International Journal of Creative Multimedia

From Structural Logic to Visual Semiosis: Genealogical Trajectories and Digital Translation of Mortise-and-Tenon Craft

Shirong Feng
P20241000507@siswa.upsi.edu.my
Universiti Pendidikan Sultan Idris, Perak, Malaysia
ORCID iD: 0009-0003-9521-6284
(Corresponding Author)

Mohd Ekram Alhafis bin Hashim
ekram@fskik.upsi.edu.my
Universiti Pendidikan Sultan Idris, Perak, Malaysia
ORCID iD: 0000-0002-1096-6306

Abstract

This study investigates the traditional Chinese mortise-and-tenon craft through an interdisciplinary framework, exploring its transformation from practical structural logic to a visual symbolic system. Drawing on Foucauldian genealogy, the research analyses the historical rupture and reconstruction in the knowledge system of mortise-and-tenon joints, tracing the shift from tacit embodied skills, transmitted through master-apprentice lineage, to explicit graphic representations such as those found in Yingzao Fashi. By integrating visual language theory and digital media studies, this paper proposes a three-tiered model of "Encoding–Abstraction–Dissemination". At the encoding level, parametric tools such as Rhino and Grasshopper deconstruct physical structures into geometric units. At the abstraction level, these components are semantically distilled into visual morphemes embodying aesthetic values of East Asian craftsmanship. At the dissemination level, AR interfaces and digital platforms recontextualise these symbols into culturally resonant narratives. The study reveals semantic stratification in the digital visualisation of mortise-and-tenon joinery. While its surface layer expands cultural dissemination through 3D modelling, its deep layer suffers sign deconstruction of structural logic due to commercial conversion. Although conceptual in orientation, the study highlights pathways through which theoretical models may inform creative multimedia practices in areas such as cultural exhibition, interface design, and heritage visualisation. This research provides a transferable visual syntax framework for the digital preservation of intangible cultural heritage, and its methodology for constructing visual language can be applied to cultural and creative industries and exhibition design.

International Journal of Creative Multimedia (2025) 6, 2, 165-184
doi: https://doi.org/10.33093/ijcm.2025.6.2.8

Published by MMU PRESS. URL: https://journals.mmupress.com/index.php/ijcm

Keywords Mortise-and-tenon; Digital translation; Visual grammar; Parametric design; Knowledge genealogy.
Received: 8 April 2025, **Accepted:** 1 September 2025, **Published:** 30 September 2025

Introduction

As a core embodiment of traditional Chinese woodworking craftsmanship, the mortise-and-tenon structure represents the pinnacle of the Eastern philosophy of “nail-less yet firm” construction in both architecture and furniture. This ingenious joining method not only demonstrates exceptional technical skill and structural intelligence but also encapsulates profound cultural connotations and philosophical values (Wang, 2021; Liang, 2020). Historically, mortise-and-tenon joints have existed primarily as implicit structural components embedded within physical objects and rarely visualized as autonomous forms. However, with the growing awareness of cultural heritage preservation and the increasing application of digital technologies, mortise-and-tenon has gradually evolved from a functional structure into a visual image, transitioning from a craft-based internal logic to a subject of visual communication and media expression.

In the context of contemporary visual design and creative multimedia, mortise-and-tenon has become more than just a construction method—it is now recognised as a visual language resource, widely applied in graphic symbols, 3D modelling, interactive interfaces, augmented reality (AR), and cultural communication. This visual transformation not only satisfies the demand for visibility in today’s information-driven society but also addresses the need for re-encoding traditional culture in contemporary design discourse (Sun, 2021; Shang, 2021). This phenomenon raises a fundamental research question: What is the historical formation trajectory of mortise-and-tenon visual language? Through what semiotic transformation mechanisms does digital mediation reconstruct its semantics? What cultural tensions manifest in its visual translation process?

Existing research on mortise-and-tenon primarily focuses on areas such as structural mechanics, typological classification, and digital reconstruction technologies (Lin, 2022; Yu, 2020). While these studies contribute to our understanding of technical forms and practical applications, they often neglect the symbolic transformation and media translation of mortise-and-tenon as a visual system. There remains a theoretical gap in understanding how this once-invisible structural logic evolves into a recognizable visual language, and how it functions as a cultural symbol within digital environments.

To address this gap, this study adopts genealogical theory as a primary framework, aiming to uncover the nonlinear process through which the mortise-and-tenon visual language shifts from invisibility to visual identifiability. It further integrates visual language theory and digital media translation mechanisms to analyse how mortise-and-tenon is deconstructed, encoded, and reassembled into a system of visual representation in the digital age. This study aims to construct a genealogical-mediatic dual evolution model for mortise-and-tenon visual language, proposing a transferable design methodology for intangible cultural heritage (ICH) visual symbols.

