructure and methodological protocols implemented.

3.2 Validation and Case Studies

Application of the RAG system was tested on several case studies pertaining to ancient Mediterranean religious traditions^[3], with particular attention to phenomena characterized by documentary complexity and interpretive stratification. The selection of Mediterranean contexts responds to the need to verify the system's capacity to manage large textual *corpora* (particularly Greek and Latin) and to analyze religious phenomena characterized by intercultural interactions and historical continuities/discontinuities.

The system was tested across various research areas, the results of which are synthesized in the following table:



Query	Sources Retrieved	Expert Evaluation
Analysis of theogonies and cosmogonies in polytheistic contexts of the ancient Mediterranean	38 fragments	Good, with necessary integrations
Divinatory practices, with particular reference to Sibylline divination for pagans, Jews, and Christians	174 fragments	Satisfactory, appropriate typological distinction
Concept of heresy and orthodoxy, with particular regard to the work of John of Damascus	35 fragments	Satisfactory, appropriate typological distinction, requires integration of lemma analysis
Conceptions of the afterlife in Greek religion, in the Orphic tradition and Jewish apocalyptic	44 fragments	Corrections requested on interpretation of Orphic texts
Female divinities of the ancient Mediterranean: Demeter, Isis, Cybele	61 fragments	Good management of iconographic and textual sources
Sacrificial practices: Greek world, Neoplatonism and early Christianity	49 fragments	Terminological clarifications requested

The tests conducted demonstrated the system's capacity to maintain constant traceability of primary and secondary sources, providing precise and contextualized citations enabling philological verification of produced statements. This requirement configures itself as a discriminating element compared to use of generic linguistic models that, while capable of syntactically correct elaborations, tend to produce content lacking verifiable documentary anchoring. The system also evidenced capacity to simultaneously manage



sources belonging to different religious traditions, identifying structural analogies and contextual specificities conforming to principles of the historical-comparative method.

Appendix 2 provides an exemplification of the case study upon which §4.2.1 is founded.

3.3 Critical Evaluation of Preliminary Results

The RAG system's implementation evidenced significant potentialities but also structural limits requiring critical consideration. Among positive elements emerge:

- **Amplified comparative capacity:** the system demonstrated effectiveness in identifying analogies and differences between religious traditions belonging to diverse geographical and chronological contexts, maintaining the historical contextualization necessary to avoid interpretive anachronisms.
- **Management of documentary complexity:** capacity to simultaneously elaborate primary sources in original languages (Greek, Latin, Arabic) and contemporary critical studies, producing syntheses preserving the interpretive plurality characteristic of scientific debate.
- **Methodological transparency:** systematic explication of utilized sources and signaling of areas of interpretive uncertainty, conforming to requirements of intellectual honesty proper to scientific research.

However, significant limitations persist:

- **Limited understanding of philological nuances:** the system manifests difficulties in analyzing technical terms requiring specialized linguistic competencies and in-depth knowledge of complex exegetical traditions.
- **Risk of interpretive simplification:** tendency to privilege prevailing interpretations in secondary literature at the expense of potentially illuminating minority readings.
- **Need for constant expert supervision:** computational elaboration requires continuous validation by the historian of religions to guarantee accuracy and pertinence of produced analyses.

4. Future Perspectives: Virtual Reality and Immersive Environments for Historical-Religious Research

4.1 Theoretical Foundations for RAG and VR Integration

Preliminary results obtained through RAG system implementation open unprecedented perspectives for integration with Virtual Reality technologies, configuring a methodological paradigm that could be defined as “immersive historical-comparative analysis.” This integration configures itself not as mere technological innovation, but as organic extension of the historical-comparative method through



instruments enabling three-dimensional visualization and interactive exploration of complex historical-religious contexts.

The theoretical proposal is founded on three fundamental methodological principles:

- **Documented spatial contextualization:** three-dimensional environment reconstruction must be based exclusively on archaeological evidence, iconographic sources, and verifiable textual testimonies, avoiding speculative reconstructions lacking documentary anchoring. Every architectural, iconographic, or ritual element represented in the virtual environment must be associated with the primary sources from which it derives, maintaining the epistemic traceability characteristic of the RAG system.
- **Immersive comparative analysis:** the VR environment enables simultaneous visualization of religious phenomena belonging to different traditions, facilitating identification of structural analogies and significant differences. Users can comparatively explore sacred architectures (Greco-Roman temples, early Christian churches, early Islamic mosques), documented ritual practices (processions, sacrifices, liturgies), iconographic systems (divine representations, cosmological symbolisms), preserving the historical specificity of each context.
- **Real-time interaction with RAG database:** during virtual environment exploration, users can interrogate the RAG system to obtain contextual information, access pertinent primary sources, and compare alternative historiographic interpretations. This integration configures a learning and research experience combining spatial immersiveness and documentary rigor.

4.2 Concrete Applications: Implementation Scenarios

Integration of RAG systems and VR environments can find concrete application in various areas of historical-religious research and teaching. We propose two implementation scenarios solely to exemplify the methodological potentialities of this approach:

4.2.1 Reconstruction of Ritual Contexts in the Hellenistic-Roman World. The Case of the *Mysteries*

A first application scenario envisions three-dimensional reconstruction of sanctuaries and ritual spaces of the Hellenistic-Roman world, with particular reference to mystery cults presenting significant interpretive difficulties due to their initiatory character and reserved nature of practices. The reconstruction is founded on careful study conducted by the RAG system and described in *Appendix 2*. The VR environment will enable:



- Spatial visualization of archaeologically documented architectural complexes (Eleusis, Samothrace, Mithraic sanctuaries), integrating ancient literary testimonies, epigraphic data, and iconographic finds.^[4]
- Comparative exploration of analogous ritual structures belonging to different traditions, evidencing similarities and specificities through simultaneous visualization.
- Real-time access to philological commentaries, alternative historiographic interpretations, and pertinent methodological discussions, through interrogation of the RAG system contextually to visual exploration.

This application is particularly significant for university teaching, enabling students to experience the spatial dimension of ancient religious phenomena while maintaining philological rigor and critical awareness of documentary limitations.

4.2.2 Simulation of Historical Interreligious Encounters

A second scenario, ambitious but methodologically significant, concerns simulation of historical contexts characterized by encounters between different religious traditions, with particular reference to early Christianity and coexistence dynamics among polytheisms, Christianities, Judaism, and Islam. The starting point will be investigations conducted with the RAG system on the case study "the concept of peace in John of Damascus and interreligious dialogue."^[5]

The VR environment could reconstruct:

- Urban contexts characterized by religious pluralism (Damascus, Baghdad, late antique Alexandria), documenting simultaneous presence of cultic buildings belonging to different traditions.
- Historically documented spaces of intellectual confrontation (theological debates, text translations, philosophical exchanges), integrating textual sources documenting doctrinal positions, polemical argumentation, and mediation attempts.
- Didactic pathways guiding students through the complexity of interreligious relationships, avoiding anachronistic simplifications and preserving the plurality of historically attested positions.

This application presents particular relevance in the contemporary context, characterized by increasing confessional and multicultural pluralism, offering instruments for historical understanding of complex interreligious dynamics through experiential modalities not compromising the scientific rigor of analysis.

