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The Japanese *Shakuhachi*: Comparing the Ancient Tuning with the Modern One

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Abstract

The difference between traditional and modern *shakuhachi* construction and tuning is significant in that it represents a paradigm shift in the psychological aim and embodied techniques employed in association with the instrument. Beginning in Edo-era Japan as an ostensibly religious instrument, the *shakuhachi* was at first played with a similar technique to its predecessor, the *hitoyogiri*, using the breath to modify pitch and giving priority to tone color. Coming into the modern era, the *shakuhachi* came to be used increasingly as a modern musical instrument; the resulting higher priority of pitch-precision brought about changes in construction and playing techniques that make the instrument better suited for performances and ensemble contexts. Tracing aspects of history, theory, technique, and tuning, including an analysis of traditional and modern tunings, the authors, both *shakuhachi* players, explore the differences between ancient and modern *shakuhachi*, showing that while both maintain certain fundamental characteristics, they differ greatly in psychological aim and playing technique.

Keywords: *shakuhachi*, Japanese music, Japanese traditional music, tuning, *honkyoku*, *jiari shakuhachi*, *jinashi shakuhachi*

Introduction

When the Tokugawa shogunate collapsed at the end of the nineteenth century in Japan and Japan opened its doors to the world, the *shakuhachi*, a bamboo flute emblematic of a sect of Zen Buddhist mendicant monks during the Edo Period (1603–1868), went through a number of major changes. Firstly, the newly formed Meiji government (1868–1912) completely banished the sect in the fall of 1871. These monks had previously been given special privileges with respect to travel (which was highly restricted at the time). Despite their ostensibly religious vocation, they were often seen as somewhat lawless, philandering, and possibly being employed as spies by the Tokugawa shogunate. They were looked upon with suspicion. This, combined with the modernizing and Westernizing trends of the Meiji government, nearly resulted in the flute being disposed of altogether. Thankfully, two *shakuhachi* monks were able to convince the government that this was unnecessary. Rather than mendicancy, they would make their living by teaching and performing their instrument.

Up until that time, the *shakuhachi* was officially the exclusive right of such monks, whose vocation was to play the flute and beg for alms; laypeople were not permitted to use it. It was to be used only for religious music, and not for the folk or popular songs heard in the pleasure quarters. However, in the second half of the nineteenth century, the *shakuhachi* began to appear alongside the *koto* (Japanese table zither) and the *shamisen* (a three-stringed lute) replacing the *kokyū* (Japanese fiddle). In order to play in tune with other instruments with greater ease, the tuning and construction of the *shakuhachi* had to be adjusted. We thus see appear professional makers who radically changed how these flutes were made to create what is now the modern *shakuhachi*. In the past, flutes were made primarily by monks or their teachers, with only a smattering of professional makers (such as one maker named *Kokyo*[1]) appearing during the Edo era.[2]

Since the monks were playing their own music for their own purposes (ostensibly religious), they were composing music in a bit of a separate world. The closest thing to the *shakuhachi* in terms of contemporary music was the *hitoyogiri*, a flute about half the size of the *shakuhachi* that was played by both the samurai class as well as mendicant monks. This small flute, originally itself called a *shakuhachi*, is rightly considered to be the predecessor to the other iterations of *shakuhachi* discussed here. Although *shakuhachi* monks were with little doubt exposed to the music of their time, the music they composed was not strictly bound by the contemporary rules of melodic, metric, and modal structures.[3] Owing perhaps to their religious vocation, they either intentionally (creating specifically non-secular music suited to meditation) or unintentionally (crossing the bounds of contemporary music theory simply due to lack of knowledge thereof, having a religious rather than a musical vocation) found the latitude to create a music that is unique and distinct from other genres of Japanese music.[4]

Being in tune with a specific key or scale was not an important aspect of their playing since these mendicant monks were not playing with other instruments, although their *shakuhachi* were generally of the same length and could be played together in unison at temple ceremonies and while travelling, or in turn-based call-and-response duets when meeting their peers on the road. Today, many *Myoan* players still play older, simpler

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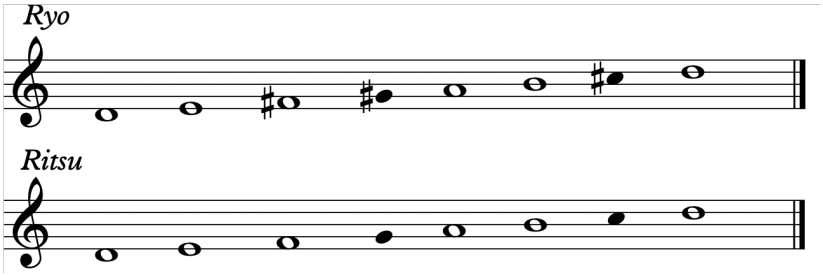
1. The transition from a religious to a secular instrument was gradual. Although technically illegal, many *komusō* were already making a living by teaching *shakuhachi* to laypeople toward the end of the Edo era. Kokyo's existence is evidence that there was a market for *shakuhachi*. Still, even these early "professional" flutes differ substantially in construction to those that developed after the flute's secularization.

2. There were other changes (for example, some players created new schools and styles of playing, and composers started to write modern works), but for the aim of this essay, these are the most important.

3. For more detail, see Hitoshi Imai, "Fuke-shu Shakuhachi no Onritsu (Temperament of Fuke-shu Shakuhachi Music)," *Nihon Onkyou Gakkaishi* 67, no. 3 (2011): 101–12.

4. The closest parallel would be the solo repertoire of the *hitoyogiri* mentioned above, which is free-rhythm but differs from much of the *shakuhachi* music mentioned here in that it is bound to the *ryo* and *ritsu* scales (see example 1).



Example 1. *Ryo* and *ritsu* modes, mainly used in folk and popular music of the time. Adapted from William P. Malm, *Traditional Japanese Music and Musical Instruments*, New York: Kodansha International (1959; 2000), 68.

versions of religious pieces in unison at their gatherings.[5] Most are not professional musicians, and they use more traditional instruments; this results in a loose spectrum of pitches and timings being played in a staggered unison, suggestive of a flock of birds taking flight from a field *en masse*. The phenomenon is quite distinct from a unison musical performance where players are expected to be rhythmically and tonally in sync with one another.

Shakuhachi monks viewed their bamboo flute as a spiritual tool, not a musical instrument, although not all of them were necessarily in search of Buddhist enlightenment. The *shakuhachi* "became" a musical instrument in the regular sense of the term when the sect was banished in 1871. Afterward, *shakuhachi shokunin* (*shakuhachi* tradesmen) radically changed the overall construction of the flute so as to modernize it, including how it was tuned, in hope that it could compete with Western instruments.[6] Since the 1980s, thanks to new innovations in its construction, including taking advantage of modern acoustics, it has become even easier to play the flute alongside Western and other instruments that are tuned according to the Western tempered tuning. Growing international interest now sees it being played with all kinds of instruments and styles of music.

This essay compares the tuning of the Edo period *Fuke shakuhachi* with the modern one, a comparison that has been lacking in the field of ethnomusicology, particularly outside of Japanese-language publications. Today, very few *shakuhachi* makers use the traditional tuning. Usually being made on order, it is used only by a few who want to play the traditional repertoire in an older style.

The difference between traditional and modern tunings is significant in that it represents a paradigm shift in the psychological aim and physical techniques used with the instrument. Before moving on to analysis, we give a short historical, theoretical, and technical outlook of the *shakuhachi*, touching on its ancestor, the *hitoyogiri,* and then comparing the *Fuke shakuhachi* from the Edo period with the modern one. Afterward, we

5. A loosely defined "school" of *shakuhachi* that focuses on *Fuke shakuhachi* pieces from the Edo era, playing primarily as a meditative practice rather than a performance art.

6. "*Shakuhachi shokunin"* is a general term. Today, the term used is for professional makers is *shakuhachi seikanshi.*

compare their tunings, followed by an analysis of a short piece played on both types of flutes.

