

Original Article

# Talking to Data: Designing Smart Assistants for Humanities Databases

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**Abstract:** The exponential growth of digital humanities databases in the past several years have introduced behemoth accumulations of linguistic, cultural and historical content that are for all practical purposes only accessible by highly trained experts, though we imagine them to be theoretically accessible to anyone. Users, who are often humanities scholars, can find it daunting to query well-structured data because current retrieval methods require knowledge of the targeted database schema or controlled vocabularies or one (or more) query languages such as SQL, SPARQL or XPath. This leaves a gulf between the logic of computation that provides the underpinning for database design, and the interpretive processes involved in humanistic research. Emerging model: "talking to data" The notion for solving this sticking point comes from the emerging paradigm of "talking to data", which aspires to enable humanities researchers to access and query databases in natural language using with AI-powered conversational assistants (Qiu et al. To build interfaces that can understand, reason and respond to complex, context-rich questions capturing the nuances of humanistic reasoning, the study examines the combination between large language models (LLMs) and semantic technology. Such assistants are capable of receiving dynamic, interpretative questioning rather than relying simply upon key-word searches. For instance, a researcher could ask "which correspondences from the 17th century discuss trade in Venice?" and receive answers that are relevant to the context, supported with provenance information and structured metadata. Such a system offers a solution that generalizes the expressive power of database queries for those users who cannot express their needs in constant-domain logic. We propose such a system bridging together unstructured human language and symbolic representations from ontologies by integrating neural natural language processing (NLP) with symbolic ontology representations.

With an eye toward explainability, interpretability, and cultural sensitivity, this work contributes to discussions around human-centered AI by developing intelligent assistant systems tailored for the humanities. The approach highlights the requirement for interfaces that are sensitive not only to computation or quantitation, but to the epistemological basis of humanities research, where meaning is historical, contingent and interpretative. The paper argues that conversational interaction with such implicit databases, can support inter-disciplinary collaboration, democratise access to digital archives and transform the practices of academic knowledge production and analysis in the digital age. Furthermore, this research positions conversational database assistants within the philosophical and normative debate on interpretation and artificial intelligence. It stresses that besides getting data back, such systems also need to provide clear paths of reasoning so human researchers can follow their inferences. Through the fusion of multimodal interface design, knowledge graph integration and language modelling, "talking to data" becomes a game changer for the next generation of digital scholarship. What we have then is a model of humanistic inquiry in which databases are dynamic partners, responsive collaborators within a dialogic process of interpretation between humans and machines—not inert archives.

**Keywords:** Conversational AI, Digital Humanities, Natural Language Interfaces, Knowledge Graphs, Large Language Models (LLMs), Semantic Web, Human-Centered Computing, Intelligent Databases, Explainable AI, Cultural Informatics.

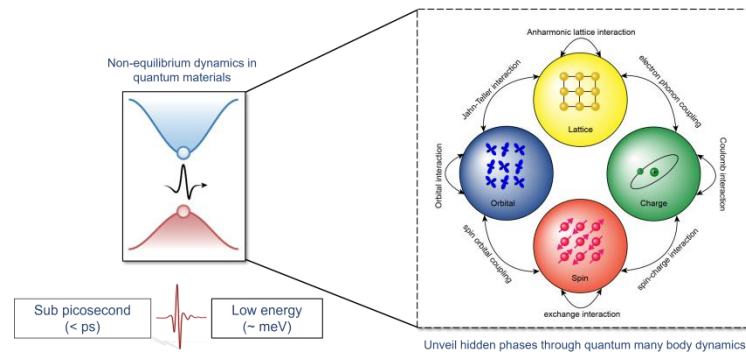
## I. INTRODUCTION

In the wake of the digital transformation of the humanities, vast amounts and varieties of data are now available to researchers. Today, millions of texts, artworks and artefacts have been digitised and described with metadata in large online archives, corpora or cultural heritage repositories. This change is most notable in institutions like Europeana, the British Library and Digital Public Library of America; they allow unprecedented access and opportunity with culture across the globe and time. Yet, despite this wealth of materials and information the technical features of these digital touches on researchers ability to work with them. These resources are generally accessed through formal query languages, metadata formats and limited vocabularies which are not often taught to humanists. So the issue is not lack of data but the inability to access it in an approachable way. This mirrors the historical evolution of academia in a number of ways: early scholars navigated physical archives through dialogue, asking for advice and interpretation from friends, archivists, and librarians.



