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Postprint: Spatiotemporal Trajectory Analysis of Exiled Poets in the Complete Tang Poems from a Digital Humanities Perspective

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Abstract

[Purpose/Significance] From the perspective of digital humanities, this study conducts visualization and analysis of the spatiotemporal information of exiled poets in the Complete Tang Poems, which mutually corroborates with research in the fields of history and literature, helping relevant scholars discover new research clues and providing references for their studies.

[Method/Process] Using quantitative statistical methods and the QGIS geographic information system, data were collected, cleaned, and analyzed to visualize the spatiotemporal information of exiled poets in the Complete Tang Poems.

[Results/Conclusion] The visualization research on the spatiotemporal trajectories of exiled poets in the Complete Tang Poems helps explore methods for mining relevant elements of exiled poets, providing new clues for historical and literary research on exiled poets in the Complete Tang Poems.

Full Text

Preamble

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Digital Humanities Perspective on Analyzing the Spatiotemporal Trajectories of Exiled Poets in the *Complete Tang Poetry*

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Abstract: [Purpose/Significance] From a digital humanities perspective, this study visualizes and analyzes the spatiotemporal information of exiled poets in the *Complete Tang Poetry*, providing corroborating evidence for historical and literary research while helping scholars discover new research 线索 and offering valuable references. [Method/Process] Using quantitative statistical methods and QGIS geographic information systems, we collected, cleaned, analyzed, and visualized the spatiotemporal data of exiled poets from the *Complete Tang Poetry*. [Result/Conclusion] Visualizing the spatiotemporal trajectories of exiled poets in the *Complete Tang Poetry* facilitates exploration of mining methods for related poetic elements and offers new clues for historical and literary scholars studying this poetic corpus.

Keywords: digital humanities; exiled poets; spatiotemporal analysis

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Introduction

With the development of digital humanities, the humanities have continuously engaged in interdisciplinary integration supported by digital technologies. These technologies enable new perspectives for excavating and interpreting knowledge in humanistic fields, transforming traditional research paradigms and offering fresh approaches to scholarship. The *Complete Tang Poetry* encompasses poetry from the entire Tang Dynasty and Five Dynasties period, holding significant research value for understanding Tang history and culture. The characteristics of exiled poets as a group and the historical and cultural contexts hidden within their works represent a major research focus in both historical and literary studies. This study examines poets in the *Complete Tang Poetry* who experienced exile, employing statistical measurement and geographic information visualization methods to analyze the spatiotemporal distribution of their banishment. This research not only helps identify patterns in the spatiotemporal distribution of exiled poets but also enables scholars in history and literature to more intuitively discover and study the timing and locations of these exiles, improving retrieval efficiency and providing new research perspectives. Furthermore, by analyzing the behavioral trajectories of specific social groups within particular historical contexts, this study's methodological approach can inspire research on other social groups and identify new analytical angles.

1. Research Status

As digital humanities has developed domestically, researchers in humanistic fields have continuously explored new frontiers, with digital technologies opening broader and more vivid academic vistas. This section reviews relevant literature on poetry research in digital humanities and geographic information visualization studies.

In digital humanities poetry research, Peking University's Chinese Department

has developed the *Complete Tang Poetry Analysis System* and *Complete Song Poetry Analysis System*, digitizing 57,000 Tang poems and 254,000 Song poems while establishing data models and datasets for full-text annotation and analysis [1]. The Digital Humanities Research Center at Wuhan University has led the construction of a Chinese Poetry Knowledge Map, analyzing and presenting the intrinsic relationships between poetry and poets in a panoramic manner [2]. Zhou Lina et al. proposed an intelligent knowledge service platform called Know-Poetry based on Tang poetry knowledge graphs, offering intelligent services such as knowledge exploration, spatiotemporal trajectories, and semantic queries [3], which facilitates deeper knowledge mining of Tang poetry in the future. Li Wenjuan studied spatial information in classical poetry [4], combining GIS disciplinary expertise to provide methods and approaches for researching spatial information in classical poetry. J.W. Chen et al. conducted text mining research on Tang poetry and the *Shishuo Xinyu* [5]. D.R. Riande et al. applied digital humanities to medieval poetry processing, using hybrid databases such as the POS-DATA project to digitize medieval poetry [6].

