Topic 5: Many musical Instruments in China are similar to those in other countries or regions. Please give some examples and explain the similarities and differences.

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Title: Comparisons between construction in Western and Chinese musical instruments

# Introduction

The parallels between the appearance of certain traditional Chinese instruments to Western counterparts are easily visible upon visual inspection; the *erhu* is a bowed, necked soundbox similar to the violin. These similarities range from the construction of the instruments to the musical techniques used to play them and their role in the ensemble. Western influences are already evident through inspection of the playing technique and resulting sound of the *erhu* – for example, Stock (1993) notes how Chinese musicians switched to using the pads of the fingertips to stop the string rather than the middle of the fingers (as I instinctively do as a classically-trained violist on the *erhu*), and the technique of shifting hand position is used more frequently, as is done by violinists to achieve a wide range of pitch. These technique changes will be well-observed by musicians who are familiar with performing on both instruments. This author is a violinist and violist but has only experimented with the *erhu* without expertise, so this paper will instead go in-depth into instrument construction, a factor that is less visible to the performer and audience but equally influential to the future of Western and Chinese musical instruments.

This topic is worth exploring because instruments are constantly evolving, shaped by their constantly changing social and industrial environments. Examples will primarily come from string instruments due to the author’s expertise, but the construction and distribution of these instruments are not limited to these specific instruments, or even the wider family of chordophones.

By examining the historic similarities and differences in instrument construction, this essay will discuss how instruments have co-evolved to their present form, and what facets of instrument construction remain unique. We then discuss trends in instrument co-evolution and convergence on common traits and explain why certain developments could happen in the future.

# Strings

Strings for any instrument can be produced from a variety of materials, so long as they are flexible to allow vibrations to propagate along their length, and elastic to sustain the vibration for a length of time (elastic, as in, return energy after being deformed so that the vibration wave is not dampened). Historical Western violin strings were made of *catgut*, usually from dried sheep intestine, either alone or wrapped in metal wire. This string has a unique, dark timbre and is now used for authentic Baroque period music. Objective characteristics that disadvantage catgut versus modern strings include poor durability (my violin teacher’s deteriorated after a couple months of comparatively light use, whereas I replace my nylon/steel strings after 6-12 months), lack of dynamic range at the *forte* end, cost and variability in quality, and animal products. These considerations push almost all modern violinists to use synthetic strings wrapped with steel, chrome, silver, or tin. This pattern is common across the violin and guitar families.

In comparison, the historical *erhu* (and many other Chinese instruments in the ‘silk’ category) uses silk strings. In Stock’s personal correspondence with Wu Zhimin, Wu notes that the contemporary shift from silk to steel occurred between 1950 and 1958. This comparatively rapid change is undeniably due to the availability of existing metal violin strings, with musician Lu Wencheng initially using a modified violin E string. This is one example of cross-influences causing these two instruments to cease using less durable, natural fibres and converge on nylon/metal. In fact, strings for both instruments can be found from the same eminent manufacturers such as Pirastro (n.d.). The production of strings for both instrument families from the same companies could result in the transfer of manufacturing expertise and/or a similar sound, with the former a benefit to product quality and the latter a detriment to the individuality of the instrument.

One notable difference is that on the violin, the G, D and A strings are most commonly steel-wound nylon; only the E string is steel-wound with a steel core. On the *erhu*, both strings are steel-wound steel cores. The nylon core is preferred (by this author) because of its mellow, gentle sound that is closer to the original catgut, whereas the E string pierces through orchestral music better. This begs the question – would synthetic cores allow the *erhu* to match the style of its original silk strings more closely? If so, this would be yet another example of technology transfer that allows one instrument to take advantage of developments in construction techniques from another. In a similar vein, could silk strings be applied to a viola (for its bridge to nut length that is more like the *erhu*) to provide an *erhu*-like sound when an *erhu* is not available?