Historical, Theoretical, and Technical Background

The first *shakuhachi* came to Japan from China through Korea with the *gagaku* (refined music) ensemble during the Japanese Nara period (710–794).[7] It was removed from the ensemble at the beginning of the ninth century with a few other instruments to streamline the ensemble. The *shakuhachi* at the time, similar to Chinese *dongxiao*, had six holes and was made of a thin upper section of bamboo. It could be made as well from other material, and had different lengths from today's flutes. The ancestor of the *shakuhachi* as we know it today is believed to be a small upright flute called the *hitoyogiri* (literally "cut from one node" of bamboo) that is mentioned for the first time in documents around the eleventh century.[8]

The *hitoyogiri*'s origin is unclear. It was played by wandering and belligerent monks, as well as used in popular *sarugaku* theater, which gave birth to *nō* theatre, and was used in *dengaku*, a music accompanying dances both from *shintō* (the native religion of Japan) and Buddhist rituals. Its length ranged from about 0.9 *shaku* (about 27 cm) to about 1.4 *shaku* (42.4 cm), and was made from a small piece of bamboo with a single node toward the center.[9] Having five holes, it could play popular folksongs of the time (as well as its own solo repertoire, primarily in the *ritsu* and *ryo* scales that were in fashion), something which the *gagaku shakuhachi* with its six holes could not do. Instructions for making the flute appear in the Muromachi-era *gagaku* manual *Taigensho* (1512). We also have playing manuals from the early and late-Edo era with playing instructions as well as scores for folk songs and free-rhythm solo pieces, but these still rely heavily on an aural tradition that has since been lost.[10] Since the art died out completely as the *shakuhachi* grew in popularity, we don't know precisely how the flute's repertoire was played. Even so, similarities with the *shakuhachi* in terms of construction, playing technique, and demographics remain clear.

Interestingly, the *hitoyogiri* was also referred to as a *shakuhachi*, in this case perhaps due to its standard measurement being 1.08 *shaku* (*hachi* meaning "eight," the length translating to 32.7 cm).[11] It was "tuned" to a neutral scale, the expectation being that players adjust the pitch using their breath while playing. Its small (6 to 8 mm) finger holes were undercut so as to open up toward the bore, giving it a rich tone color, and they were bored mostly equidistant from one another, like the front holes in *Fuke shakuhachi*. Its solo repertoire, like that of the *Fuke* shakuhachi, is free-rhythm, and its musical notation consists of symbols indicating fingerings and techniques rather than mere pitches, many pitches having multiple

7. During China's Tang dynasty (618–907).

8. For instance, *The Tale of Genji*, in which it is called a *sakuhachi*.

9. The lengths are inferred from the instructions in Toyohara's *Taigensho*. The *shaku* is a unit of measure, originally from China, that is about 30.3 cm.

10. *Tanteki Hiden Fu* (1608), *Shichiku Shoshin Shu* (1664), and *Shichi ku Kokon Shu* (1818), among several others.

11. Juntei Kamiya, *Shichiku Kokin-shu* (Edo: Baitetsu-do, 1818), 3.

fingerings that provide a variety of tone-color effects. The *hitoyogiri* was popular among Zennists such as Ikkyū as well as the literati–samurai of the time;[12] waning interest in the *hitoyogiri* throughout the Edo era suggests that the more versatile *Fuke shakuhachi*, ranging more than two octaves (compared to the *hitoyogiri*'s 1.5 octaves) and having lower sounds, attracted many of its players.

The *shakuhachi* as we know it today appeared in early forms during the seventeenth century. It is made of young male *madake* bamboo. The name *shakuhachi* means "1.8 *shaku*" (measuring 54.5 cm). However, the reasons for the change to a thicker, heavier, longer cut of bamboo are obscure. Australian *shakuhachi* player Riley Lee mentions a story of a *kyōkaku* (literally "one who champions the underdog") named Karigane who played the shakuhachi. According to that story, he was the one who thought of using a bigger root-end piece of bamboo so that it could also be used as a cudgel for fighting.[13] According to Lee, a number of historians suggest that the employment of this type of *shakuhachi* by beggar priests and *kyōkaku* of the early Edo period brought about a change in its construction.[14] However, historical discrepancies throw doubt on Karigane's role in said change.[15] James H. Sanford gives us another possible reason: a number of former samurai called *rōnin* (masterless samurai) joined the ranks of these wandering beggar flute players of the Fuke sect. Sanford suggests that they did not want to be associated with the earlier low-class wandering and thuggish priests, who seemed to favor the smaller *hitoyogiri*.[16] These prior priests were called *komosō* (straw mat priest) because they were carrying a straw mat on their back, while the monks of the Fuke sect opted to call themselves *komusō* (priests of nothingness), a name with an underlying spiritual meaning, thus suggesting that their flute was a spiritual tool, not a musical instrument or, for that matter, a weapon.[17]

During the Edo period, most *komusō* were travelling around Japan, usually in groups of two, in populated areas.[18] There were three head temples, two around Tōkyō and one in

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12. Ikkyū Sōjun (1394–1481) was a Rinzai Zen priest and *hitoyogiri* player whose influence on *Fuke shakuhachi* can be seen in that the piece *Murasaki Reibo* (or *Murasaki no Kyoku*) is attributed to him, having been adapted for the *shakuhachi*.

13. Some Kabuki plays have characters carrying a *shakuhachi* on their back, suggesting it is used as a weapon.

14. Riley Lee, "Yearning for the Bell: A Study of Transmission in the Shakuhachi Honkyoku Tradition" (PhD diss., University of Sydney, Sydney, Australia [Ann Arbor: University Microfilm International, No. 982066], 1993), 65–67.

15. Lee does not indicate if Karigane also joined the rank of the Fuke sect as other *rōnin* did. At the beginning of the seventeenth century, the shogun requested that only *rōnin* join the Fuke sect, in the hope to control these unemployed samurais, which was not always possible.

16. James H. Sanford, "The Fukeshu and Komuso," *Monumenta Nipponica* 32, no. 4 (1977): 428.

17. For a detailed account of the history of the *shakuhachi*, see Henry Johnson, *The Shakuhachi: Roots and Route* (Boston: Brill, 2014); Lee, "Yearning for the Bell."

18. They could be seen in the north, in Hirosaki in Aomori prefecture, all the way south to Kumamoto in the northern part of the island of Kyūshu. They were not seen in Kagoshima in the southern end of that island.

Kyōto, as well as a large number of other affiliated temples around the country.[19] Almost all of them were using a single length of *shakuhachi*, the 1.8 *shaku* size. Some of these *komusō* were hermits, residing away from the population, possibly using *shakuhachi* of longer lengths. Today's use of long *shakuhachi* by many players is a twentieth-century development. This is in part an outcome of the popularity of the twentieth-century iconoclastic *shakuhachi* master Watazumi-Dōso. Unlike many popular contemporary players, he was making his own flutes instead of relying on *shakuhachi shokunin*, without necessarily following the current standards, as well as inventing some of his own. Today, the lengths can be from 1 *shaku* to 3 *shaku* and beyond. The longer ones between 2.4 and 3 *shaku* are preferred by a large number of players today, being considered better suited for expressing the spiritual character of the pieces these monks composed.

Japanese musicologist Yosihiko Tokumaru mentions in regard to all traditional Japanese music that tone color is of greater importance than tones or pitches.[20] This applies as well to the *shakuhachi*, the quality and timbre of a sound being more important than pitch and melody. The characters used in its notations, which mostly appeared in the second half of the nineteenth century, refer to fingerings, not pitch, like those of the *hitoyogiri*.[21] Some of them can be produced with different fingerings, resulting in different tone color, each being represented with a different symbol. When composing a piece, the symbol can be chosen according to the tone color, not just pitch. The construction of the *shakuhachi* also emphasizes tone color (and variety thereof), a trait that is even more prominent in older flutes' construction style due to its greater variability between flutes and even between tones on the same flute. The blowing edge of the embouchure does not easily allow for the production of a regular and steady pitch. The movement of the lips and the head, the position of the flute on the lips while holding it, or movement inside the throat, mouth, and even the abdomen can alter the tone color of any pitch. Having only five holes (but producing well more than five tones) does not easily provide for a perfect tuning according to the tempered scale. There are always pitches, even on the modern *jiari shakuhachi*, that must be adjusted while playing, be it by using the fingers to shade holes, or altering the

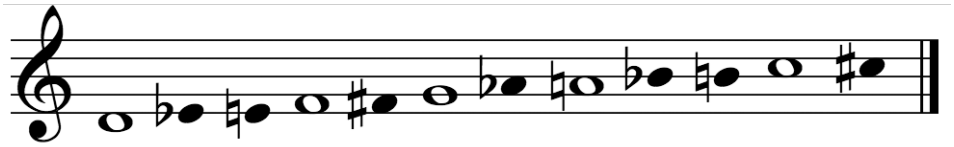
19. There is no consensus about the number of these affiliated temples (some authors say more than 100, some others less). When the Meiji government banished the Fuke sect, a number of these temples were simply destroyed; some were put down, rebuilt in another location, and given another name.