Although conceptual in orientation, the study seeks to clarify its practical resonance by framing how theoretical insights can inform design practice in creative multimedia contexts such as interface development, cultural exhibition, and heritage visualisation.

The Genealogical Evolution of Structural Language and the Foundations of Visual Translation

A Genealogical Perspective: The Rupture and Reconstruction of Structural Knowledge

Genealogy, as proposed by French philosopher Michel Foucault, is a historical method that emphasizes the entanglement of knowledge, language, and power. It calls for a critical interrogation of concepts that appear natural or self-evident, exposing how such notions are continuously constructed, reorganized, and redefined within specific regimes of discourse and sociocultural contexts. Unlike traditional linear historiography, genealogy pays closer attention to discontinuities, contingencies, and emergences—highlighting how forms of knowledge and mechanisms of expression are disembedded and reassembled across shifting epistemic configurations.

Applying genealogy to the study of traditional craftsmanship enables us to understand that the mortise-and-tenon visual language was not inherently a well-defined or legible system of representation. Instead, it was historically constructed through long-term processes of artisanal practice, technical transcription, image evolution, and media dissemination. As a wooden joinery technique, mortise-and-tenon initially existed as an integrated craft practice, where its structural logic was transmitted primarily through embodied skill and master-apprentice lineage, rather than through drawings or codified symbols. Thus, its knowledge remained tacit and corporeal, difficult to externalize via formal language or visual representation.

It was not until the flourishing of Ming–Qing furniture and the emergence of architectural diagramming systems that mortise-and-tenon began to enter a phase of visual articulation. This shift can be regarded as the first genealogical rupture in its structural language: the technique, once rooted in silent, material-based practice, was transformed into an object of observation, emulation, and instruction. It migrated from experiential knowledge to visual knowledge through component diagrams and craft illustrations. In contemporary design and digital media environments, mortise-and-tenon has undergone a second rupture—reassembled as a visual-cultural symbol integral to interface design, graphical motifs, and cultural imagery. This process of "iconisation" is not merely about visualizing structure, but rather about reconstructing its semantic system—what Foucault would call a process of re-discursivisation.

From a genealogical viewpoint, the visual language of mortise-and-tenon can thus be seen as a multi-stage, multi-contextual trajectory of symbolic evolution—one that progresses from "invisible structural knowledge" through technical diagrams, modelling logic, and interface expression to ultimately become a visible syntax of structure with symbolic and communicative potential. This paper will, in the following chapters, trace the formal characteristics, representational mechanisms, and semantic transformations of mortise-and-tenon visual language across these stages, aiming to construct a historically grounded pathway from structure to image.

Visual Language Theory: Formal Logic and Semiotic Expression of Images

In the historical evolution of mortise-and-tenon structures, the shift from implicit technical constructs to visualized graphic forms signifies not only a transformation in knowledge formats but also a reconfiguration of language systems. To better understand how mortise-and-tenon structures are constructed as identifiable visual symbols within digital media and contemporary design contexts, this study draws on Visual Language Theory, exploring the mechanisms through which its image-based language is built—particularly in terms of formal composition, semantic expression, and graphic readability.

American scholar Donis A. Dondis, in her seminal work A Primer of Visual Literacy, was among the first to systematically conceptualize the basic components of visual language. She proposed that images, like verbal languages, consist of structured elements—points, lines, planes, direction, colour, shape, space, texture, proportion, and rhythm—which together form a system capable of articulation, combination, and meaning-making. According to Dondis, any visual work derives its meaning from the selection, arrangement, and organisation of these visual units. Applying this framework to mortise-and-tenon representations, we may interpret components such as tenons, mortises, wedges, and dovetail joints not only as functional parts but also as potential visual morphemes, which, through abstraction and recombination, can constitute a distinct visual language system.

Complementing this perspective, the theory of Visual Grammar developed by Kress and van Leeuwen provides a semiotic framework for interpreting visual meaning. They argue that visual images do not merely convey formal aesthetics but are embedded in cultural and discursive structures. Elements such as composition, perspective, framing, spatial organisation, and gaze function similarly to grammatical syntax in language, carrying directionality, emphasis, and narrative functions. In the case of mortise-and-tenon design, visual reconstruction should not be limited to technical replication; rather, it should be seen as a process of rearticulating a cultural grammar. Visual relationships such as "interlocking–embedding" or "offsetting–misalignment" express not only structural connections but also symbolic meanings within a cultural context.

From a visual language standpoint, mortise-and-tenon structures can be recoded as symbolic and semantically rich graphic language systems. In multimedia environments, they may detach from physical wooden constructs and transform into graphic units with qualities of structural logic, East Asian aesthetics, and cultural identity. These forms are widely used across user interfaces (UI), educational animations, interactive installations, and cultural product design. Such language-driven visual representations enhance both communicative clarity and symbolic resonance, facilitating a deeper translation of traditional structural logic into modern design discourse.

