ARCHAIC CHINESE GEOMANCY AND GRECO-ROMAN URBANIST THOUGHT: TOWARDS A CROSS-CULTURAL HISTORY OF URBAN DESIGN

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Abstract

Present-day concerns with urban design for pedestrians largely surround the issue of microclimate in streetscapes. Such concerns are not new and have been extensively discussed during the European Renaissance. Western historical references on urban design and microclimate primarily converge on a single source: the octagonal, radial-centric plan of an ideal city in Book I of the *Ten Books of Architecture* written in the late first century BCE by Marcus Vitruvius Polio. As his own source, Vitruvius pointed to the Tower of the Winds in Athens, designed c. 50 BCE by Andronicus of Cyrrhus on an octagonal plan, respectful of eight wind directions. The proposition made is that the octagonal *Bagua* 八卦 geomantic map made its way from Chang'an in China to Cyrrhus in western Asia during the first century BCE and was possibly one of two sources that stirred Andronicus toward his design of the tower, the other source being the Pharos Lighthouse in Alexandria. The *Bagua* guided the ideal city plan of Han China, while the octagon, through Vitruvius, inspired several city plans in Renaissance and Baroque Europe. Beyond the rainbow of multiple impacts on Roman urbanism from neighboring civilizations, the ancient Chinese ideal city plan through the intermediary of the *Bagua*, may also have played a role in Vitruvius's own ideal city, by way of the Tower of the Winds. The environmental message of the *Bagua*, thus, has possibly carried an indirect impact upon Renaissance and Baroque urbanism, and upon urbanist concerns lasting to this day.

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1. Introduction

1.1 Research Problem

The notion of the ideal city has been central to the early history of urban planning. It has been commonplace to identify as a major urban planning source the ideal city introduced by Marcus Vitruvius Polio in his book *De Architectura*, written over the period 30-20 BCE (Vitruvius, 30-20 BCE/1960). For example, in Book I, he gives detailed accounts of the choice of a city site, the layout of alleys and streets, and the choice of public building sites, in Chapter IV, VI, and VII, respectively. In articulating his ideal city in Chapter 6, Book I, Vitruvius, in turn, points to the Tower of the Winds in Athens as his inspiration and conceptual source. Yet, there has been no research done on the possible sources for the design of the Tower of the Winds. Thus, a question that ought to be asked is: Were there any early sources in the design and construction of the Tower of the Winds that might have then also indirectly constituted an impact upon Vitruvius' ideal city?

The octagonal design of the Tower is attributed to Andronicus of Cyrrhus (fl late 2nd century BC– mid-1st), a city in Western Asia, lying on the Silk Road from China to south-eastern Europe (Lyttleton, 2003). The plan of the Tower of the Winds has a conspicuous resemblance to what is known as the *Bagua* Map 八卦图, an octagonal representation of a spiritual concept used in ancient Chinese geomancy. Wind directions and wind energy play a significant role in the *Bagua* Map. Since the Silk Road was an established trading route (c. the 2nd century BCE) between China, Central Asia, the Near East, and south-eastern Europe and the Tower of the Winds was built c. 50 BCE, the Historical Hypothesis put forward is that the *Bagua* Map made its way from China to Cyrrhus through the Silk Road, and Andronicus himself was inspired by the Chinese geomancy of the *Bagua* in designing his tower.

1.2 Research Purpose and Objectives

The major objective of this thesis is to formulate a conjecture regarding the impact of the Chinese geomancy system upon early European urban planning. The purpose is to show that the *Bagua* Map, as the source of Andronicus' Tower of Winds, is the likely first link in the chain that had ultimately led to early modern urban design, inspired by the Vitruvian ideal city. Whereas modern urban design, based upon the priority of the automobile, has often underemphasized wind tunnels and wind directions in streetscapes, the Vitruvian ideal city, Andronicus' Tower of the Winds, and the *Bagua* Map, all point to the significance of wind currents and directions. Reintroducing this archaic concern into urban design might be perhaps one of the main challenges in the planning of pedestrian-friendly urban streetscapes today.

Objective:

- To articulate the likely connection between the *Bagua* Map and the Tower of the Winds by Andronicus of Cyrrhus.
- To show the connection between the *Bagua* and Vitruvian ideal city by pointing to the Silk Road as the medium of transport of ideas to Europe of late Antiquity.
- Outline the significance of the *Bagua*, the Tower of the Winds, and the Vitruvian ideal city in considerations of pedestrian movement in our cities.

2. Literature Review

The prevailing opinion holds that the western notion of an ideal city is inextricably bound with the urban planning narrative in Book I of *De architectura* by Marcus Vitruvius Polio, the Roman architect and engineer of the first century CE. The Vitruvian ideal city, in turn, is linked, on Vitruvius' own testimony, with the Tower of the Winds at Athens, c.50 BCE. The following literature review will begin, first, with the definition of the ideal city and then distinguish it with another influential notion in the history of urban planning, the utopian city.

Second, some previous research conducted on the Tower of the Winds will be reviewed. There were few papers studying the Tower, and none exploring its source of antiquity. This suggests the need for further research into the architectural, cultural, and urbanist origins of the Tower of the Winds. As the present study suggests, these origins appear to be in Han China, stemming from the geomantic practice of *Feng Shui* 风水, and the related concept of the *Bagua.*

Third, the basic knowledge of ancient Chinese geomancy, Feng Shui, will be introduced, and the relation between the *Bagua* and the Chinese religion Daoism will be briefly reviewed. In the view of the present study, the notions of the *Bagua* and possibly some of the *Feng Shui* practices were channeled to western Asia and then to the eastern Mediterranean region. The literature review thus will address some of the main routes and cities on the Silk Road, and their significance in the possible transfer of cultural and religious notions from Han China to the Greco-Roman civilization.

Contemporary, as well as twentieth century's urban planning for pedestrians, has demonstrated a lack of focus on prehistoric street design, particularly in winter cities in ancient China and Europe. In its last section, the literature review will focus on existing research addressing features of archaic or ancient urban planning relevant for street design favoring pedestrian movement.

2.1 The Ideal City

Among the most striking features of the history of urban planning are the numerous examples of ideal and utopian cities. The ideal city is the concept of a plan for a city that is conceived in accordance with a particularly rational or moral objective. In Platonic philosophy, the word "ideal" defines that which is conceived and represented in the mind, as a reflection of an independently existent Idea or Form, and the ideal city is designed to achieve all the perfection. But Stratilatis (2008) argues that the Platonic ideal city should be understood neither as a blueprint to be realized nor as a mere fiction that cannot give rise to a viable existential prospect. The two terms are sometimes interchangeable without strict definitions, but defined more closely, the Utopia as interpreted by Karl Mannheim presupposes violent change, whilst the planner of ideal cities is a reformer within his/her given society and locality (Rosenau, 2013, p. 170). Eaton (2002) states that "ideal" is sometimes used to cover those city plans that accept the political status quo, while "utopian" is employed for those that are designed to induce a radically new political situation. Similarly, according to Slodczyk (2016), plans of utopian cities were designed as visual extensions of particular social theories since authors of utopian concepts placed their models of a new and perfect social order in urban space.

Ideal and utopian city plans abound in the history of urban planning, from Plato's *Laws*, through *Utopia* by Sir Thomas More, to *City of the Sun* by Tommaso Campanella. Plato's ideal city plan surely has a great influence on western urban planning from antiquity and Plato himself, as a philosopher, has a key role in inspiring architects and thinkers of the Italian Renaissance, and the founder of the utopian literary tradition, Sir Thomas More (Brown, 2002). In addition, Aristotle drew heavily on Plato's urbanist vision but also made some improvements on it. The starting point of any study on the ideal or utopian city is Plato's treatises, *Republic* and *Laws*, presenting a rationale for the ideal model of the city-state (Slodczyk, 2016). Plato's ideal city, or *polis*, as

described in the Book V of his treatise, *Laws*, is intended to be quite small, with 5040 citizen households as an ideal number:

> The city shall be placed in a suitable situation, as nearly as possible in the centre of the country, and shall be divided into twelve wards. First, we will erect an acropolis, encircled by a wall, within which shall be placed the temples of Hestia, and Zeus, and Athene. From this shall be drawn lines dividing the city, and also the country, into twelve sections, and the country shall be subdivided into five thousand and forty lots (Plato, c. 353-347 BCE/2008, Book V).

Many ancient cities also featured symmetrical design with grid streets, being divided into several distinctive neighborhoods responsible for different functions. Although these neighborhood units do not originate with the Athenian of the *Laws*, their formalization into a geometrically stylized whole bears Plato's stamp, and in this regard he must be credited with being an innovator whose vision is strikingly reflected in the designs of several ideal cities by such Renaissance architects as Filarete, G. Maggi and the younger Vasari (Golding, 1975).

His city plan is highly concerned with justice, rules, and universal principles and emphasizes the importance of harmony in a chaotic world. However, it is also criticized for the focus on collective benefits and the sacrifice of individual needs and aspirations that have left a negative impact on contemporary city planning. Additionally, contemporary city planners often had to determine how far they could limit the rights of an individual for the benefit of a community in realization of various projects, giving a new form to urban tissue (Paszkowski, 2011, p.151). In contrast, Stratilatis (2008) states that the utopian perspective is marked by shareability of political reason and by mutuality between participants in a common discursive venture rather than by individualist authoritarian projections or by harmless day-dreaming. Critical and questioning opinions also appear in some other scholars' studies. Schwember and Urabayen (2018) focus on the dystopian character of utopian cities, one of the most

relevant problems in modern utopian tradition, and point out the exclusion, such as foreigners, atheists, and people who are not full citizens, and disciplinary power that every utopia inevitably generates. Akkerman (2014) analyses the platonic myth from a perspective of masculine and feminine features in urban space, representing voids (streets and squares, etc.) and edifices, respectively, and points out that whereas the inherently masculine paradigms of the Ideal City have shaped Western city-form across historic times since antiquity, the feminine myth of the Garden, one of the two gender-related myths, has been all but excluded from a design expression in the city.

The *De Architectura* by Vitruvius is the only extant architectural treatise of the Roman period focusing on various building projects, town planning, and social problems beneath them. The ideal city put forward by Vitruvius is designed to be enclosed by a circular wall for protection and reinforced by surrounding towers. The noticeable characteristic of Vitruvian ideal city is the radial-centric arrangement and the octagonal outline. Streets and dwellings are carefully laid out to avoid eight directions of the prevailing winds. Although both Vitruvian and Platonic ideal cities pursue harmony between people and the universe, there are many differences between the two. For example, the division of the city into eight compartments is a deviation from Plato, who favored twelve divisions in his *Laws*. Vitruvius applies the natural division of the circle in multiples of four, while Plato's arrangement is reminiscent of the twelve subdivisions of the square, used in calculating the lunar year (Rosenau, 2013, p. 16).

2.2 Research on the Tower of the Winds

It is the ideal city of Vitruvius in *De Architectura*, along with Roman plans of colonies, that had provided much of the operational basis for urban planning ideas through medieval times and the Renaissance in Europe. According to Vitruvius' own testimony in *De Architectura*, his plan for an ideal city was inspired by Athens' Tower of the Winds.

There has been only sporadic research studying the Tower of the Winds, on the edge of the Roman agora in Athens, built by the Greek architect Andronicus of Cyrrhus c. 50 BCE. The two archaeologists and painters James Stuart and Nicholas Revett measured the Tower of the Winds and published the *Antiquities of Athens* in 1762 in which they gave accurate drawings of this Tower (Noble & De Solla Price, 1968). The only studies about this tower are either tracing the history of the tower and its builder or focusing on the astronomic mechanism of the sundial and the water clock in the tower. For instance, Panou and Liritzis (2017) have given a general description of the Tower of the Winds, and briefly analyzed its inventory and the state of management and use as well. Lyttleton (2003) describes how this ingenious small marble octagonal building was designed externally as a monumental sundial and weathervane, with a representation of each of the eight winds carved on the sides of the octagon. At the apex of the roof a bronze statue of the god Triton was affixed, functioning as a weathercock. The study conducted by Tryfona and Georgopoulos (2016) describes and investigates the implementation of almost entirely image based contemporary techniques for the three dimensional geometric documentation of the Tower of the Winds in Athens, and a 3D tour of the Tower has also been created for a more integrated view of the monument. Damianidis (2011) focuses on the two earliest Roman ship graffiti identified on the interior walls of the Tower of the Winds, suggesting that the graffiti represent a type of warship and probably date to between the 2nd and the beginning of the 4th century AD.