20. Yosihiko Tokumaru, "Le timbre dans la musique japonaise," in Jean-Baptiste Barrière, ed., *Le timbre, Métaphore pour la composition* (Paris: Ircam-Centre Pompidou/Christian Bourgeois Éditions, 1991), 94–95. Tokumaru adds to this that the attraction of Japanese musicians to Western instruments at the end of the nineteenth century was at the onset about timbres that were unknown to them (91–92). Similarly, Henry Burnett suggests that the importance of tone color in traditional Japanese music is such that a musicological analysis of a piece based on pitch does not have much meaning for these musicians; see Henry Burnett, "Minezaki Kōtō's Zangetsu: An Analysis of a Traditional Japanese Chamber Music Composition," *Perspectives of New Music* 27, no. 2 (1989): 78–117.

21. Some schools borrowed their notation from that of the *hitoyogiri*, which dates back several hundred years.

blowing angle or breath. On traditional flutes that do not add *ji* to shape the bore but rely on the bamboo's natural shape and taper, the physics are such that the two octaves are never perfectly in tune with each other and must be adjusted by the player. The shape and the thickness of the bamboo also have an influence on the overall timbre of the flute as well as its tuning. For example, a 1.8 *shaku* flute made from a fat, large-bore piece of bamboo can sound a semitone lower than a 1.8 flute made from a thinner, small-bore piece.[22]

Another important aspect of tuning in the playing of the *shakuhachi* is what is called the *meri* tones. These are produced on modern *shakuhachi* by lowering the head and partially opening finger holes. In example 2, the whole notes indicate the ones that are produced by fully closing holes, while the intermediary notes, represented by the unstemmed quarter notes, are the *meri* ones. Up until around 1870, these notes were produced only using the



Example 2. The notes produced by the regular (modern) 1.8 *shakuhachi*.

breath; that is, by altering air flow using the head, tongue, throat, lungs, and abdomen. At that time, some players developed a way to play them by partially opening holes, which is now standard on the modern *shakuhachi*. The best example to illustrate the difference between these two ways of playing concerns the notes E and E♭, E♭ being the hardest note to produce on both the traditional and the modern flutes. Before the implementation of newer construction techniques, the E was easy to produce, necessitating only a slight adjustment of the head or breath, while the E♭ was not, requiring a much greater adjustment. Depending on the flute and the player, it was often not possible to lower it enough to get E♭ around a semitone higher than the D. With the modern *shakuhachi*, the E is produced by covering the first hole by about 1/4 while slightly lowering the head.[23] For the E♭, the first hole is opened about 1/5 and the head lowered more than for the E. In some schools, the head will also be lowered, angling the breath further inside the flute, while the upper lip will be pushed over the embouchure, so as to get an E♭ as near as possible to the D, sometimes less than a semitone. It is extremely difficult, and in fact near to impossible, to play the E♭ exactly at the same pitch each and every time since the movement of the head, the arms, and the lips cannot be controlled perfectly when playing. What is most important is not to be in pitch, but to get a tone-color contour of a melodic line. The tone-

22. The *shinobue* or *fue*, a small bamboo transverse flute that is used mainly in folk and festival music, is very interesting in this regard. It is tuned differently from region to region, even from village to village. It can also be tuned in such a way so that a particular flute is used uniquely for a particular song, or a specific type of village music.

23. Holes are numbered from the bottom up. The one in the back is the fifth one.

color relationship between pitches is more important than their tuning. Again, the extent to which a musician lowers the head and opens the first hole differs from one flute to another, from one length of flute to another, between the traditional and the modern flutes, as well as with respect to which pitch came before.[24] Moreover, the opening of holes is not equal with all tones. The E♭ requires a small sliver of an opening, while the hole used to produce an F♯ is opened halfway. For this reason, *Fuke shakuhachi* generally play the E♭ closer to an E, since it is more difficult to lower the pitch using the breath alone, and not partially covering finger holes. For these older flutes, this is appropriate, as the *Ritsu* scales employed primarily used E, and evolved to include the E♭ only during the latter portion of the Edo period, when the *Miyakobushi* scale came into vogue. On many of these flutes, the F♯ will also be a bit sharp for the same reason. So, the opening differs from one tone to another, from one flute to another, and even more so with *shakuhachi* of different lengths.

While there exists a spectrum of *shakuhachi* that developed over time, for our purposes we contrast two extremes—Edo-era *Fuke shakuhachi* and the modern *jiari shakuhachi*. Both types are similar in that they are made from a stalk of *madake* bamboo usually having seven nodes (including three at the root end), a hole at each end, and five finger holes. The distance from the bottom root-end node to the top node determines the length, thus determining what we could call the "tonality" of the flute. For example, for the modern 1.8 *shaku shakuhachi*, the base note is D (*Fuke shakuhachi* of the same length are approximately a semitone lower, usually around C♯); a 1.7 is E♭, while on a 2.0 it is C.[25]

During the Edo period, the placement of the finger holes on a *shakuhachi* was determined using a calculation method called *towari* (literally meaning "divided by ten"). Using this method, the four finger holes on the front of the flute are placed having an equal distance between them, i.e., 0.18 *shaku* (1/10th of the total length) on a 1.8 *shakuhachi*.[26] When played "straight" with no adjustment of the breath or the head, the resulting uneven tuning does not precisely correspond to any particular musical mode.

This same characteristic is present on the *hitoyogiri*, whose holes are also for the most part spaced evenly. In this case, the *ryo* and *ritsu* scales are employed. In an early Edo-era manual,[27] the section for the *ōshiki* mode (A) begins with instructions to "stretch [J. *haru*] *ōshiki* [A] and *ichikotsu* [D]," meaning that players have to make conscious effort to adjust their breath when playing the base note (all holes closed) and the third note (bottom two holes open). In this case, the flute uses the notes A–B–D–E–F♯. The same flute is used to play the *sōjō* mode (G), in which case the scale becomes A–C–D–E–G, this time with instructions to "stretch" C, D, and G, i.e., to raise the chin with respect to the flute to bring

24. If the tone that precedes the E♭, for example, is an A. Because of such a large interval, it will be more difficult to be in tune than if it is a F or a D.

25. The difference in pitch between, let's say, a 1.8 *shakuhachi*, a 1.9, and a 1.7 is pretty much a semitone. This interval gets shortened with shorter bamboo pieces and expanded with longer ones.

26. There exist two more methods: dividing by 9.5 and by 10.5. The division by 10 is the most common.

27. *Tanteki Hiden-fu*, 1608.

them up to pitch. In addition to allowing the same flute to be played in multiple modes, the even spacing of the holes is both ergonomic and attractive to the eyes. The "neutral" tuning allows players to use their breath to adapt the flute to play a variety of scales, depending on their needs. The same practice was inherited by early *shakuhachi* flutes, using the breath to modify the pitches of various fingerings to fit a certain mode.

On the modern *jiari shakuhachi*, the positions of the finger holes are staggered so as to produce standardized pitches, while taking into consideration the dimension, shape, and thickness of the bamboo. On a well-made flute, these pitches can be produced consistently without any substantial head movements or adjustments to the breath, making the flute particularly suited for ensemble music, or for music including rapid successions of different notes that would make such adjustments difficult (solo music for the *Fuke shakuhachi*, by contrast, makes little or no use of this technique). The range of the flute is about two and a half octaves, although higher tones are possible. The positions of the finger holes are worked out by the maker, with distances between them as well as relative sizes varying so as to correspond as much as possible to the Western tempered scale. Generally speaking, modern *jiari shakuhachi* have larger finger holes than do *Fuke shakuhachi*.[28] Larger finger holes produce a louder sound (which was especially desirable before the advent of the microphone, when the *shakuhachi* began to be employed in solo and ensemble performance environments) and make it easier to produce the *meri* tones using partial hole openings. Many modern *shakuhachi* facilitate this even further, having an upside-down triangular portion of the bottom hole shaved away so that all but a small portion of the hole can be easily shaded.

