

**Listen, Measure, Calculate:  
In Search of the Urton of the "Yellow Bell" in Chinese Music Theory<sup>1</sup>**  
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Today, I would like to introduce you to a concept which is very important in traditional Chinese music theory and music history. Unfortunately, it is not cherished in musicology today – neither in China nor outside of China. The Chinese term for this concept is *huangzhong*<sup>3</sup> 黃鐘<sup>4</sup>. This word is generally translated as ‘Yellow Bell’. However, the concept of Yellow Bell does neither refer to the color yellow nor does the character *zhong* 鐘 (“bell”) in combination with *huang* 黃 necessarily suggest a bell or bell-like object. That means although it partly does, the scope of its overall concept is extended to further transferred meanings in ancient music theory and other related. There are also many other ancient Chinese words that are hard to explain by translating them literally either, such as *dao* 道 and *yinyang* 陰陽. To prevent the emergence of misleading mental images of “yellow bells”, I first have to explain the terminological origins of the term *huangzhong* 黃鐘 more in detail.

The earliest references to the character *zhong* 鐘 (‘bell’) can be traced in the later stages of the dynasty *Shang* 商. This period lasted approximately from the end of the 17<sup>th</sup> to the 11<sup>th</sup> century BCE. The oldest monuments of the Chinese writing language date back to this era of the Chinese Bronze Age. The first known versions of the character for ‘bell’ are to be found engraved on bronze vessels of the later phase of Shang. Such bronze vessels were used in rituals. On different bronze vessels we find variations of this earliest character for today’s word *zhong* 鐘. Despite the writing variations, the character always consists of the same four parts (see fig. 1), which can be analyzed in the sense of individual words:<sup>5</sup>

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<sup>1</sup> This speech manuscript represents the content of a lecture which I have presented online at the EASA *Colloquium Science Meets Art* on March 18, 2022. Herewith, I would like to express my gratitude for the invitation. Especially, I would like to thank the organizers of this event, Prof. Violeta Dinescu, who has been my academic teacher in musicology and composition for many years at CvO University Oldenburg in Germany, and Prof. Dr. Ioannis Liritzis! It also has been a great honor and delight that Prof. Dr. Klaus Mainzer and my “Doktormutter” Prof. Dr. Dorothea Redepenning (Heidelberg University) have attended and commented this session. I thank all participants in the discussion for enlightening remarks!

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<sup>3</sup> This is the modern standard pronunciation of the word in standard transliteration (*pinyin*-system). As this text is addressed to a general audience, I have omitted the diacritical signs in all transliterations. In ancient times and in various phases of Chinese history as well as in different dialects this word has been pronounced differently.

<sup>4</sup> I have used Chinese traditional characters throughout this text.

<sup>5</sup> The components also exist as individual characters.

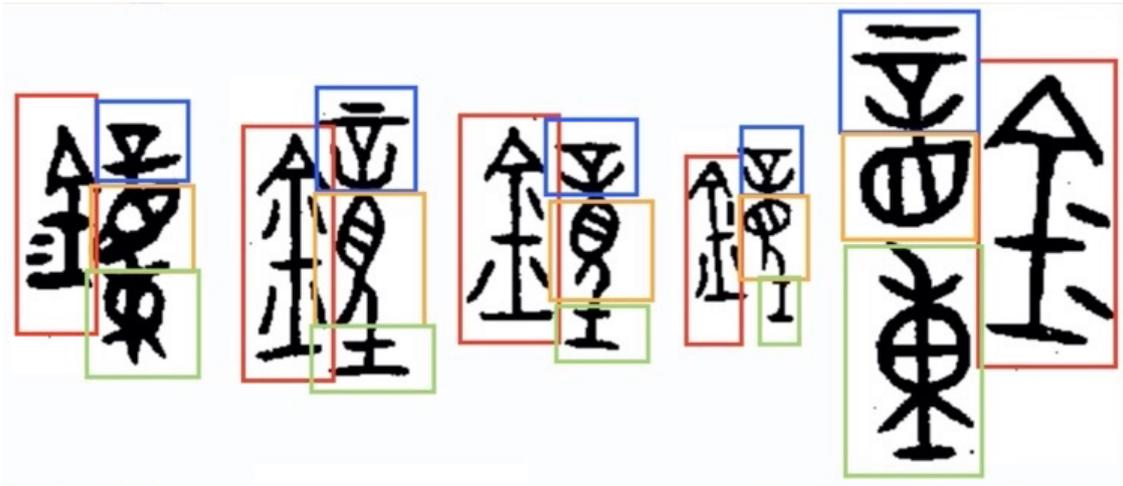


Fig. 1: Early character variations of *zhong* 鐘 (“bell”).

