Mirrors have a long history in both Western and Asian cultures. In the East, besides their standard uses, mirrors have been associated with special or ‘magical’ powers. Several early Chinese texts present accounts of mirrors that were capable of a particular medical capability – seeing the internal organs of the human body. How should we read such accounts? The Chinese work known as the Xijing Zaji (‘Miscellaneous Records of the Western Capital’), dating from around C.E. 500, provides one such account. What is particularly interesting is that this and other texts on these strange mirrors include not just ‘fantastical’ language, but also what appear to be technical descriptions. The explanation may be found in the Chinese art of ‘magic mirrors’, with their technologically sophisticated design involving dual reflecting surfaces.

Mirrors appear throughout human history in many forms. These pieces of polished metal or metal and glass have been used for everything from magic rituals to scientific investigations. Passages discussing mirrors are found in early Chinese, Indian, Roman, Greek and many other sources. The word ‘mirror’ itself has an interesting history; it first appears in English in the early thirteenth century, coming from the Old French term *mireor*. This term, in turn, came from the Latin verb *mirari*, meaning ‘to wonder at, admire’.

Already in Latin, the words for the common mirror and for something special or magical were intertwined: *speculum* was the general term for a mirror, while *speculatio* had a broad range of meanings from ‘watching’ to ‘contemplation’. In Greek, the term for mirror was κατοπτρο; in the seventeenth century, there appeared in English the term ‘catoptromancy’ – meaning divination by means of a mirror.¹

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Mirrors, then, are intimately connected with the idea of seeing or perceiving – but also unmasking and revealing. That revelation might be of the future or other hidden matters. Indeed, one early Chinese text speaks of a mirror with a particularly peculiar power to unmask. But before I present that text, I note an entry in a Chinese work entitled *Kaiyuan Tianbao Yishi* (‘Anecdotes of the Kaiyuan and Tianbao Periods’) by Wang Renyu, who was active in the first part of the tenth century. The entry is entitled *zhao bing jing* – literally, ‘illuminating [zhao] illness [bing] mirror [jing]’:

**A Mirror to Illuminate Illness**

Ye Fashan had an iron mirror that could reflect objects in the same manner as water. Whenever a person had an illness, the mirror could be used to illuminate and see completely any obstructions in his internal organs. Then, using medicines, he would be treated until he recovered.2

A puzzling and rather ambiguous description: the mirror is described as reflecting in the same manner as water, yet we are told in the next line that mirror was able to do more than reflect – it could also reveal what was inside a person’s body.3 Certainly, the Chinese spoke of mirrors in a fantastical way – capable of ‘miraculous deeds’4 – but the passages here provide a somewhat more ‘technical’ description.

Another brief mention, similar to the one above, is found in a work known as the *Gujing Ji* (‘Record of an Ancient Mirror’), dating from Tang dynasty (C.E. 618 - 907).5 In a story there, we read of a monk saying the following concerning a special mirror: ‘... to illuminate and see the *fu* and *zang* [organs]*, unfortunately, there was not the necessary medication. ...’ The implication is that this medication or special substance is to be used in conjunction with the mirror. As with many of these references, very little detail is provided, although it is sufficient to see that the actual use of the mirror described is quite pragmatic. What to make of such descriptions? In this paper, I will look at some accounts of these peculiar devices and suggest that they derive from a simple but subtle illusion. That illusion was produced through mirror technology developed by the Chinese centuries ago.

The *Kaiyuan Tianbao Yishi* has been described as an ‘informal’ text, ‘comprised of very short and titled anecdotes in no apparent order’, moreover, the author does not cite sources for these entries.6 What we do know is that Ye Fashan (d. C.E. 720) was a so-called ‘Daoist’ master who lived during the

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1. This refers to the system of internal organs in traditional Chinese medicine, where certain organs are classed as *yang* and others as *yin*. The *fu* are *yang* organs, and comprise the large intestine, small intestine, stomach, gall bladder, urinary bladder, and the ‘triple-warmer’ (the openings of the stomach, small intestine, and the bladder). The *zang* are *yin* organs, and comprise the heart, liver, spleen, lung, and kidneys. On this classification, see Daniel P. Reid, *Chinese Herbal Medicine* (Boston: Shambhala, 1987), 32.
Tang dynasty. Such masters were often said to have special powers, but here we see something more than fanciful magic: there is the explicit mention of a physical implement; i.e., the mirror, an element that makes the text seem more than a bit of whimsy.

The main account of a special mirror of this kind appears in another Chinese text, the *Xijing Zaji* ('Miscellaneous Records of the Western Capital'), another collection of anecdotes, of uncertain authorship and dating from around C.E. 500 (figure 1). The description here is more detailed, and begins with a discussion of other curious mechanical devices:

When Gaozu* first entered the palace at Xianyang, † he toured the treasury storehouse, which was filled with unfathomable amounts of gold, jade, and other precious treasures. They were beyond description, and particularly surprising were five green columns seven chi five cun in height,‡ made of jade, [supporting] a lamp. Below them, there was a coiled hornless dragon§ holding a lamp in its mouth. When the lamp was lit, the scales [of the dragon] all moved and shone like stars, lighting up the whole room.

