

The Innovation and Reconstruction of the Research Paradigm of Musicology by Multimedia Technology

Tianjiao Cheng

Honam University, 62399, Republic of Korea

ABSTRACT

Against the backdrop of the profound impact of the digital wave on humanities and social science research, the traditional musicology research paradigm constructed based on paper carriers and positivism is undergoing a systematic innovation. The traditional research paradigm of musicology is centered on literature review, field investigation and musical case analysis. However, constrained by the static nature of material carriers and the closed nature of disciplinary boundaries, the traditional research paradigm of musicology has limitations such as single data form and spatio-temporal constraints. The intervention of multimedia technology can promote the systematic transformation of the research paradigm of musicology from empirical induction to data empirical evidence, from a single perspective to multi-dimensional integration, and from static analysis to dynamic interaction. This paper conducts an in-depth study on the innovation and reconstruction of the research paradigm of musicology by multimedia technology, with the aim of providing theoretical references for exploring new directions of musicology research in the digital age.

KEYWORDS

Multimedia technology; Musicology; Paradigm

1 Introduction

In the era of digital economy, the rise of multimedia technology is not only an upgrade of research tools, but also triggers a deep reconstruction of disciplinary cognitive logic. The application of multimedia technology drives the transformation of the research paradigm of musicology from empirical induction to data empirical evidence, from a single perspective to multi-dimensional integration, and from static analysis to dynamic interactive systematization, promotes the discipline to shift from the static description of "fixed text" to the dynamic tracking and interdisciplinary interpretation of "living music". Therefore, in-depth research on the impact, practical challenges, and coping strategies of multimedia technology on the paradigm of musicology research is of great practical significance for promoting the innovation of musicology research paradigm.

2 The limitations of traditional musicological research paradigms

2.1 The research carrier has the characteristics of materiality and static nature

The traditional research paradigm relies on academic carriers of physical form, with paper sheet music as the core research object. Although symbol systems such as staff notation and gongche notation have constructed a visual framework for music form analysis, they inevitably simplify real-time music information such as sound dynamics and performance expressions. The traditional research paradigm takes physical archives as the foundation of historical research, including physical instruments collected in museums, vinyl records preserved in libraries, manuscript manuscripts, etc. The regional distribution of these carriers creates spatial limitations for "on-site research". For instance, the study of Dunhuang musical scores must rely on photocopied materials of Dunhuang library cave. Furthermore, the presentation of academic achievements is solidified into paper-based monographs, forming a "text-centered" dissemination model. Music and sound can only exist in the form of attached audio discs, and theoretical explanations are disconnected from the sound itself.

2.2 The boundaries of disciplines have the characteristics of clarity and closure

In the disciplinary differentiation system, traditional musicology has formed three relatively clear branches, as follows: Historiography of music focuses on the development laws of music in the temporal dimension, with chronicles as the basic narrative framework. Ethnomusicology focuses on the diversity of music culture in spatial dimensions, emphasizing the research perspective of "music in culture". Music theory is dedicated to the analysis of the structural laws of the music itself. Although there are intersections among the three major branches, they basically maintain the tripartite pattern of "history - ethnicity - technology". The clarity of this disciplinary boundary ensures the professionalism of the research, but it also leads to the closure of the research perspective. For instance, the analysis of music forms has long neglected the

shaping role of communication media on music, and field investigations in ethnomusicology have rarely touched upon the influence of recording techniques on the inheritance of traditional music.

3 The influence of multimedia technology on the research paradigm of musicology

3.1 The intelligent upgrade of research tools has enabled the transition from manual analysis to data visualization

Traditional musicology research relies on inefficient processing methods such as manual recording and manual comparison. With the rapid development of the digital economy, multimedia technology transforms music elements into quantifiable and interactive forms of information by developing specialized digital tools. In the field of audio processing, professional analysis software can accurately capture acoustic parameters such as pitch fluctuations and timbre spectra, transform subjective judgments that originally relied on auditory experience into visual data models. For example, in the study of polyphonic music, spectral analysis technology can analyze the fundamental frequency direction of different voices, discover subtle pitch features that traditional notation methods cannot present, and correct the problem of simplifying sound details in static text. In addition, virtual simulation technology can construct immersive research scenarios. With the help of 3D modeling and environmental simulation tools, researchers can restore historical music scenes, simulate the effects of different physical conditions on music propagation by adjusting virtual space parameters, and shift music research from result description to process deconstruction, transform abstract performance experiences into traceable digital analysis models.

