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WRITING BEFORE INSCRIBING: ON THE USE OF MANUSCRIPTS IN THE PRODUCTION OF WESTERN ZHOU BRONZE INSCRIPTIONS

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Abstract

While research on Warring States, Qin, and Han manuscripts is flourishing, much less is known about the use of manuscripts during the earlier stages of Chinese history, for which material evidence has not been preserved. Based on the layout features and textual anomalies in the Western Zhou bronze inscriptions, this article explores the traces of use of perishable writing supports in the process of the production of bronze inscriptions in this period and reconstructs their functions and physical qualities. Based on the surveyed evidence, the article posits that two distinct exemplar manuscripts were used in the inscription-making process: an original "master copy" that was kept aside for proofreading purposes and a secondary "blueprint" that was employed directly in the technical process of inscription-making. A single blueprint would be used consecutively by several craftsmen to produce a set of inscriptions on different types of vessels. The word count and layout of many inscriptions were already carefully planned during the process of their composition, and any study of a bronze text should therefore begin with the evaluation of its visual qualities. Moreover, this probe provides unambiguous evidence for the use of tube-lining in the inscription-making process and reconstructs the complete *chaîne opératoire* of bronze inscription production in the Late Western Zhou period. The article also offers insights into the level of literacy and the division of labor in bronze workshops, and touches upon the display function of bronze epigraphy during the Western Zhou period.

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Introduction

Casting a bronze inscription was undoubtedly the most ambitious and complex way of fixing a text to a material medium during the Western Zhou period (1045–771 B.C.E.).[1] Following the Late Shang (ca. 1250–1045 B.C.E.) tradition, casters in the Zhou period further advanced their inscription-casting technique to a level of refinement that proved to be extremely challenging for both forgers' imitations and modern scholarly reconstructions. Recent years have seen increasing attention to the techniques employed to transmit a text to a clay mold prior to casting, with some significant contributions to our understanding of the issue.[2] The preparation of an inscribed clay mold for casting, however, represented only the final step in the scrupulous process of inscription-making, which was preceded in many cases by several instances of writing on perishable media. However, as the earliest manuscripts unearthed so far postdate the Western Zhou period by half a millennium, such instances of writing remain buried by time. Unlike research on inscription-making, which can to a certain extent rely on direct evidence of debris of ceramic molds recovered from the ancient bronze foundry sites, an inquiry into "writing before inscribing" can draw only on the indirect testimony of inscriptions themselves. As a consequence, scholars have focused on those aspects of

1. A still more challenging way of textual preservation includes inlaid inscriptions. There is some evidence for inlaying short bronze inscriptions with turquoise in the Anyang period; see for example the *gongxingqi* 弓形器 (M54:393) excavated from the tomb M45 at Huayuanzhuang, Locus East, published in Zhongguo shehui kexueyuan kaogu yanjiusuo, *Anyang Yinxu Huayuanzhuang Dongdi Shangdai muzang* 安陽殷墟花園莊東地商代墓葬 (Beijing: Kexue, 2007), 159, Figure 121:3 and Plate 49:2. More common are inscriptions inlaid with gold from the Eastern Zhou period; however, to the best of my knowledge, no instance of inlaid inscription dating to the Western Zhou period has been reported. All dates for the Western Zhou follow Edward L. Shaughnessy, *Sources of Western Zhou History: Inscribed Bronze Vessels* (Berkeley: University of California Press, 1991), 217–87. The Western Zhou period is conventionally divided into three subperiods: Early Western Zhou (1045–957 B.C.E.), Middle Western Zhou (956–858 B.C.E.), and Late Western Zhou (857–771 B.C.E.).

2. An incisive and up-to-date overview of issues related to inscription production techniques can be found in Zhang Changping 張昌平, "Shang Zhou qingtongqi mingwen de ruogan zhizuo fangshi: yi Zeng guo qingtongqi cailiao wei jichu" 商周青銅器銘文的若干製作方式—以曾國青銅器材料為基礎, *Wenwu* 2010.8, 61–70. For an English translation, see Changping Zhang, "Some Considerations of the Bronze Inscriptions Techniques Used during the Shang and Zhou Dynasties," trans. Ling-en Lu, in *Original Intentions: Essays on Production, Reproduction, and Interpretation in the Arts of China*, ed. Nicholas Pearce and Jason Steuber (Gainesville: University Press of Florida, 2012), 265–81. For an earlier reconstruction of the various modes of bronze inscription production, see Noel Barnard and Wan Chia-pao, "The Casting of Inscriptions in Chinese Bronzes—with Particular Reference to Those with Rilievo Guide-Lines," *Soochow University Journal of Chinese Art History* 6 (1976), 43–134. See also the discussion towards the end of this article, where the most recent literature is reviewed.

their creation that are readily extractable from their contents: the process of their composition or compilation and, more specifically, the process of selection of what an inscription is going to say.[3] But were the composers concerned also with how the inscription was going to say it? And if so, which "formal" aspects of their inscriptions mattered? Apart from the drafts, did the casters rely on some other, auxiliary technical manuscripts during the inscription-making? And what were the material qualities of the writing supports employed in this process? To the best of my knowledge, no attempt has been made to explore these questions.

Such questions are by no means trivial. Viewing inscriptions as witnesses (perhaps not always entirely faithful ones) of their long-perished drafts or master copies brings the perspective of textual scholarship into the field of epigraphy. If we include the issue of textual transmission in our research on the creation of bronze inscriptions, not only we can gain a better understanding of occasional mistakes or textual discrepancies in bronze texts, but, more importantly, we are compelled to appreciate all other possible facets of the relationship between an inscription and its exemplar (that is, its draft, master copy, or any other kind of *Vorlage*), including the question of form. During such inquiries, we necessarily touch upon aesthetics, and more specifically, the symmetry in epigraphic display. There has been some discussion as to whether symmetry was desired in the decoration of early Chinese bronzes.[4] When we regard inscriptions as witnesses of their exemplars, the question of symmetry turns out to be more complex: the fact that an inscription was cast with an asymmetrical layout does not necessarily mean that it was not planned to be symmetrical. At this point, the consideration of material qualities of writing supports used in inscription-making might shed some additional light on the way the process of transmission from a perishable to a durable medium influenced the content and form of the final cast inscription, and it might also indicate how much readability mattered to the casters. Finally, an examination of the use of exemplars in bronze workshops can offer some insights into the level of craftsman's literacy, workflow of inscription-making, and related division of labor during the Western Zhou. On a more general level, such considerations also can inform discussion of the function of bronze inscriptions and textual display in Early China.

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3. Edward L. Shaughnessy, "The Writing of a Late Western Zhou Bronze Inscription," *Asiatische Studien/Études asiatiques* 61.3 (2007), 845–77; Lothar von Falkenhausen, "The Royal Audience and Its Reflection in Western Zhou Bronze Inscriptions," in *Writing and Literacy in Early China: Studies from the Columbia Early China Seminar*, ed. Li Feng and David Prager Branner (Seattle: University of Washington Press, 2011), 239–70.

4. Lukas Nickel, "Imperfect Symmetry: Rethinking Bronze Casting Technology," *Artibus Asiae* 66.1 (2006), 5–39; Robert Bagley, "Anyang Mold-Making and the Decorated Model," *Artibus Asiae* 69.1 (2009), 39–90.

To shed more light on the use and nature of perishable media in the production process of bronze inscriptions, and in turn to address the issues outlined above, I will explore the available evidence from the Western Zhou period (1045–771 B.C.E.). To be sure, the evidence for such an inquiry, always an indirect one, can only be extracted by close scrutiny of epigraphic data. In the first step, I will survey the evidence of the visual qualities of inscriptions to explore what information was specified in an inscription's master copy. Next, I will examine the evidence of textual anomalies in inscriptions to reconstruct the use of manuscripts in the process of transmission of the text from a perishable to a durable medium. Such an undertaking takes its toll in a more descriptive style of the essay. I believe, however, that the generous reader will find the conclusions based on such a detailed treatment to be rewarding.

Inscription Drafts, Layout, and the Properties of the Master Copy

Scholars generally agree that prior to casting, a draft of the intended inscription was prepared in written form, presumably on a perishable writing support, such as wooden or bamboo tablets or strips. Such an assumption seems reasonable, as the sole reliance on oral transmission of the draft would require its memorization by several individuals, which would clearly be inefficient, particularly with longer texts. Moreover, the use of written exemplars is implied by the occasional occurrence of fission (*fen shu* 分書), a scribal error where two or more components of a single graph are written divided as separate graphs.[5]

There is no consensus as to who was responsible for drafting the inscriptions, and it is likely that different modes of composition and production of inscriptions coexisted. The traditional view, which goes back to the *Li ji* 禮記,[6] holds that the inscriptions were composed by the donors of the vessels themselves. Uniformity in the wording and structure of the investiture inscriptions, however, led certain scholars to challenge this view, and to assume a degree of central guidance in the composition of these inscriptions.[7] While there can be no doubt that certain types of inscriptions were

5. For several instances of fission in Western and Eastern Zhou bronze inscriptions, see Sun Zhichu 孫稚雛, "Jinwen shidu zhong yixie wenti de shangtao" 金文釋讀中一些問題的商討, *Zhongshan daxue xuebao* 1979.3, 57; Sun Zhichu, "Jinwen shidu zhong yixie wenti de tantao (xu)" 金文釋讀中一些問題的探討(續), *Guwenzi yanjiu* 9 (1984), 409–10.

6. *Li ji zheng yi* 禮記正義 (*Shisanjing zhushu* 十三經注疏 ed., 1815; rpt. Beijing: Zhonghua, 1980), 49.379. For translation and discussion of this passage, see Christian Schwermann, "Composite Authorship in Western Zhōu Bronze Inscriptions: The Case of Tiānwáng guǐ 天亡簋 Inscription," in *That Wonderful Composite Called Author: Authorship in East Asian Literatures from the Beginnings to the Seventeenth Century*, ed. Christian Schwermann and Raji C. Steineck (Leiden: Brill, 2014), 41–44.

7. Among the most important works, see for example Matsumaru Michio 松丸道雄, "Sei Shū seidōki seisaku no haikei: Shū kinbun kenkyū—joshō" 西周青銅器製作の背景:

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based on fixed-format administrative documents, the question is whether a sort of general underlying structure pervading the inscriptions should be envisioned as a top-down royal monopoly on inscription drafting or rather as a bottom-up effort to adhere to a conventional epigraphic style of the high elite that also might have served as marker of social status.

Recent research seems to suggest bottom-up dynamics in the process of inscription composition, with the lineage as a basic unit. Li Feng has shown that both aristocrats in the regional states and members of non-Zhou peripheral societies cast their own inscribed bronzes, and most recently Li has suggested that major aristocratic lineages in the royal domain could produce inscribed bronzes as well.[8] Similarly, my own analysis of epigraphic behavior reflected in contemporary sets of bronze inscriptions reveals that, from the available evidence, the highest degree of uniformity in inscriptions' structure and content can be seen in inscriptions produced within the same lineage, and in certain cases, certain textual patterns are reiterated in the inscriptions of several generations of lineage members.[9] It is quite likely that aristocrats of higher status had their own scribal resources; such specialists might have been, among other scribal tasks, responsible for drafting inscriptions.[10]

The complexity of the drafting procedure varied. While composition of a short inscription of several characters did not constitute a significant

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周金文研究·序章, *Tōyō bunka kenkyūsho kiyō* 72 (1977), 1–128. Matsumaru however acknowledges that aristocrats in regional states could also cast their own inscribed bronzes. See also the insightful treatment of the problem of authorship in Western Zhou bronze inscriptions in Schwermann, "Composite Authorship in Western Zhōu Bronze Inscriptions," 30–57.

8. Li Feng, "Literacy Crossing Cultural Borders: Evidence from the Bronze Inscriptions of the Western Zhou Period (1045–771 B.C.)," *Bulletin of the Museum of Far Eastern Antiquities* 74 (2002), 210–42; Li Feng, "Western Zhou Bronzes: Archaism as a Divergent Tradition," in *Dialogue with the Ancients: 100 Bronzes of the Shang, Zhou, and Han Dynasties—The Shen Zhai Collection*, ed. Patrick K. M. Kwok (Singapore: Select Books, 2018), 73–83.

9. See my "You 'tong shi yi ming,' 'yi ren tong ming' he 'yi jia zhu ming' san zhong xianxiang kan Xi-Zhou tongqi mingwen de ji zhong bianzuan moshi" 由"同事異銘"、"異人同銘"和"一家諸銘"三種現象看西周銅器銘文的幾種編纂模式, paper presented at the conference Inscribed in Bronze: New Directions in the Study of Ancient Chinese Bronze Vessels and Their Inscriptions, Chicago, May 14–15, 2016. The complexities of vessel-making within aristocratic lineages were insightfully explored by Zhu Fenghan 朱鳳瀚 in his articles "Jinwen suo jian Xi-Zhou guizu jiazu zuoqi zhidu" 金文所見西周貴族家族作器制度, *Qingtongqi yu jinwen* 1 (2017), 24–45 and "Zongren zhu qi kao: jian ji zai lun Xi-Zhou guizu jiazu zuoqi zhidu" 宗人諸器考: 兼及再論西周貴族家族作器制度, *Qingtongqi yu jinwen* 2 (2018), 16–28.

10. For various uses of writing in aristocratic lineages as attested to in bronze inscriptions, see Li Feng, "Literacy and the Social Contexts of Writing in the Western Zhou," in *Writing and Literacy in Early China*, ed. Li and Branner, 271–301. The point that higher aristocracy had their own scribes who could compose inscriptions for them is commonly raised in scholarship; see, for example, Shaughnessy, "The Writing of a Late Western Zhou Bronze Inscription," 876–77.

scribal challenge, for the longer ones, especially the so-called "investiture inscriptions" (usually 50 or more characters), the compiler would need to draw on various official documents, extract the relevant content from them or rework them for the needs of the inscription, be familiar with the common inscriptional formulas, and occasionally, make use of rhymes.[11] The final draft of the inscription was then submitted to the bronze workshop for casting. It is not clear whether the text of the inscription was fully completed before arriving at the workshop, or whether the initial draft could have been completed, elaborated, or adjusted by the workshop specialists. This was the case in, for example, ancient Roman stonecutter shops (*officinae*), in which the stonecutters would polish the original drafts of inscriptions provided by customers, often adding standard (and versed) formulae based on manuals created and shared by the stonecutter community.[12] Comparable manuals or repertoire catalogues were possibly used by Han dynasty stone relief carvers.[13] Although fragmentary evidence suggests that the drafts of bronze inscriptions were largely accomplished before reaching the workshop,[14] it may still be useful to make a terminological distinction

11. For a case study on the compositional process of bronze inscriptions, see Shaughnessy, "The Writing of a Late Western Zhou Bronze Inscription," 845–77. In addition to the official documents issued by the royal court, a compiler might have consulted transcripts of oral exchanges at the court; see von Falkenhausen, "The Royal Audience and Its Reflection in Western Zhou Bronze Inscriptions," 267–70.

12. Giancarlo Susini, *The Roman Stonecutter: An Introduction to Latin Epigraphy*, trans. A. M. Dabrowski (Oxford: Basil Blackwell, 1973), 46–48. For the manuals, see René Cagnat, "Sur les manuels professionels des graveurs d'inscriptions romaines," *Revue de Philologie, de Littérature et d'Histoire Anciennes* 13.1 (1889), 51–65.

13. Tseng Lan-ying 曾藍瑩, "Zuofang, getao yu diyu zichuantong: Cong Shandong Anqiu Dongjiazhuang Han mu de zhizuo yiji tanqi" 作坊、格套與地域子傳統: 從山東安丘董家莊漢墓的製作遺跡談起, *Guoli Taiwan daxue meishushi yanjiu jikan* 8 (2000), 45. For one instance of what Tseng believes was a repertoire catalogue, see Wu Hong, "Beyond the 'Great Boundary': Funerary Narrative in the Cangshan Tomb," in *Boundaries in China*, ed. John Han (London: Reaktion Books, 1994), 81–104.

14. Consider for example the sets of *gui*-tureens commissioned by two members of the same lineage, the senior Bo Si 伯獃 and his younger brother Wei 衛. So far 10 *gui*-tureens commissioned by Bo Si are known, which can be divided into three subsets based on shape and décor. The earlier set (A) has a shorter inscription containing a prayer for blessings. See Wu Zhenfeng 吳鎮烽, *Shang Zhou qingtongqi mingwen ji tuxiang jicheng* 商周青銅器銘文暨圖像集成 (Shanghai: Shanghai guji, 2012), no. 05275, hereafter abbreviated as "Mingtu," and Wu Zhenfeng, *Shang Zhou qingtongqi mingwen ji tuxiang jicheng xu bian* 商周青銅器銘文暨圖像集成續編 (Shanghai: Shanghai guji, 2016), no. 30460, hereafter abbreviated as "Mingxu"; two other vessels are reported but not published. Two later sets (B [*Mingtu* 05315–18] and C [*Mingxu* 30457–58]) differ in shape and décor, but both contain identical inscription commemorating the reception of gifts from the king. The *gui* tureens commissioned by Wei (*Mingtu* 05368–69) are completely identical in shape and décor with Bo Si's set B, and thus can be assumed to have been cast together. However, while the structure and wording of the first half of the Wei *gui*

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between the draft text sent to the workshop and the final outcome of the compositional and editorial processes—the ultimate exemplar of text that was to be cast in bronze. I will refer to the former as "draft" and to the latter as "master copy." Of course, it is possible that the drafts were fully accomplished and served directly as master copies for the inscriptions.[15] The main focus of the following discussion will be the master copy, and all subsequent instances of writing involved in the process of production of a bronze inscription in the Western Zhou period.

Any discussion on the nature of the master copy must bear in mind the basic epigraphic features of bronze inscriptions. While spatial limitations played some role in the setting of the column length (best exemplified by the *gui* 簋 lid inscriptions; see Figure 3 below), a pervasive trend in alignment observable on vessels with larger inscriptional surfaces (e.g., *pan* 盤, *ding* 鼎, *gui*, or *xu* 盨) was to keep the length of all columns largely equal, by allotting each column the same or similar number of spaces on the virtual inscriptional checkerboard, and at the same time to keep the inscription's vertical dimension longer than the horizontal one—that is, to keep the number of columns smaller or equal to the number of character-spaces in each column.[16] This habit is observable

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inscription is nearly identical to that of Bo Si's sets B and C, the second half takes over the formulas solely seen in Bo Si's earlier set A. This implies that should the inscriptions be drafted in the workshop, the master copies of previously cast inscriptions would need to be stored here, which seems quite unlikely. The case of Bo Si's and Wei's vessels thus seems to confirm that at least within a lineage, the inscriptions for various lineage members were drafted using internal scribal resources, with reference to previously drafted inscriptions, and that the drafts received by the bronze workshops were elaborate and complete. On the relation between Bo Si's and Wei's vessels, see Zhu Fenghan 朱鳳瀚, "Wei gui yu Bo Si zhu qi" 衛簋與伯獃諸器, *Nankai xuebao* 2008.6, 1–7.

15. It is unclear to what extent the donor participated in the selection of a vessel's shape and décor, and once he decided to have an inscription cast into the vessel, whether there were limitations other than material ones regarding the length of the inscription. Notably, there are scores of large vessels bearing very brief inscriptions and small vessels on which the inscriptions run well beyond the common inscriptional area, indicating that it was possible to accommodate longer texts, even on very small vessels, when needed. It would then appear that in the majority of cases, the inscriptions had to fit the vessels and not vice versa. However, from the perspective of production techniques, the inscriptions were not mere appendages of the vessels, as their inclusion necessarily invoked a much more complex production procedure requiring different treatments of piece-molds, as well as specialized personnel who were possibly not available in every workshop.

16. This is generally true for inscriptions with less than 100 characters, i.e., the majority of Western Zhou inscriptions. Longer inscriptions tend to expand horizontally (i.e., increasing the number of columns) rather than vertically (increasing the length of columns). However, some long inscriptions, like that of Larger Yu *ding* 大盂鼎 or Shi Qiang *pan* 史墻盤, are divided into two separate blocks, meaning that these smaller inscriptional fields again have the shape of a vertical rectangle. The layout aesthetics of bronze inscriptions certainly deserves further inquiry.

also in very short inscriptions (fewer than ten characters), and possibly mimics the common appearance of texts written on perishable media.