In geographic information visualization, Zhang Jing conducted visual research on boundary changes across dynasties, presenting statistical data for comparative analysis of ancient dynastic borders [7]. Deng Jun and Sun Shaodan et al. utilized GIS to visualize the spatiotemporal distribution framework of Ming Dynasty jinshi degree holders, constructing a spatiotemporal network relationship for this group and providing new perspectives for humanities scholars to examine Ming examination records in granular detail [8]. P. Jason performed GIS network analysis on Buddhist poets of the Song Dynasty [9]. Jiang Ligang employed map visualization to display exiled officials in the early and late Tang periods [10]. Song Xueyan, Cui Haonan et al. conducted location analysis and regional hotspot mapping of geographic information in diaries, using the Wang Shijie diary resources as a foundation [11].

In summary, poetry research in digital humanities has evolved from simple text digitization to constructing poetry knowledge graphs and integrating other disciplinary fields, while geographic information visualization research has combined with literary studies to provide diverse presentation forms and valuable references. Building on these approaches, this study visualizes the exile location information of poets in the *Complete Tang Poetry* to explore relevant patterns in exile destinations.

2. Research Design and Methods

2.1 Research Object and Data Sources

Compiled during the Kangxi reign, the *Complete Tang Poetry* comprehensively collects poetry from the Tang and Five Dynasties periods, offering convenience for researchers. The *Siku Quanshu Zongmu Tiyao* praises it: “With this compilation, the origins, development, and evolution of Tang poetry become clear; no previous anthology has achieved such breadth and precision” [12], demonstrat-

ing its high documentary and academic value. In Tang literary history, most major poetic school figures experienced exile, with unprecedented numbers of exiled individuals and extensive geographic distribution [13]. Therefore, this study selects poets from the *Complete Tang Poetry* with exile experiences as its research object.

Data on exiled poets were sourced from the “Complete Tang Poetry Database” [14] and the Zhonghua Book Company edition of *Complete Tang Poetry* (15-volume set) [15]. Information on exile timing and locations was obtained through searches in the China Biographical Database Project (CBDB) and relevant historical and literary literature.

2.2 Data Processing

We extracted author, exile location, and coordinate entities from each exiled poem in the *Complete Tang Poetry*, establishing mappings between these entities and processing them into formats recognizable by the QGIS platform. This information classification and entity extraction forms the foundation of the entire research process. Data processing consists of four stages: data acquisition, data cleaning, visualization, and analysis.

Data Acquisition: We retrieved exile poems from the “Complete Tang Poetry Database” and the *Complete Tang Poetry* collection, using search terms including “贬谪” (banishment), “谪” (exile), “贬” (demotion), and “左迁” (relegation). We compiled titles, authors, and full texts into editable digital format, initially identifying 929 exile poems by 162 poets, with manual supplementation from the Zhonghua Book Company edition.

Data Cleaning: First, we cleaned poet data by removing anonymous authors and those without exile experiences. Since this study focuses on poets demoted or reassigned due to external causes, we excluded those who voluntarily requested external appointment or lacked exile experiences, removing 68 poets. Additionally, as this research requires poet coordinates, we searched CBDB for the remaining poets, finding that 77 poets had locatable exile coordinates, leaving 75 exiled poets and 698 poems as our final research objects.

Next, we cleaned exile location data. We verified exile locations and timing through historical and literary literature, cross-referencing with CBDB for coordinates. Some locations lacked specific place names; for example, Cui Shi was exiled to “Lingnan” and Wei Chengqing to “Lingbiao,” both referring to areas south of the Five Ridges. During Tang administrative adjustments, Lingnan served as a separate administrative region encompassing present-day Guangdong, Guangxi, Hainan, and northern Vietnam [16]. Therefore, we designated Lingnan, Lingbiao, and Lingwai as Lingnan Circuit, using Guangzhou’s Lingnan Five Prefectures coordinates (113.2643, 23.1335) from 618-907 CE as their location.

Visualization: Using QGIS, we visualized the cleaned geographic data of exiled

poets from the *Complete Tang Poetry*, presenting data more intuitively through maps for subsequent analysis.

Analysis: This stage combines the visualization maps of exiled poets to identify spatiotemporal trajectory patterns, achieving knowledge discovery from data.