The main aspect that distinguishes the *jiari shakuhachi* is the use of *ji*, a plaster-like mixture of *urushi* and clay powder that is gradually layered and polished inside the bore to build it up (ideally) to a perfectly round, smooth shape that is wide at the top, tapers down toward the fourth node, and then opens up again slightly toward the bottom. The taper, diameter, and uniformity of the bore differ slightly from maker to maker, with higher-end shakuhachi being pitch-perfect between octaves, with all of the open-holed notes balanced to produce an even tone without adjusting the strength or angle of the breath.

Today in Japan, the *jiari shakuhachi* is the *de facto shakuhachi* for the vast majority of players, with *Fuke shakuhachi* being used by a small subgroup of the already small *shakuhachi* subculture. Again, the modern tuning is also the *de facto* tuning for both modern *jinashi* and *jiari* flutes. Even so, the *Fuke shakuhachi* is a subject of gradually growing popularity. A handful of makers offer these flutes for sale, and some musicians will harvest bamboo to make their own, to the point of making a flute for a particular piece. For these musicians,

28. Most *shakuhachi* up to the beginning of the twentieth century have comparatively small finger- and end-holes. However, since *Fuke shakuhachi* were often made by individuals, there can be found examples with larger finger holes as well.

making the flute is an important part of the spiritual practice of playing the *shakuhachi*. Some of these players even offer workshops for people to make their own *shakuhachi*.[29]

Edo Tuning vs. the Modern Tuning

EDO TUNING

Traditional *Fuke shakuhachi* use the *towari* calculation method for determining hole positions and spacing. While there are several versions of these calculations, they all yield basically the same results. The simplest version can be expressed as follows:

1. Distance from bottom of *shakuhachi* to first hole: total length x 0.225
2. Distance between holes 1, 2, 3, and 4 (1 being the bottom hole): 1/10th of total length
3. Distance from bottom to rear hole: total length x 0.575
4. Distance from top to rear hole and bottom to third hole are equal[30]

The distance from the fourth to the rear hole can also be calculated as 1/2 (length/10). Alternately, it can be calculated at 7/10 (length/10), producing a higher top hole, which becomes necessary on flutes of about 1.5 *shaku* and shorter. Again, for particularly thin- or wide-bore flutes, the holes may be moved slightly up or down to adjust for the difference in pitch. A notable result of the *towari* method is that the front holes are equidistant, making the *shakuhachi* both ergonomically and aesthetically pleasing.

There is also a variant calculation known as *kyu-han* (meaning 9.5) *wari*, wherein the holes on the front are set at a distance of (length/9.5) rather than (length/10). Thus, on a 1.8 *shakuhachi*, the *towari* method puts the holes at a 0.18 *shaku* distance from one another, while the *kyu-han wari* method puts them at a slightly greater distance, about 0.19 *shaku*. The longer distance can be desirable for certain types of bamboo, or the needs of the player for a particular piece or pieces to be played on the flute. The bottom two holes have a lower position than they do with a *towari* flute, making it easier in some cases to play lower *meri* tones with the bottom hole open, using only the breath, as the lower hole position naturally lowers the pitch.[31]

Either of these methods assumes that the holes will be undercut. Modern *jiari shakuhachi* have large holes bored straight into the bamboo; *Fuke shakuhachi* have smaller holes that grow wider as they move toward the bore, creating a bubble of air. Undercutting the holes allows the maker to balance the relative pitches of the holes, as well as regulate how much

29. Koji Matsunobu, "Artful Encounters with Nature: Ecological and Spiritual Dimension of Music Learning," PhD diss., University of Illinois at Urbana-Champaign, 2009.

30. Reigetsu Uchiyama, *Kinpu-ryu Shakuhachi Honkyoku-den* [1972], trans. Nick Bellando (self-published, 2016), 114.

31. This and other calculation methods are detailed in Deiko Toya, *Komuso Shakuhachi Seikan Hiden* (Tokyo: Komuso Kenkyu-kai, 1987), 86–92.

Example 3. A photo showing a modern *jinashi shakuhachi* that was originally tuned with the modern tuning. The maker reworked it to reflect *towari* hole positions by filling in and re-drilling the holes. We can see the positions of the new holes as well as the patched positions of the holes of the original modern tuning. The change for the first, second and third holes is especially noticeable.

air is allowed to escape from each hole, which assists in balancing the sounds so that they don't break up or jump octaves too easily. This tapering also imbues each pitch with the capacity to be bent more easily upward or downward by adjusting the breath. The pitches are not, however, designed to be pitch-perfect when played straight without adjusting the breath. Rather, they are balanced to be in a neutral position, with the needs of various *honkyoku* (referring to the Edo-era versions of the classical solo repertoire) pieces in mind, so that each tone can be adjusted to have a tone color and pitch that fits the player as well as the pieces, without having to strain.

With the *towari* method, the basic pitches tend to result as follows:

1. *Ro* (all holes closed): This is played slightly *meri* in the lower register to give a full, stable sound; its tone color may suffer if it is played too sharp, as is the standard with modern flutes. For the same reason detailed in number 5 below, the same note in the upper register may be a bit higher, but can easily be adjusted with the breath. Although the length is the same as modern flutes, the pitch is around C♯, a semitone lower than the D in modern flutes (subsequent tones are also a semitone lower).[32]
2. *Tsu* (first/bottom hole open): Plays close to the expected E in both registers, but often needs to be sharpened with the breath.
3. *Re* (bottom two holes open): Plays close to the expected F♯ in both registers, but often needs to be sharpened with the breath.
4. *Chi* (bottom three holes open): Often significantly sharper than the expected A♭ in both registers, and needs to be played *meri* using the breath. This characteristic keeps the tone from being played too loudly, and also makes the note *san-no-u* (third hole open) easily reachable, which is difficult to do on modern flutes. Again, this note needs to be played sharp for pieces in some alternate modes.
5. *Ha* (bottom two holes closed, holes three and four open): Significantly lower than the expected B in the lower register, but plays close to the expected B (or sharper) when the flute is played in the upper register. The lower octave can be sharpened using the breath with little effort. The discrepancy between octaves owes to the natural shape of the bamboo, which grows narrower in stages toward the root end, with a taper that is relatively slight in comparison with that of modern *shakuhachi*. The natural taper of the bamboo necessitates that the breath be adjusted to bring the registers in tune with each other.
6. *I* (pronounced "ee," bottom two holes closed, upper three open): Significantly lower than the expected C♯ (one octave above *Ro*) in the lower register, but easily

32. For a more detailed analysis of pitch in *Fuke shakuhachi honkyoku*, see Hitoshi Imai, "Fuke-shu Shakuhachi no Onritsu [Temperament of Fuke-shu Shakuhachi Music]," *Nihon Onkyou Gakkaishi* 67, no. 3 (2011): 101–12.

adjustable as with *Ha*, for the same reasons. *I* in the upper register requires little adjustment, if any.

As for *Ha* and *I*, as well as the other notes: with a little experience, most players will come unconsciously to adjust their breath to produce the desired pitches. Interestingly, this effect is engrained in the *shakuhachi* world to the extent that many modern *jiari shakuhachi* have it built into their flutes. The makers are using *ji* to build up the shape and taper of the bore to bring the registers into balance, but the habit of sharpening *Ha* and *I* in the lower octave still remains from previous generations. It appears that the makers as well as the players have retained this habit unconsciously, so that even if they intend to make the octaves come into tune with one another, they are slightly adjusting their breath so that if a player makes conscious effort to play these modern flutes without any breath adjustments, the *Ha* and *I* of the lower octave become flat. Very high-end flutes, however, are made so that the registers match.[33]

Tuning (or, more accurately, balancing) is also carried out using the nodes inside the *shakuhachi*. At the beginning, the bamboo is divided into four major chambers, each being closed off at either end by the nodes. A hole is drilled in the bottom, and the root nodes are usually taken out completely to create a bottom chamber whose inner diameter matches or exceeds that of the end hole. Likewise, the other nodes are gradually opened up, but not completely removed, so that each chamber is closed off at either end by a narrower opening at the node. Gradually opening up the nodes allows the maker to regulate airflow through the *shakuhachi* as well as the relative pressure between chambers, compensating for imperfections in the shape and taper of the natural bamboo bore. If the nodes are filed away completely, only the rarest perfect stalk of bamboo will yield a stable sound.