In addition, the column length appears to have been constrained by other than these symmetry- and proportion-driven factors. A quick comparison reveals that of the 50 longest Western Zhou *gui* inscriptions,[17] 23 (46%) have exactly ten character-spaces[18] in each column, or the predominant (at least three-quarters) number of character-spaces per column is ten. The remaining inscriptions typically have an uneven length of columns (between eight and fourteen characters). A similar situation is observed in the case of the *ding* inscriptions (eleven out of the twenty longest, 55%). The longest column ever to appear consistently (more than three quarters of the columns) on *gui* vessels contains fourteen character-spaces (the lid of Shi Li *gui* 師麩簋, *Jicheng* 04324.2);[19] on *ding* vessels, the longest column is eighteen character-spaces (Hu *ding* 曶鼎 inscription, *Jicheng* 02838). There is also a significant number of shorter inscriptions with five character-spaces per column. It is probably not a coincidence that some of the most exquisite instances of Western Zhou epigraphy, such as the Larger Yu *ding* 大盂鼎 (*Jicheng* 02837) or the Shi Qiang *pan* 史墻盤 (*Jicheng* 10175), both have 15 character-spaces per column. These observations suggest that five character-spaces was a basic length unit for laying out the inscriptions, and that ten character-spaces was the preferable and perhaps default length of a column in longer inscriptions (c. 80 characters and more) to which the inscription-makers tried to adhere when possible.

In general, inscriptions of any length could be cast in bronze, regardless of the exact number of characters, following either strictly or loosely the requirements of symmetry and proportions. At the same time,

17. These observations are based on the Zhongguo shehui kexueyuan kaogu yanjiusuo, ed., *Yin Zhou jinwen jicheng (xiuding zengbuben)* 殷周金文集成 (修訂增補本), 8 vols. (Beijing: Zhonghua, 2007). Only fully legible rubbings were considered. *Gui* tureens and *ding* cauldrons were chosen specifically as the most common vessels to have been inscribed throughout the Western Zhou period.

18. A "character-space" is a virtual graphic cell, mostly in the shape of a vertically oriented rectangle. One character of regular size, or more characters of smaller size could be written into one character-space. It does not belong to the domain of writing a text but to that of formatting a text, being an "organizing principle," see Kyle Steinke, "Script Change in Bronze Age China," in *The Shape of Script: How and Why Writing Systems Change*, ed. Stephen D. Houston (Santa Fe: School for Advanced Research Press, 2012), 154–55.

19. "Jicheng" is used as an abbreviation for *Yin Zhou jinwen jicheng*. Further abbreviations used in the present article are "Xinshou" for Jung Bor-sheng 鐘柏生, Ch'en Chao-jung 陳昭容, Hwang Ming-chorng 黃銘崇, and Yuen Kwok Wa 袁國華 eds., *Xin shou Yin Zhou qingtongqi mingwen ji qiying huibian* 新收殷周青銅器銘文暨器影彙編 (Taipei: Yiwen, 2006), and the above-mentioned "Mingtu" and "Mingxu" for Wu Zhenfeng's *Shang Zhou qingtongqi mingwen ji tuxiang jicheng* and *Shang Zhou qingtongqi mingwen ji tuxiang jicheng xu bian*, respectively.

however, there are scores of inscriptions in the present corpus, typically those with fine calligraphy, that strive to adhere to certain aesthetic qualities by maintaining an equal number of character-spaces in each column.[20] As a result, many inscriptions achieve an ultimately symmetrical layout with all the characters in alignment both vertically and horizontally, i.e., the so-called *stoichedon* style.[21]

It is important to note that the *stoichedon* layout is often reached only with the assistance of various "space-saving" devices such as the use of ligatures and the (intended) sharing of a single character-space by two or more characters (both referred to as *hewen* 合文 "combined graphs" in Chinese scholarship)[22] or the use of reduplication marks (*chongwenhao* 重文號).[23] The "combined graphs" *hewen* are particularly crucial for

20. For insightful deliberations on how the display function shaped the visual qualities of bronze inscriptions including the layout, see Steinke, "Script Change in Bronze Age China," 135–58.

21. The *stoichedon* style is a term used in Greek epigraphy to refer to a pervasive habit in mainly Attic inscriptions between the sixth and third centuries B.C.E. to engrave letters so that they "are in alinement vertically as well as horizontally, and are placed at equal intervals along their respective alinements"; see R. P. Austin, *The Stoichedon Style in Greek Inscriptions* (Oxford: Oxford University Press, 1938), 1. In Chinese scholarship, the neat arrangement of an inscription is usually referred to as *cheng hang cheng lie* 成行成列 etc., but I am not aware of a specific term for this type of graphical arrangement; I thus borrow the term "stoichedon style" for the purposes of this discussion.

22. From the perspective of writing habits and their transmission in time, it would be instructive to make a distinction between ligatures in the original sense of a word (i.e., instances of graphical coalescence when strokes of two or more characters join/touch (as in 𠀆 *wu shi* 五十) or merge (so-called *jiebi* 借筆, as in 𠄎 *wu yue* 五月) and characters that share only the character-space (like 𠫓 *si yue* 四月 or 𠂆 *xiao zi* 小子). It would appear that the former cases represent a more customary writing habit, whereas the latter cases are more *ad hoc* devices for space-saving. However, regarded through the emic perspective of Warring States scribes, the two instances appear to have been considered as functionally identical, as they tend both to be marked by a ligature mark. This shows that the basic characteristic of *hewen* is in fact the sharing of a graphic cell, and further confirms that the ancient scribes worked with the notion of "character-space." I will thus refer to ligatures and sharing of a character-space jointly as "combined graphs," or *hewen*. For traditional views on ligatures in Chinese paleography, see Liu Zhao 劉釗, "Guwenzi zhong de hewen, jiebi, jiezi" 古文字中的合文、借筆、借字, *Guwenzi yanjiu* 21 (2001), 397–410. For a more recent reassessment, see Bao Huifang 暴慧芳, "Hanyu guwenzi hewen yanjiu"漢語古文字合文研究, M.A. thesis (Xinan University, 2009). For an English introduction to the problem, see Imre Galambos, "Scribal Notation in Medieval Chinese Manuscripts: The *hewen* (Ligature) and the *chongwen* (Duplication) Marks," *Manuscript Cultures* 2 (2009), 5–9; Haeree Park, *The Writing System of Scribe Zhou: Evidence from Late Pre-imperial Chinese Manuscripts and Inscriptions (5th–3rd centuries BCE)* (Berlin: De Gruyter, 2016), 94–97.

23. While a "combined graph" *hewen* could function as a direct space-saving device providing *ad hoc* solutions for textual compressions, reduplication marks *chongwenhao* could function as a space-saving device only indirectly at earlier stages of the compositional process. At the stage when the composer was selecting the wording of an intended inscription, it is conceivable that sometimes he would favor the use of a certain expression

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discussion of the nature of the inscriptions' master copy. For example, consider the Hu *gui* 獄簋 inscription (*Jicheng* 04317, Figure 1), cast in the twelfth year of King Li's 厲王 reign (ca. 846 B.C.E.) and commissioned by none other than King Li himself. The inscription was cast using a neat rilievo grid that divides the writing surface into twelve columns, each consisting of ten character-spaces, totaling exactly 120 character-spaces.[24] All character-spaces are carefully filled with one character or, on three occasions, with two characters (*xiao zi* 小子 [VI.6]  ; *zai xia* 才下 [XII.5]  and *shi you* 十又 [XII.10] ), all being instances of a shared character-space commonly seen in Western Zhou bronze inscriptions.[25]

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or construction that would enable reduplication, and as a consequence, the abbreviation of the written text. The Early Western Zhou Tai Bao *gui* 大保簋 inscription (*Jicheng* 04140) is to my knowledge the only clear-cut instance that does not apply reduplication marks for the writing of an "ABAB" sequence (*wang jiang zheng ling yu Tai Bao, Tai Bao ke jing* 王降征令于大保大保克敬 "the King sent down a campaign command to the Grand Protector. The Grand Protector was capable of being respectful"; translation after Edward L. Shaughnessy, "The Role of Grand Protector Shi in the Consolidation of the Zhou Conquest," *Ars Orientalis* 19 [1989], 51). Interestingly, the layout of this inscription is 9/9/9/7, and it is thus conceivable that it was originally designed as 8/8/8/8 (the same as the more or less contemporary Li *gui* 利簋) with the use of reduplication marks for *Tai Bao* 大保. The repetition of the characters *Tai Bao* may thus indicate some distortion in the process of textual transmission from the master copy to the clay slab with inscription. Slightly later Er *you* 耳卣 inscription (*Jicheng* 05384) duplicates the character 耳 in the sentence *Ning shi xi Er, Er xiu fu gan ju* 寧史錫耳耳休弗敢沮 "The secretary of Ning awarded [me,] Er, [I,] Er was perfect and do not dare to cease [in it]"; here, however, it is quite likely that *Er* and *xiu* were misplaced, and that the inscription was intended to read *Ning shi xi Er xiu, Er fu gan ju* 寧史錫耳休耳弗敢沮 "The secretary of Ning awarded [me,] Er beneficence, [I,] Er do not dare to cease [to be diligent in my service]." "Awarding beneficence" *xi xiu* 錫休 is a commonly used expression in bronze inscriptions. The layout of this inscription is 6/6/5.

24. It is a common practice in scholarship on Chinese bronze inscriptions since the Song dynasty that the information about inscriptions' graphic presentation is fully entrusted to the rubbing itself, and that the annotation is compressed into the number of characters (*zishu* 字數)—in more recent publications being accompanied by notes on the number of reduplication marks (*chongwenhao*) and "combined graphs" (*hewen*). Nearly all epigraphic qualities of the inscriptions are obliterated by such a description, however. For example, for the Hu *gui* inscription, the *Yin Zhou jinwen jicheng* description is "122 characters, 1 reduplication mark, 1 'combined graph'"; see Zhongguo shehui kexueyuan kaogu yanjiusuo, *Yin Zhou jinwen jicheng* (vol. 4), 03421. Supplementing such description with the number of "character-spaces" would give much clearer impression. Noel Barnard often used the notion of character-space in his discussions, but viewed it as a modern concept that he often related to the problem of the cataloging of information concerning the length of the inscription; see Noel Barnard 巴納 and Cheung Kwong Yue 張光裕, *Zhong Ri Ou Mei Ao Niu suo jian suo ta suo mo jinwen huibian* 中日歐美澳紐所見所拓所摹金文彙編 [Rubbings and Hand Copies of Bronze Inscriptions in Chinese, Japanese European, American, and Australasian Collections], Introductory Volume (Taipei: Yee Wen Publishing Company, 1978), 51–52. Lothar von Falkenhausen also uses this term, see his "Ritual Music in Bronze Age China: An Archaeological Perspective," Ph.D. dissertation (Harvard University, 1988).

25. Most instances of *xiao zi* 小子 are written as *hewen* in the bronze inscriptions, including the earliest instances in the Late Shang period; *shi you* 十又 appears written

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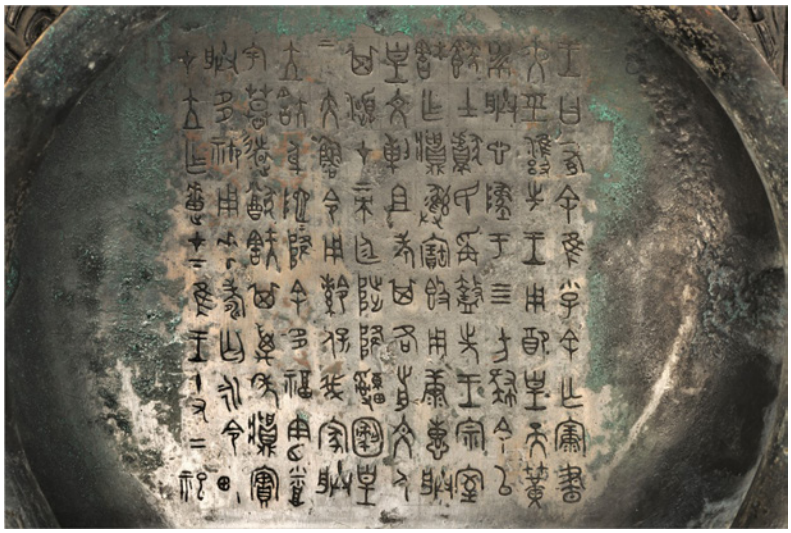

Figure 1 The inscription on the Hu *gui* tureen (after Zhang Tian'en 張天恩, ed., *Shaanxi jinwen jicheng* 陝西金文集成, vol. 5, *Baoji juan: Fufeng* 寶鷄卷: 扶風 [Xi'an: San Qin, 2016], 128–129). Reproduced with permission.[26]

To achieve the aesthetic *stoichedon* style, laying out this inscription involved a division of the text into twelve columns, setting the column length in ten character-spaces and, in order to fit the text to this regular grid, the use of space-saving devices—"combined graphs" *hewen*—in three places.

Moreover, the presence of a 12×10 rilievo grid confirms that such *mise-en-page* was indeed a result of previous planning and was not a random or *ad hoc* solution. This suggests that either the composer or the

as *hewen* in the Middle Western Zhou Yong *yu* 永盂 (*Jicheng* 10322) and Fifteenth Year Que Cao *ding* 趞曹鼎 (*Jicheng* 02784) inscriptions; *zai xia* 在下 is written as *hewen* in the Late Western Zhou Guo Shu Lü *zhong* 虢叔旅鐘 (*Jicheng* 00238–44) and Fifth Year Hu *zhong* 五祀䜌鐘 (*Jicheng* 00358) inscriptions. Clearly, the conventions for use of *hewen* were quite stable in time, yet the question is whether all the *hewen* used in bronze inscriptions stem from general scribal practice, or if there are also some that were devised and used specially for space-saving in bronze inscriptions. A diachronic comparison with oracle bones, covenant texts, and bamboo manuscripts might shed some light on this issue, for the moment, Bao Huifang, "Hanyu guwenzi hewen yanjiu" serves as a handy reference.

26. I am grateful to Ren Xueli 任雪莉 of Baoji Bronzeware Museum 寶鷄青銅器博物館 for providing this photograph and facilitating contact with the Fufeng County Museum 扶風縣博物館 where the vessel is housed; I am equally grateful to the director of the Fufeng County Museum, Wang Yutang 汪玉堂, for the kind permission to reproduce the photograph here.

person responsible for the transfer of the text from the master copy onto the clay slab, which may be conveniently referred to as the *ordinator*,[27] had to operate consciously with the notion of character-space. A character-space was the fundamental structural unit that, together with layout, constituted the basic operational framework for the composing/editing and the transfer of the text to the inscriptional surface, a process that is termed *ordinatio* or "ordination" in Roman epigraphy. The conscious use of the notion of character-space and of commonly seen "combined graphs" *hewen* suggest that the 12×10 layout of the Hu *gui* inscription was the result of meticulous planning, possibly already during the compositional process.

The origins of the quest for a symmetrical layout can be traced to the very beginning of the Zhou dynasty. The inscription on the bottom of the Li *gui* 利簋 (*Jicheng* 04131, Figure 2.1), one of the earliest Western Zhou vessels cast probably during the reign of King Cheng 成王 (ca. 1042–1006 B.C.E.), runs in four columns, each of them numbering eight characters. Notice that in the first column, the name of King Wu 武王, commonly written as 珷王 in most Early Western Zhou inscriptions,[28] is shortened to 珷. It is clear that the Li *gui* inscription opted for an abbreviated form

27. There is no fixed term by which scholars refer to the person who inscribed the clay slabs. If we exclude "craftsman" or "scribe" as inappropriate because they obscure the fact that this was a highly specialized task, the most approximate term seems to be Barnard's "artisan-scribe." On the Eastern Han Wu Liang Shrine stela 武梁碑, the stonecutter responsible for carving the texts referred to himself as *liang jiang* 良匠 ("skilled craftsman"); the carver of another Eastern Han Stela for Sacrificing to the Mountain of Three Dukes 祀三公山碑 (carved 117 C.E.) calls himself simply *gong* 工 ("artisan"); other Han dynasty terms include *zao shi gong* 造石工 ("Chief Mason"), *bei shi* 碑師 ("Stele Master") and, most commonly, *shi shi* 石師 ("Master Mason"). Today, these stonecutters are referred to as *kegong* 刻工, which is a term originating in the Three Kingdoms period, but which still does not distinguish between a stonecutter producing stone reliefs and one carving texts. Regarding the evolution of stonecutters' self-appellations, see Cheng Zhangcan 程章燦, *Shike kegong yanjiu* 石刻刻工研究 (Shanghai: Shanghai guji, 2008), 50–62. For lack of a better term, I borrow the word "ordinator", which is used in Latin epigraphy to denote the person responsible for transferring the text from the master copy onto an inscriptional surface, which I find is quite a good parallel for the responsibilities in the process of the preparation of the bronze inscription in Western Zhou times. The process of the transfer of the text itself can be then conveniently referred to as "ordination" (from the Latin *ordinatio*). While using the masculine pronouns in reference to ordinators, I do not exclude the possibility that some of them (if not all) could be females. On female artisans in Early China, see Anthony J. Barbieri-Low, "Craftsman's Literacy: Uses of Writing by Male and Female Artisans in Qin and Han China," in *Writing and Literacy in Early China*, ed. Li and Branner, 370–99.

28. These include the famous He *zun* 何尊 (*Jicheng* 06014), Yi Hou Ze *gui* 宜侯矢簋 (*Jicheng* 04320), Larger Yu *ding* 大盂鼎 (*Jicheng* 02837) and Zhong *fangding* 中方鼎 (*Jicheng* 02785) inscriptions.

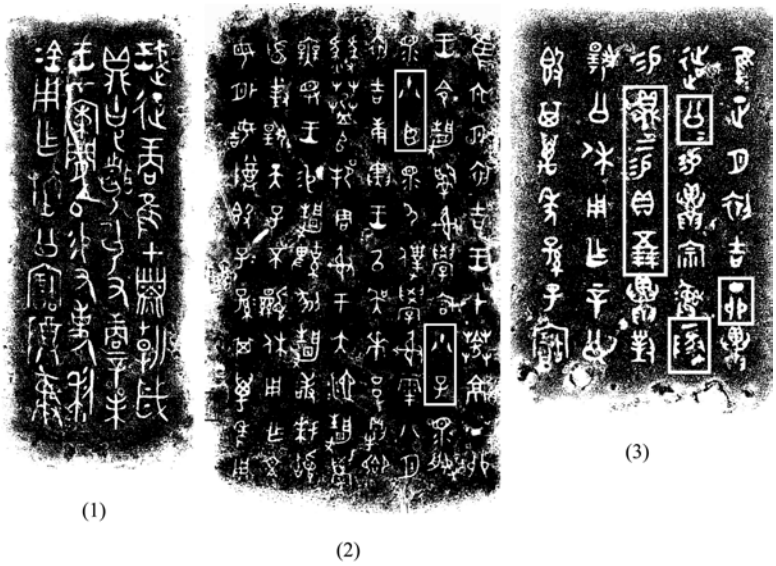

Figure 2 Rubbings of Li *gui* (1), Jing *gui* (2) and Min *gui* (3) inscriptions.

of the common designation 珷王, and the reason for that might well be that its composers aspired to reach a certain symmetry of the text, although in this period it was reached solely at the abstract, arithmetic level of equal number of character-spaces in each column and not at the visual level embodied by the *stoichedon* style.

The real *stoichedon* style in the layout of inscriptions, in which every character-space is equally high and wide, appears towards the middle of the Early Western Zhou period, with the Larger Yu *ding* 大盂鼎 (cast presumably in the twenty-third year of the reign of King Kang 康王, r. 1005–978 B.C.E.)[29] as its foremost representative, but is more prominent from the reign of King Mu 穆王 (956–918 B.C.E.), with the Jing *gui* 静簋 (*Jicheng* 04273) as an exquisite example (Figure 2.2). In this instance, even the commonly abbreviated compounds *xiao chen* 小臣 ("minor servitors") and *xiao zi* 小子 ("young boys") are written in full, with each character being assigned an equally sized character-space. Compare also

29. There are also recent voices arguing that the Larger Yu *ding* should in fact date to the reign of King Mu; see Li Shan 李山 and Li Hui李輝, "Da Xiao Yu ding zhizuo niandai Kang wang shuo zhiyi" 大小盂鼎制作年代康王說質疑, *Beijing shifan daxue xuebao* 2012.2, 31–36; Maria Khayutina, "Reflections and Uses of the Distant Past in the Chinese Bronze Inscriptions from the 10th to 5th Centuries BC," in *Historical Consciousness and the Use of the Past in the Ancient World*, ed. John Baines, Henriette van der Blom, Yi Samuel Chen, and Tim Rod (Sheffield: Equinox, 2019), 166–67.