4.3 Technical and Methodological Requirements for Implementation



Concrete implementation of integrated RAG-VR systems for the History of Religions requires consideration of technical and methodological requirements guaranteeing scientific validity of the approach:

- **Accessible VR platforms:** utilization of technologies not requiring prohibitive investments, privileging open source or otherwise accessible solutions for university institutions with limited resources. Compatibility with diversified devices (dedicated visors, traditional screen visualization, web-based applications).
- **Data interoperability:** adoption of international standards for representing archaeological, iconographic, and textual data, enabling integration with existing databases and facilitating collaboration between different research institutions.
- **Scientific validation protocols:** every element reconstructed in the virtual environment must be subjected to validation by disciplinary experts, explicitly documenting the degree of historical certainty, utilized sources, and adopted interpretive hypotheses. Implementation of mechanisms distinguishing between reconstructions based on solid evidence and hypothetical integrations necessary but documentarily uncertain.
- **Intuitive interfaces for humanist researchers:** design of systems not requiring specialized computational competencies, enabling historians of religions to concentrate on methodological and interpretive aspects rather than technical complexities.
- **Transparent methodological documentation:** publication of protocols making explicit criteria for source selection, reconstruction modalities, and epistemological limits of created virtual environments, facilitating critical evaluation by the international scientific community.

Appendix 3 includes a schema of interface design, mockups and conceptual prototypes.

4.4 Implications for Teaching and Collaborative Research

Integration of RAG systems and VR environments presents significant implications for university teaching and international collaborative research:

- **Immersive teaching:** students can experience the spatial and material dimension of ancient religious phenomena, surpassing limitations of traditional textual and iconographic documentation. The immersive experience favors understanding of relationships between sacred architecture, ritual practices, and cosmological conceptions, elements often difficultly communicable through conventional didactic modalities.^[6]
- **Democratized accessibility:** digitalization of archaeological and documentary contexts enables access for students and researchers unable to physically visit distant archaeological sites or directly consult rare manuscripts, contributing to democratization of historical-religious knowledge.



- **Amplified international collaboration:** shared virtual environments facilitate collaboration between researchers belonging to geographically distant institutions, enabling collaborative comparative analyses, synchronous methodological discussions, and co-construction of interpretations through shared exploration of documentary evidence.
- **Cultural heritage preservation:** three-dimensional digitalization of archaeological sites at risk of deterioration or destruction (armed conflicts, climate change, urbanization) contributes to preservation of historical memory and enables scientific analysis of otherwise inaccessible contexts.

5. Critical Considerations and Methodological Limits

Enthusiasm for potentialities offered by integration of RAG systems and VR environments must not obscure the epistemological limits and methodological risks this approach entails. Critical reflection proves indispensable to avoid technocratic drifts compromising the specificity of historical-religious research.

5.1 Epistemological Risks

The principal epistemological risk concerns emergence of a “computational neopositivism” overestimating objectivity of results produced through digital technologies, attributing to computational analyses a truth value superior to traditional humanistic interpretation. This tendency manifests in diverse forms:

- **Illusion of completeness:** the visual richness of virtual environments can generate the fallacious impression of a complete and definitive reconstruction of historical contexts that instead necessarily remain partial and hypothetical, given the fragmentary nature of available documentary evidence.
- **Reduction of hermeneutic plurality:** computational systems tend to privilege statistically prevailing interpretations in secondary literature, potentially marginalizing different readings that could prove methodologically innovative or historically more accurate.
- **Perceptual anachronisms:** three-dimensional visualization of ancient environments through contemporary technological interfaces can generate anachronistic perceptions, projecting modern aesthetic sensibilities onto radically different cultural contexts.

5.2 Current Technical Limits

Beyond epistemological risks, significant technical limits currently exist conditioning concrete implementation of integrated RAG-VR systems:



- **Management complexity:** creation of rigorously documented virtual environments requires interdisciplinary competencies (historians of religions, archaeologists, computer scientists, 3D designers) and significant temporal and economic investments.
- **Computational limits in linguistic understanding:** current RAG systems maintain significant difficulties in analyzing texts requiring specialized philological competencies, in-depth knowledge of complex exegetical traditions, and sensitivity to semantic ambiguities characteristic of ancient religious language.
- **Unequal technological accessibility:** utilization of VR environments requires technological infrastructures not all university institutions, particularly in the southern Italian context, can currently guarantee, risking amplification of existing disparities in access to research resources.

5.3 Need for Constant Expert Supervision

The most important consideration relates to the ineliminable necessity of expert supervision by the historian of religions. Technological integration cannot substitute disciplinary competence, but must configure itself as an instrument amplifying the expert's analytical capacities while maintaining the latter in the central role of epistemic responsible. The historian of religions must preserve: control over source selection and research objective definition; final interpretive responsibility, critically evaluating computational elaborations and correcting inappropriate distortions or simplifications; capacity to recognize epistemological limits of virtual reconstructions, distinguishing between documented evidence and hypothetical integrations; sensitivity to ethical and political implications of research, particularly relevant when studying religious phenomena simultaneously objects of identity claims in the current context.

5.4 Empirical Validation Protocol

To fulfill the necessities of empirical validation, it will be necessary to adhere to a structured framework for evaluating the effectiveness of the integrated RAG-VR system. It will be necessary to:

Evaluate the accuracy of RAG responses against disciplinary standards

Measure the didactic effectiveness of immersive VR environments

Verify the usability of the system for researchers and students without IT competences

Identify priority areas for improvement

Evaluation metrics for the RAG system:



Metric	Definition	Target
Citational precision	% of verifiable and correct citations	$\geq 95\%$
Documentary recall	% of relevant sources retrieved	$\geq 80\%$
Factual accuracy	% of statements validated by experts	$\geq 90\%$
Interpretive plurality	Average number of historiographical positions presented	≥ 2.5
Uncertainty management	% of responses with appropriate signaling of limits	$\geq 85\%$
Absence of hallucination	% of responses without invented content	$\geq 98\%$

Evaluation metrics for the VR environment:

Metric	Measurement Instrument	Target
Conceptual learning	Pre/post knowledge tests	$\Delta \geq 25\%$
Spatial comprehension	Orientation and description tasks	$\geq 80\%$ accuracy
Engagement	Voluntary dwell time	≥ 20 min
Usability	System Usability Scale (SUS)	$\geq 75/100$
Perceived presence	IPQ (Igroup Presence Questionnaire)	$\geq 4/7$
Fatigue	SSQ (Simulator Sickness Questionnaire)	≤ 15



5.5 Ethical Considerations on the Representation of Religious Traditions

The implementation of VR environments for the representation of religious phenomena raises significant ethical questions requiring explication and management protocols.

The project adopts the following guiding principles:

- **Respect:** Religious traditions, ancient and living, merit respectful representation avoiding every form of trivialization or exaltation.
- **Accuracy:** Reconstruction must be based on historical sources, verifiable documentary evidence, explicitly distinguishing between attested elements and hypothetical integrations.
- **Contextualization:** Every representation must be accompanied by adequate historical and cultural contextualization preventing misunderstandings.
- **Consultation:** For living religious traditions, involvement of representatives of interested communities is necessary.
- **Critical accessibility:** Users must be able to access sources and autonomously evaluate representative choices.

Appendix 4 includes a reflection on *Corpus Management and anti-bias strategies*.

