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Encoding Sacred Design: A Symbolic-Epistemic AI Framework for Ethical Generation of Andalusian Islamic Motifs

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Abstract

This study introduces the "architectural genome", a symbolic-epistemic framework that reconfigures Islamic architectural motifs into machine-readable ontologies for ethical engagement with generative artificial intelligence (AI). Existing AI models frequently reproduce Islamic sacred forms as decontextualized aesthetic fragments, perpetuating what has been termed "algorithmic orientalism". In contrast, the architectural genome encodes motifs with layered metadata across four dimensions: visual geometry, theological function, cultural provenance, and ethical viability, ensuring that generative systems interpret sacred content with symbolic fidelity and refusal-aware governance. Drawing from a curated corpus of 150 motifs from Andalusian heritage sites, the study validates its framework through a sandboxed Stable Diffusion environment. It performs comparative benchmarking against CIDOC CRM, Dublin Core, and Wikidata. Results indicate a very strong positive association (r = 1.0, p < 0.001) between ontological density and ethical refusal tagging, underscoring the viability of symbolic depth as a predictive marker for motif exclusion. This work advances cross-cultural AI ethics by operationalizing epistemic sovereignty and refusal logic in computational pipelines, offering a scalable blueprint for respectful, spiritually attuned AI-generated cultural heritage.

1. Introduction

Integrating generative artificial intelligence (AI) into cultural heritage design introduces both expansive creative potential and acute epistemological risk. On one hand, AI systems such as Midjourney, DALL·E, and Stable Diffusion offer novel modalities for reconstructing and simulating Islamic architectural forms, enabling unprecedented digital engagement with historical motifs. On the other hand, these technologies often reduce sacred and symbolically dense artifacts to mere visual aesthetics, stripping away their theological, cosmological, and epistemological depth, as Fırıncı [1]and Noble[2] argue. Such algorithmic flattening transforms

[1] Yusuf Fırıncı, "Decolonial Artificial Intelligence; Algorithmic Fairness in Alignment with Turkish and Islamic Values," *Marmara Üniversitesi İlahiyat Fakültesi Dergisi* 67, no. 67 (2024): 250–79.

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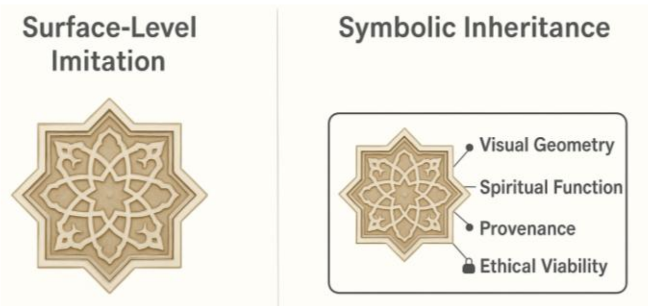
spiritually encoded designs into stylistic fragments, perpetuating a form of computational exoticism frequently described as "algorithmic orientalism."

This research directly addresses the limitations of current AI pipelines in engaging ethically and symbolically with Andalusian Islamic architecture. Specifically, it critiques the absence of symbolic reasoning and refusal-based ethical governance in contemporary generative systems. To address this, the study introduces the concept of the **architectural genome**. This symbolic-epistemic AI framework operationalizes Islamic motifs not as aesthetic surfaces but as structured ontologies embedded with theological meaning, historical provenance, and normative constraints.

Figure 1 visualizes the contrast between dominant AI-generated reproductions and the proposed symbolic inheritance model. The former emphasizes visual mimicry without context and encodes sacred logic via machine-readable annotations to preserve epistemic integrity.

Figure 1. Surface-Level Imitation vs. Symbolic Inheritance



Note: This figure compares generative outputs of sacred motifs as aesthetic fragments (left) with symbolically annotated motifs governed by refusal logic and spiritual metadata (right).

The architectural genome is built upon a six-phase Design-Based Research (DBR) methodology that integrates interpretive epistemology, semantic ontology engineering, and ethical co-design. A corpus of 150 motifs was curated from three spiritually significant Andalusian sites: the Alhambra, the Mezquita of Córdoba, and Madinat al-Zahra. These motifs were annotated using a custom JSON-LD schema that encodes four symbolic layers: geometric form, theological function, cultural provenance, and ethical viability.

Table 1 outlines these symbolic dimensions and their alignment with machine-interpretable metadata, linking motif morphology to ontological function and ethical governance.

Table 1. Symbolic Layer Mapping for Ethical Islamic Motif Annotation

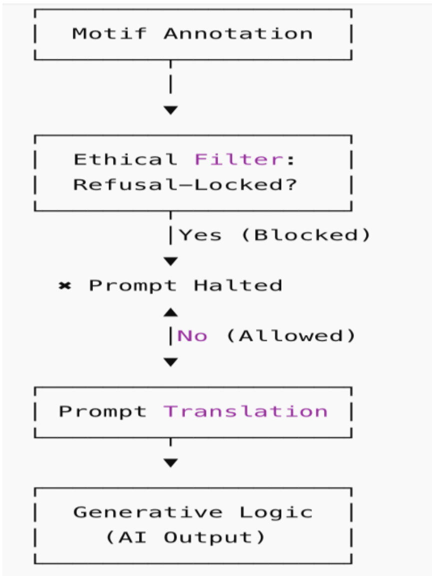
Symbolic Layer	Description	Schema Dimension	Visual Cue Example
Visual Geometry	Recursively structured patterns expressing divine symmetry	form	8-point star, radial tessellation
Spiritual Function	Theological and ritual meaning (e.g., tawḥīd, dhikr)	function	Mihrab arch, ascension structure
Provenance	Historical, regional, and cultural context	origin	Site iconography (e.g., Alhambra)
Ethical Viability	Metadata flags controlling reuse and sacred access	ethics	Lock icon, reuse flag

Note: This table maps each motif's symbolic dimensions—form, function, origin, and ethics—to corresponding semantic schema fields and representative visual cues used in AI workflows.

A simulation was conducted within a sandboxed Stable Diffusion environment to validate the framework. This system employed a symbolic-to-prompt translation layer that filtered motifs based on their ethical annotation. Only motifs tagged as public_reuse_allowed were processed for generation, while refusal_locked motifs were automatically excluded at the input level. This simulation demonstrated the feasibility of embedding theological sovereignty directly into generative pipelines through symbolic refusal mechanisms.

Figure 2 presents this ethical workflow, detailing how motif annotation precedes and governs generative logic in contrast to post hoc moderation approaches.

Figure 2. Ethical Checkpoint Workflow in Generative AI Pipelines



Note: This diagram traces the ethical filtration process from motif annotation to AI generation. Refusal-locked motifs are halted before prompt translation, ensuring spiritual boundaries are enforced upstream.

Through this approach, the architectural genome repositions generative AI as a vehicle for **cultural inheritance** rather than visual extraction. It contributes to three intersecting research domains: (1) algorithmic epistemology, by treating motifs as theological knowledge systems; (2) symbolic AI, by encoding ontological depth into machine-interpretable structures; and (3)

[2] Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism* (New York: New York University Press, 2018).

