E.T and Visual Culture Ontology (ETVCO): Perspectives on Extraterrestrial Influence in Visual Heritage

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ABSTRACT (ENGLISH)
The ETVCO ontology models visual representations related to Ancient Astronaut Hypothesis, integrating cognitive and visual dimensions to analyze interpretations of artifacts and artworks. By leveraging the Cognitive Perspectivisation Pattern (CP) and the ICON ontology, it highlights biases and alternative perspectives. Following the Extreme Design (XD) methodology, the ontology captures diverse interpretations by incorporating Perception Recognition, Iconographic Levels, and Cognitive Perspectivisation. This contribution presents an ontology designed to represent the interactive relationship between visual imagery and cognitive perspectives. The evaluation confirms its effectiveness for the study of visual heritage, support for interdisciplinary research, and the analysis of interpretive biases. Future work will focus on enhancing cognitive modeling and expanding the dataset.
Keywords: Visual Heritage; Ontologies; RDF

ABSTRACT (ITALIANO)
ETVCO – Extraterrestri e Cultura Visiva: un'ontologia delle teorie alternative sul patrimonio artistico
L'ontologia ETVCO modella rappresentazioni visive relative alla teoria degli antichi astronauti, integrando aspetti cognitivi e visivi per analizzare le interpretazioni di artefatti e opere d'arte. Utilizzando il Cognitive Perspectivisation Pattern e l'ontologia ICON, l'ontologia evidenzia bias e prospettive alternative. Seguendo la metodologia Extreme Design (XD), l'ontologia modellizza le varie interpretazioni sfruttando il riconoscimento della percezione, i livelli iconografici e la prospettivizzazione cognitiva. Nel presente contributo si fornisce un'ontologia per la relazione interattiva tra immagini visive e prospettive cognitive. L'evaluation conferma la sua efficacia per lo studio delle fonti iconografiche, il supporto alla ricerca interdisciplinare e l'analisi dei bias interpretativi. In futuro, ci si concentrerà maggiormente sulla modellazione cognitiva e sull'espansione del dataset.
Parole chiave: Patrimonio visivo; Ontologie; RDF

1. INTRODUCTION
The E.T. and Visual Culture Ontology (ETVCO)[1] project aims to develop a structured framework for modeling and analyzing visual representations associated with the Ancient Astronaut Hypothesis. This hypothesis posits that extraterrestrial beings visited earth in the distant past and influenced early human civilizations, leaving traces in their cultural artifacts and artistic expressions (Rayhan, Abu, 2023). The ontology focuses on visual artifacts from ancient, medieval, and early modern periods, examining diverse interpretations by archaeologists, art historians, and conspiracy theorists. It integrates both visual and cognitive dimensions, capturing the formal characteristics of artworks (e.g., shapes, motifs, and compositions) and the cognitive perspectivization processes underlying these interpretations.
To achieve this, the project leverages well-established ontology design patterns like the Cognitive Perspectivisation Pattern (Gangemi & Presutti, 2022: 208-228) and integrates ontologies such as ICON (Sartini, Baroncini, van Erp, Tomasi & Gangemi, 2022: 1-38). In addition, the project adopts the Extreme Design (XD) methodology (Presutti, Daga, Gangemi & Blomqvist, 2009) to ensure a user-focused and iterative approach, incorporating requirement stories and competency questions tailored to stakeholders (ChatGPT has been used as a fictional stakeholder).
The ontology provides a solid foundation for documenting and analyzing visual heritage, focusing on the cognitive mechanisms that influence artifact interpretation from diverse perspectives. By integrating cognitive perspectivization processes, the tool enables the construction of alternative interpretations of visual motifs, shaped by the background knowledge of interpreters. This includes the varying attitudes of different conceptualizers, which result in divergent interpretations of the same visual themes.
Furthermore, the ontology supports semantic queries to explore how these interpretations differ from

[1] https://raw.githubusercontent.com/knowledge-representation-2024/E.T-and-visual-culture-ontology-perspectives-on-Extraterrestrial-influence-in-visual-heritage-ETVCO-/refs/heads/main/etvcontology.ttl#

mainstream perspectives, fostering interdisciplinary research into the cognitive frameworks and cultural contexts shaping these narratives. Ultimately, it reveals the interpretative biases underlying different perspectives.