Figure 3 Violation of master-layout due to lack of space (Da *gui* 大簋 lid, *Jicheng* 04299).

the Min *gui* 黽簋 inscription (*Jicheng* 04159, Figure 2.3), a rather short text in which no fewer than five space-saving devices are employed to maintain the 5×7 layout, which most likely was the master-layout: one ligature (*wu peng* 五朋, III.5), three character-space sharings (*ding mao* 丁卯 [I.6], *yi si* 一肆 [II.7], *er xi* 二錫 [III.3]) and one reduplication mark (*gong*, *gong* 公二 [II.2]).

Many other inscriptions assume the *stoichedon* layout with the help of conventional space-saving devices, especially the "combined graphs" *hewen*, and some of them will be scrutinized in the following discussion. There are also inscriptions like that of the aforementioned Jing *gui* that achieve a neat *stoichedon* layout without the help of a single instance of *hewen*, or even like that of the Shanfu Ke *xu* 善夫克盨 (2nd half of 9th century B.C.E., *Jicheng* 04465) that assume the *stoichedon* format and their overall number of character-spaces is in multiples of ten. It is therefore hardly by coincidence that the inscriptions like those of the Xing *zhong* 㺬鐘 (*Jicheng* 00246–250), Shi Chen *ding* 師晨鼎 (*Jicheng* 02817) or on the above-mentioned Jian *gui* (all from the middle of the ninth century B.C.E.) all have exactly one hundred character-spaces. All such inscriptions must have been planned with the utmost care, anticipating the desired symmetry of the layout. In such cases, the ultimate wording of the text cast into the bronze was a result of a compromise between the intended

content and the formal appearance of the text. To be sure, the content of the inscription mattered, but so did the form of its presentation.

It is thus reasonable to expect that a master copy of such well-planned inscriptions would specify the desired layout, either in the form of annotation or more likely by direct execution of the layout,[30] along with suggestions of instances of "combined graphs" and reduplication. I will call this planned intended layout a "master-layout."

Master-Layout and Its Violations

While in the case of Hu *gui* and scores of other vessels the actual cast layout seems to follow the master-layout accurately, several instances in sets of vessels on which identical inscriptions are reproduced show that such a master-layout was not always preserved. This situation is best exemplified by the case of the set of eight Ci *gui* 此簋 tureens (*Jicheng* 04303–04310), unearthed together with another three Ci *ding* 此鼎 cauldrons in 1975 from a cache in Dongjiacun 董家村 in Qishan 岐山 County, Shaanxi, and dating to the Late Western Zhou period (ca. 809 B.C.E.). All vessels and their lids bear identical inscriptions. Li Feng's meticulous analysis of their calligraphic features indicates that three individuals were responsible for inscribing these vessels, and thus provides solid grounds for the discussion of their master copy.[31]

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30. Note that in Latin epigraphy, for example, scholars usually agree that the drafts written on ephemeral materials did not always specify the layout and abbreviations; these would follow routine. Quite likely, the drafts were also not made to full size. See Susini, *The Roman Stonecutter*, 33, 44–47; Richard D. Grasby, "Latin Inscriptions: Studies in Measurements and Making," *Papers of the British School at Rome* 7 (2002), 153. Unlike in Chinese or Greek inscriptions, however, the tabular alignment of graphs was not of great importance in the Latin epigraphy which preferred proportional layout of the letters. The size of cast characters in Chinese bronzes was also usually more or less comparable to the size of handwriting. In such situations, the most economical solution would be to exemplify the layout together with the space-saving devices directly in the master copy.

31. Li Feng, "Ancient Reproductions and Calligraphic Variations: Studies of Western Zhou Bronzes with 'Identical' Inscriptions," *Early China* 22 (1997), 1–41. Based on the calligraphic features and the shape and décor of the *ding* cauldrons, Li Feng tentatively proposed that originally there was a set of 15 *ding* + 12 *gui*. This argument presupposes that only one person was responsible for producing inscriptions in each subset consisting of four or five vessels. However, Li Feng's reasoning was misguided by a photograph of one of the *ding* vessels published in Shaanxi sheng kaogu yanjiusuo, Shaanxi sheng wenwu guanli weiyuanhui, Shaanxi sheng bowuguan, eds., *Shaanxi chutu Shang Zhou qingtongqi* 陝西出土商周青銅器, vol. 1 (Beijing: Wenwu, 1979), Plate 197, which is probably mistaken for another *ding* from the cache, most likely the Shanfu Lü Bo *ding* 善夫旅伯鼎 (75QDJ:21). See Cao Wei 曹偉, *Zhouyuan chutu qingtongqi* 周原出土青銅器, vol. 3 (Chengdu: Bashu shushe, 2005), 443. Cao Wei,

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The inscription contains exactly 110 characters, which are, as expected, arranged either into eleven (11×10 characters) or ten columns (10×11 characters). The former is the case for the two Ci *ding* inscriptions (*ding* 75QDJ:5 [*Jicheng* 02823] and 75QDJ:3 [*Jicheng* 02821]), which are both inscribed by one hand (Li Feng's type C), preserving a neat, *stoichedon* arrangement. The third *ding* (75QDJ:4 [*Jicheng* 02822]), inscribed by another hand (Li Feng's type B), shifts the *mise-en-page* to the latter form, accommodating eleven characters into each of the ten columns, preserving the "arithmetic"[32] but not the visual symmetry of the inscription. The same hand also inscribed one subset of four *gui* tureens (75QDJ10–13 [*Jicheng* 04307–04310]), with more or less the same visual effect.[33] We thus have two ordinators opting for different layouts, while we can expect that they based themselves on the same master copy. In this case, the master-layout was subject to variation, but the overall (arithmetic) symmetry of the inscription was still preserved.[34]

A more layout-intrusive variation can be observed in the subset of four *gui* inscribed by type A calligraphy (75QDJ:6–9 [*Jicheng* 04303–04306]). While hand B was still precisely and coherently following the master-layout, hand A, the calligraphy of which is remarkably inferior to hand B, adhered to it only twice (*Jicheng* 04303.1 and 04303.2), mostly

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Zhouyuan chutu qingtongqi, vol. 3, 390–401, provides correct photographs of Ci's vessels that show that all three *ding* are nearly identical in shape and décor, and could be thus part of one subset. In fact, it will be shown later that more individuals indeed took part in the production of inscription slabs for the same subset of vessels in a consecutive fashion. The most intriguing textual variation in the set of inscriptions on Ci's vessels is rendering the ancestor's name *Gui gong* 癸公 twice as *Zhu gui* 朱癸, which is most likely due to an eye-slip to a neighboring line with a gift list; however, the problem is that the same mistake is repeated by two separate hands. This introduces the possibility that the subset inscribed by hand A was reproduced with some temporal distance from the subset by hand B and was not based on a manuscript but directly on the vessel's inscription. The text of *gui* 75QDJ:9 inscription would be then copied directly from the *gui* 75QDJ:10, including the mistake. The other *gui* inscriptions by hand A would then use a corrected version or were again copied directly from the remaining inscriptions by hand B; however, in the extant sample by hand A, the omission of three characters in *gui* 75QDJ:13 by hand B is not reproduced. See also n. 88 below.

32. Meaning that each column has the same number of character-spaces but these are not in line with each other. I am indebted to Yegor Grebnev for suggesting this term to me (personal communication, April 9, 2017).

33. One *gui* inscription (75QDJ:13) omits three characters *xiang* 享, *yong* 用, and *qi* 其, but still pertains to the 10x11 layout (eight characters in the ultimate column). See the related discussion below where based on this feature, I suggest that hand B perused the same exemplar text as hand C.

34. Since there was enough space to accommodate columns of 11 character-spaces on these two *ding* cauldrons, one may speculate that the 10x11 layout was motivated not by more space but by the general habit of having an inscription vertically "longer" than wider.

Table 1 Layout of the inscriptions in the set of Ci's vessels

#	vessel	hand	layout	*Jicheng*	note
1	*ding* 75QDJ:3	C	10/10/10/10/ 10/10/10/10/ 10/10/10	02821	h. 42.1 cm
2	*ding* 75QDJ:5	C	10/10/10/10/ 10/10/10/10/ 10/10/10	02823	h. 32.1 cm
3	*ding* 75QDJ:4	B	11/11/11/11/ 11/11/11/11/ 11/11	02822	h. 36.1 cm
4	*gui* 75QDJ:10	B	11/11/11/11/ 11/11/11/11/ 11/11	04307	has 朱癸
5	*gui* 75QDJ:11	B	11/11/11/11/ 11/11/11/11/ 11/11	04308	
6	*gui* 75QDJ:12	B	11/11/11/11/ 11/11/11/11/ 11/11	04309	
7	*gui* 75QDJ:13	B	11/11/11/11/ 11/11/11/ 11/11/8	04310	omits其,用, 享
8	*gui* 75QDJ:6	A	11/11/11/11/ 11/11/11/ 11/11/11	04303.2	
9	*gui* 75QDJ:6 lid	A	11/11/12/13/ 11/11/10/10/ 10/11	04304.1	
10	*gui* 75QDJ:7	A	11/11/11/11/ 11/11/11/11/ 10/12	04304.2	
11	*gui* 75QDJ:7 lid	A	11/11/11/11/ 11/11/11/11/ 11/11	04303.1	
12	*gui* 75QDJ:8	A	13/10/10/10/ 12/11/11/11/ 11/11	04305	
13	*gui* 75QDJ:9	A	11/11/12/11/ 11/10/10/12/ 9/13	04306	has 朱癸

failing to abide by it (see Table 1). The penultimate column of the *Jicheng* 04303.2 inscription reveals clear traces of the ordinator's struggle to fit all eleven characters into this column. Lack of experience seems to have taken its toll here.

A pair of inscriptions on the vessel and lid of the Jian *gui* 諫簋 (*Jicheng* 04285) from the end of the Middle Western Zhou period offers another, albeit rare, violation of the master-layout. Whereas the lid inscription has a rather neat alignment of ten character-spaces in all ten columns, the inscription cast into the inner bottom of the vessel runs only in nine columns, each composed of eleven character-spaces, omitting one character-space (i.e., the character *you* 攸 [鎧] ["bronze-plated"] from the compound *you le* 攸 [鎧] 勒 ["bronze-plated bridle"] in the VIII.3 position on the vessel inscription). Both inscriptions were written in the same hand, and the careful *stoichedon* order on the vessel's inscriptions suggests that the omission was an intentional step in the pursuit of equal length of all the columns and, in turn, a higher aesthetic quality of the inscription.[35] Here, the form seems to have overruled the content.

It is evident that in addition to cases where the ultimate layout preserves the intended arrangement of the master-layout, as in the inscriptions on Hu *gui*, Jing *gui* or Min *gui* above, there were also instances in which a symmetrical master-layout was assigned, but where the ultimate outcome for some objective or subjective reason did not follow this assignment.

Among objective reasons, we can cite the lack of space, a phenomenon often seen on the *gui* lid inscriptions where the ordination had to accommodate to the smaller round surface and thus did not follow the master-layout. Inscriptions on bells, which constitute a special category in regard to layout, could also be meticulously planned with regards to the character-space count, but such efforts are often traceable only on the largest bells in a graded chime, while the layout of the inscriptions on the remaining smaller bells is driven mostly by the need to accommodate as many characters as possible (see, for example, the discussion of the set of Liangqi *zhong* 梁其鐘 below).[36] Violation of the master-layout

35. The 9x11 layout again seems to reflect the general habit of writing longer rather than wider. There is also a possibility that the original master copy had only *le* and that *you* was added later, but I am inclined to rule out this possibility, since we do not commonly see *le* appearing in gift lists on its own. Interestingly, it is the modifier *you* "bronze-plated" that is omitted from the modifier-head noun phrase "bronze-plated bridle," so the inscription remained grammatical despite this omission. While this may be a coincidence, it may also hint that the person who decided to make this omission was literate to some degree.

36. For the various types of layout on bronze bells in Shang and Zhou periods, see von Falkenhausen, "Ritual Music in Bronze Age China," 626–44.

Figure 4 Rubbing of the lid of Xiaochen Qiu *gui* (*Jicheng* 04239.1) inscription.

did not necessarily lead to the violation of symmetry. The above case of Jian *gui* shows that when the master-layout was not observed, ad hoc measures could be taken to maintain visual symmetry.

Subjective factors contributing to a misrepresentation of the master-layout included lack of experience (such as the set of Ci *gui* inscribed by hand A), and possibly also contamination from the ordinator's writing habits. For example, the Xiaochen Qiu *gui* 小臣謎簋 inscription (Figure 4, *Jicheng* 04238–39) contains 64 characters arranged in eight columns, and the layout of eight character-spaces per column would be expected. However, the characters *yi yue* 一月 ("first month") in the third column (III.3) were executed such that they share one character-space. As a result, the ultimate (*Jicheng* 04239 [vessel and lid] and 04238 [vessel]) or penultimate (04238 lid) column has only seven character-spaces.[37] Indeed, the common scribal habit reflected in contemporary inscriptions was to condense *yi yue* into a *hewen*. It is likely that in order to achieve symmetry, the two characters were written separately in the master copy of this inscription, but a negligent ordinator performed them in

37. Note also that each of the two pairs of *gui* vessel and lid inscriptions are performed by a different hand, see Liu Xiaoxia 劉曉霞, "Xiaochen Lai gui xin lun" 小臣謎簋新論, *Kaogu* 2016.4, 109. For further implications of this observation, see the discussion below.

Figure 5 Rubbing of the Yin *gui* inscription (*Jicheng* 04287), with the characters *bai shou qi shou* and *yang* outlined.

a habitual way—as *hewen*, thereby decreasing the number of character-spaces in the inscription and violating the assigned layout.[38]

Another type of ordinator writing habit penetrating an inscription's text can be observed in the Yin *gui* 尹簋 inscription (Figure 5, *Jicheng* 04287), dating to the twenty-seventh year of King Xuan (801 B.C.E.). Of the ten columns, nine contain ten character-spaces, making use of the standard *hewen* in II.1 (*ding hai* 丁亥); however, column VIII accommodates eleven character-spaces. Although it is possible that the master copy did plan 102 characters in 101 character-spaces, note that instead of the commonly used abbreviated form *bai qi shou* 拜稽首, column VII has the full form *bai shou qi shou* 拜手稽首 ("with folded hands bowing prostrate") (Figure 5, outlined), which was in vogue for a certain period in the Middle Western Zhou, but appears to be rather anachronistic

38. For an instructive discussion on the causes of violations of the *stoichedon* order in Greek inscriptions, see M. J. Osborne, "The Stoichedon Style in Theory and Practice," *Zeitschrift für Papyrologie und Epigraphik* 10 (1973), 258–70.

in this late inscription. The abbreviated version *bai qi shou* was largely preferred in bronze inscriptions, perhaps for space-saving or rhythmical purposes; it seems likely that in the spoken language, the full tetra-syllabic version was employed.[39] It is possible that the ordinator included the character *shou* 手 simply because this was how the phrase was usually vocalized.[40] One other common cause for the violation of master-layout, the unintentional omission of a character during the ordination, will be discussed later.

Not all of the bronze inscriptions seek arithmetic or even visual *stoichedon* style symmetry in terms of layout; in fact, it may well be that the majority of them were drafted without taking the question of symmetry into account. However, a number of inscriptions still conspicuously employ space-saving devices to achieve symmetry in their graphic presentation. It appears that in such well-planned inscriptions, their intended visual organization constituted a fixed framework by which the contents had to abide. What mattered was not only what to write, but also how to present it. In light of the above discussion, I believe we have good reason to assume that the final outcome of the composition or compilation process, i.e., the master copy, visually reflected the intended master-layout of the inscriptions, specifying instances of ligatures, sharing of character-spaces, reduplications and, in a few cases, paragraph spacing.[41] For various reasons, some of which include, apart from mistakes, the lack of experience or contamination by conventional scribal habits, the final outcome did not always respect the assignments of the master copy. Thus, when reading bronze inscriptions, we should first ascertain how much symmetry mattered to their producers, and thereby

39. The line *Hu bai qi shou, dui yang wang xiu* 虎拜稽首, 對揚王休 "Hu with folded hands bows prostrate and extolls the King's beneficence," in the *Shi jing* 詩經 hymn "Jiang Han" 江漢, also employs the trisyllabic variant, arguably also for purposes of space-saving, though here the goal is to preserve the tetrasyllabic verse. Note that *bai shou qi shou* was also used as a polite (often speech-opening) formula; such use is attested to not only in bronze inscriptions, but also in the "Shao gao" 召誥 or "Li zheng" 立政 chapters from *Shang shu* 尚書 or the Warring States manuscripts from Xincai Geling 新蔡葛嶺. For a more detailed discussion, see my "You tongqi mingwen de bianzuan jiaodu kan Xi-Zhou jinwen zhong 'bai shou qi shou' de xingzhi" 由銅器銘文的編纂角度看西周金文中"拜手稽首"的性質, *Qingtongqi yu jinwen* 1 (2017), 541–59, where I argue that *bai shou qi shou* in Western Zhou bronze inscriptions is used predominantly as a polite formula expressing gratitude.

40. The highly phonetic writing of the character *yang* 揚, in which only the phonophoric component 昜 is written instead of the usual complex 飄, is also noteworthy.

41. This phenomenon can be sporadically observed in longer inscriptions, see for example Larger Ke *ding* 大克鼎 (*Jicheng* 02836) or Hu *ding* 曶鼎 (*Jicheng* 02838) inscriptions. For a brief discussion about these inscriptions, see n. 90 below.

identify and duly appreciate their visual qualities that arguably present formal limitations to the text being analyzed.

Between "Instruction" and "Production": The Blueprint

In the above discussion, I assessed what can be assumed about the information contained in the master copy based on the visual qualities of bronze texts. In this section, I focus on the actual use of the manuscripts in the process of "ordination," i.e., the laying out of an inscription's text on the clay mold ("inscription block"). In the majority of cases, an inscription was prepared on a separate clay slab, which upon completion was embedded into a niche in the inner mold of the casting assembly and then used for casting.[42] Since it should not be automatically assumed that the text of an inscription was copied directly from the master copy, the term "blueprint" will be used in the following discussion to refer to the manuscript from which the text was copied on the clay slab.[43]

Inscriptions on the set of Late Western Zhou Liangqi *zhong* 梁其鐘 bells (*Jicheng* 00189–192) yield valuable evidence for the inquiry into the process of textual transmission from perishable to durable media.[44] An incomplete set of six bells was unearthed in 1940 from a cache in Fufeng county 扶風縣, Shaanxi, and was subject to an extensive study by Noel Barnard and Cheung Kwong Yue 張光裕 in the mid-1990s.[45] An inscription of 137 characters was cast divided onto two pairs of larger bells, with bells A (*Jicheng* 00187) and B (*Jicheng* 00188) forming the first pair, and bells C (*Jicheng* 00189) and D (*Jicheng* 00190) forming the second pair, and presumably also on four smaller bells from which only the

42. The issue of casting of bronze inscriptions will be discussed in detail below. For a brief introduction to the piece-mold casting procedure, see Shaughnessy, "Sources of Western Zhou History," 37–43; for a more elaborate treatment, see Yung-ti Li, "Co-Craft and Multicraft: Section-Mold Casting and the Organization of Craft Production at the Shang Capital of Anyang," in *Craft Production in Complex Societies: Multicraft and Producer Perspectives*, ed. Izumi Shimada (Salt Lake City: University of Utah Press, 2007), 184–94.

43. An alternative to the term "blueprint" tentatively used in this article would be the bibliographic term "setting copy." Apart from its conciseness, I find the technical undertone of the term "blueprint" quite fitting in the context of inscription-making.

44. I am indebted to Jeffrey R. Tharsen for drawing my attention to this case (personal communication, March 2015). For the general complexities involved in the transposition of text from an exemplar manuscript onto an epigraphic artifact, see the examples from Latin epigraphy discussed by Jean Mallon, "Paléographie des papyrus d'Egypte et des inscriptions du monde romain," *Museum Helveticum* 10 (1953), 141–60; see also Grasby, "Latin Inscriptions," 151–56.

45. Noel Barnard, in association with Cheung Kwong-yue, *The Shan-fu Liang Ch'i Kuei and Associated Inscribed Vessels* (Taipei: SMC, 1996), 37–71.

