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# Calling out Zheng Xuan (127–200 CE) at the crossroads of ritual, maths, sport and classical commentary

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Having formed over the first millennium BCE by a desultory process of accretion, transmission, translation, loss, recovery, and redaction, the Classics (*jing* 經), as they have come down to us, are hard to read.<sup>1</sup> They are *old*, and to understand their very language, let alone the ‘subtle words’ (*wei yan* 微言) of the ‘plainclothes [sage] king’s’ (*su wang* 素王) supposed curation thereof, one must rely on the *zhuan* 傳—the ‘traditions’ and/or/as ‘commentaries’—of Confucius’ (551–479 BCE) intellectual successors from the fifth to second century BCE. And so it goes for the *zhuan* as well, for they came about by a similarly desultory process requiring that second-century CE scholastics (*ru* 儒) fix *their* meaning with ‘chapter & verse’ (*zhangju* 章句) ‘annotation’ (*zhu* 注)—an expansive genre made possible by Ma Rong’s 馬融 (79–166 CE) invention of the double-line commentary (see Figure 2). History repeats itself, but for every layer of exegesis that the Classics have since accrued, there is one name to which the question of ‘how do we know that?’ consistently leads back: Zheng Xuan 鄭玄 (127–200 CE), Ma Rong’s preeminent disciple. In the words of Wang Shao 王邵 (fl. 577–605 CE), ‘One would rather say that the [Duke of] Zhou (r. 1042–1036 BCE) & [Master] Kong were mistaken than hear that Zheng [Xuan] & Fu [Qian] 服虔 (fl. 189–92 CE) were wrong’ 寧道孔聖誤，諱聞鄭服非.<sup>2</sup>

Our modern reading of ancient texts is similarly dependant on the likes of Zheng Xuan; the difference is that, in Wang Shao’s time, and in the first millennium CE more broadly, the implications of such hermeneutic authority went well beyond scholastics. As the ‘warp’ (*jing*) of civilisational order—the blueprint for returning to the golden age of

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<sup>1</sup> For an excellent study of this process in all its complexity, see Shaughnessy (2006); on issues of ‘translation’ and ‘domestication’ between pre-imperial (< 221 BCE) scripts, see Feng (2007).

<sup>2</sup> Cit. in *Jiu Tang shu* 舊唐書 (Zhonghua shuju ed.), 102.3181. I thank Zhu Yiwen for bringing this quote to my attention. On the Chinese commentarial tradition, see Makeham (2003).

Zhou (1045–771 BCE)—different interpretations of the Classics framed one’s options as concerned political and religious state-building. Consider for example Erudite Feng Gui’s 封軌 debate-opener on how the Manchurian-origin Tuoba-Wei (386–585 CE) should construct a Bright Hall (*mingtang* 明堂) ritual complex on the model of their Chinese neighbours in 477/79 CE:

明堂者，布政之宮，在國之陽，所以嚴父配天，聽朔設教，其經構之式，蓋已尚矣。故周官匠人職云：夏后氏世室，殷人重屋，周人明堂，五室、九階、四戶、八窗。鄭玄曰：『或舉宗廟，或舉王寢，或舉明堂，互之以見同制。』然則三代明堂，其制一也。The Bright Hall is a palace for promulgating policy. Located on the sunny (southern) side of the polis, it is that by which [the emperor] consigns his respected father to heaven, hears [the announcement of] the new moon & establishes the teachings, and the model for its construction was already there in the distant past. Thus does the *Offices of Zhou* 周官 ‘Post of Artisan’ 匠人職 [entry] say ‘FOR THE KINGS OF XIA, THE CHAMBER OF GENERATIONS, FOR THE PEOPLE OF YIN, THE DOUBLE HOUSE, AND FOR THE PEOPLE OF ZHOU, THE BRIGHT HALL—FIVE CHAMBERS, NINE STAIRWAYS, FOUR DOORS, AND EIGHT WINDOWS’. Zheng Xuan says ‘Some raised ancestral temples, some raised royal mausolea, and some raised Bright Halls—compare them and one sees that they are of the same construction’. As such, the Bright Halls of the Three Dynasties were of a single construction.<sup>3</sup>

And so it was that the Tuoba-Wei erected the architectural symbol of their legitimacy in occupied Luoyang in 496 CE on the basis of Zheng Xuan’s ‘annotations’—because it takes the second-century CE classicist to supply a single floor plan where the Classics themselves are generally silent or inconsistent on the details.<sup>4</sup>

It is not of course as if Sagetime institutions were self-evident or even agreed upon in Zheng Xuan’s time. Lu Lübing 盧履冰 (fl. 688–717 CE) reminds us of the confusion lingering around the most basic of rites in yet another public debate of 717 CE:

三年之制，說者紛然。鄭玄以為二十七月，王肅以為二十五月。又改葬之服，鄭云服總三月，王云訖葬而除。...鄭、王祖經宗傳，各有異同；苟摯采古求遺，互為損益。方知去聖漸遠，殘缺彌多。As to the institution of the ‘three-year’ [paternal mourning period], the explanations are in disarray: Zheng Xuan took it to be twenty-seven months, and Wang Su 王肅 (195–256 CE), twenty-five. Furthermore, as to changing from one’s funeral garments, Zheng says that one wears the light hemp for three months, while Wang says that one removes it at the end of the funeral. ... Zheng & Wang treated the Classics as their forefathers & the commentary/traditions as their ancestors, [and yet] each had their differences & commonalities; Xun [Yi] 荀顛 (d. 274 CE) & Zhi [Yu] 摯虞 (fl. 265–307 CE) picked over antiquity in search of the vestiges, [and yet] the one added & subtracted (*sun yi* 損益) from the other—it is at this that one understands our ever-increasing distance from the Sages and the surplus of deficiencies & gaps [in our understanding thereof].<sup>5</sup>

Wang Su’s commentaries are now lost, as are the writings of Zhi Yu, Xun Yi, and Lu Lübing, leaving us today but with one voice in a cen-

<sup>3</sup> *Wei shu* 魏書 (Zhonghua shuju ed.), 32.765.

<sup>4</sup> On the Bright Hall, see Maspero (1951), Soothill (1951), Forte (1988), Lewis (2005), 265 ff., and Tseng (2011), 17–88.

<sup>5</sup> *Jiu Tang shu*, 27.1024. On the debate between Xun Yi and Zhi Yu over the commentaries of Zheng Xuan and Wang Su to which Lu Lübing is referring, see *Jin shu* 晉書 (Zhonghua shuju ed.), j. 19; cf. Goodman (2010), 353–62.

turies-long, multi-party exchange over second-millennium BCE practice.<sup>6</sup> The reason for Zheng Xuan's modern pride of place therefore has everything to do with selection.

