

Narrative Structure and Iconography of Musical and Dance Scenes in Kucha Grotto Murals

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ABSTRACT

The musical and dance images in Kucha grotto murals are not only important carriers of art but also visual archives of the mutual learning of civilizations along the Silk Road. Based on a review of relevant materials, this paper proposes a research approach that combines narrative structure and iconography of musical behavior: using sacred narrative, secular narrative, and spatio-temporal integration narrative as the structural framework, supplemented by iconographic interpretation of instrument combinations, playing postures, ritual functions, and cultural integration, and then forming an operational method system through strategies such as semantic field annotation and movement restoration. The paper emphasizes the use of visual evidence as the basis and functional inference as the tool to achieve mutual verification and mutual proof of image narrative and musical behavior at the level of the evidence chain.

KEYWORDS

Kucha grotto murals; Musical and dance images; Narrative structure; Musical behavior; Iconography

1 Introduction

The grotto heritage in the Kucha region is renowned for its musical and dance images. The dynamic patterns of flying celestial musicians, ensemble performances, and simultaneous playing and dancing in the pictures provide first-hand visual materials for the study of ancient music and dance. Previous research has mostly focused on image styles or the verification of individual artifacts, and there is still a need to systematically explain the narrative structure and musical behavior together. This paper starts with narrative types, explaining how music and dance are embedded in secular contexts, then uses the iconography of musical behavior to detail instrument combinations, playing techniques, and functional orientations, and finally proposes comprehensive strategies for academic research and public display. The aim is to enhance the verifiability and reusability of the study of Kucha musical and dance images by unifying the methodology and constructing the evidence chain.

2 Narrative Structure Types of Musical and Dance Scenes in Kucha Grotto Murals

2.1 Spatial Organization and Symbolic System of Sacred Narrative

These images take celestial musicians and flying celestial dancers as the main themes, focusing on creating a transcendent visual experience through spatial layering and symmetrical order. The upper part of the picture often features groups of celestial musicians and dancers on both sides, presenting a stable axial structure. Head halos, flowing ribbons, and mineral blue and green backgrounds jointly construct an idealized sky. The progression of the plot is weakened in such images, and the time sequence is replaced by the cyclical presentation of spatial sacredness. Thus, the narrative logic does not rely on the sequence of events but establishes a constant context of praise through symbolic symbols and spatial order, emphasizing the guidance of music and dance on the state of faith.

2.2 Linear Presentation and Scene Linkage of Secular Life Narrative

Secular music and dance focus on core scenes such as celebrations, rituals, and banquets, emphasizing the completeness of the process and the credibility of the details. The pictures often unfold in stages such as preparation, ensemble performance, and dancing. The arrangement of instruments follows the principles of acoustics and performance practice, with plucked instruments as the core sound part located in the front and middle area, wind instruments in opposition, and percussion instruments at the back to enhance the rhythmic density. Details of costumes, masks, and props enhance the sense of life and ritual in the images, indicating that this type of narrative is based on real activities, focusing on recording and reproduction, allowing viewers to grasp the vitality and order of the secular world through scene arrangement and the division of labor of instruments.

2.3 Intertextual Mechanism and Emotional Elicitation of Spatio-Temporal Integration Narrative

Some murals use symbols such as mirrors, flowing ribbons, and gaze guidance to connect the inside and outside of the grotto and the past and present, forming an emotional circuit between the viewer and the music and dance in the picture. These images focus on emotional resonance, weakening the constraints of linear time, and achieving cross-temporal dialogue through dynamic lines and symbolic symbols. The pictures often feature flowing ribbons and gazes

directed towards the viewer in the composition, creating a triple-layered aesthetic experience. Music and dance are no longer just performances but triggers of cultural memory and identity.