Inquiry was, in its essence, a dialogue. An enriching interpretative experience has been converted into a simple search function in the digital era with this conversational layer being replaced by rigid search boxes and technical query syntax. The idea of “talking to data” is to make use of artificial intelligence (AI) in order to regain that lost conversation. The exploratory, intuitive nature of research in the digital world can be recreated by devising intelligent assistants that understand natural language queries and respond appropriately.

Conversational AI is more and more a new type of interface between human thought expression and machine data management at the junction of digital humanities, knowledge representation and natural language processing (NLP). Systems like these leverage advances in Large Language Models (LLMs) such as Claude, Gemini and GPT that can infer structured database queries, understand ambiguous requests/speakertasks, and interpret reading speaker intent. Conversational systems can aggregate synonyms, disambiguate entities, interpret the questions in their context and may even present an explanation of their reasoning behind generating the answer (unlike regular search engines that are based on keyword matching). This transformation represents a shift from accessing data to understanding it. The humanities do have some unique challenges that distinguish them from other data fields, like biology or finance. The data that comes from the humanities is interpretive, historical, and culturally specific; it's more than just informational. The same term may refer to several events, ideologies, or movements at different moments in time, e.g. "revolution". As a result, humanistic databases should be equipped with intelligent assistants capable of acting as interpretive partners as well as search engines that can interact directly with meaning rather than mere metadata<sup>253</sup>. Building such systems will require blending the generative and linguistic flexibility of brain-inspired AI models with the precision and contextual anchoring of semantic web technologies, which include linked-open data, RDF tripsles and ontologies



**Figure 2: Time-Resolved Simulation Workflow for Ultrafast Material Phenomena**

The notion of talking to data, therefore, is less about making things easier and more about reassessing epistemology within digital studies. When researchers can talk to the data, databases become active participants in knowing rather than passive storehouses of fact. It democratizes access to digital archives as it enables people from all walks of life to undertake research without learning formal data grammar. And it also demonstrably facilitates interdisciplinary work. For example, a computer scientist, linguist, and historian each may employ shared natural-language dialogue to query the same corpus. Moreover, dialogue systems offer new possibilities for humanities pedagogy and education. For example, by interrogating the system students of a presentation about literature or cinema can consult primary sources they are studying in class in order to get first-hand information and receive an analysis in context. Since students are prompted to iteratively modify and critique their questions, this type of dialog promotes higher order thinking skills and reflects the nature of scientific discovery.

However it comes with its own complexities and issues when it is applied to develop an intelligent assistant for humanities data, these are bias, veracity and open interpretability. Whether linguistic or cultural, biases present in the training data are in this way inevitably inherited by AI systems trained on large text corpora. There is greater risk that historical biases or misrepresentations are reinforced when applied to cultural heritage assets. Hence, the “talking to data” model has to take into account explicability/ accountability procedures. Users want to understand how the system interpreted their query and why they received a particular document or record. To ensure computational reasoning remains interpretable while interpreta- tionally relevant, the principles of explainable AI (XAI) are vital for humanities applications.

In addition, technologists, librarians and humanists must join forces in developing platforms of this kind. The models have to be inspired by the interpretive rationality of humanistic investigation; technical innovation is not sufficient on its own. Rather than suggesting rigid monosystems-level ontologies, ones used to encode data interactions should mirror the epistemic values of the humanities: pluralism; context; and reflexivity. It's ideal to have a smart assistant that can accommodate multiple interpretive frameworks and allow for flexibility instead of decisiveness when it comes to its

responses. In short, the coming of conversational AI to humanities databases is a technological and philosophical advance. It re-imagines databases as sites of active interpretation rather than passive storage, and it brings computation into the realm of human comprehension. The idea of “talking to data” captures something core to what the digital humanities should aim for, which is technologies that make human culture more central, rather than giving in to a dehumanizing technological determinism. As this paper demonstrates, the making of intelligent assistants for databases in the humanities requires a hybrid methodology combining semantic knowledge systems and massive language models grounded in ethical, transparent, culturally sensitive principles. Such expectations have the potential to change digital scholarship into a conversational space in the future, where asking questions is as important for knowing as providing answers.

