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Taosi: An archaeological example of urbanization as a political center in prehistoric China

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ABSTRACT

According to Chinese historical texts such as Zuo Zhan (770-475 BCE) and Shuo Wen (206 BCE-8 CE), the term cheng for city could mean a town or a capital. The capital had shrines containing the ancestral plaques, but the town had no such shrines. Generally, a prehistoric city may be considered as a political, economic, ceremonial, military and cultural center in a given region. Cities are characterized by a high level of complexity in settlement patterns, social organizations, population components, as well as life styles. I argue that prehistoric cities in the Middle Yellow River functioned primarily as political, ceremonial, and military centers, rather than economic centers, of monarchic states. Therefore, they can be considered as the capitals of monarchic states.

This paper investigates the rise and fall of the Neolithic state and its urban center at Taosi (2300–1900 BCE) in southern Shansi province, China. Taosi was enclosed with a huge rammed-earth enclosure, covering an area over 200 ha. Archaeological excavations in the past three decades have revealed a palace enclosure, elite residential area, royal cemeteries, ceremonial centers, craft production districts, an exclusive storage area, and a commoners' dwelling area. Taosi provides a good example of urbanization as a political center in the Central Plain of prehistoric China. The state was conquered during the Late phase at Taosi. The monumental constructions such as the palace enclosure, palaces, enceinte, and altar were almost razed. The royal tombs were thoroughly destroyed. I consider such violent behavior as political retaliation. From then on, Taosi ceased to be the capital. My discussion in this paper will focus on such aspects as urban structure, cosmological configurations in urban design, and characteristics of the early state's capital.

1. Brief theoretical discussion

“City” is translated into Chinese as cheng shi 城市. However, in ancient Chinese vocabulary, cheng and shi were not combined as one word to describe a city. They were frequently used separately. The Shuo Wen written by Xu Shun during the Han dynasty (206 BCE–8 CE), explained that cheng meant containing people; while shi referred to a place for trade (namely the market) with an enclosure. But in the Book of Songs (Shi Jing), believed to be completed during the Spring and Autumn period (770–475 BCE), the Huang yi 皇矣 (The Rise of the Zhou) section said, “yi fa chong yong 伐崇墉”, meaning “destroyed cheng 城 state wall” (Xu, 1994: 275), and Zheng Xuan of the Han dynasty provided more explanation about yong 隍 as cheng. Indeed, Xu Shun, in his great book Shuo Wen, explained that yong meant the wall of cheng (enclosure). One can realize that in Chinese historic texts, the term cheng ambiguously was referred to as a fortified enclosure to contain a population.

On the other hand, there is a Chinese word yi 邑 describing urbanized settlements, both as towns and capitals of a given state. But the meaning of yi in early texts also is unclear. According to the record of the 28th Year of Duke Zhuang in the Zuo Zhan, the Annals of the Spring and Autumn period (ca. 770–475 BCE), yi was referred to as capital or town, and the capital contained ancestral shrines, while the town did not. The text in the Shuo Wen agrees about the concept of capital with the Zuo Zhan, but argues that yi meant guo 国, meaning the capital. Lin (1998: 85–99) a Chinese paleographer, pointed out that actually only yi as a capital could be understood as guo. But other paleographers argued that each yi settlement was merely encircled with a moat rather than an enclosure (Feng, 2008: 273–290).

Given the above interpretations regarding cheng, shi, or yi, none of these terms is immediately appropriate to indicate a city or urban area. Consequently, the characteristics of cheng or yi in historical literature cannot be used to infer prehistoric urban areas on the basis of archaeological features. Even if one can archaeologically denote a moat settlement as yi, and a walled-town as cheng, the terms still do not help us clarify the nature of urban areas. Clearly, it is necessary to apply anthropological and archaeological criteria about cities to better understand prehistoric urban areas in China.

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Gordon Childe (1936) argued that the Urban Revolution meant the emergence of the city could be identified according to a series of criteria. One of the crucial indicators was the development of metalurgy which would have helped create a new class of full-time specialists and caused changes in social organization. Saggs considered the city as a heavily populated settlement supported by a complex economy, composed of public buildings and fortified with walls (Saggs, 1989: 114). However, the definition of “city” varies and seems to indicate diverse processes of urbanization (Fagan, 1992: 419–420; Norwich, 2014: 6–13). Archaeologically, Fisher and Creekmore stress that ancient cities can be analyzed as urban areas (Fisher and Creekmore, 2014: 1–31). On the other hand, Adams (1966) argued that the city resulted from the expansion of social classes and a political institution, namely, the development of early state society. Grinin declared that the early state could adopt two different forms: monarchic and democratic (Grinin, 2004: 425).