2. STATE OF THE ART

Several ontologies have been developed to address image-related entities. For example, CIDOC-CRM enables the exchange and integration of information from heterogeneous sources, supporting the reconstruction and interpretation of the past at a human scale, based on all kinds of material evidence (Bekiari, Bruseker, Canning, Doerr, Michon, Ore, Stead, & Velios, 2024). It includes classes such as E22 Human-Made Object and E4 Period.

The Icon ontology, based on Panofsky's theory of iconography (Sartini, Baroncini, van Erp, Tomasi & Gangemi, 2022: 1-38), adopts a layered interpretative model, howbeit it focuses primarily on the pre-iconographic level, and incorporates less cognitive patterns. In contrast, ETVCO make also use of the CP pattern and adds a perception-recognition layer to capture multiple paths of interpretation of the same visual motif (e.g., a circular shape being interpreted as an UFO). This approach enhances the ontology's capacity to represent interpretive diversity and the dynamic interaction between visual imagery and cognitive processing.

3. METHODOLOGY

To ensure a user-focused and iterative approach, we adopted the Extreme Design (XD) methodology, incorporating user stories and competency questions (CQs) to address the needs of stakeholders like archaeologists, art historians, and cognitive scientists.

Firstly, we conducted extensive research on visual representations linked to the Ancient Astronaut Hypothesis, including sculptures, petroglyphs, and paintings. We then synthesized insights from academic papers, conspiracy theorist forums, and alternative narratives to encapsulate both mainstream and non-mainstream perspectives. To conclude the domain study, recurring visual motifs were analyzed, such as humanoid figures and celestial symbols, often interpreted as evidence of extraterrestrial contact.

In alignment with the subsequent steps of the Extreme Design (XD) methodology, ChatGPT was employed as a fictional stakeholder to simulate the needs of different users, including art historians, archeologists, and conspiracy theorists. Through iterative sessions, we formulated user stories that reflected practical use cases, such as the interpretation of artifacts with anomalous features or the exploration of intersections between conspiracy theories and cultural heritage. Additionally, we developed testable competency questions (CQs) to inform the ontology's structure and properties, including: "Which artifacts are interpreted as humanoid figures with exaggerated proportions?" and "How are celestial symbols in medieval manuscripts reinterpreted by different groups?".

Due to constraints in time and resources, ChatGPT was employed as a fictional stakeholder in the ontology development process. Despite this workaround, it proved to be a valuable tool for accelerating the design phase. Large Language Models (LLMs), when prompted appropriately, can effectively simulate fictional end users, offering a promising means of eliciting and understanding user requirements. Nevertheless, this approach presents certain limitations. In particular, the quality of the generated user stories is highly dependent on the structure and specificity of the prompts provided.

In our case study, we instructed the LLM to assume the roles of various domain experts, such as art historians, archaeologists, and cognitive scientists. Subsequently, it was asked to generate user stories and associated competency questions tailored to each role, following the template outlined in the Extreme Design Methodology (Presutti, Daga, Gangemi, & Blomqvist, n.d.). Selected portions of the output were then manually refined to better align with the anticipated needs of professional end users.

While the use of LLMs in this context shows promise, it remains an emerging area that requires further refinement. For instance, we did not implement a systematic prompting strategy, nor was the model fine-tuned with domain-specific documentation, both of which could potentially enhance the relevance and quality of the results.

In line with established integration practices, we reused the ICON ontology to model artistic interpretation and introduced a new *Perception Recognition* layer to represent the initial stages of visual recognition. This layer captures perceptual features, such as shape, size, color, and position, prior to any cultural or symbolic interpretation. Additionally, by incorporating the Cognitive Perspectivisation (CP) Pattern, we modeled agent-specific perspectives and biases, allowing for the analysis of how cultural and cognitive factors shape interpretation processes. The ETVCO core components include:

- Perception Recognition class: Captures basic perceptual elements before interpretive processing occurs.
- Pre-iconographical and Iconographical Levels: Aligned with the first and second levels of the ICON ontology to maintain conceptual continuity (see Fig. 1).
- Cognitive Perspectivisation: Models diverse agent perspectives, integrating concepts such as conceptualizer attitudes, interpretive lenses, and inherent biases.