At Athens, now within the Roman Republic, Andronicus designed his octagonal tower so that:

> The lower level of the octagon is undecorated except for the markings for the sundial on each face. In the upper level, personifications of the winds, identified by inscriptions, are depicted in relief sculpture. The winds are represented as winged males who carry an attribute associated with the type of weather each one brings. All except Zephyrus, who is nude, are dressed in short tunic,

billowing cloak, and boots. Four of the winds have beards to indicate adult status, while the remaining four are beardless youths. Boreas (north) blows into a conch shell to summon the group. Caecius (northeast) pours hailstones from a shield. Apeliotes (east) is young and carries grain and fruit in his cloak. Eurus (southeast) has his arm hidden in his cloak to summon a hurricane. Notus (south) is youth who pours rain out of a vase. Lips (southwest), also young, leans on the stern of a boat and blows it on its way. Zephyrus (west), shown as a nude youth, scatters flowers. And Sciron (northwest) is an older man who empties a cauldron to signify the beginning of winter (Darling, 2004, p. 216).

Likewise, little literary mention of the Tower of the Winds was found even in antiquity materials. In the account of Vitruvius,

> Some have held that there are only four winds, […] But more careful investigators tell us that there are eight. Chief among such was Andronicus of Cyrrhus who in proof built the marble octagonal tower in Athens (Vitruvius, 30-20 BCE/1960, p. 16).

In *De Re Rustica* the Roman scholar and writer Terentius Varro (c. 116-27 BCE) writes:

> […] a compass of the eight winds, as in the horologium at Athens, which was built by the Gyrrestrian. […] This is the water-clock, popularly called the "Tower of the Winds," built by Andronicus of Cyrrhus, in the first century BC, and still to be seen. Each of its eight sides corresponded to one of the eight winds and held a picture of that wind (Varro, c. 36 BCE/ 1934, p. 457).

2.3 Fengshui, *Bagua*, and Daoism

The hypothesis to be introduced later in this thesis will state that the plan of the Tower of the Winds had been heavily influenced by the octagonal design of the ancient Chinese geomantic map, the *Bagua*. Indispensable to the concept of the *Bagua* is the ancient Chinese geomancy Feng Shui. Feng Shui 风水, literally meaning "wind-water", is the ancient Chinese geomantic art that is related to architecture, human beings, and

the built environment. This concept helped ancient Chinese interpret the environment, ostensibly so that they could live a better and more harmonious life in the world. The primitive knowledge of Feng Shui is based on the observation of three sources: astronomical phenomena, natural phenomena, and human behavior (Feuchtwang, 1974, p. 104). In nature ancient Chinese people sensed some special 'energy', called *qi*, the breath of life in all things. By recognizing this 'energy' *qi* 气 in a landscape, they determined which locations would be safe and healthy for the human body, or harmoniously align with the universal principles (Levitt, 2000, p.1). *Qi* is the basis of Feng Shui and is described as the cosmic spirit that vitalizes and infuses all things, giving energy to human beings, life to nature, movement to water, and growth to plants (Skinner, 1989, p.17). The ancient Chinese work, the *Book of Burial*, is considered the root of Feng Shui theory and provides the definition of Feng Shui:

> *Qi* will disperse by wind and bound by water. When ancients tried to accumulate *Qi*, they will not disperse it; and when they tried to move *Qi*, they will bound it. Therefore, this practice is called Feng Shui (Guo, 276-324 CE/2003, p.16).

The philosophy of the balance of nature gradually became the religion of Daoism. Most of the religious texts, such as the *Book of Master Zhuang* 庄子, and the rich array of formative concepts that became significant within the later Daoist tradition first emerged during the Warring States period c. 770-256 BCE and the history of Daoism as an organized religion begins during the Han Dynasty (202 BCE-220 CE) (Miles et al., 2015, Vol. 1, pp. 1505-1506). Although the founder of Daoism is traditionally identified as Laozi and his treatise, *The Scripture of the Way and Its Virtue* 道德经, is considered the keystone work in the Daoist tradition, the accurate identification remains questionable. Levitt (2000) gives an interpretation of Daoism:

> Priests of Daoism discovered and developed Feng Shui geomancy through observation of landforms, river flows, the movement of planets, the behavior of animals, and changing weather conditions […] According to Daoists, all energy is interconnected. Every natural force has its opposite and they create and define

each other. For example, because of the existence of the dark, the concept of light has meaning (pp. 1-6).

The leading ideas of Feng Shui were inspired by one of the ancient classic texts *Yi Jing* 易经 (*I Ching* or the *Book of Changes*), which tradition attributes to a mythical emperor, Fu Xi, in 2000 BC. The text *Yi Jing* introduces a theory that the universe is made of constant flowing and contrary forces, like *Yi* 阴 (darkness) and *Yan* 阳 (brightness) that affect the activities of daily life (Bruun, 2008, p. 96). One of the basic concepts in *Yi Jing* is *Bagua*, literally meaning "eight trigrams", which can represent the dynamic state of all natural phenomena (Wu, 2019). The eight trigrams played a prominent role in religion, philosophy, and proto-science for more than two thousand years. In Daoist cosmology, they have played an important role in signifying different cosmic directions and dimensions. For example, they were arranged in two different patterns that represented the state before creation or "Early Heaven *Bagua*" and the forces of the universe after creation or "Later Heaven *Bagua*". The former one was believed to be created by Fu Xi 伏羲 and the latter one is attributed to King Wen who re-examined and brought the eight trigrams to prominence in the Chinese imperial court (Levitt, 2000). It is the arrangement of King Wen that was mostly used by subsequent Chinese dynasties.

The Daoist believes that the *Limitlessness* produces the *Limitedness* which produces the *Absolute (extreme limit).* In the Daoism vision of cosmogenesis, first, there was the Dao 道 (often translated as "the Way"), empty and still. Then, gradually, primal energy (*qi*) was spontaneously generated out of the Dao. The Dao then generated the complementary forces known as *Yin* and *Yang*. The interaction of these forces directed the primal energy into patterns of movement and transformation, which in turn created the workings of the universe. The above process of the creation of the universe can be concluded by *Yi Jing* as: The Absolute produces two forms, named Yin and Yang. The two forms produce four phenomena, named lesser yin, great yin, lesser yang, and great

yang. And then the four phenomena give rise to the eight trigrams (the *Bagua*). Similarly, Daoism teaches that to be content as a human being, one must accept that change is the absolute reality and that all things and transformations are unified in the Dao.

A fundamental cosmological principle of ancient Chinese thought, and the one adopted by Daoism, is that all things correspond to each other. And this is also what *Bagua* reflects: the eight trigrams are used to represent the fundamental principles of reality, seen as a range of eight interrelated elements in nature. The *Bagua* played a vital role in the Daoist tradition. The eight trigrams are subtle visual symbols of cosmic flux and are easily adopted by the Daoist to help explain cosmological principles of transformation. For example, for the Early Heaven sequence, Trigram Qian and Kun are, in cosmological terms, Heaven and Earth, south and north.

Other than the importance to architecture, as many studies on Feng Shui suggest, this ancient geomancy has been playing a crucial role in urban planning of Chinese imperial cities. Meyer (1978) uses ancient Beijing as a case to show how Feng Shui principles were actually applied in the geomantic planning of ancient Chinese cities. He analyzed the surrounding environment of Beijing and showed that this city was planned partially in accord with the "Later Heaven *Bagua*". He came to a conclusion that the Feng-shui of cities is vastly indeterminate and should not be considered a "system" at all because of too many variables that a geomancer must deal with when planning a city, such as eight trigrams, yin-yang duality, and the topography. Bonaiuto, Bilotta, and Stolfa (2010) make a comparison between Feng Shui and environmental psychology in the influence on human well-being in the design process and suggest that restorativeness and control are two points of convergence between the two disciplines. Besides, Feng Shui principles integrate cosmological symbolism within design, which presents a way to explore design with meaning, with respect of human history and culture diversity (Xu, 1997).

2.4 The Silk Road

The *Bagua*, as a religious and cultural notion of the time, was likely transmitted from China to western Asia along with merchandise during the first century BCE, along the Silk Road. The Silk Road was a trade route connecting the Far East with Central and Western Asia, and with the eastern Mediterranean, dating back to the 2nd century BCE (Elisseeff, 2000, p.3). One of the main routes usually associated with the Silk Road is the one originating from Tun-huang, and then it went westwards across the Taklamakan Desert towards Hami in Easter Xinjiang, China (Hopkirk, 2001, p.17), which was also called the Desert Silk Road (Yu, 2015).

The most common transportation type on the Silk Road was riding domestic animals, such as horses, oxen, and camels, and the goods were loaded on the animals' back:

> Interaction with the nomads was complex though, […] they were important partners in the supply of animals, and especially fine horses, […] Extremes of temperature had to be negotiated – one reason why the Bactrian camel was so valued. Hardy enough to brave the harsh conditions of the desert, these animals have advance knowledge of deadly sandstorms (Frankopan, 2016, p.3).

During the Xia and Shang Dynasties (approximately 3000 years ago), ancient Chinese began to use large wagons, drawn by oxen or horses, to carry heavy loads for the purpose of travel and wars (Qin, 2012). The Desert Silk Road originated during the Western Han Dynasty in 139 BCE, a time when carts were already invented. Therefore, the common means of transportation were the cart and the caravan (Frankopan, 2016, p. 3), both of which were pulled by animals like horses and oxen due to their strength and endurance.

The Silk Road linked the two great civilizations China with Rome and they may have gathered some sketchy information on each other, but neither the Greco-Romans nor the Han Chinese were fully aware of the other's existence (Ball, 2008, p. 81). But they did know of each other and attempt to get contacts. The first and second century CE

witnessed their efforts of communication and cooperation between the two countries that controlled the Far East and the West in Eurasia, respectively. The Chinese history book, *Book of Late Han*, recorded a diplomatic incident around 97 CE. A mission led by a Chinese military ambassador Gan Ying was sent to the Roman Empire for a political purpose under the order of the Chinese government. The book recorded:

> In the 97 AD, Protector General Ban Chao sent his Subordinate Gan Ying to Daqin (大秦) [the Roman Empire], who probed as far as the Western Sea, which is either the Persian Gulf or the Black Sea and then returned […] He reached somewhere in the Seleucid Empire next to a large sea. He wanted to cross it, but the sailors of the western frontier of Parthia said to him: The ocean is huge. Those making the round trip can do it in three months if the winds are favorable. However, if you encounter winds that delay you, it can take two years. When Gan Ying heard this, he discontinued (his trip) (Fan, c. 398-445 CE/2005, Chapter 88).

Although Gan Ying's mission failed to make their way to Rome, they brought back valuable resources and information about western regions along their journey.

Back in the last years of Roman Republic, during the 1st century BCE, the silk produced by Han had already been used in Rome (Guo, 2011). When Roman general Marcus Licinius Crassus' legion was at the Battle of Carrhae (modern Harran in Turkey) with Parthia force in 53 BCE, the military flag of the legion was made from silk. After the establishment of Rome Empire, Romans became increasingly wealthy and the demand for silk increased and they became more curious about its origin, although they knew little of the mysterious oriental civilizations. There was a slow and gradual process of Romans learning about the origin of the silk and cultures of eastern countries. The book *Natural History*, written by Roman author Pliny the Elder and first published in 77 CE, was considered a model for later scholarly works. He thought that the "Seres" (meaning the "silk people") was an ethnic group famous for their woolen substance obtained from their woods; and the silk was a kind of vegetable fiber from some leaves (Pliny,

77CE/1961, xx.53–xxi.56). It was until the second century CE when Greek geographer and traveler Pausanias wrote his book *Description of Greece* that the fact of how silk was produced came out. He wrote:

> The Seres make their clothes from threads which are not produced from a tree, but are made by an insect that the Greeks call ser, though the Seres themselves give it another name […] a large beetle, like a spider, that can spin webs in trees. These creatures are reared by the Seres, who build them houses adapted for winter and for summer. The product of the creatures, a clue of fine thread, is found rolled round their feet (Pausanias, 1918, VI, 6.26.6-7).

Although Pausanias's description was close enough to the truth of the process of the silk production, it is uncertain whether ancient Romans believed this idea and they might still insist on the previous notion that silk was from woods.

After decades of years importing silk from Parthia merchants and other intermediary agents, Rome Empire began to directly reach out to China. According to the *Geography*, originally written by Claudius Ptolemy in Greek at Alexandria around 150 CE, the first official meeting of the Han Dynasty and Rome Empire happened sometime around 100 CE (Guo, 2011). The commercial mission was arranged by a Roman businessman Maes Titianus and they journeyed through the northern part of the Kushan Empire towards the Tarim territories. Somewhere near the Pamirs they were intercepted by Han authorities who took them eastward through the Tarim kingdoms to China (McLaughlin, 2016, Chapter 14). The Roman group was received by the emperor of the Eastern Han and was given plenty of gifts including silks. After they came back to Rome, the team gave an account of their experience in China and Maes then wrote a report which was read by educated Greeks and Romans. Ptolemy used the information from Maes to construct new maps of the Far East and determine the geographical position of the people that the Romans called the Sinae (the Chinese) (McLaughlin, 2016, Chapter 14).