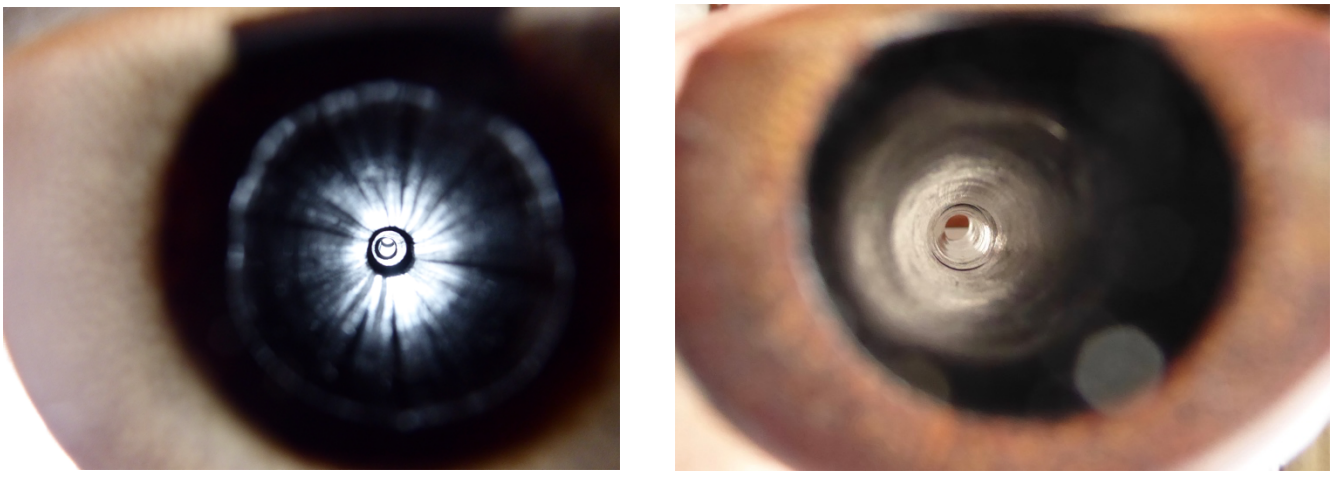
MODERN TUNING

Modern *jiari shakuhachi*, as mentioned above, are especially distinguished in that they use *ji* to round and taper the bore into an ideal shape. This is a rather complex process, and the skill of the maker is perhaps displayed more in the bore than it is anywhere else. Each *shakuhachi* of a given size from the same maker will generally have an identical shape and taper at the bore; the only difference is that finger holes may need to be moved slightly up or down to compensate for the thickness of the bamboo. For example, if a position x produces a pitch of F at a bamboo thickness of 10 mm (including the thickness of the *ji* forming the bore), the maker would know to position the hole slightly higher at position $x + \alpha$ to compensate for a thicker piece of bamboo. Alternatively, some makers will leave the hole positions as is and cut away material inside the hole toward the bore so that the direction of the hole angles upward, resulting in a slightly higher pitch. This is distinct from the hole-tapering performed on *Fuke shakuhachi*, which is carried out in 360° rather than only in one direction.

33. To provide a concrete example, those made by Japanese *shakuhachi* maker Miura Ryūho.

Example 4. Top: A *Fuke shakuhachi* using *towari* hole calculations; Center: A modern *jiari shakuhachi* with staggered hole placement; Bottom: A late Edo or early Meiji-era *Fuke shakuhachi* using *kyu-han wari* hole calculations. Note that the bottom holes are lower.

Example 5. Rear view of the above.



Example 6. A view inside the bore of (left) a modern *jiari shakuhachi* and (right) a *Fuke shakuhachi*. Note the smoothness and uniformity of the former, and the natural fibrous contour of the bamboo along with the nodes of the latter.

As the bore is formed, gauges are used to check roundness and diameter at various points along the bore, ensuring that the taper is formed according to the maker's calculations. Unlike *Fuke shakuhachi*, whose airflow is balanced between four major chambers, the *jiari* shakuhachi functions as a single chamber, tapering toward the bottom and then opening up again. Owing to this, the bore must be very smooth and precise; any irregularities diverging from the flute's taper will result in uneven pressure distribution along the length of the flute, causing certain notes to roll or jump octaves. Again, if the taper is imprecise or calculated incorrectly, the octaves will not be in tune with one another, and some notes may turn out louder than others.

The modern *jiari shakuhachi* maker also relies on many custom-made bore-polishing tools that are used to ensure that every millimeter of the bore has the right taper and diameter at the right location. Unlike *Fuke shakuhachi*, it is not necessary for the maker to pay attention to the nuances of each individual piece of bamboo as the *shakuhachi* takes shape. Rather, he has a preset ideal model into which the bamboo is formed. Provided that the tools, calculations, and skills of the maker are in place, a nearly perfect flute can be made without playing it until its completion, after which some fine-tuning may take place if required.

As mentioned above, the finger holes' positions are determined according to pitch, so they are not equidistant. If the distance between holes one and two is x, then the distance between holes two and three would be $x-\alpha$; the distance between holes three and four would be $x+\alpha$, and the distance between the fourth and fifth (back) holes would be smaller than $x-\alpha$. It is also notable that the length of the *shakuhachi* itself can be made to two different standards at present. A *shoritsu* ("correct pitch") *shakuhachi* has a length that is adjusted so that the base tone of the *shakuhachi* is perfectly in pitch; a *shosun* ("correct measurement") *shakuhachi* is made according to its stated length, i.e., 1.8 *shaku*, 2.0 *shaku*, etc. A *shoritsu* 1.8 *shakuhachi* (about 54.4 cm) is only 1 or 2 millimeters shorter than a *shosun* 1.8 (54.5 cm), but the difference grows as the *shakuhachi* increases in length. A 2.0 *shosun* is 60.6 cm, while a *shoritsu* is 61.5 cm, nearly one cm longer this time. While *shosun* 1.8 *jiari shakuhachi* are often preferred because of their more traditional feel for Japanese music ensemble performances, most applications prefer *shoritsu* flutes, which depart from traditional measurements in order to match pitches with other instruments.

Using a *Fuke shakuhachi* as a base for comparison, we can say that the modern *jiari shakuhachi* corrects the former's most outstanding discrepancies with respect to pitch. Specifically, the third hole (*Chi*, which plays sharp if not adjusted) is moved down and made slightly smaller than the other holes, which operations effectively lengthen the vibrating column of air inside the flute to create a lower pitch. The fourth and fifth holes (*Ha* and *I*, respectively) may be moved slightly, but are primarily compensated for using the taper of the bore, which has the effect of raising the relative pitch of the lower octave to match that of the upper. Thus the *Fuke shakuhachi* has evenly-spaced finger holes on the front, all with a

uniform size, while the modern *jiari shakuhachi* has staggered holes on the front, with the third hole smaller than the rest.

Analysis

In this section, we present a concise pitch analysis of the *Fuke shakuhachi* and the modern *shakuhachi*, with the Western tempered tuning as basis for comparison, as well as a short traditional piece from the Edo era. The analysis highlights the difference in pitches in that modern flutes are closer to a Western (D pentatonic) scale without adjusting the breath. It also shows that when it comes to playing, regardless of tuning methods, the player's sense of pitch is just as important as (if not more so than) the tuning of the flute itself.

TUNING OF THE *FUKE* AND THE MODERN *SHAKUHACHI*

Example 7 shows the frequencies of the *towari* tuning of a *Fuke Shakuhachi* and the tuning of a modern *shakuhachi*, alongside the modern Western tempered tuning.

Right from the onset, we must give a caution about the numbers in example 7. The tones on the *shakuhachi* vary minutely over time; the numbers indicate average frequencies (Hz) for each tone. They apply to two flutes with distinctive tunings: a *Fuke Shakuhachi* using the *towari* tuning method, and a modern one. They cannot be applied to all flutes from the Edo era, nor to all modern ones. Although modern *shakuhachi* makers try to tune their flutes as much as possible according to the Western tuning (some of them using modern acoustics), it is impossible to tune each and every flute exactly the same, especially since some tones rely on partial hole openings, making them nearly impossible to produce perfectly in tune with Western tuning. Again, the peculiarities of playing this type of bamboo flute, in particular the strength of the air stream, the angle of the flute, the position of the head, the opening of the lips, or the position of the upper lip, among other things, are such that even a well-tuned flute will give different results from one player to another.

