Postprint of Digital Humanities Research on Female Figures in the Three Commentaries on the Spring and Autumn Annals

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Date: 2023-04-01T16:16:04+00:00

Abstract

[目的/意义] Computational humanities research on ancient texts, based on the digitalization of classical works and intelligent processing of classical Chinese, has emerged as a new focal point in classical Chinese information processing in recent years. Data-driven quantitative analysis methods can offer novel perspectives and approaches for traditional research questions concerning ancient texts.

[方法/过程] This study takes female figures in the Three Commentaries of the Spring and Autumn Annals as its research object, utilizing multi-perspective knowledge annotation of female figures as the data source. It conducts quantitative analysis of female figure knowledge, including "surname, state, clan", birth order, posthumous title, honorific title, and temporal distribution, as well as quantitative analysis of marriage alliance relationships among feudal states, focusing on participation in marriage alliances, using female figure knowledge as a guiding framework.

[结果/结论] This research provides a new perspective on the interpretation of female figures in the Three Commentaries of the Spring and Autumn Annals, offers a quantifiable and visualizable research methodology, and furnishes reliable data validation for related studies.

Full Text

Preamble

Humanities Computing Research on Female Characters in the Spring and Autumn Annals and the Three Commentaries*

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Abstract: [Purpose/Significance] Humanities computing research on ancient classics based on digitalization and intelligent processing of classical Chinese texts has emerged as a new focus in classical Chinese information processing in recent years. Quantitative analysis methods grounded in data can provide novel perspectives and approaches for traditional research questions related to ancient classics. [Method/Process] This study examines female characters in the Spring and Autumn Annals and the Three Commentaries as its research object, using multi-angle knowledge annotation of female characters as its data source. The research conducts quantitative analysis of female character knowledge including surnames, states, clans, birth order, posthumous titles, honorifics, and temporal distribution, as well as quantitative analysis of interstate marriage alliances centered on female character knowledge, with particular focus on participation in marriage diplomacy. [Result/Conclusion] The study offers a new interpretation of female characters in the Spring and Autumn Annals and the Three Commentaries, provides a measurable and visualizable research approach, and delivers credible data validation for related research.

Keywords: ancient classics digital humanities; female characters; Spring and Autumn Annals and the Three Commentaries; digital humanities
Classification Number: G250
DOI: 10.13266/j.issn.0252-3116.2020.23.011

Introduction

In recent years, driven by advances in classical Chinese information processing research [1], humanities computing (also known as digital humanities) studies on ancient classics have attracted increasingly widespread attention. Unlike simple digitalization or intelligent processing of classical texts, humanities computing research on ancient classics not only focuses on the application or practice of modern information technology and artificial intelligence methods in classical texts, but more importantly, builds upon digital resources or even structured knowledge to integrate research methodologies from information science, history, linguistics, statistics, and other disciplines. This approach attempts to provide new interpretations of traditional research questions from perspectives of knowledge quantification, correlation, and visualization [2]. Humanities computing has introduced new research paradigms to traditional classical studies [3], bringing fresh vitality and becoming an important vehicle for the inheritance

and innovation of excellent traditional Chinese culture.

A crucial distinction between humanities computing and traditional research lies in their perspective on texts. Traditional research typically begins with textual content, focusing on case analysis and induction, and demonstrates characteristics and patterns through qualitative argumentation. Consequently, such research requires not only thorough familiarity with classical texts but also solid professional expertise to understand them. Humanities computing, by contrast, first conducts structural analysis and annotation of textual content, then performs structured processing, quantitative analysis, and visual presentation based on the annotated knowledge, describing, analyzing, and explaining from a quantitative perspective. In terms of research methods alone, the characteristic of humanities computing research lies in leveraging the advantages of computer data processing to apply various interdisciplinary statistical analysis methods to large-scale structured data, obtaining quantitative conclusions such as statistical measurements, correlation analysis, and social network analysis. Additionally, combining visual graphical presentation of statistical data and conclusions is a common approach, making humanities computing research more intuitive and accessible from methodology to results. This distant perspective on texts, also known as "distant reading" [2], can yield more objective and quantitative research conclusions compared to traditional "close reading" when facing the same textual content. This "viewing the mountain from different angles" approach can effectively expand the perspectives of traditional classical studies, while visual presentation also facilitates understanding and scientific popularization.

Currently, research in ancient classics humanities computing primarily focuses on methodological discussions, with applied studies being relatively scarce, and exhibits different development trends domestically and internationally. Foreign research places greater emphasis on the implementation of technical tools, such as constructing digital humanities research platforms for ancient classics that include automatic annotation systems and social network relationship tools for characters [4]. Domestic research focuses more on methodological exploration, such as Ouyang Jian et al.'s [5] proposal for humanistic data organization and reconstruction from the perspective of data integrity, and Yao Tianhong et al.'s [6] knowledge organization of historical materials based on the CIDOC-CRM conceptual framework. Studies that address specific problems based on actual resources are rare both domestically and internationally. C. L. Liu et al. [7] constructed a resource containing nine collections of ancient poetry and comprehensively introduced various research methods for analyzing poetic aesthetic styles; Yan Chengxi et al. [8] used social network analysis to examine historical figure relationships and their underlying social issues. These studies provide new approaches for digital humanities research on ancient classics. Technically and methodologically, digital humanities research on classical Chinese has been thoroughly discussed, and the importance of resource construction and knowledge organization has been validated. However, more in-depth and comprehensive exploration of research content remains needed.

This paper takes female characters in the pre-Qin classic Spring and Autumn Annals and the Three Commentaries as its research object. First, based on digitized classical resources, we conduct knowledge annotation and resource construction for female characters. Then, using this knowledge resource, we carry out humanities computing research from two perspectives: (1) Through comprehensive quantitative statistics, we reveal relevant knowledge and discover the profiles and characteristics of female characters in the Spring and Autumn Annals and the Three Commentaries reflected in this knowledge, and explore from a temporal dimension the correlation between female numbers and the rise and fall of states, using the states of Qi and Lu as examples; (2) Building upon the insights from the correlation between female numbers and state prosperity, we further use female characters' surnames and husbands' surnames and clans as clues to construct an interstate marriage alliance network for the Spring and Autumn Annals and the Three Commentaries, and quantitatively present the marriage participation, relationship strength, and relationship changes among states. This study aims to provide new interpretive perspectives for research on women and marriage alliances based on the Spring and Autumn Annals and the Three Commentaries.