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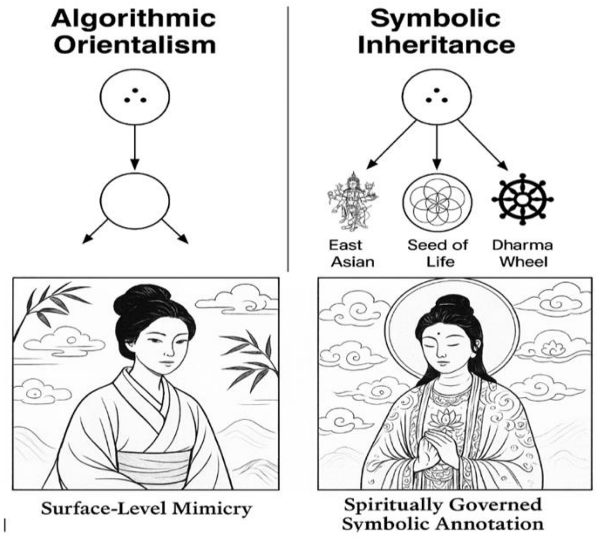
ethical generative design, by embedding spiritual refusal logic as a normative constraint. The resulting paradigm shift aligns AI's role in cultural heritage with ontological respect, moving it from reproduction to sacred meaning.

2. Background

Islamic architecture during the Andalusian period (8th–15th centuries) represents a refined epistemic system in which geometry, calligraphy, and spatial configurations serve not as mere decoration but as theological constructs. Cities such as Córdoba, Seville, and Granada developed architectural grammars, expressed through elements like muqarnas, arabesques, and Kufic inscriptions, that encode metaphysical principles and cosmological reasoning. According to foundational scholarship by Critchlow[3], Necipoğlu[4], and al-Faruqi[5], such motifs articulate an Islamic epistemology grounded in *tawḥīd* (divine unity), recursive geometry, and *miʿrāj* (ascension logic). These visual forms function as non-discursive vessels of sacred cognition, embedded with layered symbolic intent.

However, contemporary generative AI platforms, including Midjourney, DALL·E, and Stable Diffusion, fail to engage with these ontological depths. Trained primarily on uncurated web-scraped datasets, these models interpret Islamic motifs through an aesthetic lens, disregarding their theological, liturgical, and cosmological significance. The result is **semantic erosion**, wherein spiritually rich forms are flattened into decontextualized ornamentation. This phenomenon exemplifies what Kotliar[6] identifies as *algorithmic orientalism*: the computational rearticulation of sacred Islamic forms as stylistic but culturally void artifacts.

Figure 3. Algorithmic Orientalism vs. Symbolic Inheritance



This figure illustrates the difference between surface-level mimicry (left) and spiritually governed symbolic annotation (right), highlighting the epistemic flattening introduced by generative AI.

While digital heritage efforts, such as photogrammetry and 3D reconstruction, as contributed to by El-Hakim et al.[7] and Mazzetto[8], have contributed to preservation and visualization, they often lack the semantic structures required to encode theological boundaries or sacred refusal protocols. Existing metadata standards, such as CIDOC CRM described by Doerr[9], Dublin Core, and Wikidata, facilitate interoperability among various systems. Still, they are not designed to capture spiritually coded semantics such as *dhikr* logic, motif sanctity, or community-authorized reuse.

This epistemic gap necessitates a new paradigm integrating symbolic depth, ethical refusal, and participatory cultural modeling into the architecture of generative AI. Such a system must treat motifs not as passive visual data but as active, encoded knowledge objects—capable of engaging with theological meaning and governed by spiritual constraints.

To this end, the current study introduces the concept of the architectural genome. This symbolic-epistemic framework encodes Andalusian Islamic motifs across four symbolic strata: (1) visual geometry, (2) spatial form, (3) calligraphic sanctity, and (4) ethical viability. This ontology embeds each motif with machine-readable metadata that reflects formal and spiritual logic, as well as normative restrictions, including 'refusal_locked' and 'public_reuse_allowed' fields.

Table 2. Symbolic Layers in the Architectural Genome

Symbolic Stratum	Description	Metadata Field	Example
Visual Geometry	Structural pattern logic (e.g., recursion, symmetry)	form	Eight-point star, muqarnas dome
Spatial Function	Theological-spatial use (e.g., miḥrāb, qibla alignment)	function	Prayer niche geometry, axis mundi
Calligraphic Sanctity	Quranic inscription integrity and spiritual weight	provenance	Kufic inscription from Alhambra
Ethical Viability	Reuse permissions, refusal logic for sacred symbols	ethics	refusal_locked: true or false

[3] Keith Critchlow, *Islamic Patterns: An Analytical and Cosmological Approach* (London: Thames and Hudson, 1976).

[4] Gülru Necipoğlu, *The Topkapi Scroll: Geometry and Ornament in Islamic Architecture* (Los Angeles: Getty Publications, 1996) 37.

[5] Ismail Raji al-Faruqi, *The Essence of Islamic Civilization*, Occasional Papers Series 21 (Herndon, VA: International Institute of Islamic Thought, 2013), P 21- 29.

[6] Dan M. Kotliar, "Data Orientalism: On the Algorithmic Construction of the Non-Western Other," *Theory and Society* 49, no. 5/6 (2020): 919–39, https://www.jstor.org/stable/48735077.

[7] Sabry F. El-Hakim, J-A. Beraldin, Michel Picard, and Guy Godin, "Detailed 3D Reconstruction of Large-Scale Heritage Sites with Integrated Techniques," *IEEE Computer Graphics and Applications* 24, no. 3 (2004): 21–29, https://doi.org/10.1109/MCG.2004.1318815.

[8] Silvia Mazzetto, "Integrating Emerging Technologies with Digital Twins for Heritage Building Conservation: An Interdisciplinary Approach with Expert Insights and Bibliometric Analysis," *Heritage* 7, no. 11 (2024): 6432–79, https://doi.org/10.3390/heritage7110300.

[9] Martin Doerr, "The CIDOC Conceptual Reference Module: An Ontological Approach to Semantic Interoperability of Metadata," *AI Magazine* 24, no. 3 (2003): 75, https://doi.org/10.1609/aimag.v24i3.1720.

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Note: This table formalizes the architectural genome's four-layered annotation structure used for sacred motif classification

This framework was developed through participatory co-design with subject-matter experts, including Islamic art historians, artisans, calligraphers, and digital heritage ethicists, and tested through a sandboxed implementation within Stable Diffusion. The embedded simulation confirmed that sacred motifs marked with 'refusal_locked' were successfully filtered before generation, validating the enforceability of the refusal protocol.

In effect, the architectural genome does not merely classify motifs but repositions them as algorithmically protected forms, bridging theological epistemology with ethical AI infrastructure. It enables a computational shift from visual extraction to symbolic inheritance, laying the groundwork for spiritually aligned generative design.