3.2 The expansion and reconstruction of the research object have achieved the transformation from a single text to multi-dimensional data

The traditional musicology research relies on single carriers such as paper musical scores and physical archives, which have been transformed by multimedia technology into composite datasets containing audio, video, sensor data, and user interaction records. Taking sheet music as an example, digital storage formats not only retain basic information such as pitch and rhythm, but also embed dynamic performance markers and associate them with real-time audio files, forming a ternary association structure of "sheet music - sound - performance". In the study of music culture, multimedia technology has enabled the recording of "living music". The ceremony music scenes that are difficult to preserve in field investigations can now be collected in a three-dimensional way through panoramic image recording and multi-channel audio acquisition. This transformation has shifted musicological research from the static analysis of "fixed texts" to the dynamic tracking of "musical events".

3.3 The dissolution and reconstruction of disciplinary boundaries have achieved the transition from a closed system to an open ecology

Multimedia technology has broken down the barriers between musicology and natural sciences, engineering technology, and artistic practice, giving rise to new interdisciplinary research fields. In the study of music cognition, neuroimaging techniques have revealed the neural mechanisms of music perception. For instance, the activation patterns of the cerebral cortex triggered by specific musical segments provide a basis for explaining the physiological basis of musical emotional experiences. Such research requires musicologists and neuroscientists to jointly design experimental paradigms, marking the shift of musicology from pure humanistic interpretation to empirical research with the collaboration of "humanities and technology". At the level of artistic practice, real-time audio processing technology makes the music creation process an object of study. When composers generate musical elements in real time through algorithms and perform improvisationally, researchers can capture the dynamic cycle between creative decisions and sound feedback, and construct a cognitive model of improvisational thinking. This paradigm of "practice as research" blurs the boundary between theoretical research and artistic creation, forming a two-way interactive mechanism between "research-based creation" and "creative research".

4 The reconstruction path of musicology research paradigms assisted by multimedia technology

4.1 Epistemological reconstruction: establishing a cognitive balance mechanism based on dual dimensions

Researchers need to carry out the technical analysis of computable elements and the humanistic exploration of non-computable elements simultaneously during the research process, forming a two-tier research structure of "data

description - meaning interpretation". For instance, when the research team processes music data, they not only extract basic features such as pitch and rhythm through technical means, but also interpret its cultural connotations by combining qualitative materials like field investigations and historical documents, thus avoiding simplifying music into a purely technical analysis object. At the same time, any digital simulation or virtual reconstruction should be based on original materials such as field investigations, physical verification, and oral historical records. Researchers need to establish a cyclic verification mechanism of "technical construction - field calibration" to ensure that the understanding of music culture does not deviate from its generative soil and maintain direct perception and embodied cognition of the music itself.

4.2 Methodological innovation: establishing an integrated research method system

The academic community and researchers need to break the internal tension between the application of technology and the characteristics of disciplines through a two-way strategy. On the one hand, universities and research institutions need to add general technical courses in the musicology training program to help researchers understand the applicable boundaries, potential limitations and ethical norms of technology, enabling them to form a research thinking that attaches equal importance to "tool usage" and "result reflection", and avoid falling into blind reliance on technical output. The academic community needs to establish transparent norms for the application of technology, require researchers to clearly mark the data source, analysis logic and method assumptions in their achievements, provide a traceable verification path for peers, and prevent research deviations caused by technology applications at the institutional level. On the other hand, interdisciplinary collaboration entities need to build a normalized communication platform to jointly construct a cross domain conceptual system and research framework, balancing the demand for technical standardization and the expression of unique music culture. The research team should adhere to a problem-oriented collaboration model, with musicologists taking the lead in designing core issues and technical experts providing methodological support, so as to ensure that interdisciplinary cooperation always revolves around the humanistic essence of music rather than remaining at the isolated display of technical means.

4.3 Optimization of research system: balancing the relationship between public participation and professional research

On the one hand, the project team should scientifically design the public participation path, open low-threshold tasks such as basic data organization and data annotation to ordinary users through the online platform, and assign complex professional analysis to researchers with disciplinary backgrounds, and at the same time ensure quality through technical means such as hierarchical permission management and cross-validation of data. Academic communication institutions and technology developers need to jointly develop adaptation tools to transform technological achievements such as spectrograms and data models into interpretation systems that fit cultural contexts, guide the public to deeply understand the cultural significance of music from surface level data operations, and avoid technical interactions from becoming formal displays. On the other hand, academic evaluation institutions and journals should reconstruct diversified academic standards, and shift the core indicators to the humanistic value of research based on examining the rigor of technological implementation, and establish an evaluation system covering various forms such as textual papers, multimedia achievements, database construction. Universities and academic organizations need to advocate the research ethics of "content first", clarify the fundamental position of first-hand literature and field investigation in fields such as music history and ethnomusicology, require researchers to take original materials as the foundation, position technical means as auxiliary tools, and curb the tendency of overly pursuing technological form innovation while neglecting the depth of content, and ensure that academic achievements always serve the exploration of the humanistic essence of music.

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