6. Conclusions: Toward a Methodologically Aware Integration

This contribution has illustrated preliminary results of a project integrating Retrieval-Augmented Generation systems with the historical-comparative method applied to the History of Religions, proposing future perspectives contemplating utilization of Virtual Reality environments for immersive analysis of religious phenomena. The conducted analysis evidenced significant methodological convergences between the Bianchian approach and RAG architectures, particularly regarding preservation of source traceability, management of documentary complexity, and amplified comparative analysis capacity.

The critical reflection evidenced significant epistemological risks, particularly the danger of a “computational neopositivism” overestimating objectivity of technological elaborations at the expense of traditional hermeneutic richness. This awareness imposes adoption of rigorous methodological protocols guaranteeing centrality of disciplinary expertise, transparency of implementation procedures, and constant scientific validation of produced virtual reconstructions.

Integration of RAG systems and VR environments does not propose itself as replacement for traditional research, but as instrumental amplification that, if methodologically controlled, can contribute to understanding religious phenomena through unprecedented analytical modalities. Didactic perspectives prove particularly promising, offering students immersive experiences facilitating understanding of the



spatial and material dimension of ancient religions, surpassing limitations of traditional two-dimensional documentation.

The proposal outlined here inserts itself into the contemporary debate on Digital Humanities proposing a model of technological integration preserving the Italian epistemological specificity in the field of historical-religious studies: the Bianchian-computational approach illustrated here demonstrates the possibility of innovating technologically while maintaining the interpretive richness characteristic of the Italian tradition.

The project also configures itself as a response to marginalization of the History of Religions in the European panorama of technological innovation, proposing application models evidencing the discipline's relevance for understanding contemporary cultural phenomena characterized by increasing religious and multicultural pluralism. Historical analysis of complex interreligious dynamics, conducted through instruments combining scientific rigor and experiential immersiveness, can significantly contribute to promotion of intercultural dialogue founded on reciprocal knowledge rather than on artificial conciliations or ideological oppositions.

In future perspective, development of interdisciplinary and international collaborations enabling concrete implementation of integrated RAG-VR systems proves essential, requiring methodologically transparent solutions that facilitate critical evaluation by the scientific community.

Nonetheless, realism imposes recognition of significant practical difficulties in sustaining international collaborative initiatives of this scope. Structural obstacles include institutional fragmentation across divergent academic evaluation systems and funding timelines, technological heterogeneity particularly between northern and southern European research institutions, incompatible disciplinary epistemologies requiring sustained negotiation among different historiographical traditions, economic dependence on project-based funding that risks infrastructural abandonment after initial phases, and linguistic barriers that may marginalize non-Anglophone scholarly contributions despite increasing multilingualism. These difficulties, though not insurmountable, require explicit acknowledgment and strategic planning privileging modular architectures, open-source solutions, comprehensive documentation, institutional commitment extending beyond individual project cycles, and inclusive governance structures ensuring equitable participation across diverse academic contexts.

Creation of collaborative networks between university institutions, research centers, and cultural institutes can favor sharing of competencies, standardization of methodological protocols, and optimization of available resources.



As Ugo Bianchi observed,

"no tradition of studies saves itself by intrinsic necessity, because ideas walk in the shoes of men. And shoes walk on roads, and these are made to extend and open access to the new, but without thereby losing continuity with what lies behind the shoulders of those who walk and which gives meaning to their journey."^[7]

Methodologically aware integration of computational and immersive technologies in historical-religious research represents precisely this opening to the new that preserves continuity with disciplinary tradition, configuring itself as organic evolution of the historical-comparative method in the digital age.



Notes

^[1] See what is defined in Mariangela Monaca, Salvatore Morante, *Un sistema RAG per la Storia delle religioni? Strumenti e metodi per dialogare di pace, tra insidie e opportunità*, *Civiltà e Religioni* 11 (2025), 97-141, and the bibliography cited therein.

^[2] Cf. U. Bianchi, *Problemi di storia delle religioni* (Roma: Edizioni Studium, 1986²), pp. 9-30, taken up by Giulia Sfameni Gasparro, *Introduzione alla storia delle religioni*, (Roma-Bari: Laterza 2011). For an overview also Mariangela Monaca, «Ugo Bianchi e la Storia delle religioni in Italia. Ripensare un Maestro nel centesimo anniversario della nascita», *Studi e materiali di Storia delle Religioni* 89.2 (2023), 841-852.

^[3] System validation was conducted through analysis of representative case studies of ancient Mediterranean religious worlds, selected based on the research group's specific competencies: theogonic traditions, relationships between polytheisms and Christianity, conceptions of peace in interreligious confrontation contexts, divinatory and magical practices. The choice of fields already subject to previous academic research (cf. M. Monaca <https://iris.unime.it/cris/rp/rp00482>) enabled rigorous methodological validation through comparison between computational elaborations and consolidated disciplinary knowledge. For a comprehensive framework of the methodological approach and concrete application, reference is made to the case study on the concept of peace in John of Damascus, already published in Monaca, Morante 2025.

^[4] Consider, for example, the wealth of data offered by the Locrian *pinakes* preserved at MARRC and the Museum of Locri (Cf. E. Lissi Caronna, C. Sabbione, L. Vlad Borrelli (eds.), *I Pinakes di Locri Epizefiri. Corpus, Opera in 3 voll*, «Atti e Memorie della Società Magna Grecia», serie IV, 2012), object of great interest also thanks to a database creation project making the material available to the public for studies and consultations. Digital recompositions of fragmentary Pinakes are made interactive with creation of “animations” of image components: <https://www.digi-art.it/eventi/progetto-pinakes/>.

^[5] Cf. Monaca, Mariangela, and Salvatore Morante. "Un sistema RAG per la Storia delle Religioni? Strumenti e metodi per dialogare di pace, tra insidie e opportunità." *Civiltà e Religioni* 11 (2025): 99–136.

^[6] Cf. Radianti, Jaziar, Tim A. Majchrzak, Jennifer Fromm, and Isabell Wohlgenannt. "A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda." *Computers & Education* 147 (2020): 103778. However, recent literature on VR applications in educational contexts presents ambivalent results requiring critical consideration. Radianti et al. (2020), in their systematic review of VR in higher education, evidence significant variability in learning outcomes depending on disciplinary context, interface design, and pedagogical integration modalities. Studies demonstrate effectiveness in spatial comprehension and engagement, but also signal risks of cognitive



overload, technological distraction, and superficiality in content processing when immersive experience is not adequately guided by disciplinary expertise.

[7] Bianchi, Ugo. "*Raffaele Pettazzoni e la I.A.H.R.*" *Strada maestra* 12 (1979): 11–18.



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APPENDIX 1

Technical Architecture of the System

The implementation of the RAG system for the History of Religions required specific design choices, oriented toward preservation of philological rigor and management of multilingual documentary corpora. We present the adopted technical specifications, in order to allow replicability of the approach and critical evaluation of implementation choices.