As for Chinese archaeological data, an urban center can only be identified by analysis of community and regional settlement patterns, with respect to both urban space and change in social organization. In addition, one must realize the distinctions between different modes of polities, monarchic and democratic. Most scholars are convinced that the principle mode of polities in the Middle Yellow River Valley before the Qin Dynasty (before 220 BCE), could be referred to as monarchic 君主专制 (Shen and Zhang, 2009: 126; Xie, 1995: 474; Wang et al., 1997: 335–545; Li, 2011a: 43–53). Following this interpretation, I argue that prehistoric cities as part of monarchic states in the Middle Yellow River Valley functioned primarily as political, ceremonial, and military centers, and secondarily as economic centers manipulated by the monarch. Prominently, such cities could be considered as the capitals of the monarchic states. I believe that other examples of early monarchic states are Wangchenggang in Dengfeng and Guanchengzai in Xinxi, Henan Province, both approximately contemporary to the Taosi site. There were rammed-earth enclosures protecting a number of rammed-earth foundations. At Guanchengzai, a huge rammed-earth platform (F1–F4) in a relatively complex structure was found, considered as a small palace by some scholars. Apart from a great quantity of pottery and many sacrificial pits from Wangchenggang, one fragment of a bronze vessel considered a gui 鼎 tripod pitcher was unearthed. Some scholars believe that the Wangchenggang walled site might have been the capital of Yu, the founding king of the Xia dynasty (Zhao, 2013: 245–246).

With respect to internal settlement pattern, the function of the monarchic capital can be identified by a number of principle features. Generally, the palace enclosure, palaces, enceinte (outer enclosure) and royal cemeteries functioned as physical indicators of political power and social hierarchy. The ceremonial centers symbolized the tremendous power of religion. The special craft production district and exclusive storage district indicated the administration of the economy (He, 2009b: 3–58). Actually, for the distinct districts described above, the political, administrative, ritual, and economic functions tended to overlap.

From the perspective of regional settlement pattern for the wider urban area, the monarchic capital seems to have exhibited an array of essential attributes, such as the capital being surrounded by subsidiary settlement clusters and supported with special sites for extracting resources. In addition, it appears the planning of the capital was designed according to indigenous cosmology to attain permanent stabilization and dynamic harmony.

Below I aim to show how archaeological evidence from Taosi indicates the settlement is a good example of a monarchic capital.

2. Internal settlement pattern of Taosi

The Taosi site, covering an area over 300 ha, is located 7 km northeast of the Xiangfen county seat, in southern Shanxi province. From 1978 to 1985, the Institute of Archaeology of CASS excavated Taosi, trying to find the early capital of the Xia dynasty. Based on one kind of statement in historical documents, southern Shanxi was called the Ruin of Xia, leading scholars to believe it had served as the capital of the Xia dynasty (Shanxi Team and Linfen, 1980, 1983, 1986). One of the outcomes of those excavations is the chronology of the Taosi culture, which can be divided into three periods according to radiocarbon dates and ceramic typology. The dates of the Taosi culture are as follows: the Early period (ca. 2300–2100 BCE), the Middle period (ca. 2100–2000 BCE), and the Late period (ca. 2000–1900 BCE).

Fieldwork for over 37 years at Taosi (primarily 1978–2015) has been conducted to explore the settlement pattern at more than one spatial scale and the role of Taosi as a regional center. Taosi began to function as capital of the Taosi state in the Early period, reached its peak of development in the Middle period, and ceased to be the capital in the Late period (He, 2013a: 255–277).

2.1. The Taosi urban settlement of the Early period

During the Early period the Taosi state authorities organized construction of the palace precinct, moat, royal cemetery, an area with an altar for the earth in the north, a residential area for commoners, and an exclusive storage area. These projects seem to have been accomplished within a relatively short period of time. At first, the palace precinct at Taosi was merely enclosed with a dry moat for defense, rectangular in shape, covering an area nearly 13 ha, oriented exactly southeast (Shanxi Team et al., 2015b: 64–66). Later on, in the latter part of the Early period, the moat circling the palace area was gradually filled up with rammed-earth and the wall was built up, connecting with the outer enclosure protecting the lower elite residential district. Then the palace enclosure was constructed, combined with the outer enclosure to form the core part of the urban settlement in a “凹” shape (Fig. 1), nearly 20 ha in area. Beyond both sides of the palace enclosure, commoners’ residential areas were settled.

Within the palace enclosure, we have recovered one corner of what we believe was an underground ice storage house (IFJT2) from the Early period, underlying the rammed-earth foundation of a monumental building (IFJT3) of the Middle period. The IFJT2 feature is a trench rectangular in shape, 30 m long, 20 m wide, and 9 m deep. It is structured with a rectangular pit in the center of the trench, connecting to the southern entrance on the ground with a zigzag-shaped ramp constructed with rammed-earth. In the southern edge of the central pit, two post holes were recovered, indicating that there was a trestle across the central pit. Several layers of silt sediments were found at the base of the central pit. A number of fragments of dry mud with plant temper from the fill in the trench resulting from destruction of the feature suggest that the pit might have been roofed with dry mud. The roofed, nine meter deep structure suggests a unique building aimed to keep a low temperature and involving the use of ice. The silt sediments at the foundation of the central pit could have resulted from the melting of ice. And the trestle might have served for accessing stored ice cubes. Indeed, the chapter “ Yue Ling” in the Li Ji (Book of Ritual), believed to be finished in the Eastern Zhou period (770–221 BCE), mentioned that in the last winter month people got ice from frozen rivers. The poem “Life of Peasants” in the Shijing (the Book of Songs) recorded the practice of cutting ice and storing it in 里 in the ice house, or ice houses, in order to keep sacrificial lamb fresh (Xu, 1994: 155). Such a historical record was archaeologically demonstrated by the discovery of an ice house at the Yongcheng Capital of the Qin State dating to the Spring and Autumn period (770 to 475 BCE) (Yongcheng, 1978: 43–47). The same archaeological feature was unearthed within the palace district of the Zheng Han Old City Site (the capital of the Zheng State of the Warring States period (475 to 221 BCE), considered as an underground structure for freezing food (Henan, 1991: 1–15, 112). Enlightened by such historical records and related archaeological discoveries, I postulated that IFJT2 might have served as an ice storage house during the Early Taosi period. The ice house was constructed to serve the palace in order to keep food...
fresh and freeze the corpses of elites as recorded in “Yue Ling” of the Li Ji, and in the chapter “Ling Ren” (Ice Man) of the Zhou Li (Rites of the Zhou), written during the Eastern Zhou period.