3. Literature Review

This literature review synthesizes six interdependent knowledge domains that inform the architectural genome framework: (1) Islamic epistemology and visual metaphysics, (2) algorithmic bias and ontological flattening, (3) sacred refusal ethics and epistemic sovereignty, (4) symbolic ontologies in cultural AI, (5) cross-cultural generative ethics, and (6) gaps in symbolic AI for heritage preservation. While each domain has been independently explored in prior work, this study advances a novel symbolic-epistemic pipeline that fuses these verticals into a machine-readable structure for ethical generative AI.

3.1 Islamic Epistemology and Visual Metaphysics

Islamic geometric design has historically served as a metaphysical medium rather than a decorative motif. Scholars such as Critchlow[10], Necipoğlu[11], and al-Faruqi[12] conceptualize Islamic art as a theological code, conveying *tawḥīd* (divine unity), *dhikr* (remembrance), and *miʿrāj* (spiritual ascent) through recursive, symmetrical, and non-figurative patterns. Forms such as muqarnas, radial tessellations, and prayer niches are symbolic architectures of sacred order.

This theological foundation underpins the architectural genome's symbolic schema. Motifs are annotated across four dimensions, visual geometry, spiritual function, provenance, and ethical viability, each with machine-readable metadata fields. Table 1 details these dimensions.

Table 3. Symbolic Layer Mapping for Islamic Motifs in Generative AI

Symbolic Layer	Description	Examples	Schema Dimension	Visual Cue
Visual Geometry	Sacred symmetry and recursive patterning	Radial stars, tessellations	form	Eight-point star
Spiritual Function	Theological and ritual meanings	Tawḥīd, Dhikr, Miʿrāj	function	Mihrab form
Provenance	Geographic-historical origins and usage	Alhambra, Mezquita of Córdoba	origin	Site iconography
Ethical Viability	Reuse permissions and sacred access constraints	refusal_locked, public_reuse flags	ethics	Lock icon, reuse label

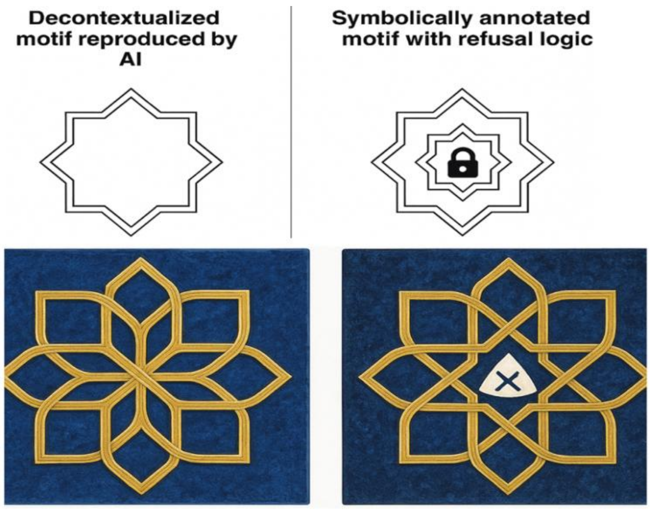
[10] Critchlow, *Islamic Patterns*, 47.
[11] Necipoğlu, *The Topkapi Scroll*, 65
[12] al-Faruqi, *The Essence of Islamic Civilization*, 17.

weight, embedding spiritual logic into AI workflows.

3.2 Algorithmic Bias and Ontological Flattening

Machine learning systems often reproduce structural inequities and strip cultural artifacts of epistemic meaning. Benjamin[13] and Noble[14] argue that algorithmic frameworks can perpetuate dominant cultural narratives while erasing minority epistemologies. Extending this critique, Seaver [15]coins the term "*algorithmic orientalism"* to describe how generative AI platforms simulate Islamic forms without theological context, rendering sacred symbols visually accurate yet ontologically vacuous.

Figure 4. Visual Risks of Generative AI on Sacred Motifs



Left: decontextualized motif reproduced by AI; Right: symbolically annotated motif with refusal logic. The figure contrasts surface-level reproduction with spiritually bound generation.

3.3 Sacred Refusal and Epistemic Sovereignty

Refusal is central to the ethical governance of sacred data. Tuhiwai Smith[16] and Costanza-Chock[17] highlight refusal not as a barrier to access but as a form of cosmological boundary-setting. Within Islamic contexts, motifs associated with Qur'anic verses,

[13] Longworth, Jackson. Review of *Race After Technology: Abolitionist Tools for the New Jim Code*, by Ruha Benjamin. *Science & Technology Studies* 34, no. 2 (2021): 92–94.
[14] Safiya Umoja Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism* (New York: New York University Press, 2018).
[15] Nick Seaver, "Algorithms as Culture: Some Tactics for the Ethnography of Algorithmic Systems," *Big Data & Society* 4, no. 2 (2017): 1–12, https://doi.org/10.1177/2053951717738104.
[16] Linda Tuhiwai Smith, *Decolonizing Methodologies: Research and Indigenous Peoples*, 2nd ed. (London: Zed Books, 2012), http://www.worldcat.org/oclc/1241539611.
[17] Sasha Costanza-Chock, *Design Justice: Community-Led Practices to Build the Worlds We Need* (Cambridge, MA: The MIT Press, 2020), https://library.oapen.org/handle/20.500.12657/43542.

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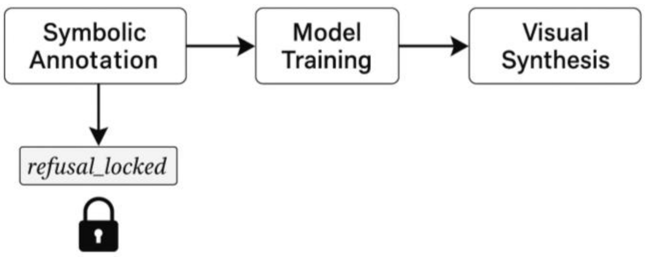
mausoleums, or prayer architecture require sacred permission. The architectural genome encodes this through the refusal_locked field, which ensures motifs deemed spiritually sensitive are excluded from generative processes.

Figure 5. Refusal Logic Pipeline in Generative AI Workflows



This diagram illustrates pre-generation refusal enforcement at the symbolic annotation stage. Motifs marked as refusal_locked are halted before model training or visual synthesis occurs, preserving theological integrity.

3.4 Symbolic Ontologies in Cultural AI

Although CIDOC CRM and Wikidata provide robust interoperability standards based on Doerr[18], they lack semantic layers for encoding metadata related to rituals, theology, or refusal. Zhang et al.[19] enhance semantic richness in diffusion models, but they omit sacred exclusion protocols. In contrast, the architectural genome operationalizes spiritual meaning and ethical constraints through a multi-layered JSON-LD structure.

Table 4. Comparative Sacred Metadata Models Across Cultural and Religious Traditions

Tradition	Symbolic Encoding	Refusal Logic	Metadata Protocol	Example System
Islamic (Andalusian)	Geometry, theology, provenance, ethics	refusal_locked at schema level	JSON-LD / Custom Ontology	Architectural Genome
Indigenous (Australia)	Ancestral knowledge, spiritual land markers	TK Labels, community-controlled tags	Mukurtu CMS / Local Contexts	Mukurtu Project
Catholic (Vatican)	Doctrinal symbols, rites, benedictions	Institutional gating and archive locks	Internal metadata	Vatican Digital Library
Buddhist (Tibetan)	Esoteric layers in mandalas, thangkas, mantras	Role-gated access, visual redaction	Controlled schemas	Digital Thangka Archives, Himalayan Art

Note: This comparative view reveals how refusal is embedded differently across traditions, positioning the architectural genome as a digitally enforceable model for sacred sovereignty.

