RECONTEMPLATING THE CLASSIFICATION OF MULTIPLE REEDS

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ABSTRACT

The 2011 Revision of the von Hornbostel and Sachs Classification of Musical Instruments by the MIMO Consortium categorises the 'reedpipes with double (or quadruple) reeds' (422.1) according to the number of pipes, bore shapes, and finger holes, as it does to many other instrument groups. However, this scheme rather overlooks the significantly varied features of the multiple reeds themselves – their structural difference that determines their making and functioning, and how they connect to the pipe body – especially considering the vast varieties and distribution of multiple reeds compared with other types of reed pipes. Following the hierarchical classification of reed pipes (422) primarily according to the types of reeds, this paper would propose a further classification based on the 'subtypes' of multiple reeds. The first level divides into 'idioglot reeds' and 'staple-mounted reeds' based on the connection of reeds with the pipe body. Idioglot reeds make one-part and two-part reed pipes, the former 'usually a flattened stem' of the upper end of the pipe itself and the latter made from unbroken thick cane that fits inside the pipe bore. In contrast, staple-mounted reeds make three-part reed pipes. Some have fixed sides so that only the tips of reed blades are free to vibrate, while others have detached individual leaves that can vibrate on all sides. Given that reeds, as the primary source of sonic vibration, decide many fundamental features of a reed pipe, this recontemplated classification is likely to provide more distinct insight into their construct, functioning, and historical lineages.

KEYWORDS

von Hornbostel and Sachs, Classification, Multiple reeds, Shawm, Timbre

INTRODUCTION

The 2011 "Revision of the Hornbostel–Sachs Classification of Musical Instruments" by the MIMO Consortium (MIMO Consortium, 2011) categorises the 'reed pipes with double (or quadruple) reeds' (422.1) according to the number of pipes, bore shapes, and finger holes, as it does to many other instrument groups. However, this scheme rather overlooks the significantly varied features of the multiple reeds themselves – their structural difference that determines their making and functioning, and how they connect to the pipe body – especially considering the vast varieties and distribution of multiple reeds compared with other types of reed pipes. In fact, there have been earlier scholars who noticed the significance of the multiple reeds themselves rather than the body in the characterisation of these instruments. For example, Anthony Baines gave a widely quoted definition of the shawm type as 'the reed-instrument sounded with a double reed carried on the narrow end of a conical metal staple. The body of the instrument usually, but not always, continues the bore-expansion of the staple' (Baines, 1957: 228). This statement from 60 years ago already challenges the classification according to the bore shapes as it still does today. On the other hand, from the perspective inside the 'von Hornbostel and Sachs Classification', following the hierarchical classification of general reed pipes (422) primarily according to the types of reeds, this

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paper would propose a further classification based on the 'subtypes' of multiple reeds, in the hope of providing more distinct insight into their construct, functioning, and historical lineages.

IDIOGLOT REEDS VERSUS MOUNTED REEDS

As the above definition by Baines has pointed out, it is the staple, a small conical metal tube onto which the reeds are inserted, that defines shawms as opposed to other multiple reed pipes. But shawms are actually a latecomer in this family, and the idioglot double reeds predate shawms for thousands of years, at least from the time of the ancient Egypt (Figure 1). Idioglot double reeds are conceivably much easier to make, just by flattening an end of a natural tubular material, usually the stem of herbaceous plants. It is probably for this reason that the idioglot double reeds are the earliest documented reed pipes among all types. Yet, despite their facility in making, idioglot double reeds have a severe drawback as follows: the flattened and scraped tips are very fragile, and once they are broken, the whole pipe is useless. Therefore, idioglot double reeds today usually serve merely as disposable toys for children, for example, *pipi* of the Uyghur people (Figure 2). In order to make genuine durable musical instruments, harder materials like wood are used for the pipe body, which leads to the separation of the reeds since they must still be made of softer flexible materials. Nevertheless, such detachable double reeds retain the traits of idioglot reeds, made from unbroken thick cane that fits inside the bore of the pipe body. So far, we have one-part and two-part double-reed pipes; the extant examples of the latter include Central Asian *duduk*/*mey* and East Asian *bili*/*hichiriki*.

Figure 1: Painting from the tomb-chapel of Nebamun, circa 1350 BC, Ancient Egypt (British Museum, London, open access).Figure 2: Pipi of the Uyghur people (MúSIC Musée des instruments Céret, open access).