Namely, in 631 CE the emperor the fledgling Tang empire (618–907 CE) ordered the imperial academician Kong Yingda 孔穎達 (574–648 CE) to lead a multicultural North–South project to produce standardised editions and subcommentaries (*shu* 疏) for the Five Classics, two of which would incorporate Zheng Xuan's 'annotations'—*Mao's Odes* and the *Record of Rites*. After fifteen years of collaboration, negotiation, renegotiation, and reorganisation, the project would result in 653 CE in *The Correct Meaning of the Five Classics* (*Wujing zhengyi* 五經正義), which would come to serve as a pillar of the civil service examination and, thus, of the aspiring officeholder's education. Tellingly, it is Kong Yingda who coined the modern term *kecheng* 課程, which we now translate as 'curriculum' though what it originally/still means is administrative 'test norms'. One of Kong's collaborators, Jia Gongyan 賈公彥 (fl. 637 CE), further took it upon himself to compose standard editions and subcommentaries of the lesser Classics *Rites of Zhou* and *Book of Etiquette & Ceremonial*, also on the basis of Zheng Xuan's 'annotations', which would eventually find their way into the expanded canon of the Southern Song (1127–1279 CE).<sup>7</sup> Of the later Thirteen Classics, Zheng Xuan's 'annotations' were selected for four—and 3/3 of the ritual classics—thus canonising his interpretations in what has for centuries been the mainstay of the Chinese book industry: test preparation materials.<sup>8</sup>

Just because Zheng Xuan's interpretation was the right answer on the test does not of course mean that it was *right*, which brings us back to the question of 'how do we know that?' as concerns Sagetime institutions. How does he know that the 'Chamber of Generations' has five chambers and nine stairways, or that the 'three-year' mourning period is really twenty-seven months? It stands to reason that Zheng Xuan *learned* this, and luckily we know something about his education. According to his official biography:

玄少為鄉畜夫，得休歸，常詣學官，不樂為吏，父數怒之，不能禁。遂造太學受業，師事京兆第五元，先始通京氏易、公羊春秋、三統歷、九章算術。又從東郡張恭祖受周官、禮記、左氏春秋、韓詩、古文尚書。以山東無足問者，乃西入關，因涿郡盧植，事扶風馬融。

Xuan served as a district manager in his youth, but he obtained a discharge to return [home at 11 or 12 years of age]. He paid frequent visit to instructional officers, taking no pleasure from serving office [himself], [but though] his father reprimanded him numerous times, he was unable to prohibit [his son from doing as he desired]. [Zheng Xuan] then went to the Imperial Academy (*Taixue* 太學) [in Luoyang] to receive instruction (lit. 'his patrimony'), serving Diwu Yuan 第五元 of the Capital as his disciple, [under whom] he first mastered (1) *Mr Jing [Fang's Book of] Changes*, (2) the *Gongyang Tradition of the Spring & Autumn Annals*, (3) the *Triple Concordance li*, and (4) the *Nine Chapters of Mathematical Procedures*. He also became a follower of Zhang Gongzu 張恭祖 of Dong Commandery, [from whom] he re-

<sup>6</sup> To be precise, all that survives of their writing is fragments cited in later sources: for Wang Su, see *Quan Sanguo wen* 全三國文 (Zhonghua shuju ed.), j. 23; for Xun Yi, see *Quan Jin wen* 全晉文 (Zhonghua shuju ed.), j. 31; for Zhi Yu, see *ibid.*, j. 76; for Lu Lübing, see *Qinding quan Tang wen* 欽定全唐文 (Zhonghua shuju ed.), j. 335. Fragments of lost commentaries such as Wang Su's can be found in *Yuhan shanfang ji yishu* 玉函山房輯佚書 (Xuxiu Siku quanshu ed.).

<sup>7</sup> On the *Correct Meaning of the Five Classics* project, see McMullen (1988), 67–112.

<sup>8</sup> On the civil service exam and the history of education in China, see Lee (2000).

ceived (5) the *Offices of Zhou*, (6) the *Record of Rites*, (7) the *Zuo Tradition of the Spring & Autumn Annals*, (8) *Han's Odes*, and (9) the [excavated] ancient-text *Book of Documents*. As there were not enough [masters] to question East of the Mountains, he therefore entered the Passes to follow Lu Zhi 盧植 (d. 192 CE) of Zhuo Commandery and serve Ma Rong of Fufeng.

融門徒四百餘人，升堂進者五十餘生。融素驕貴，玄在門下，三年不得見，乃使高業弟子傳授於玄。玄日夜尋誦，未嘗怠倦。會融集諸生考論圖緯，聞玄善筭，乃召見於樓上，玄因從質諸疑義，問畢辭歸。融喟然謂門人曰：「鄭生今去，吾道東矣。」

[Ma] Rong's disciples numbered more than four-hundred, of which only some fifty [were permitted to] ascend the hall & approach [the master]. [Ma] Rong was proud & elitist of nature, and [so Zheng] spent three years beneath his gate without seeing him before [Ma Rong] dispatched an advanced disciple to transmit [his teachings] to [Zheng] Xuan. [Zheng] Xuan researched & recited night & day, [succeeding] never once to idleness or exhaustion. One day [Ma] Rong gathered his various students to study & discuss (10) the charts & wefts (i.e. the apocrypha), and having heard that [Zheng] Xuan was good at maths (*suan* 筭) he thereupon summoned him to appear upstairs. [Zheng] Xuan obeyed, testifying to them on doubtful points [of interpretation] and, when the interrogation was finished, politely announced his return [home]. [Ma] Rong sighed, saying to his disciples, 'With Student Zheng's departure today my *dao* [now travels] east'.<sup>9</sup>

In short, Zheng Xuan received his education through private exchange ('visits'), the Imperial Academy, and private school, and it was an education that focused, in the order presented, on the modern-text Classics (1–2), *li* 曆 mathematical astronomy (3), *suan* 筭 mathematics (4), the ancient-text classics (5–9), and the 'weft' apocrypha (10).<sup>10</sup> Not surprisingly, Zheng Xuan's subsequent commentarial activities are clustered around the self-same domains of study. Moreover, of the twelve classical commentaries of his to survive to the seventh century, the *Book of Sui* bibliographic monograph (656 CE) records commentaries by his master, Ma Rong, to six of the self-same texts—'annotations' with the same title and, often, in the same number of rolls (see Table 1). Whatever that means, there is one case where our primary sources draw the link between learning and commentary fairly clearly—his visit with Liu Hong 劉洪 (fl. 167–206 CE) over the latter's Supernal Emblem *li*:

獻帝建安元年，鄭玄受其法，以為窮幽極微，又加注釋焉。

In [196 CE], Zheng Xuan received his method, and considering it to plumb all that is recondite & crown all that is subtle, he further added annotations & explanations thereto.<sup>11</sup>

Such commentary, written by a 'master' (*shi* 師), would go on to serve as the textual embodiment and transmission vector of an academic 'family' (*jia* 家)—its 'master's method' (*shi fa* 師法), or 'family method' (*jia fa* 家法), and, most importantly, its *test norms*. Even before the civil service exams of the later dynasties, if one in Zheng Xuan's day wished to pursue scholastic office through the Imperial

<sup>9</sup> *Hou Han shu* 後漢書 (Zhonghua shuju ed.), 35.1207. Note that the numbers are added by the author and that insertions are as per Li Xian's 李賢 (654–84 CE) commentary in *ibid*.

<sup>10</sup> On the apocrypha and the 'ancient-' vs. 'modern-text' divide in Eastern Han (25–220 CE) scholarship, see Dull (1966) and Lü (2003).

<sup>11</sup> *Jin shu*, 17.498. On the transmission of Liu Hong's work in astronomy, see Chen (1986) and Morgan (forthcoming).