The exclusive storage zone is located east of the eastern commoner residential district (Fig. 1), covering an area over 1000 m², isolated by a buffer zone. The entrance to the storage pits might have had guard stands. The huge storage pits range 5–10 m in diameter, and 4–5 m deep. Such an exclusive storage zone might have been controlled by the monarch, because it does not seem to be associated with any individual household. If these pits were for grain storage, the Taosi elites must have collected taxes in the form of grain from the population living in the surrounding regions.

The royal cemetery of the Early period is located southeast of the palace enclosure, covering an area nearly 4 ha, containing over 10,000 burials dating from the Early to the Late period. The area ceased to be used as a cemetery exclusively for the royal family during the Middle and Late periods. Archaeologists have excavated 1379 burials from this cemetery. Among them, six Early period monarchic tombs were discovered, producing burial goods symbolizing royal identities, including a ceramic tray painted with a dragon design, a ceramic drum, a wooden drum covered with alligator skin, a big chime stone, jade axes, colorful wooden vessels, along with pottery vessel forms probably used for daily life including ding 鼎 tripods, jia 饕 tripods, dou 豆 dishes, ovens, jars, urns, vases, and cups (Archaeology Institute and Linfen, 2015 II: 391–530). The number of artifacts from each tomb ranges from 100 to 200. There are 30 elite tombs about 2.5 m. long, and 2 m. wide, each containing 20 to 40 funeral artifacts, similar to the assemblage of the monarchic tombs except for the presence of a tray with a dragon design, a wooden drum and a chime stone. There are 178 graves, each associated with several pottery and jade ornaments, estimated as constructed for individuals of lower elite status as well as for some people who attained special status through acquisition of wealth. A total of 556 small graves contained nothing except for a few ornaments (Archaeology Institute and Linfen, 2015 II: 531–533). They are believed to be the burials of commoners.

Over 1 km northwest of the palace enclosure, there is an earthen square feature which I believe was an altar. Since it was surrounded by a waterlogged environment, it might have functioned as an earth altar (Shanxi Team et al., 2013: 60–63; He, 2013b: 19–37).

Bounded by the royal cemetery, the earth altar, the Zhongliangou Gully, and the Nanhe Stream, the entire settlement of the Early period occupies an area about 160 ha (Fig. 1), being big enough to be a primary urban settlement in the Middle Yellow River valley at that time. Given what appears to be evidence for functional planning of sections of Taosi during the later phase of the Early period, the Taosi site was probably the first urban center with features of cities in later historical periods that developed in the Yellow River valley (Fig. 1).

2.2. The Middle period urban settlement

During the Middle period, the palace enclosure, storage zone, and the earth altar (Shanxi Team et al., 2013: 60) continued to be used, but the urban settlement organization of Taosi was modified a great deal (Fig. 2). The previous outer enclosure for the residences of lower elites was abandoned. The huge enceinte was constructed, in turn to complete an institutional mode of double enclosures for the capital—the palace enclosure and the enceinte, common features for Chinese capitals during the early Bronze Age. The entire urban settlement of the Middle period extended to over 280 ha, composed of a southeastern outer enclosure for a “spiritual precinct”, southern corner enclosure for craft production, and commoners’ residential district occupying the northwestern portion, except for the palace enclosure (He, 2009b; He,
So far it is still uncertain why the enclosures at Taosi, both the palace enclosure and the enceinte, had rectangular shapes oriented in non-cardinal directions (Fig. 2). One possibility was that the Nanhe Stream naturally extended from southeast to northwest, offsetting in 45°, in turn to guide the entire Taosi enclosure to be constructed in the non-cardinal rectangular shape. But Wu (2015) argued that such an offset might have resulted from the central axis of the Taosi city that was different from the guide line of the celestial pole (true north) for the city. He believes that the axis was determined by preparation of an observatory on the top of the inner eastern enclosure of the Middle period enceinte, aligned exactly to the southeast, focusing on the sunrise position at the Winter Solstice (Wu, 2015: 149–153). In contrast to Taosi, contemporary small-sized walled towns (from ca. 2100–2000 BCE) scattered in Henan Province (Wei, 2010) of the Central Plain almost took a cardinal square or rectangular shape, aligned exactly north (Xu, 2014:44–51, 61–70). It seems that the central axes of such 11 walled-towns in Henan province were integrated into the guide lines of a celestial pole.