2 Data Sources and Knowledge Annotation

2.1 Data Sources

The research data is derived from digitized texts of the Spring and Autumn Annals and the Three Commentaries. The "Three Commentaries" collectively refers to the *Spring and Autumn Annals* proper and the three classical commentaries: *Guliang Zhuan*, *Gongyang Zhuan*, and *Zuo Zhuan* (for brevity, hereafter collectively referred to as the "Spring and Autumn Annals"). The female characters studied and discussed in this paper specifically refer to women in the Spring and Autumn Annals. The acquisition of these characters is based on the identification and disambiguation of female names. In previous work, the research team automatically identified all names in the Spring and Autumn Annals and manually verified them. According to pre-Qin name-related research [9-10], we conducted detailed manual annotation of the structural components of these names; performed automatic disambiguation and manual verification of the two types of ambiguity commonly found in the corpus: same name referring to different persons and different names referring to the same person; and based on this work, constructed a name database for the Spring and Autumn Annals, which also includes the contextual usage of names in the text (see Table 1 for examples). According to the structural characteristics of female names [9-10] and combined with contextual knowledge, this study extracted 200 candidate female names from the Spring and Autumn Annals name database. After manual verification, we removed three names from non-Spring and Autumn periods (Da Si, Yi Jiang, and Bao Si) and two non-female names (Qin Ying and Ning Ying), resulting in 129 female characters. It should be noted that female figures such as "Shu Xiang's mother" and "Shu Hu's mother" are not within the scope

of this study.

Table 1 Names, Structures, and Contextual Usage in the Spring and Autumn Annals (Simplified)

Name (Disambiguated)	Name and Structure	Context (Excerpt)
Xi Gui (Lady Wen)	Xi Gui: Clan + Surname	"Cai Aihou married Xi Gui because of Shen"
	Lady Wen: Posthumous + Honorific	"Chu Lingyin Ziyuan wanted to bewitch Lady Wen"
Zhao Zhuang Ji (Meng Ji, Ji Shi)	Zhao Zhuang Ji: Clan + Posthumous + Surname	"Zhao Ying had an affair with Zhao Zhuang Ji"
	Meng Ji: Birth order + Surname	
	Ji Shi: Surname + Suffix	"Wu was raised by Ji Shi from the Duke"
Bo Ji (Lady Qin Mu, Mu Ji, Qin Mu Ji)	Qin Mu Ji: State/Clan + Posthumous + Surname	"Used as a dowry for Lady Qin Mu"
	Mu Ji: Posthumous + Surname	"Qin Mu Ji entrusted Jia Jun"
	Lady Qin Mu: Clan/State + Posthumous	"Qin Mu Ji heard the Marquis of Jin would arrive"
	Bo Ji: Birth order + Surname	"Duke Xian of Jin divined about marrying Bo Ji to Qin"

2.2 Female Character Knowledge Annotation

The Spring and Autumn Annals contains limited descriptions of women, and female names almost exclusively consist of surnames and clans without given names or courtesy names. However, this does not mean we can overlook women's value and influence in that era. Their untold stories and elegance are often implicitly contained within their names, and the related character knowledge harbors rich clues about individuals, clans, and even states. Among these, structural components such as surname and clan are crucial for discovering women's origins, status, influence evaluation, and even interstate marriage alliances. Therefore, full acquisition and annotation of character knowledge forms the data foundation for humanities computing. This paper, based on the surname, clan, posthumous title, birth order, and honorific components in the Spring and

Autumn Annals name database, added knowledge about birth state (maternal state), husband's state, character relationships, offspring, and personal virtue. Combined with name context and external knowledge, we manually annotated female character knowledge, including maternal state, maternal surname, maternal clan, husband's state, husband's surname, husband's clan, birth order, posthumous title, honorific, number of offspring, and era. Among these, maternal state, surname, and clan represent the woman's birth state and corresponding surname and clan; husband's state, surname, and clan represent the state she married into and corresponding surname and clan. If remarriage occurred, it was marked in chronological order; unverifiable knowledge was marked as "unknown." For data completeness, the Zhou royal house's clan was annotated as "Zhou."

In humanities computing, temporal knowledge can provide interpretations from additional perspectives. The historical period recorded in the Spring and Autumn Annals was one where the Zhou royal house's authority declined and rival states contended for supremacy, with states forming alliances and marriage pacts one day and waging war the next. In such a complex social environment, women favored by historical records played different roles and exerted different important influences in different periods. Their status and influence were condensed by the Spring and Autumn Annals authors into character knowledge such as surnames and clans, presenting unique distribution characteristics over time. The Spring and Autumn Annals records the history of 12 rulers of the state of Lu by era. This study automatically annotated the era to which each female character belonged based on contextual usage. For women appearing in multiple eras, the earliest era was annotated. For example, Ai Jiang experienced the eras of Duke Zhuang, Duke Min, and Duke Xi, but was annotated as belonging to Duke Zhuang's era. After the above annotation work, the resulting knowledge of female characters in the Spring and Autumn Annals is shown in Table 2 , and all subsequent humanities computing research on women in this paper is based on this data.

Table 2 Knowledge of Female Characters in the Spring and Autumn Annals (Simplified)

Character	Maternal State	Maternal Surname	Maternal Clan	Husband's State	Husband's Surname	Husband's Clan	Birth Order	Posthumous Title	Honorific	Offspring	Era
Bo Ji (Lady Qin Mu, Mu Ji, Qin Mu Ji)	Lu	Ji	Lu	Qin	Ying	Zhao	-	Mu	Lady	2	Duke Xi
Xi Gui (Lady Wen)	Xi	Gui	Xi	Chu	Mi	Xiong	-	Wen	Lady	2	Duke Zhuang
Xia Ji	Zheng	Ji	-	Chen	Gui	-	-	-	-	1	Duke Xuan
Chen Gui (Hui Hou)	Chen	Gui	Chen	Zhou	Ji	Zhou	-	Hui	Queen	2	King Xi-ang
Lady of Duke Huan of Qi	-	-	-	Qi	Jiang	Lü	-	-	Lady	1	Duke Huan
Qin Kang Gong Wen Ying (Lady of Duke Wen of Jin)	Qin	Ying	Zhao	Jin	Ji	-	-	Wen	Lady	1	Duke Wen

Character	Maternal State	Maternal Surname	Maternal Clan	Husband's State	Husband's Surname	Husband's Clan	Birth Order	Posthumous Title	Honorific	Offspring	Era
Lady of Duke Mu of Qin	Jin	Ji	-	Qin	Ying	Zhao	-	-	Lady	2	Duke Mu
Daughter of Duke Xian of Jin	Ji	-	-	-	-	-	-	-	-	-	Duke Xian

3 Quantitative Analysis of Female Character Knowledge

From a humanities computing perspective, names are the starting point for exploring stories behind characters, and the special structure of female names in the Spring and Autumn Annals makes them particularly valuable for mining. Knowledge components such as surname, state, and clan represent the states behind women from different levels; birth order, posthumous titles, and honorifics reflect the status and influence of women in the Spring and Autumn Annals from multiple angles; and combined with maternal and husband's family knowledge, women become direct clues to interstate marriage alliances. This section begins with female character knowledge, employing statistical analysis and data visualization methods to provide an overview of women in the Spring and Autumn Annals.