Academy and its parent ministry, the Ministry of Rites (*Taichang* 太常), one would need to prepare for ‘testing’ (*shi* 試) and ‘classification’ (*ke* 科) by ‘shoot-strips’ (*shece* 射策): ‘making bamboo-strip with challenging questions, arranging them atop a desk, and having examinees randomly throw-shoot (cast lots) to select and answer [a question]’ 作簡策難問，列置案上，任試者意投射取而荅之。<sup>12</sup> Whether or not *commentary* was a criterion of advancement from the Academy’s inception, under Emperor Wu of Han (r. 140–87 BCE), it was certainly adopted with the approval of Xu Fang’s 徐防 (fl. 75–107 CE) policy paper of 103/104 CE:<sup>13</sup>

臣聞詩書禮樂，定自孔子；發明章句，始於子夏。其後諸家分析，各有異說。漢承亂秦，經典廢絕，本文略存，或無章句。收拾缺遺，建立明經，博徵儒術，開置太學。孔聖既遠，微旨將絕，故立博士十有四家，設甲乙之科，以勉勸學者，所以示人好惡，改敝就善者也。

Your humble servant has heard that the [Classics of] *Odes & Documents* and *Rites & Music* were fixed from the time of Master Kong, and that the revelation & illumination of their chapter & verse began with [his disciple] Zixia 子夏; thereafter, the various ‘families’ split apart, each possessed of different sayings. The Han (203 BCE – 220 CE) inherited the mess of Qin (221–207 BCE), and the Classics & canons [of state] were abandoned & lost; their original text survived in part, some devoid of chapter & verse [commentary]. We collected & tidied what was defective & lost, establishing & erecting the Enlightenment of the Classics [exam], and we broadly recruited scholastics & technicians for the opening & institution of the Imperial Academy. Sage Kong is already far away, and his subtle directives on the verge of dissolution, and thus did we establish ten-and-four Erudites (*boshi* 博士) and introduce their A & B classification (*ke*) to encourage & reward scholastics—that by which to show people good & bad and correct the faults of those wont to go to goodness.

伏見太學試博士弟子，皆以意說，不修家法，私相容隱，開生姦路。每有策試，輒興爭訟，論議紛錯，互相是非。...臣以為博士及甲乙策試，宜從其家章句，開五十難以試之。解釋多者為上第，引文明者為高說：若不依先師，義有相伐，皆正以為非。五經各取上第六人，論語不宜射策。雖所失或久，差可矯革。]

Prostrate [before You, I] see that the Imperial Academy’s testing (*shi*) of the Erudites’ disciples is [now conducted] solely by wayward rhetoric, cultivated not of family models; by forgiveness of sensibilities by private accord, they open the road for students’ jealousies. Every time there is a strip-exam, it immediately provokes argument & accusation; discourse & opinions entangle & divide, calling right & wrong on one another. ... Your humble servant that the Erudites as well as the A & B [class] strip-exam had best follow their family of chapter & verse [commentary] and open fifty challeng[ing questions] by which to test them. [We should recognise] those who amply analyse & explain as upper-rank, and those who clearly cite the texts as advanced exegesis (?); any [answer] that does not rely on a former master, [and/or] that militates against itself in its meaning, [should] in all cases be considered wrong [even] if it is correct. For each the Five Classics one [should] take six people from the upper-rank, [while/but] the *Analects* is inappropriate for shoot-strips. It may be that some of [these] missteps are persistent, but they are nonetheless amenable to prideful reform.<sup>14</sup>

<sup>12</sup> *Hou Han shu*, 6.260 (comm.).

<sup>13</sup> On the Imperial Academy and civil service recruitment in the Han, see Bielenstein (1980), 132–42.

<sup>14</sup> *Hou Han shu*, 44.1500–01.

If there is anything peculiar about Zheng Xuan's intellectual origins, it is not the intimacy of commentary and education, nor the intermingling of philology, mathematics, and prophecy—polymathy, if anything, was both common and central to gentlemanly education—what is peculiar, rather, is how he skated around all the conventional avenues of personal advancement for a scholar of his calibre.<sup>15</sup>

Zheng Xuan began in the setting of the Imperial Academy—the Imperial Academy as reformed in 103/104 CE and rebuilt in 132 CE—but he eschewed the opportunities for advancement that it offered its members, preferring instead to ‘enter the Passes’ out of his apparent boredom of what Luoyang had to offer. He hadn't classed in shootstrips to become an academician, nor, as such, could he have participated in the greater (con)test held by the Ministry of Rites: the ‘Big Shoot’ (*da she* 大射) archery contest held at the Bright Hall's Circular Moat (*biyong* 辟雍) sporting and ritual centre for the prize of assisting in the imperial ancestral sacrifices. *That* was not Zheng Xuan's world, so he left instead to study with Ma Rong, far from modern instantiations of the royal rites he would later expound.

It is easy to understand why he might seek out Ma Rong, because Ma Rong, like Zheng Xuan, was a free-spirited genius whose life took an unconventional path. Ma Rong too devoted his youth to ‘wandering studies’ (*youxue* 遊學), successfully avoiding employment until 108 CE, when, at age thirty, he was discovered on campaign by the Empress Dowager's brother. Ma ran into a war zone to get away from his job offer, but, after suffering hunger and exhaustion behind Qiang 羌 lines, he finally caved in, accepting an appointment to the Eastern Observatory (*Dongguan* 東觀) upon its founding as an academic institution in 110 CE. The Eastern Observatory was a special place: it was founded by Empress Dowager Deng Sui 鄧綏 (b. 81; r. 105–121 CE) around an existing library/archive *within the palace*, where men were normally forbidden. With the death of her husband in 105 CE, the death of his infant heir in 106 CE, and the installation of a thirteen-year-old nephew 107 CE, the reins of government fell by happenstance to this then unassuming, twenty-five-year-old widow otherwise known for her kindness, beauty, and passion for classical, mathematical, and omenological learning. After family tragedy, unprecedented flooding, a refugee crisis, an assassination attempt, and a near-fatal illness, Empress Deng began to worry about her understanding of the Classics—the ‘warp’ of civilisational order—so she repurposed the palace library into a think-tank of eminent scholars whose task was to ‘check & collate the commentary/traditions & records’ 讎校傳記 and ‘instruct the palace women’ 教授宮人.<sup>16</sup> With the Imperial Academy having suffered a long decline in elite men's education under competition from the Circular Moat, the Eastern Observatory quickly became the preeminent centre of textual scholarship in all the empire, and it was there, as a disciple of Ban Gu's 班固 (32–92 CE) sister, Zhao 昭 (44/49 – 118/121 CE), that Ma Rong made his name as a commentator.<sup>17</sup>

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<sup>15</sup> On the culture of polymathy amongst the intellectuals of Zheng Xuan's time, see Goodman (2005); on the popularity of mathematical learning in particular, see Cullen (2009).

<sup>16</sup> *Hou Han shu*, 10A.424. For a translation of Empress Deng's biography, see Swann (1931); on the Eastern Observatory, see Goodman (2005).

<sup>17</sup> For Ma Rong's biography, see *Hou Han shu*, 60A.1953–73. According to Ban Zhao's biography, one notes, Ma ‘lay beneath the pavilion [there] and received the reading [of her brother's *Book of Han*] from [Ban] Zhao’ 伏於閣下，從昭受讀 (ibid., 84.2785).

The Imperial Academy was back in full force by 145/64 CE, when Zheng Xuan studied there with Diwu Yuan and Zhang Gongzu, and so too, for that matter, did the Circular Moat continue as the premier centre for archery and ritual.<sup>18</sup> Still, Zheng Xuan, our sole and most precious authority on the ritual classics in transmitted literature, passed up this man's world to seek out a retired vestige of the Empress' women's college. His choice is noteworthy, and it begs the question of how his book-learning on royal ritual may have suffered from his relative lack of exposure to living practice.

