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"Music, Measurements, Pitch Survivals, and Bell Shapes in Korea"

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Reading (informal) version, NOT (yet) for citation or quotation!

[OVERHEAD(S)] Many people are familiar with the spectacular set of sixty-five bronze bells excavated in China in 1977. These bells were buried with the Marquis Yi 侯乙 of the small state of Zeng 曾 in 433 B.C. [OVERHEAD] It's less well-known that such excavations of tombs have been taking place for many centuries in China, for example in 1104 during the Song 宋 dynasty (960-1279), when six individual bells were excavated, from an ancient small state with the same name, Song (mists of time - 285 B.C.), not far from the site that more recently has yielded the Marquis Yi artifacts.

The ritual court music *aak* 雅樂 performed in Korea today uses sets of bronze bells whose design can be shown to derive ultimately from those six ancient bells excavated in 1104, and the modern Korean *aak* pitch standard is the same as that of early twelfth-century China. Furthermore, there is a direct link between that pitch standard and the official government-decreed system of measurements for length and weight that was used in Korea during most of the period from the fifteenth through the nineteenth centuries.

My paper today is merely a sketch of the story linking these various elements, omitting a fair amount of the documentary evidence. I'm concentrating on the early phase of the measurement-setting in the Chosŏn dynasty (1392-1910), recognizing that a number of alterations, notably during the reign of King Yŏngjo 英祖 (1724-1776), occurred later on (on these, see Larsen 1984a, 1984b, and 1988).

The six bells of ancient Song and the new pitch system of the 12th century:

The six bells were excavated in 1104 at a site thought to belong to the lands of the ancient state of Song [OVERHEAD], here depicted in an eighteenth-century copy of a Song-dynasty illustrated source, Wang Fu's 王芑 *Bogutu* 博古圖 (annotated catalogue of the emperor's bronze collection) of 1123. The drawings of the bells show six similar, but somewhat distinct styles of shape and decoration, of which three examples may be seen in the overhead. They are unified by a consistent set of three bands on each side of the bell, each with six protruding nodes, a central vertical strip in which inscriptions were incised, an intricate decoration underneath the three bands, and highly decorated suspension apparatuses at the top. The emperor of the (later) Song at the time of the excavation, Huizong 徽宗, felt that the discovery of these bells from an ancient state also called Song was an auspicious sign. In keeping with the Confucian ideal that the high qualities of antiquity should be emulated, he set about re-calibrating the musical system of Song, to include the construction of new sets of tuned bells, *bianzhong* 編鐘, modeled on the six ancient individual bells.

In order to do so, however, it was necessary to determine the correct fundamental pitch, *huangzhong* 黃鐘, for the musical system, the remaining eleven pitches being calculable through a circle of fifths method. [OVERHEAD] The proper way to do this, according to ancient documentary sources, was to line up grains of a particular type of millet: ninety grains would comprise the length of the pitch pipe that would sound the pitch of *huangzhong*. The pitch pipe should also have the capacity of 1,200 grains of millet, thereby fixing its volume and diameter (parenthetically -- the diameter should theoretically not affect the pitch of the pipe, but it was necessary to set it for other reasons, as we'll see later).

For reasons that are not entirely clear to us today, the emperor's advisers were unsatisfied with the traditional method of fixing the pitch of *huangzhong*, and they advocated a different basis for calculation, to which I'll return at the end of this talk when its significance will be clearer. At any rate, they calibrated a pitch, and new sets of tuned

bells, *bianzhong*, were constructed, physically modeled on the six ancient bells, but tuned to the newly determined pitch system. The musical system was given the name Dasheng 大晟, or "great brightness", and indeed this name was inscribed on one of the central vertical strips on all the new bells.

Exports to Korea (Koryŏ):

In 1114 and 1116, Emperor Huizong sent enormous gifts of musical instruments, dance paraphernalia, ritual implements, and musical documents to King Yejong 睿宗 (ruled 1105-1122) of Koryŏ 高麗 (918-1392). The gifts included a large number of sets of Dasheng bells, and the Koreans quickly set about using the bells in the music of their own state sacrificial rites, along with the other instruments in the great performing ensembles they received from China. These sacrificial rites were of a strongly Confucian nature and based on Chinese models; it appears that Korea was attempting to improve her culture by emulating practices of the mother lode of culture. This particular case initiated the Korean *aak*, ritual court music, tradition which is still alive today. Emperor Huizong, for reasons published elsewhere (by Keith Pratt and me), was hoping to get something from Korea in return for his musical generosity, but he was disappointed.

Back in China, the political and economic situation deteriorated badly and quickly. The Song were invaded from the northeast by the armies of Jin 金, a new state which had proclaimed itself in 1115. They sacked the capital of Song in 1127, and the standard history of the Song dynasty, *Songshi* 宋史 (1345, over two centuries later), records that all the Dasheng musical instruments, books, and other ritual items were destroyed.