Mounted reeds, on the other hand, make three-part reed pipes. Such multiple reeds are comprised of separate blades made from tubular materials (usually herbaceous stems, but locally also cocoons, or nowadays plastic drinking straws) cut in half or flat and tough leaves (usually from palm-like species) cut in small pieces. The blades of varying numbers from 2 to 8 are tied together in a circle that fits on top of a small metal tube; some remain detachable like on bassoons and many Asian shawms, while others are permanently glued like on European oboes and many bagpipe chanters. This, however, does not make a difference in the nature of the reeds and should still be regarded as three-part reed pipes.

The relatively advanced craftsmanship required to make the small metal tube put shawms much later in the history of reed pipes compared with idioglot double reeds, with the earliest extant evidence dating back no further than the third century AD (Farmer, 1977: 69–86), on artefacts such as silver plates from the Sasanian Empire (224–651 AD) that depicted shawms with a staple. Yet, the latecomer's effort has paid off: the mounted reeds have become the more prevalent type of reed pipes in the Eurasian continent and found new roles for its repertoire. Around a millennium later, Śārṅgadeva (1175–1247 AD) spoke of the shawm as 'sweet-sounding' instead of a warlike instrument as it was in the Persian and Arabian empires, which sound was attributed to the staple-and-reed (Dick, 1984: 89).

Figure 3: Sasanian plate depicting a shawm with a staple being played (Hermitage Museum, Saint Petersburg, open access).

As in Baines's definition, the metal tube has to be conical in shape (figure 3) in order to become known as the staple, but the pipe bore does not have to be. Many European Renaissance double-reed pipes with wind caps also have their reeds tied to a small metal tube that is inserted into the bore of the pipe body, including *crumhorn*, *cornamuse*, and rarer *kortholt*. These instruments, however, are obviously not shawms, not only because they have a narrow cylindrical bore instead of a conical bore but also because the tube that connects their reeds to the body is also cylindrical. This should be classified into another type of three-part reed pipes. In fact, some instrument makers have already noticed that the cylindrical metal tube plays a different role than a staple: being the extension of the pipe body, it can be lengthened or shortened to adjust the pitch just like a trombone and hence, the ingenious innovation of the 'telescoping reeds' (Figure 4).

On the other hand, reed pipes with conical staple and (nearly) cylindrical bore should also be regarded as shawms. Examples of such instruments are actually not rare: *zurna* in Bulgaria and Turkey, among others (Dick, 1984: 94; Montagu, 1997: 74–79; Liu, 2019: 74–75), *terompet* of East Java that uses bamboo to make the body which is naturally cylindrical (Figure 5) and possibly also *pi-nai* of Central Thailand despite its unusual outer shape (Liu, 2020: 99).

Figure 4: 'Telescoping reeds' of a bass crumhorn, contracted (above) and extended (below).[2]

[2] All photographs were taken by the author if not stated otherwise.

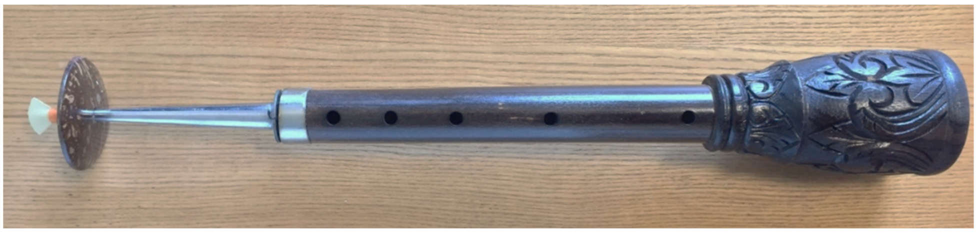

Figure 5: Terompet from Ponorogo, East Java, Indonesia, featuring a large conical staple and a cylindrical body.

FIXED SIDES VERSUS OPEN SIDES

Among the multiple reeds, some have fixed sides so that only the tips of reed blades are free to vibrate, while others have detached blades that vibrate on all sides. Idioglot double reeds, being made of a whole unbroken tubular material, all must have fixed sides. But mounted reeds are different: although their individual blades primarily all have open sides, they are sometimes glued together into fixed sides during the later process (like the Scottish Highland bagpipe chanter reeds) or their sides join naturally due to their curved shape and elasticity (like European oboe reeds). This is common on reeds made of cane; however, on other multiple reeds made of leaves, the sides of the blades usually remain open, which is quite common on South Asian and Southeast Asian multiple reeds (Figure 6).