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* Emperor Gaozu (256 B.C.E. - 195 B.C.E.) was the first emperor of the Han Dynasty. He was one of the leaders of an insurrection in the late Qin Dynasty. Although this has been characterised as comprising ‘peasant uprisings’, one author argues that instead it was a true rebellion left by ‘men eager ... to establish new socio-political identities for themselves’. See, J.L. Dull, ‘Anti-Qin Rebels: No Peasant Leaders Here’, *Modern China*, 9:3 (July 1983): 315, 285–318.

† This was the royal palace of the state of Qin, at Xianyang, the capital; when Qin Shihuang unified China, it became his palace.

‡ These are traditional Chinese units of measurement; one chi equals approximately one-third of a meter, and one cun equals approximately one-thirtieth of a meter, but the precise definitions of these units has varied during the course of Chinese history. See K. Ruitenbeek, *Carpentry and Building in Late Imperial China: A Study of the Fifteenth-Century Carpenter’s Manual* Lu Ban Jing (Leiden, 1996), 1.

§ This is a typical Chinese decorative element.
There were also twelve seated figures made of cast bronze. They were all the same height, three \( ch_i \), and were seated on bamboo mats, playing the \( qin \), \( zhu \), \( sheng \), etc.\(^*\) All [the figures] were decorated with multi-coloured designs. They almost looked like real people. Underneath the bamboo mats, there were two bronze pipes, the top openings of which were several \( ch_i \) in height beyond the mats.\(^\dagger\) One of the pipes was empty, and inside the other there was a rope as thick as a finger. If one blew into the empty pipe while another person twisted the rope, all the instruments started playing, and [the effect] was no different from real music.

There were also lutes, six \( ch_i \) in length, with thirteen strings and twenty-six frets; each was completely decorated with the seven treasures\(^\ddagger\) and an inscription that read ‘music of precious jade’.

There [also] was a wind instrument of jade, two \( ch_i \) three \( cun \) in length, with twenty-six holes. When it was played, one would see vehicles, horses, and mountain forests, one right after another.\(^\S\) When one ceased playing [the instrument], one stopped seeing these images. [This instrument] was inscribed ‘jade tube of brightness and beauty’.

The text then turns to another device in the storehouse, a large mirror:

There was [also] a rectangular mirror, four \( ch_i \) wide and five \( ch_i \) nine \( cun \) high. The outside and inside [of the mirror] were luminous. If one were coming directly to face the mirror, then their image would be reversed. If one touched one’s heart with the hand, and approached the mirror, then the colon, stomach, and the five \( zang \) were clearly visible [in the mirror]. If one had an internal illness, and covered their heart and faced the mirror, then the location of the illness would be known. And if a woman who had an evil heart was facing the mirror, her gall would swell and her heart would palpitate. Qin Shihuang\(^#\) often used [the mirror] to check his

\(^*\) The \( qin \) is a Chinese instrument similar to a zither, the \( zhu \) is another type of Chinese stringed instrument, and the \( sheng \) is a kind of panpipe.

\(^\dagger\) The description here is not particularly clear; Joseph Needham translates this line as follows: ‘Under the mat there two bronze tubes, the upper opening of which was several feet high and protruded beyond the end of the mat.’ See, J. Needham, *Science and Civilisation in China*, vol. 4 (Cambridge, 1971), 158.

\(^\ddagger\) The ‘seven treasures’ refer to gold, silver, lapis lazuli, crystal, coral, agate, and pearl.

\(^\S\) The meaning here is not entirely clear; the phrase ‘one would see vehicles, horses, and mountain forests’ may mean that one would see images of these when playing the jade wind instrument, but even that interpretation leaves a number of questions. Perhaps some kind of ‘magic lantern’ device is being referred to.

\(^#\) Emperor Qin Shihuang (259 B.C.E.–210 B.C.E.) is perhaps most famous today for the Great Wall and the terracotta warriors of his mausoleum. He was born as Ying Zheng in 259 B.C.E., and was the son of the king of the State of Qin. Ying Zheng’s ambition was to subjugate and then unify the other states such as Han, Zhao, Wei, Chu, Yan and Qi. He realised this goal by 221 B.C.E., building the first centrally-governed empire in Chinese history, and commencing what is now called the Qin Dynasty.
concubines. If their galls swelled and hearts were agitated, he had them executed. Knowing this, Gaozu had [the storehouse] closed and waited for Xiang Yu,* who took it all [i.e., the contents of the storehouse] eastward. Afterwards, [its] whereabouts were unknown.10

In this text, it is interesting to see how the discussion of the mirror with special powers is part of a larger discussion of mechanical devices or automata. This makes the story seem less fantastic, although still quite peculiar.

