Spatial-Temporal Footprints Dataset of Wang Yangming's Activity in Zhejiang Province

Zhu, J. Y. Hu, X. R. Ma, R. F. Wang, J. Y. Wang, Y. T.

Department of Geography and Spatial Information Techniques, Ningbo University, Ningbo 315211, China.

Abstract: Wang Yangming was a distinguished thinker, philosopher, educator, and politician of the Ming Dynasty. His philosophy has profoundly influenced Chinese cultural history. Integrating both geographical and historical perspectives, this study offers an in-depth examination of Wang Yangming's life, further contextualizing his philosophical contributions. Employing key data fields such as person, time, location, and events, the paper constructs a spatiotemporal dataset that maps Wang Yangming's activities in Zhejiang, culminating in a dynamic three-dimensional visualization of his movements. The dataset comprises: (1) textual data detailing Wang Yangming's activities in Zhejiang (.xlsx); (2) geographic information data of his footprints (.shp); and (3) three-dimensional polyline representations of these footprints (.shp). The dataset consists of 16 files, totaling 258 KB, and is compressed into a single file of 114 KB.

Keywords: historical geography; GIS; spatial-temporal trajectory; Wang Yangming

DOI: https://doi.org/10.3974/geodp.2024.01.06

CSTR: https://cstr.escience.org.cn/CSTR:20146.14.2024.01.06

Dataset Availability Statement:

The dataset supporting this paper was published and is accessible through the *Digital Journal of Global Change Data Repository* at: https://doi.org/10.3974/geodb.2024.04.08.V1 or https://cstr.escience.org.cn/CSTR:20146.11.2024.04.08.V1.

1 Introduction

Digital humanities, emerging from humanities computing, have flourished with the rapid advancements in modern information technologies such as Geographic Information Systems (GIS), data mining, and visualization. These technologies have revitalized traditional humanities disciplines by expanding research paradigms and methodologies. A notable innovation is the integration of geographic information technology with historical studies. Modern historical geography marries "space" and "time" by integrating tools and methods from modern information technology, quantitative analysis, comparative research, and scientific statistics into humanities research. It leverages GIS technology for collecting spatial data,

Received: 05-12-2023; **Accepted:** 10-03-2024; **Published:** 25-03-2024

Foundation: Department of Education, Department of Science and Technology, Youth League Committee, Department of Finance in Zhejiang Province (2023R405073)

***Corresponding Author:** Ma, R. F. AAX-8655-2021, Department of Geography and Spatial Information Techniques, Ningbo University, marenfeng@nbu.edu.cn

Data Citation: [1] Zhu, J. Y., Hu, X. R., Ma, R. F., *et al*. Spatial-temporal footprints dataset of Wang Yangming's Activity in Zhejiang Province of China [J]. *Journal of Global Change Data & Discovery*, 2024, 8(1): 51–57. https://doi.org/10.3974/geodp.2024.01.06. https://cstr.escience.org.cn/CSTR:20146.14.2024.01.06.

[2] Zhu, J. Y., Hu, X. R., Ma, R. F., *et al*. Spatial-temporal dataset of footprints of Wang Yangming's Activity in Zhejiang Province of China [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2024. https://doi.org/10.3974/geodb.2024.04.08.V1. https://cstr.escience.org.cn/CSTR:20146.11.2024.04.08.V1.

integrating temporal data, and superimposing multilayer maps[1]. This method seeks to reconstruct geographical landscapes from various historical periods, examine their relationships with history, society, and nature, and discern the patterns of their development and evolution.

Wang Yangming (1472–1529), originally named Wang Shouren and hailing from Yuyao, Zhejiang, was a distinguished thinker, philosopher, educator, and politician of the Ming Dynasty, and one of the foremost representatives of the School of Mind. His philosophical tenets, notably "The supreme principle is buried in one's heart-mind" and "The unity of inner knowledge and action" have profoundly influenced Chinese cultural history. Contemporary research on Wang Yangming has predominantly focused on the content of his ideas and written works, with less attention given to the geographic and temporal aspects of his activities, largely due to the absence of a comprehensive and authoritative geographical and temporal dataset. This dataset, embracing both geographical and historical perspectives, systematically organizes relevant literature and historical documents. Using GIS software, we analyze the spatial and temporal dimensions of his activities to construct an attribute table detailing Wang Yangming's movements in Zhejiang. The dataset visualizes these movements, providing a robust foundation for cultural studies and interpretations related to Wang Yangming, aiding in the preservation of the cultural heritage of historical figures in Zhejiang, and advancing digital humanities research.