3.1 Maternal Surname, State, and Clan

Maternal surname, state, and clan are key clues to the aristocratic origins of women in the Spring and Autumn Annals. Examining the distribution characteristics of these three types of knowledge is essential for exploring the full picture of women. Surname is the most important information in female names and the basic element indicating a woman's origin. Among the 129 women obtained in this study, 128 had identifiable surnames, accounting for 99.22% of the total. During the pre-Qin period, there were few types of surnames. To reduce name duplication, female names sometimes included the state name indicating their birth state, such as Cai Ji, Qi Jiang, and Chen Gui. We could identify the birth state name for 121 women, accounting for 93.80%. The clan in female names was often the birth state or husband's state name, with few exceptions where the clan name differed from the state name, such as Yong Zhen of Song and Xiao Tongshu Zi. However, through character knowledge annotation, we

could more accurately distinguish between a woman's clan and state. The most noteworthy exception is the Lü clan of the Qi state. We could identify the "clan" for 112 women, accounting for 86.82%.

The distribution of women by surname, state, and clan is shown in Figure 1 [Figure 1: see original paper]. The pie chart uses a three-layer structure: the inner ring shows surname distribution, the middle ring shows state distribution, and the outer ring shows clan distribution. The proportions indicate the percentage of each surname, state, and clan among all women. From the surname perspective, the Ji and Jiang surnames hold absolute dominance, with a combined proportion of 53.48%. The Ji surname is primarily associated with the states of Lu, Wei, Jin, and Zheng, with Lu being the most significant; the Jiang surname is almost monopolized by the Qi state, with other clans appearing only sporadically. From the state perspective, the four Ji-surname states led by Lu, plus Qi, Song, Chen, and Qin, collectively account for 61.24%, with Qi and Lu as the leaders, followed by Song and Wei, and other states being relatively evenly distributed. From the clan perspective, aside from Qin and Chen, other states have a few women from other clans, but the Lu and Lü clans of Qi and Lu states still hold dominant positions. The four clans of Lu, Lü, Wei, and Song account for 36.43%, making them the "four major families." Overall, women in the Spring and Autumn Annals are concentrated in Qi, Lu, and surrounding states. Since the Spring and Autumn Annals is primarily a history of Lu, this distribution is not surprising.

3.2 Husband's Surname, State, and Clan

While maternal surname, state, and clan reflect a woman's origins, the corresponding husband's surname, state, and clan can reflect a woman's influence after marriage, including her political and familial (offspring) influence. They also reflect the influence of states in marriage diplomacy. Among the 129 women, we could identify husband's surname, state, and clan for 125 (96.90%), 128 (99.22%), and 120 (93.02%) individuals respectively. This shows that the husband's state is important because it reflects a state's status in marriage diplomacy. After marriage, all a woman's activities were based on her husband's family; almost all recorded female events in the Spring and Autumn Annals occurred after their marriage, with the only exception being Jian Bi, daughter of Duke Mu of Qin and Lady Mu Ji, where the *Zuo Zhuan* records that Lady Mu Ji threatened Duke Mu of Qin by preparing to burn herself with Jian Bi to save Duke Hui of Jin.

The distribution of husband's surname, state, and clan shows significant differences from the maternal distribution, as illustrated in Figure 2 [Figure 2: see original paper], which uses the same visualization method as Figure 1. From the surname perspective, the dominance of Ji and Jiang is more pronounced, with a combined proportion of 72.09%, and the Ji surname alone accounting for 48.06%. On the other hand, the Ying and Gui surnames are no longer prominent and fall into the "other surnames" category, while the Mi surname holds a sta-

tus comparable to the Zi surname. From the state perspective, Figure 1 shows Ji surname distributed beyond Lu, Wei, Jin, and Zheng, while Figure 2 shows Ji surname completely occupied by these four states. The absolute dominance of Jiang surname in Qi and Zi surname in Song persists, with the Mi surname's Chu state also occupying a certain position. Due to the diminished prominence of Ying and Gui surnames, the states of Qin and Chen are also merged into "other states." The states can be divided into four tiers: Qi stands alone at the top, Lu and Jin are second, Wei and Zheng are third, and Song and Chu are fourth. These seven states account for 79.85%, showing a more pronounced advantage than the eight states in Figure 1. From the clan perspective, aside from Chu where all are of the Xiong clan, other states have women from other clans, but the six clans of Lu, Jin, Wei, Zheng, Lü, and Song remain dominant, accounting for 65.89%, while the Zhao and Chen clans belonging to Qin and Chen states are merged into "other clans." Overall, on one hand, the Ji and Jiang surname states are more prominent, and on the other hand, women's husband's families are more concentrated across the three levels of surname, state, and clan.

Notably, the number of women from Qi (21, including 17 from the Lü clan) is slightly higher than from Lu (18, including 14 from the Lu clan). This phenomenon of "the guest outshining the host" may have several causes: culturally, the Spring and Autumn period adhered to the Zhou ritual principle of "no marriage within the same surname," giving Qi an inherent advantage in marriage alliances; historically and geographically, Lu was adjacent to Qi and had intergenerational marriage ties; and in terms of national power, Qi was stronger, especially with Duke Huan of Qi as the first of the Five Hegemons, establishing Qi's initiative in marriage diplomacy, with various states competing to form marriage alliances with Qi. Although few Qi women are recorded as virtuous in the Spring and Autumn Annals, from the perspective of female influence, whether beautiful and benevolent or passionate and unrestrained, the elegance of Qi women was unparalleled in the Spring and Autumn period, as praised or satirized in the *Book of Songs · Airs of Qi*.

3.3 Analysis of Other Character Knowledge

3.3.1 Birth Order Some female names use modifiers such as Bo (Meng), Zhong, Shu, Ji, Zhang, Da, or Shao, indicating birth order within the family. First, Bo (Meng) and Zhong indicate sisterly birth order, such as Meng Zi being the eldest daughter of Song and Zhong Zi the second daughter. Second, Zhang, Da, Shao, and Xiao indicate birth order in the husband's family, such as Zhang Wei Ji and Shao Wei Ji. Using birth order in names can further reduce ambiguity; for example, both Qi Bo Ji and Qi Shu Ji were called Qi Ji, but adding Bo and Shu distinguishes them. Moreover, under the Zhou ritual principle of "the eldest is honored," birth order also signals important information about a woman's status.