Thus, Visual Language Theory not only provides analytical tools for understanding the formal and semantic dimensions of mortise-and-tenon representations but also lays the theoretical groundwork for examining their composition, visual paradigms, and dissemination mechanisms within digital media. By approaching mortise-and-tenon as a structural visual language, this study offers a design-oriented perspective to explain how it participates in the cultural regeneration and visual reconstruction of intangible heritage in contemporary contexts.

Media Translation and Digital Construction: From Structural Knowledge to Visual Re-encoding

In the transformation of mortise-and-tenon from an implicit craft practice to an explicit visual form, digital media functions not merely as a representational platform but as an active translational mechanism. Media intervention does not simply “reproduce” traditional structures; rather, it re-encodes, reorganizes, and re-visualizes structural knowledge through its unique image logic, interaction patterns, and communicative syntax. This process reshapes not only the visual representation of mortise-and-tenon but also alters the perceptual and communicative channels through which this cultural knowledge is accessed and transmitted.

Media theorist Lev Manovich, in his influential work The Language of New Media, identifies key characteristics of digital media such as variability, visual encoding, and automation. These affordances allow digital tools to deconstruct physical objects into abstract and data-driven formats, enabling new modes of expression. In the case of mortise-and-tenon, these characteristics manifest through the disassembly of structural logic into modular components, parametric dimensions, and joinery rules, which are then reconstructed via 3D modelling software such as Rhino, Fusion 360, and Grasshopper. During this transformation, a form of knowledge once dependent on tactile skill and embodied experience is converted into geometric units, visual nodes, and interactive elements, effectively acquiring the properties of a digital language.

Within the creative multimedia environment, this translational process extends beyond technical simulation. Mortise-and-tenon is recontextualized as a visual symbol embedded in both semantic systems and user-perception frameworks. Through interactive animations, motion graphics, UI interfaces, and AR platforms, its visual elements are regenerated within new media grammars, producing novel narrative logics and cultural meanings. This study extends Kress's theory by defining mortise-and-tenon components as "cultural visual semiotic units". Media translation here functions not only as a technical tool but as a discursive and symbolic agent that redefines how structural language is interpreted, circulated, and experienced.

Notably, this digital translation process carries a dual nature: on one hand, it expands the reach and appeal of mortise-and-tenon visual language, enhancing its communicative power and aesthetic resonance; on the other hand, it risks formalizing, flattening, or decontextualizing the underlying structural logic, potentially diminishing its craft-based depth and cultural integrity. Thus, digital representations of mortise-and-tenon are not neutral renderings—they are shaped through a complex interplay of technological mediation, symbolic negotiation, and visual reconstruction.

In this sense, digital media does not merely extend the visual space of expression—it actively participates in the disassembly and reconstruction of structural language. From 3D modelling to graphic generation, from parametric logic to interface design, the re-encoding of mortise-and-tenon within media platforms entails both formal reconfiguration and semantic transformation. Media ceases to be a passive conduit and emerges as a co-constructive force in the visual evolution of traditional structural knowledge. It is within this entangled process of technology, meaning, and form that mortise-and-tenon acquires a new digital life, initiating a contemporary trajectory from structure to visual language.

Genealogical Construction, Language Formation, and the Nested Mechanism of Media Translation

This study begins with the generative logic of mortise-and-tenon visual language and proposes a theoretical framework spanning three interrelated levels: historical evolution, image construction, and media expression. To that end, the research integrates three theoretical perspectives—genealogical theory, visual language theory, and media translation mechanisms—which respectively correspond to the historical trajectory of structural knowledge, the construction of graphic language, and the dissemination process within digital media. These perspectives are not positioned in parallel but rather form a nested, progressive structure that moves from historical emergence → formal construction → media expansion.

Genealogy provides the historical dimension of the study. Foucault’ s genealogical lens emphasizes the nonlinear, discontinuous, and reconstructive nature of knowledge formation. Drawing on this approach, the study traces the transformation of mortise-and-tenon from experiential constructive practice to diagrammatic structural language, and ultimately to a visual cultural symbol. Within this evolution, each rupture marks a key shift triggered by changes in media technologies, institutional structures, or expressive demands — moments where knowledge is disembedded and reassembled.

Visual language theory forms the linguistic foundation of the model. Dondis’ theory of visual composition and Kress and van Leeuwen’s grammar of visual design offer systematic pathways for analysing the visual elements, morphemic structures, and compositional logic of mortise-and-tenon imagery. The visual representation of structural components is not merely schematic; it embodies a process of symbolic abstraction, where shape, proportion, and arrangement contribute to a visual syntax of structure.