One component (see fig. 1, red frame, and fig. 2) represents the contemporary character versions of *jin* 金, meaning ‘metal’ (which could actually designate copper, gold, or bronze at the time). In general, it symbolizes metal ore concealed in the ground.



Fig. 2: Early character variations of *jin* 金 (“metal”).

The second original character component of *zhong* 鐘 (“bell”) is basically and mostly given in the form of a triangular-shaped symbol (see fig. 1, blue frame). It has been very important during these early times of *Shang*, because this symbolizes the power of a ruler, or rule and punishment (see fig. 3a). One can also find this component in the contemporary character versions for the ruling dynasty *Shang* 商 (see fig. 3b). It is also written over the ancient versions of the character for *Di* 帝 (see fig. 3 c), which refers to the supreme ruler or the God of the *Shang*-religion. The triangular symbol is also included in the characters for the most important mythological sacred animals, the dragon (see fig. 3 d) and phoenix (see fig. 3 e).

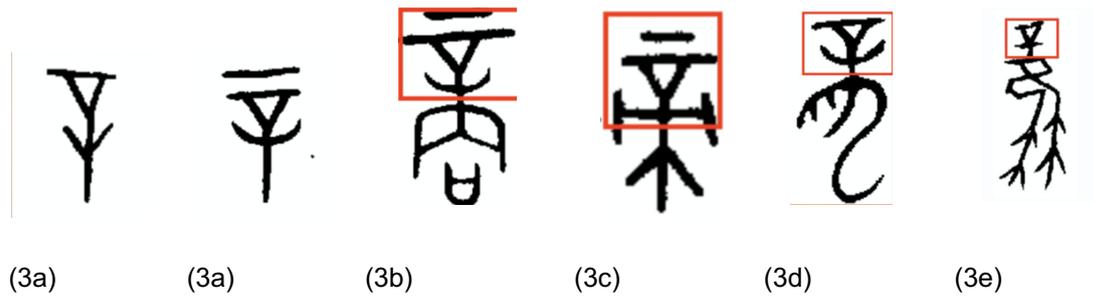


Fig. 3a-3e: Early characters containing the symbol of power and rulership.

It is also worth noting that the triangle-based symbol is also found in the ancient character versions for the modern word *yan* 言 (see fig. 4a), which today refers to language and speech in general. At that time of Shang, it didn't carry that wide conceptual scope. Instead, it referred to the language code of the ruling class and especially to words with the related religious connotations. As we also find the triangular symbol in the ancient character for *yin* 音 (see fig. 4b) – **music** – we can infer from this that music at that time did not refer to everyday “secular” music or to the folk music traditions of the common people but to the state rituals performed by the ruling class. It was linked to the music of rituals, and maybe also to military music in the related sense.



Fig. 4a and 4b: the triangular symbol in *yan* 言 (“(ritual) speech”) and *yin* 音 (“(ritual) music”).

The *third* element in the Bronze Age character versions of *zhong* 鐘 (‘bell’) consists of a large eye and a body (see fig. 1, orange frame, fig. 5a). As a single character, it means ‘looking’ or ‘watching’ (*jian* 見). Finally, the fourth part of the character versions of *zhong* 鐘 is pronounced “*dong*” (東) today (see fig. 1, green frames, and fig. 5b). In the ancient character for *zhong* 鐘, the early forms of *dong* 東 functioned as the phonological element of the character, i.e. as the “sound symbol” showing how to pronounce the whole character at the time.<sup>6</sup>

<sup>6</sup> Although there have been attempts to reconstruct early pronunciations of ancient Chinese characters, these are all linguistic approximations. The sounds have first been recorded by means of alphabet-based writing languages at a much later phase (in the contact with Sanskrit and other South Asian languages). As for ancient times, we can't be exactly sure how *zhong* 鐘 was pronounced back then. However, the current standard pronunciations “*zhong*” and



Fig. 5a and 5b: ancient versions of the characters *jian* 見 and *dong* 東.

Now we can interpret the whole constellation of symbols that make the character *zhong* 鐘 ('bell'): it is an object made of metal that symbolizes power and order; only the people with certain (ruling) knowledge (the German word would be '*Herrschaftswissen*') could produce such a bronze bell. Even the modern version of the character (鐘) preserves these etymological origins of meaning. It still consists of the four parts explained further above.

The other Chinese character in the word 'Yellow Bell' – 黃 – is pronounced as "*huang*" in modern standard Chinese (*putonghua*); its literal meaning is 'yellow'. The earliest versions of the character *huang* 黃 (see fig. 6a) have appeared during the same period than those of *zhong* 鐘 ('bell') – more than three thousand years ago! But we find them slightly earlier than those of the latter, and on other materials: it wasn't inscribed on bronze ware at first but engraved on oracle bones, carved on tortoise shells, or cow bones, which all have been used in divination rituals of the later period of the Shang era. These character variants belong to some of the earliest contexts of the Chinese writing language.