Here again, the zang comprise the heart, liver, spleen, lung, and kidneys. However, one modern commentator has noted that ‘the zang and fu weren’t anatomically conceived’ in early Chinese medicine but were understood in a more ‘functional’ sense.11 However, this does not mean that we should interpret the description above as not referring to actual human anatomy. The early and well-known Chinese medical work Huangdi Neijing (‘The Yellow Emperor’s Classic of Internal Medicine’) includes ‘descriptions of the [human] body ... largely based on dissections’.12

The passage above also notes the use of the mirror by the emperor ‘to check his servants’, to see if ‘their galls swelled’. At first, this might seem rather strange; however, a Tang dynasty mirror, currently at the Cleveland Museum of Art, bears an inscription noting that it can reveal a person’s gall, and, by extension, reveal their emotions.13 In traditional Chinese medicine, the gall bladder is an organ with a key role in determining a person’s initiative and resolve.14

But what is it exactly that makes for the peculiar nature of the account? Some of the other devices described – the seated figures and the musical instruments – fit with our contemporary notion of mechanical possibilities for a pre-modern civilisation. It is the other devices in the text that defy easy historical placement or explanation; in particular, there is the strange ‘wind instrument of jade’ which allows the player to see ‘vehicles, horses, and mountain forests, one after another’ and hear ‘the hidden rumble of the vehicles’ – and, of course, the rectangular mirror which could reveal the internal organs.†

A similar account, perhaps deriving from this one, is found in a ninth-century C.E. work, the Youyang Zazu (‘Miscellaneous Morsels from Youyang’) by Duan Chengshi. In this account, the mirror is also described as being large in size and able to display the five viscera.15 This text also notes

* Xiang Yu (232 - 202 B.C.E.) was a famous military leader and a leader of the coalition against the Qin (Dull, ‘Anti-Qin Rebels’, 307ff). Gaozu – at that time known as Liu Bang – was a member of this coalition, but he and Xiang Yu subsequently became enemies. In 202 B.C.E., Gaozu, as emperor, defeated Xiang Yu; for a brief summary of this conflict, see M. Bennett, The Hutchinson Dictionary of Ancient & Medieval Warfare (Chicago: Fitzroy Dearborn, 1998), 139.
† It is vaguely possible that the device described there that allows one to see ‘vehicles, horses, and mountain forests, one after another’ was a kind of magic lantern or early form of zoetrope.
that this mirror was known as the *zhao gu bao*; i.e., the ‘treasure [bao] that illuminates [zhao] the bones [gu]’.

How should we read these texts? We could read them as pure fiction, fabrications of the author or his source; but we see that these texts, particularly the *Xijing Zaji* with its context of mechanical devices, have details that go beyond the framework of a simple, fanciful tale. We know that the Chinese had standard hand mirrors of polished metal, similar in design to those of the Greeks and Romans.\(^{16}\) Research into this field has been quite extensive, with examinations of mirrors carried out by a number of sinologists in the nineteenth and twentieth centuries. Friedrich Hirth, who compiled an extensive study and bibliography on the subject, notes that the invention of mirrors in China was attributed to the legendary Emperor Huang Di.\(^{17}\)

Even before the Han dynasty, there were already established terms used to refer to mirrors: *jian* or *jing*. At the beginning of this paper, I noted that in the West, terms for mirrors included broader meanings, such that *speculatio*, for example, had the definition of ‘contemplation’. In Chinese, *jian* also includes the more metaphorical meaning of ‘reflect’ and is even found in book titles such as *Zizhi Tongjian*, translated as ‘A Comprehensive Mirror for the Aid of Government’, a historical work written by an eleventh-century Chinese historian.\(^{18}\)

More pragmatically, both Chinese terms for mirror include the radical *jin*, here meaning ‘metal’. Chinese metallurgy in the crafting of mirrors developed over a long period of time, but, with very sophisticated casting techniques already in evidence by the fourth-century B.C.E., Chinese mirrors were made of bronze, and bronze is an alloy of copper, tin and lead; the alloy may be gold or silver in appearance, depending on the ratio of tin in the mixture (figure 2). When polished, bronze is highly reflective, and it was used in many cultures for the creation of mirrored surfaces for various purposes before the development of glass mirrors.\(^{19}\)

In China, bronze mirrors came into wide circulation by the time of the Warring States period (roughly from the fifth-century B.C.E. to the third-century B.C.E.).\(^{20}\) These mirrors often had auspicious designs on the back, and sometimes had inscriptions as well.\(^{21}\) Hirth notes that mirrors were said

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**Figure 2.** A traditional Chinese bronze mirror. From A.G. Wenley, ‘A Chinese Sui Dynasty Mirror’, *Artibus Asiae* 25.2–3 (1962): 143, fig. 1.
by the Chinese to have a number of magical powers, including the ability to ward off evil spirits.22

But the texts I examine here describe mirrors that are not simply for reflection – nor are they for magical or shamanistic practices. In the Kaiyuan Tianbao Yishi account, we have a mirror that had the ability, the text tells us, to ‘illuminate’ the inside of a patient’s body. The language is strange to us, because we think of mirrors simply as objects that show us a reflective image, not a penetrating one.