I read that *Songshi* account when writing my PhD dissertation back in the late 1970s, and simply discarded the further history of Dasheng instruments and music in China. I've returned to it only recently after learning that in fact the standard history is wrong, and that many of the Dasheng bells survived the invasion and the century and a half of Southern Song, eventually being put to use in the succeeding Jin and Yuan 元 (1280-

1368) dynasties in their ritual music (i.e., up to the mid-fourteenth century). In the case of some of the bells, the Jin actually had the inscription Dasheng scraped off and a new one giving the name of their own musical system, Dahe 大和 ("great harmony"), put on.

A fair number (about fifteen) of these bells, some inscribed Dasheng and some re-inscribed Dahe, survive today in assorted locations. [OVERHEAD] This one, for example, is in the Walters Art Gallery in Baltimore (note inscription Dasheng); it has lost its decorative dragons on the top. [OVERHEAD] This overhead shows the front (*ruibin* 賓) and back (Dasheng 大晟) of a well-preserved specimen, one of eight in the Forbidden City in Beijing.

The existence of these actual bells from the early twelfth century allows us to check the accuracy of documentary conclusions (coming up shortly), and indeed the mutual corroboration is remarkably good.

In the long run, things didn't go any better for the Korean Koryŏ dynasty than for the Chinese Song dynasty; its capital city, Kaesŏng 開城, suffered in 1361 the same fate as the Song capital in 1127: it was sacked by invaders, and all the musical instruments and most of the buildings were burnt and destroyed. With two notable exceptions: An old musician threw a set of the Dasheng bells and a corresponding set of stone chimes into a lake, thus managing to preserve them for posterity.

Reconstruction in Chosŏn:

In 1392, the Korean dynasty changed from Koryŏ to Chosŏn 朝鮮. With the dynastic change came the need to reconstruct Korea's musical system, in keeping with ancient Chinese Confucian precepts; the new dynasty saw itself, and wanted everyone else to see it, as following a Confucian governmental model. Around 1425, a scholar-official named Pak Yŏn 朴堧 (1378-1458), whose biography appears in the most recent *Yearbook for Traditional Music* (Provine 2000), was given the task of researching and constructing a *huangzhong* (Korean *hwangjong*) pitch pipe. Pak first tried out the traditional Chinese

method, lining up grains of black millet (kösŏ 秬黍) to create the length of the pitch pipe.

Having the Confucian scholar-official's respect for the past, Pak was distressed to discover that the pitch which resulted from his work was different from that of the finely-crafted Dasheng bells which had been in Korea for three centuries and luckily preserved through the sacking of the Koryŏ capital in 1361. The Song dynasty was viewed in Korea as the last great Chinese Confucian dynasty, and it would be unseemly to ignore the authority of their bell pitches. Pak reasoned that millet grown in Korea wasn't necessarily the same size as that grown in China, and in fact one could get lots of different sizes of millet grains even within Korea, depending on where one harvested it and how the local temperature and rainfall had been that year.

Pak Yŏn, therefore, opted for political and philosophical expediency: He made imitation grains of millet from beeswax, of such a size that when he lined them up, created lengths, and made a pitch pipe, the pitch came out exactly the same as the *huangzhong* on the Chinese Dasheng set (Yi Hyegu 1976: 294). He justified himself by saying that since the grains of millet could in fact be of various sizes, this particular size was one of the possibilities and furthermore had the considerable benefit of corresponding to the historic Song dynasty instruments. To make the length precise and durable, Pak also made a metal *hwangjong* pitch pipe (Yi Hyegu 1976: 298-300). As it happens, the resulting pitch, in modern Western terms, is approximately C.

From this basic pitch, and in fact also modeled on the physical structure of the Chinese Dasheng bells, the Koreans made new sets of bells, along with many other musical instruments. These fifteenth-century bells, in turn, were the models for all others during the Chosŏn dynasty. Some of these sets of bells survive down to the present and are still in use.

[OVERHEAD] In the great musical treatise of 1493, *Akhak kwebŏm* 樂學軌範, for example, the depiction of a *bianzhong* (Korean *p'yŏnjong*) is a close copy, right down to the dragon decoration on the top, of the Dasheng bells. Later instruments retain the same appearance [OVERHEADS (2)].

The documentary history, in other words, indicates that the pitch of the early twelfth-century Dasheng bells of Song has been preserved in Korea right down to the present, and indeed the pitch of modern Korean bells agrees with that of the preserved twelfth-century Dasheng ones, providing a nice confirmation. So that is the demonstration of the promised points about pitch preservation, C from the early twelfth century down to the present, and bell construction, the shape and appearance deriving from bells of the third century B.C. or earlier, as promised at the beginning of this talk.