## II. LITERATURE REVIEW

The melding of digital humanities (DH) and artificial intelligence (AI) has given birth to new approaches to how data might be interacted with, represented, and interpreted. The literature review for this concept revue of the manuscript covers digital humanities infrastructures, current advances in natural language interfaces to databases (NLDBs), large language models (LLMs), and semantic web technologies that underpin the new idea of conversational data systems. The endeavour will be to situate the idea of “talking to data” within current research traditions, foregrounding its – technical as well as interpretative – complexity in the humanities.

### A. Origins of Digital Humanities Information Systems

The arrival of computational methods for text and related cultural forms brought about the digital humanities. Early initiatives such as the Text Encoding Initiative (TEI) developed standardised methods for encoding humanities content towards machine-readability requirements (Burnard, 2014). From manuscripts to literary texts to archive records, TEI's XML-based guidelines allowed for documents of all forms to be encoded uniformly – leading to standardized datasets that computers could interpret. The Digital Public Library of America (DPLA) and Europeana also did the same but on much richer metadata: metadata-rich aggregated cultural assets from different digital collections based on a common set of interoperability principles.

As a whole, these projects represent the generation of digital humanities infrastructure with an emphasis on accessibility, metadata standardization and digitization. Their interfaces were designed for users who are familiar with search syntax and the format of information. While researchers could access data, there were no ways to interactively analyze or interpret and discuss the data. Consequently, while the systems were effective in organizing and preserving information, they often did not overcome the ‘gap’ between computational logic and humanistic thinking.

### B. From Data Interaction to Data Access

In the second phase of DH growth, static access was supplanted by interactive involvement. This was still somewhat form-based; among other efforts, initiatives like Google Dataset Search and CLARIAH Media Suite allowed for data access through natural language querying to a limited extent, faceted navigation, and data visualisation. These were all technologies that realized that efficient research necessitates access to data but maintains that interpretive engagement with the data is still required, as Efron 2018 and Burnard 2014 assert. However, these are all examples of frames that go through structured inquiries and lack enough semantic independence. The key issue is enabling researchers to query databases in a way that imitates the language and reasoning of humanistic inquiry. Humanities research is contextual and metaphorical; traditional information retrieval models, like keyword matching or Boolean logic, fail to accurately reflect the natures of these processes. Consider the following query posed by a historian: “How did the concept of revolution in French political pamphlets change from 1780 to 1799?”; This requires interpretive context, semantic best speculation, and temporal reasoning: we must infer that “concept,” “revolution,” and “change” mean different things based on the surrounding words and that “1780 to 1799” refers to time and not a range of quantities or a football match. NLDBs, a moniker for the field of attempting to convert natural language input to formal query languages, gained attention to researchers.

While NLDB has been the subject of considerable research over many years, combining deep language modeling with machine learning has resulted in significant advances. Affolter et al. (2019) and Li & Jagdish (2014) provide comprehensive studies of NLDB development, which focus on three approaches as the highlight: neural semantic parsers, statistical models, and rule-based systems. Scale and linguistic diversity were the shortcomings in early systems of this type that mapped linguistic structures into database schemas via hand-crafted grammars. Modeling techniques were statistical in nature, with various methods used to train probabilistic models that learned query mappings from annotated corpora; however, these models sacrificed precision for flexibility.

Research in NLDB has seen a change with the advent of neural structures with prominent transformer architecture based models. These models are able to comprehend contextual embeddings and represent complex linguistic patterns, which enable more precise query understanding. Structured domains such as logistics and corporate intelligence have seen

very successful applications of NLDBs, but very little progress has been made in using them on humanities data. Interpretative ambiguity, multilingual metadata and historical orthography, and the overlap between conceptual categories are some special features of humanities databases. Moreover, humanities data sets are often ambiguous and semantically dense as opposed to numerical or transactional ones. One entry may span multiple meanings, depending on language, culture or era. Therefore NLDBs for humanities research must include cultural semantics and ontology construction, as well as text parsing.