As mentioned earlier, because of its large bore without *ji*, and although it has the same length as the modern flute, the *Fuke shakuhachi* starts on C♯ rather than D, and as such all pitches are about a semitone lower than on a modern *shakuhachi*. In order to better compare and analyze traditional and modern tunings, the recording of the scale has been raised by a semitone to be on par with modern tuning. The first thing that is clearly noticeable is that for both the *Fuke shakuhachi* and the modern one, the pitches vary with the player. The D on both flutes is 296 Hz, while the tempered D is 293.66. Similarly, none of the other tones are in tune with the Western tempered scale, a difference which can be attributed both to the flutes and the players. Some are higher in the modern tuning (indicated by the single bracket on the left), while others are lower (as indicated by the double bracket on the right). As the numbers in the third line show, these variations in tuning are not linear or regular. Interestingly, the tones of the modern tuning are all higher than the tempered scale. The modern shakuhachi is often tuned around A 442 or 443. When *shakuhachi* players play these flutes along with Western instruments, they must lower the head slightly in order to be in tune, though a large number of players (because of their playing habits) are inclined to raise

First octave	*Ro* / D4	*Tsu* / F4	Re / G4	*Chi* / A4	*Ha* / C5
Towari Traditional Tuning	296,00	349,80	392,90	452,10	511,30
Modern Tuning	296,00	355,20	403,60	446,70	527,40
Variations in frequencies		5,40	10,70	-5,40	16,10
Tempered Scale	293,66	349,23	392,00	440,00	523,25

Second octave	*Ro* / D5	*Tsu* / F5	Re / G5	*Chi* / A5	*Ha* / C6
Towari Traditional Tuning	597,40	694,30	785,80	909,60	1071,00
Modern Tuning	592,00	705,00	796,50	888,00	1049,50
Variations in frequencies	-5,40	10,70	10,70	-21,60	-21,50
Tempered Scale	587,33	698,46	783,99	880,00	1046,50

Example 7. Comparisons among *towari* tuning, modern tuning, and the Western tempered scale. These numbers were obtained using the Spectrum analysis function of the audio edit software Amadeus Pro. The straight line on the left indicates that both pitches are the same. The single bracket on the left indicates that a note of the traditional tuning is lower. The double bracket on the right indicates that a note in the traditional tuning is higher. To hear a recording of both scales, click below.[34]

the pitch instead of lowering it. These two scales were purposefully recorded with a conscious effort *not* to adjust the breath (or the pitch), which itself is difficult, as this adjustment becomes an unconscious habit as the player grows accustomed to any discrepancies in tuning that exist on either type of flute.

Interestingly, all the tones on the modern *shakuhachi* are higher than the tempered scale, while two tones are lower on the *Fuke shakuhachi* (C_5 and F_5). Again, the difference in pitch between both *shakuhachi* does not show a regular pattern between the two octaves. For

34. For the values in example 7, the *Fuke shakuhachi* was recorded by Nick Bellando, the modern one by Bruno Deschênes. Bellando plays both scales in the audio examples.

example, though D_4 on both flutes are the same, D_5 is higher on the traditional flute. While C_5 is lower on the traditional flute than on the modern one, it is much higher on C_6. Although G_4 and G_5 in both octaves show that the *Fuke shakuhachi* is lower than the modern one, this is no indication that it is constant when playing a piece, from one player to another, or even when holding a note.

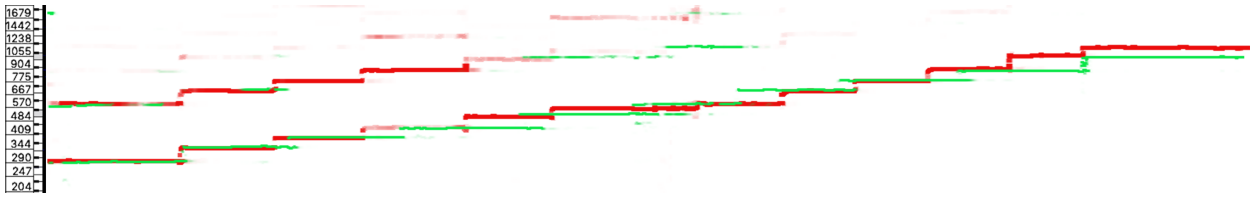
To show this lack of consistency, both players recorded the scale a second time a few months later. As example 8 shows, the results differ from the previous recording. On the flute using *towari* traditional tuning, except for the three first tones, all the others are lower in the second recording. Similarly, on the modern flute, excepting the first tone which is slightly higher, all tones are lower, though to a much lesser extent in the last 3 tones of the second octave. A third recording would give different results as well.

First octave		***Ro* / D4**	***Tsu* / F4**	**Re / G4**	***Chi* / A4**	***Ha* / C5**
Towari Traditional Tuning	1st	296,00	349,80	392,90	452,10	511,30
	2nd	296,00	349,80	392,90	441,30	505,90
Variations in frequencies					-10,80	-5,40
Modern Tuning	1st	296,00	355,20	403,60	446,70	527,40
	2nd	296,60	349,80	392,90	441,30	522,10
Variations in frequencies		0,60	-5,40	-10,70	-5,40	-5,30

Second octave		***Ro* / D5**	***Tsu* / F5**	**Re / G5**	***Chi* / A5**	***Ha* / C6**
Towari Traditional Tuning	1st	597,40	694,30	785,80	909,60	1071,00
	2nd	586,60	688,90	769,60	893,40	1049,50
Variations in frequencies		-10,80	-5,40	-16,20	-16,20	-21,50
Modern Tuning	1st	592,00	705,00	796,50	888,00	1049,50
	2nd	586,60	699,70	785,80	877,30	1038,70
Variations in frequencies		-5,40	-5,30	-10,70	-10,70	-10,80

Example 8. Tuning discrepancies among tunings resulting from a later recording. These numbers were obtained using the Spectrum analysis function of the audio edit software Amadeus Pro.

To give a different perspective of the tunings of both *shakuhachi*, visual this time, example 9 gives a peak frequency spectrum analysis of both tunings, that is, the dominant amplitude of the frequencies of the tones. The red line indicates the *Fuke Shakuhachi*, the green line the modern *shakuhachi*. We can see that in the lower octave, both flutes are somehow in tune, while the higher octave of the *Fuke shakuhachi* has higher frequencies. The



Example 9. A peak frequency spectrum analysis of both shakuhachi. The red line indicates the Fuke Shakuhachi, the green line the modern shakuhachi, adapted from Sonic Visualiser software (Queen Mary, University of London), a visualization, analysis, and annotation of music audio recordings (sonicvisualiser.org).

aim of this example is solely to give a visual idea of the discrepancies of tunings between both flutes.