The earliest character variants of *huang* 黃 clearly show the icon of a person wearing jade-jewelry on his or her body. During these times, the meaning of jade was more general than today. It is more congruent with our modern word 'gemstones' than with 'jade' in the current sense.<sup>7</sup> While the hint at gems doesn't refer in particular to yellow stones, it clearly alludes to an aristocratic person. The nobles of that time always wore "jade" necklaces. This tradition has always been carried on. In fig. 6c, I have provided a depiction of a noble woman wearing jade. It dates back to a much later time, namely to the 8th or 9th century CE. Furthermore, and in relation to the connotation of power and nobility, the word 'yellow' (*huang* 黃) also symbolizes 'earth' (*di* 地), that is, soil (one might think of "yellowish" loess here) and, on the other hand, as an abstract world-constitutive basic potentiality in the sense of the 'Five Phases' or 'Five Elements' (*wuxing* 五行) that are at the core of all things.

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"*dong*" (東) derive from that earlier way of pronouncing the early forms of the character 鐘.

<sup>7</sup> Today, jade means either jadeite or nephrite.



Fig. 6a: ancient version of the character 'huang 黃'.



Fig. 6b: jade necklace, 1<sup>st</sup> century BCE.<sup>8</sup>



Fig. 6c: nobles wearing jade, 8<sup>th</sup>/9<sup>th</sup> cent. CE.<sup>9</sup>

The table further below (see fig. 8) has been provided by the famous British sinologist Joseph Needham (1900-1995). It summarizes how the ancient Chinese divided the world in terms of “five (basic) elements”, “five (intertwined) phases”, called *wu xing* 五行 (see fig. 7), thus connecting and integrating all the different phenomena of their experience in one “explanatory matrix”, so to speak. Yellow, the color of the element earth, is at the center. It also represents the (sacred) mythological emperor *Huangdi* 皇帝 (“the Yellow Emperor”), but also the planet Saturn, the heart, the ability to think, the basic tone in music, etc. etc.

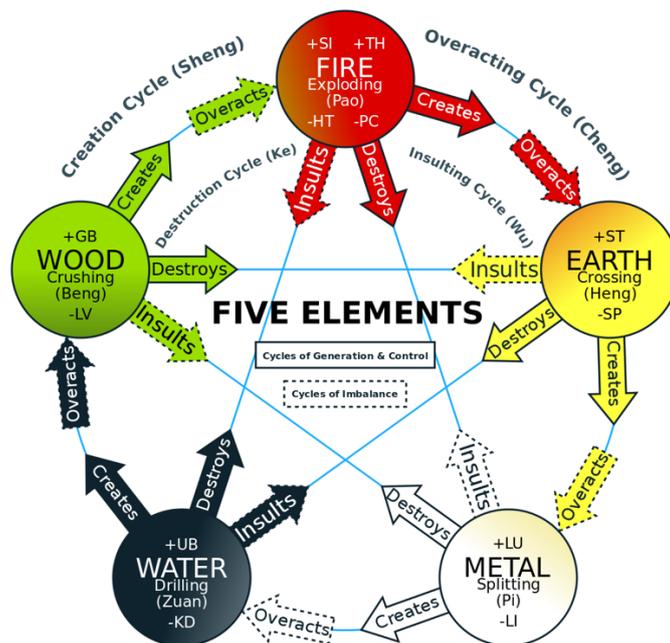


Fig. 7: *wu xing* 五行.<sup>10</sup>

<sup>8</sup> Image source: <https://www.163.com/dy/article/GDHUSKU5053738TW.html>.

<sup>9</sup> Image source: <http://www.76380.cn/zhongguofushilishi/57.html>.

<sup>10</sup> Image source:

[https://commons.wikimedia.org/wiki/File:FiveElementsCycleBalanceImbalance\\_02\\_plain.svg](https://commons.wikimedia.org/wiki/File:FiveElementsCycleBalanceImbalance_02_plain.svg).

Elements <i>hsing</i> 行	Classes of living animals <i>chung</i> 蟲	Domestic animals <i>shêng</i> 牲	'Grains' <i>ku</i> 穀	Sacrifices <sup>c</sup> <i>ssu</i> 祀	Viscera <i>tsang</i> 臟	Parts of the body <i>thi</i> 體	Sense-organs <i>kuan</i> 官	Affective states <i>chih</i> 志
WOOD	scaly (fishes)	sheep	wheat	inner door	spleen	muscles	eye	anger
FIRE	feathered (birds)	fowl	beans	hearth	lungs	pulse (blood)	tongue	joy
EARTH	naked (man)	ox	panicked millet	inner court	heart	flesh	mouth	desire
METAL	hairy (mammals)	dog	hemp	outer door	kidney	skin and hair	nose	sorrow
WATER	shell-covered (invertebrates)	pig	millet	well	liver	bones (marrow)	ear	fear