By integrating these elements, the ontology (see Fig. 2), enables nuanced analyses of how varying agents perceive and interpret visual motifs, revealing underlying cultural influences and interpretative activities.

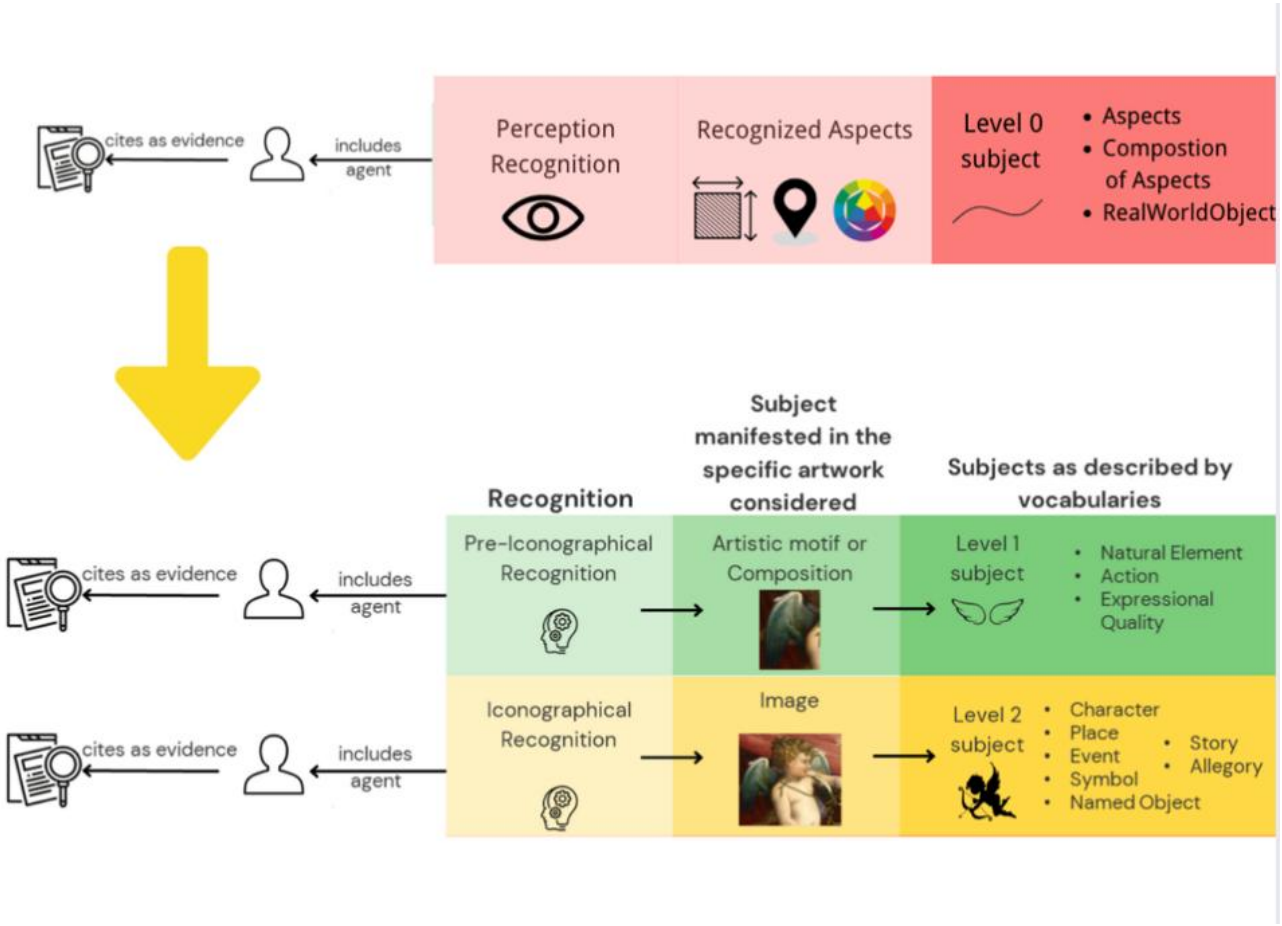

Figure 1. Align Perception-Recognition (in red) with the first two levels of the ICON ontology[2]

[2] Original image sourced from: https://dl.acm.org/doi/10.1145/3594724.