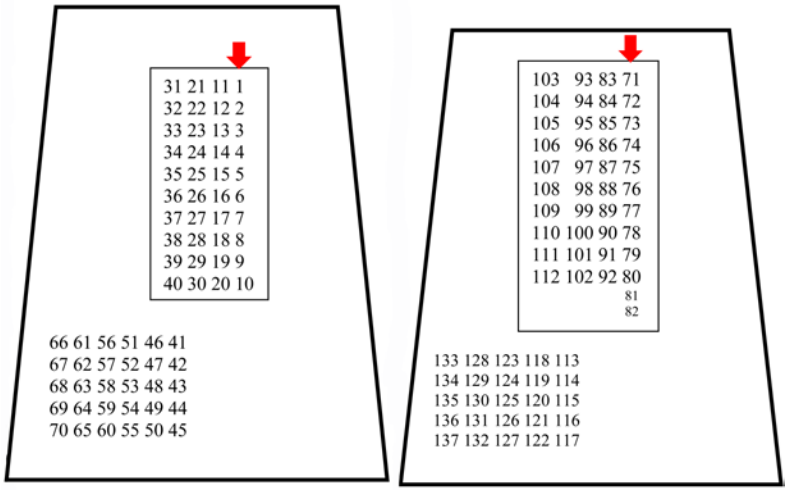

Figure 6 Inscription layout on Liangqi *zhong* bells A (left) and B (right).

first two bells are extant (bells E [*Jicheng* 00191] and F [*Jicheng* 00192], in the latter case only in the form of rubbing). It is these two smaller bells that are crucial to the present discussion. Unlike the inscriptions on the four larger bells, which contain only one minor defect (the character *Liang* 梁 is missing in the inscription on the left-hand side of the lower-belt section of bell D), inscriptions on the smaller bells E and F exhibit serious discrepancies in textual sequence that have hitherto not been satisfactorily explained. For convenience, Figure 6 shows the correct textual sequence on bells A and B, and the characters are numbered 1–137 according to this sequence. The textual corruption on bells E and F is depicted in Figure 7.

Instead of the expected opening phrase *Liangqi yue* 梁其曰 ("Liangqi says"), that is, starting the textual sequence from character 1 as on bell A in Figure 6, the text on bell E begins with the phrase *bi Tian zi, Tian zi yi shi Liangqi* 辟天⿱子⿱肩(夷)[46]事(使)梁其 ("assists the Son of Heaven, the Son of Heaven, oh, sent Liangqi"). That is, it begins with the inscription's thirty-seventh character, and runs unbroken to render thirty-eight characters of this sequence, all the way until the seventy-fourth character according to the original sequence. Next, the text leaps back to the very first two characters of the entire inscription, *Liangqi* 梁其 (from the opening sentence *Liangqi yue* 梁其曰). The situation is diagrammed in Figure 7.1.

46. For the reading of this character, see Yu Haoliang 于豪亮, "Shaanxi sheng Fufeng xian Qiangjiacun chutu Guo Ji jiazu tongqi mingwen kaoshi" 陝西省扶風縣強家村出土虢季家族銅器銘文考釋, *Guwenzi yanjiu* 9 (1984), 259.

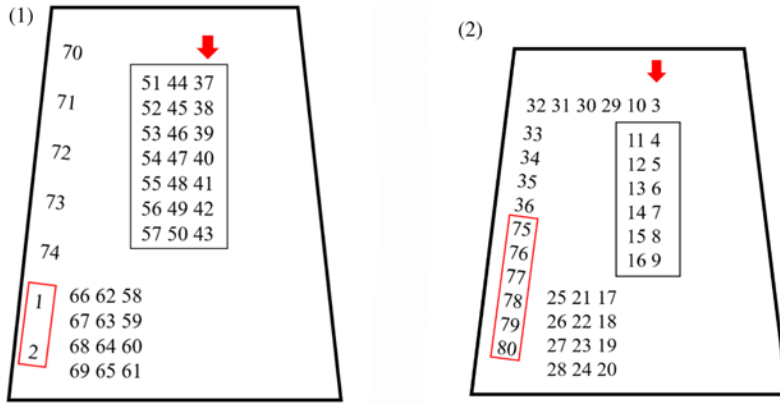

Figure 7 Inscription layout (1) on Liangqi *zhong* E and (2) on Liangqi *zhong* F (the arrows indicate the usual beginning of the text).

Correspondingly, the text on bell F continues with the remaining characters of this opening sequence (*yue* 曰 …) all the way to character 36, after which it skips characters 37–74 (which are already present on bell E) and continues on, starting from character 75 (see Figure 7.2). The two missing bells (G–H) probably bore the rest of the inscription, i.e., characters 81–137.

Discontinuity in textual sequence led Barnard to the conclusion that at least five more bells must have been part of the chime.[47] In fact, Wang Shimin 王世民 had already shown that the problematic textual sequence can actually be rearranged to form a complete inscription, and thus the subset could have comprised no more than four bells.[48]

47. Barnard and Cheung, *The Shan-fu Liang Ch'i Kuei and Associated Inscribed Vessels*, 68–71. However, eight or sixteen bells usually formed a chime from the Middle Western Zhou period onward.

48. Wang Shimin 王世民, "Xi-Zhou ji Chunqiu Zhanguo shidai bianzhong mingwen de pailie xingshi" 西周暨春秋戰國時代編鐘銘文的排列形式, in *Zhongguo kaoguxue yanjiu: Xia Nai xiansheng kaogu wushi nian jinian lunwenji (er ji)* 中國考古學研究—— 夏鼐先生考古五十年紀念論文集 (二集), ed. Zhongguo kaoguxue yanjiu bianweihui (Beijing: Kexue, 1986), reprinted in Wang Shimin 王世民, *Kaoguxue shi yu Shang Zhou tongqi yanjiu* 考古學史與商周銅器研究 (Beijing: Shehui kexue wenxian, 2017), 431–32. The same observation was made recently also by Jeffrey R. Tharsen; see his "Chinese Euphonics: Phonetic Patterns, Phonorhetoric and Literary Artistry in Early Chinese Narrative Texts." Ph.D. dissertation (University of Chicago, 2015), 147 n. 8. Note, however, that Tharsen's reconstruction does not consider the dimensions of the two bells, and it appears that he considers bell F to have been originally preceding bell E, and that only the characters *Liangqi* 梁其 (bell E) and the final six characters on bell F were misplaced. However, it is clear from the dimensions of the two rubbings that bell E indeed preceded bell F, and it will be shown that in fact, the last two characters *Liangqi* on bell

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This is undoubtedly correct, but what were the causes for such a distortion in textual sequence?

Note that the places of content discontinuity do not coincide with the borders of the inscription slabs, as is sometimes the case when an inscription was prepared on several clay slabs that were then embedded into the inner mold in wrong order.[49] I thus believe that the clue that reveals the reason for this textual corruption lies in the consideration of the writing supports employed in the process of preparation of the inscription for casting.

As a first step, I suggest focusing on the two breaks in textual sequence, first between characters 36 and 37 and second between characters 74 and 75. What would be the objective reasons for breaking the text exactly in these places? Notably, the inscription divided onto bells C and D breaks exactly after 74 characters, with bell C bearing 74 and bell D bearing the remaining 63 character-spaces of the inscription.[50] We could thus assume that two separate blueprints were used for the ordination of the inscription on bells C and D, one with 74 characters and another with the remaining 63 characters, and that once the production procedure turned to the last subset of the four smaller bells (E–H), the same blueprints prepared for the larger bells C and D were employed. However, as the inscription needed to be divided now onto four and not two bells, it was necessary to split the two larger textual units on the two blueprints into four smaller units, i.e., one for each bell. This procedure is schematized in Figure 8.

It is noteworthy that bells E–H are based on blueprints for bells C and D and not on blueprints for bells A and B. There might be an easy explanation of this: The inscription on bell A contains exactly 70 characters and that on bell B 67 characters, obviously a result of more mathematical than contextual planning. In fact, in the transition between bells A and B,

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E are the only two characters from the present inscription originally projected to appear on this bell.

49. The best example of this is one of the Forty-third Year Qiu *ding* 卅三年逑鼎 cauldrons unearthed from the famous cache in Yangjiacun 楊家村, Meixian 眉縣, Shaanxi in 2003 (2003MYJ:7); for rubbing, see *Xinshou* 748. This inscription was originally prepared on three separate clay slabs that were embedded into the inner core mold; however, in the case of 2003MYJ:7 *ding*, the first and the third slab were embedded in the wrong order, resulting in sequence 3–2–1 instead of 1–2–3 (thus, the columns of the inscription run as follows: original columns XX–XXIX, then columns X–XIX, and then I–IX). For an Early Warring States period example of misplaced slabs, see Song Huaqiang 宋華強, "Aomen Chongyuan xin jian Chu qingtongqi chu yi" 澳門崇源新見楚青銅器芻議, *Zhongwen xueshu qianyan* 3 (2011), 193–96.

50. The inscription on bell D in fact omits the character *Liang* 梁 and writes *zai shang* 才上 as *hewen*; thus, it only contains 61 character-spaces. The visualization in Figure 8 correspondingly omits position 124 of the original character *Liang*.

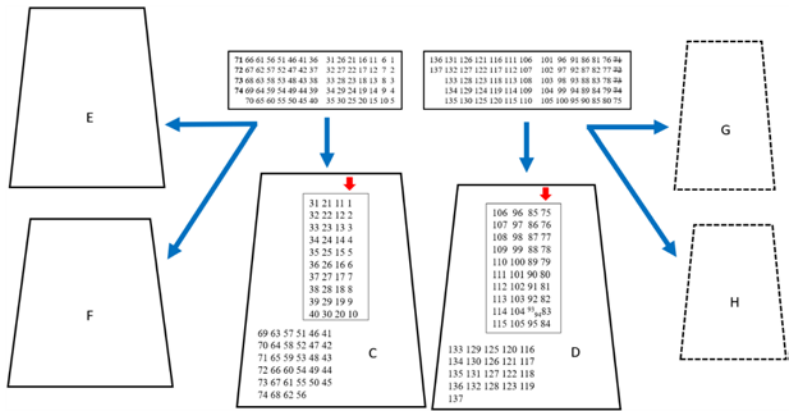

Figure 8 Scheme of sharing a blueprint for inscriptions on bells C =E+F and D = G+H.

the inscription breaks in the middle of the dedication *yong zuo zhen huang / zu kao he zhong* 用乍朕皇/且考龢鐘 ("and thus making for my august / ancestors and father [these] harmonious bells"), which might have been perceived as disruptive, as it breaks both the syntactical and rhythmical unit. On bell C's inscription, the length was expanded from 70 to 74 characters to include the whole dedication phrase on the same bell, rather than splitting it down the middle.[51] While it is possible that a new blueprint reflecting these changes was prepared for the inscription on bells C and D, it is more likely in my view that these changes were incorporated directly into the extant blueprint of bells A and B, by adding four characters to the original blueprint for bell A and deleting four characters from the beginning of the original blueprint for bell B. The latter possibility is reflected in the blueprint reconstructions in Figures 8–9.

Several scenarios can be devised for the following step; I will limit the presentation here to what appears to be the most likely, which still requires a detailed specification of the nature of the blueprint. It will be shown below that the inscriptions on the set of Ci's vessels or the Larger Ke *ding* 大克鼎 used blueprints that contained five characters in each column, presumably to facilitate the ordination process. In such a scenario, the split between characters 36 and 37 appears almost exactly in the middle of the blueprint. Here, too, it is possible that the blueprint for bell C, originally containing 70 (plus four additional) characters, was split into two parts (containing 35 and 35+4 characters respectively), but

51. This would suggest that at least in this case, the casters were concerned with facilitating the reading of the inscription. The question is who made the decision to alter the layout of the inscription, which obviously demanded several editorial actions in the blueprint.

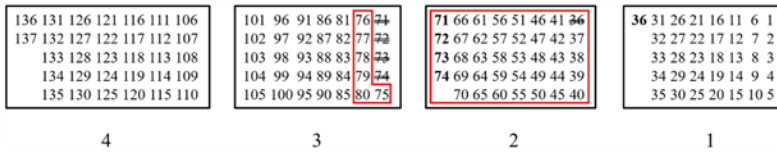

Figure 9 Blueprint for the Liangqi *zhong* bells, alternative with four smaller blueprints, taking account of textual adjustments (added characters in bold, deleted characters crossed).

to avoid splitting the compound *su xi* 夙夕 ("day and night")—characters 35 and 36—the character *xi* 夕 was copied on the first half of the blueprint (1–35[+36]) and deleted from the second (originally 36–70[+4], now 37–70[+4]).

In fact, it is quite possible that four smaller blueprints were originally produced for this set of bells, each containing 35 (only the last blueprint 32) characters with five characters per column (Figure 9). These were then used for ordination of inscriptions on bells A and B. Before ordination of inscription on bells C and D, a textual adjustment to facilitate readability of the inscription was made in these blueprints, namely adding four characters at the end of the second blueprint (originally containing characters 36–70, now 36–74) and deleting the same four characters from the beginning of the third blueprint (originally containing characters 71–105, now 75–105). Still further adjustment was made when the ordination turned to inscriptions on bells E and F: One character was added at the end of the first blueprint (originally 1–35, now 1–35+36), and this character was deleted from the beginning of the second blueprint (originally 36–74, now 37–74). Whether further adjustments were made cannot be assessed, since bells G and H have been lost.[52]

52. Since the bells were graded in size, we can expect that bell G would accommodate more characters than bell H; thus, the larger blueprint for bell D can be expected to split between characters 115 and 116, possibly even between characters 120 and 121 (see Figure 9). Further possible scenarios for the textual discrepancy might be: 1) 36 character-spaces were conceived originally for bell E. The person responsible for the task, possibly the ordinator, would then take the manuscript with 74 characters (which was used to inscribe bell C) and mark the place between character 36 and 37 to split the text. The manuscript would then be split into two parts, one containing characters 1–36, and another with characters 37–74; 2) 38 characters were planned for the inscription, but the person responsible counted not from the beginning but from the end (see also later discussion for this point); 3) the larger blueprint was just mechanically split into two halves; in this case, we could conjecture that the blueprint originally had nine character-spaces in each column, and thus the split would appear exactly between characters 36 and 37, resulting in two smaller blueprints, one with characters 1–36 and another with characters 37–74. Except for the last one, however, these scenarios do not

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In any case, the mistake must have occurred in the following stage. Instead of using the first part of the blueprint with characters 1–36, the ordinator mistakenly took the second part with characters 37–74 and engraved them on the clay slabs for bell E. After engraving all the characters from this blueprint (37–74), he switched (perhaps since there was still space available) to the second part of the original blueprint (with characters 1–36) and continued the ordination. He would have first added two characters (1–2) to bell E and continue the ordination on the new bell F. After engraving all the characters from the second blueprint here (3–36), he would then turn to the third small blueprint and continue engraving characters 75–80, by which he filled the inscriptional space of bell F. After this step, we would expect him to have continued engraving the remaining text on the clay slabs for bells G and H (now lost).

The case of the Liangqi *zhong* inscriptions enables us to make several basic observations. First, the production of presumably eight bells of a single chime was performed in consecutive order, beginning from the largest bell and proceeding to the smaller bells.[53] This observation is particularly important, given that the three pairs of bells were each inscribed by a different hand,[54] further supplementing the observation made by Hayashi Minao 林巳奈夫 and further elaborated on by Li Feng that identical inscriptions could be inscribed by different hands.[55]

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satisfactorily explain why exactly 36 or 38 characters would be planned for the bell E inscription.

53. Moving from larger to smaller vessels seems to have been a common practice in the production of the graded vessels of a set. Typically, the layout and calligraphy of larger vessels in a set was performed carefully and with high quality, but moving towards smaller pieces, mistakes would occur. For a good example, see the set of Forty-third Year Qiu *ding* cauldrons unearthed in 2004 from a cache in Yangjiacun, Meixian: the two largest cauldrons (YJ18 [*Mingtu* 02503] and YJ13 [*Mingtu* 02504]) are cast without textual flaws; in the third cauldron (YJ3 [*Mingtu* 02505]), the slabs with inscriptions were misplaced (see n. 49 above); the fourth, fifth, and seventh cauldrons (YJ6 [*Mingtu* 02506], YJ12 [*Mingtu* 02507] and YJ16 [*Mingtu* 02509]) are also without mistakes; the inscription on the sixth cauldron (YJ5 [*Mingtu* 02508]) misses characters *zai* 才 [II.2] and *wo* 我 [XVI.6], and the inscription on the seventh (YJ2 [*Mingtu* 02510]) misses the character *zu* 且 [VII.10]. The inscription divided onto the two smallest cauldrons (YJ8 [*Mingtu* 02511] and YJ4 [*Mingtu* 02512]) omits a whole portion of 15 character-spaces, but this omission was probably intentional; see the discussion below.

54. Barnard and Cheung, *The Shan-fu Liang Ch'i Kuei and Associated Inscribed Vessels*, 42, 43 Figure 17.

55. Hayashi Minao 林巳奈夫, "In Shū seidōki meibun chūzōhō ni kansuru jakkan no mondai" 殷周青銅器銘文鑄造法に關する若干の問題, *Tōhō gakuhō* 51 (1979), 38–40; Li Feng further suggested that this may be connected to the sharing of responsibilities in the production of subsets of a final set or a result of later reproduction; see his "Ancient Reproductions and Calligraphic Variations," 13–15, 24–26, 37, 40.

Second, during the process of production of clay slabs with identical inscriptions, the text was apparently not copied from one inscribed slab to another, but always from an independent manuscript.[56] Moreover, the consecutive production of the inscriptions suggests that a single exemplar, composed of two or four parts, was consulted in the process of the ordination of the entire set of inscriptions on Liangqi's bells. During the ordination process, the individual parts of the manuscript were very likely adjusted after the first pair of clay slabs was inscribed, and then again before inscribing the third subset of bells. It is possible that two larger blueprints were graphically or even physically bisected before the ordination turned to the subset of smaller bells, but it is more likely that four smaller blueprints were used from the beginning. As the size of the inscriptional area differs for every single bell in a graded chime, it seems reasonable to assume that the master-layout was not specified in the master copy. On the other hand, it is very likely that the blueprint contained five characters in each column. Note that the confusion with respect to textual sequence followed after the annotations were made in the blueprint.[57]

There is evidence suggesting that the ordination procedure and sharing of a single blueprint, as reconstructed above, was not particular to the Liangqi *zhong*, but rather represents a more general practice. Consider, for example, the set of four First Year Shi Shi *gui* 元年師旋簋 (*Jicheng* 04279–04282) tureens excavated in 1961 in a cache in Zhangjiapo 張家坡 near present-day Xi'an and dating to the reign of King Yi 夷王 (r. 865–858 B.C.E.).[58] The inscription on the inner bottom of these vessels

56. Such a copying scenario was already anticipated by Edward L. Shaughnessy, "The Writing of a Late Western Zhou Bronze Inscription," 874 n. 29. Notably, a certain period of time was needed for inscribed slabs to dry before they were fired, which made them available for consultation during the ordination of subsequent slabs.

57. One can only speculate about the reasons for the mismatch of the two blueprints. While negligence is a fairly acceptable explanation, I wonder whether the fact that the first character on the second blueprint was crossed or blackened might have been a contributing factor, as it might have been interpreted as an index sign for the beginning of the text. Compare the later practice of marking the beginning of text by a blackened upper margin in the Mawangdui manuscripts *Jingfa* 經法, *Shiliu jing* 十六經, *Cheng* 稱 and *Daoyuan* 道原, or the use of black squares to mark the beginning of smaller textual units within the abovementioned *Jingfa* and *Shiliu jing* manuscripts. For the Mawangdui marks, see Qiu Xigui 裘錫圭, ed., *Changsha Mawangdui Han mu jianbo jicheng (qi)* 長沙馬王堆漢墓簡帛集成 (柒) (Beijing: Zhonghua, 2014), 60–76 (photographs). We could further speculate that the blueprint was two-sided, and in his search for the beginning of the text, the ordinator opted for the wrong side, being misguided by the blackened character.

58. Shaughnessy, *Sources of Western Zhou History*, 267–71.

(1) 10/10/10/9/10/10/10/10/10/7 *Jicheng* 04280.1

(2) 10/10/10/10/10/10/10/10/10/6 *Jicheng* 04279.1

(3) 10/10/10/10/10/10/10/10/10/6 *Jicheng* 04282.1

Figure 10 Inscriptions on the three lids of First Year Shi Shi *gui*, detail of the fourth column (caption omits the first character in each column).

counts ninety-seven characters in ten columns, with ten characters per column, except for the final column with seven characters. Three of these tureens were preserved with lids, whose inscriptions are identical to the vessel inscriptions, except for one important difference: the character *Ke* 克 from the personal name of Zuoce Yin Ke 作冊尹克, a person who is said to have read the royal investiture to the donor of the vessel Shi Shi 師 旗, is omitted in all three lid inscriptions (Figure 10, compare IV.6 in the vessel inscriptions).

Noticeably, all three lid inscriptions (*Jicheng* 04279.1, 04280.1, 04281.1) were executed by the same hand as the inscriptions on the inner bottoms of three vessels (*Jicheng* 04280.2, *Jicheng* 04281 and *Jicheng* 04282.2); only the vessel inscription *Jicheng* 04279.2 was executed by a different hand. This shows that the ordination did not proceed holistically in the "vessel–lid" manner, but rather in batches: "all vessels–all lids" (or vice versa).