Elements <i>hsing</i> 行	Rulers <sup>b</sup> <i>ti</i> 帝	Yin-Yang 陰陽	Human psycho-physical functions <i>shih</i> 事	Styles of government <i>chéng</i> 政	Ministries <i>pu</i> 部	Colours <i>ssu</i> 色	Instruments <i>chhi</i> 器
WOOD	Yü the Great [Hsia]	Yin in Yang or lesser Yang	demeanour	relaxed	Agriculture	green	compasses
FIRE	Wán Wang [Chou]	Yang or greater Yang	vision	enlightened	War	red	weights & measures
EARTH	Huang Tí [pre-dyn.]	Equal balance	thought	careful	the Capital	yellow	plumbines
METAL	Thang the Victorious [Shang]	Yang in Yin or lesser Yin	speech	energetic	Justice	white	1-squares
WATER	Chhin Shih Huang Tí [Chhin]	Yin or greater Yin	hearing	quiet	Works	black	balances

Elements <i>hsing</i> 行	Musical notes <i>yin</i> 音	Hsiu <i>hsiu</i> 宿	Star-palaces <i>kung</i> 宮	Heavenly bodies <i>chhen</i> 辰	Planets <i>hsing</i> 星	Weather <i>chhi</i> 氣	States <i>kuo</i> 國
WOOD	<i>chio</i> 角	1-7	Azure Dragon	stars	Jupiter	wind	Chhi
FIRE	<i>chih</i> 徵	22-28	Vermilion Bird	sun	Mars	heat	Chhu
EARTH	<i>kung</i> 宮	—	Yellow Dragon	earth	Saturn	thunder	Chou
METAL	<i>shang</i> 商	15-21	White Tiger	<i>hsiu</i> constellations	Venus	cold	Chhin
WATER	<i>yü</i> 羽	8-14	Sombre Warrior	moon	Mercury	rain	Yen

Fig. 8: the “matrix” of the “five elements” or “five phases” (*wu xing* 五行).<sup>11</sup>

When analyzing the etymology of the word ‘*huangzhong* 黃鐘’ (“Yellow Bell”), one first gets the impression that it was an ancient Chinese musical instrument made of metal that represented supreme power (see fig. 9c). This meaning of the word can be supported by archaeological findings of musical instruments from this period: clay bells (see fig. 9a) from late Neolithic sites, respectively, bronze bells from earliest Chinese Bronze Age sites (see fig. 9b) – all still relatively small – from around 4000 years ago must raise our interest here.



Fig. 9a: clay bell, c. 2000 BCE.<sup>12</sup>



Fig. 9b: early bronze bell, c. 2000 BCE.<sup>13</sup>



Fig. 9c: bronze bell, c. 1000 BCE.<sup>14</sup>

<sup>11</sup> Image source: Joseph Needham. 1956. *Science and Civilisation in China*, vol. 2: *History of scientific thought*. Cambridge: Cambridge University Press, p. 262.

<sup>12</sup> Image source: <https://zhuanlan.zhihu.com/p/411952251>.

<sup>13</sup> Image source: <https://zhuanlan.zhihu.com/p/411952251>.

<sup>14</sup> Image source: <http://ny.zdline.cn/h5/article/detail.do?artId=87657>.

One fascinating discovery has been the tomb of a priest. It is 3800 years old and has been excavated in today's Henan province. Placed on the body of the priest, a wooden tablet was discovered. On this tablet, a dragon figure, which has been made out of more than 2300 pieces of turquoise, was found (see below, fig. 10).



Fig. 10: dragon figure made of more than 2300 pieces of turquoise upon discovery.<sup>15</sup>

These pieces can also be considered as “jade” in the, as mentioned further above, more general archaic sense of gems that were attributes of people in ruling positions. In the center of the dragon, a bronze bell had been attached. Archaeologists believe that this dragon shield was tied to the priest's arm when he was performing rituals, and that he held the bronze bell in his other hand and played it while dancing with the dragon shield (see below, fig. 11).



Fig. 11: dragon shield with bronze bell  
(as placed in the grave and as it has possibly been positioned while being in use).<sup>16</sup>

<sup>15</sup> Image source: <http://kgzg.cn/a/397497.html>.

In my own interpretation, however, I think that this dragon figure does not simply form an imaginary animal. I am convinced that it represents an ancient star constellation. In regard to ancient Chinese astronomy, we know a star constellation called the Dragon. It appears in the eastern sky in spring. Exactly on the day of the beginning of spring, the “horns” of this star constellation of the Dragon rise from the horizon. This has been the sign of the beginning of spring in ancient times already, and it has been very important for agriculture. On this day, rituals were also always performed for the sun and the ancestors. In the oldest songbook of the Chinese, in the *Shijing* 詩經, we find this sentence: “The Dragon flies, and the bell rings (tr. BP).”<sup>17</sup> I have overlaid the dragon figure on the dragon shield here with a traditional star map that shows the ancient constellations (see below, fig. 12). You can see that they largely overlap – and it is very compelling that the position of the bell is *exactly* where in regard to the ancient star constellation Dragon the star of the dragon’s “heart” is located!