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The question of whether Zheng Xuan's understanding of pre-first-millennium BCE ritual is *accurate* is one that is somewhat fatuous considering the time at which he lived. Not surprisingly, the fruits of archaeology and palaeography have, in the last several hundred years, revealed that much of what the Classics and their commentaries report of these subjects is wrong: the Bright Hall and the 'monthly ordinances' (*yue ling* 月令) performed there, for example, are clearly products of late-Warring States (475–221 BCE) metaphysics, and it is doubtful that there was ever a single 'institution' (*zhi* 制) as concerns the exact length of time one mourned one's father. Sure, 'classical' (or supposedly classical) ritual made its way through fits and starts into contemporary practice, but only in a response to and as amalgamated with modern exigencies, the classicist's philological insights representing more often than not an overt position taken for or against the institutions of his own day.<sup>19</sup> Still, in as much as the Classics were thought infallible, and Zheng Xuan selected as their mouthpiece, it would be good to know if the latter *was* wrong—*really* wrong, as in on the level of describing 'institution' that are physically impossible—and what later commentators did about it.

To this end, I shall draw an example from Zheng Xuan's 'annotations' on the 'Big Shoot' chapter of the *Book of Etiquette & Ceremonial*, which the reader will find translated in the Appendix. The *Book of Etiquette & Ceremonial*, for which one can turn to the translations of de Harlez (1890), Couvreur (1916), and Steele (1917), is a book of liturgy describing the step-by-step practice of rites at the centre of the other Classics' historical and philosophical expositions of the nature of civilised man. The 'Big Shoot', as already mentioned, is a ritual drinking and shooting event, the purpose of which is to 'observe the virtue' (*guan de* 觀德) of the participants and send the winning team to assist in the royal ancestral sacrifices. The rite begins with a reception, which involves pledging, drinking, washing, and going up and down from seats and stairs. Once everyone has paid their respects, and had a couple of drinks, the host then appoints a director of shooting, who selects and equips three couples and offers them a demonstration. There are then three rounds, with four arrows per person per round. The first round is practice, the second round is scored, and the third round requires that participants shoot in time to music. The second and third rounds are followed each by a tally and drinking punishments for the losing team (the couples are divided into 'left' and 'right' teams formed by the 'top' and 'bottom' shooters of each couple). After that is done, there is another reception, an optional one-arrow bo-

<sup>18</sup> On the Imperial Academy, see Note 13. For instances of archery shoots held at the Circular Moat during this period, see *Hou Han shu*, 6.260, 30A.1050, 79A.2547.

<sup>19</sup> On the historical origin of the Bright Hall and 'monthly ordinances', see the references cited in Note 4; see also Mo (2009) as concerns Zheng Xuan and Wang Su on the vaunted *di* 禘 and *xia* 禘 ancestral sacrifices.



nus round, and, finally, limitless ‘goblets without counting’ (*wu suan jue* 無筭爵) drinking. To reiterate, this was a male event—a very male event—the practice and symbolism of archery being at the foundation of contemporary masculine identity.<sup>20</sup>

Let us focus here on target geometry. Between the various chapters of the *Book of Etiquette & Ceremonial* and *Offices/Rites of Zhou*, the Classics describe the event as employing three targets at a distance of 50, 70, and 90 ‘bow[-lengths]’ (*gong* 弓) or, alternately, ‘fox-strides’ (*li bu* 狸步). These are odd measuring units that appear uniquely in this context. The targets are described as being made of cloth and suspended into the air from poles on either side. The target (*hou* 侯) itself is comprised of a square *zhong* 中 (‘centre’ or ‘hit-area’), at the centre of which, at one third its size, is a *hao* 鵠 (‘bull’s-eye’, lit. a ‘swan’ or some other type of bird) made of animal skin; attached to the top and bottom of the *zhong* are cloth ‘bodies’ (*gong* 躬) and ‘tongues’ (*she* 舍) that extend outwards like limbs to connect the target with to poles. As concerns target cloth, dimensions are given in a mixture of bolts, ‘arm spans’ (*xun* 尋), and civil length-measures:

$$1 \text{ zhang 丈} = 10 \text{ chi 尺} = 100 \text{ cun 寸} = 1000 \text{ fen 分} = 231 \text{ cm}$$

The three targets are described as all but identical in proportion except that the two ‘bodies’ and ‘tongues’ remain a constant height of 1 bolt. Each however uses a different animal skin for the *hao*, and absolute size is determined by distance: ‘bow 2 *cun* makes the target *zhong*’ 弓二寸以為侯中,<sup>21</sup> which commentators read to mean that that the ratio of the length of the *zhong*’s sides to its distance is 2 *cun* to 1 bow.

That is all the Classics give us to work with, and it is not much, nor, for that matter, does it make a lot of physical sense. The Classics, for example, would have one shooting at a *hao* on what is essentially a sail hoisted into the sky (as if unaware of wind), while later historical records of archery trails, by contrast, describe targets installed (much more reasonably) against ‘embankments’ (*lie* 埒).<sup>22</sup> The same thing goes for the commentaries: just consider Zheng Xuan’s disagreement with Zheng Zhong 鄭眾 (d. 83 CE) about how literally we are to take the *Office/Rites of Zhou*’s ‘dividing the breadth [of the *zhong*] in three, the *hao* occupies one thereof’ 參分其廣，而鵠居一焉。<sup>23</sup> Zheng Zhong says of the 50-bow/fox-pace target that ‘the square of 10 *chi* [to the side] is called the “target,” and that of 4 *chi* is the *hao*’ 方十尺曰侯，四尺曰鵠， and Zheng Xuan corrects him that ‘for a target *zhong* of 1 *zhang*, the *hao* is a square of 3 *chi* 3 *cun* & [1/3] *cun* [to a side]’ 侯中一丈者，鵠方三尺三寸少半寸。<sup>24</sup> Zheng Xuan is right that one third gets you 3.3333 *chi*, but Zheng Zhong’s numbers are clearly sensitive to the practicalities of construction: Han regulation cloth bolts came at a width of 2 *chi*, which would have made it much easier to fashion a 4 *chi* × 4 *chi* square than to shave 0.6667 *chi* off a bolt of cloth with the aid of a *chi*-rule—a *chi*-rule, one notes, that would have only been graduated to 0.1 or 0.01 *chi*.<sup>25</sup> This aspect of the classical archery rite, to Zheng Xuan, was clearly a problem of mathematics abstracted from physical considerations.

<sup>20</sup> On this point, see the ‘Meaning of Shooting’ chapter of the *Record of Rites*, cf. Morgan (2017), chp. 5.

<sup>21</sup> *Yili zhushu* 儀禮注疏 (Shisanjing zhushu ed.), 5.151b.

<sup>22</sup> See for example *Sui shu* 隋書 (Zhonghua shuju ed.), 8.165–66.

<sup>23</sup> *Zhouli zhushu* 周禮注疏 (Shisanjing zhushu ed.), 41.639a.

<sup>24</sup> *Zhouli zhushu*, 7.108a (comm.).

<sup>25</sup> See Qiu (1992).