According to the Spring and Autumn Annals female character knowledge ta-

ble, only 35 women have birth order information, accounting for 27.13% of the total. The distribution of these women is shown in Figure 3 [Figure 3: see original paper], where each birth order category has two sets of bar charts showing maternal and husband's state distributions. The number of eldest daughters is the largest, with Bo and Meng totaling 16; Shu and Ji, representing third and fourth daughters, are 8 and 5 respectively; second daughters number only 2; and women using husband's family birth order total just 4. The distribution of eldest, third, and fourth daughters follows general patterns, while the predominance of eldest daughters aligns with the "concubinage system" followed in aristocratic marriages, where the eldest daughter was married with her younger sisters as dowry companions. The eldest daughter thus held honorable status as the principal wife and received more attention in the Spring and Autumn Annals. On the other hand, multiple factors determined a woman's status, including lifespan and offspring, which explains why women of Zhong, Shu, and Ji birth orders could also stand out and make their mark in the Spring and Autumn Annals.

The distribution of maternal and husband's states for women with birth order knowledge is also noteworthy. In maternal state distribution, Lu has the most female characters, which is related to the Spring and Autumn Annals being a history of Lu, as scribes were more familiar with and recorded their own state's women in greater detail. In husband's state distribution, Qi has the most female characters, likely because Qi's strength and active participation in diplomatic marriages meant more married-in women needed birth order distinctions. Combining birth order categories, we find that Lu married out 8 eldest daughters but married in only 3; Qi married out no eldest daughters but married in only 2; Jin married out only 3 women but married in as many as 7, with more dispersed birth orders; other states had few women either married out or in.

3.3.2 Posthumous Titles Posthumous titles are evaluative judgments made after death. In the Spring and Autumn Annals, generally only aristocratic men received this honor; women qualified for posthumous titles only if they were queens of Zhou, wives of dukes, or mothers of rulers. Therefore, women with posthumous titles were both honored and rare. Notably, women's posthumous titles fall into two categories: one shares the husband's posthumous title, generally belonging to principal wives of dukes, such as Lady Mu Ji, wife of Duke Mu of Qin; the other enjoys an independent posthumous title derived from life deeds, also generally reserved for principal wives or mothers of dukes, such as Cheng Feng, who was a consort of Duke Zhuang of Lu but mother of Duke Xi of Lu, and thus enjoyed the posthumous title Cheng.

In the Spring and Autumn Annals, 42 women have posthumous titles, accounting for 32.56% of all women. Statistical analysis of the maternal and husband's states of these women reveals that, aside from the consistently powerful Qi and Lu, maternal state distribution is relatively dispersed while husband's state distribution concentrates on the three major states of Wei, Jin, and Song. This is

because posthumous titles were granted after death, and women mostly died in their husband's states. The specific distribution is shown in Figure 4 [Figure 4: see original paper].

The distribution of posthumous title characters for Spring and Autumn Annals women is shown in the word cloud in Figure 5 [Figure 5: see original paper], where larger font size indicates higher frequency. The most frequent posthumous title (6 occurrences) is Mu. According to the *Yi Zhou Shu · Posthumous Title Explanations*: "Bestowing virtue and upholding righteousness is called Mu; inner feelings revealed in appearance is called Mu," which is a favorable posthumous title. Gong, Wen, Jing, and Sheng are similarly favorable. Among all posthumous titles, unfavorable titles appear only 4 times: Ai (2 occurrences), Li, and Dao. We can infer that women received posthumous titles due to their honored status or virtuous conduct, and "concealing for the honored" made it extremely rare for women to receive posthumous titles for misconduct. The posthumous titles of Lady Ai Jiang, wife of Duke Wen of Lu, and Lady Dao of Jin indicate lament and pity for them, while the earlier Ai Jiang received an unfavorable title due to her notorious reputation. The case of Li Gui, a consort of Duke Zhuang of Wei, is special: "Killing the innocent is called Li," but the Spring and Autumn Annals contains no detailed records of her misdeeds. What she did is buried in history, but this posthumous title seems to be an indelible mark, engraved with a hidden story that invites speculation.

3.3.3 Honorifics Women's honorifics, similar to posthumous titles, indicate their identity and status. The *Book of Rites · Quli Xia* records: "The emperor's consort is called Queen (Hou), a duke's is called Lady (Furen), a grandee's is called Ruren, a scholar's is called Furen, and a commoner's is called Wife (Qi)." Since the Spring and Autumn Annals primarily records queens of Zhou and wives of dukes, not all 4 Zhou queens and 69 ducal ladies could be recorded with these honorific titles. Only 2 Zhou queens and 12 ducal ladies were so recorded, as detailed in Table 3 .

Table 3 Knowledge of Women Addressed as Queen or Lady in the Spring and Autumn Annals

Female Character	Maternal State	Husband's State	Honorif
Wen Ying (Lady of Duke Wen of Jin)	Qin	Jin	Lady
Lady of Duke Mu of Qin	Jin	Qin	Lady
2	King Cheng of Chu, King Du'ao of Chu	-	-

Besides Queen and Lady, another common honorific for women is Xiaojun (literally "little lord"). According to the *Mao Shi Zhengyi*: "Husband and wife are one body; a woman follows her husband's rank, thus sharing the name Xiaojun." This means those called Xiaojun were generally wives or mothers of state rulers, such as Xiaojun Wen Jiang, wife of Duke Huan of Lu. In the Spring and Autumn Annals, Xiaojun was primarily used to "record the burial of a completed

funeral," as in *Zuo Zhuan · Duke Zhao Year 11*: "We buried our Xiaojun Qi Gui."

Statistical analysis of the maternal and husband's states of women with honorifics reveals a striking contrast between Qi and Lu in maternal and husband's state distributions, as shown in Figure 6 [Figure 6: see original paper]. This indicates that many Qi women obtained honored status after marriage, while the opposite was true for Lu women, closely related to Qi's strong national power. Among the 7 Qi women with honorifics, 1 married into Qin as Lady of Qin Mu, 1 married into Wei as Lady of Wei Xiang, and the remaining 5 all married into Lu. Qi's strength and its influence on other states are evident.

3.4 Temporal Distribution of Female Characters

3.4.1 Temporal Distribution of Female Characters Based on temporal knowledge, we can refine various types of character knowledge in chronological order to discover patterns in Spring and Autumn Annals character knowledge over time and the characteristics of state social development behind them. Using the 12 rulers of Lu recorded in the Spring and Autumn Annals as temporal segments, we can 统计 the distribution of female numbers across eras, as shown in Figure 7 [Figure 7: see original paper].

Overall, the distribution of female numbers across eras in the Spring and Autumn Annals is extremely uneven, with a difference of over 21 between the most populous era (Duke Xi with 23 women) and the least populous (Duke Ding with 2 women). Numbers fluctuated continuously without obvious patterns. However, when combined with data on the reign lengths (in years) of Lu rulers, we find that the two fluctuation trends are highly consistent. We can calculate the correlation coefficient between female numbers per era and reign lengths of Lu rulers using Formula (1), where r represents the correlation coefficient, Cov represents covariance, and VAR represents variance. According to this formula, the higher the correlation coefficient, the stronger the correlation between two random variables.

$$r(X,Y) = \frac{Cov(X,Y)}{\sqrt{VAR[X]VAR[Y]}} \quad (1)$$

The correlation coefficient between female numbers per era and reign lengths of Lu rulers reaches 0.80, indicating a very high positive correlation. This suggests that the longer a Lu ruler's reign, the more active female characters appeared during that period. This aligns with intuitive experience but does not help us better understand the distribution patterns of female characters, requiring more knowledge to discover other patterns hidden in this correlation.