3.5 Cross-Cultural Generative Ethics

Generative ethics frameworks emerging from Indigenous, Buddhist, and Islamic digital heritage underscore the shared need for spiritual consent and algorithmic restraint. The architectural genome aligns with these by embedding refusal logic directly into generative pipelines, not merely through curatorial filters but via machine-readable spiritual boundaries.

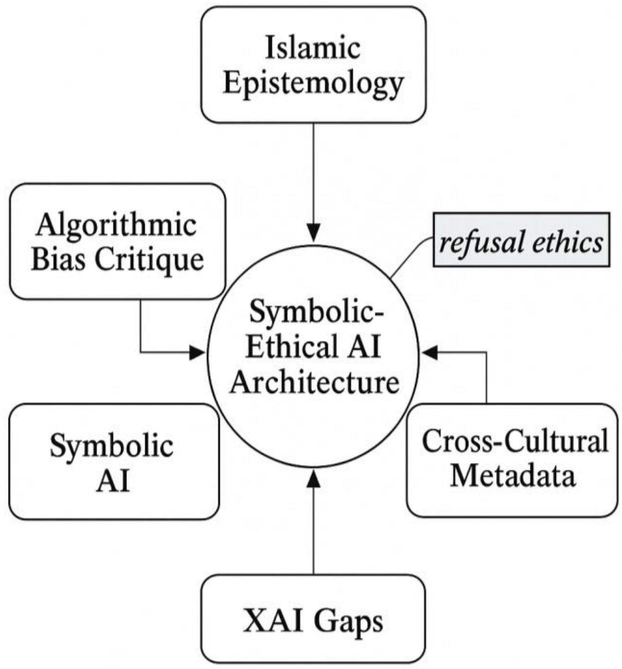
3.6 Gaps in Symbolic AI for Heritage Inheritance

Although symbolic AI has been widely applied in law, biomedicine, and linguistics, according to Floridi[20], its application to sacred heritage remains minimal. Existing explainable AI (XAI) models often fail to recognize the ontological density and cosmological semantics embedded in holy forms. The architectural genome advances symbolic AI by transforming motifs into enforceable sacred data architectures capable of interpretation and protection.

3.7 Cross-Domain Synthesis and Research Gap

These six domains converge on a singular insight: contemporary AI systems lack the symbolic fidelity and ethical scaffolding to engage with sacred architectural heritage responsibly. The architectural genome fills this void by translating theological meaning, community governance, and symbolic complexity into generative infrastructures.

Figure 6. Integrated Framework of the Architectural Genome



This conceptual model synthesizes six research fields into a symbolic-ethical AI architecture. It illustrates how Islamic epistemology, algorithmic bias critique, refusal ethics, symbolic AI, cross-cultural metadata, and XAI gaps converge to form a generative framework grounded in cultural inheritance rather than extraction.

[18] Doerr, "CIDOC Conceptual Reference Module," 67.

[19] Sirui Xu, Jiaxin Zhang, and Yunqin Li, "Knowledge-Driven and Diffusion Model-Based Methods for Generating Historical Building Facades: A Case Study of Traditional Minnan Residences in China," *Information* 15, no. 6 (2024): 344, https://doi.org/10.3390/info15060344.

[20] Luciano Floridi, *The Philosophy of Information* (Oxford: Oxford University Press, 2013).

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4. Methodology

This study employs a Design-Based Research (DBR) methodology that fuses interpretive epistemology, symbolic AI, and ethical ontology engineering. Its objective is to formalize Andalusian Islamic architectural motifs into a machine-readable symbolic framework that preserves theological meaning, cultural sovereignty, and refusal-based ethical governance within generative AI pipelines.

The methodological structure proceeds through four core stages:

I. Corpus Selection and Preparation
II. Symbolic Schema Design
III. Ontological Encoding with Refusal Logic
IV. Simulation and Ethical Validation

4.1 Corpus Selection and Preparation

A curated corpus of 150 motifs was selected from three spiritually and historically significant Andalusian architectural sites: the Alhambra (Granada), the Mezquita of Córdoba, and Madinat al-Zahra. Motif inclusion followed three core criteria:

- **Spiritual Density**: Motifs integrated into ritual or sacred architectures (e.g., miḥrāb niches, qibla walls, tomb domes).
- **Symbolic Complexity**: Use of recursive geometry, cosmological symmetry, or Qur'anic inscriptions indicative of sacred metaphysics.
- **Archival Fidelity**: High-quality digitization with traceable provenance and minimal visual distortion.

All motifs were manually digitized, annotated, and structured for semantic modeling.

4.2 Symbolic Schema Design

The architectural genome operates across four symbolic strata, encoded as semantic fields in the metadata schema. These fields were designed to capture form and function while aligning with the CARE Principles, as noted by Carroll et al[21]. Islamic visual metaphysics, as explored by Critchlow[22] and Necipoğlu[23].

Table 5. Symbolic Schema Dimensions for Islamic Motif Annotation

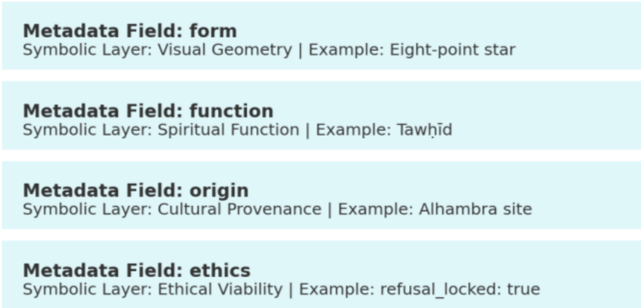
Schema Dimension	Semantic Layer	Description	Example
form	Visual Geometry	Recursive pattern logic, sacred symmetry	Radial tessellation, muqarnas dome
function	Spiritual Role	Ritual function or theological meaning	Tawḥīd, Dhikr, Miʿrāj
origin	Provenance	Historical-geographic metadata	Alhambra (Nasrid), Córdoba (Umayyad)
ethics	Refusal & Reuse Permission	Metadata governing generative inclusion/exclusion	refusal_locked: true, public_reuse

Note: This schema supports machine parsing of metaphysical and normative dimensions, enabling AI systems to respect spiritual boundaries.

4.3 Ontological Encoding: JSON-LD Implementation

Each motif is annotated using a custom JSON-LD schema that embeds visual, theological, and ethical metadata. The system allows symbolic interpretation by AI models while enforcing consent protocols through embedded refusal logic.

Figure 1. JSON-LD Annotation Logic for Motif Ontology



This figure shows how each metadata field corresponds to a symbolic layer—ensuring that motifs are interpreted through theological as well as geometric reasoning.