The textual deviation between lid and vessel inscription suggests that either 1) all three lid inscriptions were engraved after a different blueprint than the inscriptions for the vessel bottoms and that this different blueprint did not register the character *Ke* 克, either due to an eye-slip in the process of copying from the master copy or due to intentional omission, or 2) the same blueprint was used, but there was a deliberate decision to omit the character *Ke* after the ordination of vessel inscriptions was accomplished.

The layout of the three lid inscriptions seems to support the second possibility. While the lid inscriptions *Jicheng* 04279.1 and *Jicheng* 04282.1

are aligned more or less in a regular, *stoichedon* style with ten character-spaces per column (except for the last column with six characters), the inscription *Jicheng* 04280.1 diverges in an interesting way: The fourth column, where the character *Ke* was placed in the vessel inscriptions, has only nine character-spaces, with the rest of the inscription following exactly the layout of the vessel inscriptions (i.e., seven characters in the last column). The four characters *ce yin ce ming* 冊尹冊命 (VI.4–7) in the fourth column cover five character-spaces and disrupt the otherwise careful *stoichedon* layout (see Figure 10.1 and compare with Figures 10.2 and 10.3). It is more than likely that this lid inscription was originally ordinated with 97 characters, including the character *Ke* in the fourth column, but for unknown reasons this character was subsequently deleted, and the four characters *ce yin ce ming* were laid out again to cover proportionally a larger inscriptional surface of five character-spaces. The omission of the character *Ke* was then presumably marked in the manuscript serving as a blueprint for the inscription, and other lid inscriptions were thereafter ordinated without this character, preserving a neat alignment.[59] The observation that the ordination of the lid inscriptions occur in consecutive order is corroborated by the fact that all are laid out by a single hand. As in the case of Liangqi *zhong*, here too more vessels shared the same blueprint, which was subject to textual adjustments during the ordination.

A more puzzling case is the set of Late Western Zhou Shi Ke *xu* 師克盨 containers and their inscriptions. Two vessels and three lids are preserved: both vessels are inscribed by one hand (A) and three lids by two other hands (B and C, see Table 2), and it is reasonable to expect that the set was originally formed by four *xu* vessels (and four lids).[60] The two

59. Numerically, this process can be rendered as follows: 10/10/10/10/10/10/10/10/7 (vessel inscriptions) →10/10/10/9/10/10/10/10/7 (lid 04280.1) →10/10/10/10/10/10/10/10/10/6 (lids 04279.1 and 04282.1). Another possibility is that the omission was marked prior to the ordination of the 4280.1 lid, but the character was mistakenly included. Since only a local correction was made without shifting the position of remaining characters, it is clear that the mistake was detected only after the entire inscription was laid out during the proofreading process. Subsequently, the character *Ke* was deleted and the four characters were rewritten again. On proofreading, see the discussion below. The observation that the omission of *Ke* was deliberate is clear not only from this reconstruction, but also from the fact that should this omission be unintended, it should be easy to identify it with the help of the master copy during proofreading. Note that should the blueprint have five character-spaces per column, the omitted character *Ke* would be positioned as the first character of the eighth column of the blueprint, i.e., possibly a visually salient position.

60. Yang Xiaoneng, "The Shi Ke *Xu*: Reconsideration of an Inscribed Late Western Zhou Vessel," *Artibus Asiae* 52.3/4 (1992), 192–93. Based on the measurements, Yang

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Table 2 Basic information about the Shi Ke *xu* inscriptions

vessel	hand/cols.	layout (char./col.)	omission
Jicheng 04467.2 vessel 19.5 x 27.4 cm	A/14	10/10/10/11/10/11/ 11/11/10/10/10/ 10/10/10	冥 X.4
Xinshou 1907 vessel 19.1 x 27.45 cm	A/14	11/10/10/11/10/11/ 10/12/10/9/10/10 /10/10	冥 X.3
Jicheng 04467.1 lid 19.5 x 27 cm	B/14	10/10/10/10/10/10/ 10/11/10/10/11/ 12/11/9	冥 X.7
Xinshou 1907 lid 19.55 x 28.55 cm	B/14	9/10/9/11/10/10/10 /11/10/10/11/11/ 12/13	繇 II.10 冥 X.5
Jicheng 04468 lid 19.8 x 27.6 cm	C/13	10/11/11/12/12/11/ 12/11/10/10/11/ 12/11	繇 II.9

vessels inscribed by hand A omit the character *mi* 冥 ("canopy") in column X, as do two lid inscriptions inscribed by hand B. However, the lid inscription *Xinshou* 1907 also omits the character *you* 繇 ("indeed") in the second column, which is an omission shared by the *Jicheng* 04468 lid inscription by hand C (see Table 2). This variance in omitted characters again confirms the observation that the inscriptions were not copied from one slab to another, but rather from an independent written medium. Conversely, the fact that omissions are shared by more inscriptions indicates that they were not caused haphazardly. If we presuppose the consecutive ordination procedure, we must conclude that this blueprint originally contained both characters *you* and *mi*, and that for unknown reasons, they were marked to be left out.

Supposing that both *mi* and *you* were originally included in the blueprint and thus in turn in the master copy, we can assume that the inscription was conceived to contain 145 characters. From the layout of the extant inscriptions, we may further conjecture that two instances of *hewen* were planned for this inscription, *yi you* 一卣 (or *chang yi* 鬯一) and *si pi* 四匹,[61] giving a total of 143 character-spaces, and the master-layout

observes that only the *Jicheng* 04468 lid inscribed by hand C would fit on the vessels *Jicheng* 04467.2 or *Xinshou* 1907, i.e. vessels inscribed by hand A.

61. These were common ligatures at the time. All extant Shi Ke *xu* inscriptions write *yi you* (or sometimes *chang yi*) into one character-space, but none of them ligate *si pi*, even though these characters are written into one character-space in the *Jicheng* 04467.1

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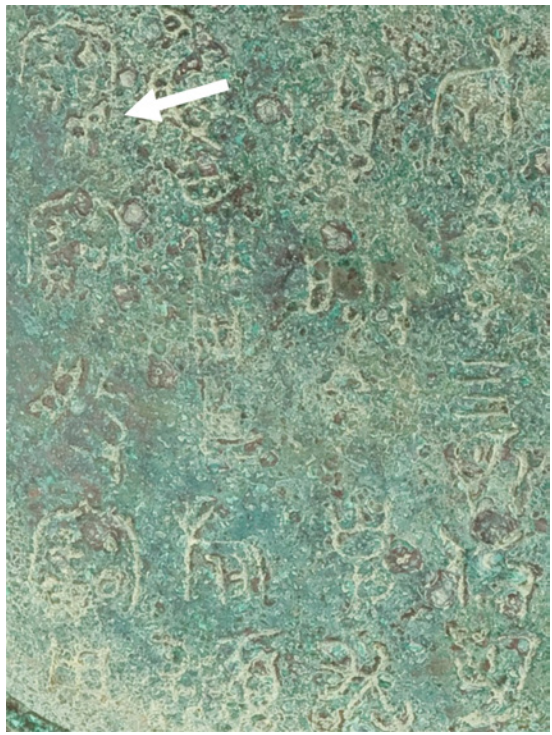

Figure 11 Detail of the ending of the *Xinshou* 1907 lid inscription. This vessel is housed in Saint Louis Art Museum, Spink Asian Art Collection, as a bequest of Edith J. and C. C. Johnson Spink (36:2014). Reproduced with permission. Characters *bao yong bao pan bao yong* 寶用寶般寶用 appear in the very left-hand column, with the arrow pointing at the reduced character *yong* 用.

can be thus reconstructed as thirteen columns with eleven character-spaces each (Figure 12).

Note also that in the *Xinshou* 1907 lid inscription, four redundant characters, *bao pan bao yong* 寶般(盤)寶用 ("precious *pan*-basin, use it as treasure"), are added at the very end of the inscription (Figure 11).[62] This reveals that the blueprint for this *xu* inscription was also planned to be used for a *pan* 盤 inscription, and the characters *bao pan* 寶盤 ("precious *pan*") were noted in the blueprint to replace the characters *lü xu* 旅盨 ("*xu* for *lü*-ing,") probably somewhere close to these characters or at the

inscription and are extremely close to each other in the *Xinshou* 1907 lid inscription, i.e. in the two inscriptions by hand B.

62. Yang Xiaoneng, "The Shi Ke *Xu*," 204–5, notes this textual corruption and proposes rightly, in my view, that a *pan* basin was cast together with the set of *xu* containers.

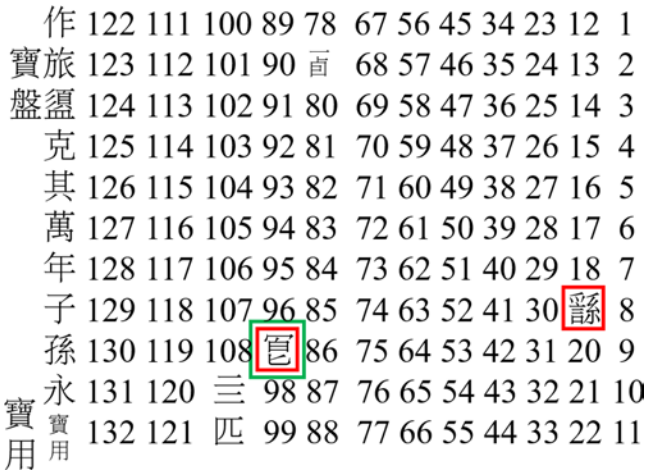

Figure 12 Schematic reconstruction of the blueprint used for *Xinshou* 1907 lid.

end of the blueprint.[63] This indicates that a single blueprint was reused for several types of vessels (here *pan* and *xu*), which further corroborates the consecutive production hypothesis.

The repetition of *bao yong* 寶用 ("use it as treasure") is even more revealing. To explain the textual discrepancies in the Shi Ke *xu* inscriptions, I would like to tentatively suggest the following scenario as visualized in Figure 12: Examining the abovementioned ligatures, *yi* 一 is consistently ligated throughout all five inscriptions (either with *chang*

63. In this case, both suggested positions overlap; see Figure 12. The position of the alternative vessel name at the end of the blueprint is suggested by the inscription on a Late Chunqiu Yin *yi* 君匜 (*Jicheng* 10284). The inscription identifies the vessel as *hui pan* 盥(沫) 盤 "*pan*-basin for face-washing," but the character *yi* 匜 "ewer" is added after the closing phrase of the inscription (*zi zi sun sun, yong bao yong zhi* 子子孫孫，永寶用之 "for generations of descendants, eternally use it as treasure"). This indicates that the blueprint drafted for a *pan* inscription was also to be employed for a *yi* inscription, and that the alternative vessel name *yi* "ewer" was noted at the end of the blueprint. In this case, however, the ordinator had not replaced the character *pan* as intended, and simply included the annotated character *yi* at the end of the inscription. Similar traces of the sharing of a blueprint by different vessel types can also be observed in the Late Western Zhou Tai Shi Shi Jiang *yi* 太師氏姜匜 (*Mingtu* 14999) inscription. Here, the water-pouring vessel *yi* denominates itself as *bao pan* 寶盤 "precious *pan*-basin." As the *pan* basins and *yi* pouring vessels were usually cast and used in a set, it is quite likely that in this case a blueprint prepared for a *pan* was copied verbatim on the *yi* inscription without changing the vessel name. The same situation occurs on the Middle Western Zhou Qiu Wei *he* 裘衛盉 inscription (*Jicheng* 09456), which denominates itself also as *bao pan*. Any research on vessels' self-appellation should therefore take into consideration the phenomenon of the sharing of blueprints in the bronze vessel production process.

or *you*), but *si pi* is generally written separately in two character-spaces. It is thus possible that *si pi* was accidentally written in full on the blueprint that was prepared for the ordination of the inscriptions. Such a decomposition of the planned ligature then resulted in one extra character in the ultimate column of the blueprint, a problem initially solved by compressing the last two characters *bao yong* into a single character-space. Notice that this compression is still observable on the *Xinshou* 1907 lid inscription (Figure 11). However, since this compression is rather unusual, prior to the ordination the ordinator probably decided to omit one character of the inscription to preserve the visual quality of the layout. For an unknown reason, he first opted to omit the character *mi*, which he probably also marked in the blueprint. All of the characters following after *mi* were thus ordinated one character-space ahead of their blueprint position. Possibly at this stage, two full-size characters *bao yong* were added next to the original compressed *bao yong* characters to enhance the clarity of the phrase in the blueprint.

Based on this blueprint, inscriptions on the vessels were produced (only two are extant now, both by hand A). The ordination of the lid inscriptions then continued using the same blueprint. However, once the lay out of the first lid was concluded (*Jicheng* 04467.1 by hand B), it was decided to stet the character *mi* and to omit the character *you* instead; thus, *you* was also marked for omission in the blueprint. It was also before the lay out of the second lid inscription that the two characters *bao pan* were noted close to the characters *lü xu*, which suggests that prior to the ordination of this second lid inscription, the blueprint was borrowed to produce a *pan* inscription, and an annotation of alternative wording (*bao pan*) was thus included in the blueprint. It is possible that the omission of *mi* was reconsidered on this occasion, replaced by the omission of the character *you*.[64] This would also be another suitable moment for addition of the characters *bao yong*.

Subsequently, hand B again laid out the inscription for the *xu* lid, now omitting the character *you* but also mistakenly omitting the character *mi*. This is understandable, if we consider the graphically confusing situation in the blueprint: the character *mi* was originally marked for omission in

64. While the omission of *you* "indeed" from the phrase *ze you wei* 則鬳唯 "then indeed it was" is certainly acceptable, the omission of *mi* "canopy" from the phrase *hu mi xun li* 虎冒 (冪-幕) 熏 (纁) 裏 "tiger-skin canopy with light-red lining" obviously leads to undesired mangling "tiger [skin] with light-red lining." It is therefore understandable that the omission of *mi* was reconsidered and replaced by the omission of *you*. For further elaboration on *you*, see Shen Pei 沈培, "Xi-Zhou jinwen zhong de 'you' he Shang shu zhong de 'di'" 西周金文中的"鬳"和《尚書》中的"迪", *Guwenzi yanjiu* 25 (2004), 218–24.

the blueprint, but after it was stetted, a further annotation must have been added to clarify that this character was now to be retained. The confusion of hand B is even more evident in the last line, where it first copies *bao yong* in the original compressed form and then attaches the four annotated characters *bao pan bao yong* to the end of the inscription. This mistake becomes more understandable in the visualization in Figure 12, in which the state of the blueprint during the *Xinshou* 1907 lid ordination is reconstructed. The supposed 13×11 master-layout is used, and places of space-saving and additional notes are marked. With such a layout, the characters *bao pan bao yong* appear at the very end of the text, and their inclusion in the *Xinshou* 1907 lid inscription can be easily understood. The confusion of hand B suggests that the changes in the blueprint were made by someone other than hand B himself, possibly by a superior ordinator who was responsible for the textual adjustments or even some kind of "blueprint management."[65] The interruption of the ordination process of the *xu* inscriptions by the ordination of a *pan* inscription might have also been a contributing factor, as it is clear that at this point, textual adjustments were made in the blueprint.

Finally, hand C would lay out two remaining lid inscriptions correctly, omitting only the character *you* as planned. We may thus reconstruct the production procedure as follows:

Vessels 1–4 (two lost, two inscribed by hand A: *Jicheng* 04467.2 and *Xinshou* 1907) →lid 1 (hand B: *Jicheng* 04467.1) → lid 2 (hand B: *Xinshou* 1907) → lids 3–4 (hand C: *Jicheng* 04468, another one lost)

The cases of the Liangqi *zhong*, First Year Shi Shi *gui*, and Shi Ke *xu* inscriptions all point to a consecutive mode of ordination, during which a single manuscript served as an exemplar for every single instance of ordination. Moreover, the fact that this manuscript could be and indeed was subject to further *ad hoc* corrections, markings, and possibly even physical division can be traced based on textual discrepancies preserved in these inscriptions. A question thus arises as to whether such auxiliary manuscripts can be identified with the supposed master copy that served as the ultimate model for the text of inscriptions. We have seen that the hypothetical blueprint of the Shi Ke *xu* inscription misrepresented the master-layout that was very likely planned and specified in the master copy, and the same phenomenon was observed above in the Xiaochen Qiu *gui* inscriptions (Figure 4), where the mistaken inclusion of *hewen* is

65. This also applies to the case of the Liangqi *zhong* bells above. But compare Susini, *The Roman Stonecutter*, 42: "We must envisage a fairly complex relationship, full of uncertainties and misunderstandings, among the different participants in the production of an epigraphic monument, and we must include the possibility that they were the same person."

repeated by two different hands. These seem to suggest that the blueprint that the ordinator followed during the process of "lettering" the inscription was not the master copy itself, but yet another auxiliary manuscript. The failure to track the original ligature *si pi* during the laying out of the Shi Ke *xu* inscription further suggests that the ordinator had only the mistaken blueprint at hand and did not consult the master copy, which was probably stored in a safe place. The blueprints thus represent a transition between the phase of "instruction," which was concerned with the text to be inscribed, and the phase of "production," during which the text was transferred to the durable medium.[66] While the production of such an intermediary manuscript may seem somewhat superfluous at first, there are at least two practical reasons for the existence of blueprints,[67] and these will be discussed in the following sections.

Note on the Proofreading of Bronze Inscriptions

The first practical reason is proofreading. The textual discrepancies exemplified by the inscriptions analyzed above are rather rare, and there is generally a surprising scarcity of mistakes in Western Zhou bronze inscriptions. It is also worth noticing that when a mistake appears in a set of inscribed vessels, it is usually in those produced later in a sequence, while the first inscriptions (on the largest vessels) were prepared with the utmost care (see n.53 above). This general observation necessarily leads to the assumption that some routine mechanisms for proofreading the ordinated texts were usually in place. Unlike bamboo strips, where corrections were usually made by scraping the ink off together with a tiny layer of the writing surface and are thus visible even to the naked eye, a mistake on a clay slab became virtually invisible after it was corrected because the clay could be simply leveled up and characters engraved again, leaving no traces of correction. One inscription that preserves traces of characters to be erased from the slab, that of the famous Larger Ke *ding* 大克鼎, will be

66. For this division of the procedure of inscription-making, see Grasby, "Latin Inscriptions," 151–56. For an analogy from ancient Egypt, see the set of ostraca that served as handy blueprints during the process of inscribing the burial chamber in the tomb of Nakhtmin (late 14th century B.C.E.); see Barbara Lüscher, *Die Vorlagen-Ostraka aus dem Grab des Nachtmin (TT 87)* (Basel: Orientverlag, 2013). I am grateful to Christelle Alvarez for this and other references concerning the ancient Egyptian pyramid texts.

67. I am grateful to Thies Staack for pointing out that the use of such an intermediary manuscript would also increase the likelihood of incurring mistakes in the inscription (personal communication, August 17, 2018). This is certainly true, and it is exactly due to such mistakes that we can retrieve more information about inscription-making in this period.

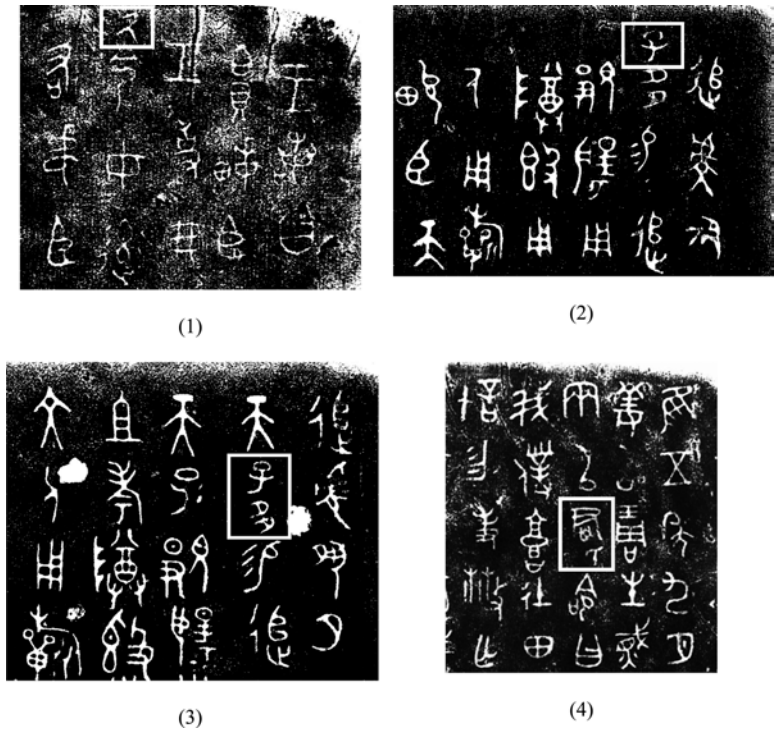

Figure 13 Details of corrections on (1) Shi Yuan *gui* (*Jicheng* 04314), (2) Zhui *gui* (*Jicheng* 04219), (3) Zhui *gui* (*Jicheng* 04220), and (4) Diaosheng *zun* (*Mingtu* 11816).

discussed below. In addition to this example, only a handful of apparent instances of textual corrections can be noted in the entire corpus of several thousand Western Zhou inscriptions. Three of them are listed here and visualized in Figure 13:

1. Shi Yuan *gui* 師袁簋 inscription (Late Western Zhou, *Jicheng* 04314, Figure 13.1): *jue* 卒 was omitted before *gong* 工 (III.1), then added in a smaller size above the upper margin of the inscription, though not before *gong* but mistakenly before the neighboring *ling* 令 (IV.1).