3. Spatiotemporal Trajectory Analysis of Exiled Poets in the *Complete Tang Poetry*

Visualizing and studying the temporal and spatial information of exiled poets facilitates understanding of these officials' movements and reveals patterned phenomena, providing references for historical and literary scholars. The *Complete Tang Poetry* spans from the late Sui/early Tang to the late Tang/Five Dynasties. Following traditional periodization [17], we divide the Tang into Early Tang (618-712 CE), High Tang (712-766 CE), Mid Tang (766-827 CE), Late Tang (827-907 CE), and Five Dynasties (907-960 CE). In the Tang Dynasty, exile was both a common political and literary phenomenon, with many scholar-officials experiencing banishment, some repeatedly. Exiled scholars often expressed their emotions through literary creation [18]. This section examines 75 exiled poets from the *Complete Tang Poetry*, exploring their spatiotemporal distribution patterns from temporal and spatial perspectives.

3.1 Temporal Distribution Patterns of Exiled Poets

Using exile timing as our benchmark (counting multiple exiles separately), we compiled distribution frequencies across periods (see Table 1). Five Dynasties poet Xu Xuan, exiled during the Song Dynasty, was excluded from Tang periodization. No poets were exiled during the Five Dynasties period, so analysis focuses on the four Tang periods.

Table 1 shows Mid Tang had the most exiled poets (42 instances) across 7 reigns and 61 years, despite not being the longest period. This reflects how “the proportion of scholar-officials among exiled ministers increased as the jinshi examination system strengthened in the civil bureaucracy” [19]. Historical literary scholars have documented approximately 344 exiled scholar-official instances in Mid Tang [20], the highest among the four periods, corroborating our *Complete Tang Poetry* statistics' value for studying Tang exiled scholars.

Early Tang and High Tang show similar frequencies (30 and 33 instances respectively), while Late Tang shows the fewest (17 instances). Examining Table 2 by emperor, the top five periods for *Complete Tang Poetry* exiled poets are: Emperor Xianzong (23 instances), Emperor Xuanzong (19), Emperor Suzong (12), Emperor Zhongzong (11), and Emperor Dezong (10). Shang Yongliang's statistics show: Emperor Xuanzong (171), Emperor Xianzong (119), Emperor Wenzong (116), Emperor Dezong (99), and Empress Wu (80). Xuanzong, Xianzong, and Dezong appear in both top-five lists.

Our study ranks Xianzong first with 23 exiles in 15 years, while Xuanzong's

44-year reign saw 19 exiles. Shang’s data shows Xuanzong averaged 3.89 exiles annually versus Xianzong’s 7.93, confirming our results’ accuracy. Though Xuanzong’s total exceeds Xianzong’s, his annual average was not highest, aligning with historical findings that “despite Xuanzong’s flourishing literary scene, the prosperous, stable, and economically thriving era provided limited opportunities for poets to enter officialdom” [23], and “the Mid Tang period of Xianzong represented the peak of exiled officials” [20] with “large-scale, intense factional struggles like the Yongzhen Reform” [25].

Our statistics for Emperors Dezong and Wu largely corroborate Shang’s findings. Dezong’s reign includes 10 exiled poets in *Complete Tang Poetry*, ranking fifth, reflecting how “after Dezong, most chancellors were appointed from scholar-officials who had served as Hanlin Academicians” [26] and his emphasis on literary talent made the jinshi examination crucial for political selection [27]. Empress Wu’s period ranks sixth with 7 instances, consistent with her era’s Li-Wu factional struggles producing the first large-scale exiles in Early Tang [13].

Significant discrepancies appear in Emperor Wenzong’s period: our *Complete Tang Poetry* data shows only 2 exiled poets (Wang Jian and Li Deyu), while Shang documents 116. Many of Shang’s cases involve Li Zongmin, Li Xun, and Zheng Zhu’s political machinations (19 instances) or corruption charges (10 instances), but *Complete Tang Poetry* contains only one poem by Li Zongmin and none by Li Xun or Zheng Zhu, explaining the divergence.

Thus, our *Complete Tang Poetry* statistics show Mid Tang had the most exiled poets, with Emperors Xianzong and Xuanzong’s reigns ranking highest by imperial period. These results help historical and literary scholars quickly organize historical data for further research, though discrepancies with existing historiography warrant further investigation.

3.2 Spatial Distribution Patterns of Exiled Poets

As scholars have deepened research on exiled officials, representatives like Wuhan University’s Shang Yongliang have applied statistical methods to study Tang exile spatiotemporal distribution, while Jiang Ligang [10] used map visualization for early and late Tang exiled officials. This study combines these approaches using QGIS to generate heat maps and route maps, exploring exile location distribution patterns through statistical measurement and geographic visualization.