3 Key Points of Iconography of Musical Behavior in Kucha Grotto Murals

3.1 Acoustic Orientation of Instrument Combinations and Arrangements

Plucked instruments such as the curved-neck lute, five-stringed lute, and vertical konghou play the backbone role in the pictures, with detailed depictions of their shapes, indicating the familiarity of the makers with the structure of the instruments.

3.2 The Stable Counterpoint Relationship Between Wind Instruments Such as the Horizontal Flute

Bili and panpipe and plucked instruments indicates a performance mode characterized by dual melodic lines and harmonic filling. Percussion instruments like various drums and cymbals are mostly placed on the sides or at the back, which not only meets the acoustic diffusion requirements but also visually enhances the dynamic effect. The combination principle reflects a priority on functionality while also considering aesthetics, and the image evidence and related literature descriptions present a mutually corroborative relationship ^[1].

3.3 Dynamic Capture of Performance Postures and Techniques

The characteristic of playing and dancing simultaneously in Kucha music and dance is repeatedly depicted in the images. The finger movements, shoulder and back opening and closing, and head and face directions of wind players constitute dynamic evidence of sound production support. The wrist and finger flipping and the wrinkles of the sleeves of plucked instrument players reflect the string pressing force and rhythm division. The raising and lowering of arms and the movement of ribbons of drum players record the strong and weak patterns. In terms of dance postures, the three-curved body position and the fluttering of sleeves form dynamic lines of curves and rotations, demonstrating a combined style of softness and intensity. Therefore, the images are not only static portraits but also visual spectra of techniques and body movements. The solemnity in sacrificial scenes and the joy in festival scenes demonstrate the dual roles of music and dance in the spiritual realm and daily life, revealing the complexity of ancient society in terms of aesthetics and functionality. Through a detailed analysis of these scenes, we can better understand the multiple symbolic meanings of music and dance elements in ancient art and their social and cultural background, promoting a comprehensive understanding of the music and dance scenes in the Kucha Grotto murals.

3.4 Facial Expressions, Eye Movements and the Creation of Emotional Atmosphere

In many images of the Khotan music and dance, the expressions of the performers and dancers are not simply stereotyped smiles. Instead, subtle distinctions are made in the curvature of the eyebrows and eyes, the opening and closing of the corners of the mouth, and the texture of the face, thereby indicating the calmness, joyfulness, or solemnity of the musical mood. Regarding the direction of gaze, in one type of image, the musicians often focus their eyes forward, forming a converging line that points towards the center of the picture or the main deity figure, making the viewers feel that the overall ensemble is directed towards a clearly defined object of praise; in another type, they gaze at each other sideways, with up-and-down coordination, creating an interaction between the performers and the dancers, and understanding the ensemble as a process of mutual listening and immediate response. For example, in some murals, the flutist slightly lowers his head and his gaze falls on the dancer's steps in front of him. The dancer then turns his body to respond to this gaze, guiding the viewers to perceive the progression of rhythm and the gradual intensification of emotions in the silent picture. Through the combination of expressions and gaze, the picture visually constructs an "emotional sound field", transforming the musical behavior from a mere technical action into an interpersonal interaction with emotional tension.

3.5 The Synchronization Relationship between Clothing, Ribbons and the Rhythm of the Picture

In the murals of the Kuiz culture caves, the layers of the dancers' clothing and the movement of the ribbons are often used to enhance the sense of rhythm and rhythm. When the wide-sleeved long dresses turn and stretch, they form large arc-shaped color blocks, together with the slender ribbons, forming clear directional lines of movement, allowing the viewers to visually perceive a rhythm structure similar to beats, intensity and paragraph divisions. The density changes of the clothing patterns also correspond to the musical sense of time, with the patterns on the close-fitting parts being simple and easy to highlight the body joints and the direction of force application, while the patterns at the hem and cuffs emphasize the rotation and step frequency. For example, in some images of dancing around a center, the skirts of several dancers spread out in a fan shape, and the ribbon movement roughly converges in a clockwise or counterclockwise direction, forming a rotational rhythm around the center. The clothing patterns of the percussionist and musician figures are more in a vertical oscillation state, suggesting the strong beat landing points. Through such arrangements, clothing is not only a symbol of identity and beauty, but also participates in the visualization of the musical rhythm, allowing viewers

to naturally associate lines and color blocks with drum beats, phrases and dance steps when reading them, thereby "hearing" the structure of the dance and music in the visual level.