Media translation mechanisms explain how visual forms are re-encoded and re-semanticized in digital contexts. Manovich’s analysis of new media emphasizes properties such as variability, encodability, and interface logic, which enable traditional structural graphics to acquire new symbolic meanings and communicative strategies through modelling, interaction, and animation. At this stage, the visual language of mortise-and-tenon is no longer a static reproduction, but a dynamic cultural process — one that is continually generated, transformed, and circulated across varying media environments.

The Genealogical Evolution of Mortise-and-Tenon Visual Language

The Craft Experience Phase: Embodied Knowledge of Invisible Structures

As a hallmark of China’s traditional woodworking system, the mortise-and-tenon structure did not initially possess the attributes necessary for visual transmission. It originated within a craft-based system of oral instruction and manual practice; wherein structural logic was rooted in bodily perception and experiential knowledge rather than textual documentation or graphical representation. In this early stage, mortise-and-tenon was primarily constituted as tacit knowledge—an accumulation of skills transmitted through hands-on experimentation, visual judgment, and intuitive manipulation. The relationships between wood types, joint angles, and applied force were learned through embodied engagement. The resulting "structural language" remained embedded in the act of making rather than being externalised as visual or symbolic form.

During this period, there were no standardized terms, diagrams, or models to describe the morphology, dimensions, or mechanical principles of mortise-and-tenon joints. Instead, technical continuity was sustained through apprenticeship systems and memory-based knowledge within workshops. This highly experiential model rendered mortise-and-tenon an invisible form of knowledge—not only because the joints were physically concealed within components, but also because their underlying logic resisted formalisation in two-dimensional diagrams or visual systems. Although the structural beauty, spatial order, and mechanical intelligence of mortise-and-tenon were already present, they had not yet entered the realm of visual language.

From a genealogical perspective, this stage constitutes the "pre-discursive" phase of mortise-and-tenon's visual language. That is, the structure had not yet become an object that can be named, recognised, or visually interpreted—it remained unsymbolised and unmediated. As Foucault noted, the emergence of knowledge often begins with the moment something "no longer remains silent". In this sense, the structural language of early craftsmanship was still in silence—it existed, but could not yet be widely perceived, reproduced, or disseminated.

Yet this embodied knowledge was far from meaningless. On the contrary, it laid the foundation for future systems of visual expression by encoding operational logics and spatial intuitions. For example, the staggered interlocking of the "dovetail joint" or the multi-point engagement of the "bridle joint" reflect latent principles of spatial nesting and directional control that would later become central to visual composition. These design potentials had not yet been extracted, codified, or integrated into formal visual or communicative systems.

Therefore, the craft experience phase can be understood as the first layer in the genealogy of mortise-and-tenon's visual language, a phase representing the primordial state of structural logic, or what may be called "pre-visualized craft language". Its conclusion did not mark the disappearance of craft-based knowledge but rather provided the historical foundation for the subsequent transformation from diagram to image to symbol.

The Technical Diagram Phase: Visual Emergence of Structural Logic

With the advancement of woodworking techniques and the institutionalisation of architectural practices, mortise-and-tenon structures gradually detached from purely embodied experience and entered systems of representation that included drawings, models, and technical texts. This phase marks the first significant transformation in the genealogy of mortise-and-tenon as visual language: a pivotal shift from experiential knowledge to visual logic, in which mortise-and-tenon joints could now be seen, described, and reproduced.

The earliest known diagrammatic forms of mortise-and-tenon can be traced back to the Song Dynasty's Yingzao Fashi and the construction diagrams from the Ming and Qing periods. Although most illustrations focused on entire architectural frameworks, they included depictions and breakdowns of individual joinery nodes. Joint types such as the "inserted shoulder joint" (chā jiān sǔn) and "embracing shoulder joint" (bào jiān sǔn) were standardised in diagrammatic form, presented as geometric shapes with linear outlines, proportional annotations, and spatial indicators. This visualisation allowed even non-experts to intuitively comprehend the interlocking logic of mortise-and-tenon assemblies. In this sense, the "diagrammatisation" of mortise-and-tenon represented its transition from an invisible internal structure to an observable and learnable visual unit.

While mortise-and-tenon visual representations in this period were primarily limited to schematics and structural illustrations, and had not yet evolved into a standalone visual system, this phase initiated two critical shifts:

A: Sectionalisation and Expansion of Form

In technical diagrams, mortise-and-tenon structures are frequently decomposed into plan and elevation views, using top-down projections, sectional drawings, and exploded views to simulate the spatial logic of real-world assembly. This expanded mode of representation not only preserves the geometric rules governing the joints but also initiates a rudimentary graphic compositional syntax. As a result, mortise-and-tenon gains visual recognizability as a structural graphic unit.