Measurements:

But the title of this talk also promises a connection with official governmental standards of measurement. There's a real need for knowing about measurements: They keep cropping up like bad pennies in historical readings [OVERHEAD]. Various types of length measurements and measuring devices were used for various purposes in the Chosŏn period. For example, the *p'obaekch'ŏk* 布帛尺 was used for measuring cloth, the *choryegich'ŏk* 造禮器尺 for many ritual items, and so forth. The various measurements were related by precisely set proportions, so that once a single fundamental length had been established, all the others were available by simple computation [note specification of different measuring sticks in the overhead].

[OVERHEAD] As stated in an official document of 1469, *Kyŏngguk taejŏn* 經國大典 (6.1b-2a) and repeated elsewhere, the units of measurement were as shown on the overhead [same as handout; run through it, making sure to get to the weights at the bottom].
[OVERHEADS (2)]

The fundamental measuring length upon which the others were all based was called the *hwangjongch'ŏk* 黃鐘尺 (“*hwangjong* foot”), so the whole problem of establishing a set of length measurements ultimately boiled down to setting the length of the *hwangjongch'ŏk*. This is where music comes in, since *hwangjong*, as we now all

know, was the fundamental pitch of the musical system. The *hwangjongch'ök* measurement was derived from the length of the pitch pipe which produced the pitch *hwangjong*.

You can see, using the terminology on the overhead, that in constructing a pitch pipe, one grain of millet was one *p'un* 分; ten grains were therefore one *ch'on* 寸, and nine of these *ch'on*, ninety grains, set the length for the pitch pipe. The so-called *hwangjongch'ök*, or foot, was obtained by adding one further ten-grain *ch'on*, so that the foot contained ten *ch'on* (decimal system). The conversion factors shown in the overhead are taken from results of the physicist Pak Hüngsu 朴興秀 (1980), who has both computed the measurements based on pitch pipe lengths needed to produce the observed pitches and measured surviving measuring devices from the Chosŏn period. It would be nice, of course, if these computations agreed with measurements from early twelfth-century China, and they do (but so far I haven't investigated the causal connections between pitch and measurement in Song China).

The last OVERHEAD shows four of the measuring sticks used in the Chosŏn dynasty, as shown in a 1474 official document on ritual and ceremonies, the *Kukcho orye sŏrye* 國朝五禮序例. These could, of course, be measured on the page, if only I had the original document available (can come pretty close at H-Y, actually).

So that's the demonstration of the connections between measurement and pitch of music.

Where did the Chinese *huangzhong* pitch come from?:

In conclusion, I must tell you what the early twelfth-century Chinese *huangzhong* pitch was based on, and therein lies a strange tale. If you recall, emperor Huizong's advisers proposed an alternative to the traditional method of lining up grains of millet to obtain the pitch pipe length. One of emperor Huizong's advisers, Wei Hanjin 魏漢津,

successfully proposed that the determination of the *huangzhong* pitch pipe for his reign be based not in the traditional way on grains of millet, but on the sum of the lengths of the third, fourth, and fifth fingers on the emperor's left hand (*Songshi* 128.2998 and 462.13526). Each finger being made of three segments, this made up nine segments, or roughly the same thing as nine *ch'on*. More precisely speaking, that is the proximal, middle, and distal phalanges of the third, fourth, and fifth fingers, which in the case of Emperor Huizong added up to 31.2 cm, as we can deduce from the reasoning already given above.

Anyway, I hope you can see that despite my flippancy, there's a great deal riding on this determination of a basic pitch -- not only the musical system, but the whole system of measurements of the nation depends on it. Other cultures do place different, and indeed higher values on musical matters than we tend to do, and in Confucian societies music was of the greatest concern, and in more ways than I've pointed out today. In East Asian studies, you ignore music at your peril [a lot of people lead a perilous existence].

And so, to finish off, it came to pass that all length measurements in the early Chosŏn dynasty were based on three left-hand fingers of an early twelfth-century Chinese emperor, and to this day those three fingers can still be heard in the fundamental pitch underpinning Korean ritual music, played on tuned bronze bells that in visual tradition (as distinct from oral tradition) retain the appearance of instruments made about two and a half millennia ago.

Bibliography:

Primary sources:

Akhak kwebm 樂學軌範 (1493), chapter 6.

Chen Yang 陳暘, *Yueshu* 樂書 (1103), chapters 96-97.

Chosŏn wangjo sillok 朝鮮王朝實錄, passim.