2 Metadata of the Dataset

The metadata of the spatial-temporal footprints dataset of the Wang Yangming's activities in the Zhejiang Province of China[2] is summarized in Table 1, including the dataset full name, short title, authors' information, dataset year, data format, data size, data files, data publisher, and data sharing policy, etc.

3 Technology Roadmap and Data Sources

3.1 Technology Route

To accurately depict Wang Yangming's footprints in Zhejiang both geographically and historically, this study constructs a technical roadmap according to based on empiricism and humanism, as shown in Figure 1.

This study is structured into four distinct layers—data sourcing, data processing, dataset construction, and visualization. Each layer corresponds respectively to the portrayal of empiricist space and the projection of humanist emotions. Data sources include literature and geographical data on Wang Yangming, such as chronologies, the China Biographical Database Project (CBDB)[1], and the China Historical Geographic Information System (CHGIS)[2], among others. In the data processing layer, geographic information is first extracted and repeatedly compared to refine the data specific to Wang Yangming in Zhejiang, followed by a thorough verification process. The dataset construction layer develops keywords from the concept of "ontology," and establishes vital fields—location, time, position, and events—that depict Wang Yangming's activities in Zhejiang. These elements are integrated into a spatial-temporal dataset. The visualization layer first sets the z-value of the dataset, transforming 2D geographic data into a 3D spatial-temporal model. This model creates a spatial-temporal prism that vividly illustrates Wang Yangming's activities in Zhejiang, enhancing the intuitive understanding of spatial-temporal dynamics.

[1] Harvard University, Academia Sinica, and Peking University. The China biographical database [DB/OL]. (2021-8) [2024-4-12]. https://projects.iq.harvard.edu/cbdb.

[2] The Center for Historical Geographical Studies at Fudan University, Fairbank Center for Chinese Studies of Harvard University. CHGIS, Version 6 [DB/OL]. (2016-12) [2024-4-12]. https://dataverse. harvard.edu/dataverse/chgis_v6.

Table 1 Metadata summary of the spatial-temporal dataset of the footprints of Wang Yangming's activities in Zhejiang Province of China

Items	Description		
Dataset full name	Spatial-temporal dataset of the footprints of Wang Yangming's Activities in Zhejiang Province of China		
Dataset short name	FootprintWangYangmingZhejiang		
Authors	Zhu, J. Y. KDN-3665-2024, Department of Geography and Spatial Information Techniques, Ningbo University, 216003428@nbu.edu.cn Hu, X. R. KDN-4143-2024, Department of Geography and Spatial Information Techniques, Ningbo University, Ningbo, China, a1940064760@163.com Ma, R. F. AAX-8655-2021, Department of Geography and Spatial Information Techniques, Ningbo University, Ningbo, China, marenfeng@nbu.edu.cn Wang, J. Y. HPF-5568-2023, Department of Geography and Spatial Information Techniques, Ningbo University, 13607434177@163.com Wang, Y. T. KDN-4033-2024, Department of Geography and Spatial Information Techniques, Ningbo University, Ningbo, China, m19190735133@163.com		
Geographical region	Zhejiang Province	Year	1472 A.D. to 1529 A.D.
Data format	.shp, .xlsx	Data size	258 KB (114 KB after compression)
Data files	(1) text data of Wang Yangming's activities in Zhejiang (.xlsx); (2) footprint geographic information data (.shp); (3) 3D line data of Wang Yangming's footprints (.shp)		
Foundation	Department of Education, Department of Science and Technology, Youth League Committee, Department of Finance in Zhejiang Province (2023R405073)		
Data publisher	Global Change Research Data Publishing & Repository, http://www.geodoi.ac.cn		
Address	No. 11A, Datun Road, Chaoyang District, Beijing 100101, China		
Data sharing policy	(1) *Data* are openly available and can be freely downloaded via the Internet; (2) End users are encouraged to use *Data* subject to citation; (3) Users, who are by definition also value-added service providers, are welcome to redistribute *Data* subject to written permission from the GCdataPR Editorial Office and the issuance of a *Data* redistribution license; and (4) If *Data* are used to compiling new datasets, the 'ten percent principal' should be followed such that *Data* records utilized should not surpass 10% of the new dataset contents, while sources should be noted in suitable places in the new dataset[3]		
Communication and searchable system	DOI, CSTR, Crossref, DCI, CSCD, CNKI, SciEngine, WDS/ISC, GEOSS		