B: Modularisation and the Systematisation of Nomenclature

Mortise-and-tenon joints also began to be classified and named, forming a triadic technical discourse system that integrated terminology, graphic form, and structural function. This modular and identifiable component system can be seen as the historical precursor to what is now understood as visual morphemes in contemporary visual language.

From a genealogical perspective, this phase represents the discursive emergence of mortise-and-tenon as visual language. Its "visibility" was no longer confined to the site of physical construction but became encoded within technical illustrations and institutionalized knowledge systems. As Foucault noted, the point at which knowledge is named, codified, and made reproducible marks its transformation into a regime that can be disseminated, regulated, and reappropriated. Here, structural logic begins to shift from individual craftsmanship to collective knowledge; artisan memory is gradually replaced by visual tools; and visual representation becomes the precondition for structural control and standardized transmission.

It is important to note that although the mortise-and-tenon images of this stage served expressive functions; they remained largely function-oriented, designed primarily for technical instruction and construction regulation. Their visuality belonged to what may be called a“semi-linguistic” system—not yet a fully developed visual language. Only when the mortise-and-tenon schematic enters higher domains of visual communication, aesthetic design and cultural symbolism does it truly become a cultural graphic system with autonomous visual language attributes.

Thus, the technical diagram phase constitutes a pivotal node in mortise-and-tenon’s transition from invisibility to graphical expression. It not only forms the structural and diagrammatic basis of a craft visual language system but also prepares the groundwork for its reconstruction as a visual symbol in contemporary design and digital media contexts.

The Symbolic Phase: The Cultural Iconisation of Structural Imagery

In contemporary contexts, mortise-and-tenon structures are no longer confined to their original roles as architectural or furniture components. Instead, they have been distilled into graphic symbols imbued with cultural meaning and communicative value across diverse domains such as cultural dissemination, visual design, and digital media. This phase marks the evolution of mortise-and-tenon from a structural diagram to a cultural image, wherein its visual form is no longer tied solely to functional construction, but rather assumes multiple roles as a cultural motif, design language, and media symbol. This constitutes what may be termed the symbolic transformation period within its visual language genealogy. The Forbidden City's cultural product "Mortise-and-Tenon Blind Box" (2022) simplified the "drawer runner tenon" into slot-together toys, detaching the components from their mechanical wisdom and epitomizing the commercial dissolution of structural logic.

First, the visual language of mortise-and-tenon has been widely adopted in contemporary visual communication and the cultural and creative industries. In recent years, numerous cultural brands and design institutions—such as Palace Museum Culture, Liangzhu Creative, and Alibaba Design—have employed mortise-and-tenon graphics as core elements of visual identity, building recognizable graphic systems that embody Eastern structural philosophy, artisanal spirit, and the ideal of harmony between nature and humanity. These visuals no longer serve structural purposes but instead operate as cultural icons within modern media scenarios such as product packaging, UI iconography, and promotional posters. Mortise-and-tenon has thus become a cultural totem that can be recognized, appropriated, consumed, and reimagined.

Second, driven by digital technologies, mortise-and-tenon graphics have gained expanded visual capabilities. Through 3D visualisation, motion graphics, and parametric modelling, designers are able to abstract structural components, reconstruct them visually, and reorganize their symbolic functions—imbuing them with new dynamic logics and visual semantics. This reconstruction is not limited to visual form; it also represents a narrative shift from technical illustration to cultural language unit. Mortise-and-tenon has been transformed into interactive visual maps, interface elements, and kinetic modules, exemplifying the re-culturalisation of structural form.

From a genealogical perspective, this symbolic phase represents the most pronounced instance of rupture and recombination in the evolution of mortise-and-tenon visual language. No longer merely a representation of physical logic, mortise-and-tenon now occupies a cultural position within discursive space: it may signify Eastern wisdom, precise craftsmanship, and structural philosophy, while also functioning as aesthetic icon, graphic resource, or abstract ornamental motif. It is precisely this multiplicity that grants mortise-and-tenon graphics the capacity for continuous reinvention and cross-disciplinary circulation in today's media landscape.

However, such high degrees of symbolisation also carry the risk of de-structuralisation. Through repeated visual manipulation, mortise-and-tenon imagery may become detached from its structural origins and artisanal depth, devolving into a superficial visual trope. Therefore, the application of mortise-and-tenon as a visual language in cultural communication must strike a balance between aesthetic construction and structural integrity.

In sum, the symbolic phase not only signals the modern transformation of mortise-and-tenon visual language but also provides the symbolic foundation for its integration into the digital media era. Building upon this, the next chapter will explore how mortise-and-tenon visual language is systematically reconstructed and re-encoded in digital media environments, completing its contemporary translational pathway from structural logic to visual communication system.