The two Chinese texts that talk about these mirrors with penetrating abilities give very specific details, and again we should ask the question: if the account is a complete fabrication, why the specificity of detail? One of the particular details is the fact that the mirror is rectangular, rather than disk-shaped, the latter being much more common – Hirth notes that almost ‘all the Chinese metallic mirrors we know of are disk-shaped …’23 However, he goes on to comment:

Very large mirrors, a number of feet long and broad, probably rectangular in shape, and reflecting the whole human body, are also mentioned in the post-Christian literature, some of them being imported from abroad. Several passages are on record which tell of the importation of such mirrors under the Emperor Wu-ti, who hoarded up many precious things he had sent for from western Asia; but they are mostly blended with legendary matter, which makes it difficult to treat them seriously. Such large metallic mirrors, aside from the possibility of their having been originally constructed in China itself, could easily be accounted for as importations, or imitations, of Western specimens, certainly during the first century C.E., when Seneca the Younger mentioned mirrors of sizes equal to those of human bodies.24

However, Western accounts of mirrors – which include discussions by Seneca the Younger, Pliny the Elder, Pausanias and others – do not attribute to them any penetrative powers. These sources have discussions of various kinds of ‘trick’ mirrors – for example, convex and concave mirrors – that can distort reflections, but nothing exactly as we have in our two Chinese texts here.25

It seems as if the authors of these Chinese texts are struggling to explain some kind of mechanical device, but with their language not being sufficient to the task. This does not mean that the Chinese language itself is to blame, and in fact the belief that Chinese is somehow inherently unable to communicate scientific and technological concepts has been roundly refuted.26 However, the authors of the Chinese texts under examination here were not technical experts; they were chroniclers and collectors of anecdotal information, and they did not have the ‘language’ – in the more abstract sense of that
word – to describe fully the matter at hand. It would be as if we had a contemporary English-speaking poet or historian who lacked any technical knowledge try and describe a new invention or device.

The word ‘mirror’ – and that is the precise term used in these Chinese texts – might be metaphorical, standing in for some other metallic or glass-like material or a contraption utilising such material. Even in our contemporary technological age, we often use metaphorical language to describe mechanical devices: a space ‘ship’, a ‘computer’ (although it does much more than simply compute), and so on. The term ‘horseless carriage’ was used to refer to automobiles in the beginning of the twentieth century, as a way of explaining a new technology by using existing language.

We cannot rush to assume from these ancient texts an unreasonable technological knowledge on the part of the early Chinese, either. However, there may be a few scattered clues in the history of Chinese mirrors to help us interpret these peculiar texts, with two primary elements worth considering. The first is the connection between medicine and mirrors, notable because both our texts have mirrors serving a medical function; the second is the existence in Chinese history of so-called ‘magic mirrors’. Hirth points out several accounts where mirrors were used to prevent or cure sickness, with the methods never sufficiently articulated – at least from a modern perspective – by the Chinese authors.

Our texts here are somewhat more explicit, in that they at least explain specifically what these mirrors were said to do: reveal the organs of the human body. Despite evidence for a number of uses of mirrors in ancient Chinese sources – including simple reflection, light intensification, rituals, and keeping away evil spirits – the precise medical utilisation of mirrors recounted in the Kaiyuan Tianbao Yishi and the Xijing Zaji does not seem to appear in any other accounts in Chinese texts. Nor do we find any similar account in Western texts.

What we do find in early Chinese is an odd miscellany of medical uses for mirrors, even including bits of them being ground up and consumed orally as a prescription. We also find what one writer calls ‘mirror lore’, particularly in the Six Dynasties period, which ran from the early third century to the late sixth century. This ‘lore’ involved a number of different kinds of mirrors with special powers: the zhaoyao jing (‘Mirror that Reveals Demons’), the zhaogu jing (‘Mirror that Reveals Bones’), the wuji jing (‘No Illness Mirror’), the zhishi jing (‘Mirror that Knows [Future] Matters’), and the jianshen jing (‘Mirror that Sees the Spirits’).

In some sense, then, these strange ‘X-ray’ mirrors are part of a larger cultural context. At the same time, the Chinese certainly had an understanding of mirrors in technical terms – that is, the principles of reflection, inversion and so on. But those technical discussions of mirrors that we find in
Chinese texts do not appear to match the odd accounts we see here in the *Kaiyuan Tianbao Yishi* and the *Xijing Zaji*.