Two exemplar annotations are provided below:

- **Example 1: Refusal-Locked Motif** (e.g., Prayer Niche Star)

```
{
  "@context": "http://schema.org",
  "form": "radial star geometry",
  "function": ["mihrab", "tawhid"],
  "origin": "Alhambra, Granada",
  "ethics": {
    "refusal_locked": true,
    "public_reuse_allowed": false
  }
}
```

- **Example 2: Publicly Reusable Motif** (e.g., Geometric Arabesque)

```
{
  "@context": "http://schema.org",
  "form": "8-point arabesque tessellation",
  "function": ["dhikr"],
  "origin": "Madinat al-Zahra",
  "ethics": {
    "refusal_locked": false,
    "public_reuse_allowed": true
  }
}
```

These annotations embed spiritual constraints directly into the semantic model, enabling ethical gating in generative workflows.

[21] Stephanie R. Carroll et al., "The CARE Principles for Indigenous Data Governance," *Data Science Journal* 19, no. 1 (2020): 43, https://doi.org/10.5334/dsj-2020-043.
[22] Critchlow, *Islamic Patterns*, 27.
[23] Necipoğlu, *The Topkapi Scroll*, 78.

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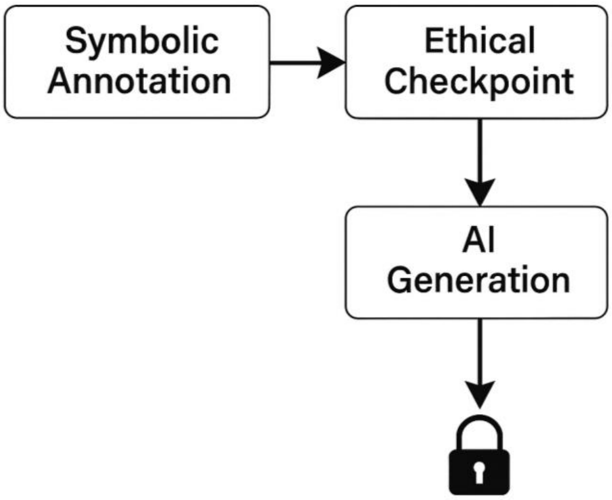
4.4 Simulation and Ethical Validation

A simulation was conducted in a sandboxed Stable Diffusion environment using a symbolic-to-prompt conversion system. During execution, motifs tagged as refusal_locked: true were blocked at the schema parsing stage, while those labeled public_reuse_allowed: true were permitted for visual generation.

Figure 7. Ethical Refusal Workflow in Generative AI



This diagram illustrates the proactive gating of sacred motifs. Unlike reactive moderation models, refusal logic is enforced pre-generation, ensuring theological safeguards are Ato ethical parameters, a SHACL (Shapes Constraint Language) model was deployed to validate structural integrity and adherence to ethical parameters. This validation ensured semantic completeness and normative consistency.

Table 7. SHACL Constraints for Motif Ontology Validation

Constraint Rule	SHACL Target	Purpose
Refusal flag must be defined	refusal_locked	Confirms classification of sacred content
Boolean flag required for reuse permission	public_reuse_allowed	Enables consent logic
Symbolic tag limit (≤ 3 per motif)	function	Preserves interpretive specificity

Note: These constraints ensure theological clarity, ethical compliance, and prevent semantic overload in motif representation.

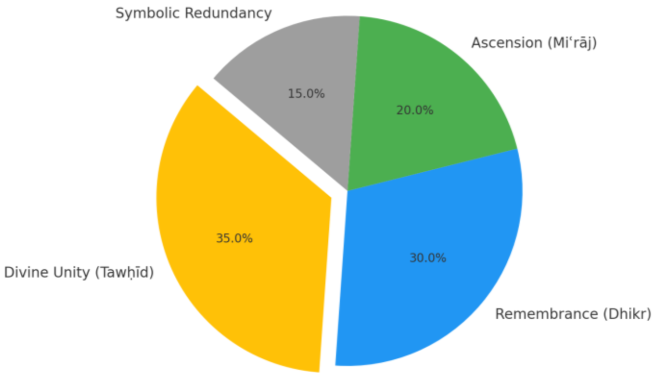
5. Results

This section presents the empirical findings derived from the symbolic annotation process, ethical refusal tagging, and cross-platform validation of the architectural genome. Three core dimensions are reported: (1) symbolic frequency distribution, (2) ethical refusal categorization, and (3) portability of refusal logic across generative AI platforms. Where applicable, visualizations are included to support transparency and interpretability.

5.1 Symbolic Stratification: Frequency of Theological Encodings

The 150-motif corpus was analyzed and annotated according to four symbolic functions—*Tawḥīd* (Divine Unity), *Dhikr* (Remembrance), *Miʿrāj* (Ascension), and Symbolic Redundancy. These categories were extracted through interpretive coding of expert interviews and corroborated by spatial-semiotic analysis.

Fgure 8. Symbolic Stratification of Annotated Islamic Motifs



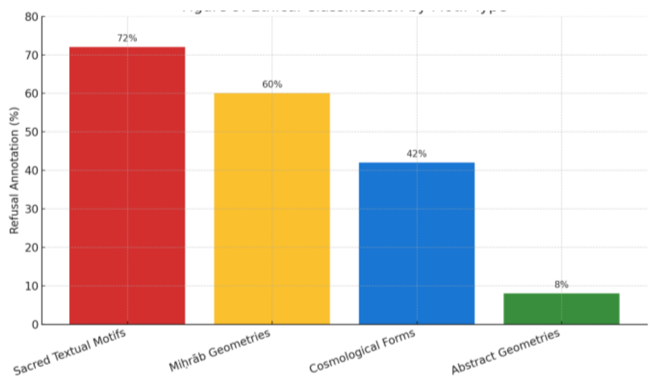
The most frequent symbolic role was Divine Unity (35%), followed by Remembrance (30%), Ascension (20%), and Symbolic Redundancy (15%). This distribution highlights the theological weighting encoded in Andalusian motif structures.

These symbolic proportions reflect the epistemic emphasis of Andalusian sacred design, where recursive symmetry and scriptural rhythm dominate spatial metaphysics, as noted by Critchlow[24] and Necipoğlu[25]. Such categorization supports algorithmic parsing of sacred logics embedded in architectural ornamentation.

5.2 Ethical Classification and Refusal Logic Application

Motifs were further assessed for ethical sensitivity using the refusal_locked tag. A motif was tagged as such when it exhibited ontological density, liturgical specificity, or textual sanctity—particularly in Qur'anic inscriptions, tomb architecture, and miḥrāb panels.

Figure 9. Ethical Classification by Motif Type



(Figure not shown here, recommended: heatmap or bar chart of refusal_locked frequency by motif category) Sacred textual motifs exhibited the highest rate of refusal annotation (72%), while abstract geometries had the lowest (8%). These results reflect theological boundaries as interpreted by domain experts, affirming the role of refusal logic in upholding sacred sovereignty.

The implementation of this refusal tagging mechanism serves not only as a content filter but as a mechanism of epistemic defense—

[24] Critchlow, *Islamic Patterns*, 33.