Where things get weird, however, is in Zheng Xuan's explanation of how these targets are to be installed upon the field. To summarise, the *Book of Etiquette & Ceremonial* tells us that the three targets are to be hoisted at their respective distances, presumably on a straight line, such that the *hao* of one peeks out over the target in front of it, and, also, that the nearest target 'does not reach the ground military' 不及地武.<sup>26</sup> Zheng interprets this last line to mean 'is a footstep off the ground', gives this an 'average human' value of 1.2 *chi*, and provides the respective heights of the other targets as 'calculated' (*ji* 計) therefrom: 10.5333 *chi* and 22.5333 *chi*, respectively. Zheng does not show all of his work, but what he does show matches his *modus operandi*: faced with a melange of questionable anthropometric and object-based measuring units, he supplies philological evidence for how each converts into *chi* so as to turn this into a proper mathematical problem. A 'fox-pace', for example, appears here where another text uses 'bows'; the Zhou bow 'institution' makes the bow 6 *chi* long, thus 1 fox-pace = 6 *chi*, Q.E.D. Of all there is to say about his commentary to these lines, the most important is this: Zheng Xuan's heights are calculated in *two dimensions*, as if he forgot that the targets were at different distances (see Figure 1).

This oversight is not due to the limitations of contemporary mathematics. Here, for example, is problem 9.22 of the *Nine Chapters of Mathematical Procedures*, which Zheng Xuan studied in the Imperial Academy, and which instructs the reader how to calculate the height of objects aligned at different distances from the observer:

有山居木西，不知其高。山去木五十三里，木高九丈五尺。人立木東三里，望木末適與山峰斜平。人目高七尺。問山高幾何？

Supposons qu'on ait, à l'ouest d'un arbre, une montagne, dont on ne connaît pas la hauteur, que la montagne soit à une distance de 53 *li* de l'arbre, que l'arbre ait une hauteur de 9 *zhang* 5 *chi* et que si une personne se tient à 3 *li* à l'est de l'arbre, elle voie l'extrémité de l'arbre et le sommet de la montagne juste sur une même oblique. Si l'œil de la personne est à une hauteur de 7 *chi*, on demande combien vaut la hauteur de la montagne.

答曰：一百六十四丈九尺六寸、太半寸。

Réponse : 164 *zhang* 9 *chi* 6 *cun* deux tiers de *cun*.

術曰：置木高減人目高七尺，餘，以乘五十三里為實。以人去木三里為法。實如法而一，所得，加木高即山高。

Procédure : on place la hauteur de l'arbre, et on en soustrait la hauteur de l'œil de la personne, 7 *chi*. Le reste, on en multiplie les 53 *li*, ce qui fait le dividende. On prend la distance de la personne à l'arbre, 3 *li*, comme diviseur. Et on effectue la division du dividende par le diviseur. Ce qu'on obtient est ajouté à la hauteur de l'arbre, ce qui donne la hauteur de la montagne.<sup>27</sup>

Zheng Xuan supposedly knew this—he was, after his training, 'good at maths' (above)—and so too, for that matter, should Kong Yingda, the leader of the committee who chose Zheng Xuan's commentaries for canonisation. According to his biography, Kong was 'good at maths & mathematical astronomy' 善算曆, which is borne out by the fact of his participation in a public debate on *li* mathematical astronomy in 640 CE<sup>28</sup>, his contribution to one of the more impenetrable theo-

<sup>26</sup> *Yili zhushu*, 5.110a.

<sup>27</sup> Tr. Chemla & Guo (2004), 741. Chapter 9, one notes, is devoted in part to similar (and similarly applicable) types of problems.

<sup>28</sup> See *Jiu Tang shu* 舊唐書 (Zhonghua shuju ed.), 73.2601.

ries of cosmology in his day,<sup>29</sup> and the mathematical proofs running throughout his own classical subcommentaries.<sup>30</sup> So, after Liu Hui 劉徽 (fl. 263 CE) had significantly fleshed out the theory and practice of problems like that cited here in the *Sea Island Mathematical Classic* (*Haidao suanjing* 海島算經) and his famous commentary to the *Nine Chapters*, what was a mathematically-savvy seventh-century CE classicist like Kong Yingda to do with Zheng Xuan's numbers?

Most of what we know about Kong's collaborator, Jia Gongyan, we know based on his subcommentaries, and these, one notes, share a similar interest, idiom, and approach to the mathematics of classical scripture.<sup>31</sup> Curiously, what Jia's subcommentary does, as we see in the Appendix, is tortuously add and subtract the heights and dimensions of the targets' constituent elements, filling in philological lacunae where they appear, so as to supply Zheng Xuan's commentary with a mathematical proof—'Thus do [his] annotations arrive at these numbers' 故注於此數也, O.E.D. (see Figure 1).<sup>32</sup> It would seem that he hesitates, since he frames his inquiry around 'how it is known' and is quick to point out where Zheng has moved away from scriptural evidence, e.g. 'there is nothing [in the] text's body, [so Zheng Xuan] knows this by visual inspection' 無正文以目驗而知 as concerns the size of human feet.<sup>33</sup> Still, one gets the sense that what was true a half-century earlier was still true in Jia Gongyan's day: 'One would rather say that the [Duke of] Zhou & [Master] Kong were mistaken than hear that Zheng [Xuan] & Fu [Qian] were wrong'.

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The lesson that I want to draw from this example it is this: Our learning of the Confucian Classics is irrevocably filtered through commentaries written by later figures like Zheng Xuan, Kong Yingda, and Jia Gongyan, and such, indeed, was the case as far back as the Classics go. The scholars upon which we rely were generally 'good at mathematics', and *that*, it is worth stressing, is not simply a curious historical fact about them, but an integral part of the epistemological toolkit(s) that they brought to bear on literary, historical, philosophical, and ritual texts. 'Ritual' (*li* 禮) in these texts inevitably boils down to 'numbers' (*shu* 數); thus the common portmanteau *lishu* 禮數 for 'ritual', and thus the likes of a Ma Rong or a Jia Gongyan, who looked for a *mathematician* to explain ancient texts. Such is no longer the case. With sensibilities rooted in twentieth-century academic specialisation, and early twentieth-century anthropology of the 'primitive', which denied mathematics a place in 'Chinese thought',<sup>34</sup> we have in sinology built a *cordon sanitaire* around the topic of numbers. On the one side stands *li*, and the other, *shu*—on the one side, *history*, and the other, *the history of science*—thus balkanising the coherent mental universe of *the individual* and *the individual text* into Zheng Xuans of which one another has never heard. *Numbers*, as I have offered the present example to demonstrate, go a long way towards revealing what Zheng Xuan is about when put (back) into dialogue with his classical scholarship, but *numbers*, as Zheng Xuan's own scholarship reminds us, had best not be treated as a solution in themselves.

<sup>29</sup> See Chen (2007), 484–92.

<sup>30</sup> See Zhu (forthcoming).

<sup>31</sup> See Zhu (2015; forthcoming).

<sup>32</sup> *Yili zhushu*, 7.189a (subcomm.).

<sup>33</sup> *Yili zhushu*, 7.188b (subcomm.).

<sup>34</sup> See, in part, Saussy (2000) and Brown (2006).