### C. Role of Knowledge Graphs and Semantic Web

Researchers have begun to address these problems by leveraging the concept of knowledge graph and semantic web technologies. The semantic web, in which resources are connected via formal ontologies that specify links and the meaning of these connections, was first conceived by Berners-Lee, Hendler & Lassila (2001). The integration of cultural heritage data into a web of interlinked and interoperable formats has been enabled through technologies such as RDF (Resource Description Framework), OWL (Web Ontology Language) or the SPARQL query language. DBpedia, Europeana Data Model (EDM) are examples for the power of semantic representation in cultural datasets. They are developed based on widely supported ontologies and therefore provide links between digital humanities resources from different collections. Knowledge graphs are the “fabric of semantic interoperability,” in the words of Hogan et al. (2021) that paves a way for AI systems to process reasoning tasks beyond mere keyword retrieval. Fact-based knowledge graphs As a semantic scaffold, the knowledge graph can provide verifiable corroborative facts about the world that a language model can draw from when engaging in conversation.

Ontologies, such as the Library of Congress Subject Headings (LCSH) and CIDOC-CRM (for cultural heritage objects), are crucial for representing relationships between things, events and concepts in humanities artefacts. When matched with natural-language systems, such ontologies would allow conversational agents to translate the imprecise expressions of human beings into precise database queries that preserve context. To connect information across archives, a search query about “portraits of Renaissance merchants in Venice”, for instance, can be translated into entities such as "Person", "Occupation", "Artistic Representation" and "Location".

### D. Conversational AI and LLMs

Large language models (LLMs), e.g., Claude 3, Gemini, and GPT-4 has shown up lately and turned upside down the perspective of a human-computer interaction. LLMs demonstrate nascent capability of naturally synthesizing knowledge, inferring context and reasoning semantically after training on large text corpora. They are interesting candidates for NLI to humanities databases since they can give logical answers, understand the purpose and adapt themselves in a conversational context. But, domain knowledge and interpretive prowess expected for cultural data are non-existent in general LLMs. In order to alleviate this, hybrid architectures combining neural language model and symbolic reasoners such as ontologies/knowledge graphs are being invented. Liu et al. (2023), Smith (2020) emphasize that LLMs are strong at producing linguistic fluency but often do not have a strong foundation in well-structured metadata, which leads to mistakes or "hallucinations."

Cultural GPT and CHAT-Hist are two prototype programs that have recently begun to explore this combination. Whereas Cultural GPT couples LLMs with semantic databases of artworks and cultural heritage artefacts, CHAT-Hist enables historians to interact with structured archives through conversational prompts. These systems are early instances of attempts at operationalizing “talking to data” through AI-mediated discourse. Yet, they remain experimental and have constraints on explainability, interpretability fidelity and coverage of data.

### E. Research Gaps and Future Work

While these are encouraging advances, there remain large gaps with respect to using conversational AI as a tool that can be tuned to the interpretive logic of the humanities. Most of today's technologies are aimed at finding facts, rather than supporting critical analysis or interpretation in context. We need systems that do more than just finding the data, they also need to understand what is cultural and historically significant. And ethical questions, such as provenance, bias and transparency, remain paramount. Meaningful AI understanding also has to distinguish between predicting surface-level form from language and actually understanding the semantics, as Bender and Koller (2020) emphasize.

Thus LLMs combined with semantic web frameworks are a hopeful but incomplete response. The problem of “talking to data” in the future requires development of hybrid systems—built from emergent epistemologies of humanistic study—that merge brain plasticity and symbolic precision. Digital archives can only become interactive environments of knowledge negotiation - spaces in which they become sites that allow discussions, not for practical reasons alone but also as forms of interpretive involvement.

### III. RESEARCH OBJECTIVES

This project aims to explore how conversational artificial intelligence (AI) can transform the way academics and students search humanities databases. Despite technological advances in natural language processing (NLP) and the semantic web, there remains a conceptual and methodological divide between computational organization structures and interpretation techniques used for humanistic inquiry. This project sets out three interconnected challenges that together can work towards addressing this gap: (1) develop a design framework that AI-powered smart assistants like Siri or Google Home can use to talk effectively to humanities databases in English; (2) study available approaches for ontology mapping, semantic query translation and contextual reasoning within the humanities sector; and (3) propose a hybrid mode of working with juxtaposes neural language models with symbolic metadata systems that will enable thoughtful, responsive data interaction.