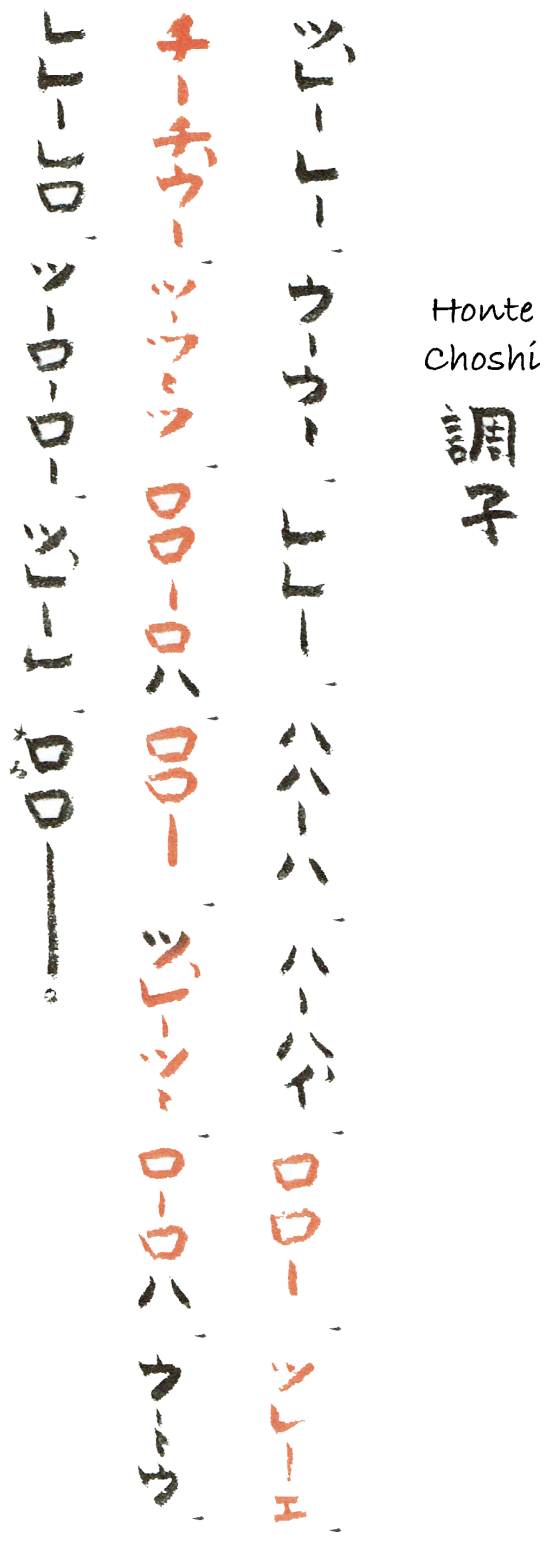
A Piece: *Honte Choshi*

Honte Choshi is a traditional piece whose name suggests a purpose of checking one's "tuning" (*choshi*). We compare how a piece played with two different types of *shakuhachi*, one ancient and one modern, gives different tuning results. The version performed on the *Fuke shakuhachi* is done using the traditional fingering in a traditional style, e.g., by lowering the head or making use of the breath, while the one performed on a modern *shakuhachi* (both performed by Nick Bellando) is done using modern techniques, e.g., shading holes, which allow greater flexibility in tuning. At times, Bellando includes elements that are not explicitly indicated on the score. Example 10a (p. 20) gives the original score, while example 10b (p. 21) is a transcription in Western notation. Both players add stylistic devices particular to the style in which they are playing (more traditional for the *Fuke Shakuhachi*, more modern for the other), which are not indicated on the scores. This analysis concerns the original score, not these devices.

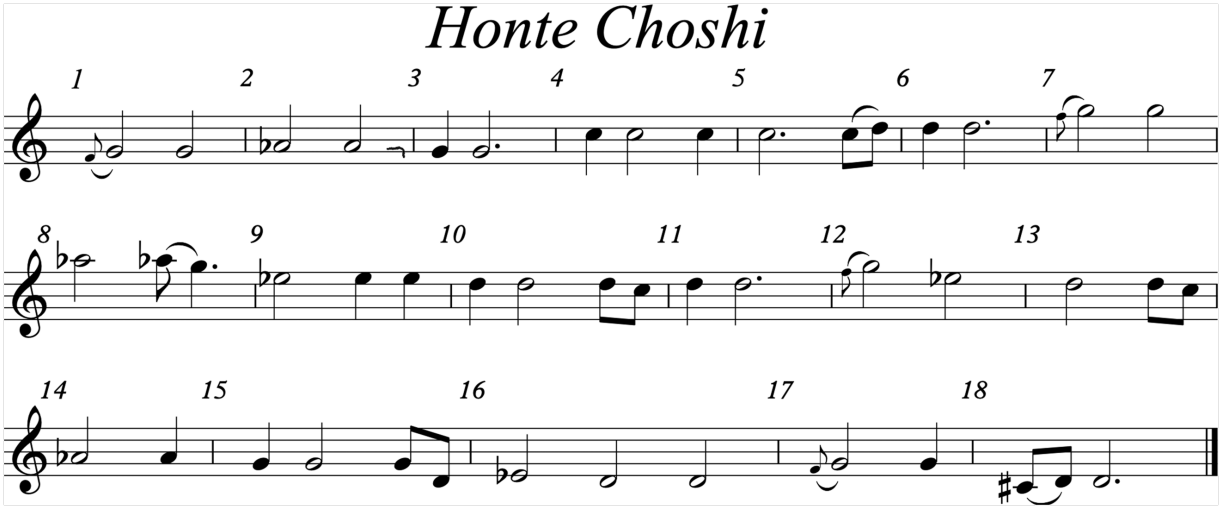
Example 11 (p. 22) lists the tuning of the 18 phrases for each note heard in the piece, both for traditional and modern tunings. In line with the scale shown in example 7, the recording of the *Fuke shakuhachi* version starts a semitone lower than the modern *shakuhachi*. We raised the pitch to match it with the tempered scale and the modern *shakuhachi* for the sake of comparison. We were able to get the first note for each recording to be exactly the same. As mentioned earlier, the tone being played on a *shakuhachi* is never perfectly stable; although the table shows the same frequency between some phrases, these numbers indicate mean frequencies (Hz).

Here are the main points of our analysis:

1. Some tones are exactly the same on both flutes—for example, the first G_4 in phrase 3, although the second G_4 on the *Fuke shakuhachi* is higher. Yet, as can be seen on phrases 15 and 17, the G_4 on the *Fuke* flute is higher than the first one on phrase 3. The first G_4 on both phrases 15 and 17 are the same on the modern flute as the *Fuke*



Example 10a. The original score of *Honte Choshi* (the phrases in black indicate to play in the lower octave, and the orange ones in the second octave).



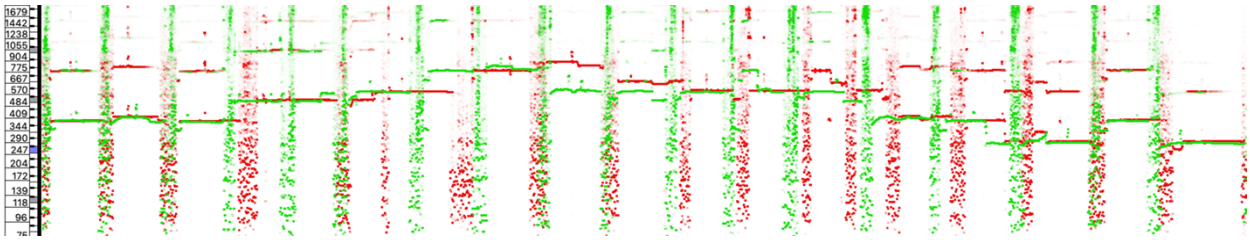
Example 10b. Transcription of *Honte Choshi*. To hear recordings in ancient and modern tuning, click below.

	Phrase 1: F4-G4	Phrase 2: G#4	Phrase 3: G4	Phrase 4: C5	Phrase 5: C5-D5	Phrase 6: D5
Towari Traditional Tuning	349.8 398.3	419.8	392.9 398.3	527.4 527.4 532.8	532.8 527.4 586.6	597.4 597.4
Modern Tuning - BD	349.8 398.3	414.4	392.9 392.9	522.1 522.1 516.7	522.1 516.7 581.3	597.4 592.0
Modern Tuning - NB	349.0 392.9	414,4	392.9 392.9	527.4 522.1 527.4	522.1 522.1 597.4	597.4 592.0
Tempered scale	349.2 392.0	415,3	392,0	523,3	523.3 587.3	587,3

	Phrase 7: G5	Phrase 8: G#5-G5	Phrase 9: D#5	Phrase 10: D5-C5	Phrase 11: D5	Phrase 12: G5-D#5
Towari Traditional Tuning	796.5 801.9	898.8 898.8 855.7	688.9 683.5 694.3	608.2 608.2 608.2 532.8	602.8 602.8	796.5 683.5
Modern Tuning - BD	796.5 796.5	850.4 845.0 812.7	613.5 608.2 602.8	597.4 597.4 597.4 527.4	597.4 597.4	801.9 618.9
Modern Tuning - NB	791.2 791.2	828.8 828.8 796.5	629.7 629.7 629.7	592.0 597.4 592.0 522.1	592.0 592.0	785.8 629.7
Tempered scale	784,0	830.6 784.0	622,3	587.3 523.3	587,3	784.0 622.3

	Phrase 13: D5-C5	Phrase 14: G#4	Phrase 15: G4-D4	Phrase 16: D#4-D4	Phrase 17: G4	Phrase 18: C#4-D4
Towari Traditional Tuning	608.2 608.2 538.6	425.2 419.8	398.3 398.3 398.3 301.4	344.4 296.0 296.0	398.3 398.3	263.7 296.0
Modern Tuning - BD	597.4 592.0 522.1	419.8 414.4	398.3 398.3 398.3 290.6	301.4 290.6 290.6	398.3 392.9	279.6 290.6
Modern Tuning - NB	592.0 592.0 522.1	414.4 414.4	387.5 392.9 392.9 290.6	312.2 290.6 290.6	392.9 392.9	279.9 290.6
Tempered scale	587.3 523.3	415,3	392.0 293.7	311.1 293.7	392,0	277.2 293.7

Example 11. Comparison of *towari* and modern tunings for all notes in the 18 phrases of *Honte Choshi*. These numbers were obtained using the Spectrum analysis function of the audio edit software Amadeus Pro. To hear both recordings of *Honte Choshi* by Nick Bellando, click the link under Example 10b.