2. Zhui *gui* 追簋 inscription (Late Western Zhou, *Jicheng* 04219, Figure 13.2): either the character *duo* 多 or *zi* 子 was omitted in the phrase *Tian zi duo xi Zhui xiu* 天子多錫追休 ("the Son of Heaven repeatedly awarded beneficence to Zhui"). If the character *zi* 子 was omitted, it sufficed later to add it in a smaller size above the upper margin of the inscription before the character *duo* 多

(i.e. on the correct place in the textual sequence). If *duo* 多 was omitted, it was necessary to delete *zi* and rewrite the two characters. Another Zhui *gui* (*Jicheng* 04220, Figure 13.3) obviously also originally omitted one of the characters, so here also the original character had to be deleted and two smaller graphs *zi duo* 子多 were crowded into one character-space. In certain other Zhui *gui* inscriptions, especially in *Jicheng* 04221, 04222, and 04223.1, the character *zi* is written in full but *duo* 多 and *xi* 錫 appear crowded. This would point to the fact that the character originally omitted was indeed *duo* and not *zi*.

3. Two Diaosheng *zun* 琱生尊 inscriptions (Late Western Zhou, *Mingtu* 11816–17, Figure 13.4): the character *shi* 氏 was omitted from the compound *jun shi* 君氏 "milady" in both inscriptions (III.3–4), then added under the character *jun* 君 in a small size; this possibly involved rewriting the character *jun* (or the lower part of). In this case, the omission substantially influenced the overall layout qualities of the inscription. The *zun* inscription was designed to accommodate eight character-spaces in each of 14 columns, but due to the omission, the ultimate column in the actual cast inscription has only seven character-spaces, while the third column had to accommodate an additional character. This confirms that as in the previous cases of Shi Yuan *gui*, Zhui *gui*, and the abovementioned Shi Shi *gui*, the mistake was noticed only after the process of ordination was terminated, or it was in such an advanced stage that the ordinator considered it too tiresome to delete such a large portion of engraved text and lay it out again from scratch. Considering that similar corrections are usually found in the first lines of the inscriptions, this reveals that the ordination proceeded from the beginning of the text, rather than from its end. It is likely that the ordinator would still take pains to rewrite several lines in case he discovered a mistake in the final lines of the ordinated text. Notably, the same omission is repeated several times in Zhui *gui* inscriptions by at least two distinct hands and twice in Diaosheng *zun* inscriptions by two distinct hands, but in each case was later detected and corrected.

The cases of the Shi Yuan *gui*, Zhui *gui*, and Diaosheng *zun* inscriptions seem to corroborate the fact that two separate manuscripts were used during the inscription production: one that incidentally contained the mistake (the blueprint), and another based on which the mistake was detected and corrected (the master copy). Based on this, we can postulate the existence of the proofreading procedure in the *chaîne opératoire* of the production of a bronze inscription. It is conceivable

that the master copy was kept untouched away from possible editorial changes or even physical damage that may have occurred during the ordination process in the workshop and served as a basis for proofreading. To secure the safety of the master copy, another manuscript such as the blueprint would be produced for the purposes of the ordination. It seems that in cases where identical inscription was reproduced on several vessels in the set, sometimes only a part of the inscriptions was proofread.[68]

In light of these observations, we can formulate another cause for the violation of an inscription's master-layout: an omission of a character and its subsequent addition during the proofreading. Inscriptions with this type of mistake are fairly easy to identify, especially among those with the *stoichedon* format, as their ultimate column has one character-space less than the preceding columns, while one of these preceding columns contains one additional "squeezed" character that violates the *stoichedon* layout. The earliest instance of this phenomenon I am aware of is the inscription on the Lu *gui* 親簋 (*Mingtu* 05362), usually dated to the twenty-fourth year of King Mu (933 B.C.E.).[69] The inscription contains exactly 110 characters, neatly arranged in a *stoichedon* format into eleven columns; the master-layout is thus clearly predictable as 11×10. However, one character was obviously dropped during the ordination in the fifth column of this inscription, either *nai* 乃 (V.2) or *zu* 且 (V.3), and as a consequence, the last column contains only nine characters. During proofreading, the missing character was inserted on its due position, but as this position was already occupied by another character, this character had to be erased and both characters (*nai zu* 乃且) recarved again in a limited space, which resulted in violation of the *stoichedon* layout at this spot in a similar fashion as observed in the above cases of Zhui *gui* and Diaosheng *zun* inscriptions. Based on the Lu *gui* inscription, the

68. See for example the set of Forty-third Year Qiu *ding* cauldrons mentioned in the above n. 53, where it seems that only the larger cauldrons were proofread. In the set of the Ci *gui* tureens, omission of three characters in the 75QDJ:13 inscription (*Jicheng* 04310) and misspelling of the ancestor's name in 75QDJ:9–10 inscriptions (*Jicheng* 04306–07) indicates that they were probably also not proofread.

69. On Lu *gui*, see Edward L. Shaughnessy, "Newest Sources of Western Zhou History: Inscribed Bronze Vessels, 2000–2010," in *Imprints of Kinship: Studies of Recently Discovered Bronze Inscriptions from Ancient China*, ed. Edward L. Shaughnessy (Hong Kong: The Chinese University Press, 2017), 151–54. Based on the maturity of this inscription, some scholars date the vessel to the following reign of King Gong (917–900 B.C.E.); see for example Han Wei, "Lu gui niandai ji xiangguan wenti" 親簋年代及相關問題, in *Xin chu jinwen yu Xi-Zhou lishi* 新出金文與西周歷史, ed. Zhu Fenghan 朱鳳瀚 (Shanghai: Shanghai guji, 2011), 57–70.

proofreading procedure can be traced with some confidence to as early as the end of the tenth century B.C.E.[70]

Further insight into the proofreading process can be gained from the following pair of inscribed vessels. In the set of Late Western Zhou Zheng Guo Zhong *gui* 鄭虢仲簋 (*Jicheng* 04024–26) inscriptions, the dating formula *shi you yi yue* 十又（有）一月 ("the eleventh month") is miswritten at least once[71] as *shi yi you yue* 十一又月 ("*eleven and a month") (*Jicheng* 04024.2). As already observed by Guo Moruo 郭沫若, the incidental transposition of characters *you* 又 and *yi* 一 was obviously noticed during the inscription-making and was indicated by a transposition sign in shape of a curving stroke written over the bottom part of the character *you* (see Figure 14.2).[72] A similar correction was further noted by Sun Zhichu 孫稚雛 in the Late Western Zhou to Early Chunqiu Bi *yi* 簟匜 (*Jicheng* 10251) inscription, where the characters *qi* 其 and *yi* 匜 are misplaced, but a transposition sign, "(", was added on the right-hand side next to the two characters to mark the correct reading sequence (Figure 14.3).[73] At the present stage it is impossible to determine whether these editorial

70. The same kind of mistake also appears on the inscriptions on the lid of Shi Ju *gui* 師遽簋 and on the Yong *yu* 永盂. In the Shi Ju *gui* lid inscription (*Jicheng* 04214), dated by some scholars to the third year of King Mu's reign (ca. 954 B.C.E.), either the character *zai* 才 (II.5) or *Zhou* 周 (II.6) were omitted during the ordination and then supplemented upon proofreading, but as a result, the ultimate column has one character-space fewer than planned. In the Yong *yu* inscription (*Jicheng* 10322), commonly dated to the twelfth year of King Gong's reign (ca. 906 B.C.E.), the fifth column omitted either character *jue* 畧 (V.1) or *ming* 命 (V.2) during the ordination; again, the missing character was supplemented after proofreading, but one character-space is missing in the last column as a consequence.

71. This phrase is miswritten also in the *Jicheng* 04026 inscription; however, there are two factors that deem the *Jicheng* 04026 inscription (present location unknown) rather suspicious: 1.Its size, layout, calligraphic features, and even spacing between characters are almost completely identical with the *Jicheng* 04024.2; 2. The shape and décor of the *gui* vessel bearing this inscription differs significantly from the *Jicheng* 04024 and *Jicheng* 04025 vessels. Since the *Jicheng* 04024.2 inscription was first published in the Qing imperial catalogue *Xi-Qing gu jian* 西清古鑑 in 1755 and thus was long available for potential forgers, the authenticity of the *Jicheng* 04026 inscription, first published in 1937, remains questionable.

72. Guo Moruo 郭沫若, *Liang Zhou jinwen ci da xi kaoshi* 兩周金文辭大系考釋, vol. 3 (Tokyo: Bunkyūdō, 1935), 181a. The vessel inscription *Jicheng* 04025.2, also by the same hand, reads correctly *shi you yi yue* 十又一月, but has in the last column *sun sun sun sun* 孫二孫二 "grandsons and grandsons" instead of *zi zi sun sun* 子二孫二 "sons and grandsons"; this easily correctable mistake (by simply effacing the "silk" element in the first *sun* 孫) was left unmarked.

73. Sun Zhichu, "Jinwen shidu zhong yixie wenti de shangtao," 56–57. Note the inferior quality of this inscription's calligraphy. The sequence *zuo hui qi yi wan nian wu jiang sun xiang* 乍 (作) 𣪊 (沫) 其也 (匜) 萬年無疆孫富 (富-享) should thus read *zuo hui yi, qi wan nian wu jiang sun xiang* 乍 (作) 𣪊 (沫) 也 (匜)，其萬年無疆孫富 (富-享)

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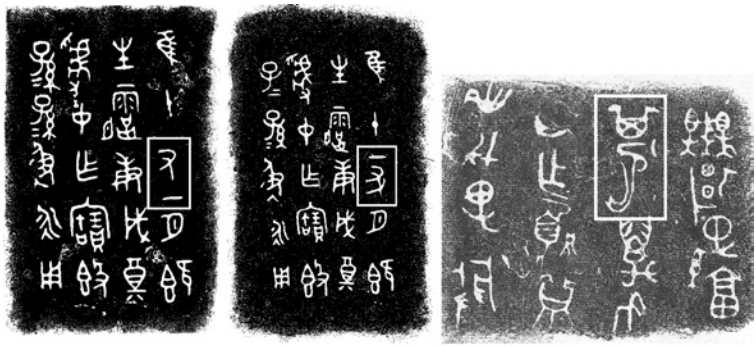

(1) (2) (3)

Figure 14 Transposition signs in (2) the Zheng Guo Zhong *gui* inscription (*Jicheng* 04024.2) vis-à-vis (1) *Jicheng* 04025.2 and in (3) Bi *yi* inscription (*Jicheng* 10251).

marks were copied from the blueprint or were an *ad hoc* solution during the ordination. The former case would hint that the blueprints were also proofread, and that the obelisms were copied only by mishap. The latter case would suggest that besides effacing and recarving of text, other corrective measures were acceptable, too.[74] In any event, it is conceivable that these marks followed general conventions, and the two short inscriptions thus offer a glimpse on how copyediting marks might have looked in this period.

Note on the Production Technique of Bronze Inscriptions

Another motive to produce blueprints might have been the technique of inscribing the clay slabs itself. The traditional and widely accepted view holds that the inscriptions were first carved onto a clay slab and, after

("makes *yi* for face-washing, he will for ten thousand years without limit for generations perform (ritual) service").

74. In case of Zheng Guo Zhong *gui* vessels, should the *Jicheng* 04026 inscription be authentic, the repetition of the transposition sign in two inscriptions by the same hand would suggest that the obelism was copied from the blueprint. Thies Staack further proposes that the editorial mark was originally an independent sign in the blueprint, but that it was wrongly interpreted by the ordinator as an additional stroke of the character *you* 又 (personal communication, August 17, 2018). It is worth noticing that the same ordinator performed the text in the correct sequence in *Jicheng* 04025.2, but had not corrected the passage in *Jicheng* 04024.2. Given the spurious nature of *Jicheng* 04026, I am inclined to leave this question open. The overall scarcity of these marks in the inscriptions seems to suggest that in the two cases under scrutiny, they were probably copied from the blueprint.

having dried, were impressed into an inscription mold (*mingwenxin* 銘文芯), which would then be embedded into the inner core mold that formed the part of the piece-mold casting assemblage. The ordinator would thus inscribe the characters in positive writing in a right-to-left direction, identical to the physical appearance of the final inscription. This is the so-called "master-pattern" technique.[75] However, several scholars suggested that yet another different technique was employed in the bronze inscription production: the so-called "tube-lining" (or "piping," *nitiao duisufa* 泥条堆塑法).[76] In tube-lining, the text (or contours of a decorative motif) is first sketched (engraved) in mirror-reverse form. Thin clay cords are then modelled or piped into these grooves, possibly using a bag with semi-liquid clay, so that they are anchored in the grooves and yet stand out in relief.[77] Zhang Changping 張昌平 has recently provided convincing evidence for tube-lining being employed in the fifth century B.C.E.,[78] and a very recent excavation of a bronze

75. The *locus classicus* for reconstruction of this procedure is Noel Barnard, *Bronze Casting and Bronze Alloys in Ancient China* (Tokyo: Monumenta Serica Monograph, 1961), 157–61. See also Barnard and Wan, "The Casting of Inscriptions in Chinese Bronzes," 54–55.

76. Chen Chusheng 陳初生, "Yin Zhou qingtongqi mingwen zhizuo fangfa pingyi" 殷周青銅器銘文製作方法評議, *Jinan xuebao* 1998.1, 117–21; Nickel, "Imperfect Symmetry," 5–39; Dong Yawei 董亞巍, *Fan zhu qingtong* 範鑄青銅 (Beijing: Beijing yishu yu kexue dianzi, 2006), 110–13; Zhang Changping, "Shang Zhou qingtongqi mingwen de ruogan zhizuo fangshi," 61–70; Guan Shuqiang 管樹強, "Shang Zhou qingtongqi yinxian mingwen zhuzao fangfa tantao" 商周青銅器陰線銘文鑄造方法探討, (paper presented at the Peking University Graduate Student Conference "Bronzes and Bronze Inscriptions," Beijing, December 25, 2016, unpublished conference handbook, pp. 178–92; a digest of this paper is published as Guan Shuqiang 管樹強, "You qingtongqi mingwen zhuzao fangfa tan guwenzi shidu de jige wenti" 由青銅器銘文鑄造方法談古文字釋讀的幾個問題, *Zhongguo wenzi xuebao* 8 (2017), 69–76). Ceramic molds with traces of the tube-lining technique have been unearthed from the Zhougongmiao bronze workshop site in early 2000s and are analyzed in Chen Yang 陳陽, "Zhouyuan zhutong yizhi suo chu taofan de chubu yanjiu" 周原鑄銅遺址所出陶範的初步研究, M.A. thesis (Peking University, 2005). For a critique of tube-lining, see Bagley, "Anyang Mold-making and the Decorated Model," 39–90. It should be noted that the existence of tube-lining, in my view, does not exclude the existence of carving on the clay model; it is quite likely that the two techniques could have been used complementarily. In light of the present evidence, the question is no longer whether tube-lining was used, but since when, on what scale, and how exactly was it performed. Nickel, "Imperfect Symmetry" and Zhang Changping, "Shang Zhou qingtongqi mingwen de ruogan zhizuo fangshi," observe the use of tube-lining on piece-molds with décor already in the Yinxu period, while Dong Yawei, *Fan zhu qingtong*, 110–13, asserts that most of the Shang bronze inscriptions were produced by tube-lining.

77. Nickel, "Imperfect Symmetry," 16.

78. Zhang Changping, "Shang Zhou qingtongqi mingwen de ruogan zhizuo fangshi," 61–70. As for the earlier vessels, Zhang shows evidence that the Late Western

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foundry at the Guanzhuang 官莊 site, Xingyang 滎陽, Henan Province, yielded shreds of inscription slabs that confirm the use of tube-lining by the Early Chunqiu period at the latest.[79] The calligraphy on these slabs differs significantly from the inscription slab unearthed from the Xiaomintun 孝民屯 site at Anyang 安陽, but scholars have already indicated that this one also was produced using tube-lining or similar techniques.[80] While the origins of the tube-lining technique will require further investigation, considering the calligraphic unity of Early Chunqiu and Late Western Zhou inscriptions, there seems to be no doubt that tube-lining

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Zhou bronze bell Chu Gong Jia *zhong* 楚公豪鐘 (*Xinshou* 659) was also inscribed with the use of tube-lining; see *ibid.*, 67.

79. I inspected the Guanzhuang foundry excavation site on October 29, 2017 and studied the unearthed inscription slabs, on which intaglio grooves of few characters are preserved; in certain places, the rilievo residues of character strokes that have been built up from clay can be observed. The same technique was employed on the molds with decorative motives unearthed from this site. I am indebted to Gao Xiangping 郜向平, Hui Xiping 惠夕平, and to the organizers of the Academic Conference on Shang and Zhou Bronzes and Bronze Inscriptions 商周青銅器與金文學術研討會, Henan Provincial Institute of Cultural Heritage and Archaeology, Zhengzhou (October 28–29, 2017) for providing the opportunity to visit the site. The discovery of the inscription slabs and ceramic molds was reported at this conference by Gao Xiangping, "Xingyang Guanzhuang yizhi faxian de zhutong yicun" 滎陽官莊遺址發現的鑄銅遺存 and Hui Xiping, "Guanzhuang yizhi H1573 mingwenfan keng fajue ji xiangguan wenti de chubu renshi" 官莊遺址H1573銘文範坑發掘及相關問題的初步認識. Some of the introductory remarks presented at the conference were recently published in Gao Xiangping 郜向平, Zhao Hao 趙昊, and Ding Sicong 丁思聰, "Henan Xingyang Guanzhuang yizhi faxian Liang Zhou ji Han dai shougongye zuofang yicun" 河南滎陽官莊遺址發現兩周及漢代手工業作坊遺存, *Zhongguo wenwu bao*, Feb. 22, 2019, 8. Several Western Zhou period inscription slabs were unearthed from the bronze foundry site at Luoyang Beiyao 洛陽北窯, but only line-drawings that do not allow a reliable assessment of the production technique were published in Luoyang shi wenwu gongzuodui, "1975–1979 nian Luoyang Beiyao Xi-Zhou zhutong yizhi de fajue" 1975–1979 年洛陽北窯西周鑄銅遺址的發掘, *Kaogu* 1983.5, 439 Figure 12.

80. Guan Shuqiang, "Shang Zhou qingtongqi yinxian mingwen zhuzao fangfa tantao," 184–85; Dong Yawei, *Fan zhu qingtong*, 112, proposed that tube-lined strokes could be sometimes carefully trimmed, especially in earlier (and shorter) inscriptions, which could explain the difference in calligraphy between earlier and later inscriptions. Sakikawa Takashi 崎川隆 concurs and points out that an inscription slab from the former Luo Zhenyu's 羅振玉 collection (now in possession of the Lüshun Museum in Dalian, Liaoning Province, dating between the Late Shang and Early Western Zhou period) was also produced by tube-lining or a similar method (personal communication, October 29, 2017). One may expect the technique to have evolved over time. For the Xiaomintun clay slab, see Zhongguo shehui kexueyuan kaogu yanjiusuo Anyang gongzuodui, "2000–2001 nian Anyang Xiaomintun Dongnandi Yindai zhutong yizhi fajue baogao" 2000–2001 年安陽孝民屯東南地殷代鑄銅遺址發掘報告, *Kaogu xuebao* 3 (2006), 376 Figure 21:3 and Plate 15:2. For the Lüshun Museum slab, see Lüshun bowuguan, ed., *Lüshun bowuguan guancang wenwu xuancui: taoci juan* 旅順博物館館藏文物選粹: 陶瓷卷 (Beijing: Wenwu, 2009), 28.

was in use during the Late Western Zhou period and quite likely even earlier.