Fig. 12: overlapping the dragon shield with the star constellation of the Dragon.<sup>18</sup>

<sup>16</sup> Image source: <https://www.history.sdu.edu.cn/lab/info/1027/2034.htm>.

<sup>17</sup> 《*Shijing* 詩經》, 《頌 [Odes of the temple and the altar]》, 《周頌 [Sacrificial odes of Zhou]》, 《臣工之什 [Decade Of Chen Gong]》, 《載見 [Zai Jian]》, 1: “龍旂陽陽、和鈴央央。” Cf. Ctext.org. Accessed on April 2, 2022. <https://ctext.org/book-of-poetry>. (I would like to add that the English translation of this passage by James Legge is outdated and wrong.)

<sup>18</sup> This is a collage by me. The star map in the background is from: <https://baijiahao.baidu.com/s?id=1663261321801940751&wfr=spider&for=pc>.

Numerous bronze bells of later Chinese dynasties, respectively, later historical periods have been unearthed – mostly in the tombs of nobles as burial objects (see below, fig. 13). Single bells and whole sets of bells were found. In many cases, depending on the type and style of the bell and the inscriptions on the bell, the status of the buried person could be determined.

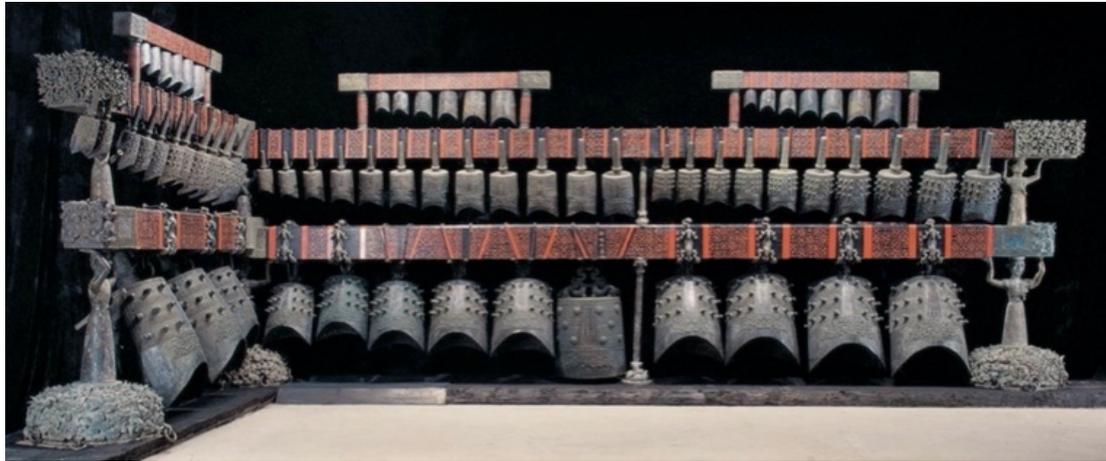


Fig. 13: *bianzhong* 變種-chimes, c. 433 BCE.<sup>19</sup>

By keeping these contexts or backgrounds in the back of our heads, we must now take a turn that will open up a new horizon of meaning of the word ‘*huangzhong* 黃鐘’ (“Yellow Bell”). Actually, this term is a major concept in Chinese *music theory*. The term ‘*huangzhong* 黃鐘’ does not refer to a material bell in the first place. It carries the abstract principal meaning of the tuning tone of the tonal system. *Huangzhong* 黃鐘 is considered as the original tone from which all other tones originate.<sup>20</sup>

You may be familiar with the ancient Greek legend of Pythagoras, who passed by a forge and discovered the mathematical laws of intervals while listening to the hammering sounds. There is a comparable legend in China. It has been passed down in the book *Guanzi* 管子, a work bearing the name of an ancient Chinese philosopher, who is said to have lived approximately at the same time as Pythagoras. The story goes as follows: the mythological and sacred Yellow Emperor (Huangdi 皇帝) is said to have ordered his music master Ling Lun 伶倫 to go westwards in search of true music. Ling Lun then found a perfect piece of bamboo in the bamboo forest of Mount Kunlun. It was 3 *cun* and 9 *fen* long. A *cun* is an ancient measure for length. It is approximately 3 cm long. So, we might say it is an ancient Chinese version of an “inch”. Ling Lun blew into this hollow bamboo cane, and it made a pleasant sound. He is said to have it

<sup>19</sup> Image source: <https://movie.douban.com/review/9082847/>.