3.2.1 Patterns of Exile Location Concentration Tang Dynasty texts rarely conceptualized “South” and “North” as geographic categories [30]. Based on Emperor Xuanzong’s 15 circuits from 733 CE and existing regional research [31], we define the Tang’s north-south boundary along the Qinling-Huaihe line, classifying Guannei, Henan, Hedong, Hebei, Longyou, Jingji, and Duji circuits as northern, and Jiangnan East/West, Qianzhong, Lingnan, Jiannan, Shannan

East/West, and Huainan circuits as southern.

Figure 1 [Figure 1: see original paper] reveals southern exile locations outnumber northern ones, with clear thermal aggregation effects in certain southern regions. Northern hotspots concentrate in Jingji and Duji circuits, with sparse distribution elsewhere. Southern hotspots are more numerous. Figure 2 [Figure 2: see original paper] focuses on southern regions, showing pronounced thermal aggregation in Shannan East Circuit and the border region of Shannan East, Huainan, and Jiangnan circuits, as well as Lingnan Circuit—these are the exile hotspots for *Complete Tang Poetry* poets.

In Shannan West Circuit, hotspots at Tongzhou and Kaizhou align with Kang Sufeng’s statistics showing Tongzhou had the most exiled scholars (32 instances across 14 Shannan West prefectures) and Kaizhou had 4 instances [21]. In Shannan East Circuit, the hotspot in southern Jingzhou matches its ranking as top exile destination in Shannan East with 5 instances.

Jiangnan West Circuit shows the highest concentration of exile locations, forming core regions centered on Jiangzhou, Yuezhou, Yuanzhou, Lianzhou, and Qianzhou. This corroborates findings that Jiangnan West had the broadest distribution (100% of prefectures hosted exiles) [10] and the highest concentration of exiled scholars (86 instances total, with Jiangzhou at 8 instances and Qianzhou at 7) [21].

Lingnan Circuit forms another hotspot, centered on Chaozhou, Hengzhou, Qinzhou, and Fengzhou, primarily distributed in southern and eastern Lingnan, with higher density in the south than north. Historical literary research confirms Chaozhou had the most exiled civil officials (9 instances), Hengzhou had 5, and Qinzhou had 3, with exiled officials concentrated in the east and north while exiled convicts were more common in the southwest and south [16]. Another study found Chaozhou, Xunzhou, Duanzhou, Yazhou, Qinzhou, and Guizhou accounted for 36 instances—half of the eastern region’s total [21], aligning with our findings.

We separately analyzed poets with multiple exile experiences (Table 3) and mapped their routes (Figure 3 [Figure 3: see original paper]). Of 75 exiled poets, 29 (over one-third) experienced multiple exiles: 9 had three exiles, 3 had four, and 2 had five. Yuan Zhen and Li Qiao each experienced five exiles. Yuan Zhen’s exile path moved from Jingzhou to Jiangling, Tongzhou, Tongzhou (again), and finally Wuchang; Li Qiao’s moved from Runzhou to Tongzhou, Huaizhou, Chuzhou, and Shaozhou. Both poets’ multiple exile locations span the Yangtze River basin and northern regions, with wide distribution and long distances between successive locations, rarely remaining within a single circuit. This demonstrates that repeatedly exiled poets in *Complete Tang Poetry* experienced broad geographic spans and large distances.

Figure 3 [Figure 3: see original paper] shows exile routes for multiply-exiled poets, with arrows indicating subsequent exile locations. Arrows point to more remote locations than their origins, showing increasing distance from the capital.

Most arrows concentrate in southern regions, particularly Lingnan and Jiangnan West circuits, indicating repeated exiles generally moved from north to south. Line lengths combined with Tang regional distribution reveal that the longest route stretched from Longyou Circuit to Jiangnan East Circuit, nearly spanning the entire Tang territory diagonally. Most routes crossed two circuits, rarely remaining within a single administrative region.

In summary, exile locations for *Complete Tang Poetry* poets show southern predominance with clear spatial clustering effects. Shannan East Circuit, the border region of Shannan East/Huainan/Jiangnan circuits, and Lingnan Circuit are hotspots. Multiply-exiled poets show broad distribution, large spans, and increasingly southern, remote destinations with greater distances from the capital.