Figure 6: Reeds of 2–8 blades with open sides, from left to right: terompet (East Java), horanawa (Sri Lanka), pi-nai (Central Thailand), pi-nai (Southern Thailand), and hne (Myanmar).

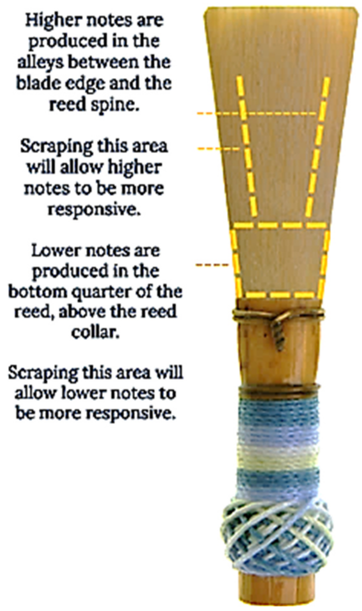

Figure 7: Analysis of bassoon reeds (Double Reed Ltd., UK, open access).

Fixed sides reduce the width of the entrance where the air current is forced between the reed blades, thus raising the air pressure required to vibrate the reeds, as on modern oboe compared with Baroque oboe. If the blades are made wider to counter the reduction of width by fixed sides, it would result in louder volume with equally high air pressure, as in the case of the Scottish Highland bagpipe chanter.[3] Generally, fixed sides enhance the stability of pitches with a more defined timbre, as in both cases above. Open sides, on the contrary, allow playing in relatively lower air pressure and reduce the stability of notes, which actually better serves the ubiquitous inflection and intonation in Asian music. Also, open sides totally free up the vibration all around the reed blades, including their bottom area. An analysis of the bassoon reeds (Figure 7) reveals that their bottom area is responsible for lower frequencies. Multiple reeds with the broader bottom area and open sides may induce lower frequencies, which facilitate the technique of under blowing (the opposite of overblowing, it utilises lower air pressure for downward extension of the playing range), and sometimes this lower frequency is involved with another fundamental frequency to produce multiphonics, the instinctive feature of the musical language of central Thai *pi-nai* and *pi-chawa* (Liu, 2019: 182).

EFFECT OF DIFFERENT TYPES OF MULTIPLE REEDS ON TIMBRES

The proposition of reclassification of multiple reeds is not only due to their different appearances and making, but more importantly based on their effect on timbres, given that reeds, as the primary source of sonic vibration, decide many fundamental features of a reed pipe.

A spectrum comparison of audio samples of the same pitch of $^{b}e^{1} \approx 153$ Hz played on *duduk*, bass *crumhorn*, tenor shawm, and clarinet is done using the software Adobe Audition CC 2018 and SpectrumView version 1.26, as shown in Figure 8. Psychoacoustic studies have suggested that peaks in spectrum envelope, or formants, play a key role in the perception of the attributes of different timbres (Campbell, 2001: 153–154). Therefore, the following comparison mainly focuses on the formants and troughs of the spectra.

In the current H-S classification, both *duduk* and *crumhorn* fall in the category 422.111.2 'Reed pipes with double reeds, with cylindrical bore, with finger holes.' However, their spectra reveal contrary traits: overall, *crumhorn* has a nearly even distribution of energy across the spectrum up to around 6 kHz, while *duduk* has much weaker partials above 2 kHz. More specifically, the spectrum of *duduk* has a trough around 1.5 kHz and a formant near 2 kHz, while that of *crumhorn* has a formant near 1.7 kHz and a slight trough near 2 kHz, which are almost the opposite. Interestingly, clarinet, although being single reed, has some similar spectrum features to *duduk*: a trough around 1.7 kHz and a formant near 2.3 kHz. In fact, this result also corresponds to a common impression that *duduk* is more similar to clarinet compared with other double reeds, in terms of both sound and playing, which leads to the invention of a hybrid instrument 'ClarDuk' (Figure 9). The multiple similarities between *duduk* and clarinet could be due to the fact that the large inherent cavity inside the idioglot double reeds resembles the cavity inside the clarinet mouthpiece, both with a tapered tip and bulging body (Figure 10), while other types of double and single reeds only have little space inside.