<sup>20</sup> Cf. the detailed analysis in my German doctoral dissertation Bei Peng, 2019. *Musik als Harmonie von Himmel und Erde – Zhu Zaiyu (1536-1611) und seine Musiktheorie* [Music as the Harmony of Heaven and Earth – Zhu Zaiyu (1536-1611) and His Music Theory]. Universität Heidelberg. <https://archiv.ub.uni-heidelberg.de/volltextserver/26815/>.

called ‘Yellow Bell’ (*huangzhong* 黃鐘) then! Based on its length, he found the remaining eleven tones, and he got a twelve-tone series. What we see here is that the Ling Lun-legend contains several key ideas: First, the Yellow Bell *is represented by the material object of a pitch pipe, and not by a bell originally*. Secondly, the length of the pipe and therefore also the “tone-length” are absolute. Thirdly, ‘*huangzhong* 黃鐘’ is the name of the basic note or key of a twelve-note system.

On the right side (fig. 14), we see twelve bamboo pipes. They were found in the famous tomb of Mawangdui, and they are about 2200 years old. The longest pipe has the two characters ‘*huangzhong* 黃鐘’ (“Yellow Bell”) written on it.



Fig. 14: bamboo pipes, first third of the 2<sup>nd</sup> century BCE<sup>21</sup>

At this point, two central questions have to be mentioned which are at the core of the whole history of Chinese music theory: (1) How is the absolute length of a *huangzhong* 黃鐘 pipe to be determined? (2) How can the length of the *huangzhong* pipe be calculated so that a scale results whose 13th step is exactly an octave of the *huangzhong*? The earliest discussion of these questions is found in the 4th century BCE book *Guanzi* 管子, which summarizes various schools of thought of that period. In this work, the Yellow Bell-pipe is related to the number 81 – *but without providing a measure unit*. The book *Guanzi* only talks about the method, that is, the “Law of Adding or Taking Away a Third”, but it is not providing the foundation itself, that is, the concrete measures which would be the basis to perform this method. In short, based on the length of the (pipe of the) Yellow Bell, one third of the length must always be subtracted or a third of the pipe length resulting from the subtraction must be added to this pipe length resulting from the subtraction of one third of the former length and so on to obtain the rest of all the tones. In fact, this adds up to a spiral of fifths. The following table and illustration explain this method:

Calculation method:	Calculation method:	Calculation result:
Original length	<b>81</b>	<b>81</b>
Add 1/3	<b><math>81 \times 4/3</math></b>	<b>108</b>
Add 1/3	<b><math>108 \times 2/3</math></b>	<b>72</b>
Remove 1/3	<b><math>72 \times 4/3</math></b>	<b>96</b>
Remove 1/3	<b><math>96 \times 2/3</math></b>	<b>64</b>

Tab. 1: the “Law of Adding or Taking Away a Third”.

<sup>21</sup> Image source: <https://baike.baidu.com/item/中国古代律学/10213221>

This method has been the dominant method for calculating tone systems in ancient China, and it was used for thousands of years. But it consists of one imperfection – namely *the inability to produce a pure octave*. During the eighteenth century, the Jesuit China missionary Joseph-Marie Amiot (1718-1793), who had studied Chinese music theory, referred to this method as *la Progression Triple*.<sup>22</sup> You should note that the number Three plays a very important role here. In the ancient mythology of numbers, the number three represents the basis for all the changes in the world. Chapter 42 of the ancient classic *Daodejing* 道德經 says that “*Dao* 道 gives rise to the One, the One brings forth the Two, the Two gives birth to Three and from the number Three the ten thousand things [that is, all things BP] emerge.”<sup>23</sup> The ancient Chinese believed that all things are built on the principle of this number Three.

But how is the number Eighty-one related to the “Yellow Bell”? Can we still know how long the tuning pipe for this basic tone must have been? To find a way forward, it is worth noting that in ancient Chinese civilization, everything revolved around *agriculture*. Therefore, it is not surprising that the most common but also most important organic substance, grain, was used as the basic unit. The most common practice was to arrange millet pieces of a particular similar size in rows, as shown in the 1606 book *Yuelu Quanshu* 樂律全書 on Chinese music theory by Zhu Zaiyu (朱載堉, 1536-1611). Eighty-one grains of millet were arranged to determine the length of the *huangzhong* 黃鐘 -pipe. From this, Zhu Zaiyu obtained a length of 25,6 cm for the geometric equivalent measure of the Yellow Bell (see below, fig. 15).