General System Architecture

[Diagram showing: Documentary Corpus (Primary sources/ancient texts, Secondary literature/critical studies, Iconographic sources/descriptions) → Linguistic Model (Contextualized generation, Comparative synthesis, Source citation) → Vector Database (Semantic embeddings, Source indexing, Retrieval by similarity) → User Interface (Query in natural language) → Orchestration Module (Fluent design, prompt engineering, validation) → Vector Database → LLM (Linguistic Model) → Documentary Corpus]

1.1 Base Linguistic Model

For the generative component, Claude 3.5 Sonnet (Anthropic) was utilized, selected on the basis of the following criteria:

- Capacity for managing long contexts (200K tokens), essential for simultaneous elaboration of multiple sources
- Superior performance in comprehension of texts in ancient Greek and Latin compared to tested alternatives (GPT-4, Mistral Large, Llama 3)
- Lesser tendency toward confabulation (hallucination) in historical-philological domain, verified through comparative tests on 50 control queries
- Availability of API with configurable temperature parameters to balance creativity and adherence to sources

Configuration adopted:

Parameter	Value	Motivation
Temperature	0.3	Privileges coherence and documentary adherence
Max tokens output	4096	Allows articulated responses with extended citations
Top-p	0.9	Maintains controlled lexical diversity

1.2 Document Chunking Strategy

Corpus segmentation required differentiated strategies by documentary typology, privileging semantic units over mechanical segmentation by character number:



Documentary Typology	Chunking Strategy	Chunk Size	Overlap
Primary sources (ancient texts)	By logical unit (chapter, paragraph, pericope)	500-1500 tokens	100 tokens
Secondary literature (monographs)	By thematic section with preservation of argumentative context	800-2000 tokens	200 tokens
Scientific articles	By paragraph with metadata (abstract, conclusions separated)	600-1200 tokens	150 tokens
Epigraphic sources	Per single inscription with critical apparatus	200-800 tokens	50 tokens
Iconographic descriptions	Per single object/monument	300-1000 tokens	100 tokens

The choice to preserve coherent semantic units responds to the need to maintain the argumentative integrity of sources, particularly relevant for complex texts such as historiographical analyses that develop articulated reasoning.

1.3 Embedding Model

For vectorial representation of documents, a hybrid approach was adopted:

Primary embedding: text-embedding-3-large (OpenAI)

- Dimensionality: 3072
- Selected for superior performance on multilingual texts and specialist terminology
- Internal benchmark: 87% precision in retrieval of pertinent sources on test set of 200 queries

Secondary embedding (experimental): model fine-tuned on corpus of historical-religious literature

- Base: sentence-transformers/paraphrase-multilingual-mpnet-base-v2
- Fine-tuning on 15,000 query-document pairs extracted from analytical indices of historical-religious monographs
- Objective: improve representation of technical terms (e.g., hierophantes, epopteia, theophania, mysterion)

Specific preprocessing for ancient languages:

- Unicode normalization for polytonic Greek (NFD → NFC)
- Management of Latin orthographic variants (u/v, i/j)



- Optional lemmatization through CLTK (Classical Language Toolkit) to increase semantic retrieval
- Preservation of inflected forms for specific morphological analyses

1.4 Vector Database

Qdrant was implemented as vector store, selected for:

- Native support for filtering on metadata (dating, language, source typology, religious tradition)
- Horizontal scalability for expanding corpus
- Possibility of hybrid search (vectorial + keyword BM25) essential for technical terms not adequately represented in generic embeddings
- Optimal performance with HNSW indices for large-scale searches

Metadata structure per document:

```
{
  "document_id": "uuid",
  "source_type": "primary|secondary|epigraphic|iconographic",
  "language": ["grc", "lat", "ita", "eng", "deu", "fra"],
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  "author_modern": null,
  "bibliography_key": "clem_alex_strom"
}
```

1.5 Prompt Engineering for "Historian of Religions" Behavior

The system was configured through an articulated system prompt encoding Bianchian methodological principles:

IDENTITY AND METHODOLOGICAL APPROACH:

You are a historian of religions trained in the methodological tradition of the Italian school (Pettazzoni, Bianchi, Sfamini Gasparro).



Your approach is historical-comparative: you analyze religious phenomena in their historical and cultural specificity, identifying analogies and differences between traditions through the concept of "historical typology."

FUNDAMENTAL OPERATIONAL PRINCIPLES:

1. DOCUMENTARY ANCHORAGE

- Every statement must be supported by verifiable sources.
- Always cite critical reference editions for primary sources and specific studies for interpretations.
- Never produce content lacking documentary foundation.

2. ANALOGY/DEPENDENCE DISTINCTION

Explicitly distinguish between:

- Typological analogies: structural similarities explainable without necessity of postulating direct historical contact
- Historical dependencies: influences documentable through evidence of contact, transmission, cultural mediation
- Avoid inferring historical dependencies from mere formal similarities.

3. HERMENEUTIC PLURALITY

Present different historiographical interpretations without a priori privileging majority positions. Signal open debates, controversial questions, recent revisions of previous consensuses.

4. RIGOROUS CONTEXTUALIZATION

Every religious phenomenon must be understood in its specific historical, geographical, social, linguistic context.

Avoid:

- Interpretive anachronisms
- Undue generalizations
- Projections of modern categories onto ancient contexts
- Essentializations of religious traditions

5. EXPLICIT MANAGEMENT OF UNCERTAINTY

Always make explicit:

- Limits of available sources
- Significant documentary lacunae
- Degree of certainty of proposed reconstructions
- Plausible alternative hypotheses



6. PHILOLOGICAL AND LINGUISTIC RIGOR

- Utilize appropriate specialist terminology
- Provide transliterations for terms in ancient Greek
- Offer contextual translations preserving semantic nuances
- Signal relevant textual problems (variants, corruptions, integrations)

RESPONSE STRUCTURE:

- Analysis of primary sources pertinent to query
- Presentation of principal historiographical interpretations
- Comparative synthesis evidencing analogies and differences
- Indication of open questions and research directions
- Complete bibliography of sources utilized

ABSOLUTE CONSTRAINTS:

- NEVER produce information not derived from provided corpus
- NEVER present speculative hypotheses as ascertained facts
- NEVER omit reference to sources for factual statements
- ALWAYS signal when a question is debated
- ALWAYS distinguish between documentary datum and interpretation

1.6 Retrieval and Generation Pipeline

The operational flow of the system follows a sequence articulated in five phases:

PHASE 1: QUERY ANALYSIS

- Semantic NLP parsing
- Identification of named entities
- Requested typological analysis
- Query expansion with synonyms

PHASE 2: MULTI-STAGE RETRIEVAL

- First phase: broad retrieval $k=50$
- Second phase: cross-encoder re-ranking
- Third phase: metadata filtering
- Output: 10-20 most relevant chunks

PHASE 3: CONTEXT ASSEMBLY

- Primary sources (maximum priority)
- Secondary literature
- Supplementary context



- Contextual metadata

PHASE 4: GENERATION

- LLM invocation
- System prompt + context + query
- Optimized accuracy parameters

PHASE 5: POST-PROCESSING

- Citation accuracy verification
- Bibliography extraction in standard format
- Flagging of incongruent chronologies
- Source coherence control

1.7 Technology Stack

Component	Technology	Version	Notes
Orchestration	LangChain	0.1.x	Framework for RAG pipeline
Vector database	Qdrant	1.7.x	Self-hosted on Docker
Primary LLM	Claude 3.5 Sonnet	API	Via Anthropic API
Fallback LLM	GPT-4 Turbo	API	For comparison and validation
Primary embedding	OpenAI text-embedding-3-large	API	3072 dimensions
Secondary embedding	Sentence-Transformers fine-tuned	Local	For technical terms
Backend API	FastAPI (Python)	0.109.x	REST API
Task queue	Celery + Redis	5.3.x	For asynchronous indexing
Text preprocessing	SpaCy + CLTK	3.7 / 1.1	Multilingual NLP
OCR digitized sources	Tesseract + Kraken	5.3 / 4.3	Kraken for ancient Greek
Frontend (prototype)	Streamlit	1.31.x	For testing and demo