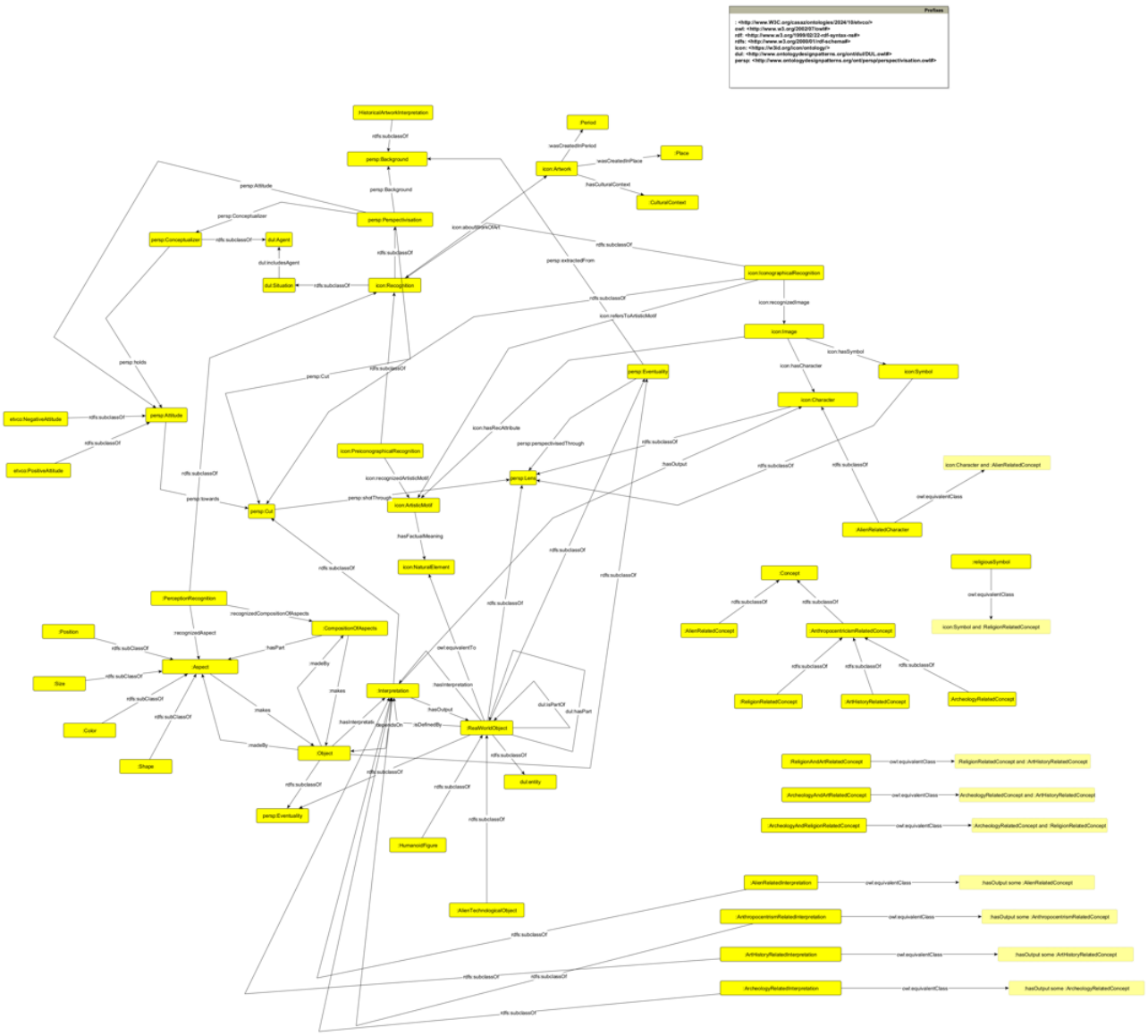

Figure 2. key classes and properties of ETVCO

4. EVALUATION

To assess the effectiveness and applicability of the ontology, we followed an iterative and user-centric evaluation methodology grounded in the Extreme Design (XD) framework. This process involved multiple stages, including data collection, knowledge graph construction, and competency question (CQ) testing, all designed to ensure the ontology meets the nuanced needs of diverse stakeholders.