Quite a few other modern works also have been studying on the connection between ancient China and Rome through the Silk Road. During the Roman Empire, in the first

to third centuries AD, intense commercial and cultural contacts were maintained between East and West through the Silk Road; and Romans see the Chinese as powerful but unforthcoming, not threatening but clearly a developed civilization (Bueno, 2016). There once existed a large number of written records describing contacts between ancient China and Rome. Chinese historiographical texts turn out to be surprisingly rich sources for the flow of real information between the Roman and Chinese empires, while the surviving Roman records on ancient China differ from their Chinese counterparts in one essential aspect: no official records from the West have survived, probably due to an alleged fact that the Roman envoys mentioned in Chinese historiography are most likely to have been merchants (Kolb & Speidel, 2017, pp. 50-51). Christopoulos (2012) attempts to establish links between great ancient civilizations, such as Rome, Persia, India, and China by elements from historical texts and archaeological discoveries and refers to a fact that modern Chinese and Western scholars connect Daqin (大秦), as mentioned above, to the Romans of Rome, or the Roman Orient. He also points out that the changing borders following the Seleucid Empire, the Bactrian kingdom, Rome, Roman Egypt, and then Byzantium, are reflected in the Chinese sources, with their locations left unclear, although the Chinese sources all linked them historically with the Daqin.

2.5 Contemporary Planning for Pedestrian Movement

Although the present research is of primarily historical value, it bears some relevance upon contemporary attempts in urban planning and design, addressing pedestrian movement in cities, and the particularly challenging issue of urban design for pedestrians in winter cities. Neighborhood walkability, based on environmental attributes concerning street connectivity, safety, and aesthetics, is associated with pedestrian street design and use in the neighborhood (Azemati et al., 2011). Walkability has emerged as a general topic in various forums related to transportation and urban planning (see Hutabarat, 2009), as one of the common indexes measuring sustainable neighborhoods. Several factors impede people's walking experience and reduce the

attractiveness of streets and sidewalks, thus challenging researchers to find solutions that improve walkability. Those factors can be divided into three aspects: discomfort reality of urban microclimate, conflicts between pedestrian and automobile, and safety and security concerns. Ancient urbanist traditions, East and West, were heavily focused on climate and urban microclimate. For example, a very concern with wind directions stems from both Greek urban traditions, represented by Hippocrates of Kos around 400 BCE in his book *On Airs, Waters, and Places*, and the Etruscan attention to environmental conditions throughout Etruria (Stoddart et al., 2020). Further, for some ancient Chinese cities, it is believed that streets are set in a grid pattern that favors the layout of residence as "sitting in the north and facing the south," partly as buildings facing the south can take better advantage of the sunlight, which is beneficial to residents' health (Zhang, 2004).

In contemporary urban planning considerations, outdoor thermal comfort of people is considered to be affected by thermal built environment, and people's usage of outdoors is affected by their perception of outdoor thermal conditions (Hwang et al., 2011). Chatzidimitriou and Yannas (2017) have discussed favorable canyon geometries in terms of pedestrian thermal comfort, and they support the incorporation of basic climatic parameters into urban design, by taking environmental measurements in street canyons in both winter and summer periods. In mixed traffic flow, motor vehicles, non-motorized vehicles (such as bicycles and tricycles), and pedestrians share the same facilities (roads and intersections), and therefore pedestrian-vehicle conflicts frequently occur (Almodfer et al., 2015). Akkerman (2013) indicated that all-round use of the automobile, buttressed by perception of harsh climate, is associated with, and feeds into, downtown safety concerns.

Most contemporary research focuses on modern concerns, such as increasing street network density (Marshall & Garrick, 2011) and integrating street segments (Koohsari et al., 2017). What is still not well understood is how street design in early history or

prehistory worked to provide a healthy and safe place for people to walk on the streets, particularly in ancient Chinese and European cities.

3. Methodology: The logic of historic inquiry in comparative urbanism

Several features of Vitruvius' ideal city could be seen within the historical and regional context of the Roman Empire at the time. Thus, Vitruvius' striking radial-centric pattern could be seen previously in the regional plan of Mycenea, whereby "a well-planned radial pattern of built roads covering the immediate hinterland," converged on Mycenae as the center (Castleden, 2005, p. 31). The circular flair of Vitruvius' plan, so different from the gridiron practice of Roman planning, may have been inspired by Celtic hillforts in central and western Europe, many of which were disposed on a circular plan (Hill, 1995). Furthermore, the very concern with wind directions stems from both Greek urban traditions, represented by Hippocrates of Kos, and the Etruscan attention to environmental conditions throughout Etruria (Stoddart et al., 2020), the geographical setting of the city of Rome during its pre-republican era.

But Vitruvius' counsel on the ideal city plan cannot go unnoticed when comparing his account also with early Chinese practice for the founding of the capital city that had been recorded in the manual *Kao Gong Ji*, thought to have been written sometimes after the first half of the fifth century BCE (Wenren, 2013, pp. 3-5):

> When the Jiangren build the [capital] city, [first,] they use plumb lines and water levels to gauge the flatness of the land; plant a straight pole in the ground and align it with plumb lines; observe and mark the shadows of the pole during the time when the sun rises and sets; draw circles and make it cross the shadows; and then discriminate the east-west direction [from the north-south direction] by […] consulting the shadow of the pole at noon and the position of the polestar at night (Wenren, 2013, pp. 95-96).

In contrast with the radial-centric plan of *De architectura*, however, it is the square plan on an orthogonal pattern that is the result of the procedure for the founding of the ideal city in the ancient Chinese manual. Furthermore, as Wright (1965) observes, "[t]he

division of a city into blocks is implied by the Chinese ritual canons, and cities were so divided at least from the beginning of centralized empire in 221 BCE." Though considerations of geographic latitude, implicit in both procedures, might be legitimately regarded commonplace among ancient surveyors, East and West, the comparison begs a question of certain parallelism in procedures between the ancient Chinese planners, and the Roman architect and engineer. Evoking comparative urbanism of historic Chinese cities Paul Wheatley (1975) had alluded to a similar question, pointing out that the square grid plan of the ancient Chinese ideal city "is identical both with that prescribed by Ezekiel for the city of the Levites (*Book of Ezekiel*, chap. 48) and with that envisioned by St. John the Divine (*Revelation*, chap. 21)." The orthogonal plan of the Chinese ideal city in the *Kao Gong Ji* 考工记 has three gates on each of the four sides of the square perimeter, and these are also the features of plans arising from the urbanist visions of both Ezekiel and St. John.

Similitude of the urbanist vision in the *Book of Ezekiel* with the plan in the *Kao Gong Ji* remains an enigma. Separated from China by thousands of kilometers along which menacing deserts and the world's highest mountain ranges pose a forbidding palisade, Ezekiel had sounded his urbanist vision in Babylonia of the sixth century BCE (Drinkard, 1996). But similarly, parallelism could be sought also between *On Airs, Waters, and Places*, written at the turn of the fourth century BCE, the admittedly superstitious compendium of beliefs by Hippocrates of Kos on the placement of settlements, and the ancient Chinese geomancy, *Feng shui*, literary, "wind-water," whose medicinal applications are dated to about the same time and later (Hsu, 2007).

The *Revelation to St. John*, on the other hand, is sourced in place and time to the reign of the Roman emperor Domitian, 81–96 CE (Charles, 1920, pp. 70-75). The orthogonal plan in the *Revelation* comes about a century after Vitruvius' *De architectura,* and some two centuries after the founding of a continuous merchant travel route between China and the eastern Mediterranean region, the Silk Road (Stuckenbruck, 2003). It was due

to the Silk Road that the eastern Mediterranean became a major geographic medium for interaction between East and West from the 2nd century BCE till the Renaissance. The significance was largely economic, in carrying goods between the regions along the multibranched routes of the Silk Road, but of further significance was also the dissemination in both directions of ideas in religion and philosophy.

Traces of correspondence between *De architectura* and *Kao Gong Ji* could be thus due to two reasons, or more likely, their combination:

- Vitruvius was somehow, and quite unknowingly, in receipt of knowledge originating in an ancient source utilized in Chinese urbanist thought of the time.

- Similar geographic configurations of the north-eastern Mediterranean, such as latitude and the environment, on the one hand, and of the location of the Chinese source, on the other hand, had led to similar considerations for the founding and design of an ideal city.

While the affinity in *procedures* for the founding of an ideal city between the Chinese manual and *De Architectura* is apparent, the radial-centric plan of Vitruvius, bounded by an octagonal perimeter, is radically different from the orthogonal plan in *Kao Gong Ji* referred to by Wheatley. Guiding the orthogonal plan of the Chinese ideal city in antiquity, to a greater or lesser extent, was the *Bagua*, a geomantic map of eight trigrams arranged in an octagon, and used as a divination device pointing to opportune directions and locations in geographic space (Madeddu & Zhang, 2017; Wright, 1977; Zhang, 2019).

Noticeable at first sight is the obvious similarity between the octagonal plan of the Tower of the Winds (Figure 3.1) and the *Bagua* geomantic map (Figure 3.2). The

additional likely source to Andronicus' octagonal tower was the middle section of the Pharos Lighthouse off the coast of Alexandria, which was said to be octagonal as well (Heinle et al., 1988, p. 32). Construction of the Pharos Lighthouse was completed c. 280 BCE, some two centuries before Andronicus. If a link between the *Bagua*, the Pharos Lighthouse, and the Tower of the Winds could be proposed, Vitruvius' distinct reference to the Tower of the Winds as his inspiration would implicate the *Bagua* as possibly one of the sources to his own octagonal radial-centric plan. The *Bagua* and the Tower of the Winds could then be affirmed as intermediaries between the orthogonal plan described in the *Kao Gong Ji* and Vitruvius' octagonal radial-centric plan.

The present study attempts to show that, indeed, a piece of strong circumstantial evidence suggests that the ancient octagonal trigram map, specifically its version known as King Wen's "Later Heaven" *Bagua*, was likely transmitted from China as a geomantic concept during the first century BCE, inspiring the design of the Tower of the Winds. In its methodological framework, the research presented here ought to be seen as a case study in source criticism, whereby, as Howell and Prevenier observe (2001, p. 29), the multiplicity of independent sources lending support to the same proposition, enhance the validity of that proposition. The proposition posited here, and referred to henceforth as Historical Hypothesis on the Tower of the Winds, is the claim that Andronicus' tower in Athens has an archaic Chinese source, primarily in the "Later Heaven" *Bagua*. The support for such a proposition, this study shows, can be sought in four observations that together constitute circumstantial evidence of high degree:

- The weathervane atop the Tower of the Winds is the first such device outside of China where it was first invented.
- The Tower of the Winds is due south of Athens' Acropolis, the city's most important site, while the south is the most opportune direction in the ancient Chinese geomancy of *Feng shui* (风水).
- Aligned to the south, the sequence of Greco-Roman wind-deities depicted on the frieze of the Tower of the Winds corresponds, almost

exactly, to the sequence of the traditional Chinese winds as represented by the eight trigrams of the geomantic map referred to as the "Later Heaven" *Bagua* (八卦).

- The design and configuration of the Tower of the Winds were by Andronicus of Cyrrhus, a city and a major trading port in the western portion of the Silk Road. Prior to coming to Athens, Andronicus is known to have spent several years on the Mediterranean island of Tinos, where he arrived possibly via Alexandria, where he would have observed the octagonal mid-section of the Pharos Lighthouse.

As detailed in the ensuing discussion all four observations are stand-alone propositions set apart from each other, yet jointly leading to a conclusion that suggests octagonal design of the *Bagua* as a source, reinforced by Andronicus' observation of the partial octagonal design of the Pharos Lighthouse. Though mutually independent, collectively the four propositions converge to the same strong possibility that the plan of the Tower of the Winds had a Chinese origin, which very likely was the "Later Heaven" *Bagua*, thus lending robust support to the Historical Hypothesis. The proposition that the Tower of the Winds ought to be sourced to the *Bagua* as its origin has implications for the comparative urbanism involving Han China and early European urban planning. To be sure, actual cities laid out on an octagonal plan are found neither in Ancient China nor in Roman Empire. But the apparent guidance Han designers sought in the *Bagua* for the plan of their ideal city, and the inspiration Vitruvius found in the Tower of the Winds for his own ideal city plan, enkindle tenets of urban design for pedestrian precincts within cities of our own times.