	Text annotated	rolls
1	周易 <i>Book of Changes</i> *	9
2	尚書 <i>Book of Documents</i> *	9
3	尚書大傳 Great Comm. to the Book of Documents	3
4	毛詩 <i>Mao's Odes</i> *	20
5	周官禮 <i>Offices &amp; Rites of Zhou</i> *	12
6	儀禮 <i>Book of Etiquette &amp; Ceremonial</i>	17
7	喪服經傳 <i>Mourning Garments, Classic &amp; Commentary</i> *	1
8	喪服譜 <i>Mourning Garment Tables</i>	1
9	禮記 Record of Rites	20
10	論語 <i>Analects</i>	10
11	孝經 <i>Classic of Filial Piety</i> *	1
12	孟子 <i>Mencius</i>	7
13	易緯 <i>Changes Weft(s)</i>	8
14	尚書緯 <i>Documents Weft(s)</i>	3
15	尚書中候 <i>Book of Documents On-target [Omen] Observations</i>	5
16	禮緯 <i>Rites Weft(s)</i>	3
17	禮記默房 <i>Record of Rites Silent Chamber</i>	3
18	乾象曆 <i>Supernal Emblem li</i>	?
19	日月交會圖 <i>Lunar &amp; Solar Crossing Diagrams</i>	1
20	九宮經 <i>Classic of the Nine Palaces</i>	3
21	九宮行碁經 <i>Classic of the Nine Palace Moving Chess Pieces</i>	3

Table 1: Zheng Xuan's commentarial writing as documented in his biography (*Hou Han shu*, 35.1207–1213) and the *Book of Sui* bibliographic monograph of 656 CE (*Sui shu*, j. 32–35). The asterisks mark those works for which Zheng's master, Ma Rong, wrote his own commentary in the context of the Eastern Observatory collation project. As to the subject of Zheng Xuan's exegetical work, one notes that entries 1–12 consist of 'Classics' (*jing*) and their 'commentary/traditions' (*zhuan*), 13–17 are 'weft' (*wei*) apocrypha, 18–19 are works of *li* 曆 mathematical astronomy, and 20–21 are on 'classics' of 'five-agents' (*wu xing* 五行) personal fate divination. Grey highlighting indicates those commentaries that were selected for canonisation in the seventh century CE.

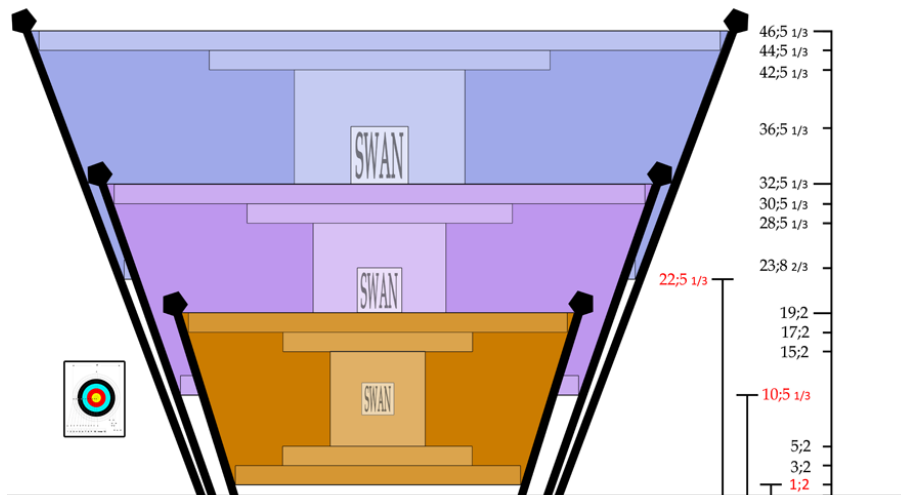


Figure 1: Reconstruction of Zheng Xuan's target height numbers and Jia Gongyan's mathematical proof thereof. Numbers are annotated  $x;y$ , where  $x$  is *chi* and  $y$  is *cun*, the terminal fraction applying to the previous unit. On the left, I have supplied the modern World Archery Federation's regulation long-range 70 m target face as it would appear set at the same distance (using Zheng Xuan's rate of 1 bow = 6 *chi*, and 1 *chi* = 23.1 cm).

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Appendix

Excerpt from Book of Etiquette & Ceremonial, 'Big Shoot' annotated (zhu 注) by Zheng Xuan with subcommentary (shu 疏) by Jia Gongyan, edition Ruan Yuan 阮元, Shisanjing zhushu 十三經註疏 (1815)

公卿大夫則司士或士贊者唯有不兼大夫已上不同... 射者以威不寧侯也此上下文所云宿者皆謂祭前... 儀疏十六大射

至北十注量人至不射釋曰云量人司馬之屬... 儀疏十六大射

Figure 2: Woodblock print version of the following text from Ruan Yuan's Shisanjing zhushu edition. The text of the classic is large, single-line characters, followed in small, double-line characters by Zheng Xuan's 'annotations' (zhu 注) and, following the circle, by the subcommentary (shu 疏) of Jia Gongyan.

## Classic:

司馬命量人量侯道與所設乏以狸步，大侯九十，參七十，干五十，設乏各去其侯西十、北十。

THE MASTER-AT-ARMS COMMANDS THE MEASURERS TO MEASURE THE TARGET PATHS AND THE POSITIONS IN WHICH THE SCREENS ARE TO BE SET UP IN FOX-STRIDES: NINETY FOR THE BIG TARGET, SEVENTY FOR THE THREE, FIFTY FOR THE POLE, AND SETTING UP SCREENS AT A DISTANCE OF TEN WEST & TEN NORTH OF EACH TARGET.

## Zheng Xuan ‘annotation’:

量人司馬之屬，掌量道巷塗數者，侯謂所射布也。尊者，射之以威不寧侯；卑者，射之以求為侯。量侯道謂去堂遠近也。容謂之乏，所以為獲者之禦矢。狸之伺物，每舉足者，止視遠近為發必中也。是以量侯道取象焉。《鄉射記》曰：侯道五十弓。《考工記》曰：弓之下制六尺，則此狸步六尺明矣。大侯、熊侯謂之大者，與天子熊侯同參讀為糝糝雜也。雜侯者，豹鵠而麋飾下天子大夫也。干讀為豸，豸侯者，豸鵠，豸飾也。大夫將祭於已射麋侯士無臣祭不射。

The ‘MEASURERS’ (*liangren* 量人) are subordinates of the master-at-arms responsible for measuring the numbers of paths, alleys, and roads; the ‘TARGETS’ (*hou* 侯) are the cloth at which one shoots. The noble shoot for the dignity, rather than for the target [itself], while the base shoot seeking the target. ‘TO MEASURE THE TARGET PATHS’ (*liang hou dao* 量侯道) refers to [measuring] the distance from the hall. The ‘SHIELDS’ (*rong* 容) refers to ‘screens’ (sic.), i.e. that by which the hit-callers are shielded from the arrows. The FOX (*li* 狸) examines things at the raise of each foot, [as the archer must] stop & look at the distance so that his release be on-target (*zhong* 中), and it is thus that the measuring of the target paths takes the image thereof. The [*Book of Etiquette & Ceremonial*], ‘Record of the District Shoot’ 鄉射記 says ‘THE TARGET PATH IS FIFTY BOW[LENGTHS]’ 侯道五十弓. and the [*Offices of Zhou*], ‘Record of the Investigation of Artisans’ 考工記 says ‘THE BOW’S LOWER DESIGN (vertical dimensions?) IS 6 CHI’ 弓之下制六尺, so it is evident that this ‘FOX-STRIDE’ (*li bu* 狸步) is 6 *chi*. As to the ‘BIG TARGET’ (*da hou* 大侯), the ‘bear[-skin] target’ is referred to as the ‘BIG’—this is none other than the son of heaven’s bear[-skin] target. ‘THREE’ (*san* 參) is read as ‘blended’ (*san* 糝), ‘blended’ [meaning] ‘mixed’ (*za* 雜); the ‘mixed target’ having a leopard[-skin] *hao* (bull’s-eye) beneath which it is decorated with elk [skin at around its edges]—this is for the son of heaven’s grandees. ‘POLE’ (*gan* 干) is read as ‘wild dog’ (*an* 豸), the ‘dog[-skin] target’ having a dog[-skin] *hao* (bull’s-eye) & dog[-skin] decorations. If a grandee is to offer his own sacrifices, he shoots at the elk[-skin] target, while the knight/gentleman does not shoot unless there is a vassal’s sacrifice.