Also contrary to the common knowledge that reed pipes with cylindrical bore lack even-number partials (Benade, 2001), *crumhorn* has a very dense spectrum over all partials, and *duduk* also gives a spectrum containing all partials, though the even-number ones are truly weaker. This unusual phenomenon incoherent with theoretical models is also attributed to the reeds as the narrow aperture-tipped cavity inside them may function as a conical part, providing even-number partials missing on the cylindrical bore, similar to the conical mouthpiece on cylindrical lip-reed instruments (Howard, 2006: 193–194). This further demonstrates the underestimated effect of the

[3] Indeed, besides the entrance width of the air current, the air pressure required to vibrate the reeds also depends on the elastic modulus of their materials as well as the distance between their apertures; these factors are not exclusive to multiple reeds.

reeds themselves on the acoustic nature of reed pipes and hence the emphasis laid on them in terms of classification.

The case of the low shawm shows the difference made by the staple in combination with the pipe bore. With its reeds almost identical to tenor *crumhorn* reeds (Figure 11), the conical staple combined with conical bore contribute to the characteristic timbre of low shawms, including bassoon. The combination of a conical staple and a cylindrical bore is common, as mentioned above; but on the contrary, a cylindrical tube may not connect the reeds to a conical bore, as no such instrument has been mentioned so far. The mechanism behind this disparity requires further studies, but it is comparable that the combination of a single reed and a conical bore did not prevail until the modern invention of saxophone and the modified *tárogató* in Hungary around the same time. This parallelism again hints at some similarity between the idioglot double reeds and the single reeds.