This technique possibly had some influence on the nature of the writing process that preceded the ordination of an inscription: Should tube-lining be employed, the ordinator would need to align the inscription in mirror writing in the left-to-right direction.[81] From this perspective, it is possible that an auxiliary manuscript would be prepared to ease the transmission of the positive master copy text into a mirror-reverse inscription, and it is conceivable that this manuscript itself would be written in mirror writing.[82]

While it is not the purpose of this article to argue for the tube-lining technique, it should be noted that this technique more or less resolves all the debated issues in the production of a bronze inscription, beginning from the use of rilievo grid-lines and ending with the question of why, if the inscriptions were mechanically imprinted from the master-pattern, no traces of mechanical reproduction of inscribed text are found in the Western Zhou inscriptions.[83]

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81. The left-to-right direction is corroborated by the appearance of corrections in the initial columns of longer inscriptions, as discussed above. This is quite an interesting observation because the ordinators might have also proceeded with the ordination from right to left, which was a general habit at the time. The fact that they did not shows, in my view, that they preferred the consecutiveness (and thus intelligibility) of the text they were writing to habitual writing directionality, which would suggest that they might have relied on reading the text when copying it, and that they were at least to some extent literate. The left-to-right direction might be also more suitable for right-handed ordinators, although this is only speculation since we do not know exactly how tube-lining was performed. Finally, when vertically written texts are copied from their end, omissions of letters or characters result in garbling of the text in a particular fashion, as is sometimes the case in the ancient Egyptian retrograde inscriptions. I am not aware of any instance of such garbling in Zhou dynasty bronzes. For an insightful case study of mistakes in the transmission of a text from a perishable to durable medium in ancient Egypt, see Christelle Alvarez, "An Epigraphical Journey in the Pyramid of Ibi: Between Textual Transmission and Mistakes," in *Current Research in Egyptology 2015: Proceedings of the Sixteenth Annual Symposium, University of Oxford, United Kingdom, 15–19 April 2015*, ed. Christelle Alvarez, Arto Belekdanian, Ann-Katrin Gill, and Solène Klein (Oxford: Oxbow, 2016), 20–33.

82. Lukas Nickel was quick to note that the ordinators using tube-lining would have to write in mirror writing. He also connects this, correctly in my view, to the emergence of the phenomenon of "reversed writing" (*fanshu* 反書), prominent especially in the Chunqiu period bronzes. See his "Imperfect Symmetry," 37. It is worth noticing that, for the purposes of the study of calligraphy, the inscriptions in *fanshu* are of the utmost importance, since in case the inscriptions were produced by the tube-lining technique, they in fact represent the only instances of normal writing (*zhengshu* 正書) from this period.

83. One more common feature of Western Zhou cast inscriptions is that the lower part of their grooves is usually wider than their mouth, a phenomenon that Rutherford

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Final Case: The Larger Ke *ding* Inscription

The two factors discussed above, proofreading and tube-lining, can be illustrated by the singularly important inscription cast in the Late Western Zhou period on the inner wall of the Larger Ke *ding* 大克鼎 (*Jicheng* 02836), now in the collection of the Shanghai Museum. During his studies of inscriptions with the rilievo grid, Noel Barnard noticed on the rubbing of the Larger Ke *ding* the presence of several "ghost" characters, i.e., fine rilievo lines centrally located in the graphic spaces of the inscription's intaglio characters, as if these were written over them. Barnard identified these traces of rilievo strokes as sketchings of the characters that were to be engraved into the clay slab, and he provided an initial reconstruction of the sketch-lines visible on the rubbing.[84] In a recent article, Li Feng identified three of these "ghost" characters.[85] In a rejoinder to Li Feng's article, Zhou Ya 周亞 of the Shanghai Museum confirmed the existence of this phenomenon and provided detailed photographs and clearer rubbings of the characters in question, but without

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Gettens called "undercutting"; see Rutherford John Gettens, *The Freer Chinese Bronzes*, Volume II: *Technical Studies* (Washington, DC: Smithsonian Institution, 1969), 141–47. Lukas Nickel pointed out that tube-lining can explain the undercutting as well as the absence of mechanically produced inscriptions; see his "Imperfect Symmetry," 36–38. Zhang Changping has further explained the presence of rilievo grid commonly seen in inscriptions; see Zhang Changping, "Shang Zhou qingtongqi mingwen de ruogan zhizuo fangshi," 65. Guan Shuqiang adds another specific feature of tube-lined inscriptions, i.e., the thickened intersections of two or more strokes (the so-called *tuan dian* 團點) created by redundant clay in places where one clay cord was piped over another; see Guan Shuqiang, "Shang Zhou qingtongqi yinxian mingwen zhuzao fangfa tantao," 185; Guan Shuqiang, "You qingtongqi mingwen zhuzao fangfa tan guwenzi shidu de jige wenti," 72. Mechanically reproduced inscriptions can be seen on several Chunqiu period bronzes; see Sakikawa Takashi 崎川隆, "Chunqiu shiqi qingtongqi mingwen zhuzao gongyi zhong jixie fuzhi jishu de chuxian yu fazhan" 春秋時期青銅器銘文鑄造工藝中機械複製技術的出現與發展, in *Chutu wenxian yu wuzhi wenhua* 出土文獻與物質文化, ed. Adam C. Schwartz 史亞當 (Hong Kong: Zhonghua, 2017), 301–22.

84. Barnard and Cheung, *The Shan-fu Liang Ch'i Kuei and Associated Inscribed Vessels*, 261–62. Barnard called these residual characters "skeleton sketch-lines." I agree with Edward L. Shaughnessy (personal communication, December 15, 2017) that it might be more fitting to call them "ghost" characters.

85. Li Feng 李峰, "Xi-Zhou qingtongqi mingwen zhizuo fangfa shiyi" 西周青銅器銘文製作方法釋疑, *Kaogu* 2015.9, 78–91. Li Feng correctly identifies the sketch-lines under the character *jing* 巠 as *xiao* 孝 and under the character *fang* 方 (mistakenly rendered as *zai* 才 in the article) as *zai* 才. He also identifies the sketch-lines under character *sheng* 聖 as *wang* 王; however, from the textual sequence, we can be certain that this is rather the character *jing* 巠 (note that the bottoms of characters *wang* 王 and *jing* 巠 are identical). It seems from Li's identification that he has not realized the relationship between the "ghost" characters and the characters registered in the final inscription.

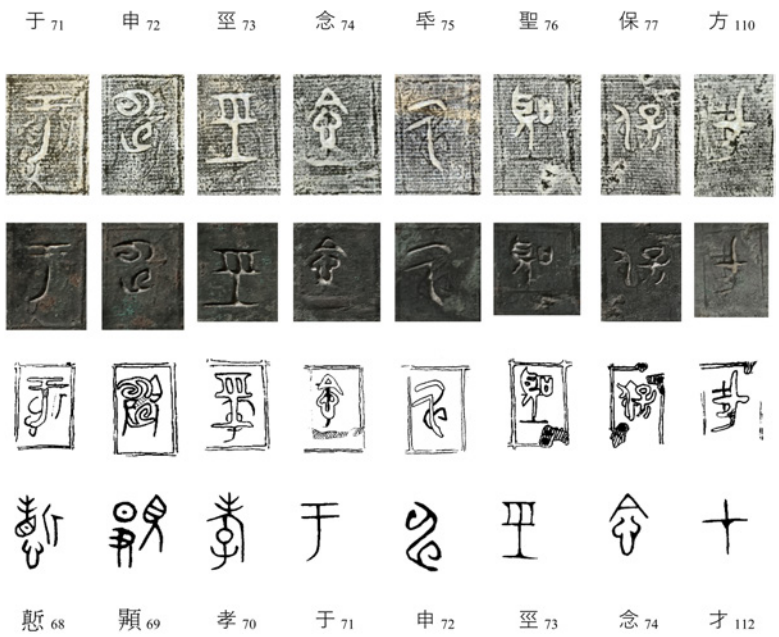

Figure 15 Details of the instances of "ghost" characters in the Larger Ke *ding* inscription.
Legend: line 1: transliteration of the intaglio character and its position in inscription; line 2: rubbing of the character-space; line: 3: photograph of the same spot (lines 2 and 3 after Zhou Ya, "Guanyu Da Ke ding de jige wenti," reproduced with permission); line 4: line-drawing of the same spot by author; line 5: full form of the "ghost" character (type), after Rong Geng 容庚, ed., *Jinwen bian* 金文編 (Beijing: Zhonghua, 1986); line 6: transliteration of the "ghost" character and the position in the inscription where its "full" intaglio form appears.

further elaboration.[86] Close examination of these materials now enables us to decipher the "ghost" characters with some confidence, and the results are presented in Figure 15.[87] It is obvious that the "ghost" text

86. Zhou Ya 周亞, "Guanyu Da Ke ding de jige wenti" 關於大克鼎的幾個問題, *Qingtongqi yu jinwen* 1 (2017), 306–22.

87. I am greatly indebted to Zhou Ya, who has provided me with the opportunity to study a clear photograph of the Larger Ke *ding* inscription, and to the Shanghai Museum for the kind permission to reproduce the relevant close-ups here. Close scrutiny, however, did not reveal any further "ghost" characters. It is obvious that the inscription was polished upon the vessel's completion, proceeding from the left end of the inscription towards the right side, but the polishing procedure was not completed, and as a result, the rilievo grid lines and "ghost" characters were preserved at the right-hand part of the inscription. The reason for leaving the remainder of the inscription unpolished was to ensure that the text will remain legible; see discussion below. Figure 15 provides my own line-drawings, which are not as nice as Barnard's, but are

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Figure 16 Visualization of the final layout and position of "ghost" characters in the Larger Ke *ding* inscription.

running "under" the final inscription in column VIII can form a textual sequence that is identical to that preserved in the extant inscription; however, for some reason, the sketched text is shifted three characters back (see Figure 17). Another "ghost" character (*zai* 才) under the last character in column XI (XI.10, *fang* 方) suggests that in this instance, the textual sequence is shifted two characters *forward* (the ultimate correct location of *zai* is XII.2).

This phenomenon suggests that the original ordering of the inscription was flawed, and the inscription needed to be laid out *de novo*. If we suppose that the final inscription as we see it today faithfully reflects the text in the master copy, we can assume that two mistakes occurred during the original ordination. First, as indicated by the post-position of the "ghost" characters in column VIII, three characters must have been added to the textual sequence at some point of ordination, most likely as a result of dittography. Second, the pre-position of the "ghost" character *zai* 才 two spaces ahead indicates that five characters were omitted somewhere between columns VIII and XI (see Figure 16).

A quick inspection of the Larger Ke *ding* inscription reveals that the first section of the inscription is indeed prone to bring about dittography: Both column VIII (with the sketch-lines) and neighboring column VII begin with the character *yu*于. In column VIII, the sequence runs *yu shen jing nian jue* 于申亟念毕, while column VII has the sequence *yu jue* 于毕. It appears more than likely that during the ordination of column VII, four (*sic*) characters from the neighboring column VIII (*shen jing nian jue*申亟念毕) were mistakenly incorporated into column VII right below the first character *yu*, and only after laying out the character *jue* which

based on clearer rubbings and photographs and thus reflect the actual appearance of "ghost" characters more accurately. A fairly clear photograph of the Larger Ke *ding* inscription has been published in Zhang Tian'en, ed., *Shaanxi jinwen jicheng*, vol. 4, *Baoji juan: Fufeng*, 32–33.

was, coincidentally, planned to follow immediately after *yu* in column VII, the ordination returned to the correct order. This shifted the textual sequence three characters back, exactly as is indicated by the "ghost" characters.

The subsequent omission of five characters indicated by the appearance of the character *zai* 才 under the character *fang* 方 is more problematic. No two characters appearing in the position of the fifth or tenth character-space in each column are sufficiently similar to provide grounds for consideration of haplography. This finding leads to a consideration of the possibility that the text on the blueprint might have been divided into shorter textual sequences of five characters per column to facilitate the ordinator's orientation in the process of copying long columns in mirror-writing. While this was perhaps not the case for the Shi Ke *xu* inscriptions, such division seems to explain best the textual mismatch in the Liangqi *zhong* inscription analyzed above. The case of the aforementioned Ci *gui* further confirms that this was indeed a practice in at least some Late Western Zhou bronze workshops. As noted above, the inscription on one of the *gui* tureens, 75QDJ:13 (*Jicheng* 04310, layout 10×11), omits three characters, namely, the character *xiang* 享 in column VIII and the characters *yong* 用 and *qi* 其 in column IX. The occasional omission of characters is not uncommon in bronze inscriptions; however, if we project the location of omitted characters on the supposed master-layout for the two Ci *ding* (*Jicheng* 02821, 02823, layout 11×10), we can observe that the omitted characters are positioned either as the fifth (*xiang*, *qi*) or the tenth (*yong*) character of the column (Figure 17 left). If we rearrange the layout into five characters per column, the three omitted characters end up in the bottom position in three neighboring columns (Figure 17 right). We can thus conjecture that despite its difference in layout (ten columns with eleven characters each), the 75QDJ:13 *gui* inscription was laid out using the 11×10 blueprint of the 75QDJ:3/5 *ding* inscriptions, and the omission of the three characters was brought about by physical damage to the blueprint or by accidental covering of the characters during the ordination process. This case further corroborates the above observations that one blueprint was reused by several ordinators working on a set of identical inscriptions, and that one blueprint was reused for several types of vessels (here *ding* and *gui*).[88] Further circumstantial evidence can be drawn from the inscription on

88. In light of the above discussion, the confusion of *Zhu gui* 朱癸 for *Gui gong* 癸公 on 75QDJ:10 *gui* inscription seems somewhat more understandable. All three characters involved, *zhu* 朱 (Old Chinese in Baxter-Sagart reconstruction *to), *gui* 癸 (*k^{w}ij?), and *gong* 公 (*C.qˤoŋ) were placed either at the beginning or at the end of their columns, i.e., in visually salient positions, which may have been a contributing factor. The

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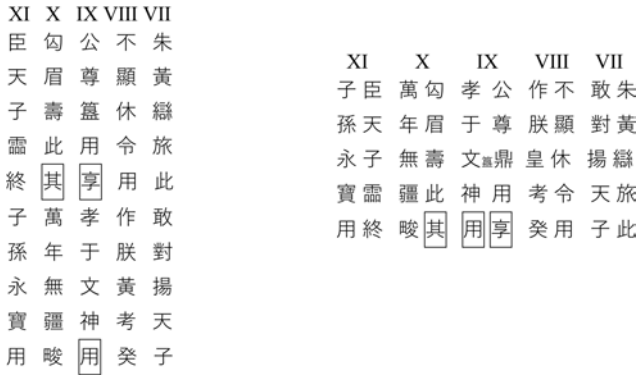

Figure 17 The master-layout of the 75QDJ:3 and 75QDJ:5 Ci *ding* inscriptions (left) and reconstruction of their short-column blueprint (right). The characters omitted on the 75QDJ:13 *gui* inscriptions are marked by enclosure. The character *gui* 簋 is noted next to the character *ding* 鼎 (right).

the smallest Forty-third Year Qiu *ding* 冊三年逑鼎 (YJ4 [*Mingtu* 02512]), which, most likely for spatial reasons, omits exactly 15 character-spaces *si yi, huang kao qi yan zai shang, yi zai xia, mu mu bing ming de* 釁彝, 皇考其嚴才上, 廙才下, 穆〓秉明德 ("sacrificial vessel. [My] august father is majestic on high, respected below, beautifully holding fast the bright virtue"). As this omission disrupts the syntax of the remaining inscription, it is very likely that the blueprint for the set of Forty-third Year Qiu *ding* cauldrons also contained five character-spaces in each column, and that for the sake of space, three columns were mechanically dropped in the process of ordination of the YJ4 vessel's inscription.

Returning to the Larger Ke *ding* inscription, it is possible that its blueprint was written in five-character columns like that of the Ci vessels, and that somewhere between the ordination of columns IX and XI, one column was unintentionally dropped, resulting in the pre-position of the "ghost" character *zai*.

But how did the "ghost" characters come into being? In my opinion, the otherwise problematic existence of the rilievo sketch-lines in the Larger Ke *ding* inscription can be easily explained by the tube-lining technique: The characters were first carved into a clay slab according to the blueprint, and it was during this carving that the two mistakes discussed above appeared. After the sketch of the inscription was carved but before the tube-lining itself, the text was proofread and mistakes were detected. Relevant parts of the text were recarved over the existing

expected addition of the character *gui* 簋 (*k^{w}ru?), possibly next to the character *ding* or next to the upper or lower margin of the column could also add to the confusion.

grooves, which were for some reason left unleveled. Subsequently, the corrected text was tube-lined, resulting in a rilievo text with leftovers of intaglio grooves of sketched characters in several places.[89] Once cast, this resulted in the intaglio inscription with rilievo traces of sketch characters. Note that should these sketched "ghost" characters be explained by the commonly accepted "master-pattern" technique, the sketch of this inscription would also have to be carved in mirror-reversed form, then imprinted, recarved again, imprinted once more, and only then embedded into the inner mold, not to mention that the only reason for such a deviation from the standard "master-pattern" procedure would be the creation of undesired "ghost" characters and the rilievo grid-line that was, for the most part in this inscription, as well as in the majority of other cases, polished off after casting.[90]

Moreover, in his treatment of the Larger Ke *ding*, Zhou Ya noticed another remarkable feature of this inscription: Several characters, for example, *gong* 龔 (III.4), *min* 民 (IV.7), *jue* 卒 (VIII.5) and *zu* 且 (VIII.8), as listed in Figure 18, are cast partially in rilievo and partially in intaglio form.[91] There seems to be little doubt that this phenomenon is a result of the rilievo strokes on the clay slab being washed away by molten bronze during the casting procedure. Should the inscription be produced by the "master-pattern" technique, the swept strokes would either leave no trace or slight intaglio traces. In the present case, however, the strokes that were swept away are still preserved in rilievo form, a phenomenon that cannot be explained by the "master-pattern" technique other

89. This shows that the person who performed tube-lining was able to navigate successfully the snarl of grooves, of which many were not to be tube-lined.

90. Such a solution was in fact suggested by Li Feng and Zhou Ya; see Li Feng, "Xi-Zhou qingtongqi mingwen zhizuo fangfa shiyi," 85–89; Zhou Ya, "Guanyu Da Ke ding de jige wenti," 318–22. Barnard himself related the phenomenon of "ghost" characters to the technique of inter-stroke space excavation, but asserted that such a production technique was very unlikely to have been employed for inscriptions as long as that of the Larger Ke *ding*; consequently, he left the question open; see his *The Shan-fu Liang Ch'i Kuei and Associated Inscribed Vessels*, 238–39, 261–67. One more peculiarity of the Larger Ke *ding* inscription is an empty space between columns XI and XII. While it may appear at first glance that this might be another remnant of the correction of the engraved sketch, from the content of the inscription, it is clear that the empty column is located between two thematical units—Ke's eulogy of his ancestors and of the ruling king on one hand (exactly 110 character-spaces) and the rendering of the investiture ceremony on another (exactly 170 character-spaces)—and serves basically as a section break between two paragraphs. A similar phenomenon can be observed on the Middle Western Zhou Hu *ding* (*Jicheng* 02838) inscription, in which three different events are recorded, each of them beginning in a new column.

91. Zhou Ya, "Guanyu Da Ke ding de jige wenti," 318.

Figure 18 Detail of the characters in the Larger Ke *ding* inscription, from left to right: *gong* 龔 (III.4), *min* 民 (IV.7), *jue* 毕 (VIII.5) and *zu* 且 (VIII.8).

than that this was indeed the caster's intention.[92] Contrary to such an unlikely scenario, this phenomenon is easily explained by the tube-lining technique, in which in case the rilievo clay cords would be washed away, the remaining intaglio sketch grooves would turn into rilievo strokes after casting.[93]

Characters of this sort are present in nearly every column on the right-hand half of the Larger Ke *ding* inscription. I believe it is this feature that explains best why this part of inscription was left unpolished. If it were polished, the rilievo strokes of many characters would disappear, and as a result, several characters would become illegible. Proceeding from the left part of the inscription, the artisans probably realized this after having polished columns XIII, XII, and the upper part of columns XI–IX, which rendered the characters *wu* 無 (XI.1), *bao* 保 (XI.3), *Mu* 穆 (XII.8), and especially *Ke* 克 (XIII.7) well-nigh illegible (see Figure 19),

92. In his article, Li Feng had already observed this phenomenon in the inscription on the bottom of the Guo Ji *gui* 虢季簋 unearthed from the Sanmenxia cemetery (M2001:86, *Xinshou* 18) and suggested that it was a result of the additional corrective carving performed on the finalized clay slabs after the strokes were damaged during the insertion of slabs into the piece-mold assembly. The fact that such hypothetical corrective efforts were nearly always thwarted by polishing, however, seems to deem such a scenario invalid. See Li Feng, "Xi-Zhou qingtongqi mingwen zhizuo fangfa shiyi," 89.