## Jia Gongyan subcommentary

...

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## Classic:

遂命量人，巾車張三侯。大侯之崇，見鵠於參；參見鵠於干，干不及地武。不繫左下綱。設乏西十、北十，凡乏用革。

HE THEN ORDERS THE MEASURERS AND THE FABRIC-&-CHARIOT [officer] TO STRETCH THE THREE TARGETS. THE LOFTINESS OF THE BIG TARGET IS SUCH THAT IT SHOWS ITS HAO 鵠 (bull's-eye) VIS-À-VIS THE THREE (mixed target), THE THREE SHOWS ITS HAO (bull's-eye) VIS-À-VIS THE POLE (dog-skin target), AND THE POLE DOES NOT REACH THE GROUND MILITARY. ONE LEAVES THE LOWER LEFT BRACES UNFASTENED. ONE SETS UP THE SCREENS TEN [fox-strides] TO THE WEST & TEN TO THE NORTH, ALL THE SCREENS BEING MADE OF HIDE.

## Zheng Xuan 'annotation':

巾車，於天子宗伯之屬，掌裝衣車者，亦使張侯侯巾類。崇，高也。高必見鵠，鵠所射之主。《射義》曰：為人君者，以為君鵠；為人臣者，以為臣鵠；為人父者，以為父鵠；為人子者，以為子鵠，言射中此，乃能任己位也。鵠之言較，較直也。射者所以直己志；或曰鵠，鳥名，射之難中，中之為俊，是以所射於侯取名也。《淮南子》曰：鵠鵠知來，然則所云正者，正也，亦鳥名，齊魯之間，名題肩，為正；正、鵠皆鳥之捷點者。《考工記》曰：“梓人為侯，廣與崇方，參分其廣，而鵠居一焉”，則大侯之鵠方六尺，糝侯之鵠方四尺六寸大半寸，豸侯之鵠方三尺三寸少半寸，及至也。武，迹也。中人之足長尺二寸，以豸侯計之，糝侯去地一丈五寸少半寸，大侯去地二丈二尺五寸少半寸。凡侯北面西方謂之左前射三日張侯設乏欲使有事者豫志焉。

The 'FABRIC-&-CHARIOT' (*jīn chē* 巾車), as a subordinate of the sun of heaven's clan administration (*zhōngbó* 宗伯), is he who is responsible for fitting clothing & chariots, and he is also charged with stretching the targets [as] targets belong to the category of 'fabric'. 'LOFTINESS' (*chóng* 崇) [means] 'height'—its height must be such that one sees the *hao* (bull's-eye), the *hao* being mainly the thing at which one shoots. The [Record of Rites], 'Meaning of the Shoot' 射義 says 'He who is the lord of another takes the lord's *hao*; he who is the vassal of another takes the vassal's *hao*; he who is father of another takes the father's *hao*; he who is son of another takes the son's *hao*', which is to say that only by shooting & hitting (*zhōng*) this can one assume one's proper station. By HAO 鵠 is meant 'comparison' (*jiào* 校), 'comparison' [meaning] 'straight' (*zhí* 直), the shoot being that by which one 'straightens' one's ambitions. Some say that HAO the name of a bird that is difficult to hit (*zhōng*) when shot at—that hitting (*zhōng*) it is [a sign] of handsome excellence, and thus does that at which you shoot upon the target take its name [therefrom]. The *Huainanzi* 淮南子 (139 BCE) says 'One knows whence the *yan-hao* 鵠 come [but not whither they go]', and, as such, what it is talking about is the *zheng* 正. *Zheng* is likewise the name of a bird, which between [the regions] of Qi & Lu is called a *tijian* 題肩, [but which] is [still] a *zheng*. *Zheng* & *hao* are both quick & cunning birds. The [Offices of Zhou], 'Record of the Investigation of Artisans' says 'THE WORKER OF PRECIOUS WOODS (*ziren* 梓人) MAKES THE TARGETS. [THE TARGETS] ARE SQUARE IN BREADTH AND LOFTINESS, AND DIVIDING THEIR BREADTH IN THREE, THE HAO OCCUPIES ONE THEREOF', so the *hao* of the big target is a square of 6 *chi* [to a side], the *hao* of the blended target is a square of 4 *chi* 6 *cun* & a grand-half *cun* (4.66...), and the *hao* of the dog[-skin] target is 3 *chi* 3 *cun* & a diminished-half *cun* (3.33...). 'REACH' (*ji* 及) [means] 'arrive' (*zhì* 至), and 'MILITARY' (*wu* 武) [means] '[by] a footstep' (*ji* 迹). The length of the average person's foot is a *chi* & 2 *cun*. Calculating from the dog[-skin] target, the blended target is 1 *zhang* 5 *cun* & a diminished-half *cun* from the ground, and the big target is 2 *zhang* 2 *chi* 5 *cun* & a diminished-half *cun* of the ground. In general, as one is facing north, the west side [of the target] is referred to as 'the left'. One stretches the

targets & sets up the shields three days prior to the shoot out of the desire to make those who have ritual business [there] set their attention on the sport.

Jia Gongyan's subcommentary:

...

云“考工記梓人為侯廣與崇方參分其廣而鵠居一焉”者，三等皆高、廣等。引之者，鄭欲解經“見鵠”之義，故先知侯鵠廣狹尺寸也。

On 'Record of the Investigation of Artisans' says "THE WORKER OF PRECIOUS WOODS MAKES THE TARGETS. [THE TARGETS] ARE SQUARE IN BREADTH AND LOFTINESS, AND DIVIDING THEIR BREADTH IN THREE, THE HAO OCCUPIES ONE THEREOF", [this means to say that] the three ranks [of target] are all equal in height & width. In citing this [passage], Zheng [Xuan] desires to explain the meaning of the classic's 'SHOWS ITS HAO', and is one [required] first to know the *chi-cun* (dimensions) of the breadth & narrowness of the target & *hao* (bull's-eye).

云“則大侯之鵠方六尺”者，以侯道九十弓，弓取二寸，二九，十八，侯中丈八尺；三分其侯而鵠居一，故知鵠方六尺也。

On 'so the *hao* of the big target is a square of 6 *chi* [to a side]', this is because the target path is 90 bow-lengths, and [for each] bow one takes 2 *cun*, two nines is eighteen, so the target *zhong* is 18 *chi* [to a side], and 'DIVIDING THEIR BREADTH IN THREE, THE HAO OCCUPIES ONE THEREOF', thus one knows that the *hao* is a square 6 *chi* [to a side].