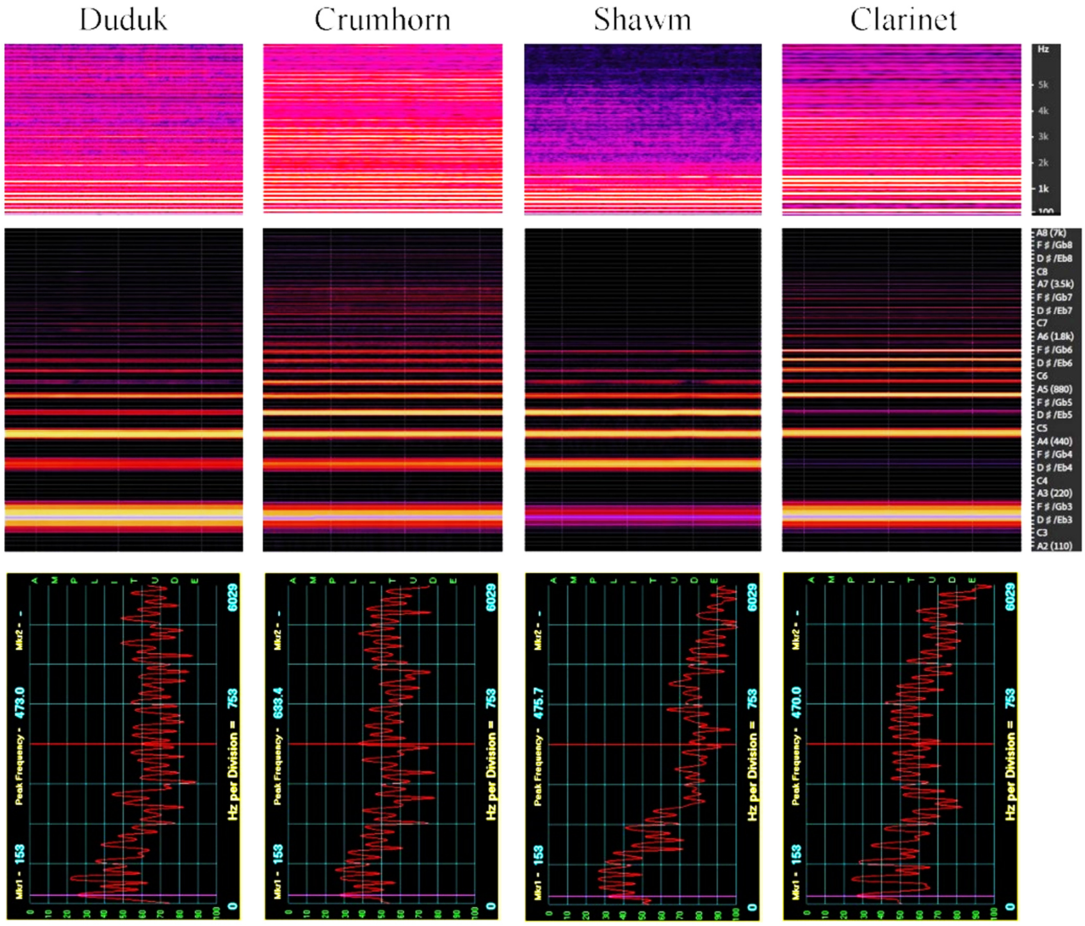

Figure 8: Spectrum comparison of audio samples of the same pitch played on duduk, bass crumhorn, tenor shawm, and clarinet.

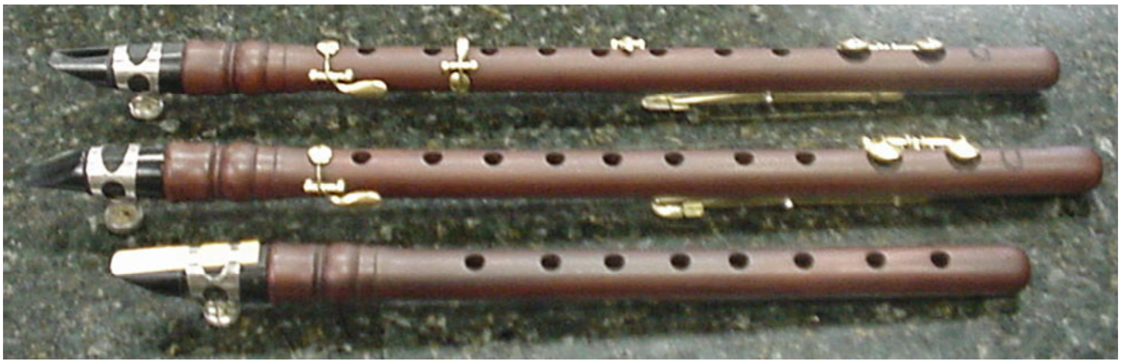

Figure 9: 'ClarDuk' made by Hovsep Grigoryan, Yerevan, and Armenia (open access).

Figure 10: Comparison of idioglot double reeds (Turkish mey) and clarinet mouthpiece.

Figure 11: Comparison of tenor shawm reeds (above) and tenor crumhorn reeds (below), both made by Volker Kernbach.

<table>
<tr><td colspan="2">422.1a Idioglot reeds</td><td colspan="3">422.1b Mounted reeds
(Three-part reedpipes)</td></tr>
<tr><td rowspan="2">422.1a1
1-part reedpipes
Uyghur pipi</td><td rowspan="2">422.1a2
2-part reedpipes
duduk</td><td colspan="2">422.1b1
On a conical staple</td><td rowspan="2">422.1b2
On a cylindrical tube
crumhorn</td></tr>
<tr><td>422.1b1.1
With fixed sides
bassoon</td><td>422.1b1.2
With open sides
pi-nai, hne</td></tr>
</table>

Figure 12: Proposed classification table under the hierarchy of 'reed pipes with double (or quadruple) reeds' (422.1), wherein letters *a* and *b* are to temporarily distinguish proposed categories from currently existing ones.

CONCLUSION

The multiple reeds as the primary source of sonic vibration decide many fundamental features of a reed pipe. Following the hierarchical classification of general reed pipes (422) primarily according to the types of reeds, a proposed classification table under the hierarchy of 'reed pipes with double (or quadruple) reeds' (422.1) is shown in Figure 12. The first level divides into idioglot reeds and mounted reeds. On the second level, the former comprises one-part and two-part reed pipes, and the latter is differentiated by the shape of the small metal tube that connects the reeds to the pipe. On the third level, multiple reeds made of separate blades are further divided according to whether they have fixed or open sides. All these types of multiple reeds are not only different in terms of their appearance and making but also affect the timbral characteristics of the reed pipe to a great extent. One mechanism among others is that the cavity inside the multiple reeds introduces additional acoustic properties to the pipe bore, capable of producing more partials that would otherwise be missing in the spectrum. By focusing on the multiple reeds themselves rather than the pipe body, each group in this recontemplated classification better embodies the similarities and differences of instrumental timbres, which is likely to provide more distinct insight into their construct, functioning, and historical lineages.

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