The cardinal square style of the enclosure affected the orientation and outline of the Erlitou urban settlement in Henan which is considered by many scholars to be the last capital of the Xia dynasty (1750–1500 BCE). The orientations of palaces and the palace enclosure at Erlitou range from 352° to 357° (magnetic azimuth degrees), rather close to magnetic north. Du Jinpeng postulated that such offsets might be the result of use of a compass (Du, 2007: 141–143). In contrast to this, the offsets of enclosures and palaces from the Shang dynasty (1600–1046 BCE) range from 8° to 15° (magnetic azimuth degrees). Du Jinpeng believes this represents the offset outcome of the direction determined by a sundial (Du, 2007: 145–146). This seems to be the same technique called “zheng zhao xi fa 正朝夕法” as recorded in the Eastern Zhou document Kao Gong Ji section of the Zhou Li.

Nonetheless, it is still hard to identify concrete reasons for the construction of the palace enclosures and outer enclosures in non-cardinal directions at prehistoric and protohistoric sites in China. But what seems certain is that the cardinal rectangular shape and integrated guide line of the celestial pole and central axis of the capitals formed the mainstream of capital planning during the early Bronze Age in China (Liu, 2016: 954–971).

2.2.1. The monumental building IFJT3
So far we have detected a dozen rammed-earth foundations of constructions inside the palace enclosure by means of probing. It is hard to identify the precise date for each foundation. But we have identified the largest monumental foundation of the Middle period enceinte, aligned exactly to the southeast, focusing on the sunrise position at the Winter Solstice (Wu, 2015: 149–153). In contrast to Taosi, contemporary small-sized walled towns (from ca. 2100–2000 BCE) scattered in Henan Province (Wei, 2010) of the Central Plain almost took a cardinal square or rectangular shape, aligned exactly north (Xu, 2014: 44–51, 61–70). It seems that the central axes of such 11 walled-towns in Henan province were integrated into the guide lines of a celestial pole.

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2.2.1. The monumental building IFJT3
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During excavation of the foundation of the palace, we also recovered some artifacts relating to royal life. I estimated that one kind of ceramic plaque might have functioned as tiles covering the roofs of palaces, which would indicate the earliest examples of roof tiles in
China (Shanxi Team et al., 2005a; He, 2006: 265–276; Li et al., 2007: 87–90). In addition, jade objects, trace of a red textile impressed in clay, pieces of lime plaster engraved in geometric patterns or painted with blue pigment (azurite), and a ceramic basin handle shaped like the head of an owl, were found in pits cutting into the foundation of IFJT3.

2.2.2. The monarchic mausoleum of the Middle period

In 2002, we excavated a magnificent tomb in the small enclosure of the Middle period estimated as a divine precinct containing a royal cemetery and an observatory-altar (Fig. 2).

The monarchic mausoleum IIM22 is located at the southern end of the royal cemetery, relatively separate from the area for graves of commoners within the same cemetery. Although it was badly destroyed in the Late Taosi period, it still clearly shows certain characteristics of a supreme monarchic mausoleum, being huge in size and containing 78 surviving grave goods, such as elegant jade objects and painted ceramics, as well as fabulously lacquered vessels (He, 2013a: 266–267; Shanxi Team of Archaeology Institute of CASS et al., 2003: 3–6).

On the eastern wall of the chamber of IIM22 was a boar mandible with broken tusks combined with three handled jade axes on both sides. The document Da Chiu in the Zhou Yi (Changes of Zhou, likely composed by the Eastern Zhou period), explained that broken tusks of boar are beneficial for the military (Fen shi zhi ya, ji 豕箸之牙，吉). The document Zhao Li in the Zhou Yi, which was discovered from the Mawangdui tomb dating to early days of the Western Han dynasty (ca. 179–157 BCE), detailed the same concept as follows.

Broken tusks of boar symbolize that kings should try to avoid frequently using troops equipped with weapons that they controlled. Moreover, the record discussed above includes a reference to “smiling to the enemy at first and then fighting with it”, which also means that a strategy of states was to avoid actually using the military when possible – in other words, overwhelming the enemy by displaying weapons and military power (Ding, 2002: 374).

The assemblage of a boar’s jaw and jade axes from IIM22 at Taosi might have illustrated the optimal concept of defeating the enemy by exhibiting military power instead of bloody warfare (Luo, 2004). Each jade axe on both sides of the boar’s mandible had dull edges indicating lack of use in warfare and instead, a ritual function. As scholars have argued that ritual axes were symbols of military power and the throne center involving beliefs about sun, fire, and heat. These would have been characterized as Yang (positive energy), that could only be overwhelmed and frustrated by Yin (negative energy) — by water in particular. A construction with a similar function was located in the southern suburb of the Capital of Luoyang from the Eastern Han to the Western Jin Dynasty (25–316 CE), named as Ling Tai (灵台, Spiritual Platform), and believed to be a foundation for astronomical equipment (Luoyang Team, 1978: 54–60).