Indeed, comparative urbanism ought to be also carried onto the broader methodological framework that juxtaposes a historical original, against its counterpart in a contemporary urban setting. Such an approach gives specific relevance and significance to the attention ancients on both sides of the known world afforded the consideration

of wind directions. Contemporary efforts to optimize the alignment, configuration and design of streetscapes ought to recognize the lasting message on the urban microclimate from the distant past. Twentieth century's car-centric urban planning and design had, by and large, bypassed forthright considerations of pedestrians in urban streetscapes, to the disquiet of a few lone urbanist critics of the time, their leading voice being Jane Jacobs (1963). The recent turnaround in urban design, redirecting attention to human gait and emphasizing out-of-the-door pedestrian movement in concert with the environment, ought to find an affirmative impulse in the urbanist work of the ancient Chinese planners, through the inspiration of environmental considerations expressed in the *Bagua*, with a like impact also upon Andronicus and Vitruvius.

It is conceivable that the extant Chinese urban planning manual that is part of the *Kao Gong Ji*, is something of a culmination of archaic considerations and practices in the laying out of human settlements in early China. According to Nancy Shatzman Steinhardt (1990, pp. 36-40), "excavation […] from Neolithic China proves that sophisticated principles of urban planning were in operation long before the *Kao Gong Ji* or earlier texts were written [… A site at] Zhengzhou has yielded the most extensive evidence to date of a second millennium BCE walled city. […] The plan of the Zhengzhou site published in 1954 shows that the Shang capital was nearly square, oriented to the south, and had a gate at each face." Such practices would have carried, most likely, into the Iron Age of the Zhou, Qin, and Han dynasties.

Both the Chinese and the Greco-Roman civilizations saw significance in wind directions. Microclimatic concerns implicit in aspects of the Han and Roman ideal city plans have been largely overlooked in contemporary urban design. Beyond ancient superstitions and religious notions about the environment, recognition ought to be given to the primeval acumen of careful observations and the methodical effort to explain them, which had led to meaningful pursuit to configure built forms accordingly. In the Roman domain, it was Andronicus and Vitruvius in their architectural and urbanist

endeavor, who – similar to their Chinese forerunners – carried these considerations onto their figurative drawing boards, in an unwitting reception of environmental thought by the ancient authors of the *Bagua*.

4. *De architectura* and the Vitruvian Ideal City

The treatise *De architectura*, or *Ten Books of Architecture*, written over the period 30-20 BCE by the Roman military engineer and architect Marcus Vitruvius Polio (c. 80 BCE – 15 BCE) is the only extant literary source of antiquity that directly addresses architecture and urban design. *De architectura* has been acknowledged as the first in documented Western architectural tradition and literature, and the significance of this book in inspiring the notion of the ideal city in later architecture and urban design, has been noted in many studies (e.g, Rosenau 2013, pp.16-17). Conspicuous is the octagonal radial-concentric plan of the Vitruvian ideal city as described in *De architectura*. Since the early Renaissance and up until the seventeenth century, *De architectura* had been an authoritative text, and it is also the octagonal pattern of the Vitruvian ideal city plan that had exerted later influence on the Renaissance model city (Lagopoulos, 2009). In spite of doubts concerning the capacity of Vitruvius to explain the ancients' conception of architecture (Cache, 2009), the octagonal pattern in numerous ideal city plans inspired by *De architectura* had continued till at least the time of the Plan for London in 1666 by Sir Christopher Wren.

De architectura is not necessarily a report on actual architectural and planning practices of the day, but "a disquisition on culture in flux […] strengthening the bonds between the City and the Roman World" (Nichols, 2017, p.15). The practice of Roman city planning was based on grid design aligned to the cardinal points. The description of a city plan in *De architectura*, however, deviates from the conventional grid plan practiced by the Romans. In Chapter VI, Book I, Vitruvius describes his octagonal and radial-centric plan, rather than a grid, upon which an ideal city is to be laid out (Figure 4.1). A clue to the reason for the difference between the actual Roman practice of city planning of the time and Vitruvius' detailed elaboration of an ideal city plan, rests possibly in the very opening of Chapter VI of Book I:

> The town being fortified, the next step is the apportionment of house lots within the wall and the laying out of streets and alleys with regard to climatic condition.

Vitruvius then proceeds with a narrative that describes a plan of an ideal city that addresses the "climatic condition" in terms of wind directions. Thermal comfort in the Mediterranean as most everywhere is bound to seasons and wind directions. In addition, in the Greco-Roman tradition since at least the time of Hippocrates' book, *On Airs, Waters and Places* (400 BCE/1881), wind directions were believed to impact the health of cities' inhabitants. It appears that Vitruvius' approach was that once the defense needs of the city are ensured, he is free to indulge in articulating his plan for an ideal city addressing the inhabitants' health and thermal comfort. Each wind direction had been represented in the Greco-Roman tradition by a minor deity, and the concern for health and thermal comfort had therefore also some religious implications.

Prior to proceeding with the outline for a city layout addressing wind directions Vitruvius points to the Tower of the Winds in Athens as the inspiration and conceptual source for his octagonal ideal city plan:

> Some have held that there are only four winds: Solanus from due east; Auster from the south; Favonius from due west; Septenrio from the north. But more careful investigators tell us that there are eight. Chief among such was Andronicus of Cyrrhus who in proof built the marble octagonal tower in Athens. On the several sides of the octagon he executed reliefs representing the several winds, each facing the point from which it blows […]

The Tower of the Winds, designed by the Greek astronomer and architect Andronicus of Cyrrhus, and still extant today, was constructed near the Roman Agora in Athens, c. 50 BCE (Figure 4.2). Overlooked by the Acropolis and the Parthenon the marble tower had each of its eight sides face a direction of the compass. From the preceding quote in *De architectura*, however, it seems that eight wind directions were not commonplace at the time; hence the reason for Andronicus to provide a "proof." On the top of the tower, Vitruvius writes,

> [Andronicus] set a conical shaped piece of marble and on this a bronze Triton [Greek god of the sea, the son of Poseidon] with rod outstretched in its right

> hand. It was so contrived as to go round with the wind, always stopping to face the breeze and holding its rod as a pointer directly over the representation of the wind that was blowing.

Other than the weathervane in the image of the god Triton, the frieze of the Tower of the Winds was decorated with minor deities in relief, *Anemoi* wind gods representing the winds blowing from different directions. Identification of the specifically eight wind directions was to successfully address the microclimate of wind currents:

> Thus, Eurus is placed to the southeast between Solanus and Auster; Africus to the southwest between Auster and Favonius; Caurus […] between Favonius and Serptenrio; and Aquillo between Septenrio and Solanus. Such, then, appears to have been his device, including the numbers and names of the wind and indicating the directions from which particular winds blow.

Vitruvius then proceeds to advise to utilize amussium, a horizontal wheel showing the direction of the wind, much as the bronze Triton vane on the Tower of the Winds, in laying out the ideal city, presumably on a level ground:

> These facts being thus determined, to find the directions and quarters of the winds your method of procedure should be as follows.
>
> In the middle of the city place a marble amussium, laying it true by the level, or else let the spot be made so true by means of rule and level that no amussium is necessary.

To align the amussium, much as aligning a sundial, finding the south was necessary. The tower as a meteorological station of sorts, and the first of its kind, had included also a timepiece thanks to which it was called at the time *horologion*. The mechanical *horologion* was a water clock with a supply from the Acropolis above, sheltered inside the structure to record the time when the sun was not shining. Affixed to the sides of the tower were sundials. To Vitruvius the sundial, or at least its gnomon part, was

critical to determine compass directions for the planned city. To adhere to straight lines and equal angles, once the centre of the Vitruvian ideal city has been determined, Vitruvius explains why both a gnomon, the part of a sundial that casts the shadow, and a clock, both associated with the Tower of the Winds, are needed:

> In the very centre of that spot set up a bronze gnomon or "shadow tracker". At about the fifth hour in the morning, take the end of the shadow cast by the gnomon, and mark it with a point. From the central point of the space whereon the gnomon stands, as a centre, with a distance equal to the length of the shadow just observed, describe a circle. After the sun has passed the meridian, watch the shadow which the gnomon continues to cast till the moment when its extremity again touches the circle which has been described.

Vitruvius has now identified four points in the plan of his radial-centric ideal city, based on Roman time measurement of the day. Time of the Roman day, measured between sunrise and sunset, was divided into twelve parts, each such part called *horae*. The four points identified in Vitruvius' approach to founding the ideal city were: (1) the city's center where the gnomon is located, (2) the first point of the town's perimeter, and its radius, determined by the end of the shadow cast by the gnomon at the fifth hour, (3) the second, northernmost point on the city's perimeter, determined by the intersection of the city's perimeter and the gnomon's shadow, or its extension, at the local meridian noon, (4) The third point of the city's perimeter, determined by the very end of gnomon's shadow touching the perimeter. At north Mediterranean latitudes, one hour was about 45 minutes at the winter solstice, and 75 minutes at the summer solstice (Laurence, 2006, pp. 103-112).

5. Tower of the Winds: Linking the Chinese Bagua with Vitruvius' ideal city

It was from the center of a new town that Roman surveyors were laying out the main *cardo* avenue, forming the town's north-south axis, for conventional grid plan. Deviating from the grid convention, in his proposed ideal city Vitruvius does not advocate the construction of the *cardo*, but the town's center is important for his radial-centric concept of streets. From the initial procedure for setting out the town's radius and some of its main radial axes, Vitruvius proceeds to identify directions of streets as a response to wind directions:

> […] From the four points thus obtained draw lines intersecting the centre from one side of the circumference to the other. Thus, we shall have an eighth part of the circumference set out for Auster and another for Septentrio. The rest of the entire circumference is then to be divided into three equal parts on each side, and thus we have designed a figure equally apportioned among the eight winds. Then let the directions of your streets and alleys be laid down on the lines of division between the quarters of two winds (Figure 3.1).

Since both Greeks and Romans associated wind directions with minor deities, the weathervane on top of the Tower of the Winds was fulfilling a religious and community function. Lending support to the Historical Hypothesis is the fact that Andronicus' weathervane was also the very first known in the West. The weathervane was invented in China at least a century before Andronicus. Referred to in Chinese as a "wind-observing fan" the weathervane was described in some detail in *Huainanzi* 淮南子, a compendium on geography, mathematics, music, philosophy, and religion dating to c. 139 BCE (Vankeerberghen, 2001, pp. 39-51). The author-editor of the *Huainanzi* was Liu An 刘安(c. 179–122 BCE), a prince of the southern territory of Huainan and advisor to his nephew, the Han dynasty Emperor Wu (r. 141–87 BCE)

A major collaborator of Prince Liu An on the *Huainanzi* was Dong Zhongshu 董仲舒 (179–104 BCE), a philosopher and civil servant under the rule of Emperor Wu of Han. Dong Zhongshu was a commentator on the works of Kong Fuzi 孔夫子, known in the West as Confucius, a founding authority in Chinese philosophy and cultural tradition (Lowe, 1986a, p. 152). Confucius (551 – 479 BCE) advocated harmony in society through strict hierarchy and conservative stratification in parallel to what he perceived as harmony in the cosmos (Lowe, 1986b, pp. 733-743). This was expressed in his commentaries on the archaic Chinese text, the *Yi Jing* 易经 (also known as *I Ching* or *Book of Changes*). According to Chinese tradition, the *Yi Jing* was composed around 2000 BCE by the mythical king Fu Xi, but scholars date its core origins to c. 1000 BCE, with additional text added over perhaps five centuries (Nylan, 2001, pp. 202-208). A major commentary on the *Yi Jing* is the book, *Ten Wings*, which according to tradition, though now disputed, was authored by Confucius. As a philosopher, Dong was the foremost authority of the time on the *Yi Jing* and the *Ten Wings* 十翼.

After a period of expressed hostility toward the thought of Confucius by the previous Qin dynasty (221–206 BC), the Han dynasty brought a major shift in the attitude towards Confucius. From the reign of Emperor Wu onward the Han imperial court had become the official sponsor of Confucianism in education and court politics. This revival of old wisdom needed official justification in a synthesis with the Confucian cosmogony and religion. A new stance of the imperial court adopted toward the Confucian philosophy led to the rise of Dong not only as a philosopher but also as a government adviser. In his capacity as a civil servant, Dong promoted to Emperor Wu establishment of the imperial Tai academy, where teaching of the *Yi Jing* would take place for the purpose of systematic recruitment of young civil servants through recommendations and written examinations. The Tai academy was established in 124 BCE by Emperor Wu, with Dong its chancellor (Nylan, 2001, pp. 34-35).