3.2.2 Distribution Patterns Across Different Periods Using exile timing, locations, and the four Tang periods, we created distribution maps for each period (Figures 4 [Figure 4: see original paper] through 7 [Figure 7: see original paper]). Early and High Tang periods show broad distribution, extending north to the Western Regions, Yizhou, and Yongzhou, and south to Fengzhou and Qinzhou in Lingnan. Early Tang distribution is more dispersed than High Tang, with many locations in frontier regions far from the capital. Representative Early Tang exiles include Song Zhiwen (exiled to Shuangzhou, modern Luoding, Guangdong) and Du Shenyan (exiled to Fengzhou, modern southern Guangxi/northern central Vietnam), both in Lingnan's southernmost regions. High Tang distribution is more balanced, with fewer locations far from the capital, corroborating research that "High Tang exiles (represented by Zhang Yue, Zhang Jiuling, and Wang Changling) differed significantly from earlier exiles in distribution, with fewer cases due to dynastic transition and locations closer to Chang'an" [32].

Mid and Late Tang exiles (Figures 6 [Figure 6: see original paper] and 7 [Figure 7: see original paper]) are almost entirely distributed south of the Yellow River, with virtually none north of it. This aligns with historical events: the Tang's public acknowledgment of Tibetan occupation of Hexi-Longshong regions [33] and Tibetan forces capturing Chang'an in 763 CE [34]. After Mid Tang, Longyou Circuit fell to Tibet, substantially reducing Tang territory and concentrating exile regions more compactly than in Early and High Tang. As Mid Tang had the highest exile frequency but reduced territory, its exiled poets show high-density, high-concentration distribution. Late Tang distribution is most dispersed. Zou Yunyue's research on Late Tang exile institutions reveals their gradual decline [22], corroborating our finding of the fewest exile instances. After Zhang Yichao nominally recovered Hexi regions in 862 CE [33], Late Tang territory expanded somewhat compared to Mid Tang, making exile locations more dispersed.

From Early to Late Tang, exile locations in *Complete Tang Poetry* exhibit distinct characteristics reflecting territorial changes and exile frequency fluctua-

tions, providing valuable references for historical and literary researchers.

4. Conclusions and Implications

This study examines the spatiotemporal trajectories of exiled poets in the *Complete Tang Poetry* from a digital humanities perspective, exploring them through temporal and spatial dimensions. Temporally, Mid Tang shows the highest exile frequency, while Late Tang shows the lowest. Emperor Xianzong's reign ranks first among the Tang's 21 reigns in exile instances. Spatially, the geographic distribution shows significant north-south disparity with clear clustering effects. Distribution patterns vary by period: Mid Tang shows the most concentrated distribution due to smaller territory and highest exile frequency, while Late Tang shows the most dispersed distribution due to fewer exiles and territorial recovery.

By exploring a social group's spatiotemporal trajectories through temporal periodization, overall spatial distribution, spatial route mapping, and cross-period spatial comparisons, this study may provide methodological references for scholars exploring new problem domains, offer research frameworks for discovering knowledge about specific social groups in other historical documents, and contribute to broader interdisciplinary digital humanities research. As digital technologies advance, scholars can employ new tools for sustained, in-depth exploration of domain-specific questions, achieving better integration of technology and humanities in research.

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Author Contributions

Song Xueyan: Conceptualization, research design, manuscript revision;
Huo Xiaonan: Data analysis and processing, manuscript writing and revision;
Liu Yinpeng: Data analysis and processing;
Deng Jun: Manuscript revision.

Analysis of the Time-Space Trajectory of Relegated Poets in Complete Collection of Tang Poetry from the Perspective of Digital Humanities

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Abstract: [Purpose/Significance] Based on the perspective of digital humanities, through the visual display and analysis of the time-space information of relegated poets in Complete Collection of Tang Poetry, it can become the research evidence in the field of history and literature, help related scholars find new research clues and provide references for them. [Method/Process] Using the method of measurement and statistics and the QGIS geographic information system, through the collection, cleaning, visualization and analysis of the data, this paper visualized and analyzed the time-space information of the relegated poets in Complete Collection of Tang Poetry. [Result/Conclusion] The visual research on the time-space trajectory of relegated poets in Complete Collection of Tang Poetry is helpful to explore the mining methods of related elements of relegated poets, and provides new clues for the study of Complete Collection of Tang Poetry in the field of historical literature.

Keywords: digital humanities; relegated poets; time-space analysis

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