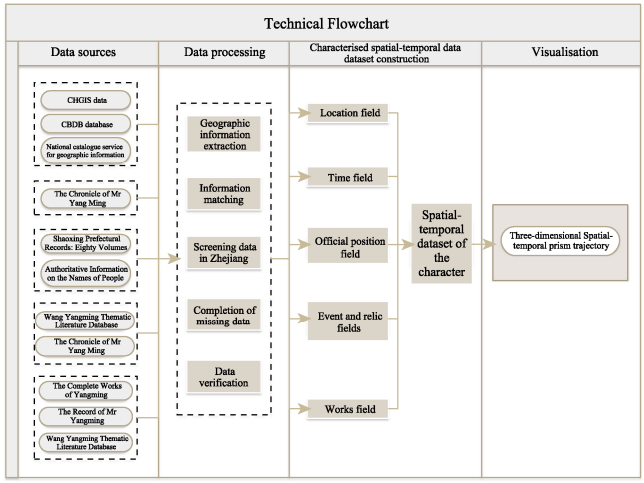

Figure 1 Flowchart of the dataset development

3.2 Data Sources

The basic data for this study are sourced from the CHGIS and the National Catalogue Service for Geographic Information[3]. Specifically, the location data includes surface and

[3] National Catalogue Service for Geographic Information. www.webmap.cn. (Note: the system is a national geographic information public service platform under the supervision of the Ministry of Natural Resources, providing functions such as surveying and mapping results query and basic geographic data download).

point data of Ming Dynasty precincts from CHGIS V6, and base maps of Zhejiang Province's administrative districts in 2023 from the National Catalogue Service for Geographic Information[5]. Time data are derived from The Annals of Mr. Yangming[4]; the position field is from the CBDB database and Shaoxing Prefecture Record: Eighty Volumes[5,6]; Additional writings include The Complete Works of Yangming[7], The Records of Mr. Yangming[8], The Collected Poems of Wang Yangming[9], and Wang Yangming thematic literature Database[10]; The dataset also includes The Genealogy of Mr. Yangming, documenting Wang Yangming's movements and impacts in Zhejiang from his birth in 1472 until his burial in 1529. This resource illustrates the reciprocal influences between Wang Yangming, the people, and the places of Zhejiang.

4 Conceptual Attribute

This project constructs Wang Yangming's spatiotemporal footprint by focusing on essential concepts from various disciplinary perspectives. To maintain disciplinary standards and improve the accuracy and reliability of our findings, this research utilizes the object-oriented Conceptual Reference Model (CIDOC-CRM), developed by the International Council of Museums and its International Committee for Documentation (CIDOC). CIDOC-CRM facilitates the visualization of Wang Yangming's footprints by providing crucial semantics, definitions, and interpretations that are essential for structuring database schemas and files in cultural heritage, featuring 81 classes and 160 properties. Here, "classes" represent the foundational ontological concepts, while "properties" delineate the semantic relationships between these classes[11]. To effectively model the historical figure and his movements, the selected ontological features encompass four classes: E21 Person, E52 Timespan, E53 Place, and E5 Event, tailored to the research requirements[12,13].