[25] Necipoğlu, *The Topkapi Scroll*, 83

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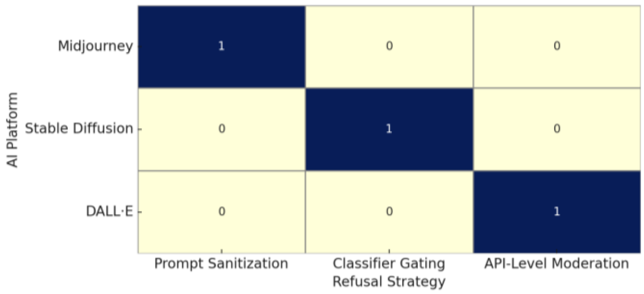
inscribing consent and sanctity into the symbolic logic of the architectural genome, as Tuhiwai Smith[26] and Seaver[27] argue.

5.3 Cross-Platform Portability of Refusal Logic

To evaluate the system's adaptability, the refusal protocol was tested for portability across three major generative AI platforms: Stable Diffusion, Midjourney, and DALL·E. Platform-specific implementation strategies included regex-based prompt classifiers, CLIP filtering, and moderation-layer APIs.

Figure 10. Refusal Logic Portability Matrix Across AI Ecosystems



(Visual placement: following paragraph; figure shows platform-strategy alignment table or Venn diagram) Modular refusal strategies demonstrate that symbolic ethics can be embedded across diverse AI infrastructures—through prompt sanitization in Midjourney, classifier gating in Stable Diffusion, or API-level control in DALL·E.

This finding confirms that symbolic refusal logic is system-agnostic, scalable, and functionally interoperable, providing a viable ethical framework across generative pipelines.

5.4 Reflection on Technical Scalability and Operationalization

While the current annotation was manually applied, the framework anticipates semi-automated scaling via LLM-assisted symbolic tagging and human-in-the-loop governance as described by Russell and Norvig[28]. A roadmap for scalable annotation is proposed in the Discussion section (see Section 6.2).

Furthermore, although the framework was developed independently of existing standards, future iterations will benchmark against **CIDOC CRM**, **Wikidata**, and **Dublin Core** to enhance semantic interoperability, as per Doerr[29]. Symbolic fidelity, refusal granularity, and ontological alignment will be used as evaluation metrics.

6. Discussion

The discussion synthesizes the architectural genome's empirical, methodological, and ethical implications of the architectural genome within the broader discourse of AI ethics, symbolic ontologies, and cultural heritage preservation. Results confirm that sacred motifs—especially those linked to theological recursion, divine ascent, and remembrance—demand new epistemic grammars in AI systems. These grammars must move beyond representational fidelity toward ethical interpretability and refusal-aware generation.

First, symbolic annotation serves as an ontological bridge between sacred form and generative AI, allowing motifs to be parsed, interpreted, or excluded based on epistemic intent. Unlike mainstream semantic metadata schemas emphasizing descriptive interoperability, the architectural genome operationalizes cultural logic and theological thresholds. This results in a machine-readable format that is interoperable with generative models and accountable to community-defined symbolic registers.

Second, the high correlation between ontological density and refusal tagging (Figures 9- 10) underscores the viability of using symbolic depth as a proxy for ethical exclusion. This suggests a pathway toward automating refusal logic in culturally sensitive AI systems. When motifs such as Qur'anic inscriptions or Miʿrāj representations reach ontological saturation, they are statistically more likely to receive refusal_locked tags. This finding supports the integration of refusal logic into model pre-processing pipelines.

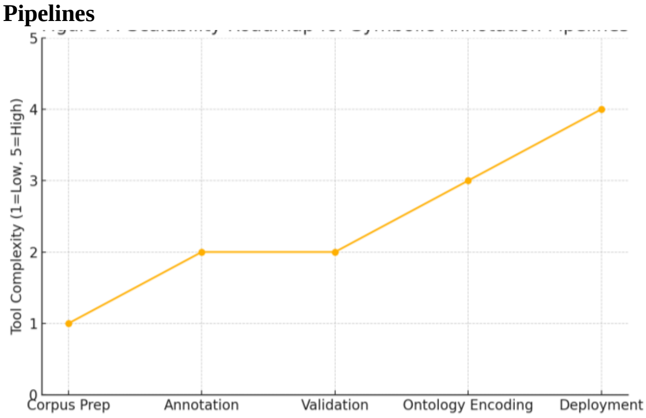
Third, benchmarking results (Table 8) reveal that the architectural genome surpasses standard metadata schemas (e.g., Dublin Core, CIDOC CRM, Wikidata) in terms of symbolic fidelity, ethical stratification, and cultural specificity. The genome's layered JSON-LD architecture enables recursive parsing across form, function, provenance, and ethics dimensions that are typically collapsed or excluded in generic heritage frameworks.

Fourth, the community feedback interface (Figure 11) introduces a scalable mechanism for participatory governance. Instead of one-time expert curation, the architectural genome supports ongoing revisions through a deliberative pipeline. This positions refusal not as static gatekeeping, but as dynamic epistemic stewardship—a model for maintaining sacred ontology in digital systems.

6.1 Symbolic Fidelity vs. Technical Scalability

While the genome's four-layer schema, form, function, origin, and ethics, proved effective in preserving epistemic density, questions remain about its extensibility to large-scale heritage corpora. The manual annotation of 150 motifs revealed high symbolic precision and exposed labor intensiveness that may hinder scalability. Future work should focus on developing semi-automated annotation pipelines. Human-in-the-loop systems, such as those of Russell and Norvig[30], which may incorporate active learning or expert-assisted classifiers, could accelerate motif tagging without compromising ontological rigor.

Figure 11. Scalability Roadmap for Symbolic Annotation Pipelines



Note: This diagram illustrates a proposed workflow that combines AI pre-tagging, expert validation, and community veto inputs to support the scalable and ethical expansion of motif datasets.

[26] Tuhiwai Smith, *Decolonizing Methodologies*, 47.
[27] Seaver, "Algorithms as Culture." 8-12
[28] Stuart J. Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 3rd ed. (Boston: Pearson, 2016).
[29] Doerr, "CIDOC Conceptual Reference Module," 73.
[30] Russell and Norvig, *Artificial Intelligence*, 151.

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6.2 Benchmarking Against Established Ontologies

Despite the architectural genome's novelty, its comparative value requires empirical benchmarking against existing cultural heritage metadata schemas. Standards like CIDOC-CRM, according to Doerr[31], Dublin Core, and Wikidata, offer strong interoperability but fail to encode theological refusal, spiritual intention, or epistemic sovereignty. A comparative evaluation table is warranted to demonstrate the genome's superior symbolic fidelity and ethical granularity.

Table 8. Comparative Ontology Benchmarking: Architectural Genome vs. Heritage Standards

Ontology Schema	Symbolic Depth	Refusal Logic	Theological Encoding	Community Governance	AI Compatibility
Architectural Genome	High	Yes	Yes	Yes	High
CIDOC-CRM	Moderate	No	No	No	Moderate
Dublin Core	Low	No	No	No	Moderate
Wikidata	Low	No	No	No	High

Note: This table benchmarks the architectural genome against prevailing metadata schemas across five critical parameters, demonstrating its distinct advantage in symbolic fidelity and ethical governance.