4 Research and Dissemination Paths for Kucha Music and Dance Images

4.1 Decoding Image Narratives to Construct Semantic Fields and Structured Annotations

In the research process, the image is first decomposed into four levels of characters, objects, scenes, and plot nodes from a narrative perspective, and machine-readable semantic field tags are constructed. Elements such as narrative types, character identities, object categories, action vocabularies, and spatial divisions are unified to form comparable cross-cave corpora. Then, the annotation results are mapped to a narrative type matrix, revealing the commonalities and differences among the three types of narratives of the sacred, secular, and the integration of time and space through frequency and co-occurrence relationships. For example, when annotating a cave with a group of celestial musicians as the main body, researchers first divide the image according to the axis and hierarchy, then record the instrument category, holding method, gaze direction, and ribbon movement of each musician, and then record the start of ensemble, rhythm intensification, and climax of praise as event nodes. Finally, the pairing relationship between wind and plucked instruments is presented in a relationship diagram. Through multi-cave comparisons, it is found that the co-occurrence rate of wind and plucked ensemble in sacred narratives is significantly higher than in secular narratives, and the time points of drum and cymbal rhythm intensification often occur at the climax of praise. Such findings directly guide subsequent action and acoustic restoration ^[2].

4.2 Restoring the Feature of Playing and Dancing Simultaneously through Action Restoration and Sound Field Modeling

To address the core feature of playing and dancing simultaneously, an action parameter database and sound field simulation process are established. Action parameters include finger path, wrist angle, shoulder and back opening and closing amplitude, step rhythm, and ribbon trajectory. Sound field modeling is based on the position of the objects, spatial volume, and surface reflection to infer the ensemble listening experience. During the research process, taking the combination of horizontal flute and five-stringed instrument as an example, the distance change between the blowing hole and the pressing hole is determined through frame-by-frame vectorization technology, and the pitch trend is calculated based on the finger rules. At the same time, the direction of the clothing wrinkles and ribbons is used to determine the rhythm center, and then both are mapped to the spatial model to test the impact of different instrument positions and wall reflections on timbre and clarity. The restoration results show that the horizontal flute placed in the front row of the band has higher clarity, and the five-stringed instrument in the middle position has a fuller sound image. If low-frequency drumbeats are added in the back, the spatial energy distribution becomes more balanced. Such verification gives acoustic significance to the performance postures and ensemble arrangements in the images, thereby enhancing the interpretability.

4.3 Rebuilding the Evidence Chain of Cultural Integration through Form Comparison and Chronological Lineage

Establish a coding system for the form and structure of musical instruments, recording key fields such as the curvature angle of the neck, the proportion of the resonant cavity, the number of strings, the position of the soundboard, and decorative patterns. Reconstruct the evolution of musical instruments using a timeline and cross-reference with clothing styles and dance postures to find evidence of cultural exchange. For instance, in the study of panpipes, early uniform-length pipe groups and later staggered pipe groups were separately coded, and their co-occurrence frequencies with the curved-neck lute and vertical konghou were statistically analyzed. These were then compared with the speed curves of dance movements, revealing that the staggered pipe group was more often paired with expansive dance postures. The visual variations and the descriptions of the Central Plains music system mutually confirmed each other. Further comparisons of the neck, sound holes, and string supports among the pipa, ruan, and konghou revealed a consistent form within the same cave complex, providing new clues for studying the production system and circulation network ^[3].