An important topic under Dong's study, and a likely subject in the Tai academy 太学, was the *Ten Wings*, attributed to Confucius. This commentary on the canonical Chinese text, the *Yi Jing*, was divided into ten chapters, or Wings, each of the ten discussing a

different topic. Sealing the *Ten Wings* are Chapters 8, 9, and 10 that address the subject of traditional Chinese hexagrams and trigrams, founded upon the cosmogonic notion of dichotomous opposites in the universe, the *yin* 阴 (darkness) and *yang* 阳 (brightness). The *Yi Jing* presents the *yin* as a broken line and the *yang* as a solid line. The Chinese hexagram in the *Yi Jing* comprises six stacked *yin-yang* combinations. All possible combinations of the dichotomous *yin-yang* configurations in groups of 6 yield exactly 64 unique hexagrams, 2^6. The *Yi Jing* provides a religious, ethical, and cosmogonic explanation to each hexagram, and to each *yin-yang* combination within a hexagram. The 64 hexagrams of the *Yi Jing* are also pairwise permutations of eight trigrams, each trigram consisting of three stacked and distinct *yin-yang* combinations. Analogous to the hexagrams, all possible combinations of the *yin-yang* configurations, in groups of three, yield exactly 8 unique trigrams, 2^3. Commentaries on the *yin-yang* and the trigrams were the subject matter of major parts of Dong's intellectual activity, and thus likely a subject under study at the Tai.

The joint representation of all eight trigrams in an octagonal pictorial rendition is referred to as the *Bagua* map in the *Yi Jing*. The *Bagua* map corresponds to the four main cardinal directions, and to the additional four sub-cardinals, with the *taiji* 太极 symbol of intertwined *yin-yang* being a much later addition. The *Yi Jing* gives interpretation to each trigram of the octagon as well as to each hexagram of the sixty-four. There is an obvious similarity between the octagonal *Bagua* map (Figure 3.2) and the plan of Andronicus' Tower of the Winds (Figure 5.1).

In its eight trigrams, each representing, among other things, the eight cardinal and sub-cardinal directions from which the eight winds blow, the "Later Heaven" *Bagua* map is a symbolism akin to that found in the Tower of the Winds. The arrangement of wind directions on the friezes of the Tower of the Winds corresponds, almost identically, to the arrangement of trigrams in the "Later Heaven" *Bagua*. Consistent with the Historical Hypothesis presented earlier, then, the sequence of trigrams representing winds, is almost identical to the sequence of wind deities on the frieze of the Tower of

the Winds (Table 5.1). The basic meanings of the eight trigrams and their corresponding winds, and the corresponding Tower of the Winds frieze deities, are as follows:

·离 Li represents the south and it symbolizes Fire epitomizing expansion, illumination, and shining as a bright flame. The wind from the south is Jing 景, the hot heavy wind bringing storms, and marking the summer solstice. It corresponds with the Greek Notus.

·坤 Kun represents the southwest and it symbolizes Earth exemplifying receptive, nurturing, and supportive mother earth. The wind from the southwest is Liang 凉, a chilly wind, standing for the beginning of fall. It corresponds with the Greek Lips.

·兑 Dui represents the west and it symbolizes Lake expressing joy, happiness, and pleasure in the world. The wind from west is Chang He 阊阖 and it marks the Fall Equinox. It corresponds with the Greek Zephyrus.

·乾 Qian represents the northwest and it symbolizes Heaven displaying perfection, strength, and the creative power of the universe. The wind from the northwest is Bu Zhou 不周, and with nature becoming withered, it stands for the start of winter. It corresponds with the Greek Skiron.

·坎 Kan represents the north and it symbolizes Water nourishing and moistening things in the universe. The wind from the north is Guang Mo 广漠, the coldest of all winds, representing the winter solstice, and it corresponds with the Greek wind god Boreas.

·艮 Gen represents the northeast and it symbolizes Mountain holding good luck and embodying stillness. The wind from the northeast is Rong 融, melting cold ice, and constituting the transition from winter to spring, standing for the start of spring. It corresponds with the Greek Kaikias.

·震 Zhen represents the east and it symbolizes Thunder, for dynamic movement, new birth, and growth. The wind from the east is Ming Shu 明庶, the gentlest of all winds bringing vitality to the world, and marking the Vernal Equinox. It corresponds with the Greek Apeliotes.

·巽 Xun represents the southeast and it symbolizes Wind gathering prosperity and then dispersing it throughout people's lives. The wind from the southeast is Qing Ming 清明, and it marks the start of summer. It corresponds with the Greek Eurus.

The names of the eight winds above are the variant names mentioned in *Huainanzi* that are of difference from those in some other associated texts, as the eight wind names seem not to have been fully standardized at the time that *Huainanzi* was written (Major, 1979). For example, for Gen Trigram, the name of the northeast wind in *Huainanzi* is Rong, but the standard wind name is Tiao 条. However, even with these differences, the meaning and nature of each wind itself remain the same because the correspondence between the eight trigrams and the eight directions does not change as the eight wind names change. Thus, with one direction and one trigram, there is one specific wind and its corresponding meaning.

6. The Silk Road and the project of Andronicus of Cyrrhus

Examining the Historical Hypothesis that the "Later Heaven" Bagua was transmitted to Andronicus, the similarity with the plan of the Tower of the Winds begs inspection of correspondence between the sequencing of the Greco-Roman religious reliefs of wind deities on the Tower of the Winds, and the sequencing of trigrams in the "Later Heaven" *Bagua* map. The question of whether the *Bagua* map could have possibly found its architectural rendition in Roman Athens, on the other side of the known world, thousands of kilometers away, is certainly related to the diffusion of many other ideas between China and the Greco-Roman civilization.

The possibility of transformation of the *Bagua* into the plan of the Tower of the Winds may rest, specifically, in the location of the Tai academy, on the one hand, and the likely residence of the young Andronicus, on the other hand. The Tai academy was located in the Han capital city of Chang'an, "the largest, richest and grandest city in the world of that time" (Boyd, 1962, p. 51). It was also Chang'an that was to become home to "mostly the scholar gentry class, their wealthy aristocratic families and their civil servants, [As a] cosmopolitan metropolis, the Han capital […] was the political, economic, military and cultural center of China, the eastern terminus of the Silk Road" (Zhang & Wang, 2019, p. 33). The westernmost part of the Silk Road was where Cyrrhus was located (Figure 6.1).

6.1 The Opening of the Silk Road

The name "the Silk Road" (die Seidenstrasse) was given by the German geographer and explorer Baron Ferdinand von Richthofen in 1877, to refer to a commercial road that carried commodities and ideas, starting from China through Central Asia to Rome. From the conventional Chinese point of view, the Silk Road was officially started by an envoy mission in the Han Dynasty in 139 BCE. The eastern starting point of this long-distance trade connection, the capital city Chang'an, became an urban hub of

conflations of people from different ethnic and religious backgrounds, with a trading post near the gate of the western city wall.

Sometime around 400 BCE, on the Central Asian steppe, there were groups of nomads, people who had no settlement and lived on livestock, and they played a crucial role in bringing West and East together. It is also during that time when the organized trade and communication along the steppe began (Liu, 2010, p. 1). Among those nomads there was a tribe called Xiongnu that became particularly active and threatening to China, tensions between nomads and north China intensified. During Qin Dynasty (221-207 BCE), emperors maintained periodic peace through sending precious gifts like silks to Xiongnu, which was called "silk diplomacy," and building the Great Wall to defend enemies; Qin was replaced by Han Dynasty (206 BCE-220 CE) whose rulers also faced a persistent threat from Xiongnu on its northern borders (Liu, 2010, pp. 3-4). As Han thrived, a capable ruler, Emperor Wu, took charge of Han c. 141 BCE. Han was desperately in need of allies against Xiongnu and thus Emperor Wu, sent a Chinese mission c. 139 BCE, led by Zhang Qian, westward to seek an offensive alliance in Central Asia. It took the mission more than a decade to complete this arduous journey and when they eventually managed to get back to the Han court in the city of Chang'an, Zhang Qian imparted a detailed account of Central Asia, a place where he called "Western Region", to Emperor Wu. This account was later recorded in the book *Records of the Grand History of China* 史记 by Sima Qian around 91 BCE that gave considerable insight into the situation in Central Asia at the time:

> Although the states from Dayuan (a country that existed in today's Ferghana valley across Uzbekistan in Central Asia) west to Anxi (Parthia), speak rather different languages, their customs are generally similar and their languages mutually intelligible. The men have deep-set eyes and profuse beards and whiskers. They are skillful at commerce and will haggle over a fraction of a cent. (Sima, c. 91BCE/1973, p. 245).

The Han continued to trade in silk and other goods with western allies in Central Asia; allies then brought these items westward as nomadic people migrated further west to regions like Bactria (Liu, 2010, p. 10). The routes along which this diplomatic mission traveled, though military and politics was its original purpose, developed into trade routes connecting Chinese states with Central Asia, promoting communications in culture, commerce, and politics. It is these routes, taken together, that came to be known as the "Silk Road."

Four of the important ancient cities through which the Silk Road passed are as follows:
1. Tun-huang 敦煌. The Silk Road started from Chang'an, moved westward, and reached Tun-huang, a crossroads on the edge of the Taklamakan desert, from where it divided into northern and southern routes bypassing the Taklimakan Desert. Tun-huang lies near the western edge of the Gobi Desert, making it a vital resting point for merchants and pilgrims traveling through the region from all directions. As such, Tun-huang played a key role in the passage of the Silk Road trade to and from China. Grateful travelers would have been provided food, water, and shelter here before setting off on their journey.

The history of this ancient city is reflected in the remarkable Mogao Caves, a collection of nearly 500 caves in the cliffs to the south of the city. These cases contain the largest depositary of historic records, primarily in the form of ancient sculptures and murals which once lined the Silk Roads and bore witness to the cultural, religious, social, and commercial activity that took place in Tun-huang across the first millennium. The Caves illustrate Tun-huang's significance as a center of commercial exchange. The range of imported goods included brocade, metal-ware, fragrances, incense, and a variety of precious stones. The exported goods included silks of many varieties, cotton, fur, tea, ceramics, and jade. Crafts and skills also moved along the Silk Roads as traders and craftsmen met and exchanged notes. A small number of scrolls in the Mogao Caves illustrate the use of woodblock printing in Tun-huang, which would later spread across

Asia as traders passed on knowledge and ideas that they had acquired whilst traveling the Silk Roads.

2. Kashgar. This city lies in far western China and is situated at the western end of the Tarim Basin. The two main trade routes, northern and southern, divided at Tun-huang and rejoined at Kashgar, a city set as a junction point of the Himalayas, the Pamir Plateau, the Tien Shan range, and the Hindu Kush (Frankopan, 2016, Chapter 1), making Kashgar a critical exchange point on the Silk Road. There are extensive records of the historical status of Kashgar on the ancient Silk Road in Persian documents. For example, *The Regions of the World*, a 10th-century geography book written in Persian by an unknown author, is a book where Kashgar first appeared. This book introduces the economy, agriculture, and culture of some important cities on the Silk Road, and sees Kashgar as "one of the critical Chinese cities on this trading route connecting the western, eastern and southern regions" (Vosoughi, 2012).

3. Balkh. This town is situated on the plain between the Hindu Kush Mountains and the river Amu Darya (historically known as the Oxus) in the north of Afghanistan. The ancient city of Balkh was known to the Ancient Greeks as Bactra, giving its name to Bactria which was the intersection of transportation between Greece-Iran and Central Asia on the Silk Road (Chang, 2017). From there, caravans could follow the well-watered foot of the mountains westward towards Herat and Iran, or across the Oxus to Samarkand and China. As a result, craftsmanship and trade flourished in Balkh, as well as theology, philosophy, and the arts.

Ancient Bactria was also known for the Bactrian camel, a large ungulate native to the steppes of Central Asia, with two humps on its back. Domesticated Bactrian camels, one of the most popular kinds of camels used by merchants on the Silk Road, have served as pack animals in inner Asia since ancient times. With its tolerance for cold,

drought, and high altitudes, it enabled the travel of caravans on the Silk Road (Potts, 2005).

4. Samarkand, a city in south-eastern Uzbekistan, has long been a central point for trade across Central Asia and was a substantial city renowned for its craft production and scholarly studies. From the late antique and early medieval period, the city and the surrounding area were inhabited by the Sogdians. As early as Han times (206 BC-220 AD) when the Chinese first committed to writing their impressions of Inner Asia, Sogdian merchants were recorded in the Chinese descriptions of the region. These merchants reached various places, as far as China, to trade precious metals, spices, and cloth. Later, during the time of Tamerlane, Samarkand thrived as a great city when it became the capital city at the end of the 14th century.