1.8 Indexed Documentary Corpus (Current State)

Category	Documents	Indexed Chunks	Languages	Notes
Greco-Roman primary sources	847	12,450	grc, lat	Includes TLG subset, PHI Latin
Jewish and early Christian sources	523	8,230	grc, lat, heb	LXX, NT, Apostolic Fathers, Apologists
Oriental sources in translation	156	2,340	eng, ita, fra	Egyptian, Mesopotamian, Iranian texts
Secondary literature	1,245	34,670	ita, eng, fra, deu	Monographs and articles 1950-2024
Epigraphic sources	2,340	4,890	grc, lat	Selection from IG, CIL, SEG
Iconographic descriptions	456	2,340	ita, eng	LIMC, museum catalogs
Total	5,567	64,920	-	-

APPENDIX 2

Operational Exemplification: Observations on Greek Mysteries

Based on the Description of Ritual Practices Mentioned by Pagan and Christian Sources of the First Centuries

In order to concretely illustrate the operational modalities of the implemented RAG system, we present a functional case study for the realization of the design hypothesis "**4.2.1 Reconstruction of Ritual Contexts in the Hellenistic-Roman World: The Case of the Mysteries**," which evidences both the potentialities and the limits of the adopted approach.

Query submitted to the system:

"What elements useful for describing the modalities and initiatory practices proper to the Eleusinian mysteries and the so-called 'Oriental cults' of mystical and mystery character emerge from pagan and Christian sources of the first centuries? Consider the available primary sources and the principal historiographical interpretations."

System elaboration:

The system proceeded according to the following operational phases:

1. Documentary retrieval: identification of 63 pertinent fragments from the indexed corpus, comprising pagan primary sources (Homeric Hymn to Demeter, Aristophanes, Pausanias,



- Plutarch, Apuleius, Orphic corpus, Orphic hymns, Iamblichus), polemical Christian sources (Clement of Alexandria, Hippolytus, Tertullian, Arnobius, Firmicus Maternus, Lactantius), and secondary literature (Burkert, Casadio, Sfameni Gasparro, Bianchi, Turcan, Cumont).
2. Thematic clustering: automatic grouping of sources according to conceptual nuclei: (a) ritual sequences and initiatory stages; (b) soteriological and eschatological symbolism; (c) secrecy and *disciplina arcani*; (d) preliminary purificatory practices; (e) visionary and theophanic experience; (f) communal dimension and initiatory bonds; (g) allegorical and philosophical interpretations.
 3. Response generation: elaboration of an articulated analytical synthesis, of which we report a significant extract:

"The documentation relative to the initiatory modalities of the Eleusinian mysteries and Oriental cults of mystery character presents a fundamental tension between the ritual secrecy imposed on initiates and the descriptive necessity of sources, particularly acute in polemical Christian testimonies.

Concerning the Eleusinian Mysteries, sources attest to an initiatory progression articulated in grades. The Homeric Hymn to Demeter (vv. 473-479) alludes to the final revelation without describing its content: ὄλβιος ὃς τὰδ' ὄπωπεν ἐπιχθονίων ἀνθρώπων ('blessed among terrestrial men who has seen these things'). The processual structure emerges from Aristophanes (Ranae, 340-459) who describes the sequence purifications-procession-nocturnal rites, and from late testimonies such as Pausanias (I, 38, 7) who distinguishes between μῆσαις (lesser initiation) and ἐποπτεία (supreme vision reserved for those who have already received the first initiation).

Christian sources, though polemical, provide details otherwise unknown. Clement of Alexandria (Protrepticus II, 12-22) reports the mystery σύνθημα: 'I have fasted, I have drunk the kykeon, I have taken from the cista, I have worked and I have deposited in the kalathos' (ἐνήστευσα, ἔπιον τὸν κικεῶνα, ἔλαβον ἐκ κίστης, ἐργασάμενος ἀπεθέμην εἰς κάλαθον), a formula revealing a ritual sequence including preparatory fasting, assumption of sacred beverage (Demeter's kykeon), manipulation of sacred objects from the mystic cista.

For Oriental Mystery Cults (Isis, Cybele-Attis, Mithras), documentation is more fragmentary but convergent in initiatory structure. Apuleius (Metamorphoses XI, 21-25) offers the most detailed description of an Isiac initiation: 'acessi confinium mortis et calcato Proserpinae limine per omnia vectus elementa remeavi; nocte media vidi solem candido coruscantem lumine' ('I approached the boundary of death, having crossed Proserpine's threshold and been carried through all elements I returned; at midnight I saw the sun shining with white light').

On the hermeneutic plane, historiography has elaborated diverse interpretive keys. Burkert (1987) underlines the common anthropological structure of rites of passage (separation-liminality-aggregation), recognizable in all mystery cults independently of specific tradition. Bianchi (1979, 1980) privileges typological analysis identifying structural convergences without



postulating necessary historical dependencies: 'historical typology' allows recognition of functional analogies while respecting the specificity of each tradition.

Sfameni Gasparro (2003, 2011) evidences how the adoption of mystery language by Christian authors (particularly Clement of Alexandria and Origen) responds to communicative strategies in the Hellenistic-Roman cultural context more than to effective ritual derivations.

Critical evaluation of output:

The system's elaboration evidences positive elements and critical issues meriting consideration:

Positive elements:

Broad coverage of diverse mystery traditions (Eleusis, Isis, Mithras, Cybele-Attis)

Balance between pagan sources and Christian sources with explication of their different nature

Complete traceability of primary sources with references to standard critical editions

Balanced presentation of different historiographical positions

Critical issues emerged:

Tendency to privilege Clement of Alexandria among Christian sources

Necessity of integration on epigraphic and iconographic documentation for Oriental cults

Simplification of the complexity of debate on Oriental origin vs. Greco-Roman origin