(1) Characters category

The character category includes both historical and contemporary figures, emphasizing their spatial and social contexts. For Wang Yangming, this category details his personal attributes such as name, aliases, era of influence, birthplace, and lifespan, which are crucial for understanding his spatial behaviors and interactions within his environment.

(2) Time category

The time category encompasses temporal scales from abstract eras to specific events, reflecting how these periods influence spatial decisions and movements. For Wang Yangming, this includes his birth year, 1472 A.D., and the broader context of the Ming Dynasty, which are integral for mapping the temporal dimensions of his geographical interactions.

(3) Location category

The location category captures specific spatial data—geographical coordinates and place names—which are fundamental in behavioral geography for analyzing Wang Yangming's movement patterns and their geographical contexts.

(4) Event category

The Event Category encompasses key events throughout the life of Wang Yangming, involving changes across cultural, social, or material systems, regardless of their scale. These transformations are triggered by coherent phenomena in material, cultural, technological, or legal contexts and may inspire the creation of related works. Moreover, these events interact with other categories such as Time, Location, and Publications, where changes within the Event Category can significantly impact these areas.

(5) Publications category

The publications category in this study encompasses Wang Yangming's creative writings and compilations.

5 Construction of Wang Yangming Spatial-Temporal Footprint Database

Following the establishment of the conceptual attribute system, we employed an empirical spatial portrayal method to catalog Wang Yangming's activities in Zhejiang, from his birth in 1472 to his burial in 1529. This method utilizes sources such as the Annals of Mr. Yangming and biographical profiles from Wang Yangming's thematic literature library, among others. The corresponding data were systematically entered into the attribute table by year and location. Subsequently, we utilized data from the CHGIS to filter entries by year and region, processing this information with the CHGIS V6 Time Series dataset. We established a geospatial database to capture Wang Yangming's movements in Zhejiang by associating textual geographic locations from the attribute table with their corresponding coordinates in the CHGIS map data, as detailed in Table 1.

Table 2 Attributes of Wang Yangming's footprint in Zhejiang Province (part)

FID	Ancient name	Present name	A.D. year	Year (Reign title)	Year (Heavenly stems and earthly branches)	Age	Office position
12	Shanyin County	Shaoxing City	1502	The 15th year of the Hongzhi reign under Emperor Xiaozong of the Ming Dynasty	Renxu Year	31	Director of the Yunnan Department of the Ministry of Criminal Justice
13	Qiantang County	Hang-zhou City	1503	The 16th year of the Hongzhi reign under Emperor Xiaozong of the Ming Dynasty	Guihai Year	32	Nothing
14	Shanyin County	Shaoxing City	1507	The second year of the Zhengde reign under Emperor Wuzong of the Ming Dynasty	Dingmao Year	36	Guizhou Longchang Posthouse Official
15	Qiantang County	Hang-zhou City	1507	The second year of the Zhengde reign under Emperor Wuzong of the Ming Dynasty	Dingmao Year	36	Guizhou Longchang Posthouse Official
16	Dinghai County	Zhou-shan City	1507	The second year of the Zhengde reign under Emperor Wuzong of the Ming Dynasty	Dingmao Year	36	Guizhou Longchang Posthouse Official
17	Shanyin County	Shaoxing City	1512	The seventh year of the Zhengde reign under Emperor Wuzong of the Ming dynasty	Renshen Year	41	Director of the Examination and Merit Department of the Ministry of Personnel in Nanjing, Vice Minister of the Taipu Temple in Nanjing
18	Shanyin County	Shaoxing City	1513	The eighth year of the Zhengde reign under Emperor Wuzong of the Ming Dynasty	Guiyou Year	42	Vice Minister of the Taipu Temple in Nanjing
19	Yuyao County	Yuyao City	1513	The eighth year of the Zhengde reign under Emperor Wuzong of the Ming Dynasty	Guiyou Year	42	Vice Minister of the Taipu Temple in Nanjing
20	Fenghua County	Fenghua District, Ningbo	1513	The eighth year of the Zhengde reign under Emperor Wuzong of the Ming Dynasty	Guiyou Year	42	Vice Minister of the Taipu Temple in Nanjing
21	Qin County	Ningbo City	1513	The eighth year of the Zhengde reign under Emperor Wuzong of the Ming dynasty	Guiyou Year	42	Vice Minister of the Taipu Temple in Nanjing
22	Shanyin County	Shaoxing City	1516	The 11th year of the Zhengde reign under Emperor Wuzong of the Ming Dynasty	Bingzi Year	45	Chancellor of the Grand Court of Nanjing