93. The intaglio sketch grooves of character strokes or décor lines in places from which the clay cord dropped or broke off when the mold was disassembled after casting can be observed on the clay slabs with inscriptions and décor unearthed from the Guanzhuang site and also on several remains of Late Western Zhou ceramic décor molds unearthed from the bronze foundry site at Lijia 李家, Fufeng County, Shaanxi. The Lijia case, for example on the mold H66:46, was described already by Chen Yang, "Zhouyuan zhutong yizhi suo chu de taofan chubu yanjiu," 28, Figure 18:1. Unused sketch-lines of decorative motifs are also reported from the Lijia site; see for example the ceramic mold H66:41 in Chen Yang, "Zhouyuan zhutong yizhi suo chu de taofan chubu yanjiu," 28, Figure 18:2. The ash pit with the two specimens is dated to the beginning of Late Western Zhou period; see *ibid.*, 32, 34. See also *ibid.*, 35–36 for the difference between the molds from the Early Western Zhou Zhougongmiao 周公廟 foundry site and the later Lijia site.

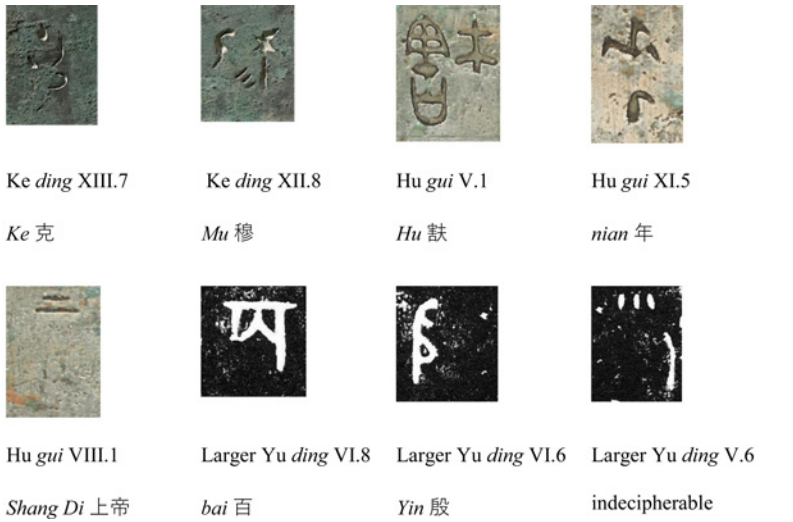

Figure 19 Detail of characters with polished strokes from the Larger Ke *ding*, Hu *gui*, and Larger Yu *ding* inscriptions.

and subsequently dismissed the polishing procedure.[94] It appears that in this case, the casters were concerned with the legibility of the inscription they produced.[95] Characters with "missing" strokes, a phenomenon fairly widespread in Western Zhou bronze epigraphy, can thus be easily understood in light of the above discussion, as they represent remnants of the rilievo strokes that appeared on places where the clay cords broke off or dropped during the casting and that were subsequently polished off. This phenomenon often occurs repeatedly within the same

94. The Larger Ke *ding* inscription was prepared divided on two separate inscription blocks. That the left-hand side of the inscription was also polished is indicated by several instances of "missing" strokes, for example in characters *wang* 王 (XV.4), *yu* 余 (XVI.8), *yu* 于 (XIX.8), or *zhen* 朕 (XXV.4). The comparison of calligraphic features seems to suggest that the two blocks were inscribed by two different ordinators, which is a phenomenon highly unusual in early Chinese epigraphy. This would explain the uneven quality of the two parts of the inscription: while the right-hand side is full of casting flaws, the left-hand side is noticeably more successful, and so is its calligraphy. The left-hand ordinator was clearly more skilled or dutiful than his right-hand colleague.

95. For another case showing casters' concern with the legibility of an inscription, see Edward L. Shaughnessy, "On the Casting of the Art Institute of Chicago's *Shi Wang Ding*: With Remarks on the Important Position of Writing in the Consciousness of Ancient China" (paper presented at the conference "The Age of Transition: Bronzes and Molds Found in Daijiawan, Shigushan, Baoji County, Shaanxi," Beijing, November 30, 2015).

inscription; in the above-mentioned Hu *gui*, for example, it occurs at least ten times; notice the slightly rilievo leftovers of polished strokes still visible in the characters *Hu* 獸 (V.1) and *Di* 帝 (VIII.1). Among the earlier inscriptions, the Larger Yu *ding* inscription has at least five instances of missing strokes. Some of these are given in Figure 19.

The palimpsestic feature of the Larger Ke *ding* inscription sheds additional light on several issues discussed in this article. Together with the inscription on 75QDJ:13 Ci *gui*, it suggests that the textual arrangement in the blueprint might have been adjusted to ease the ordination by breaking longer columns into two parts of equal length, in this case, five character-spaces. This practice seems to be corroborated by the Liangqi *zhong* case above, where the blueprint was further split into four (or two two-sided) pieces of equal length. Such a solution necessarily required that a brief annotation specifying the desired master-layout be provided in the blueprint. Disregarding or misinterpreting such an annotation would then lead to alteration of the assigned master-layout. Recall the case of Ci's vessels where one ordinator laid out 110 character-spaces in eleven columns with ten character-spaces while another opted for ten columns with eleven character-spaces.

In terms of inscription-making technique, the Larger Ke *ding* inscription corroborates the existence of the tube-lining technique during the Late Western Zhou and suggests that it was already widespread during the Middle Western Zhou. The reason we do not see more "ghost" characters in other inscriptions is simply because the inscriptions were usually finalized by polishing.[96] As for proofreading, the Larger Ke *ding* inscription specifies the time when it was performed: after the sketch of an inscription was carved, but before it was tube-lined.

96. This means that, should more "ghost" characters be discovered in inscriptions, it will necessarily be in those that remained unpolished. Original vessels or high-quality photographs of their inscriptions will need to be consulted, since rubbings can easily fail to register the "ghost" characters. One more "ghost" character can be identified in the inscription on the lid of the Middle Western Zhou Qisheng Lu *fangyi* 齊生魯方彝 (*Jicheng* 09896), where the character *shi* 十 (I.4) is written over the "ghost" character *you* 又 in the phrase *wei ba nian shi you er yue* 隹八年十又二月 "It was the eighth year, twelfth month." Clearly, the character *shi* was omitted during the initial ordination and character *you* was sketched in this position (I.4); before tube-lining, the mistake was discovered, and the correct character *shi* was tube-lined in this position, but as the sketched grooves of the character *you* in this position were not levelled up, upon casting, they registered as rilievo "ghost" strokes around the intaglio character *shi*. For a clear photograph of this inscription, see Zhang Tian'en, *Shaanxi jinwen jicheng*, vol. 2, *Baoji juan: Qishan* 岐山, *Fufeng*, 35.

Conclusion: Implications for the Study of Bronze Inscriptions

Making use of the notions of "character-space" and "master-layout," the inscriptions were planned with the utmost care and their production demanded a major mobilization of technological resources. From this point of view, any argument about textual corruption, omission, or mistake in a bronze inscription must take as its departure point an analysis of the visual qualities of an inscription. In fact, any consideration of an inscription must begin with the evaluation of its layout in order to grasp the basic framework to which the inscription's text was confined. With its compositional and visual standards, the bronze inscriptions were not mere documents cast in bronze; they constituted a genre of their own.[97]

In his introduction to a volume on the visual qualities of medieval inscriptions, Antony Eastmond writes:

> Inscriptions have tended to be treated as collections of words, whose materiality is incidental. Such assumptions underlie the origins of the great corpora of inscriptions, which were often motivated by positivist concerns about the factual content that could be gleaned by reading such texts … The essential premise of this book is that inscriptions are not just disembodied words that can be studied in isolation. Instead they must be considered as material entities, whose meaning is determined as much by their physical qualities as by their contents. None of the chapters seeks to deny the importance of reading inscriptions. Indeed the contents remain important and are central to understanding the ways in which they have been set up and used. However, in addition to their contents, the ways in which words were presented to onlookers is a key source of information and a generator of meaning that should not be ignored. Meaning can be generated simply by the formal qualities of inscriptions: the shape and arrangement of the script used, the size of letters, the legibility and readability of the inscription … Meaning is further developed by the relationship between the texts and their physical contexts. The layout and sequencing of texts can affect how viewers interact with the buildings or landscapes in which they are located. The visual qualities of texts, the ways in which they wrap around buildings or cluster in particular places, can give

97. See for example the arguments based on phonetic patterns in inscriptions as raised in Jeffrey R. Tharsen, "Chinese Euphonics." For another point exemplified by reassessment of the function of the phrase *bai shou qi shou* 拜手稽首, see my "You tongqi mingwen de bianzuan jiaodu kan Xi-Zhou jinwen zhong 'bai shou qi shou' de xingzhi," 541–59.

> them agency to encourage ritual or other interactions between readers/viewers and the texts or monuments.[98]

Despite certain qualitative differences, such as placement and size, Eastmond's observation is highly relevant to the Western Zhou bronze inscriptions. Through the study of manuscripts used in the process of preparation of bronze inscriptions for casting, it became clear that in many cases, the bronze inscriptions were conceived not as "collections of words," but rather as visually relevant display texts whose graphic presentation mattered so much that it would actually set certain limitations for their content: In the process of the negotiation of the content of an inscription, it was sometimes the form that prevailed over the meaning. A new notion that entered contemplations about the textual display in Western Zhou times was symmetry. From the second half of the tenth century B.C.E., after a century or so in which the quest for symmetry was occasionally reflected by the equal character count in each column, the regular *stoichedon* style of layout became a popular mode of textual display on bronze inscriptions cast by Western Zhou elites to the extent that the composition of a bronze text would sometimes take account of it. When reading these texts, our first task should be to identify whether and to what extent their content is circumscribed by their form. The issue that awaits further inquiry is the underlying causes that sparked such developments.[99] However, the desired symmetry was not always achieved, and the complexity of the transfer of the text from the master copy to the inscription mold is to be blamed.

The visual self-awareness of bronze texts is utterly relevant not only for the discussion about symmetry and early Chinese aesthetics, but also for any philological research that touches upon the bronze inscriptions, be it research on grammatical phenomena in the language of bronze inscriptions, where an intentional omission can serve as an argument for grammatical acceptability of the abbreviated form,[100] or

98. Antony Eastmond, "Introduction: Viewing Inscriptions," in *Viewing Inscriptions in the Late Antique and Medieval World*, ed. Antony Eastmond (Cambridge: Cambridge University Press, 2015), 2–3.

99. For a discussion of visibility and legibility of the Western Zhou bronze inscriptions as well as their audience, see Olivier Venture, "Étude d'un emploi ritual de l'écrit dans la Chine archaïque (XIIIe–VIIIe siècle avant notre ère)," Ph.D. dissertation (Université Paris 7–Denis Diderot, 2002), 277–91.

100. As an example of this, although without the necessary discussion on textual production, see Qin Xiaohua 秦曉華, "Xi-Zhou jinwen 'ze you' shixi," 西周金文"則鯀"試析, *Guwenzi luntan* 2 (2016), 189–92.

research into textual analogies, both among several inscriptions and between inscriptions and other unearthed or transmitted texts. It goes without saying that the sharing of blueprints by different vessel types has direct implications for the study of vessels' self-appellations, a trending research topic in recent years.

Inquiry into the manuscript world beyond the clay slabs also yields important observations about the organization of bronze inscription production. Note, however, that most of the evidence surveyed in this article dates to the Late Western Zhou, and the observations thus pertain first to this period. While the existence of master copies was expected, the intermediary manuscripts or blueprints represent hitherto unknown instances of writing. Based on the inscription's master copy, a blueprint served as the ultimate exemplar for the ordination of an inscription, and could be subject to further adjustments, corrections, annotations, markings, or divisions. Despite such treatment, a single blueprint would be used by different ordinators working consecutively to produce an entire set of inscriptions on various vessel types. One may only speculate what the reasons for such an economy in the production organization could have been, but the possibility that the blueprint was rendered in mirror-writing could be one of the contributing factors.[101] Upon ordination, the intact master copy was used for proofreading of the engraved text. Overall, the manuscripts certainly were not overused in a bronze workshop. Regarding their physical qualities, it was a practice in some major bronze workshops to break the longer columns into five character-spaces in order to ease the ordination process. Since it was possible to add an annotation next to the ultimate column of the Shi Ke *xu* blueprint, and since the whole chunk of text was misplaced during the ordination of the Liangqi *zhong*, it seems more likely that these auxiliary manuscripts were written on solid wooden or bamboo tablets rather than on bound bamboo strips; this hypothesis is further corroborated by the fact that so far not a single instance of a misplaced or missing strip has been identified in Western Zhou bronze inscriptions.[102]

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101. Note that the use of a single manuscript for an entire set of inscriptions did not necessarily hinder the manufacturing output of the workshop because the other ordinators could be working in parallel on other inscriptions. The reuse of a single manuscript would thus in fact be economical, both time-wise and resource-wise: it would expedite the production process because no additional time would need to be invested in the production of extra blueprints, and it would spare the material for the production of writing supports. It would also prevent further copyists' errors.

102. To my knowledge, there are only few instances of textual leaps similar to a "missing strip." The inscription on Xing *ding* 㝬鼎 (*Jicheng* 02742) seems to lack one column (seven characters) between columns III and IV (the sequence runs … *xi ju*

footnote continued on next page

Importantly, the case of Larger Ke *ding* inscription also proves that the tube-lining technique was in use by the Late Western Zhou period and places the proofreading procedure between the engraving of sketch characters and the final tube-lining. Both observations can serve as subsidiary indicators of the authenticity of an inscription. The reconstruction of the procedure of preparation of a (longer) bronze inscription for casting during the Late Western Zhou times may thus be schematized as follows:

→draft of the inscription

→ (=) master copy (specifying master-layout)

→blueprint (mirror-reversed?)

→ordination (engraving mirror-reversed sketch-line characters on the clay slab)

→proofreading

→corrections

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liang, bai qi / yong zuo huang zu wen kao yu ding 錫駒兩拜稽/用作皇祖文考盂鼎 ["was awarded two foals. With folded hands bowing / and thus make [this] *yu*-type cauldron for my august ancestors and cultured father"]). From the comparison with the Xing *hu* 癲壺 inscription (*Jicheng* 09726–27), which records events from the same year, we can assess that seven missing characters are *shou, gan dui yang Tian zi xiu* 首敢對揚天子休 "prostrate, [I] take the liberty to extoll the beneficence of the Son of Heaven." However, unlike other Xing's vessels, the *ding*-cauldron was already unearthed during the Song dynasty and its inscription is only preserved in line-drawing; it is possible that the "missing" column was present in the original inscription but was omitted during the copying process in Song times. This is probably the case also for another inscription recorded by Song scholars, that of "Shi Qin Gong" *ding* 師秦宮鼎 (*Jicheng* 02747), which also drops at least one column of seven characters between columns III and IV. Interestingly, the authors of the imperial catalogue *Chongxiu Xuanhe Bogutu* 重修宣和博古圖 (1107–1123) were confident enough to mark the missing column (as well as other missing characters) in the "Shi Qin Gong" *ding* inscription with small circles (*Siku quanshu* 四庫全書 ed., 3.35b), but no catalogue marks omission for the Xing *ding* inscription (recorded in Wang Qiu's 王俅 *Xiaotang jigulu* 嘯堂集古錄 (1176) and Xue Shanggong's 薛尚功 *Lidai zhongding yiqi kuanzhi fatie* 歷代鐘鼎彝器款識法帖 (1144); while Wang Qiu follows *Bogutu* in marking the omissions in inscriptions with small circles in his catalogue, Xue Shanggong does not observe this practice). The first scholar to note the omission in the Xing *ding* inscription (and moreover to reconstruct it correctly and link it with the "Shi Qin Gong" *ding* inscription) is thus probably Chen Mengjia 陳夢家 in 1958; see his *Xi-Zhou tongqi duandai* 西周銅器斷代 (Beijing: Zhonghua, 2004), 336–37.

→tube-lining

→casting

→polishing

Although this study does not answer the question of the authorship of an inscription, it can contribute to discussion regarding a donor's involvement in the composition and production processes. In this instance, intentional textual omissions are of high importance and should receive further attention. Were these omissions necessarily approved by the donor of the vessel, or were they performed based on the judgment of the ordinators in the workshop? The cases of First Year Shi Shi *gui*, Jian *gui*, and Shi Ke *xu* seem to indicate the latter possibility. The fact that most of these omissions take into account their context further indicates that the ordinators relied on a certain degree of literacy in their work. This seems to be corroborated by the prevalent location of corrections in the beginning lines of inscriptions, which shows that ordination followed the direction of the text from its beginning, and thus that the ordinators preferred to write the text in its natural sequence.

Incorporation of proofreading into the workflow of inscription-making shows the high concern that the workshop had with delivering a readable product. Moreover, the rearrangement of the text on the Liangqi *zhong* inscription and unfinished polishing of the Larger Ke *ding* reveal that certain effort was made by ordinators and craftsmen to facilitate both the readability and legibility of these inscriptions.

The case of Shi Ke *xu* suggests that a certain hierarchy existed among ordinators. In the lineage-based craftsman communities of Western Zhou times, we can expect that experienced senior ordinators would instruct and supervise the less experienced junior ordinators.[103] It might well be that it was chiefly these junior ordinators who were responsible for the kind of textual infelicities surveyed in this article. In light of the complexity of skills demanded in the process of ordination, it appears that this would be a highly specialized occupation that was not available in every bronze foundry. Possibly as a result, even inscriptions

103. On the reconstruction of the habitat of bronze foundry craftsmen in the Western Zhou period, see Lei Xingshan 雷興山, "Lun Zhouyuan yizhi Xi-Zhou shiqi shougongyezhe de ju yu zang: jian tan teshu qiwu zai juluo jiegou yanjiu zhong de zuoyong" 論周原遺址西周時期手工業者的居與葬—— 兼談特殊器物在聚落結構研究中的作用, *Huaxia kaogu* 2009.4, 95–101.

disregarding the prescribed master-layout could have been considered a satisfactory outcome.

Any philological work should be aware of the processes by which the text under scrutiny came into being. Although we do not have the comfortable evidence in the form of shop signs inviting ancient Roman passersby to have their inscriptions laid out and carved,[104] some insight into the complexity of the process by which a bronze inscription came into being can be gained from the above discussion. I believe that the scattered imprints of the ephemeral manuscript world in the enduring realm of cast inscriptions, complemented by archeological surveys of bronze foundry sites, will gradually yield an increasingly vivid image of the complex and dynamic background of the great cultural phenomenon of bronze inscription casting in Early China.

鑄銘之前的書寫：論西周銅器銘文製作使用的寫本

石安瑞

提要

近年來，戰國秦漢簡牘研究已成爲熱潮。相比之下，戰國以前寫本由於出土材料的闕失，其使用情況知之甚少。本文根據西周銅器銘文的佈局特徵及異常現象，對銅器銘文製作過程中使用易腐材質寫本的痕跡進行了探討，並對其物理性質及在銘文製作過程中的具體作用進行了復原。基於分析，本文指出在銅器銘文製作過程中使用了兩種不同的寫本：一種是用於審閱的“原稿”；一種是用於銘文實際製作過程的“藍本”。製作一套同銘器時（包括不同器類的器物），工匠們會輪流使用同一份藍本。不少銘文的起草過程中已對銘文字數、文字佈局進行了細心設計，因此，每一篇銘文的釋讀工作應該從考察銘文的視覺特徵入手。此外，本文爲泥條堆塑法在銘文製作過程中的應用提供了明證，復原了西周晚期銅器銘文製作的全部流程。再者，本文還關涉到西周時期銅器作坊中工匠的讀寫能力、勞動分工以及西周時期青銅銘刻的展示功能等問題。

Keywords: bronze inscriptions, manuscripts, exemplars, tube-lining, symmetry,
青銅器銘文, 寫本, 底本, 泥條堆塑法, 對稱

104. For examples of these inscriptions, see Jonathan Edmondson, “Inscribing Roman Texts: Officinae, Layout, and Carving Techniques,” in *The Oxford Handbook of Roman Epigraphy*, ed. Christer Bruun and Jonathan Edmondson (Oxford: Oxford University Press, 2014), 112. See also John Edwin Sandys, *Latin Epigraphy: An Introduction to the Study of Latin Inscriptions* (Cambridge: Cambridge University Press, 1927), 57.