# Skins and composite materials

Some industries and musicians choose to reduce the amount of animal products required in their instruments, due to ethics, sound quality, supply and sustainability, or regulations such as Chapter II of the Law on the Protection of Endangered Species (China, 1988). With the violin there is no suitable, readily available replacement for materials such as horsehair and hide glue; the animals used are also not considered endangered by any means. However, the traditional python skin of the *erhu* is affected, with *erhu*s since 2005 requiring administration-certified farm-raised python skins and limiting individuals to take a maximum of two *erhu*s across the border, reducing the burden on wild pythons but increasing instrument prices (AFP, 2005). Importing *erhu*s can also be difficult, although a friend and I did not need to provide additional details after declaring one to New Zealand customs in 2013.

In response, the Hong Kong Chinese Orchestra began creating its eco-*huqin* series that same year. As of 2019, it are into the third generation of instruments (Yuen, 2019). These eco-*huqin*s use polyethylene terephthalate (PET) membranes instead of python skin. This is not in isolation – in 2009, the EcoErhu company began developing their artificial membrane that mimics the multi-layered structure of the python dermis. Their cellulose-silica composite membrane even goes so far as to include a thickened medial strip which would normally run along the spine of the snake (EcoErhu).

Western drums have been using synthetic skins since the first commercially available PET drumhead from Remo Belli (United States Patent No. 2,934,989, 1957). Remo Inc. now create a range of products that mimic traditional materials such as calfskin in their sound and physical construction properties.

The switch in both industries towards synthetics can be attributed to similar market pressures, as both manufacturers cite improved product quality and consistency when exposed to humidity and temperature changes. Interestingly, noting the similarities and usage of PET as a feedstock albeit with different processing techniques (e.g., into Mylar for Remo, and as a multi-layer composite with more than two layers in the EcoErhu), there does not seem to be any crossover yet between companies that produce these synthetic Western and Chinese skins. However, like synthetic strings, it may just be a matter of time until production techniques and intellectual property (IP) are shared between the two families of instruments. In practice, this can be done through IP licensing or corporate mergers and acquisitions.

# Pitch

One intricacy in the construction of the *erhu* is the *qianjin* (千金), a string wrapping around the neck and the two strings that provides a vibrational node, shortening the effective length of the string. This plays the same role as the nut of the Western chordophones, but the nut is hard and fixed rigidly to the neck, whereas the *qianjin* can be adjusted vertically and is flexible. A side-effect that is unusual to violists such as myself is that as the *qianjian* flexes differently with an upbow (drawing the bow hand towards the strings) versus a downbow (drawing away from the strings), the length of the string and therefore the pitch changes. This has been verified through spectral and harmonic analysis (McLaughlin, 2000).

McLaughlin also experiments with adding a maple nut to the *erhu* to create an instrument with characteristics of both the original *erhu* and a violin/viola. In their analysis of the frequency spectrum with the *qianjin* versus the nut, the nut prevented the pitch from bending differently between upbows and downbows and also gave more defined lower harmonic frequencies. The timbre of an instrument is due to its unique combination of harmonic frequencies above the fundamental note, and McLaughlin claims this sounded more like a violin with the characteristic Chinese sound caused by harmonic instability.

If we combine this result with Stock’s insight about contemporary *erhu* technique aligning itself with Western pedagogies in the music conservatories, it would not be surprising to see changes to the *qianjin* involving a fixed nut. Some musicians may consider this departure from the traditional *erhu* construction sacrilegious as it undoubtedly removes much of the unique sound, but would make intonation easier for beginners or violists such as myself.

# Conclusions

The cross-pollination of ideas in construction between Western and Chinese instruments is easily visible, particularly in how the materials used in Chinese instruments follow developments in Western string and percussion instruments. In general, changes to modern materials in the violin family and American-manufactured drums have shown to also be beneficial to the *huqin* family such as the *erhu*, such as the use of synthetic nylon-cored strings and PET membranes to produce sound – both the result of a movement away from animal-derived products. This essay also discusses how the violin-*erhu* counterpart is not without its differences; however, we do not see the inclusion of a nut in the *erhu*. This is a fundamental structural change that is not a result of modern material development.

In general, we see Western and Chinese instrument construction converge as a result of new modern material development, but not as a result of structural differences. However, this is for the common contemporary version of each instrument. There is always scope for luthiers to experimentally combine concepts from different instruments, whether those be structural, material, or musical technique.

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