In another Chinese source, we again find the idea of using a device of some kind to be able to see *inside* a body. This time, the item in question is not a mirror, and the description and context are less technical. The late ninth-century collection of anecdotes *Duyang Zabian* (*Compilation of Miscellanea from Duyang*) by the scholar Su É includes the mention of a huge, shining rock from a country called *Rilin* – apparently, Japan. This rock revealed the internal organs of a person, aiding the work of a physician in healing them.³³ The text also includes some very peculiar descriptions:

In the *Dali* period*, the *Rilin* country sent as presents luminous beans and dragon-horn hairpins. This country lies forty thousand *li* northeast across the sea.† In the southwest of the country, there is a strange rock several hundred *li* square, luminous and clear; it can reflect a person’s five ‘solid’ organs and six ‘hollow’ organs.‡ It is designated the ‘Mirror of the Immortals’§. If a person in this country has an illness, then [the rock] is used to illuminate his body, so as to discover [the problem] in a particular organ. Then, *shen cao*# is taken, and the person without exception is healed. The size of the beans resembles that of the Chinese green bean, [but] the colour is a dark red. Moreover, their rays [i.e., the rays of light that they emit] can reach several *chi* in length.³⁴

Apparently, the story of this interesting rock was in circulation earlier; it also is found in almost identical form in the early sixth-century *Shu Yi Ji* (*Record of Strange Things*) by Ren Fang, and that seems to have been Su É’s source.³⁵ Again, despite the strangeness of the story, the word used here for mirror is simply the technical term *jing*.

At this point, it may be useful to provide a brief comment on the connections between these Chinese mirrors that are said to be able penetrate the body and the more general idea in early Chinese medicine of seeing inside the body to make a diagnosis and a prognosis, and to heal. One author has noted that, especially in terms of dissection (although it was carried out), ‘anatomy in China never gained dominance as a way of understanding the

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* This refers to a period from C.E. 766 to C.E. 779 during the Tang Dynasty.
† The value of the *li* varied through various periods of Chinese history, but it can be understood as approximately equivalent to half a kilometer here.
‡ This again refers to the system of organs as found in traditional Chinese medicine, based on the principle of *yin* and *yang*. The five ‘solid’ or *yin* organs are the heart, liver, spleen, lung, and kidneys, and the six ‘hollow’ or *yang* organs are the large intestine, small intestine, stomach, gall bladder, urinary bladder, and the ‘triple-warmer’ (the openings of the stomach, small intestine, and the bladder); see Reid, *Chinese Herbal Medicine*, 32.
§ The *xianren* are the Daoist immortals or transcendent beings of Chinese tradition.
# Literally ‘spirit herb’ — this is a traditional term for ginseng.
Nonetheless, the importance of what was going on inside the body in functional terms, certainly was discussed. One story recounts how the Chinese physician Bian Que warned Duke Huan about a ‘disease which lies in the blood vessels’, and eventually in the bone marrow. The story does not make clear how the physician knows this, but it clearly does discuss what one might term ‘levels’ of an illness, deeper and deeper in the body; Bian Que says to the sceptical Duke Huan – who subsequently dies, having delayed treatment too long – the following:

When a disease lies in the pores, it can be treated by poultices. When it lies in the blood vessels, it can be treated with needles. When it lies in the stomach and intestines, it can be treated with medicines. But when the disease lies in the bone marrow, not even the God of Life can do anything about it.

Even though a medical disorder might be internal, as deep as the viscera of the body, Chinese traditional medicine had (and still has) a method of ‘reading’ that disorder on the body’s surface, so to speak, through a complex series of pulse readings at the wrist. How does this relate to our stories here of penetrating mirrors? For Chinese physicians, a key question was how to ‘contemplate a body organised by depth’, the ‘levels’ or layers we saw in passage about Bian Que above. On the one hand, as one commentator puts it, ‘the skin is an occluding screen’ and blocks the diagnostician from understanding the underlying dysfunction. On the other hand, the skin could also reveal what was going on inside, as could the pulse. Chinese physicians used their ‘gaze’ (wang) to make diagnoses, with this ‘gaze’ not only including seeing per se, but also diagnosing through the colour or hue of the skin, smelling the patient’s body and so on. One scholar has noted that in early Chinese medicine, ‘it was sufficient to deduce the interior functioning of the body from signs observed externally’, with diagnosis and subsequent treatment ‘based [not only] on vision but also on other senses. …’

But the real coup, of course, would be the ability to see directly into the body, and perhaps the story of these penetrating mirrors arose in such a context. That is, the ‘pinnacle of medical acumen’ was wang er zhi; i.e., ‘to gaze and to know’. So, while the Chinese medical model clearly comprised levels or layers of the body, and external aspects could reveal those, what if there was a device that could allow the physician’s ‘gaze’ to enter the body unhindered?

In early Chinese medicine, a model of illness appeared that was based, in fact, on the concept of ‘dysfunctions within the systems of vessels’ and a ‘deeper physiological dysfunction’. Of course, this also suggests that the
A Revealing Reflection

physician would have desired the best possible methods of perceiving or revealing such an internal dysfunction.