云“糝侯之鵠方四尺六寸大半寸”者，以侯道七十弓，弓取二寸，則侯中丈四尺，三分其侯鵠居其一，丈四取丈二，三分得四尺，又於二尺之內，取尺八寸，又得六寸，又二寸，一寸為三分，總六分取二分，二分於三分為三分寸之二，三分寸之二即是大半寸。故云“糝侯之鵠方四尺六寸大半寸”也。

On 'the *hao* of the blended target is a square of 4 *chi* 6 *cun* & a grand-half *cun*', this is because the target path is 70 bow-lengths, and [for each] bow one takes 2 *cun*, so the target *zhong* is 14 *chi* [to a side], and 'DIVIDING THEIR BREADTH IN THREE, THE HAO OCCUPIES ONE THEREOF': from 14 *chi* one takes out 12 *chi*, which, divided by 3 gets you 4 *chi*; then, within the 2 *chi* [we set aside], one takes out 1.8 *chi*, which then gets you 6 *fen*; then, with the 2 *cun* [we set aside], 1 *cun* makes 3 parts, and from the total of 6 parts we take 2 parts, and 2 parts of 3 parts makes 2/3 *cun*, and 2/3 *cun* is a 'grand-half *cun*', thus 'the *hao* of the blended target is a square of 4 *chi* 6 *cun* & a grand-half *cun*'.

云“豸侯之鵠方三尺三寸少半寸”者，豸侯侯道五十弓，弓取二寸，則侯中方一丈，三分其侯鵠居一焉，一丈且取九尺，得三尺，一尺取九寸，得三寸，一寸分為三分，得一分，則是三分寸之一，三分寸之一則是少半寸。故云“豸侯之鵠方三尺三寸少半寸”也。

On 'the *hao* of the dog[skin] target is 3 *chi* 3 *cun* & a diminished-half *cun*', this is because the dog[skin] target target path is 50 bow-lengths, and [for each] bow one takes 2 *cun*, so the target *zhong* is a square 10 *chi* [to a side], and 'DIVIDING THEIR BREADTH IN THREE, THE HAO OCCUPIES ONE THEREOF': from 10 *chi* one takes out 9 *chi*, getting 3 *chi* (from the division); from 1 *chi*, one takes 9 *cun*, getting 3 *cun*; 1 *cun* makes 1/3 *cun*, and 1/3 *cun* is a 'diminished-half *cun*', thus 'the *hao* of the dog[skin] target is 3 *chi* 3 *cun* & a diminished-half *cun*'.

云“中人之足長尺二寸”者，無正文以目驗而知。

On 'The length of the average person's foot is a *chi* & 2 *cun*', there is nothing [in the] text's body, [so Zheng Xuan] knows this by visual inspection.

云“以豸侯計之”者，以大侯糝侯高下無文。豸侯云“下綱不及地武”，則豸侯下綱去地尺二寸，以是從豸侯計之也。豸侯侯中一丈，上下躬及上下舌，各二尺合八尺，是丈八尺矣。又下不及地尺二寸，則豸侯上綱去地丈九尺二寸也。

On ‘Calculating from the dog[-skin] target’, [Zheng Xuan does this] because there is nothing [in the] text about the big target & blended target’s [respective] heights. For the dog[-skin] target, it says the lower mainstay ‘DOES NOT REACH THE GROUND MILITARY’, so the dog[-skin] target’s lower mainstay is a distance of 1.2 *chi* from the ground—it is from this that he ‘calculates from the dog[-skin] target’. The dog[-skin] target target *zhong* is 10 *chi*, the upper & lower bodies and upper & lower tongues are each 2 *chi*, which combine for 8 *chi*—this is 18 *chi*. Furthermore, the bottom does not reach the ground by 1.2 *chi*, so the dog[-skin] target’s upper mainstay is 19.2 *chi* from the ground.

糝侯，侯中丈四尺，中上、中下各四尺，得八尺，并之，二丈二尺也。鵠居侯中三分之一，則鵠下亦有四尺六寸大半寸，通躬身四尺為八尺六寸三分寸之二矣。張法，糝鵠下畔與豸侯之上綱齊，所謂“見鵠於豸”，自餘糝侯鵠下畔八尺六寸大半寸，在掩豸侯，亦如之，豸侯上豸本去地丈九尺二寸，直掩八尺，上有一丈一尺二寸，在復掩六寸上有一丈六寸，在復掩三分寸二，唯有一丈五寸三分寸一，在少半寸者即三分寸一也。言大半寸者，即三分寸二也。故知糝侯下綱去地一丈五寸少半寸也

For the blended target, the target *zhong* is 14 *chi*, and above the *zhong* & below the *zhong* are each 4 *chi*, which gets you 8 *chi*; combine them, and that’s 22 *chi*. The *hao* occupies one third of the target *zhong*, so below the *hao* there is likewise 4 *chi* 6 *cun* & a grand-half *cun*, which, connected with the 4 *chi* of the body’s body [below], makes 8 *chi* 6 *cun* & 2/3 *cun*. As to the method of stretching [the targets], the bottom edge of the blended [target’s] *hao* is level with the upper mainstay of the dog[-skin] target—what is referred to as ‘SHOWING ITS HAO VIS-À-VIS THE [DOG]’. The 8 *chi* 6 *cun* & a grand-half *cun* remaining therefrom [beneath] the lower edge of the blended target’s *hao* is blocked by the dog[-skin] target also as such (?). [We saw that] the dog[-skin] target’s upper dog (sic.) is 19.2 *chi* from the ground; it directly blocks 8 *chi* (of the blended target’s height); above these is 11.2 *chi* (of the blended target); it again blocks 6 *cun*, [so] above there is 10.6 *chi*; it again blocks 2/3 *cun*, [so] there is only 10 *chi* 5 *cun* & 1/3 *cun*, [considering that] a ‘diminished-half *cun*’ is 1/3 *cun* and that saying a ‘grand-half *cun*’ implies 2/3 *cun*. Thus does [Zheng Xuan] know that the lower mainstay of the blended target is 1 *zhang* 5 *cun* & a diminished-half *cun* from the ground.

大侯中丈八尺，中之上下，各四尺，即八尺矣，中方丈八尺，更加八尺，二丈六尺也。糝侯去地丈五寸少半寸，本上綱下綱相去二丈二尺，其舉也。上綱去地三丈二尺五寸少半寸也。大侯鵠下畔與糝侯上綱齊，所謂“見鵠於糝”也。侯中丈八尺三分之，則鵠下亦有六尺、下躬身四尺，一丈矣。則大侯，自鵠以下，掩糝侯一丈也。自一丈以下，猶有二丈二尺五寸少半寸，在是大侯下綱去地亦然。故注於此數也。

The big target’s *zhong* is 18 *chi*, and above & below the *zhong* is each 4 *chi*, i.e. 8 *chi* (total); the *zhong* is a square 18 *chi* [to a side], which, after adding another 8 *chi* is 26 *chi*. The blended target is 1 *zhang* 5 *cun* & a diminished-half *cun* from the ground, and [we saw that] the distance between its upper mainstay & lower mainstay was 22 *chi*, and that is in total. The upper mainstay is 3 *zhang* 2 *chi* 5 *cun* & a reduced-half *cun* from the ground, and the bottom edge of the big target’s *hao* is level with the upper mainstay of the blended target—what is referred to as ‘SHOWING ITS HAO VIS-À-VIS THE [DOG]’. If one dividing the target’s *zhong* of 18 *chi* in three, then there is likewise 6 *chi* beneath the *hao*, the 4 *chi* of the lower body’s body—1 *zhang*—so the

big target, from beneath the *hao*, is blocked by the blended target [to a height of] 1 *zhang*. from below this 1 *zhang*, there is another 2 *zhang* 2 *chi* 5 *cun* & a diminished-half *cun*, and right there is the distance of the big target's lower mainstay from the ground, also as such. Thus do [Zheng Xuan's] annotations arrive at these numbers.

...