It is worth noting that pit IH24 was a pond dug in the Late Taosi period (ca. 2000–1900 BCE) in an effort to eliminate the divine functional part of the observatory dedicated to greeting significant sunrises from what we call the Sunrise Greeting Gate (Gap E11) (Fig. 3), by means of pouring water in it. According to a traditional Chinese concept, such a celestial altar was probably considered a ceremonial center involving beliefs about sun, fire, and heat. Such beliefs have been characterized as Yang (positive energy), that could only be overwhelmed and frustrated by Yin (negative energy) — by water in particular. A construction with a similar function was located in the southern suburb of the Capital of Luoyang from the Eastern Han to the Western Jin Dynasty (25–316 CE), named as Ling Tai (灵台, Spiritual Platform), and believed to be a foundation for astronomical equipment (Luoyang Team, 1978: 54–60).

Another site with a similar function called Huan Qiu (圜丘 Circle Altar) was constructed in the Sui dynasty (581–618 CE), located in the southern part outside the Mingde Gate of the capital Chang’an (Tangcheng Team, 2000), and served as the royal temple of Heaven until the Tang dynasty (618–907 CE). Some scholars estimated that special construction of the Northern Gate of the inner enclosure at Shangdu (Upper Capital) of the Yuan dynasty, could have worked as a royal observatory dating to as early as 1260 (Lu and Li, 1981: 80–89). Later on, another royal observatory was constructed in Dadu (Primary Capital, present Beijing) during the Yuan dynasty in 1279, attached to the eastern enclosure of the city (Chen, 2003: 532–534). In 1442, the observatory was moved to the southeastern corner of the Dadu Enclosure, still standing today. Therefore it seems that an observatory or celestial altar was a necessary construction for a state capital, since the capital of China (Shanxi Team et al., 2004, 2005b, 2007). The entire structure consists of the arc-shaped path and the platform (Shanxi Team et al., 2004, 2005b, 2007).
2.2.5. Executive craft production district

According to Renfrew, “the increased importance of craft specialists is another indicator of a centralized society that can be identified archaeologically. Full-time craft specialists leave well-defined traces, because each craft has its own particular technology and is generally practiced in a different location within the urban area (Renfrew and Paul, 1991: 193).”

Indeed, the entire production area occupies approximately 15 ha in the southern enceinte in the Middle period (Fig. 2). In 2008, an archaeological survey focusing on lithic production at Taosi was carried out by Dr. Zhai Shaodong (Zhai, 2012; Zhai et al., 2013: 1–26; Liu et al., 2013: 278–287). From 2010 to 2013, by means of extensive probing (coring) and small-scale archaeological excavation, we identified two ceramic and three lithic production sub-zones composed of high-ranking buildings, workshops, and related dwellings (Shanxi Team et al., 2011: 46–57). It seems that the production district might have been enclosed by a moat and wall and also that it was divided into separate zones for different types of crafts. It is remarkable that each craft zone has a rammed-earth foundation that we interpret as high-ranking buildings.

The most significant construction in the craft production district of the Middle period is the rammed-earth foundation IIIFJT2 (Shanxi Team et al., 2015a: 30–39). This construction stands on top of the slope of the whole production district, overlooking the entire area. It is in a plan shaped like 回 (Fig. 4), with an open area like a plaza in the center, totally covering an area about 1300 m². I expect that the huge foundation originally contained a main building, central courtyard, corridors on both sides, and a front gateway. We have not found any contemporary features on this foundation indicating craft production such as kilns or pits containing lithic debris. This indicates that IIIFJT2 functioned not as a workshop, but probably as an administrative office.

It appears that craft production at Taosi was managed by a bureaucracy assigned by the monarch, a practice adopted later by most Chinese dynasties. For instance, the turquoise craft district and bronze casting site were situated beside the palace enclosure at the Erlitou site, which is believed to have been the capital of the late Xia dynasty (1750–1550 BCE). It has been suggested that most craft districts recovered at Chang’an, capital of the Han dynasty, were managed by official agencies (Liu, 2016: 582–583).

In addition, the craft production district for lithics and ceramics was deliberately placed in the southeastern corner of the urban area, located over 1000 m away from the Palace Enclosure. Poor craftsmen had been driven far away from the Palace Enclosure, a result of monarchic privilege by means of spatial manipulation.

2.3. Collapse and chaos during the Late period

The Taosi State may have been conquered during the Late period,
indicated by archaeological evidence for destruction of palaces and large burials and violence against humans. Archaeological evidence also indicates that the Palace Enclosure, palace buildings, and the Earth Altar were later reconstructed, perhaps due to political restoration of the local throne at Taosi. However, during the remaining part of the Late period, the society at Taosi was seriously declining, and must have ceased to be the capital (He, 2015b: 158–171). Such astonishing violent behavior leads me to postulate that political retaliation by its enemies swept Taosi during the Late period (He, 2015a: 234–261).