It is interesting that we find an oblique connection here to another aspect of mirrors. Chinese medicine not only concerned the body itself and its functions, but the practice was also tightly connected with divination and physiognomy (a situation still found today in places such as Taiwan). This makes sense, given the framework of traditional medicine – ‘reading’ a person as part of a medical diagnosis – along with ‘reading’ a person by looking at their face, their astrological data and so on. Mirrors in the West were used for catoptromancy, as noted earlier; while the Chinese do not seem to have used the ‘medical mirrors’ in this way, they nonetheless connected other forms of divination, through such vehicles as the Yijing, to medicine. In a more general sense, too, the idea of ‘reading a face’ to reveal the personality within is not unlike the use of the mirror to reveal both the internal organs – and the inclinations – of one’s concubines!

A description concerning a rock with powers similar to the penetrating capacity of the Chinese mirrors is found in an account concerning Jivaka, the physician to the Buddha. Jivaka is reported to have come into the possession of a magic gem that – apparently like a modern fluoroscope – could light up the inside of a person’s body. We read that while traveling, Jivaka came upon

a man carrying a load of wood to the city, of whom nothing was left but skin and bone, and the whole of whose body was dropping sweat; he said to him, ‘O friend, how came you into such a plight?’ The man replied, ‘I know not. But I have got into this state since I began to carry this load.’ Jivaka carefully inspected the wood, and said, ‘Friend, will you sell this wood?’

‘Yes!’
‘For how much money?’
‘For five hundred Karshapanas.’

Jivaka bought the wood, and when he had examined it, he discovered the gem which brings all beings to belief. The virtue of the gem is of this kind: when it is placed before an invalid, it illuminates him as a lamp lights up all the objects in a house, and so reveals the nature of his malady.

When Jivaka had gradually made his way to the Udumbara land*, he found there a man who was measuring with a measure, and who, when he had finished measuring, inflicted a wound upon his head with the measure. When Jivaka saw this, he asked him why he behaved that way.

* Literally, ‘land of the fig’; it is not clear to what geographical location this term actually refers.
'My head itches greatly.'
'Come here and I will look at it.'

The man lay down and Jivaka examined his head. Then he laid on the man's head the gem which brings all beings to belief, and it immediately became manifest that there was a centipede inside. Thereupon Jivaka said, 'O man, there is a centipede inside your head.' The man touched Jivaka's feet and said, 'Cure me.' Jivaka promised to do so ... Next day Jivaka ... opened the skull with the proper instrument, touched the back of the centipede with the heated pincers, and then, when the centipede drew its arms and feet together, he seized it with the pincers and pulled it out.48

As with the Chinese account, this passage contains both fantastical elements – the magical gem – and more technical language; i.e., the description of the surgical procedure, not to mention the diagnostic function of the strange jewel. Another early South Asian tradition speaks of the bhaisajya raja tree – the name means ‘king of healing’ in Sanskrit. This tree was said to contain a gem with the ability to reveal the internal organs of a patient.49 However, just as with other accounts presented here, the precise nature of this ‘penetrating’ visual device is left unexplained.50

Similarly, the ninth century Zhou Qin Xing Ji (‘A Journey through Zhou and Qin’), includes a description of an ‘imperial-consort [who] is said to have worn a luminous jade ring which showed the bone of her finger’.51 In another Chinese story, there are no special gems or other such devices, but rather a certain drug, water or dew which allowed the physician named Bian Que, mentioned earlier, to see the ‘five viscera and the obstructions and knots of the abdomen’.52

Is there a possible explanation for this supposed ability of these early physicians to see inside the human body? Returning to our two original Chinese texts on mirrors, a possible hint might come from the so-called ‘magic mirrors’, mentioned above. ‘Magic mirrors’ were special mirrors created by Chinese craftsmen; these mirrors use various optical phenomena to cast images. The Japanese also created such mirrors, calling them makyo (literally, ‘demon mirrors’).53 A modern study of these rare devices notes that they ‘have the uncanny ability to project patterns from the back when light is shining on the front....’54

Typical ‘magic mirrors’ have cast bronze designs and sometimes written characters on the back (figure 3).55 The reflecting side is convex and made of highly polished bronze. In normal light, this kind of mirror reflects in the

* This may refer to a tumor (see B. Laufer, The Prehistory of Aviation (Chicago, 1928), 11) or to Echinococcus granulosus (a kind of tapeworm that can lodge in the brain); see R. M. Pujari, et al., Pride of India: A Glimpse into India's Scientific Heritage (New Delhi, 2006), 150.
A Revealing Reflection

typical manner. However, in bright light, one can actually see through the reflecting side. Therefore, these mirrors are able to reflect outwards from the polished side whatever designs and characters are on their back side (figure 4). In other words, these mirrors usually have two layers: the first is a lower reflecting surface bearing a design, while the second or upper layer is a polished, half-reflecting surface that also lets light through (figure 5). Because of such properties, these types of devices were called tou guang jian; i.e., ‘light-permeable mirrors’, by the Chinese.