3.4.2 Temporal Distribution of Female Numbers in Qi and Lu States The distribution of female numbers in Qi and Lu, the two states with the most

women, is shown in Figure 8 [Figure 8: see original paper]. In maternal state distribution, Qi and Lu show significant differences from the overall distribution, with correlation coefficients (calculated as the correlation between the number of women whose maternal state is Qi per era and the total number of female characters per era) of 0.46 and 0.47 respectively. In husband's state distribution, Qi's pattern is relatively close to the overall distribution, while Lu's deviates more significantly, with correlation coefficients of 0.80 and 0.12 respectively. Such obvious distribution differences may be due to insufficient data volume—whether as maternal or husband's state, Qi and Lu each have only over 20 women total, and when distributed across 12 eras, multiple years have zero counts. To address this, we comprehensively 统计 all women related to Qi and Lu, i.e., the sum of maternal and husband's state counts, and plot the temporal distribution in Figure 9 [Figure 9: see original paper].

After comprehensively examining both maternal and husband's state female numbers, the distribution characteristics of Qi and Lu are better presented. Qi's distribution is relatively close to the overall pattern, while Lu's still differs significantly, with correlation coefficients of 0.86 and 0.43 respectively. Further examination reveals that each state's distribution has a portion highly consistent with the overall distribution, and this occurs before and after Duke Min respectively. Based on the data, Lu's distribution before Duke Min is highly consistent with the overall distribution (correlation coefficient 0.80), but only 0.49 after Duke Min; Qi's distribution after Duke Min is highly consistent with the overall distribution (correlation coefficient 0.91), but only 0.39 before Duke Min. Using Duke Min as a boundary, Qi and Lu distributions show a complementary trend, each aligning with the overall distribution in turn. This ebb and flow between the two states coincides with the period around Duke Huan of Qi's hegemony, after which Lu declined from prosperity and gradually fell under Qi's control.

4 Quantitative Analysis of Marriage Alliance Relations

Quantitative analysis of character knowledge opens a window to observing the stories and elegance of women in the Spring and Autumn Annals, and through this we can also glimpse the closeness and grievances between states, specifically the marriage alliances centered on women. In the Spring and Autumn Annals, when a duke's daughter married for the first time, political marriage alliances were heavily considered. In these alliances, surname and state played important roles because of the principle of "no marriage within the same surname." This principle inherently constrained the marriage options available to states and potentially influenced their diplomatic choices. In the historical currents, marriage alliances played important roles in interstate relations: great powers used them to control smaller states and balance other great powers in seeking hegemony; smaller states used them to attach themselves to great powers for security, continuously losing initiative in the confrontations between great power blocs. This section selects knowledge related to surnames and states at the time

of women's first marriages to construct an interstate marriage alliance network, combining social network analysis methods to quantitatively analyze different states' marriage participation degrees and scopes, examine alliance characteristics, measure alliance strength, and analyze distribution patterns. This allows us to quantitatively weigh states' diplomatic activity levels from multiple angles and explore the diplomatic choices and development trajectories reflected in marriage alliance relations.

4.1 Construction of Marriage Alliance Network

Among the 129 female characters in the Spring and Autumn Annals, 20 were unrelated to interstate marriage alliances (18 were wives of grandees or sons of rulers, 1 was a ruler's daughter (Jian Bi), and 1 was "internal marriage within a state (Meng Ren)"). After removing these, we obtained 109 individuals, then removed 10 with incomplete surname or state information, finally obtaining 99 women with complete surname and state knowledge, corresponding to 99 marriage alliances. These involve 15 maternal surnames, 10 husband's surnames, and 16 surnames total; 37 maternal states, 20 husband's states, and 44 states total (for data completeness and consistency, this study treats the Zhou royal house as a state). Based on this data, we can construct the marriage alliance network for the Spring and Autumn Annals period, shown in Figure 10 [Figure 10: see original paper]. The figure uses the "surname + state" format to represent nodes, including 46 nodes corresponding to participating states (Song and Hu each contain 1 woman of other surnames, so the 46 nodes actually correspond to 44 states). Nodes are divided into 16 categories representing surnames (same-surname nodes share the same color). The 67 edges represent marriage alliances, using directed edges to distinguish between marrying out and marrying in. The arrow's starting point indicates the side marrying out its daughter (the directed edge's color matches the marrying-out node), and edge thickness indicates the number of alliances (times of marrying in or out).

From a social network analysis perspective, nodes' in-degree and out-degree respectively represent the number of states a state married its daughters to and married daughters from. For example, Qi has an out-degree of 5 and in-degree of 12, with a sum of 17, meaning Qi married its daughters to 5 states, married daughters from 12 states, and had marriage relations with 17 states total. Nodes' weighted in-degree and out-degree respectively represent the number of marriage alliances. For example, Qi has a weighted out-degree of 17 and weighted in-degree of 23, with a sum of 40, meaning Qi married out daughters 17 times, married in daughters 23 times, and participated in 40 alliances total. The network has an average degree of 1.46, average weighted degree of 2.15, and graph density of 0.032, indicating the network is relatively sparse, with edges largely concentrated on a small portion of nodes. This manifests as marriage alliances primarily concentrating on Qi, Lu, Jin, Wei, Zheng, Song, and other states. The above analysis shows that quantitative methods can evaluate states' marriage participation degrees, and the different performances of various states'

participation degrees warrant deeper investigation.

4.2 Marriage Participation Degree and Core Alliance States

4.2.1 Alliance Strength Based on nodes' in-degree and out-degree characteristics, we can define quantitative indicators for states' marriage participation degree. Alliance strength represents the number of times a state participated in marriage alliances, divided into marrying in and marrying out, corresponding to weighted in-degree and out-degree respectively. For each state, the data combining both marrying in and out is more complete, and alliance strength can reveal active alliance states from the perspective of participation frequency. The distribution of alliance strength in the Spring and Autumn Annals is shown in Figure 11 [Figure 11: see original paper], where the upper portion of the bar chart represents the number of times a state married in women, the lower portion represents marrying out, and the sum of absolute values represents alliance strength. The figure displays the 11 states with alliance strength greater than 4 in order.

The decline in alliance strength with ranking is relatively obvious, showing clear hierarchy. Based on this, we can divide the top-ranked states into two categories: first, the top-ranked Qi and Lu, whose combined alliance strength exceeds half of the total, can be called Category A core alliance states; second, Song, Jin, Wei, and Zheng, which can be called Category B core alliance states. The six core alliance states collectively participated in 64.14% of all alliances, making them the primary focus for examining marriage alliance relations in the Spring and Autumn Annals.