3. Intellectual culture serving the capital of Taosi

Rapoport suggests that urban spaces can be studied from the perspective of high-level meanings including cosmologies, philosophy, and worldview; and also from mid-level meanings including identity, status, wealth, and power (Rapoport, 1988: 325, 1990). These are considered as aspects of cognition by Flannery and Marcus (Flannery and Marcus, 1998: 35–48), but I categorize them as elements of intellectual culture (He, 2015a: 60–63). I argue that intellectual culture absolutely contributed to reinforce royal identity and the throne by means of urban planning and ideology symbolized within tombs, architecture, and the use of objects such as jade axes and ceremonial music instruments.

3.1. Spatial symbolism of hierarchical status

One can easily recognize the remarkable phenomenon of residential hierarchy at Taosi based on the archaeological evidence. The most humble part of the population settled in cave dwellings with single rooms around 25 m² in size. The majority of commoners dwelled in semi-subterranean houses with a single room around 25 m² in size. Lower ranked elites inhabited houses built at ground level or semi-subterranean apartments with double rooms around 50 m² on a rammed-earth foundation. The monarchs resided in palaces built on
platforms with thick rammed-earth foundations on a scale of several thousand square meters. These differences indicate that Taosi inhabi-
tants symbolized their social ranks in part through residential space-
——from the lowest social stratum living in cave and semi-subterranean
dwellings, to the monarch in palaces at the highest elevation.

Moreover, the dwellings of different social ranks were placed in dif-
ferent residential areas. Monarchs occupied the Palace Enclosure
nearly 14 ha in area (Fig. 1), filled with a dozen rammed-earth
platforms far away from the wastes of craft production, and few
garbage dumps are present. This area appears to have been well
maintained to keep the environment clean. The lower ranked elites
were kept 300–500 m away from the Palace Enclosure, concentrated
in an outer enclosure nearly 6 ha in area (Fig. 1). Their dwellings
were surrounded by trash dumps. The environment of this district appeared
relatively dirty (Shanxi Team et al., 2005a). The commoners were
driven nearly 1 km away from the Palace Enclosure (Fig. 2). A great
number of semi-subterranean houses surrounded with trash dumps
and grain storage pits were contained in this district, revealing a relatively
disorganized picture.

In contrast to the royal cemeteries of Taosi composed of mauso-
leums, middle-sized tombs, and small graves, the Palace Enclosure only
includes houses built with rammed-earth foundations. This implies that
residential space at Taosi was established according to a principle of
social stratification. Such a spatial segregation for different social classes was more pronounced for the world of the living than the
afterlife.

3.2. Cosmological concepts guiding urban planning

The Taosi urban space may be interpreted from a cosmological per-
spective. The Zhuo Yi written on the silk manuscript discovered from
Tomb No. 3 at Mawangdui of the Western Han Dynasty (168 BCE) in
Changsha, contains the following statement about cosmology of urban
planning. “The positions of Heaven and Earth have been respectively
established, then the Mountain communicates with the Swamp, the Fire
confronts the Water, and the Wind fights with the Thunder” (Chen and
Liao, 1993: 430). In other words, there are eight natural deities
symbolizing eight directions or positions. The attributes of each deity
direction determine each functional space of the city. Therefore an
ideal urban planning adhered to beliefs that such a special cosmology
helps provide eternal stability to the city.

Based on the analysis of the Taosi settlement pattern, the urban
spatial layout might have been designed not only based on a traditional
cosmology, but also corresponding to the local topography (He, 2013b:
19–37).

The Altar of Heaven and the Observatory were located in the
southeast enclosure of the urban area, regarded as the divine position
dedicated to the celestial deities, including the sun, sky, stars, and
moon. Opposite to the divine position of Heaven, the northwest area
beyond the enceinte was occupied by the Earth Altar, implying the
divine location for the deities of Earth (Fig. 5).

The divine position for the Mountain was estimated as being located
exactly south of the enceinte because the foot of the mountain ended
exactly south of the enceinte of Taosi. On the opposite side, exactly
north of the enceinte, the divine position of what we call the Swamp,
due to its waterlogged environment, was located by means of archae-
ological coring and survey. Therefore we conclude that the Altar of
Earth, the square altar in the swamp, was deliberately constructed in
that area (Fig. 5).

On the back of the Palace Enclosure, at the northeast side of the
enceinte, the Nanhe Stream was what may be considered a divine
position of water or channel (Fig. 5). It was identified by geographers as
a small river which was part of the Taosi area landscape 4000 years
ago. Hence I believe the Palace Enclosure was set in this zone for the
purpose of establishing a wet environment in the palace areas for the
comfort of the elites. Furthermore, people living in this naturally arid
region of the loess plateau would have known the benefits of moisten-
ing even at a conceptual level, meaning the need to balance a chongyang
(over-positive) situation by tempering a few yin (negative compo-
ment) elements.

Accordingly, the southwest part of the urban area represented the
divine position of Fire, which was mainly occupied by the craft district
focusing on lithic manufacture and pottery production. Since fire was
necessary for ceramic production, the use of fire in craft production
might have involved some special, relevant cosmological beliefs.
However, we need more archaeological evidence in the future to
identify an altar of fire.