We began by collecting a diverse dataset from scholarly articles, blogs, and conspiracy theorist websites. These sources typically featured images of cultural artifacts alongside descriptive text, often reflecting contrasting interpretations. The data was manually curated and structured into a CSV format, including fields such as image ID, title, textual description, and source URL. This structured dataset provided a foundation for both ontology development and evaluation, allowing us to simulate real-world usage scenarios.

Next, we utilized the FRED machine reader to automatically extract semantic knowledge from textual descriptions. These extractions were converted into RDF/XML files representing structured knowledge graphs. The resulting graphs were then imported into the ontology using Protégé connect individuals to classes and properties to construct a comprehensive A-box.

A central component of the evaluation involved simulating stakeholder needs through the construction of user stories. These narratives represented diverse perspectives—including those of art historians, archaeologists, conspiracy theorists, educators, and cognitive scientists—and formed the foundation for the development of competency questions (CQs). Each user story was translated into formalized CQs,

which were subsequently tested within Jupyter Notebooks to assess the ontology's expressiveness and reasoning capabilities.
These evaluations aimed to determine whether the ontology could support complex queries related to visual features, interpretive frameworks, agent perspectives, and cultural contexts. For instance, it was observed that conspiracy theorists often emphasize particular shapes or atypical anatomical features when interpreting artworks as evidence for the Ancient Alien Theory. Testing the ontology with the second competency question from the first user story ("What visual features contribute to the alien interpretation?") indicated that characteristics such as large eyes and oval-shaped heads are frequently associated with alien representations (see Fig. 3).
Furthermore, the results from testing CQ3 and CQ4 of the second user story demonstrated that circular or disk-shaped objects—especially those depicted in the sky—are commonly interpreted as unidentified flying objects (UFOs) by conspiracy theorists. A comparative analysis of these same objects revealed divergent interpretations from other agents; for example, art historians often regard such elements as symbolic representations of sacred or divine entities (see Fig. 4 and 5).
To ensure reproducibility and transparency, all CQ tests and results were documented and made publicly available via GitHub[3]. Iterative testing led to continual refinement of the ontology, confirming its capacity to support interdisciplinary research. The final evaluation demonstrated ontology's strength in enabling detailed semantic queries about visual heritage, accommodating both mainstream academic interpretations and alternative viewpoints. Moreover, it facilitated the analysis of cognitive processes such as perspectivization and recognition, reinforcing the ontology's relevance to fields like cognitive science and digital humanities.

CQ2: What visual features(attribute) (e.g., head size, body shape) contribute to the alien interpretation?

```
cq = """
PREFIX etvco:<https://raw.githubusercontent.com/knowledge-representation-2024/E.T-and-visual-culture-ontology-perspectives-
PREFIX persp:<http://www.ontologydesignpatterns.org/ont/persp/perspectivisation.owl#>
PREFIX dul:<http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#>
PREFIX icon:<https://w3id.org/icon/ontology/>

SELECT DISTINCT ?character ?realWorldObject ?visualFeature ?quality
WHERE {
    ?character a etvco:AlienRelatedCharacter;
        icon:isCharacterOf ?image.
          ?image a icon:Image;
        icon:hasRecAttribute ?artisticMotif.
    ?artisticMotif a icon:ArtisticMotif;
        icon:hasFactualMeaning ?realWorldObject.
    ?realWorldObject a etvco:RealWorldObject.
      ?visualFeature dul:isPartOf ?realWorldObject;
        dul:hasQuality ?quality.
}"""

cqres = newg.query(cq)

for row in cqres:
    print(row)
```

```
(rdflib.term.URIRef('http://www.ontologydesignpatterns.org/ont/fred/domain.owl#grey_1'), rdflib.term.URIRef('http://www.ontol
ogydesignpatterns.org/ont/fred/domain.owl#humanoid_1'), rdflib.term.URIRef('http://www.ontologydesignpatterns.org/ont/fred/do
main.owl#eye_1'), rdflib.term.URIRef('http://www.ontologydesignpatterns.org/ont/fred/domain.owl#Large'))
(rdflib.term.URIRef('http://www.ontologydesignpatterns.org/ont/fred/domain.owl#grey_1'), rdflib.term.URIRef('http://www.ontol
ogydesignpatterns.org/ont/fred/domain.owl#humanoid_1'), rdflib.term.URIRef('http://www.ontologydesignpatterns.org/ont/fred/do
main.owl#head_1'), rdflib.term.URIRef('http://www.ontologydesignpatterns.org/ont/fred/domain.owl#Oval'))
```