The proportion difference between marrying in and marrying out is quite obvious, especially for Jin and Zheng. Core alliance states show a consistent characteristic: marrying in times are significantly higher than marrying out times. Conversely, among the 26 states that participated in only one alliance, 21 married out their daughters, and 18 of these married into core alliance states. Therefore, we can consider the proportion advantage of marrying in times in alliance strength as an important characteristic of core alliance states, formed for multiple reasons. Core alliance states demonstrated their dominance by marrying in women from smaller states, while smaller states attached themselves to and curried favor with these states by marrying out their daughters.

4.2.2 Alliance Breadth Alliance breadth represents the number of a state's marriage alliance partners, measuring the scope of a state's marriage participation. It reflects both the flexibility of a state's choices in marriage diplomacy and the constraints and influences of the "no marriage within the same surname" principle. Alliance breadth is also divided into marrying in and marrying out, corresponding to in-degree and out-degree. Figure 12 [Figure 12: see original paper] shows the distribution of alliance breadth in the Spring and Autumn Annals, where the upper portion represents the number of states a state married in women from, the lower portion represents states married out to, and the

sum of absolute values represents alliance breadth. This sum does not equal the number of alliance partners but comprehensively reflects the range of partners. The figure displays the 12 states with alliance breadth greater than 5 in order.

Alliance breadth measures the scope of states' marriage alliances. The distribution of top-ranked states by alliance breadth is not significantly different from alliance strength, with core alliance state members remaining largely unchanged. However, the gap between Category A and Category B core alliance states narrows, especially between Qi-Lu and Jin-Zheng. The difference between marrying in and marrying out breadth varies significantly among states. Among core alliance states, Qi, Jin, and Zheng show obvious advantages in marrying in breadth, while Lu, Song, and Wei show the opposite. Marrying in breadth better demonstrates attractiveness in alliances, while marrying out breadth emphasizes flexibility in choice. The obvious differences in marrying in and out breadth among core alliance states reflect distinctions in marriage diplomacy strategies and differences in national power. The advantage in marrying in breadth corresponds to hegemonic Qi and Jin and contention-seeking Zheng, while the advantage in marrying out breadth corresponds to Lu, Song, and Wei, which navigated between contending powers.

4.2.3 Alliance Potential Conversion Rate The alliance potential conversion rate represents, under the premise of "no marriage within the same surname," the degree to which a state realized its potential marriage partners. Figure 13 [Figure 13: see original paper] shows the distribution of alliance potential conversion rates. The two bar charts respectively represent alliance potential and alliance breadth, while the line shows the conversion rate (amplified 100 times for convenient display). Alliance potential represents the number of all potential marriage partners for a state, and the conversion rate is the ratio of alliance breadth to alliance potential. The figure displays states with conversion rates greater than 10% in order.

The distribution of top-ranked states by conversion rate is not significantly different from alliance strength and breadth, with core alliance state members remaining unchanged. Category B core alliance states can be further divided: Jin and Zheng still show little difference from Qi and Lu, while Wei and Song show larger differences from Qi and Lu. From the data alone, all states' conversion rates are not high, with the highest Qi and Lu not reaching 42%. This indicates that although states had many optional marriage partners under the "no marriage within the same surname" principle, their final choices were also influenced by diplomatic relations, geographical location, and other factors. This also results in Lu, with obviously disadvantaged alliance potential, having a slightly higher conversion rate than Qi. The phenomenon that Qi and Lu, both of different surnames, belong to Category A core alliance states, while same-surname states are divided into Category A, B, and other non-core states, and that lower-ranked states generally have considerable alliance potential, all demonstrate that for Spring and Autumn Annals states, flexible diplomatic choices could bring ob-

vious initiative in marriage diplomacy even under restricted innate constraints. This is also why Ji-surname states, most constrained by "no marriage within the same surname," occupy 4 seats among core alliance states.

4.2.4 Changes in Marriage Participation Degree Combining female characters' temporal knowledge allows us to refine marriage participation degree indicators chronologically, discovering the overall development trends and change patterns of marriage alliances in the Spring and Autumn Annals, and more comprehensively understanding the diplomatic choices of major alliance states reflected behind them. Figures 14 [Figure 14: see original paper] through 16 [Figure 16: see original paper] respectively show the temporal distribution of alliance strength, breadth, and conversion rates for core alliance states across twelve eras. The three indicators' distributions across eras are consistent, and their overall change trends basically align with the trend of female numbers. Since alliance data derives from female character knowledge, such consistent distributions are not surprising and are suitable for unified exploration. Alliance participation degree indicators show obvious fluctuations across eras, and can be clearly divided into early, middle, and late stages using Duke Min and Duke Xuan as boundaries, with core alliance states showing distinct characteristics in each stage.

As Category A core alliance states, Qi and Lu maintain overall advantages throughout but show completely different features across the three stages: Lu was more active in the early stage but declined in the middle and late stages; Qi lagged in the early stage but experienced explosive growth in the middle stage, remaining dominant despite obvious decline in the late stage. As analyzed in section 4.4.2, the significant changes in Lu and Qi's ebb and flow before and after Duke Min are closely related to Duke Huan of Qi's hegemony. Female numbers and alliance strength reflect the impact of Qi's prosperity from different angles, and the above distribution data further demonstrates that Qi's dominance in marriage diplomacy during Duke Huan's period was comprehensive.

Among Category B core alliance states, Jin and Wei's alliance advantage periods were in the early and middle stages, showing obvious decline in the late stage; Song showed the opposite pattern, with its advantage period in the middle and late stages; Zheng maintained relatively even levels across all three stages. Given the Spring and Autumn Annals' emphasis on Qi and Lu, the alliance strength distribution of Category B core alliance states to some extent reflects status changes within the "Qi-Lu relationship circle." For example, Jin was constrained by Qi in the early stage, gradually became powerful and competed with Qi for hegemony in the middle stage, and eventually surpassed Qi; Wei remained constrained between Qi and Jin, maintaining alliance strength but remaining passive; Song experienced continuous internal turmoil in the early stage, and due to Duke Xiang of Song's hegemony and Jin-Chu contention, war raged for years in the middle stage, only gaining opportunities for 缓和 alliances in the late stage with the "Second Ceasefire Alliance"; Zheng flourished in the

early stage but gradually declined in the middle and late stages, being farther from Qi and Lu and having closer relations with Jin, Chu, and other states.