In recent years, there have been scholars pointing out the Silk Road (at least a part of it) had existed long before the Han Dynasty. As An (1998) pointed out, the Silk Road "may be traced to prehistoric times, which is exemplified by the discovery of bronze culture along the Silk Roads". Jan Romgard (2008) provided the evidence in his article:

> A major Xinjiang Bronze Age site is situated in the eastern part of the Tarim Basin. The culture is called the Gumugou Culture […] it lies just west of the dried-up lake Lop Nor, thus occupying the same area as the later ancient city of Loulan […] The finds made by archaeologist Aurel Stein in the Lop Nor area, where the so-called "Beauty of Loulan" (a female Caucasian mummy dated to c. 1800BCE.) was unearthed, belong to this culture.

Thousands of years later, before the Han Dynasty, the Chinese Qin Empire (221-207 BCE) had made contacts with the Greeks of Central Asia. Archaeological evidence found around the mausoleum of the Qin Emperor shows that the theory of Greco-Bactrian and Qin contact is coherent (Christopoulos, 2012). It reflects the influence of Greek architectures on the Chinese Qin. Lukas Nickel (2009) wrote a very convincing

article on the similarities of the mausoleum of the Qin Emperor and a tomb built around 350 BCE by Greek architects, including horses and other sculptures. Human-sized statues of wrestlers have been found near the mausoleum, and they have a typical "realistic" Hellenistic style.

6.2 Early Communications between China and Rome along the Silk Road

As an ancient trade route, the Silk Road had been the foremost physical link between the two great civilizations of antiquity, China and Rome. Initially, the merchandise that was passed westward from China to the Roman Republic was mainly silk and porcelain, while wools and precious metals were carried in reverse course eastward to China. Inevitably, not only material goods were transmitted in both directions, but ideas as well. Perhaps more than material goods, cross-fertilization of technological and spiritual ideas was the main force that contributed to the development and growth of China and Rome. Knowledge acquisition of manufacturing processes as well as scientific philosophical and religious concepts were largely behind the progress of both civilizations.

Intermediate between the spiritual and the material domains of antiquity was ecclesiastical architecture and the urbanism of royal or holy cities. During the second and third century CE, a striking feature of ornamental concepts in early Christianity were depictions of celestial motifs on ceilings and particularly on the interiors of domes of religious buildings of the Eastern Roman Empire (Lehman, 1945). Through multiple pieces of circumstantial evidence Alexander Soper (1974) had shown that this specific decorative feature was during the Middle Ages transmitted along the Silk Road into Central Asia and further east to China, later spreading also to Korea and Japan:

> From around the beginning of the Christian era to well beyond the first millennium […] and from India across Asia to the Pacific, a whole series of monuments of religious art and architecture reveals similarities to the Western tradition of celestial symbolism, which are hard to explain except by direct borrowing.

Similar to Soper's argument, the present study too reasons through several pieces of circumstantial evidence. But in contrast to Soper, it shows that embryonic architectural and urbanist features, as expressed by the Tower of the Winds, point to a much earlier transmission through the Silk Road, and in the opposite direction: from China to western Asia, and beyond, to Athens of the Roman Republic.

As the Silk Road evolved into a multibranched transport corridor between China and Central Asia, it connected to an ancient Persian Royal Road at Susa, Persia, that had led since the early sixth century BCE to the proximity of the eastern Mediterranean coast of Anatolia at Sardis, an ancient capital city of the kingdom of Lydia, incorporated in 546 BCE within the Persian Empire. Southeastern Europe thus became the westernmost region of interaction between East and West in antiquity. From the 2nd century BCE till modernity, the mutual impact between cultures along the Silk Road was largely affirmative to their economic, and phrenic development, where also ideas in religion and philosophy found their way in both directions. Later in the early Renaissance Chinese inventions in science and technology were instrumental in the early diffusion of woodblock printing as well as porcelain throughout Europe.

6.3 Ideal City Plan in Early Chinese and European Urban Design

Although there appears to be no explicit trace of Chinese impact upon European urban design, conspicuous is the octagonal, radial plan of the ideal city of Sforzinda (Figure 6.2) by the Florentine Renaissance architect Antonio Averlino Filarete (1400 – c. 1469), described in his book *Libro architettonico*. Berthold Hub (2011) points out that

> Filarete's designs show almost no similarities with the architecture of Rome; instead, they share notable common features with the architecture of the Near and Far East, while the text situates the ideal city of Sforzinda in "India" […] In Filarete's time the term India referred to a much larger geographical area than the present-day nation. China, for example, was at that time often designated "India."

It is certain that ancient Chinese cities were not planned on the octagonal pattern. Expediency in measurement, as well as cosmogonic belief in five founding elements of the universe, had guided a strict grid plan wherever topography allowed. The *Rites of Zhou* 周礼, a book on government bureaucracy includes in its sixth chapter, "Office of Winter," guidance as to the design of an ideal city. Aligned to the cardinal directions, the layout of the ideal city ought to correspond to the Five Elements – wood, fire, earth, metal, and water – and the five planets as known to the ancient Chinese, thus yielding a square plan with the palace at its center. All the same, Meyer (1978) notes, such an ideal city plan "has never been actualized in all of Chinese history, although there have been some rather close approximations, such as […] Chang'an […]." As Meyer shows in the case of the ancient plan of Beijing, the *Bagua* has been the key conceptual instrument in the planning of gates and continued to be so in the placement of important buildings or sites over the following two millennia. Similar to the Greco-Roman beliefs inopportune or adverse wind directions, so too, the eight *Bagua* trigrams, each symbolizing a compass direction as well as other geomantic attributes, is considered to signal good or bad fortunes.

It is conceivable that one or both versions of the *Bagua*, along with other religious notions adjoined with transported material goods, made their way through the Silk Road to the eastern Mediterranean. By then concepts, as well as merchandise, would no longer be transmitted by Chinese tradesmen, but by Indian, Persian, or other intermediaries. There were then possibly at least a few people in the Anatolia region of the eastern Mediterranean who encountered the concept of the *Bagua*. But it was the inquisitive mind of Andronicus, that carried the idea further – geographically and architecturally.

6.4 Andronicus and Cyrrhus

Andronicus, referred to in ancient sources with the suffix "Kyrrhestes", came to Athens very likely as an adult, after a sojourn on the island of Tinos where he built a complex

of sundials (Theodossiou et al., 2006). There were three ancient communities in the eastern Mediterranean with the name of Cyrrhus or Cyrrha, one of them precisely on the western section of the Silk Road, in what was at the time of its founding, sometime after 300 BCE, the Seleucid Empire. The island of Tinos is about halfway between Athens and Cyrrhus of the Silk Road. Founded by Seleucus Nicator, a former infantry general under Alexander the Great, and named after the Macedonian city of Cyrrhus, the Seleucid Cyrrhus came under brief Armenian control in 83 BCE, the approximate time of Andronicus' birth. In 64 BCE the city became a Roman jurisdiction following the capture of Antioch on the Orontes, the capital city of the Seleucid Empire, and the annexation of the entire region, turning it into a Roman province. It was possibly during the early life of Andronicus that Cyrrhus became also the capital of the district of Cyrrhestica (Frézouls, 1994).

Cyrrhus (near today's town of Shengal, Syria) was a Roman administrative and commercial center on the trade route between Antioch and the Euphrates River crossing at Zeugma, a city originally named Seleucia, also founded by Seleucus Nicator around the same time as Cyrrhus (Comfort, 2013). Zeugma (near today's Gaziantep, Turkey) was approximately 80 km northwest of Cyrrhus, both cities of increasing importance to the Romans. Up to 70,000 people lived in Zeugma around the beginning of the Civil Era, and its significance to the Romans was amplified due to the Silk Road passing through it (Young, 2001, p. 169). Somewhere near or within Zeugma, the Silk Road forked off, its eastern branch heading towards Sardis and Byzantium, and its southern branch merging with the existing trade route leading to Antioch on the Orontes, evidently through Cyrrhus (Butcher, 2004, p. 8; Comfort, 2019).

Supporting the Historical Hypothesis is the acknowledged significance of Cyrrhus as a major trading post on the Silk Road has been summed up by Millar (1998), thus:

> [Antioch's] geographical, military, and economic location benefited its occupants, particularly such features as the spice trade, the Silk Road, and the Royal Road. It eventually rivaled Alexandria as the chief city of the Near East.

> The city was the capital of the Seleucid Empire until 63 BC […] the existence of the Fertile Crescent meant that most traffic aiming for any point in the central Asian land-mass would leave the Mediterranean coast in northern Syria […] here there were the ports of Seleucia and Laodicea, and the inland cities of Antioch and Apamea, further up the Orontes; and further inland and to the north Cyrrhus […] and to its south Beroea (Aleppo)[…]. These two places in fact defined the two main ways by which one might continue from Antioch to cross the Euphrates: either north-east through Cyrrhus to another Seleucia, usually known as Zeugma, 'the bridge', and then into Mesopotamia, to reach Edessa [in Upper Mesopotamia]; or on eastwards through Beroea […]

On this view, sometime before 50 BCE Andronicus left Cyrrhus for Athens, sojourning on the island of Tinos, where he built a renowned white marble sundial in the sanctuary of Poseidon and Amphitrite and came to be known as "famous for constructing astronomical instruments and inventing timepieces that were not only functional but beautiful – even marvelous" (Darling, 2004, p. 216).

The weathervane atop the Tower of the Winds, and the octagonal design itself of the tower, both give ground to the belief that Andronicus had absorbed ancient Chinese wisdom from Indian or Persian merchants and travelers passing through his hometown of Cyrrhus. On this view, the potential for the architectural rendering of the *Bagua* likely occurred to Andronicus following his observation of the Pharos Lighthouse during a possible sojourn at Alexandria.

The indigenous use of the *Bagua* octagon in *Feng shui* was primarily in the location and alignment of buildings and interior spaces (Chiou & Krishnamourti, 1997), but its place in the ancient Chinese notion of an ideal city plan has been widely accepted as well (Xu, 2000, pp. 200-236; Swetz, 2008, pp. 53-64; Zhang, 2019). The evidence presented so far alludes to a likelihood that the *Bagua* played a role in the design of the Tower of the Winds. This, then, also reinforces the belief that the octagonal plan of the microclimate-conscious ideal city of Vitruvius, had been in fact indirectly inspired by the *Bagua*. To the extent that the *Bagua* represents also compass and wind directions,

the impact of the *Bagua* upon the ancient Chinese ideal city was similar to the impact of the Tower of the Winds upon the ideal city plan of Vitruvius.

7. “Later Heaven” Bagua: From the Chinese ideal city to Vitruvius

There are two sequences of the octagonal *Bagua* map, both sequences representing, among other things, wind directions. The first is the “Early Heaven” *Bagua* 先天八卦 and the second is the “Later Heaven” *Bagua* 后天八卦. The two arrangements differ in the sequencing of their trigrams (Table 7.1). The “Early Heaven” *Bagua* is traditionally attributed to Fu Xi, the mythical creator of humanity and the *Yi Jing*. Historically the texts of the *Yi Jing* are the result of an accretion process, beginning during the Shang dynasty (c. 1600-1046 BCE). But generally, modern scholars consider King Wen as the principal author of the book. King Wen was the founder of the Zhou Dynasty (c. 1046-256 BCE) that ruled China during most of the first millennium BC, the time when *Yi Jing* came into use. Sima Qian (145-? BCE) gives an account of the genealogy of the *Yi Jing* in his book *Records of the Grand Historian*:

> The ancients said that Fu Xi, who was simple and sincere, built the eight trigrams of the Yi Jing […] When King Wen was imprisoned, he probably developed the eight trigrams into sixty-four hexagrams (91 BCE/1973, Chapters 4 and 47).

The eight trigrams were said to be initiated by Fu Xi and perfected by King Wen in his dungeon. In his meditations, he restudied Fu Xi's eight trigrams and developed the system further by pairing them into hexagrams and appending a text to each hexagram as well as to each individual line (Ritsema & Sabbadini, 2005, p. 27-30). It is the arrangement of King Wen that was mostly used by subsequent Chinese dynasties. “Later Heaven” *Bagua* was also the subject of inquiry by Dong Zhongshu, who instituted the study of the *Yi Jing*, one of Five Confucian Classics, at the imperial university, and it is thus safe to assume that it was the “Later Heaven” *Bagua* that became a subject of study at the Tai academy (Nielsen, 2014).

7.1 Ancient Chinese Ideal City

Ancient Chinese technical and manufacturing practices were recorded in the *Kao Gong Ji,* a part of Chapter Six, "Office of Winter," in the *Rites of Zhou*. The title translates usually as *Records of Craftsman's Examination*, and is dated, for most of its parts, to the early Warring States Period, c. 475 BCE or shortly thereafter (Guan & Herrmann, 2014, p. 14). One of the last sections in the *Kao Gong Ji* deals with civil engineering and town planning, and according to Guan and Herrmann, it was written more than two centuries later:

> […] the descriptions about the planning of cities have not been confirmed by the excavation of cities from Chunqiua and Zhanguo periods. Therefore, this section was probably written only during the Qin dynasty (221-206 BCE) or the Western Han dynasty (206-24 BCE) (Guan & Herrmann, 2014, p. 15).