The Expressive Logic of Mortise-and-Tenon Visual Language in Digital Media

The Encoding Layer: Translating Structural Logic into Graphic Form

The visual expression of mortise-and-tenon structures begins with their transformation from craft-based constructive logic into graphic language units—a process defined here as the encoding stage. In this phase, traditional structural forms are deconstructed into visualised and modularised geometric components, gradually forming visual morphemes with the potential for cultural communication and media dissemination. The incorporation of digital modelling tools not only enables precise geometric

reconstruction of mortise-and-tenon joints but also facilitates the standardisation and systematisation of their visual language.

In practical application, Rhino and Grasshopper constitute the primary tools for mortise-and-tenon modelling. Rhino, as a NURBS-based surface modelling software, excels at capturing intricate structural features such as interlocking mouths, wedge-shaped joints, and oblique cuts. Grasshopper, as its visual programming environment, allows designers to establish parametric relationships among structural variables, enabling dynamic control over both form and logic. Taking the "dovetail joint" as an example, designers can define variables such as tongue width, insertion angle, and depth in Grasshopper and manipulate these via sliders to adjust the precision of joint fit and spatial compatibility. This ensures both structural feasibility and formal consistency within the model.

A typical modelling workflow includes the following steps:

1. drafting geometric sketches of the components;
2. setting parameters and constraints;
3. establishing associative rules and assembly logic;
4. exporting the model and generating 2D diagrams.

This workflow not only ensures efficient digital reconstruction, but more importantly, enables mortise-and-tenon joints to be treated as controllable, reusable, and abstractable design units, laying the groundwork for their integration into visual language systems.

Building upon this, some mortise-and-tenon models are exported to platforms such as Unity, ARKit, and ARCore for interactive display or augmented reality (AR) experiences. Users can rotate, assemble, and disassemble components on mobile devices to intuitively grasp the structural logic and interlocking principles. This form of interactive graphic demonstration transforms mortise-and-tenon from static digital models into operable visual language objects.

In this way, the encoding layer represents not only a geometric reconstruction of structural knowledge but also the starting point for visual language construction. By abstracting mortise-and-tenon from physical components into graphic units equipped with parametric control, designers are able to translate traditional structural logic into a system of visual grammar suitable for communication, education, and cultural design—achieving the initial shift from constructive logic to visual language.

The Abstraction Layer: Visual Paradigms and Semantic Reorganisation

Building upon the structural encoding process, the digital translation of mortise-and-tenon visual language enters a deeper phase of abstraction and semantic construction. At this stage, mortise-and-tenon joints are no longer treated merely as “structural diagrams", but rather as visual morphemes—abstracted, formalized, and embedded within a communicable and recognizable visual language system. This shift marks the crucial turning point in the evolution of mortise-and-tenon visual language: a movement from form to meaning.

From Functional Components to Visual Morphemes

The abstraction of mortise-and-tenon visuals within digital media is characterized by a shift from functionality to semiotic expression. Common joints such as the dovetail, bridle joint, and embracing shoulder joint are reinterpreted: their geometric profiles are extracted through 3D modelling and detached from their original mechanical purposes. They are thus repositioned as symbolic graphic units within a visual system. This transition—from function to form to image—elevates mortise-and-tenon components to the status of graphic morphemes in a linguistic sense.

Figure 1. Comparative Visualisation of Shoulder Tenon

As Donis A. Dondis notes in A Primer of Visual Literacy, “Dot, line, shape, direction, form, colour, texture, scale, and motion are the fundamental building blocks of visual language”. The geometric abstraction of mortise-and-tenon imagery is constructed precisely through these foundational visual units, which together generate the system’s symbolic and recognizable features. For example, typical structural elements in mortise-and-tenon joints—such as T-shaped intersections, stepped grooves, and triangular wedges—can be abstracted into visual modules representing interlocking, nesting, or joining. These geometric patterns function not only as aesthetic forms but also as carriers of visual semantics.

Constructing Paradigms: The Grammaticisation of Visual Rules

As mortise-and-tenon graphics move into broader domains of communication and design, they no longer appear as isolated components but are organized into systematic visual lexicons that follow grammatical rules. This process can be interpreted through the framework of visual grammar proposed by Kress and van Leeuwen in Reading Images: The Grammar of Visual Design. According to this theory, visual compositions, like verbal language, possess structured grammar, encompassing elements such as information value, visual salience, orientation logic, and spatial composition. The widespread application of mortise-and-tenon motifs in interfaces, icons, compositional layouts, and interactive systems demonstrates how these forms are engaged in a visual grammar process—from composition and combination to semantic generation.