Example 12. A peak frequency spectrum analysis of both *shakuhachi*. The red line is for the *Fuke Shakuhachi*, while the green line, the modern *shakuhachi*. What is most noticeable here is the irregularity of sustained tones on both *shakuhachi*, an irregularity which supports yet contradicts in some ways what is presented above, adapted from Sonic Visualiser software.

one, while the second one in phrase 17 is lower for the modern flute. Example 12 gives a peak frequency spectrum analysis of the piece *Honte Choshi* of both *shakuhachi*. The red line indicates the *Fuke Shakuhachi*, the green line the modern *shakuhachi*. The aim of this example is only to give a visual idea of the discrepancies of tunings between both flutes. As example 12 shows, though they are more stable on the modern *shakuhachi*, they do fluctuate on both flutes.

2. In a number of phrases, the pitches are clearly different between both *shakuhachi*: for example, phrases 2, 4, 5, 8, 10, 11, 12, 13, 14, 16, and 18. Except for the first tone of phrase 12, in all the others, the modern flute is lower than the *Fuke shakuhachi*.

3. The frequency of a tone is not constant from one phrase to another. For example, the $G\sharp_4$ in phrases 2 and 14, or the C_5 in phrases 4, 5, 10 and 13 are nearer to each other on the modern *shakuhachi* than the *Fuke shakuhachi*. The same with the D_5 on phrases 5, 6, 10 11, and 13, and the G_5 in phrases 7, 8, and 12. It can be noticed that the pitch is more regular on the modern flute. Yet, it is nearly impossible to have the same frequency for each occurrence of a tone, though it can happen.

4. The $D\sharp_5$ on phrases 9 and 12, as well as the $G\sharp_5$ on phrase 8 or the $D\sharp_4$ on phrase 16, are the two tones the most different between both flutes, thus showing the larger discrepancies in tuning. For example, in both phrases 9 and 12, the $D\sharp_5$ is much higher on the *Fuke shakuhachi* compared to the modern one because the head movement does not allow to lower it as much as with the modern that uses a shadowing of a hole with a finger. The same can be said about the $G\sharp_5$ in phrase 8, as well as the $D\sharp_4$ on phrase 16.

5. In most phrases, when a tone is repeated, the last one is usually lower than the previous ones. In phrase 4, however, for the *Fuke shakuhachi* we have the opposite situation: the last tone is higher. Although it happens only once here, this can be a common occurrence, though not predictable, in any performance for any piece on any *shakuhachi*.

6. When comparing both recordings, phrase 12 is most interesting. In the modern *shakuhachi* recording, the G_5 is higher than the same G_5 in the *Fuke shakuhachi* recording, while the $D\sharp_5$ is much lower—a most unusual discrepancy compared to other phrases, but which can also be common.
7. Finally, there are also some discrepancies in tuning between the previous scale in examples 7 and 8: for example, the D_4 in phrases 15, 16, and 18. In example 7, D_4 is 296.0, while in example 8, this value of 296.0 appears only in the *towari* tuning, not the modern tuning. Another example is D_5 in *towari* tuning, which is 597.40 in example 7 (a number which appear only in phrase 6, not in phrases 5, 10, 11, and 13, where there is a D_5). We have the same situation with the modern tuning. One example: D_5 in example 7 is 592.0. That number appears only on the second D_5 in phrase 13, not in phrases 5, 10, 11, and 13.

In the End

It goes without saying that the analysis presented above cannot give a full grasp of the differences in tone color and pitch between both *shakuhachi*. To do so, we would need to do a thorough harmonic spectral and formant analysis of each and every tone for a number of flutes, both *Fuke shakuhachi* and the modern one, which is beyond the scope of this essay. From our analysis of *Honte Choshi,* we can see that both flutes rely heavily on the player's skills, sensitivity, and pitch sense when it comes to the actual pitches produced when playing a piece. This is true even considering the techniques used to bring the modern *shakuhachi* in tune (staggered hole placement and bore shaping). This phenomenon exists largely due to the flute's employment of the air reed, which affects pitch on both instruments considerably.

We can see clearly, however, from the analysis of the raw scales of both flutes, that the *Fuke shakuhachi* requires greater adjustment on the G notes as well as the C and D played in the lower octave. We can also see from the relative sharpness of the E♭ (E) and G♯ on the *Fuke shakuhachi* in the analysis of *Honte Choshi* that the flute's construction, coupled with the playing technique employing the breath (rather than shading finger holes) to adjust pitch, results in a piece with *meri* notes (semitones) that give it a significantly different feel and quality than it has with the deeper *meri* notes of the modern *shakuhachi*.[35] Again, it goes without saying that an instrument tuned to a scale in D is more suited to ensemble playing that is an instrument roughly tuned to C♯, as with the *Fuke shakuhachi*.

We see represented in the *Fuke shakuhachi* and the modern *jiari shakuhachi* a vast spectrum of historical techniques, philosophies, and temperaments, many of which are not apparent through pitch analysis alone. Both flutes' employment of the air reed creates a

35. This is consistent with the playing style of many *Myoan* players. Deeper *meri* tones are possible with *Fuke shakuhachi*, but the slightly higher tones are easier to play and provide a different tone-color as well as a very different feel to the piece in general.

variability in pitch that depends heavily on the player, but the flutes' construction betrays a great difference in philosophical approach. The *Fuke shakuhachi*'s hole spacing shows more concern for ergonomics, flexibility, and tone color, prioritizing adjustment by breath without a need for strict precision (especially in the case of E♭ and G♯, the *meri* tones used in *Honte Choshi*). The modern *jiari shakuhachi*, by contrast, prioritizes pitch, this being evidenced first in that it is tuned to D, as well as that its hole spacing and bore are designed for greater pitch accuracy. Again, the former is quieter, being designed for personal spiritual practice, while the latter is capable of greater volume, being designed for ensemble playing and stage performances.

While these differing philosophical approaches are represented clearly in the construction of their respective flutes, neither is utterly exclusive. The *shakuhachi* and the *hitoyogiri* were taken up by monks in part for their sensitivity to the player's physical and mental condition. Anyone can create a pitch of C on a well-tuned piano, but the *shakuhachi*, ancient or modern, will vary in pitch and tone color between players and between the same player from day to day, as well as when using different flutes. Tension in the body, energy levels, and many other factors make the flute well suited for a sort of dialogue with one's own mind and body. Today, many players are attracted to the spiritual aspects of that flute and its music.[36] Most of these players still end up playing on a modern *jiari* or modern *jinashi shakuhachi,* simply due to their popularity and the lack of availability or knowledge of the more traditional type. Even so, a player wanting to play *honkyoku* in the older style will benefit from exploring the older *Fuke shakuhachi*, while a player aiming to become a professional performer or play modern music will have a much easier time with a modern *jiari shakuhachi*.

36. See in this regard Jay Keister, "Seeking Authentic Experience: Spirituality in Western Appropriation of Asian Music." *The World of Music* 47, no. 3 (2005): 35–53; idem., "The *Shakuhachi* as Spiritual Tool: A Japanese Buddhist Instrument in the West," *Asian Music* 35, no. 2 (2004): 99–132.

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