4.3 Marriage Alliance Network Analysis

4.3.1 Strength of Marriage Alliance Network Based on nodes' in-degree and out-degree, we can filter out some nodes to more conveniently observe important parts of the marriage alliance network. Using the criterion of in-degree or out-degree ≥ 2, we can divide the network into two parts, as shown in Figure 17 [Figure 17: see original paper]. The left portion shows the marriage alliance network where all nodes have in-degree and out-degree > 1, which can be considered strong alliance relationships; the right portion shows the opposite, representing weak alliance relationships. Strong alliance relationships highlight the characteristics of major alliance states, while weak alliance relationships focus more on small states' marriage trends. Notably, the "no marriage within the same surname" principle created marriage advantages for some "small-surname small states," explaining why seemingly weak states like Qi and Chen could occupy important positions in strong alliance relationships.

In the strong alliance relationship network, alliances unsurprisingly concentrate on Qi and Lu, with Lu-Song, Qi-Jin, and Qi-Wei relations occupying prominent positions. Except for Qin's good relations with Jin and Chu, and Chen's alliances with Zheng and Wei, all other states in strong alliance relationships married with Qi or Lu. Further observation reveals that Ji-surname states' alliance partners were primarily Qi, while other-surname states' partners were mainly Lu. Qi and Lu sometimes formed marriage alliances, sometimes each 拉拢 surrounding states in overt and covert struggle, vividly demonstrating their close yet complex relationship during the Spring and Autumn period [11]. Strong alliance relationships feature core alliance states as main participants, including 12 states total, with only 8 of 16 surnames appearing, showing strong concentration. If we set the strong alliance relationship criterion as in-degree or out-degree ≥ 3, we obtain an alliance network containing only Qi, Lu, Jin, Wei, and Song, demonstrating that core alliance states' stability is reflected in their close intermarriage relationships.

The weak alliance relationship network has more nodes, but edge weighted degree (node size) clearly shows that alliance relationships still concentrate on a few states centered on core alliance states. Thirty states with only 1-2 alliances participated in 34 alliances total, with 23 (67.65%) related to core alliance states. Therefore, even in weak alliance relationships, core alliance states still demonstrate absolute influence, with the vast majority of alliances in the Spring and Autumn Annals revolving around them.

4.3.2 Analysis of Core Alliance States Based on data presented in Figure 18 [Figure 18: see original paper], Qi's marriage alliance characteristics can be summarized as follows: (1) Many alliances and wide choice. Qi participated in 40 alliances involving 5 surnames and 14 states, ranking first in the Spring and

Autumn Annals. (2) Ji-surname states account for a large proportion. Among the 14 alliance partner states, Ji-surname states number 9. (3) Primary alliance partners are Ji-surname great powers. The most frequent alliances all involve Ji-surname great powers (Lu, Jin, Wei) as objects, for both marrying in and out, while alliances with non-Ji-surname states are significantly fewer and more evenly distributed. The wide choice provides Qi with inherent advantages in marriage diplomacy, allowing Qi to select appropriate partners based on internal and diplomatic needs from a relatively large number of states (especially Ji-surname states), an advantage Ji-surname states lack. The characteristic of frequent alliances primarily with Ji-surname great powers and secondarily with other surnames reflects Qi's clear purposefulness in marriage choices, which is the direct manifestation and inevitable choice of using marriage as a diplomatic tool. As one of the Spring and Autumn hegemons, Qi's assistance in restoring Wei, control over Lu, and mediation between Jin and Chu can all be traced in its marriage alliance characteristics. Overall, whether respecting the king and repelling barbarians in the early stage, seeking hegemony in the middle stage, or maintaining national prestige in the late stage, maintaining good neighborly relations and balancing mediation remained important diplomatic principles [12], with marriage alliance characteristics providing direct evidence of these principles. Qi fully combined inherent advantages and acquired principles to achieve prosperous marriage diplomacy, an inevitable choice on its path to hegemony.

Lu's marriage alliance characteristics are as follows: (1) Many alliances and wide choice. Lu participated in 28 alliances involving 6 surnames and 10 states (notably, Lu had one same-surname internal marriage: Lady Meng, wife of Duke Zhao of Lu), ranking second only to Qi. (2) Primary alliance partner is Qi, secondary is Song, with other states relatively even. Qi is Lu's most important alliance partner regardless of marrying in or out, with a significant difference from other states; the only states with mutual marrying in and out with Lu are Qi and Song. These characteristics demonstrate the gap between Qi and Lu in marriage alliances from both inherent and acquired perspectives. Inherently, due to "no marriage within the same surname," Jin, Wei, and other Ji-surname great powers could not intermarry, and among Jiang-surname great powers only Qi existed, making Lu's optional alliance partners inherently fewer than Qi's. Specifically, besides the Jiang-surname Qi, Lu's available great power partners were already limited, and due to the principle of "honoring close relatives," Lu, which revered Zhou rituals, disdained marrying with "barbarian" states like Ying-Qin and Mi-Chu, leaving only Zi-Song as an option. This forced Lu to choose between two great powers, and with Song's decline, Qi became Lu's only great power option. Acquired factors show that although Lu's alliances also considered surrounding small states of various surnames, its over-reliance on Qi in great power alliances constrained its diplomatic initiative and flexibility. Although Lu was one of the great Spring and Autumn states, its national power was insufficient for hegemony, forcing it to ally with great powers to seek diplomatic initiative. Lu contended with Zheng and Song in the early stage, mediated between Duke Huan of Qi and Duke Wen of Jin in the middle stage,

and had 离合 relations with Jin, Qi, and Wu in the late stage, always unable to escape Qi's shadow [13]. The inherent and acquired disadvantages Lu showed in marriage alliances, and its extreme dependence on Qi, reflect obvious defects in its diplomatic choices among great powers, which was an important reason for its frequent passivity despite variable diplomatic options.

Although Jin, Song, Wei, and Zheng were also core alliance states, they showed obvious gaps with Qi and Lu, making their alliance characteristics less distinctive but still noteworthy: (1) In terms of alliance frequency and choice scope, these states were comparable, with Song, Jin, Wei, and Zheng having 17, 15, 14, and 13 alliances respectively, involving 4, 8, 4, and 6 surnames, and 7, 12, 5, and 10 states respectively. (2) Among alliance partners, Jin and Wei, both Ji-surname states, primarily target Qi; Zi-surname Song primarily targets Lu, secondarily Qi; Zheng is more dispersed without obvious primary partners. (3) The three states have mutual alliances, but not prominently, with relatively even alliances with other small states. Notably, Jin had multiple alliances violating the "no marriage within the same surname" principle, making many Ji-surname states its alliance partners, including surrounding minority Rong groups. These four states' alliance characteristics all reflect to some extent their diplomatic relations with Qi and Lu during the Spring and Autumn period [14-16]: Jin was constrained by Qi in the early stage, formed good relations with Qin around Duke Wen of Jin's hegemony ("the good relations of Qin and Jin"); Song was always caught between Qi and Lu; Wei was deeply controlled by Qi.