Perhaps there is some connection here to the idea of mirrors as both reflecting devices and ‘penetrating’ devices. Indeed, the image cast by one of these ‘magic mirrors’ is eerily similar to an X-ray image. In the case of a Chinese ‘magic mirror’, of course, the mirror is simply casting its own image, and not that of the internal organs of a human body. Yet this still leaves us with a possible interpretation of the mirror described in the Kaiyuan Tianbao Yishi and the Xijing Zaji as some kind of trick device.

If we examine the brief description in the Kaiyuan Tianbao Yishi,
we note that the writer explicitly says that the mirror ‘could reflect objects in the same manner as water’. This indicates a mirror without any special characteristics. But the author adds: ‘Whenever a person had an illness, the mirror could be used to illuminate and see completely any obstructions in his internal organs.’ In the Xijing Zaji, the writer notes that if ‘one were coming directly to face the mirror, then one would see their image reversed’; this also seems to indicate a typical mirror. Again, though, there is an additional ability of this mirror: ‘If one touched one’s heart with the hand, and approached the mirror, then the colon, stomach, and the five organs were clearly visible [in the mirror].’

We might be able to explain these statements in the context of the well-known ‘magic mirrors’ described above. Imagine a large, rectangular version of the Chinese ‘magic mirror’. The top layer is the highly polished surface of a typical mirror. The hidden layer is a subtle relief rendering of the torso of a human body with the internal organs depicted. Again, the way such a ‘magic mirror’ works is that while the front appears as a smooth reflecting surface, when sunlight or other kind of bright light is reflected off that surface onto a wall, the design from the hidden layer appears.

Thus, our ‘medical mirror’ might have been placed in front of the patient, and then have had a strong light source projected at it (figure 6). An image would have been thrown to the wall – an image that would have appeared to be revealing the internal organs of the patient. In actuality, the image revealed would be that on the hidden layer of the mirror itself. Printed editions of the Huangdi Neijing – the early Chinese medical text mentioned above – include reproductions of early rough drawings of the various human

Figure 5. Diagram indicating the reflection of a hidden design in a ‘magic mirror’. The upper layer here reflects light normally from its surface (see upper arrows). But it also allows light through, particularly if that light is striking the upper layer in at a certain angle or if light is of certain intensity (see lower arrows); this light goes through the upper layer of the mirror, strikes the design on the lower layer, and is reflected back up through the upper layer.
organs, and the image cast on the wall may have looked something like those figures. Here, in figure 6, we have used one of those images of the organs from the *Huangdi Neijing* as the image reflected from the mirror and cast on the wall. The Chinese emperor’s mirror – supposed to reveal the mysterious inner workings of the human body – may have been no more than a well-crafted optical trick.

What might this case of these peculiar Chinese mirrors teach us in terms of the history of technology? Most importantly, we learn that descriptions of mechanical devices can be found in a broad variety of literature, from ancient Chinese narratives to Buddhist texts. How those descriptions should be treated is a complex matter, but what we have here is the potential for a broad range of new source material for the history of technology. Historians of technology will need to build new interpretive tools to address these sources, with attempts to understand the descriptions of various ancient devices through the investigation of cultural and linguistic context. Without putting the template of the present onto the past, we can also – as has been done in this paper – try to reconstruct earlier mechanical devices through looking at extant technologies. In that way, we can put together some provisional answers to the eternal question raised by early texts – what were those authors describing?

**NOTES**


3 See the mention of this passage in B. Laufer, *The Prehistory of Aviation* (Chicago, 1928), 88. Laufer does not provide an interpretation of this passage.


5 Chen, ‘Mystery of an “Ancient Mirror”’, 44.


8 See the discussion of this work in W.H. Nienhauser, Jr., *The Indiana Companion to Traditional Chinese Literature*, 2 vols. (Bloomington, Indiana, 1986–1998), I:406–407. Xijing here literally means ‘Western Capital’, and refers to the city of Chang’an and the surrounding area; today it is known as Xi’an.


10 Xijing Zaji (‘Miscellaneous Records of the Western Capital’) (Taipei, 1979), ch. 3, 3a; another edition of this text, with commentary, is found in Liu Xin, Xijing Zaji Jiaozhu (Shanghai, 1991); the translation here is by the author with the assistance of Thomas Radice, the University of Pennsylvania, and Lin Li-Chuan. The final sentence of this text is somewhat unclear; the connection between Xiang Yu and the fate of the mirror is obscure, although we do know that after the victory of Gaozu over the Qin, Xiang Yu arrived at Xianyang – the location of the palace and the storehouse with the mirror.


13 This mirror is labelled ‘Mirror with Six Circular Flowers’ (Cleveland Museum of Art, accession number 1995.341).


16 See, for example, the brief history and sample images in S. Little and S. Eichman, et al., *Taoism and the Arts of China* (Chicago, 2000), 140–141.