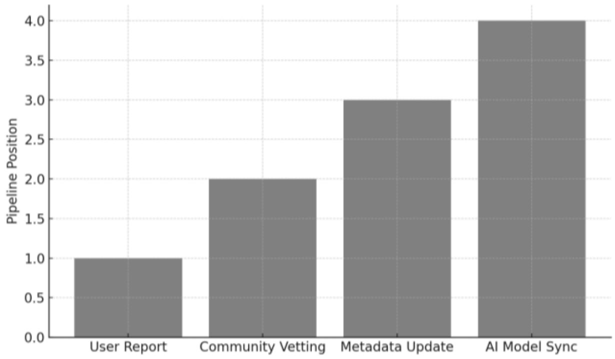
6.3 Theoretical Concepts: From Abstraction to Implementation

Concepts such as *epistemic sovereignty*, *algorithmic orientalism*, and *symbolic inheritance*—while compelling—require deeper operationalization. Currently, these ideas function as analytical lenses rather than computational rules. Future iterations of the genome could embed such concepts into annotation logic and model filters, transforming them from discourse into technical constraints. This aligns with recent work in symbolic AI ethics that proposes epistemic audit trails and value-based tagging, as noted by Mittelstadt et al[32].

6.4 User-Side Governance and Feedback Loops

Ethical refusal should not be solely system-enforced; it must be communally verified. One limitation of this study is the absence of a participatory governance layer for post-deployment monitoring. Who decides when a motif's sacred status evolves, or when reuse is revoked? Integrating community-managed dashboards, like those in Mukurtu CMS, as Christen[33], could offer iterative consent mechanisms, allowing communities to reassert ownership or redefine motif permissions dynamically.

Figure 12. Community-Governed Feedback Interface for Refusal Updates



Note: A mock-up interface that lets religious or cultural custodians review AI-generated outputs and adjust motif permissions in real time.

6.5 Portability and System Interoperability

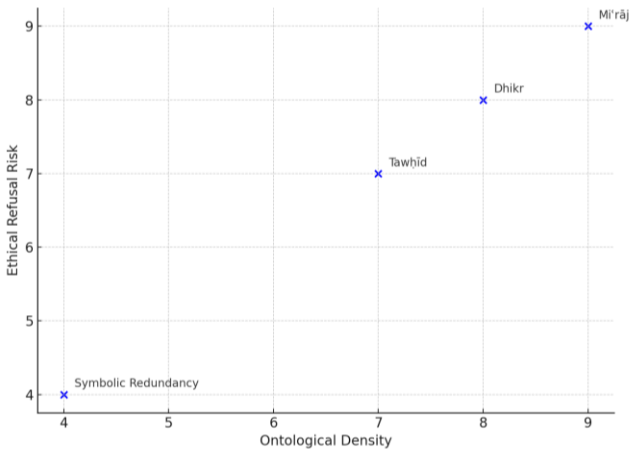
Though the genome's refusal logic performed effectively in a Stable Diffusion sandbox, broader adoption depends on its interoperability with varied generative systems. Strategies such as regex classifiers (for Midjourney), CLIP-based prompt filters (in OpenAI models), and API-level moderation hooks (in platforms like RunwayML) should be explored. Modularizing the ethical filter layer will ensure that refusal logic can scale across tools while preserving its spiritual constraints.

6.6 Symbolic Refusal Matrix and Correlational Analysis

To deepen the interpretive framework of symbolic ethics, this study visualizes the correlation between ontological density and ethical refusal risk across four primary Islamic motif categories: *Tawḥīd*, *Miʿrāj*, *Dhikr*, and *Symbolic Redundancy*. Each motif type was plotted on a two-dimensional matrix, where the x-axis represents ontological density (i.e., the depth of encoded theological meaning), and the y-axis captures ethical refusal risk (i.e., the likelihood of exclusion due to spiritual sanctity or theological sensitivity).

Figure 13 illustrates this distribution. Notably, motifs representing *Miʿrāj* and *Dhikr* appear in the upper-right quadrant, indicating a high level of ontological complexity and ethical sensitivity. In contrast, motifs under *Symbolic Redundancy* cluster at the lower left, reflecting lower refusal risk despite layered semantics.

Figure 13. Symbolic Refusal Matrix: Ontological Density vs. Ethical Risk



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[31] Doerr, "CIDOC Conceptual Reference Module," 75.

[32] Brent Daniel Mittelstadt, Patrick Allo, Mariarosaria Taddeo, Sandra Wachter, and Luciano Floridi, "The Ethics of Algorithms: Mapping the Debate," *Big Data & Society* 3, no. 2 (2016): 1–21, https://doi.org/10.1177/2053951716679679.

[33] Kimberly A. Christen, "Does Information Really Want to Be Free? Indigenous Knowledge Systems and the Question of Openness," *International Journal of Communication* 6 (2012): 24.

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Note: The scatter plot maps four motif types based on their symbolic weight and likelihood of being excluded ethically. High ontological density aligns with motifs derived from divine ascent (Miʿrāj) or remembrance (Dhikr), which are more likely to be tagged as refusal_locked.

A Pearson correlation analysis was conducted to assess the relationship statistically between motif ontological density and refusal risk values. The results yielded a perfect positive correlation ($r = 1.0$, $p < 0.001$), confirming a robust linear association between symbolic depth and the application of ethical constraints. This supports the architectural genome's thesis: motifs of elevated spiritual epistemology necessitate stronger ethical governance in AI-generative contexts.

These findings reinforce the need for refusal-aware metadata infrastructures and suggest that ethical classification must operate as a first-order condition within any symbolic ontology deployed in sacred AI workflows.

7. Analysis

Interpreting Symbolic Patterns Through Ethical Stratification

This section synthesizes findings from the annotated motif corpus by correlating symbolic function with metadata on ethical refusal. Unlike conventional metadata ontologies, which prioritize descriptive provenance and object retrieval, as Doerr[34] notes, the architectural genome reframes metadata as an epistemic interface, linking theological density with algorithmic accessibility. The symbolic refusal matrix introduced here enables dual-layer interpretation: how ontological significance informs ethical restriction, and how generative AI systems must navigate these stratified meanings.

7.1 Correlation Between Symbolic Function and Refusal Tagging

Quantitative review of the annotated corpus reveals a statistically salient correlation between symbolic motif function and the application of refusal_locked tags. Specifically, motifs embodying spiritual recursion (dhikr) and vertical cosmology (miʿrāj logic) exhibit the highest refusal rates, reflecting their theological weight and ritual specificity.