Semantic Reorganisation: Graphic Recognition in Cultural Cognition

The recognition of visual symbols is not innate but constructed through cultural experience and visual habitus. Once mortise-and-tenon imagery enters public visual culture, it gradually becomes accepted as a cultural symbol associated with notions such as "eastern craftsmanship", "precision structure" and "aesthetic artisanship". This process of semantic reorganisation enhances the recognizability and affective resonance of mortise-and-tenon graphics in contemporary media. For example, in brand visual identity design, such imagery is often employed to signify values like "cooperation", "integration"' or the "fusion of tradition and modernity".

This semantic attribution derives not only from the intrinsic formal characteristics of mortise-and-tenon graphics but also from the recontextualizing mechanisms of media environments. Through interface layout, motion graphics, and interactive visualisation, digital media continually inscribes mortise-and-tenon imagery with new contextual meanings, rendering its graphic semantics more flexible, adaptive, and reconstructible.

The Dissemination Layer: Visual Communication Pathways in Media Environments

With the rapid development of digital media technologies, mortise-and-tenon visual language has moved beyond the internal mechanisms of graphic construction and semantic abstraction. It now operates within multi-dimensional media environments as a recognizable, operable, and interactive visual resource. At this stage, mortise-and-tenon imagery completes its full translation from "encoding–abstraction" to "dissemination–recontextualisation", as its cultural meanings, visual strategies, and user perceptions are continuously restructured and expanded within new media contexts.

Mortise-and-Tenon Visual Communication in Multi-Media Contexts

Across various platforms—including interface design, mobile applications, and cultural interaction systems—mortise-and-tenon graphics are widely used as cultural identifiers and interactive visual language elements. For instance, in digital museum exhibition systems, mortise-and-tenon diagrams are used to visualize internal furniture structures; on intangible heritage education platforms, augmented reality (AR) and interactive animations simulate the assembly process of mortise-and-tenon components, enhancing user comprehension of structural logic and cultural heritage. In such contexts, mortise-and-tenon visuals are no longer static illustrations but become part of the "interface language" that shapes visual logic, user interaction, and information flow.

A notable example is the mobile application "Sunmao", which employs 3D simulation and animated demonstrations to enable users to experience interactive assembly and disassembly of mortise-and-tenon joints via web and mobile platforms. This immersive communication approach not only reinforces the interactivity and operability of mortise-and-tenon graphics, but also translates structural knowledge into visual language, making it more accessible, learnable, and shareable for non-specialist audiences.

Figure 2. *Sunmao* App Interface

Graphic Adaptability and Redesign in Dynamic Media Dissemination

The dissemination of mortise-and-tenon visual language in digital media does not involve the static replication of traditional component imagery. Instead, it undergoes dynamic evolution and recomposition across different platforms and visual tasks. This results in a high degree of adaptability and extensibility in its mediated expressions. For example, on short video platforms, mortise-and-tenon graphics are used in animated diagrams, structural demonstrations, and narrative animations to convey

the logic and ingenuity of interlocking techniques. In web interface design, mortise-and-tenon structures are abstracted into icons and modular components, seamlessly integrated into modern information systems.

Additionally, in brand identity and cultural signage systems, mortise-and-tenon visuals are often employed to construct cultural visual identities. For instance, the logos of certain universities, museums, and creative enterprises utilize abstracted or symbolized mortise-and-tenon forms to convey values such as cohesion, stability, and heritage. These practical applications demonstrate that mortise-and-tenon imagery has become a visually modular structure with significant potential for redesign and adaptation within mediated systems.

Visual Re-semantisation in Contextual Dissemination

It is important to recognize that as mortise-and-tenon graphics are widely disseminated, their semantic meanings evolve alongside the media environments in which they appear. This process of re-semantisation may reinforce cultural associations such as "eastern wisdom" and "traditional craftsmanship", but it may also dilute the original structural logic and artisanal depth through commercialisation or over-symbolisation.

As sociologist Stuart Hall famously asserted, "Meaning is always renegotiated between encoding and decoding". The circulation of mortise-and-tenon imagery in digital media is shaped not only by the visual encoding of designers, but also by the decoding processes determined by user backgrounds, platform affordances, and cultural contexts. Thus, the dissemination of mortise-and-tenon as a visual language is not simply a technical operation; it is a continuous process of cultural meaning regeneration.

Conclusion

This study, guided by the conceptual triad of "structure–language–media", proposes a three-layered analytical model of "encoding–abstraction–dissemination" to uncover how mortise-and-tenon structures are transformed from tacit craft knowledge into graphical, semantic, and communicable visual symbols embedded within multimodal media environments. Mortise-and-tenon is no longer merely a constructional joint—it has become a recognisable, reconstructible visual lexicon of cultural significance.