19 The use of mirrors or mirrored surfaces as magical amulets, etc., is common in many cultures, in locales as diverse as North America, Africa, and Siberia. See, for example, the interesting mention of shamanic uses of such objects in N.J. Saunders, ‘Stealers of Light, Traders in Brilliance: Amerindian Metaphysics in the Mirror of Conquest’, *RES: Anthropology and Aesthetics* (33: Pre-Columbian States of Being) (Spring 1998): 225–252, esp. 237.


22 Hirth, ‘Chinese Metallic Mirrors’ (n. 29 above), 229–230. Concerning different types of early Chinese mirrors, see Chen, ‘Mystery of an “Ancient Mirror”’ (n. 4 above), 35 ff. For a longer discussion on mirrors, magic, and Daoism, see M. Kaltenmark, ‘Miroirs magiques’, in *Mélanges de
23 Ibid., 223. It may be simply the case, however, that the small round mirrors are more commonly found because the Chinese used them as grave goods; therefore, it is difficult to say what sizes and shapes of mirrors the Chinese actually used in daily life. I would like to thank Nathan Sivin for making this important point.

24 Ibid., 224; there have also been finds of early Chinese square mirrors — see Hirth, ‘Chinese Metallic Mirrors’ (n. 17 above), 182. Square mirrors are also discussed in D. Dohrenwend, ‘The Early Chinese Mirror’, *Artibus Asiae*, 27:1–2 (1964): 79–98. Also see the comments on large, square mirrors in Chinese lore in Chen, ‘Mystery of an “Ancient Mirror”’ (n. 4 above), 45, n. 52.

25 For some early Western descriptions of distorting mirrors, see, for example, Pliny, *Historia naturalis*, 33.14.128–130, and Seneca, *Naturales quaestiones*, 1.5.5.


27 Hirth, ‘Chinese Metallic Mirrors’ (n. 17 above), 188, in passing, notes wryly how a mirror might be credited as ‘a protector against evil …, a disc for divination like a crystal gazer’s glove, a thought and crime detector, [or] a precursor of X-ray or a light emitting object …’ in early Chinese texts.


29 On the range of uses of mirrors in ancient China, see ibid., 225 ff.


31 Chen, ‘Mystery of an “Ancient Mirror”’ (n. 4 above), 41; for the sake of precision, I provide here more literal translations than those given in Chen’s paper.


39 Ibid., 166; this Chinese diagnostic method is unrelated to the Western method of taking the pulse to measure heart rate. See the discussion in E. Hsu, ‘Pulse Diagnostics in the Western Han: How *mai* and *qi* Determine *bing*,’ in *Innovation in Chinese Medicine*, ed. E. Hsu (Cambridge, 2001), 51–91.

40 Ibid., 167.

41 Ibid., 167.
42 Ibid., 167 ff., where Kuriyama provides an interesting discussion of this idea of the ‘gaze’, as well as the importance of the hues of the skin, in diagnosis.

43 Despeux, ‘The Body Revealed’ (n. 23 above), 637.

44 Kuriyama, The Expressiveness of the Body (n. 11 above), 179.


47 A brief mention of this is found in Laufer, The Prehistory of Aviation (n. 3 above), 11.


49 K. M. Choksey, Dentistry in Ancient India (Bombay, 1953), 9.


51 Edwards, Chinese Prose Literature (n. 51. Above), 46–47.


56 Needham, *Science and Civilisation* (n. 9 above), 93 ff; also see B. Goldberg, *The Mirror and Man* (Charlottesville, 1985), fig. 6, and note Gregory, *Mirrors in Mind* (n. 9 above), 53–54.

57 See ‘Secrets of the Chinese Magic Mirror Replica’, *Physics Education*, 36:2 (March 2001): 102–107. There are actually two techniques to hide the images. In one, an additional layer of material on the back hides the engraved designs of the mirror. There is also a technique where marks can be made on the reflective surface itself, marks that are visible only when the mirror is used to cast light on a wall; see Gregory, *Mirrors in Mind* (n. 9 above), 54–55 (caption to fig. 3.3), as well as the conjectures made in the early nineteenth century by the Scottish inventor Sir David Brewster, in *The Chinese: a General Description of the Empire of China and Its Inhabitants*, vol. 2 (London, 1840), 83–284.

58 It is interesting to note that in aboriginal art in Australia (and in other locales as well), one finds what is termed ‘X-ray art’—that is, figures of humans and animals where the bones and internal organs are rendered in some detail; see F. Kirkland and W.W. Newcomb, Jr., *The Rock Art of Texas Indians* (Austin, 1967), 31, as well as K.K. Chakravarty and R.G. Bednarik, *Indian Rock Art and Its Global Context* (Delhi, 1997), 183.

59 For some examples of the drawings of human organs in the *Huangdi Neijing*, see the reproductions in Veith, *The Yellow Emperor’s Classic* (n. 54 above), 26–27, 28, 31–33, etc. Note especially fig. 10, ‘Position of the Five Viscera, the Stomach, the Large Intestines, and the Small Intestine’, on p. 38, and fig. 13, ‘The Internal Organs’, on p. 41.

60 This is the image reproduced in ibid., 38.