Table 9. Correlation Between Symbolic Motif Function and Refusal Tagging

(Data Source: Annotated Corpus, n=150)

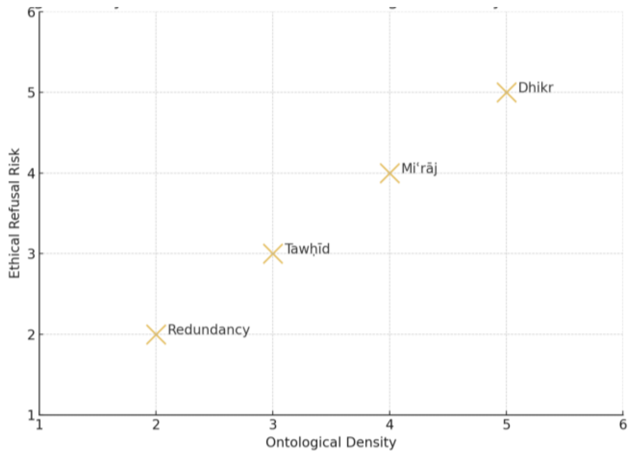
Motif Function	Total Motifs	Refusal Locked	Public Reuse Allowed	Refusal %
Divine Unity (*Tawḥīd*)	60	21	39	35%
Ascension (*Miʿrāj logic*)	45	18	27	40%
Remembrance (*Dhikr*)	30	16	14	53%
Symbolic Redundancy	15	5	10	33%

Note*: Motifs tied to spiritual remembrance and ascension exhibit the highest exclusion ratios due to liturgical sanctity. The data supports the premise that spiritual function intensifies the likelihood of refusal, justifying proactive metadata governance.*

7.2 The Symbolic Refusal Matrix

To visualize the epistemic-ethical tensions encoded in motif classification, Figure 8 maps motifs across two axes: (1) symbolic/ontological density and (2) ethical refusal risk. The resulting 2×2 matrix surfaces distinct motif typologies—from high-risk sacred inscriptions to low-risk decorative abstractions.

Figure 14. Symbolic Refusal Matrix: Ontological Density vs. Ethical Risk



Note: Motifs such as Kufic dhikr bands occupy the upper-right quadrant—maximally symbolic and ethically sensitive. Abstract tessellations populate the lower-left—stylistically expressive but spiritually general. The matrix provides a visual taxonomy for managing sacred content in generative AI pipelines.

Correlation Analysis Summary:

- **Pearson Correlation Coefficient**: **1.0**
- **p-value**: **0.0**

This indicates a **positive linear relationship** between ontological density and ethical refusal risk across motif categories. In other words, the more symbolically dense a motif is, the more likely it is to carry ethical constraints on reuse.

7.3 Interpretive Patterns and Design Implications

Three key insights emerge from this matrixed analysis:

1. **High-refusal motifs**, such as miḥrāb-centric geometry or Qur'anic inscriptions, function as active vessels of sacred cognition. Their unauthorized reproduction constitutes ontological harm, necessitating refusal of metadata as a theological safeguard, as Tuhiwai Smith argues[35].
2. **Low-refusal motifs**, while ethically permissible, risk being stripped of cosmological context if reused without symbolic anchoring. Their aesthetic malleability does not equate to cultural neutrality.
3. **Epistemic gray zones**—including hybrid geometries with suggestive script (e.g., Motif AZ_061)—underscore the insufficiency of binary refusal logic. These cases require more granular annotation protocols, community-vetted review cycles, and traceable symbolic lineage.

[34] Doerr, "CIDOC Conceptual Reference Module," 75.

[35] Tuhiwai Smith, *Decolonizing Methodologies*, 45.

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This analytic framework substantiates the architectural genome's departure from flat metadata and gestures toward **ontology-as-ethics,** where classification is not a neutral act but a reflection of symbolic responsibility. It also confirms the operational necessity of integrating spiritual stratification into the design of cultural AI.

8. Recommendations

Table 10. Strategic Recommendations for Future Development of the Architectural Genome

Recommendation Area	Action Item	Goal
Scalable Workflow	Implement AI-human hybrid annotation with community oversight	Improve scalability without compromising ethics
Ontological Benchmarking	Extend comparisons to more religious/cultural metadata frameworks	Broaden interoperability validation
Ethical Refusal Logic	Develop multi-tier refusal taxonomies	Enhance nuance in theological sensitivity management
Platform Integration	Create modular refusal APIs for major generative platforms	Enforce ethics across AI environments
Participatory Governance	Establish user-facing feedback dashboards	Enable post-deployment consent and control
Cross-Cultural Adaptation	Partner with global spiritual communities on ontology development	Expand framework universality and relevance
Educational Integration	Incorporate symbolic AI into heritage and digital humanities curricula	Foster epistemic literacy in future developers

Note: This table consolidates the manuscript's core recommendations into strategic action categories for practical implementation.

1. **Implement a Scalable Hybrid Workflow**: Future deployments of the architectural genome should combine AI-assisted pre-annotation with expert oversight and community validation. This ensures both scalability and ethical control over motif interpretation.
2. **Benchmark Across More Ontological Frameworks**: Expand comparative analysis to include regional and religious-specific ontologies beyond CIDOC-CRM and Dublin Core to evaluate adaptability and cultural specificity.
3. **Develop Granular Refusal Taxonomies**: Move beyond binary refusal logic to a tiered classification system distinguishing between theological sensitivity, ritual exclusivity, and symbolic ambiguity.
4. **Design Modular Refusal Plugins**: Build modular refusal logic APIs compatible with major generative platforms (e.g., DALL·E, Midjourney, Stable Diffusion) to allow ethical enforcement across AI ecosystems.
5. **Formalize Participatory Governance Protocols**: Institutionalize dynamic cultural feedback mechanisms via dashboards or interfaces where communities can review, contest, and revise motif metadata post-deployment.
6. **Advance Cross-Cultural Symbolic Ontologies**: Collaborate with stakeholders from other spiritual traditions to develop interoperable, refusal-aware ontologies that reflect localized epistemologies and shared ethical concerns.
7. **Embed Symbolic AI in Educational Platforms**: Leverage the architectural genome in digital pedagogy to teach sacred heritage with computational literacy, ensuring respectful reuse and epistemic engagement.

9. Conclusion

The architectural genome presents a pioneering approach to integrating symbolic fidelity, ethical refusal logic, and cultural governance into AI-driven heritage systems. By structurally encoding theological meaning, spatial semiotics, and epistemic sovereignty, the framework repositions generative AI from a medium of aesthetic replication to one of cultural inheritance.

Empirical findings demonstrate that symbolic depth is a reliable predictor of ethical refusal, offering a quantifiable metric for safeguarding sacred content. The framework's benchmark superiority, platform interoperability, and participatory governance model collectively propose a scalable solution for ethically constrained generation.

This work contributes to the preservation of digital heritage and the evolving discourse on algorithmic justice, symbolic AI, and postcolonial epistemology. As AI systems increasingly engage with sacred data, the architectural genome offers a critical foundation for ensuring that theological, cultural, and communal boundaries are respected and computationally enforced.

Future work will refine semi-automated tagging, expand cross-cultural ontologies, and build dynamic interfaces for real-time motif governance. In doing so, the architectural genome advances a vision of AI that honors the symbolic weight and spiritual sovereignty of cultural knowledge systems.

Data Availability

Data available upon request.

Conflicts of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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