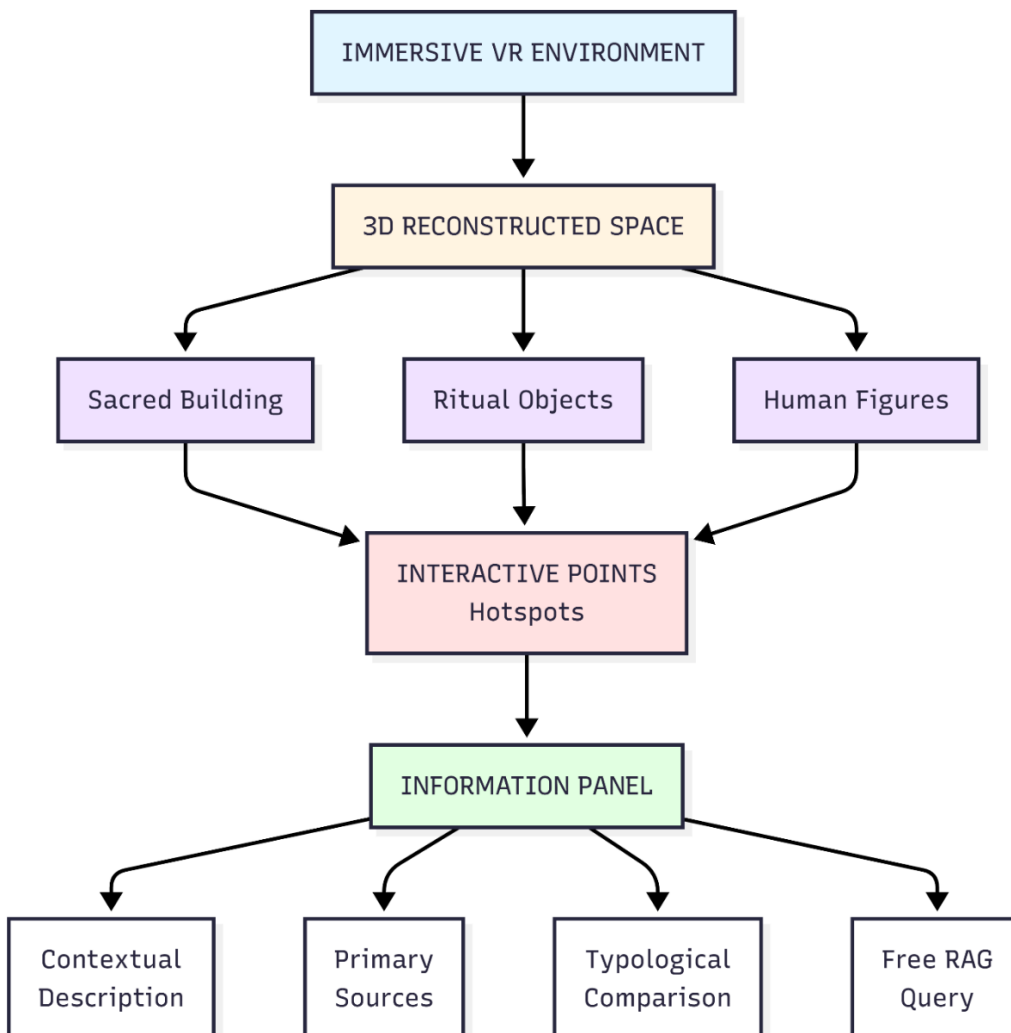


APPENDIX 3

Interface Design: Mockups and Conceptual Prototypes

In order to concretely illustrate the potentialities of RAG-VR integration, we present a series of conceptual mockups and flow diagrams delineating the architecture of the proposed user experience. Such representations, though not constituting functional implementations, offer a visualization of the envisioned operational modalities and adopted design principles.