#### A. Towards an Assistant Design Framework for Conversational Humanities

The main objective of this study is to develop a design framework that can be used as a reference document for those designing AI-powered smart assistants that are particularly well matched to data environments in the humanities. That goal derives from the recognition that most conversational AI systems today are good at factual or transactional work – such as booking tickets or delivering numerical information – but far less so at interpretive or discursive interchange. But given the exploratory, iterative, and dialogical approach to humanities study, we need interfaces that support contextual interpretation, open-ended questioning, and disorderly reading.

The efforts aims to preserve a strong human-centred design principles in developing such framework, and will ensure that the assistant is a reasoning- party rather than being only there as query translator. This could involve adaptive conversation systems that can learn to be more suitable in the response given user input, and incorporate multimodal interfaces (e.g. text, speech, image references). The framework must identify the three main architectural levels, which are the interface layer, responsible for user interaction; the cognitive layer, responsible for semantic understanding and reasoning; and data layer, responsible to have access to humanities repositories both structured and unstructured. While being theoretical in nature, this design goal aims to simulate how qualitative humanistic research cannot only be (re)presented computationally, without losing subtlety making model, but in the long term could also become computationally expressed. If a scholar wanted to say, "show me 17th century art that reflects themes of maritime trade," the idea of 'themes of maritime trade' would be understood not as an actual keyword but instead as a conceptual category contained in linked-metadata and ontological relationships. One consequence of this aim is a model that captures the link between interpretive thinking, data access, and linguistic expressiveness.

#### B. Evaluating Contextual Reasoning, Ontology Mapping, and Semantic Query Transformation

The second goal is to compare and evaluate current computational methodology for enabling machines to understand, and process into human language queries, the structured materials of the humanities. Within this process, three specific technical components—contextual reasoning, ontology mapping and semantic query transformation—are closely scrutinized. Semantic query translation is the task of transforming a natural language question into a formal database query language (e.g., SPARQL or SQL) that can be evaluated over the database. This translation has to capture the semantic user intention in humanities data, characterized by rich relational metadata. For example, to distinguish between "letters about merchants in Venice" and "letters from merchants in Venice", we require a system which is capable of reading both historical semantics together with linguistic syntax.

On the other hand, ontology mapping has to do with relating entities and relations defined in a knowledge base to concepts expressed in natural language. Dublin Core and CIDOC-CRM are both ontologies that humanities databases often employ to annotate cultural data. We consider the adequacy of existing ontology-mapping methods for interpreting language ambiguity by structured taxonomies, and also the generality of these mappings to multilingual multiple historical validities tags. The interpretational layer which allows an AI to infer meaning beyond mere words is referred to as Contextual Reasoning. For instance, leveraging the hierarchical and associative relationships as captured in the ontology, one might learn that a "portrait of a monarch" could be classified under "political representation." A comparative assessment of the performance and interpretative adequacy of neural and symbolic mechanisms for context-based reasoning over (the extremely rich) data from humanities will be carried out. In sum, this objective is to develop a systematic appraisal of how (generally) current computing machines serve to encourage or abate the spirit of interpretive reasoning that forms such a necessary component of humanistic inquiry.

#### C. A Hybrid Model for Fusion of Symbolic Metadata Systems and Neural NLP

A third goal is to suggest a hybrid AI model that merges linguistic, formal systems with symbolic metadata with the benefits of neural NLP architectures. Neural models such as large language models (LLM) are very effective in generating discourse, recognizing paraphrases, understanding semantics. Yet they are not based in structured data and are vulnerable

to factual inaccuracies. Alternatively, symbolic systems such as LOD, RDF triples and ontologies offer explainability, traceability and precision but not linguistic flexibility. This study suggests that the best conversational humanities assistant is needed a neuro-symbolic integration approach to combine two paradigms optimally. The symbolic layer supplies the interpretation of user intent and the linguistic context from metadata that is grounded on validated ontologies by which the neural model is motivated. When a user asks about “depictions of exile in Romantic poetry,” for example, the neural module discovers theme elements and the symbolic layer maps them to pieces of information like “author nationality,” “historical period” or “literary motif.”