Theoretically, the research bridges the gap between traditional craftsmanship and contemporary visual communication, highlighting the historical constructedness of visual language and the role of media environments in its semantic reconfiguration. Practically, mortise-and-tenon graphics, as a

structured visual symbol system, demonstrate strong communicative adaptability and redesign potential, with applications in cultural exhibition, interface design, and intangible heritage education.

This study addresses the research void concerning "semiotic production mechanisms of traditional craftsmanship in digital media", revealing:

1. Genealogical rupture points in the paradigm shift from technical schematics to cultural symbols.
2. An inherent paradox of translation manifested in the perpetual dialectic between structural precision and communicative efficiency.

Due to limitations of scope and data, this study does not delve deeply into the user reception mechanisms of mortise-and-tenon imagery within specific media contexts. Future research may incorporate empirical methodologies to further explore the cross-cultural dissemination pathways and interactive semantic evolution of this visual language.

In summary, the construction of mortise-and-tenon visual language reflects the restructuring logic of traditional structural techniques in the digital age. It also offers a new reference model for the visual communication and cultural regeneration of intangible heritage in contemporary design practices.

References

[1] Al-Bishawi, M. (2022). Parametric colonialism? Re-examining cultural authenticity in algorithmic heritage reconstruction. Digital Humanities Quarterly, 16(4), Article e012.

[2] Buden, B., et al. (2009). Cultural translation: An introduction to the problem, and responses. Translation Studies, 2(2), 196–219.

[3] Chen, L., & Lu, T. (2024). Transferable visual language systems for craft-based cultural identity. ACM Transactions on Computer-Human Interaction, 31(2), 1–30. https://doi.org/10.1145/3590761

[4] Gupta, S., & Rossi, M. (2023). AR-enabled craft dissemination: User reception of structural logic vs. cultural symbolism. International Journal of Human-Computer Studies, 179, 103102.

[5] Hall, S. (2003). Encoding and decoding: The production of meaning in mass media. Modern Communication, (2), 51–55.

[6] Kress, G., & van Leeuwen, T. (2006). Reading images: The grammar of visual design(2nd ed.). Routledge.

[7] Leon, R., & Kim, J. (2023). Digital semiotics in heritage preservation: Recoding material culture through parametric design. Design Studies, 87, 101203.

[8] Manovich, L. (2001). The language of new media. MIT Press.

[9] Mvller, C., Park, S., & Hassan, R. (2024). Deconstructing tacit knowledge: A visual grammar framework for intangible cultural heritage. Visual Communication, 23(1), 45–67.

[10] Lin, J. (2022). Design research on the local translation of modern timber architecture from the perspective of structural architecture (Master's thesis). Nanjing University of Technology.

[11] Liu, T. (2016). A study on the encoding mechanism of intangible cultural heritage digital preservation in the context of informatization. Library and Information Knowledge, (3), 25–31.

[12] Shang, H. (2021). Aesthetic analysis and restoration techniques of mortise-and-tenon structures. Packaging Engineering, (22), 199–203.

[13] Sun, N. (2021). Modern translation of Ming-style furniture: From Hans Wegner to Zhu Xiaojie. Art Education Research, (8), 87–89.

[14] Wang, C. (2021). Aesthetic research on the mortise-and-tenon structure in traditional Chinese timber construction. Decoration, (4), 134–135.

[15] Wang, D., Chen, D., & Zhou, X. (2017). Analysis of the information expression and encoding of intangible heritage with digital technology. Information Science, 35(7), 143–147.

[16] Yu, K. (2020). Exploration and research on the modern translation of traditional Ming-style furniture. Art Panorama, (5), 102–104.

[17] Liang, M. (2020). Innovative application of traditional Chinese mortise-and-tenon structure in modern furniture (master's thesis). Henan University of Science and Technology.

Acknowledgment

I would like to express my deepest gratitude to Mr. Mohd Ekram Al Hafis Hashim for his continuous professional guidance and invaluable insights throughout my academic journey.

Funding Information

This research was not funded by any grant.

Authors' Bio

Feng Shirong, a female scholar from Shandong, China, holds a bachelor's degree in Product Design from Shandong University of Art & Design and a master's degree in Furniture Design from Luxun Academy of Fine Arts. Feng is now pursuing her PhD at UPSI with a research focus on the genealogy of traditional Chinese furniture craftsmanship in the digital age.

Dr. Mohd Ekram Al Hafis bin Hashim is Head of Department (Creative Multimedia) at the Faculty of Art, Sustainability and Creative Industry, Universiti Pendidikan Sultan Idris (UPSI). He holds a PhD in New Media and his scholarship spans animation, extended reality (XR), visual communication, and

design pedagogy. Recent works include contributions on digital storytelling and VR/AI in creative practice. Beyond academia, he is active in Malaysia's creative scene, with exhibition and award credits, and regularly serves as reviewer, panelist, and juror.