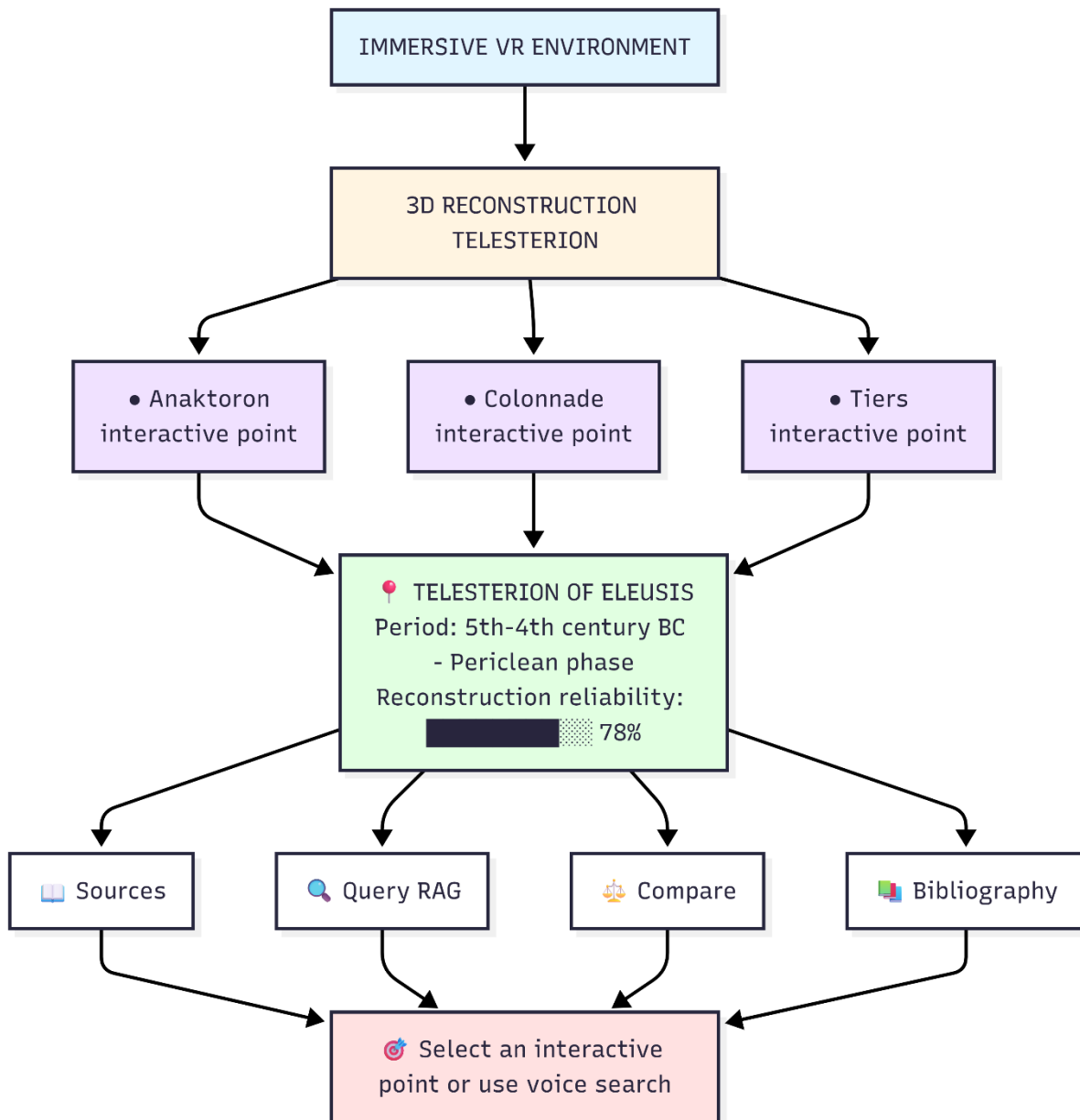
3.1 User Experience Architecture





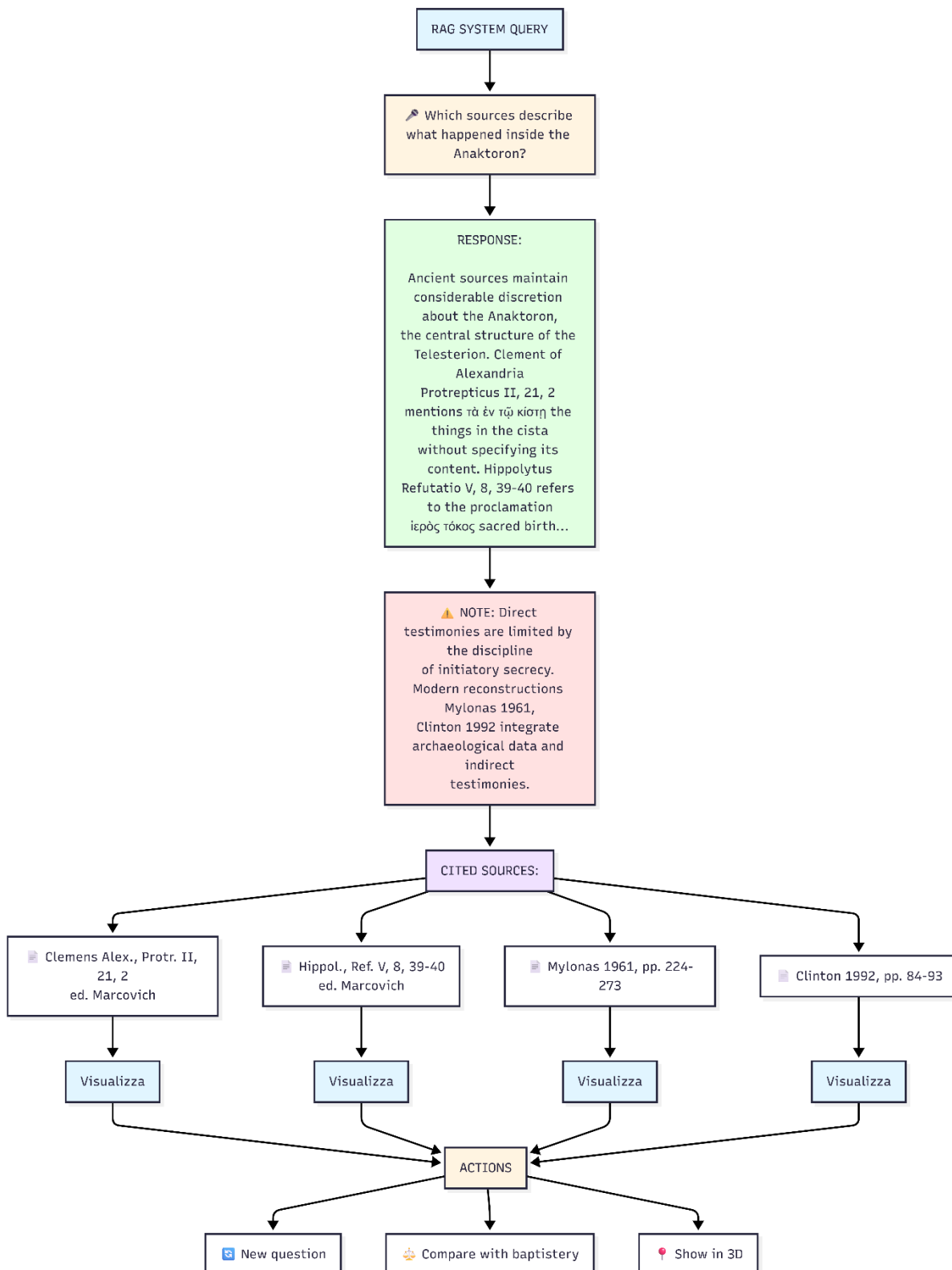
3.2 Main Interface Mockups

Screen 1: Immersive View of the Telesterion of Eleusis





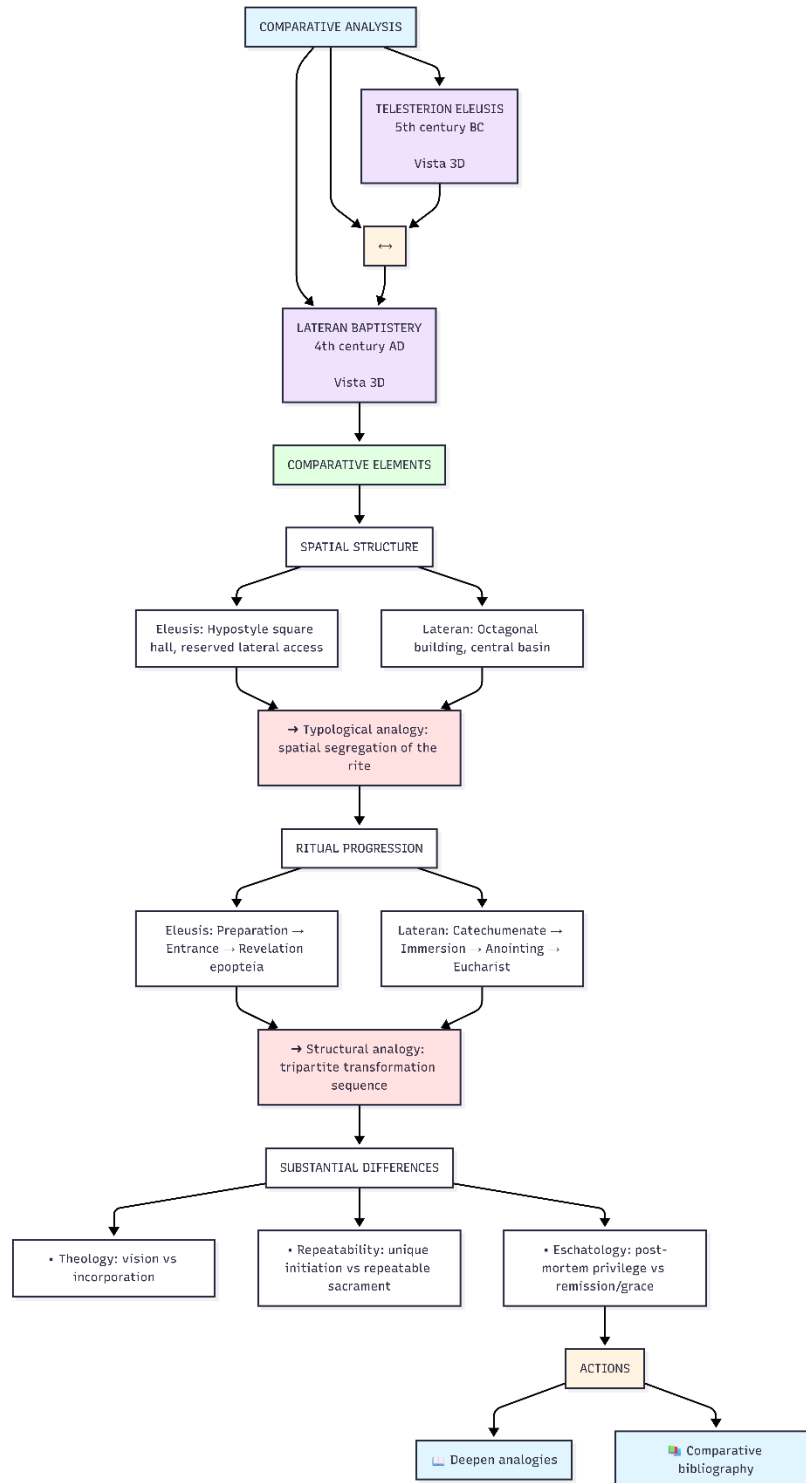
Screen 2: RAG Interrogation Panel in VR Environment





Screen 3: Comparative Mode - Side-by-Side View

The comparative analysis interface presents:





3.3 User-System Interaction Flow Diagram

The complete interaction flow follows these steps:

1. USER ENTERS VR ENVIRONMENT
2. CONTEXT SELECTION: Historical period / Geographic area / Religious tradition
3. LOADING OF CONTEXTUALIZED 3D ENVIRONMENT
4. Three parallel interaction paths:
 - HOTSPOT INTERACTION → INFORMATIVE PANEL
 - FREE EXPLORATION
 - RAG INTERROGATION
5. COMPARATIVE MODE decision point
6. If Yes → SELECTION SECOND COMPARED CONTEXT → SIDE-BY-SIDE VIEW + COMPARATIVE RAG ANALYSIS
7. If No → CONTINUATION EXPLORATION

3.4 Reconstruction Reliability Indicators

A crucial element of the VR interface is transparent communication of the degree of certainty of proposed reconstructions. The system adopts multilevel visual coding:

Level	Description	Examples
HIGH 90-100% (Green)	Direct archaeological evidence, Concordant textual sources, Explicit iconography	Telesterion floor plan, Column positions
MEDIUM 60-89% (Yellow)	Indirect evidence, Typological analogies, Prevalent historiographical hypotheses	Parietal decoration, Ritual furnishings disposition
LOW 30-59% (Orange)	Hypothetical elements, Plausible parallels, Integration for completeness	Participant garments, Nocturnal illumination
SPECULATIVE <30% (Red)	Purely hypothetical, No direct evidence, Explicit conjecture	Facial expressions, Specific ritual gestures



3.5 Technical Specifications for VR Implementation

Component	Proposed Technology	Alternative	Notes
3D Engine	Unity 3D	Unreal Engine 5	Unity preferred for accessibility
VR Framework	OpenXR	Oculus SDK	Open standard for interoperability
Modeling	Blender	3ds Max	Open source, broad community
Texturing	Substance Painter	Quixel	Photorealistic quality
RAG Integration	WebSocket API	REST polling	Real-time for fluidity
Spatial audio	Steam Audio	Oculus Audio	Acoustic immersivity
Target devices	e.g. Meta Quest 3, HTC Vive	Generic PCVR	Standalone prioritized
Non-VR fallback	Three.js web viewer	Desktop application	Accessibility without visor

APPENDIX 4

Corpus Management and Anti-Bias Strategies

The construction of the documentary corpus represents a methodologically crucial phase requiring explication of adopted criteria and awareness of potential biases introduced. We present the guiding principles and mitigation strategies implemented.



4.1 Criteria for Inclusion of Primary Sources

Criterion	Description	Methodological Ratio
Critical editions	Exclusively texts from recognized critical editions (Teubner, OCT, SC, GCS, CCSL)	Guarantee of philological reliability
Critical apparatus	Inclusion of significant textual variants as metadata	Preservation of traditional complexity
Validated translations	Translations only from scientific series	Avoid interpretive distortions
Chronological coverage	From 2nd millennium BCE to 7th century CE for antiquity	Coherence with disciplinary scope
Geographic coverage	Mediterranean area and Near East, with documented extensions	Focus of Italian tradition of studies
Traditional plurality	Proportionate representation of all religious traditions documented	Avoid overrepresentation

4.2 Criteria for Inclusion of Secondary Literature

Criterion	Description	Implementation
Peer review	Only publications subjected to peer review	Verification on bibliographic databases
Linguistic plurality	Representation of diverse historiographical traditions	Minimum quota: 25% non-Anglophone
Temporal arc	Studies from 1950 to present, with earlier classics	Balance between foundations and updates
Interpretive plurality	Inclusion of diverse hermeneutic schools	Explicit mapping of orientations
Updating	Priority to studies of last 15 years for state of the art	Annual corpus refresh

4.3 Exclusion Criteria

Excluded from the corpus:

- Popular texts not subjected to peer review
- Confessional publications with explicit apologetic finalities
- Non-philological translations (e.g., modernizing liturgical translations)



- Non-academic web content (Wikipedia, blogs, forums)
- Publications in languages not presided over by the team (currently excluded: Russian, Scandinavian languages, Japanese)

4.4 Identification and Mitigation of Biases

Identified biases:

Bias Type	Description	Mitigation Strategy
Historiographical Eurocentrism	Overrepresentation of European and North American studies	Systematic inclusion of scholarship from other areas (minimum 15%)
Linguistic bias	Predominance of Greco-Latin primary sources	Dedicated section for Oriental sources in translation
Confessional bias	Potential overrepresentation of studies on early Christianity	Quantitative balance among traditions, periodic monitoring
Chronological bias	Greater documentation for better attested periods	Explicit signaling of documentary lacunae in system
Gender bias in studies	Historical underrepresentation of female scholars	Active inclusion of recent female scholarship
Recency bias	Tendency to privilege recent studies	Preservation of classic contributions with "foundational" tag

Quantitative monitoring of corpus:

DISTRIBUTION BY RELIGIOUS TRADITION (primary sources):

- Greco-Roman polytheisms: 34%
- Early Christianity: 28%
- Ancient Judaism: 18%
- Oriental religions (Egypt, Mesopotamia, Iran): 12%
- Mystery cults and syncretisms: 8%



DISTRIBUTION BY LINGUISTIC AREA (secondary literature):

- Anglophone: 42%
- Italian: 24%
- Francophone: 18%
- Germanophone: 12%
- Other (Spanish, Portuguese, Dutch): 4%

CHRONOLOGICAL DISTRIBUTION (secondary literature):

- 2015-2024: 35%
- 2000-2014: 30%
- 1980-1999: 20%
- 1950-1979: 12%
- Pre-1950 (classics): 3%

4.5 Update and Review Procedures

Activity	Frequency	Responsibility
Integration of new publications	Quarterly	Research team
Review of corpus balance	Annual	Scientific committee
Verification of emerging biases	Semi-annual	Automatic analysis + expert review
Update of critical editions	Upon publication	Automatic signaling from bibliographic databases
Removal of obsolete content	Annual	Expert review with explicit criteria

4.6 Transparency and Documentation

The system implements transparency mechanisms allowing the user to:

- Visualize corpus composition for each generated response
- Identify potential biases in sources used
- Access alternative sources not included in response
- Signal perceived lacunae or imbalances



4.7 Ethical Considerations on the Representation of Religious Traditions

The implementation of VR environments for the representation of religious phenomena raises significant ethical questions requiring explication and management protocols.

The project adopts the following guiding principles:

1. **Respect:** Religious traditions, ancient and living, merit respectful representation avoiding every form of trivialization or exaltation.
2. **Accuracy:** Reconstruction must be based on historical sources, verifiable documentary evidence, explicitly distinguishing between attested elements and hypothetical integrations.
3. **Contextualization:** Every representation must be accompanied by adequate historical and cultural contextualization preventing misunderstandings.
4. **Consultation:** For living religious traditions, involvement of representatives of interested communities is necessary.
5. **Critical accessibility:** Users must be able to access sources and autonomously evaluate representative choices.

Prohibited Uses

The system explicitly prohibits:

- Use for contemporary religious polemics or apologetics
- Decontextualized extraction of imagery for non-academic purposes
- Commercial exploitation without proper authorization
- Modification of content to support ideological claims
- Use in contexts promoting religious intolerance or discrimination

These ethical guidelines aim to balance scholarly inquiry with cultural respect, ensuring that technological innovation serves rather than undermines the humanistic values central to the study of religious history.