Using the established spatiotemporal geographic database, we have detailed records of Wang Yangming's activities in Zhejiang, encompassing years, locations, and events. However, traditional tables and graphs are insufficient to visualize the dynamic trajectory of his movements in Zhejiang; therefore, we are utilizing spatial-temporal prisms for this purpose.

Based on the existing coordinates of Wang Yangming's footprint points, we assigned z-values to each point, corresponding to the A.D. years listed in Table 1. Considering the slight difference between years, we defined each year with a differential value of three

hundred to enhance temporal resolution. Additionally, to enhance the visual clarity, the z-values of the initial two points have been set to 100 and 1200, respectively. The XYZ coordinate data of Wang Yangming's footprint points were then transformed into a structured format and imported into Arc Scene for visualization. At the same time, we also imported the city map of Zhejiang Province and obtained Figure 2. In Figure 2, each vertical projection on the Zhejiang Province map pinpoints Wang Yangming's locations, with their relative heights indicating the timing of his activities there. A higher height means a later time of passing through the site. By mapping each point's longitude, latitude, and time into a three-dimensional coordinate system, we produced Figure 3.

Analysis of Figures 2 and 3 demonstrates that Wang Yangming's travels in Zhejiang were primarily oriented along a southwest-northeast axis, underscoring several critical junctures. In 1492, Wang Yangming journeyed to Hangzhou to participate in the provincial examinations and successfully entered officialdom upon passing. In 1503, he returned to Hangzhou to recuperate from illness, finding significant solace in Qiantang amidst his setbacks. In 1507, after offending Liu Jin, he was demoted and exiled to Longchang, Guizhou. In 1521, Wang Yangming, weary of his duties in the bureaucracy, submitted a request to resign from his official position, but it was not approved. Subsequently, due to his father's serious illness, he returned to Yuyao. In 1527, Wang Yangming departed Zhejiang and ultimately passed away in Jiangxi. Analyzing the spatiotemporal trajectory of his movements in Zhejiang offers profound insights into the decisive moments and locales that were instrumental in shaping his philosophical evolution and the establishment of the School of Mind. These key spatiotemporal contexts provide essential clues for a detailed exploration of the development of Yangming philosophy.

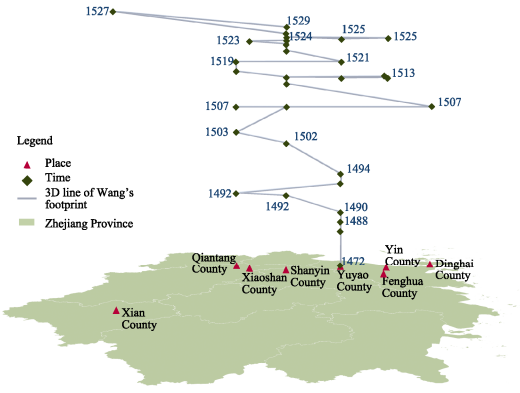

Figure 2 Spatial-temporal prism of Wang Yangming's footprint

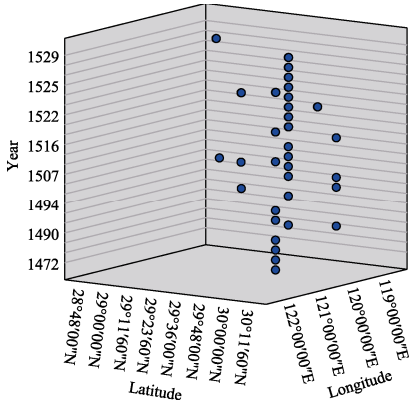

Figure 3 Timeline of Wang Yangming's footprints

6 Conclusion

This study has successfully applied GIS technology to the spatiotemporal analysis of Wang Yangming's historical footprints, showcasing a seamless integration of significant life events with spatial and temporal trajectories. Utilizing state-of-the-art tools such as textual analysis and three-dimensional mapping, the research has meticulously constructed a detailed spatiotemporal dataset of Wang Yangming's movements in Zhejiang. This methodological innovation not only transcends the traditional capabilities of humanities research but also provides a rich, dynamic foundation for further investigation.