Nonetheless, the urban planning part of the *Kao Gong Ji* could conceivably be a report on existing, or past, practices that set forth a procedure for the founding of a capital city, including its plan circumscribed by walls and ramparts. Schinz (1996, p. 69) and Sit (2010, pp. 93-94) suggest that the planning guidelines in *Kao Gong Ji* reflect the actual founding and design c. 510 BCE of the city of Zhengzhou (near today's Luoyang), the capital of the Zhou dynasty during the Eastern Zhou period (771 BCE – 256 BCE). The *Kao Gong Ji* identifies the ideal city of the royal capital as follows:

> It is the sovereign alone who establishes the capital, gives the palace a central position and proper orientation to the four directions […] Here, where Heaven and Earth are in perfect accord, where the four seasons come together, where the winds and rains gather, where the forces of *yin* and *yang* are harmonized, one builds a royal capital […] a walled square. Each wall measures nine *li* (4,500m) and has three gates. There are nine north-south and nine east-west arterial roads, each of which shall have a width for accommodating nine chariot-ways […] (Sit, 2010, p. 96).

Within the square perimeter of the city, nine square subsections are subsumed by the nine roads and the nine gates, with the central square as the site of the palace designated

as the royal quarter. The top of the plan is in the south direction, as one that is the most advantageous, yielding respective alignment to the cardinal and sub-cardinal direction of each of the eight sub-sectional squares surrounding the central royal square (Figure 7.1).

7.2 Tai Academy and Octagonal *Mingtang*

As mentioned earlier, Tai Academy was the place where people were taught and in fact there was another imperial place, *Mingtang* (also called the Bright Hall, or 明堂), that reportedly served as the academy and ritual site where emperors worshiped their ancestors and heaven. It is recorded in *Kao Gong Ji* that for imperial palaces, there was *Shi-sh*i 世室 in Shang Dynasty, *Chongwu* 重屋 in Shang Dynasty, and *Mingtang* in the Zhou Dynasty (c. 1046-256 BCE), though the historical site of *Mingtang* built in Zhou has not been found yet. However, it remained unclear whether Tai and the *Mingtang* were used for the same purpose until the Eastern Han (c. 25-220 CE), due to the fact that the educational and ritual systems were not totally separate from each other. According to *Records of the Grand History of China*, the first *Mingtang* was built during the reign of Emperor Wu of Han, c. 109 BCE (Encyclopedia of China, 2009). Usually, for *Mingtang*, there were three types with one, five, and nine rooms for different purposes. The most commonly built type since the Han Dynasty was the five-room *Mingtang* that was symmetrically arranged on a square platform, with a cross-vertical axis. The construction had a circular roof and a square base, representing circular Heaven and square Earth, which reflects the religious meaning of this construction. Narrowly defined, the *mingtang* was just this single construction instead of a "whole" complex that might include other buildings adjacent to it. But later scholars give it a broader definition including a circular ditch surrounding the construction represented that everything under the rule of the emperor was perfect without flaw. As recorded in *Kao Gong Ji,* since the Western Han, the *Mingtang* was built symmetrically on a cross-vertical axis and its plan resembled the Chinese character

“井” (pronunciation “jing” meaning a well) (Encyclopedia of China, 2009). From an aerial view, the “井” is an octagonal pattern, just as what has been shown by the *Bagua* Map, though not equilateral.

There has been some debate about whether or not the *Mingtang* was just one construction or a series of constructions, and the main point at the center of these arguments by historians and archaeologists is a construction called the *biyong* (辟雍). During the Western Han, some historians considered the *biyong* as a part of the Tai Academy and there was no big difference between the Tai and the *Mingtang* structures (Fan, 2007). This plan may have changed in the Eastern Han. During the reign of Emperor Guangwu (c. 56 CE), a *Mingtang* was completed which had a sacred tower and a *biyong* (Bielenstein, 1976). It affirms that the *Mingtang* was a whole structure, made up three elements: a *Mingtang* (in the narrow sense), a sacred tower, and a *biyong* (Forte, 1988, p. 97). Zhao and Gao (2002) also state that for the *Mingtang* built in 56 CE there was a *biyong* in the east and the *Mingtang* in the west, approximately 150 meters apart.

8. Conclusion

Vitruvius' *De architectura* is considered the foremost literary source of the Greco-Roman classical tradition that is at the founding of European urbanism. It is, however, very likely that other literary documents on architecture and urbanism were produced at the time but did not survive the turmoil and tribulations of the Middle Ages. Over three hundred years before Vitruvius, Aristotle in the *Politics* (350 BCE/1999, Book VII, Ch. 11) discussed streetscapes as an aesthetic and defensive element of city planning. It is likely that in the three centuries between Aristotle and Vitruvius other urbanist accounts were written, and subsequently lost during the Middle Ages. There exist, therefore, gaps in our knowledge on the origins of western urbanism.

This study has attempted to address one of these gaps by tracing a significant connection, conjectured to have existed. The ideal city in *De architectura* draws on the plan of the Tower of the Winds, where the sequence of Greek wind gods depicted on the frieze, matches almost exactly the sequence of Chinese wind directions in both arrangements of the *Bagua* map, a founding element of the *Feng shui*. There had been possibly only one structure disposed on an octagonal plan, built prior to the Tower of the Winds: This was the middle section of the Pharos Lighthouse of Alexandria. Andronicus had very likely observed the Pharos, which ultimately inspired the plan of his own tower, some two centuries after the Pharos was built. But in contrast to the Lighthouse, Andronicus' tower is aligned to the south, very much like both the "Early -" and the "Later Heaven" *Bagua*, and the alignment is almost straight south toward the Acropolis, the most important place in Athens. It is unlikely that such a configuration was coincidental. Due to precession of the equinoxes, it is fair to assume that two millennia ago the Acropolis was exactly due south of the Tower of the Winds. Along with the Chinese invention of the weathervane atop the Tower of the Winds, the octagon in Andronicus' design gives reason to the belief that the tower was a hybrid product synthesizing Greek and Chinese concerns for wind directions.

According to the Historical Hypothesis, it was the "Later Heaven" version of the *Bagua* that was taught at the Taixue at Chang'an and the one that Andronicus encountered. The "Later Heaven" *Bagua*, thus, emerges as an idea transmitted through the Silk Road during the first century BCE, and adapted into architectural notion by Andronicus (Akkerman & Shao, 2020), most likely, upon his observation of the octagonal middle section of the Pharos Lighthouse. Since its founding in 139 BCE until early modernity of the fifteenth century the Silk Road had become a network of trade routes that connected China to central and western Asia, and to the eastern Mediterranean, a distance of over 7,000 km. Recognized for the economic, cultural, political, and religious interactions between East and West the Silk Road brought many Chinese scientific and technological improvements, or entirely new ideas, to Europe, helping to pave the way to modernity's scientific and industrial revolutions.

Affirmative influence upon cultures, undoubtedly, went in both directions between the East and the West. But the impact of ancient China on European civilization has been acknowledged to be multifold and varied. The significant inventions carried from China to Europe over the centuries had included the magnetic compass, gunpowder, papermaking and printing, porcelain, and silk (Fara, 2009, pp. 48-54). Among significant Chinese ideas absorbed in Europe were farming techniques, iron and copper metallurgy, and exploitation of coal and petroleum (Millward, 2013, pp. 39-86).

The European notion of the ideal city had been put forward already by Plato during the third century BCE in the philosophical accounts of Atlantis and Magnesia in his dialogues *Critias* and *Laws* (Golding, 1975), and urban planning had been recognized as an important discipline since at least the time of Hippodamus (498 – 408 BCE). The significance of wind direction in site selection had been put forward in Hippocrates' book c. 400 BCE (*ibid.*). But actual street configuration in an ideal city considering wind currents occurs for the first time in Vitruvius where, as this study shows, the "Later Heaven" *Bagua* had been a critical, albeit unknown or unacknowledged source.

As a divination concept of ancient Chinese tradition, the *Bagua*, is believed to confer a mythical power on wind currents in much the same way as the Greco-Roman religion did. Andronicus and Vitruvius had transformed this belief in mythical power onto the architectural and urbanist consideration. Following on his previous account on the founding of a city in Book I, Vitruvius turns to streetscape design in Chapter Six, "The Directions of the Streets: With Remarks on the Winds":

> On this principle of arrangement, the disagreeable forces of the winds will be shut out from dwellings and lines of houses. For if the streets run fully in the face of the winds, their constant blasts rushing in from the open country, and then confined by narrow alleys, will sweep through them with great violence. The lines of houses must therefore be directed away from the quarters from which the winds blow, so that as they come in they may strike against the angles of the blocks and their force thus be broken and dispersed.

The resulting octagonal geometry of the Vitruvian ideal city, thus, bears witness to the primal recognition that the Greco-Roman religion conferred on microclimate. By way of the *Bagua*, the same ought to be said about the ancient Chinese divination.

The lasting recognition of these considerations is attested by the architectural and urbanist revival of the Renaissance. During the Renaissance, Vitruvius' concern for wind direction in the design and direction of streets had been echoed in *The Four Books of Architecture* by Andrea Palladio who wrote:

> […] when laying out streets one must ensure very carefully (as Vitruvius teaches us in Book I, chapter 6) that they do not follow the direction of any wind so that one does not suffer furious and violent gusts along them but the winds are dispersed, mollified, weakened and enfeebled, contributing to the greater healthiness of the inhabitants; one should avoid the mistake made by those who, in ancient times, laid out the streets of Mytilene on the island of Lesbos (Palladio, 1570/1997, p. 166).

Octagonal plan aligned to the eight compass directions, after small correction due to precession of the equinoxes, is recognizable in the Lateran Baptistery in Rome (c. 440 CE), in the Basilica of San Vitale in Ravenna (548 CE), and in the Florentine Baptistery of San Giovanni (built during 1059 - 1128), the latter conspicuously similar in overall design to the Tower of the Winds. Vitruvius' octagonal ideal-city plan had been ignored in actual planning until the early Renaissance in Italy, where its traces are evident in several ideal-city concepts of that period. Most prominent of these is *The Ideal City* painting from c. 1480 attributed to Fra Carnevale, now in the Walters Art Museum, Baltimore. During the Baroque, remnants of octagonal design in Christopher Wren's Plan for London of 1666 can easily be detected, evidently instilled by Vitruvius and Andronicus. A towering architect, as well as a distinguished scientist and astronomer, in 1676 Sir Christopher also designed the building, prominent through its octagonal feature, that came to house the Royal Astronomical Observatory at Greenwich, near London. Andronicus' hybridizing brilliance had been further commemorated by Oxford University when it built in 1773 its own astronomical octagon station, the Radcliffe Observatory, inspired by the Tower of the Winds (Figure 8.1).

Similar to the fate of Vitruvius' ideal city, which had to wait for a comeback till the Renaissance, in the opinion of some, the emperor's city plan in *Kao Gong Ji* was truly enacted also only about the same time, at the end of the Middle-Ages. According to Wu Luoyang, a leading scholar in the history of ancient Chinese architecture, the first city that genuinely followed the plan outlined in *Kao Gong Ji* was built only in the thirteenth century CE, when the winter capital Dadu was founded by the Mongol ruler of China, Kublai Khan, in what is now Beijing (Wu, 1986, p. 5).

The underlying environmental tenet of ideal cities in the *Kao Gong Ji* and in *De Architectura* has been awaiting, as well, recognition for a long time to come. As pertinent today as two millennia ago, antiquity's environmental wisdom is a germane reminder that facilitation of amicable pedestrian movement in cities is subject to some

timeless precepts. The age-old concern with urban microclimate in streetscape design remains a lasting challenge to planning for pedestrian-friendly urban precincts. Beyond outward superstition of archaic times, the substance of urbanist reasoning in ancient China and in the Greco-Roman architectural tradition, is vested in the careful observation of the urban microclimate, and in human ingenuity to shape built-environments accordingly. In its consideration of wind currents in street design for humans, the joint message of the *Bagua* author, the ancient Chinese city builders, and the Greco-Roman duo of architects, thus becomes a lasting legacy of antiquity's urbanist thought.