4.3.3 Changes in Marriage Alliance Relations Based on the temporal stage division criteria in section 4.2.5, we can construct marriage alliance networks for the three stages, as shown in Figure 20 [Figure 20: see original paper]. The three stages had 31, 34, and 34 alliances respectively, validating the temporal stage division. With relatively even alliance numbers across the three stages, the specific distributions of alliance networks show obvious differences.

In the early Spring and Autumn period, participating states were primarily Ji-surname and Jiang-surname, with Ji-surname states being most numerous and mostly marrying in, while Jiang-surname states were also numerous but mostly marrying out. In terms of relationship strength, the six core alliance states—Lu, Qi, Jin, Wei, Song, and Zheng—had all emerged and already formed strong alliance relationships by this time, with close Qi-Lu alliances also becoming apparent. In the middle stage, participating states were primarily Ji-surname, with only 2 Jiang-surname states remaining but 4 Ying-surname states. Alliance numbers increased slightly from the early stage, but only Qi-Lu and Qin-Jin maintained strong alliance relationships, while Qi-Jin contention also occurred during this period. In the late stage, participating states remained primarily Ji-surname, but Si-surname states increased significantly to 5. This period had the most alliance numbers, but overall alliance strength, including Qi and Lu, clearly declined, with only Qi-Lu, Song-Yan maintaining strong alliance relationships. The marriage alliance network is a mirror of war and peace among Spring and

Autumn states: the rise and fall of great powers, the attachment and extinction of small states, the betrayal of marital relatives, and alliances between enemies amidst armistice all find full expression here.

5 Conclusions and Future Outlook

This study uses the Spring and Autumn Annals and the Three Commentaries as corpus, focuses on female characters, annotates and obtains character knowledge such as maternal and husband's states, birth order, and posthumous titles, and conducts humanities computing research on Spring and Autumn women using this knowledge. The research is divided into two parts: quantitative analysis of character knowledge and quantitative analysis of marriage alliance relations. In the character knowledge analysis, we examine the overall picture of Spring and Autumn women through quantitative data analysis, from the distribution of maternal and husband's surnames, states, and clans, to studies of birth order, posthumous titles, and honorifics, and exploration of temporal changes. In the marriage alliance analysis, based on network construction, we comprehensively examine states' marriage participation degrees through three quantitative indicators—alliance strength, alliance breadth, and alliance potential conversion rate—identify core alliance states accordingly, and analyze the changing characteristics of marriage participation degrees combined with temporal knowledge. Finally, we classify the marriage alliance network by relationship strength and conduct specialized discussion and analysis combining core alliance states and temporal stage division. Compared with traditional research, this paper employs a measurable and visualizable research approach, provides a "distant reading" perspective oriented toward data and knowledge, and offers credible data validation for research conclusions.

Notably, data-based research is to some extent limited by data. The female character knowledge obtained in this study is limited to the Spring and Autumn Annals and the Three Commentaries, with a descriptive perspective primarily focusing on Lu and surrounding states. The female character knowledge and represented marriage alliances inevitably have inherent bias. On the other hand, due to the relatively small overall data volume, the analysis and conclusions have certain limitations, but this does not affect the objectivity of the data and conclusions, nor the validity of the methods used in this study. As data and knowledge continue to improve, the data-based humanities computing approach will provide more reliable data support for traditional research.

References

[1] Huang Shuiqing, Wang Dongbo. Current status and trends of classical Chinese information processing research [J]. Library and Information Service, 2017, 61(12): 43-49.
[2] Wang Jun. From humanities computing to visualization: 梳理 the development 脉络 of digital humanities [J]. Journal of Library Science in China, 2018,

44(5): 87-103.
[3] Huang Shuiqing. Humanities computing and digital humanities: concepts, issues, paradigms, and key links [J]. Library and Information Service, 2019, 63(11): 15-24.
[4] Chen CM, Chang C. A Chinese ancient book digital humanities research platform to support digital humanities research [J]. The Electronic Library, 2019, 37(2): 314-336.
[5] Ouyang Jian, Peng Songlin, Li Zhen. Organization and reconstruction of library humanistic data under the digital humanities background [J]. Library and Information Service, 2019, 63(11): 15-24.
[6] Yao Tianhong, Chen Yanmei, Liu Ge, et al. Knowledge organization of digital humanities historical materials based on CIDOC-CRM [J]. Library Science Journal, 2019, 41(7): 35-43.
[7] Liu CL, Mazanec TJ, Tharsen JR. Exploring Chinese poetry with digital assistance: examples from linguistic, literary, and historical viewpoints [J]. Journal of Chinese Literature and Culture, 2018, 5(2): 276-321.
[8] Yan Chengxi, Wang Jun. Digital humanities perspective: visualization research on Song dynasty political networks based on semiotic analysis [J]. Journal of Library Science in China, 2018, 44(5): 87-103.
[9] Li Xueqin. Archaeological discoveries and the ancient surname system [J]. Archaeology, 1987(3): 253-257.
[10] Li Xueqin. Several issues concerning pre-Qin personal names [J]. Historical Research, 1991(5): 106-114.
[11] Wang Jinglong. On Qi-Lu marriage alliances during the Spring and Autumn period [J]. Guanzi Journal, 1993(1): 53-58.
[12] Zhang Xin. Research on Qi's foreign policy during the Spring and Autumn period [D]. Jinan: Shandong Normal University, 2017.
[13] Han Tongfei. Research on Lu's foreign relations during the Spring and Autumn period [D]. Jilin: Jilin University, 2008.
[14] Jia Feifei. Research on Jin's foreign relations during the Spring and Autumn period [D]. Wuhan: Central China Normal University, 2015.
[15] Liu Li. Research on political marriage among Zhou feudal states over the past century [J]. Trends of Research on Chinese History, 2017(5): 12-19.
[16] Yu Wanhai. Research on hegemonic political marriage during the Spring and Autumn period [D]. Xinxiang: Henan Normal University, 2015.

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Humanities Computing on Women in Spring and Autumn Annals and

the Three Commentaries

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Abstract: [Purpose/Significance] The study of digital humanities in ancient Chinese classics based on the digitalization and intelligent processing of classical texts shows a promising future because quantitative analysis methods provide new perspectives for traditional research questions. [Method/Process] This study is based on the data of the Spring and Autumn Annals and the Three Commentaries. With the annotation of knowledge on women in the books, the study provides quantitative analysis based on names, states, and other important knowledge about ancient Chinese women. This study also conveys marriages between countries based on the annotated data, deeply measuring the importance in diplomacy. [Result/Conclusion] The study gives a new interpretation of the female characters in the books, proposes a measurable and visualizable research method which provides reliable data verification for relevant researches. The methods in this study will provide reliable data for related traditional studies.

Keywords: ancient Chinese digital humanities; women; Spring and Autumn Annals and the Three Commentaries; digital humanities

Note: Figure translations are in progress. See original paper for figures.