By employing GIS technology, this research offers precise localization and vivid visual representation of the collected data, significantly enhancing the comprehensiveness and depth of historical analysis. Furthermore, the development of a thematic historical GIS

dataset expands the methodological boundaries of the field, introducing new avenues for exploring the GIS data of historical figures.

The demonstrated versatility and broad applicational potential of this approach suggest promising directions for future research, with significant implications for enhancing cultural and historical studies. The convergence of geographic and historical data analysis in this study serves as a pioneering model for other scholars in the field, potentially leading to substantial advancements in the understanding and interpretation of historical narratives.

Author Contributions

Ma, R. F. and Zhu, J. Y. did the overall design of the dataset development, and Wang, J. Y. and Zhu, J. Y. contributed to the data processing and analysis. Hu, X. R. and Wang, Y. T. wrote the data paper, and Ma, R. F. finally reviewed the data and paper.

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Chen, L. An analysis of the current situation of digital humanities research in China based on knowledge map [J]. *Journal of Library Science*, 2020, 42(1): 89–94.

[2] Zhu, J. Y., Hu, X. R., Ma, R. F., *et al*. Spatial-temporal dataset of footprints of Wang Yangming's activity in Zhejiang Province of China [J/DB/OL]. *Digital Journal of Global Change Data Repository*, 2024. https://doi.org/10.3974/geodb.2024.04.08.V1. https://cstr.escience.org.cn/CSTR:20146.11.2024.04.08.V1.

[3] GCdataPR Editorial Office. GCdataPR data sharing policy [EB/OL]. https://doi.org/10.3974/dp.policy.2014.05 (Updated 2017).

[4] Qian, D. H. Chronicle of Mr. Yangming [M]. Beijing: Beijing Yanshan Publishing House, 2022.

[5] Institute of History and Philology of Taiwan. Authoritative name of people—biographical database [DB/OL]. [2024-02-09]. https://newarchive.ihp.sinica.edu.tw/sncaccgi/sncacFtp.

[6] [Ming] Xiao Liang Gan revised, Zhang Yuanxi, Sun Yixiu, *et al*. Wanli's Shaoxing Mansion Chronicles [M]. Ningbo: Ningbo Publishing House, 2012.07.

[7] [Ming] Wang Shouren. Complete Works of Wang Yangming [M]. Shanghai: Shanghai Ancient Books Publishing House, 2011.

[8] [Ming] Xu Ai edited. Yangming's Literary Record [M]. 1547.

[9] [Ming] Wang Yangming. The Poetry Collection of Wang Yangming "Yuyao Cultural and Historical Materials" Vol.6 [M]. Committee of Cultural and Historical Materials of Yuyao Municipal Committee of the Chinese People's Political Consultative Conference, 1989.01.

[10] Wang Yangming Research Association in Shaoxing. Wang Yangming thematic literature database [A/OL]. [2024-02-09]. http://www.wymsjk.com/.

[11] International Council of Museums. Version 7.1.1 | CIDOC CRM [EB/OL]. (2021-8) [2024-5-19]. https://cidoc-crm.org/Version/version-7.1.1.

[12] Gao, J. S., Zhang, Q, Li, S.K., *et al*. Poet's emotional trajectory in time and space: case study of Li Bai for digital humanities [J]. *Data Analysis and Knowledge Discovery*, 2022, 6(9): 27–39.

[13] Zhang, Q., Gao, J. S., Long, J. Q., *et al*. Visualizing the temporal and spatial emotional trajectory of poets based on knowledge reconstruction: focusing on Xin Qiji [J]. *Journal of the China Society for Scientific and Technical Information*, 2023, 42(6): 729–739.