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Tables

Table 5.1 Chinese and Greco-Roman Wind-Names

King Wen "Later Heaven" *Bagua* arrangement				Tower of the Winds frieze		
Name	**Nature**	**Season**	**Direction**	**Chinese wind names**	**Greek wind gods**	**Roman gods**
离 Li	火 Fire	Summer	South	景风 Jing	Notus (South)	Auster
坤 Kun	地 Earth	Summer	Southwest	凉风 Liang	Lips (Southest)	Africus
兑 Dui	泽 Lake	Autumn	West	阊阖风 Chang He	Zephyrus (West)	Favonius
乾 Qian	天 Heaven	Autumn	Northwest	不周风 Bu Zhou	Skiron (Northwest)	Corus
坎 Kan	水 Water	Winter	North	广莫风 Guang Mo	Boreas (North)	Aquilo
艮 Gen	山 Mountain	Winter	Northeast	融风 Rong	Kaikias (Northeast)	Caecius
震 Zhen	雷 Thunder	Spring	East	明庶风 Ming Shu	Apeliotes (East or SE)	Subsolanus
巽 Xun	风 Wind	Spring	Southeast	清明风 Qing Ming	Eurus (Southeast or E)	Vulturnus

Table 7.1 Comparison of Sequential Arrangements in “Early Heaven” and “Later Heaven” *Bagua*

Direction	**South**		**Southwest**		**West**		**Northwest**	
Bagua	"Early"	"Later"	"Early"	"Later"	"Early"	"Later"	"Early"	"Later"
Trigram	乾 Qian	离 Li	巽 Xun	坤 Kun	坎 Kan	兑 Dui	艮 Gen	乾 Qian
Nature	天 Heaven	火 Fire	风 Wind	地 Earth	水 Water	泽 Lake	山 Mountain	天 Heaven
Direction	**North**		**Northeast**		**East**		**Southeast**	
Bagua	"Early"	"Later"	"Early"	"Later"	"Early"	"Later"	"Early"	"Later"
Trigram	坤 Kun	坎 Kan	震 Zhen	艮 Gen	离 Li	震 Zhen	兑 Dui	巽 Xun
Nature	地 Earth	水 Water	雷 Thunder	山 Mountain	火 Fire	雷 Thunder	泽 Lake	风 Wind

Figures

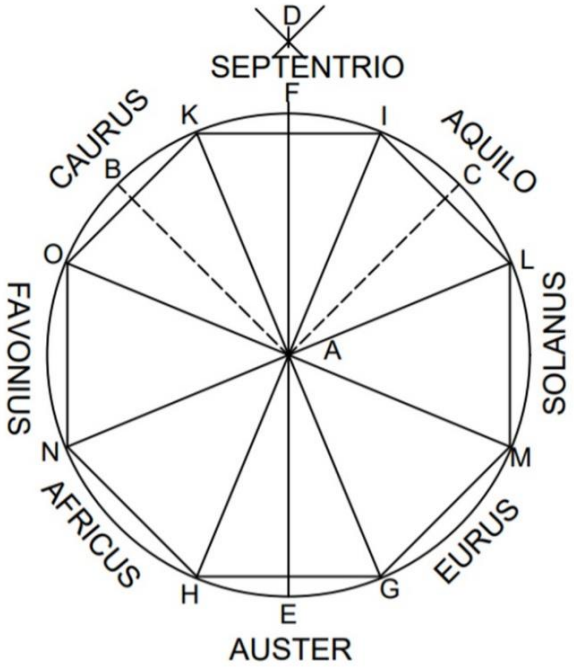

Figure 3.1 Vitruvius, Apportioning city's circumference among the Eight Winds, after woodcut by Fra Giovanni Giocondo, 1511

Figure 3.2 The Bagua Map, King Wen “Later Heaven” sequence

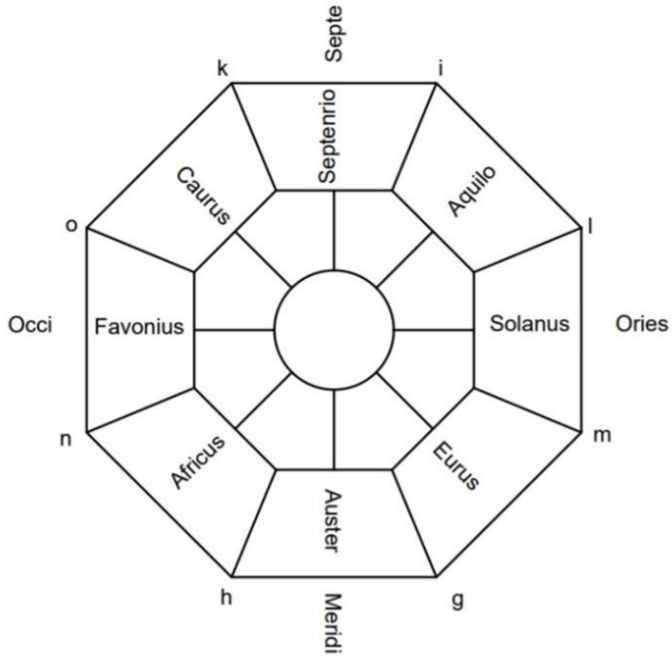

Figure 4.1 Vitruvius, Plan of an Ideal City, by Fra Giovanni Giocondo, 1511

Figure 4.2 Tower of the Winds, painting by Stuart and Revett, 1794

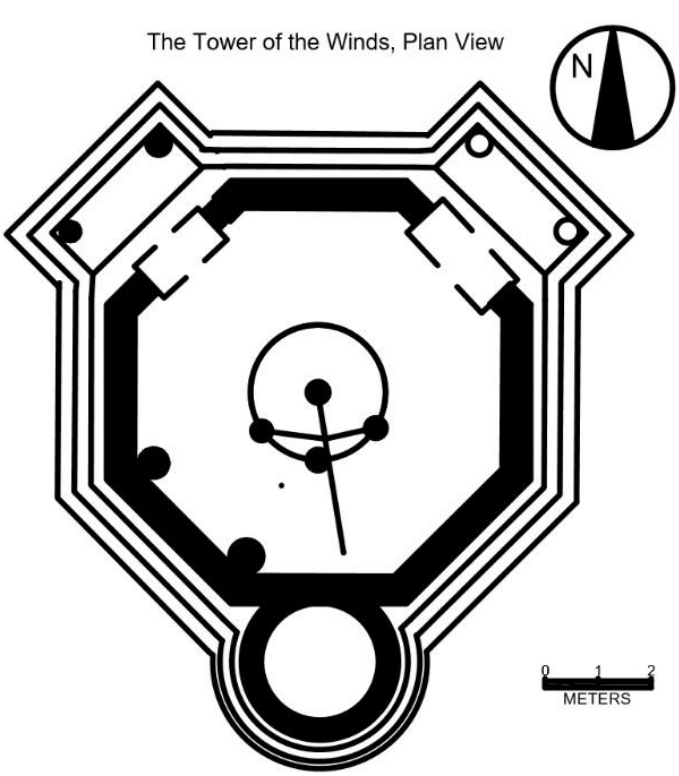

Figure 5.1 Andronicus of Cyrrhus, Tower of the Winds, plan

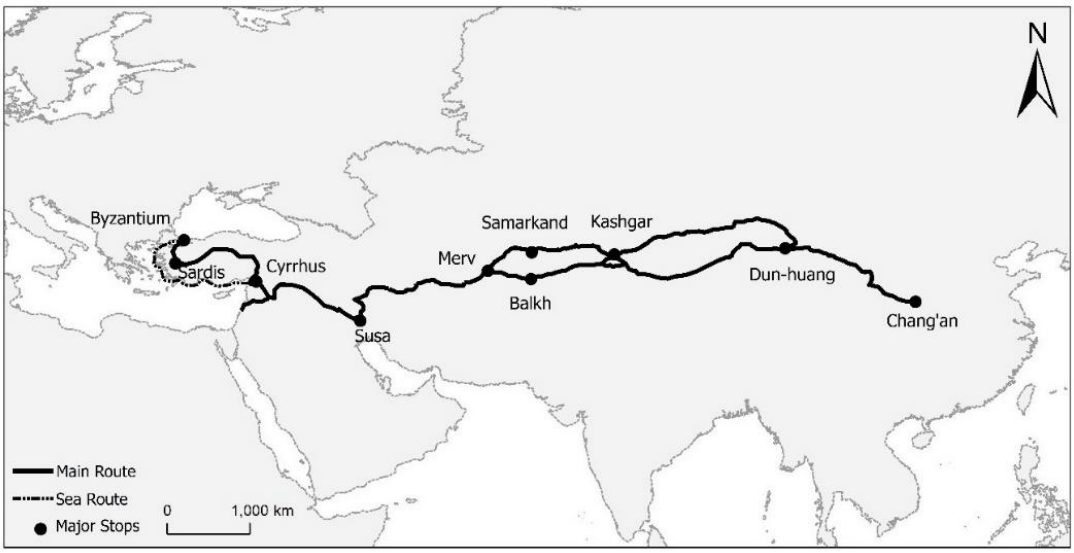

Figure 6.1 The Silk Road

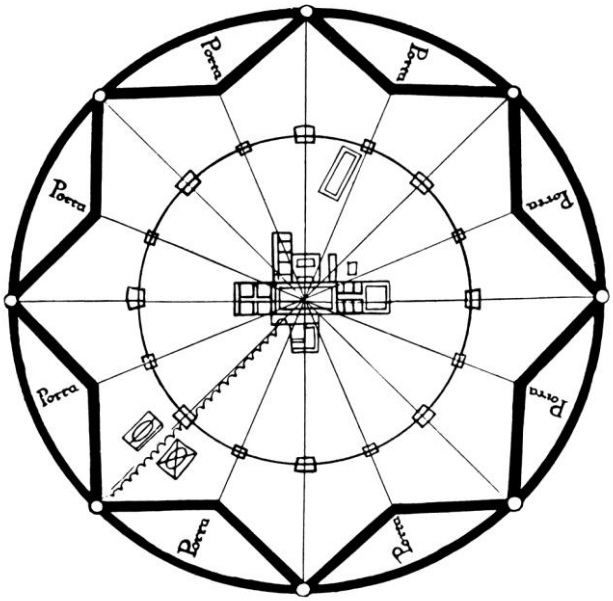

Figure 6.2 Filarete, Sforzinda, plan, 1461

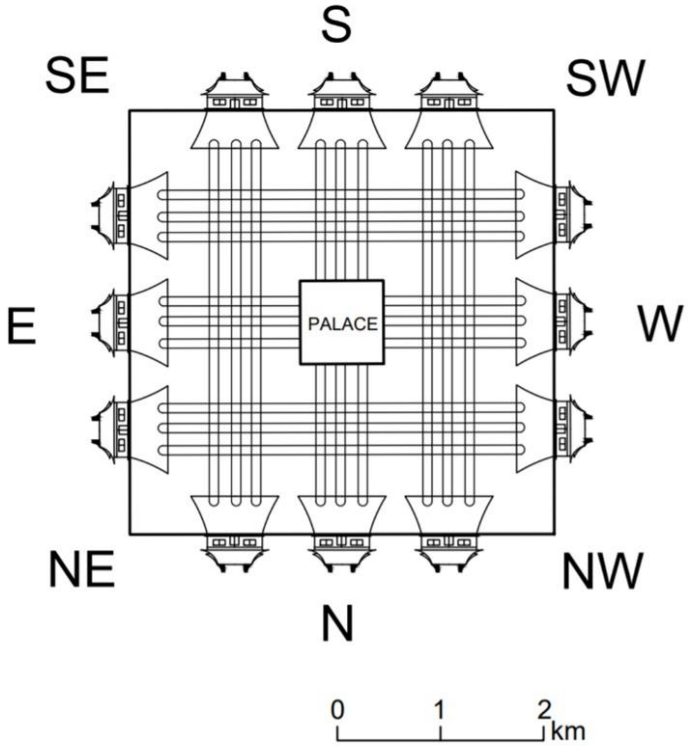

Figure 7.1 Plan of the Ideal Capital City, after 17th century illumination of *Kao Gong Ji*

Figure 8.1 Radcliffe Observatory, Oxford

Appendix

Dynasties Throughout Chinese History

Xia ……..…..….. c. 2070 – c. 1600 BC
Shang ….……..… c. 1600 – c. 1046 BC

West Zhou ……..…. c. 1046 – c. 771 BC
East Zhou ……..…. c. 770 – c. 256 BC
Qin ……..….... c. 221 – c. 207 BC
Western Han ……..…..... c. 206 BC – c. 25 CE
Eastern Han ……..……... c. 25 – c. 220
Three Kingdoms ……..……. c. 220 – c. 280
Jin ……..…… c. 265 – c. 420
North and South Dynasties ……..... c. 386 – c. 581
Sui ……..…. c. 581 – c. 618
Tang ……... c. 618 – c. 907
Five Dynasties …… c. 907 – c. 960
Song ……... c. 960 – c. 1279
Yuan ……..….... c. 1271 – c. 1368
Ming ……..….... c. 1368 – c. 1644
Qing ……..…..….... c. 1644 – c. 1911