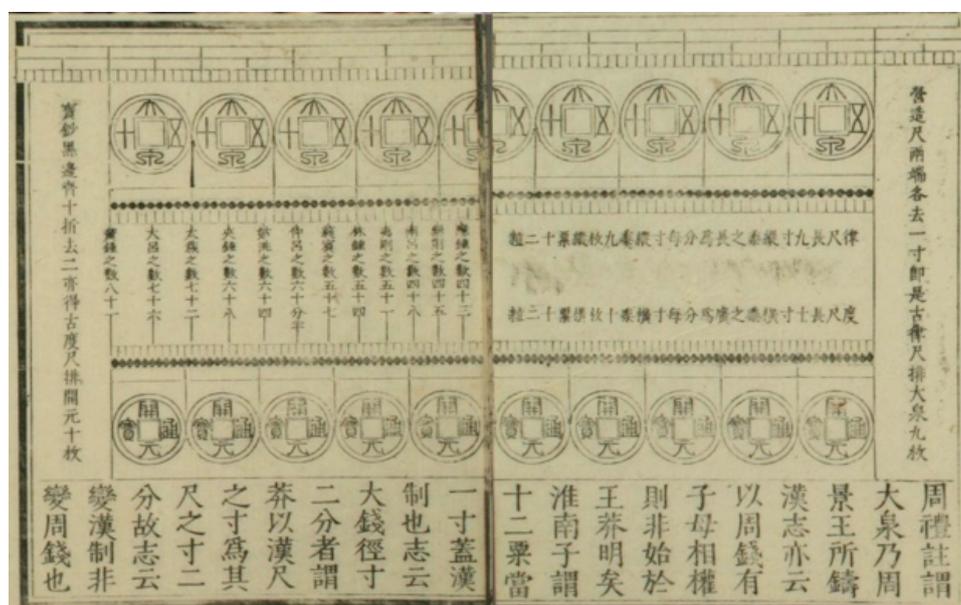


Fig. 15: 81 pieces of grain define the length of *huangzhong* 黃鐘.<sup>24</sup>

<sup>22</sup> Cf. Bei Peng. 2019. *Musik als Harmonie von Himmel und Erde*, op. cit., pp. 70-71 and 77.

<sup>23</sup> 《*Daodejing* 道德經》, ch. 42: “道生一，一生二，二生三，三生萬物。” Cf. Ctext.org. Accessed on April 6, 2022. <https://ctext.org/dao-de-jing>. (“Things” as kind of individual processes.)

<sup>24</sup> Image source: 朱載堉. 1606. *樂律全書* (鄭藩本) [*Yuelü Quanshu* (Zhengfanben)], 律呂精

Like the changing tuning pitch of European musical history, the “Yellow Bells” of Chinese music history have also been in constant developmental and transformative “flux”, so to speak. In the following table (see tab. 2), the changes of the linear measures of the Yellow Bell-tones are listed for a period of 144 years during Song-Dynasty (960-1276). Although this might be taken as a most extreme case, I am referring to it to illustrate the general problem here. Especially also when a new dynasty was established, the rules of the previous dynasty were broken, and therefore the linear measure of the Yellow Bell then has always been changed as well.

Year	Frequency (in Hertz)	Tone	Basic Unit
960	379,5	~ fis <sup>1+</sup>	Ancient <i>huangzhong</i> -ruler
966	365,2	~ fis <sup>1-</sup>	Ancient ruler
1035	286,8	~ dis <sup>1-</sup>	Aligning grains
1050	359,3	~ fis <sup>1-</sup>	Aligning grains
1080	341,9	~ f <sup>1-</sup>	Human voice
1088	272,2	~ Cis <sup>1</sup>	Aligning grains
1104	298,7	~ d <sup>1+</sup>	Length of the emperor's finger

Tab. 2: the change in the ratio of the Yellow Bell from 960 to 1104

Why has the length of the Yellow Bell been so closely associated with politics? This is mainly because the Yellow Bell had not only been thought of as a basic tone or a standard tuning device for musical instruments. It has also *served as the basic unit of length* in ancient Chinese measurement systems! One can say that the Yellow Bell-ruler, which respectively represented the length of the pipe of the standard pitch *huangzhong* 黃鐘, actually meant a standard measure in a geometric sense as well – just like the Prime Meter is for us today. Furthermore, the *huangzhong* (“Yellow Bell”) is an important foundation for measuring standards of (spacial)

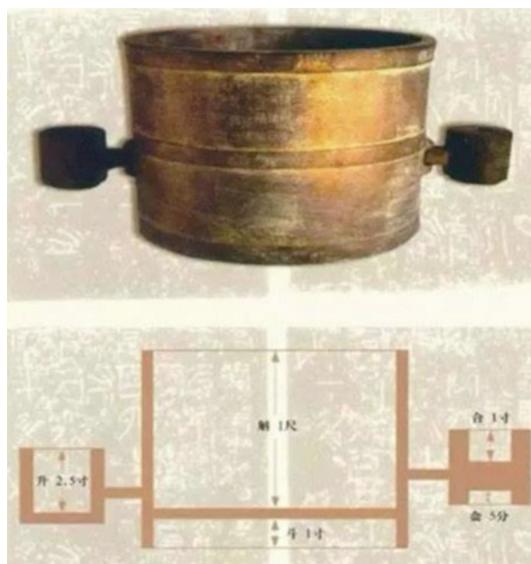


Fig. 16: measuring device for volume, based on *huangzhong*, 9 CE<sup>25</sup>

義 (Lülü Jingyi), 第六冊.