The area exactly east of the urban area was regarded as the divine
position of Di (the ancestral lord), where the royal cemeteries from the
Early and Middle periods were established. I suggest that the dead
monarchs were first buried in the royal cemetery, and then after their
spirits ascending to heaven, they transformed into the ancestral lords.
That is why both royal cemeteries from two periods were located close
to the Altar of Heaven (Fig. 5). According to the Zhou Yi, the position of
Di was also the position of Thunder. Situated exactly to the west of the
enceinte is a place that might be considered as the divine position of
Wind, as indicated in the Zhou Yi, an area devoted to craft production
(Fig. 5).

In addition, eight divine positions could be synthesized into four
quarters within the inner portion of the Taosi urban area. The northern
quarter was composed of the Swamp and Water sections to serve as the
Human Quarter (strictly for use by the monarch), represented by the
Palace Enclosure. Beyond the Palace Enclosure, there was an outer
enclosure protecting the residences of lower ranked elites during the
Early period (Shanxi Team et al., 2005a: 307–346). The eastern quarter
was the Spirit Quarter composed of the Thunder (or Ancestral Lord) and
the Heaven, which was used for royal cemeteries and the Altar of
Heaven. The southern one was the Craft Production Quarter composed
of the Mountain and the Fire, mainly devoted to crafts (Fig. 5). The
western one was the Agrarian Quarter composed of the Wind and the
Earth. The residents of this area were likely farmers, as hypothesized
from archaeological survey (He, 2013b: 19–37). The survey results
indicate that this quarter was occupied with small houses and larger
dump pits in high densities, suggesting a large residential population of
commoners. It is notable that residents in this quarter would have had
easy access to the flat land just beyond the western enceinte where
millet and rice phytoliths have been identified, suggesting that this area
was potentially used for agricultural fields (Yao et al., 2006: 19–26).

3.3. The concept of the Earth Center

A lacquered gnomon shadow template may indicate the concept of
the Earth Center. It was unearthed from the largest monarchic tomb
IIM22 of the Middle period, standing against the southeastern wall of
the chamber, with its preserved portion measuring 171.8 cm in length
(He, 2013a: 273). The complete size of the template is reconstructed as
187.5 cm in length, and it was painted with lacquer in alternate sections
dark and green in color, and bounded with pink strokes (Fig. 6). The
objects manifest the special characteristics of a gnomon shadow
template (He, 2009a: 261–276; He, 2011a: 278–287; Li and Sun,

In an alcove on the wall of the chamber in Tomb IIM22, located
beside the template, a lacquered tool-kit containing three devices for
gnomon shadow measurement was unearthed. The tool-kit includes a
jade cong tube as a nonius (Fig. 7–1), a jade qi axe with two holes as a
plumb bob (Fig. 7–2), and another jade qi axe with one hole as a
shadow definer (Fig. 7–3). According to the Kao Gong Ji discussed
above and our experimental testing on June 21, 2009, I realized that the
jade nonius was stacked on the template for chasing the movement of
the gnomon shadow (Fig. 7–4). The jade plumb bob would have been
held in one hand by a person to judge whether the standing gnomon
positioned ahead was vertical. The jade shadow definer was applied to
determine the precise position of the gnomon shadow on the template through the small hole.

I postulated that the wooden pole recovered from Tomb M2200 in the Early period Royal Cemetery at Taosi (Archaeology Institute and Linfen, 2015 II: 665) might also have worked as a gnomon (He, 2011a). This pole originally was 225 cm long (214 cm was preserved), painted with red pigment and with a sharp tip and flat top (Fig. 8).

What is the most striking is that Section 10 on the template in green color is abnormally interrupted by a pink stroke, described as Section 11 (Fig. 9). The length from Section 1 to Section 11 is 39.9 cm. According to my research, 1 chi in ancient China is equivalent to 25 cm (He, 2005), so the length of Section 11 is measured 1.596 chi, which is equivalent to the theoretical expectation for the summer solstice – 1.6 chi. This figure was recorded in the ancient text, Zhou Bi
Based on astronomical calculations and template testing observations at the Taosi Observatory on June 22, 2009, we determined that the end of Section 12 (42.3 cm in length, equivalent to 1.69 chi) could have served as a marker for the local summer Solstice over 4000 years ago (He, 2015a: 122–131). In other words, the length of the sundial shadow on the local Summer Solstice at Taosi is longer than 1.6 chi. The mark on the Taosi template of 1.6 chi (Section 11) was a figure similar to that recorded in the later text Zhou Bi Suan Jing. This means the mark on the Taosi template probably served as some kind of identification mark. Why did Taosi astronomers make such a mark that at first glance seems practically useless?