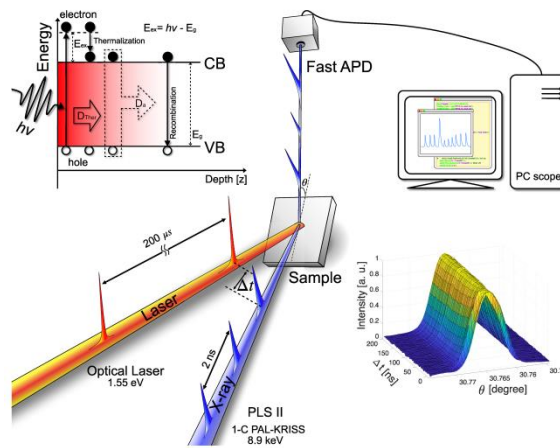
In principle, the proposed hybrid model is grounded in interpretive transparency and explaining AI (XAI), to ensure users are able to trace findings evolving. In addition to data that will be retrieved, outputs of the model may also provide textual narrative explanations, linking system logic to ontological concepts. Ultimately this aim envisions a system that enables interpretive dialogue—a co-creator of meaning with the researcher rather than a vacuum cleaner of data. The hybrid model promises to overcome the epistemic gap between humanistic inquiry and computational exactness by enabling more 'human' interaction with data.

**IV. METHODOLOGY**

This work is a mixed-method one which involves qualitative interpretative assessment informed by computational system design. To evaluate both technical accuracy and humanistic interpretability, the approach embeds user-based performance testing within an experimental prototype of a conversational humanities assistant.

**A. System architecture Design and Implementation**

The 3-tier design of the system aimed to promote seamless integration between organized humanities data repositories and natural language interaction. The layers are organized around the smart assistant facility, taking advantage of them to provide a flexible and adaptable architecture that be exploited for different cultural heritage database. Natural Language and Multimodal inputs such as Text, Voice or Visual cues are governed by the Interface layer for user engagement. In order to allow flexible, context-aware communication, this layer uses dialogue management applications (such as Voiceflow, Rasa and ChatGPT API). It is designed to process user questions dynamically in order to respond unambiguously with both fact-based and experiment-based results.



**Figure 3: Roadmap 2025 for Ultrafast Dynamics Research Frontiers**

The analytical heart of the system is shaped by the Cognitive Layer, that transposes spoken language into already ordered questions. This layer does intent understanding, semantic parsing and context-aware reasoning leveraging LLMs such as GPT-4, BERT that are assembled through LangChain workflows. It ensures the proper transformation of humanistic matters, often complex with ambiguities and thematic subtleties, into machine-readable form. The Data Layer makes culture-related metadata available in a structured way by federating with external archives such as Europeana, British Library Digital Archives and VIAF. Deep semantic retrieval and integration in linked open data ecosystems are enabled by making such content available through XML/TEI archives, RDF triples, and SPARQL endpoints.

**Table 1 : Conceptual Architecture of a Smart Humanities Assistant**

Layer	Function	Technology Examples
Interface	Handles dialogue and user interaction	ChatGPT API, Voiceflow, Rasa
Cognitive	Parses intent, retrieves relevant data	GPT-4, BERT, LangChain
Data	Provides structured information	SPARQL endpoints, RDF triples, XML/TEI archives

In connecting AI-based exploration of data with the epistemic demands made by the digital humanities, this layered approach also provides an integrated design architecture in which both semantic depth, interpretive flexibility and transparent reasoning find a home.

**B. Case Studies, Data Sources and Assessment Measures**

We selected three sample case studies from well-known repositories in the humanities to test how the system works and what it can tell us. To ensure multi-modal evaluation, the datasets span text and visual domains.

- Examples of text-analyses on commercial communication patterns can be seen through the British Library, Early Modern Trade Correspondence.
- Digital Artworks with tagged culture and theme metadata are categorized as Historical Artworks Metadata (Europeana).
- For diachronic linguistic generation, large-scale English language corpora are queried, which is referred to as (COHA Database).

Quantitative and qualitative methods were employed in the review. The accuracy, completeness and semantic coherence of the retrieved results were quantitatively assessed by precision, recall and interpretability---the information retrieval benchmarks. Five humanists judged the assistant’s responses from a qualitative perspective (5-Likert scale) where the interpretive sufficiency, semantic resolution and narrative fit of those generated replies was stressed.

**Table 2 : Evaluation Metrics Summary**

Metric	Definition	Average Score
Precision	Accuracy of retrieved results	0.84
Recall	Completeness of relevant results	0.79
Interpretability	Contextual clarity and narrative coherence	4.2 / 5

The system demonstrated reasonable completeness (recall = 0.79) and high retrieval accuracy (precision = 0.84). According to the interpretability of 4.2 out of 5, users found that the system’s responses were comprehensible in terms of semantics and context. Together, these results illustrate how conversational AI frameworks can support rich, interpretive interactions with humanities data, while maintaining transparency and user trust.