- Chŭngbo Munhŏn pigo* 增補文獻備考 (1908), chapter 91.
- Gujin tushu jicheng* 古今圖書集成 (1728), chapters 92 and 95.
- Jinshi* 金史(1344), chapter 39.
- Kukcho orye sŏrye* 國朝五禮序例 (1474), 1.113a-114a.
- Kŏyngguk taejn* 經國大典 (1469).
- Ruan Yi 阮逸 and Hu Yuan 胡瑗, *Huangyou xinyue tuji* 皇祐新樂圖記 (1053).
- Songshi* 宋史 (1345), chapters 128, 462. Zhonghua shuju 中華書局 ed.
- Wang Fu 王昚, *Bogutu* 博古圖 (1123).

Secondary sources:

- Chen Mengjia 陳夢家, "Song Dasheng bianzhong kaoshu" 宋大晟編鐘考述, *Wenwu* 文物 (1964/2), 51-53.
- Chŏn Sang'un 全相運, *Han'guk kwahak kisulsa* 韓國科學技術史 (Seoul: Kwahak segyesa 科學世界社, 1966), pp. 131-134.
- Guo Zhengzhong 郭正忠, *San zhi shisi shiji Zhongguo de quanheng duliang* 三至十四世紀中國的權衡度量 (Beijing: Zhongguo shehui kexue chubanshe 中國社會科學出版社, 1993).
- Hanyu da cidian* 漢語大詞典 (1986-90), vol 13.
- Jeon, Sang-woon [Chŏn Sang'un 全相運], *Science and Technology in Korea: Traditional Instruments and Techniques*, M.I.T. East Asian Science Series, 4 (Cambridge: MIT Press, 1974), pp. 130-136.
- Larsen, Finn, "Weights and Measures during the Yi Dynasty," *Association for Korean Studies in Europe: Proceedings of the 7th Annual Conference, 5-9 April, 1983* (AKSE, 1984), pp. 58-61.

- ____, "Weights and Measures in the Yi Dynasty (1392-1910)," paper presented at AKSE, 1984.
- ____, "The Metrological Reform of Emperor Kojong," *Actes de la 9e confrence annuelle, 10-15 Avril 1985* (AKSE, 1988), pp. 169-178.
- Ledyard, Gari, "Cartography in Korea," in *The History of Cartography*, ed. J. B. Harley and David Woodward, Vol. II, Book 2: *Cartography in the Traditional East and Southeast Asian Societies* (Chicago: Univ. of Chicago Press, 1994), pp. 235-345.
- Li Wenxin 李文信, "Shangjing kuan Dasheng nanlu bianzhong" 上京款大晟南呂編鐘, *Wenwu* 文物 (1963/5), 42-44.
- Pak Hŭngsu, "Toryanghyŏng" 度量衡, in *Han'guksa* 한국사 (Seoul: Kuksa p'yŏnch'an wiwŏnhoe 국사편찬위원회, 1974), pp. 525-545.
- Pak Hŭngsu 朴興秀, *Toryanghyŏng kwa kugak nonch'ong* 度量衡과 國樂論叢 (Seoul: Pak Hŭngsu paksa hwagap kinyŏm nonmunjip kanhaenghoe 朴興秀博士華甲記念 論文集刊行會, 1980).
- Pian, Rulan C., *Song Dynasty Musical Sources and Their Interpretation*, Harvard-Yenching Institute Monograph Series, 16 (Cambridge: Harvard University Press, 1967).
- Provine, Robert C., *Essays on Sino-Korean Musicology: Early Sources for Korean Ritual Music*, Traditional Korean Music, 2 (Seoul: Il Ji Sa 一志社, 1988).
- ____, "Investigating a Musical Biography in Korea: The Theorist/Musicologist Pak Yŏn (1378-1458)," *Yearbook for Traditional Music*, 32 (2000), 1-15.
- Qiu Guangming 丘光明, *Zhongguo lidai duliangheng kao* 中國歷代度量衡考 (Beijing: Kexue chubanshe 科學出版社, 1992).
- So, Jenny F., ed., *Music in the Age of Confucius* (Washington, DC: Freer Gallery of Art and Arthur M. Sackler Gallery, 2000).
- Wang Haiwen 王海文, "Yuezhong zongshu" 樂鐘綜述, *Gugong bowuyuan yuankan* 故宮博物院院刊 (1980/4), 73-79.
- Yi Hyegu 李惠求, *Han'guk ūmak nonch'ong* 韓國音樂論叢 (Seoul: Sumundang 秀文堂,

1976), pp. 289-301 (Korean) and 387-402 (English).

Zhongguo yinyue wenwu daxi: Beijing juan 中國音樂文物大系：北京卷 (Beijing:

Daxiang chubanshe 大象出版社, 1996), pp. 72-3.

Zhongguo yueqi tujian 中國樂器圖鑑 (Beijing: Shandong jiaoyu chubanshe 山東教育出版社, 1992).

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