In comparison to the data for the summer solstice of 1.5 chi as recorded in the Zhou Li, believed to be the criterion for the Earth Center based on data obtained at Luoyang in Henan, the figure for the summer solstice of 1.6 chi recorded in the Zhou Bi Suan Jing text might have been considered as another indicator of the Earth Center. It is very interesting that the section “Tian Wen Zhi” (the Astronomical Record) in the Sui Shu (completed ca. 636–656 CE) says that Chengzhou (today’s Luoyang in Henan) was regarded as the Earth Center with its gnomon shadow of Summer Solstice of 1.6 chi. It is important to point out that the Sui Shu confused the data about the gnomon shadow of the Summer Solstice obtained in the southern Shanxi region with the data obtained in the Luoyang region. Luoyang has been considered as the Earth Center since the Xia dynasty by many Chinese people (Du, 2007: 131–133) until today. It is quite significant that Sui Shu considered the figure of 1.6 chi of the gnomon shadow on the Summer Solstice as the diagnostic criterion for the Earth Center, but it perpetuated the traditional concept of Luoyang as the Earth Center. This indicates that the figure of 1.6 chi for the gnomon shadow on the Summer Solstice had served as the criterion of the Earth Center, rather than the figure of 1.5 chi, although the Sui Shu text shows confusion about the locations for observing such two different sets of data as single place—Luoyang.

Traditionally in ancient China, the Earth Center was recognized as a divine precinct where the exclusive channel connects the center of the earth to the zenith point, and also as the residence of the Celestial Lord or Ancestral Lord (Wu, 2009: 22–24). Zhao Gao in Shang Shu (completed in 770–475 BCE) recorded that the King of Zhou came to Chengzhou (Luoyang) to establish a capital, and he communicated with the Celestial Lord, served the Lord, and controlled the society in the Earth Center in person (王来绍上帝，自服于土中). This passage indicates that the capital of a state should be established in the Earth Center so that the monarchs can monopolize the divine channel and obtain the divine powers authorized by the Celestial Lord or Ancestral Lord. These powers would enable the monarchs to manipulate orthodox authority. How to identify or indicate the Earth Center, however, was a real problem. The intellectuals in the Middle Yellow River Valley invented a marvelous strategy of gnomon shadow measurement on the Summer Solstice in a politically important, urban area, the capital of a state. They used knowledge of geography and astronomy to promulgate the length of the gnomon shadow as the physical criterion of the Earth Center. This method enabled the rulers to keep potential competitors away and established their orthodox authority.

The mark on Section 11 on the gnomon shadow template from Taosi with 1.6 chi length, clearly indicates that Taosi monarchs probably attempted to convince people in the region about the concept of the Earth Center. They used the small trick of gnomon shadow measurement on the diagnostic mark of the Earth Center, although the gnomon shadow of the Summer Solstice at Taosi was actually a little bit (2.4 cm or 0.09 chi) longer. The small trick of using a jade cong nonius 2.8 cm in length
Given this observation, my colleagues and I realized that the word Zhong Guo (meaning China) in archaic Chinese writing means “Central State” - zhong 中 means central and guo 国 means state. In other words, this word refers to the state and its capital established in the Earth Center which was identified by a gnomon shadow template according to the Summer Solstice criterion of 1.5 or 1.6 chi.

The distinct mark of 1.6 chi on the gnomon shadow template from Taosi could have been used to proclaim that Taosi was the Earth Center and that the state and capital represented the Central State (He, 2011b: 85–119).

4. Conclusion

Based on archaeological research at the Taosi urban site, one can recognize that this monarchical political capital was organized hierarchically with respect to internal settlement pattern and the regional settlement pattern (He, 2015a: 257–259). Furthermore, the hierarchical and centralized intellectual culture played a role in urban planning and orthodox authority of the kings.

As a political capital, the Taosi urban site first emerged with fortified construction around the palace zone, and later it included lower ranking elite residences to protect the entire ruling class. Afterward, the urban site developed into a double enclosure mode, composed of a palace enclosure and enceinte, which were features later adopted by most dynasties in historic China. Attempting to re-enforce political power, orthodox authority, and eternal stabilization of the urban area, the capital was planned according to a cosmological system comprised of eight divine elements, including heaven, earth, mountain, swamp, fire, water, wind, and thunder. Each element occupied a certain direction with respectively determined attributes of each position. Eventually eight positions were integrated into four quarters referred to as Human (Monarch), Spirit, Crafts, and Agrarian based on their attributes relating to the secular world. At least by the Eastern Zhou Dynasty such eight divine elements were theorized as Ba Gua, Eight Diagrams, and transformed respectively into Qian 乾 (Heaven), Kun 坤 (Earth), Gen 艮 (Mountain), Dui 兑 (Swamp), Li 离 (Fire), Kan 坎 (Water), Xun 震 (Wind), and Zhen 震 (Thunder), as recorded in the Zhou Yi.

As the political city, the capital was prominently positioned by gnomon shadow measurement according to the criterion of the Earth Center on the Summer Solstice, and it appears the kings attempted to adhere to such a criterion in order to legitimize their thrones.

Astronomy and calendar making were crucial for re-enforcing soft political power and political legitimacy. Thus the Taosi Observatory combined with the celestial altar, calendar making, and the gnomon and shadow template, all played a critical role in the management of later historical political capitals. It is striking that astronomy and astronomical equipment were taken very seriously by later historic kings and emperors. The relevant bureaucracy and construction activities became essential elements of later dynastic capitals.

The non-cardinal, rectangular shape of 45° offset at Taosi indicates that the initial strategy of capital planning was confused with multiple guide lines and a central axis. The central axis of Taosi was likely determined by the alignment to sunrise on the local Winter Solstice, a practice which was abandoned in later dynasties.

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