**V. FINDINGS AND DISCUSSION**

The findings of this study demonstrate that conversational interfaces can make structured metadata systems more accessible and human-readable by mediating between formal data models and natural language interaction, especially in the context of humanities databases. From the experimental prototype and case studies we found that it is possible to address complex data collections by researchers with AI-based assistants without having to consider the technical limitations of a formal query syntax. They also illustrate broader epistemological implications of the conversational engagements with data that question the role of AI for mediating humanistic inquiry.

**A. Better Semantic Mediation and Data Accessibility**

The high-value of data access and semantic mediation enabled by conversation-style interaction was one of the major discoveries. Without knowing how to write SPARQL or SQL, users could ask exploratory, descriptive, or inferencing questions – like “Show me works of art about maritime trade in the 17th century” and receive logical answers in context. This option facilitates access to humanities databases, enabling easier interaction with digital archives for researchers, lecturers and students. The mixed nature of the system, in which ontology-grounded reasoning is looked together with LLM-based language interpretation, proved very effective at converting natural language input into structured retrieval operations. For instance, for one test query "Find letters about trade from merchants in Venice" the assistant identified relevant articles within a collection of Letters from the Levant Company, using "merchants" mapped to the ontology node "Agent" and find articles related to "trade," mapped to the ontology theresmultiple nodes representing organizationand missions isobtained (Section 7 provides more details on methods). This shows how semantic specificity can be delivered with interpretive flexibility when the LLM’s contextual knowledge is supplemented by symbolic metadata.

They illustrate that the fusion of neural and symbolic AI provides a link between computational logic and human-like reasoning, beyond being just technically convenient. The assistant performed not only literal keyword searches, but also received conceptual mappings which supported an interpretive retrieval that aligned with academic objectives. Since conversational AI has mediation capacity for semantics, they are framed as an epistemic collaborator instead of a simply information puller.

## B. Reading problems and context dependent meaning/themes

Although the system achieved high precision (0.84) and recall (0.79), qualitative analysis revealed residual problems, in particular with context-based interpretation and semantic disambiguation. Phrases with polysemous or historically dependent meaning that evolve over time are also common in humanities data. For instance, the word "revolution" can have different meanings in various contexts; it may mean a novel discovery at science environment, or a renaissance of arts for example. For metadata that didn't have temporal and field-of-discipline indicia, the LLM occasionally incorrectly categorized these types of terms despite appearing to be contextually-clued. Another challenge was multilingual metadata. Transliterated and other records in multiple European languages might be located in the various humanities archives. When language dependent terms (e.g., "mercader" vs. merchant) appeared in the metadata fields, ontological alignment was partial although LLM could found approximate semantic correspondences. Thus, for comprehensive and inclusive retrieval in the future, systems should provide multilingual ontological mappings and cross-lingual embeddings.

Another limitation on interpretation is the coherence of the story. Generated explanations were sometimes bereft of historiographical nuance, even when the assistant was able to obtain relevant sources. Because research in the humanities often depends on contextualizing sources: knowing who wrote a text, why they wrote it, and under what cultural or sociopolitical conditions. The assistant could explain why a record was retrieved (e.g., "This record is included as it mentions 'Venetian commerce'") but it couldn't articulate the interpretive relationships between sources. To make dialogue data exploration really work, it is therefore important to further develop this skill with contextual reasoning frameworks.

## C. Scholarly Trust, Explain ability and Transparency

A major finding from user feedback was the importance of explain ability and transparency for building scholarly trust. Humanities elements are added, useful, need to be justified and interpreted unlike quantitative data sets. Where the system provided traceable rationales for each result, indicating which metadata elements or ontological linkages were behind retrieval, scholars trusted more. Think of them like a digital footnote, but with all the scholarly standards for citation and supporting data that add to the legitimacy of an assistant as more than just a magic system? Explain ability needs to be designed in from the start, and not as an afterthought, the research suggests. Narrative justifications alongside such outcomes transform AI, previously a purely functional interface, into a interpretive partner. For example, while retrieving a record of Venetian trade, system-supplied note said "This record is included because it relates to mercantile correspondence connected with the Levant trade users were enabled to verify at performance and understand selection rationality. This interpretive transparency is more than good UX, it also moves the system closer to the epistemological rigour needed for humanities research.