<sup>25</sup> Image source: <https://page.om.qq.com/page/OxJp1yvMjqGk2Ge3gD1U9P9A0>.

volume. A famous measuring device from the year 9 CE (see on the right, fig. 16) is made of bronze and is divided into three parts. Each part consists of the same length as the respective contemporary Yellow Bell-tube, or either 1/10, 1/4, or 1/20 of its length. It was used as an *official imperial measuring standard device*, namely to be able to measure the volume of an object based on an absolute standard which was used uniformly throughout the empire.



Fig. 17: measuring device for volume, based on *huangzhong*, 18<sup>th</sup> cent. CE<sup>26</sup>

Put simply: the length of the Yellow Bell *musical* pipe determined the economic measuring units of the whole country! It was the basis for the political decisions, which therefore also had a foundation in music theory. As such, it also became the primary concern of every dynasty. In turn, each dynasty wanted to use the length of the Yellow Bell pipe in accordance with its own general “cultural orientation” and therefore always chose to revise it, especially to show that they were in charge of defining this most basic measure.

It is no wonder that there is also a very complex connection in the relationship between the Yellow Bell-number Eighty-one and pre-modern calendrics in China. The music theorists were mathematicians and also astronomers at the same time. They were always constantly trying to construct a perfect calendar, using the number 81 as the basic number. This is also inseparable from the *Yijing* 易經 (*Book of Changes*) and the philosophical idea of the “unity of heaven and man” (*tianrenheyi* 天人合一). One of the leading scholars in traditional Chinese music theory, the aforementioned Zhu Zaiyu, has established the “Yellow Bell Calendar.”<sup>27</sup>

Finally, I would like to give another brief introduction to the use of the Yellow Bell in ritual music. As mentioned above, music, calendars and politics were very closely related in ancient China. For this reason, the particular music and the time of performance for the rituals at the ancient court were very carefully chosen, because it was believed that only the correctness and “attunement” of music, time, and related rituals would make the ritual prayers effective. Therefore, each month corresponded to a particular musical scale. In some dynasties, the Yellow Bell corresponded to the month in which the winter solstice occurs, that is, the eleventh month of the lunar calendar. In other dynasties it corresponded to the first month of spring of the lunar calendar.

<sup>26</sup> Image source: <http://www.bilibili.com/read/cv372347>

<sup>27</sup> This topic that cannot be followed here. I hope to be able to present my thoughts and results of research in this regard on another occasion.

Regarding the rituals performed at this time, the music therefore had to be played in a scale in which the Yellow Bell clearly was the dominant tone. The next month's ritual then required the music to be transposed.

This tradition of musical state rituals was abandoned at the end of Qing dynasty in the early 20th century (due to the erosion of the pre-modern Chinese state system at the time). In recent years, there have been a few more attempts by scholars to reconstruct and even to revive this tradition. I have founded a student orchestra at the Zhuhai campus of Beijing Normal University to try to establish the reintroduction and the performance of traditional or pre-modern ritual music. I think that this tradition should be remembered by practicing it, because it is a central aspect of our Chinese intangible cultural heritage. But my current students are not music majors, just music lovers, and we were not able to replicate the large instruments which were used for the rituals originally. We have to use instruments that the students can already play. However, we are using a 17th century score that I have reinterpreted. I hope to provide the next generations of students with as much of a taste of traditional Chinese musical culture as possible.

In conclusion, one can say that the concept of the Yellow Bell is one of the most central concepts in traditional Chinese music theory. However, research into the topic of *huangzhong* 黃鐘 should not be the task of musicology alone. *It is to be considered from an interdisciplinary perspective.* We have seen that the history of its conceptual development is to be studied from linguistic angles; its philosophical background in ancient natural philosophical perspectives and in Confucian and Taoist ethics must be analyzed; and archeological results and interpretations have to be consulted to complete the picture and to avoid false interpretations. At the same time, from the point of view of the history of science, it is possible to calculate the sound and the measures for the pitch pipes of the Yellow Bell-tones of different epochs.<sup>28</sup> In all these approaches, however, the Yellow Bell must not be considered as an isolated sound, but must be seen in the context of the tonal system, and still very importantly, with special consideration of the educational significance of such music in pre-modern Chinese society.

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<sup>28</sup> Cf. also Bei Peng. 2019. *Musik als Harmonie von Himmel und Erde*, op. cit., p. 53.