Figure 3. First example of ETVCO-Ontology evaluation using SPARQL queries and competency questions

[3] https://github.com/knowledge-representation-2024/E.T-and-visual-culture-ontology-perspectives-on-Extraterrestrial-influence-in-visual-heritage-ETVCO-/tree/main

CQ1: "What kind of shapes are interpreted as alien technology?"

```
cq ="""
PREFIX etvco:<https://raw.githubusercontent.com/knowledge-representation-2024/E.T-and-visual-culture-ontology-perspectives-
PREFIX dul:<http://www.ontologydesignpatterns.org/ont/dul/DUL.owl#>

SELECT DISTINCT ?shape ?realworldobject
WHERE {
    ?shape a etvco:Shape.
    {
        ?shape dul:isPartOf ?composition.
        ?composition a etvco:CompositionOfAspects;
        etvco:makes ?object.
    }
    UNION
    {
        ?shape etvco:makes ?object .
    }
    ?object etvco:hasInterpretation ?interpretation.
    ?interpretation etvco:hasOutput ?realworldobject.
    ?realworldobject a etvco:AlienTechnologicalObject.
}
"""

cqres = newg.query(cq)

for row in cqres:
    print(row)
```

```
(rdflib.term.URIRef('http://www.ontologydesignpatterns.org/ont/fred/domain.owl#Disc-shaped'), rdflib.term.URIRef('http://ww
w.ontologydesignpatterns.org/ont/fred/domain.owl#ufo_1'))
(rdflib.term.URIRef('http://www.ontologydesignpatterns.org/ont/fred/domain.owl#Round'), rdflib.term.URIRef('https://raw.githu
busercontent.com/knowledge-representation-2024/E.T-and-visual-culture-ontology-perspectives-on-Extraterrestrial-influence-in-
visual-heritage-ETVCO-/refs/heads/main/etvcontology.ttl#ufo_2'))
```

Figure 4. Second example of ETVCO-Ontology evaluation using SPARQL queries and competency questions

5. RESULT AND FUTURE WORK

The evaluation confirmed the ontology's effectiveness in several key areas. First, it demonstrated the capacity to support semantic queries that explore diverse interpretations of visual motifs. Additionally, it facilitated interdisciplinary research by bridging cognitive, cultural, and historical analyses. It also proved useful in documenting the range of attitudes and biases that influence interpretation, including those associated with conspiracy theories. Collectively, these findings highlight the ontology's potential as a valuable tool for analyzing visual heritage and advancing research related to the Ancient Astronaut Hypothesis.

Future developments will build upon the current version of the ontology in several ways. One major direction involves integrating psychological theories of attention, memory, and stereotyping in order to deepen the understanding of cognitive biases that shape visual interpretation. Another focus will be on enhancing the ontology's capacity to model complex perspective-dependent analyses by incorporating more detailed representations of agent-context interactions. Furthermore, the dataset will be expanded to include a wider range of visual artifacts and interpretive narratives, thereby supporting broader applications across disciplines.

By addressing these objectives, we aim to develop a more comprehensive model that supports the study of both mainstream and alternative interpretations of human artifacts, along with the cognitive processes underlying them. This approach is expected to advance innovative research at the intersection of cognitive science and cultural analysis, particularly in the domain of visual artifact interpretation.

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In this project, ChatGPT has been used as a fictional stakeholder incorporating user stories and competency questions tailored to stakeholders.

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