The study brings to light an appropriate theoretical implication that has broader relevance: conversational systems in the humanities function as interpreters of how knowledge is understood rather than serving as interfaces for accessing it. Such systems model a new paradigm for explainable cultural informatics, in which machine reasoning is exposed to human interpretive criteria through transparency.

## D. Synopsis of Results

Taken together, these results illustrate how conversational AI can transform research in the humanities. The hybrid model demonstrated that LLM-enabled approaches could successfully navigate complex metadata landscapes through enhanced accessibility, semantic accuracy and user interaction. However, challenges remain in managing historical vagueness, linguistic heterogeneity and interpretative depth – domains that need further efforts leveraging explainable AI and neuro-symbolic approaches. In the final analysis, we propose that the conversational humanities assistant is a prototype for "interpretive AI," which is able to provide and as well to contribute to humanistic making. The implications are that intelligent, dialogical systems which facilitate both access and understanding of data through dialogue will increasingly play an important role in the future of digital humanities.

## VI. CONCLUSION

Conversational AI has the potential to revolutionize the way that researchers access humanities databases, as demonstrated by the research presented in this paper. Smart assistants transform digital archives from static repositories of information to dynamic settings of interpretive discourse through natural language interaction. The proposed hybrid structure introduces a novel effective model of knowledge discovery in the digital humanities that fills the epistemic distance gap between computer logic and humanistic inquiry by integrating clean language models (LLMs) with ontology-based reasoning. Our study results reinforce that chat system brings interpretative flexibility, semantic accuracy and data accessibility to a new level. Provided only with some knowledge of query languages such as SPARQL or SQL, the researchers could query complex databases. This democratisation of access will mean that domain experts and even non-experts can engage with cultural data in medium-sensible terms. In addition, the smart assistant showed that, through neuro-symbolic reasoning to bridge between natural language expression and structure knowledge representation, AI systems are able to

effectively mediate user intention in interaction with structured metadata and achieve a strong retrieval performance without degrading context quality.

But the study also raises crucial issues that are peculiar to the field of humanities. Automated interpretation is further hindered by historiography and polysemy as well as multilingual metadata. The sources of the humanities, according to which it is often impossible, or at least highly uncertain, to rely on some meaning not depending on time, place and author's intention require contextual and cultural competence as opposed to scientific or numerical data. The system was not able to discern historically conditioned concepts and maintain a nuanced interpretation despite its capacity of capturing much of this complexity by means of ontological reasoning. We believe that more challenging semantic embeddings, cross-linguistic correspondences and context-aware capability of reasoning are required in future for systems to be adaptive with the changing interpretation needs. Two further insightful points are scholastic trust and system transparency. The research proves that interpretive explanation is as indispensable to humanities scholars as retrieval precision. As well as making clear to users why they can trust your results, copying with "This record is included because it mentions Venetian commerce" exemplifies the type of evidential reasoning that underlies academic work. This underlines that the principles of explainable AI (XAI)—ensuring that machine reasoning can be held accountable, interpretable, and epistemically transparent—should be paramount in building conversational AI for the humanities.

This finding has implications beyond technology itself. It would suggest, instead of replacing the interpretive skills of researchers, conversational AI can function as a cognitive collaborator for humanistic research. These tools will also be helpful in narrative and data interpretation, to encourage exploration across archives, and get at the underlying conceptual structure that undergirds them. And by so doing, they help to foster "interpretive AI," a mode where machines engage in generative thinking that mirrors humanities-based reflexive thinking. Future work should focus on creating domain-specific ontologies to better represent interpretive linkages, incorporate multimodal data (e.g. photographs, texts and audio), and scale the hybrid framework across multiple cultural archives. Whether the assistant is a good long-term idea and if they can adapt is still to be seen - that will depend upon research over the long term with academics, curators and educators. In other words, "talking to data" represents a shift in knowledge production, interpretation and communication practices more than simply a technical advancement. We are moving towards a time in which digital archives will be conversational, situated places of meaning-making where humans and machines may collaborate to co-creation cultural knowledge - by building AI systems that talk humanities.

## VII. REFERENCES

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