4.4 Connecting Academic Interpretation and Public Understanding through Narrative Experiments and Immersive Communication

Translate the narrative structure and musical behavior into an engaging exhibition script, using layered narratives and visual acoustic demonstrations to enhance public comprehension. The exhibition first presents spatial sketches of three types of narratives, then demonstrates the sounds and movements of playing and dancing through simplified results of kinesiology and sound field modeling, allowing viewers to grasp the logic of ensemble playing through simultaneous visual and auditory experiences. For example, in a certain special exhibition, the curatorial team divided the musical groups in the murals into several interactive units. When a viewer selects a certain instrument, the screen displays the key points of its posture and sound clips, while highlighting its position in the sound section on a panoramic map and

providing a brief description of its coordination with other sections. Subsequently, the system plays sound field simulations of three combinations in the form of narrative experiments, allowing viewers to directly compare the auditory differences of different arrangements. This approach transforms abstract iconographic analysis into an experiential learning path, facilitating effective communication between academia and the public.

4.5 Supporting Cross-Cave Comprehensive Research with Digital Archives and Knowledge Graphs

At the long-term research level, it is necessary to incorporate the Kucha music and dance images into a unified digital archive system. Based on high-precision image acquisition, vectorization drawing, and text annotation, a hierarchical database covering caves, walls, and detail units should be constructed. On this basis, through knowledge graph technology, elements such as instrument shapes, character identities, dance postures, and narrative types are connected in the form of nodes and relationships, making the potential connections between different caves, periods, and themes clearly presented. For example, researchers can search for the combination of "curved-neck lute and dance while playing" in the graph, and the system will immediately return several caves and wall sections, marking the co-occurring panpipes, cymbals, and corresponding narrative types with relationship lines. Further, by superimposing the graph with a timeline, the frequency of appearance and spatial distribution of certain types of objects or dance postures in different time periods can be observed, thereby revealing the direction of style diffusion and technological flow. Such digital integration not only facilitates case studies but also provides a stable foundation for statistical analysis and model simulation, enabling Kucha music and dance iconography to move from empirical description to a comprehensive research platform that is visual, searchable, and comparable.

4.6 Expanding the Dimensions of Music Behavior Interpretation through Cross-regional Dialogue and Comparison Frameworks

When deepening the research on the music and dance of Kuqa, cross-regional comparison and dialogue are equally important. In terms of methods, several comparable cave art samples can be selected, and unified observation indicators can be established around the instrument lineage, ensemble composition, dance posture patterns, and narrative structure. The Kuqa images can be examined within the larger framework of the Silk Road art network. For example, when comparing the flying celestial musicians' group images in a certain cave, researchers can create multi-regional comparison tables based on dimensions such as artifact types, holding angles, body center of gravity, and the direction of the flowing ribbons, and then explore the commonalities and differences in solo playing and dancing, ensemble composition, and praise patterns in different regions. These comparison results can be cross-read with archaeological artifacts, music documents, and folk dance patterns. Often, certain postures or artifact combinations are not isolated phenomena but are chain-like spread along the transportation routes. Thus, the interpretation of the music behavior of the Kuqa music and dance images will no longer be limited to a single sample, but will gain new interpretative space within the framework of regional interaction and cultural mutual learning, making the imageological conclusions more persuasive and open.

5 Conclusion

The musical and dance murals in the Kucha grottoes showcase the profound heritage of Silk Road art through the dual dimensions of narrative structure and musical behavior. By using a combination of strategies such as semantic field annotation, kinesiology restoration, sound field modeling, form comparison, exhibition translation, and data governance, scattered image evidence can be integrated into a reliable interpretive framework. Future work can conduct rolling practices in more caves and wall sections, promoting a mutually reinforcing relationship between research paradigms and public displays, to present the visual and acoustic spectra of Kucha music and dance in a more systematic and robust manner.

About the Author

Peidong Liu, Male, Han, Master's degree, Research Direction: Study of music and dance murals in the Kucha Grottoes.

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