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The Renaissance flute in mixed ensembles: surviving instruments, pitches and performance practice

EVER since I began making and performing on copies of Renaissance flutes I have been troubled by the problem of the pitch relationship between transverse flutes and other surviving Renaissance woodwinds. Most surviving flutes seem to be at a pitch lower than $a' = 440$ Hz, and anywhere from a minor 2nd to a 4th lower than surviving recorders, cornetts and dulcians.

This problem is particularly puzzling when one looks at the type of music and ensembles with which the Renaissance flute was combined, particularly in the first half of the 17th century in Germany. Concerted music, or pieces involving both singers and instruments, became popular towards the end of the 16th century. At first the question of instrumentation would mostly have been left to the judgement of the *maestro di capella* or *Kapellmeister*, but towards the end of the 16th century composers began to use specific instrumentation. There are approximately 30 known pieces that call for the flute, predominantly in larger ensembles for mixed voices and instruments.¹ Works by Praetorius, Schütz, Schein and Tobias Michael specifically require the transverse flute, as well as dulcians, cornetts and recorders. How could these composers combine instruments that were more than a whole tone apart without any mention of their being tuned differently? Was the lower pitch of flutes a standard, like that of transposing instruments nowadays, so that no mention of a transposition was necessary? Did flutes at a higher pitch exist? Were flutes made at one pitch for playing in

consorts, and at a different one for use in concerted music?

This so-called anomaly of Renaissance flutes has been discussed by many authors, and several solutions have been offered.² The general consensus seems to be that flutes were considered to be a tone lower than the other instruments, and were not intended to play at the higher instrumental pitches. However, the situation is more complex. There is evidence that there were higher-pitched flutes, as well as sets of different families of instruments made at the same pitch as the flutes. Furthermore, it is not clear at what nominal pitch concerted music was meant to be performed, nor how this may have affected the instruments involved in the performance.

In this article I shall try to answer some of these questions by examining the evidence at hand: surviving instruments, contemporary accounts of wind instruments, and recent research on 16th- and 17th-century pitch. I shall conclude by proposing some hypotheses concerning the performance of original compositions calling for the Renaissance flute.

Surviving instruments and Renaissance pitch standards

Let us start by looking at the surviving instruments and their pitches. Filadelfio Puglisi has drawn up a checklist of extant instruments, and has pointed to the existence of two main pitch levels, namely at $a' = 408$ and 435 .³ Allain-Dupré has recently

completed the list, focusing more on consort instruments, but also discussing issues of transpositions and mixed ensembles.⁴ In a paper that I presented at the International Renaissance Flutes and Recorder Symposium (Utrecht, 2003) I supplied pitches for almost all the surviving instruments.⁵ This list is presented in appendix 2. The pitches of most instruments could be determined simply by playing them; in some cases, however, where access to the instruments was not possible or where they were not in playable condition, the pitch was calculated by making copies of the originals or from the sounding length of the instrument.⁶

Renaissance flutes give a very accurate idea of the pitch at which they were meant to play. There are several reasons for this. They are usually unaltered, as they were rarely used after the 17th century, when they became outdated and fell from use.⁷ Wood shrinkage, which occurs in almost all woodwinds, has much less of an impact on cylindrically-bored Renaissance flutes than on the later conical instruments. The sounding length of the cylindrical-bore flute (calculated in this case from the bottom of the instrument to the middle of the embouchure hole) is the most important factor influencing its pitch; although secondary factors such as embouchure and bore size play a part, they are relatively insignificant, and may be disregarded for the degree of accuracy I am aiming for in this paper (5–6 Hz). The data presented in table 1 is based on my own measurements of the instruments at the various collections, as well as measurements presented by Puglisi.⁸

As others have previously pointed out, surviving flutes can be divided into several groups according to their pitch.⁹ Most of these groups (92 per cent of the instruments) are related to one another in a series of semitones. In order to make the data easier to analyse, each pitch group has been labelled with the number of semitones from the reference point, $a' = 408$. (This pitch was chosen as a reference point simply because it contains the largest group of surviving instruments.) The pitch groups were divided with a tolerance of ± 3 Hz (giving a range of 6 Hz in total); so, for example, both instruments at $a' = 405$ and 410 have been included in the $a' = 408$ group. Only a few of the surviving instruments do not fall

into this system of semitones; these I have listed separately.

Table 1 lists these pitch groups. It includes only cylindrically-bored, six-holed flutes; thus an instrument such as the Lissieu flute has been included, but the Haka flute, which is rather similar to it in external appearance but has a tapered bore, was not. Instruments whose pitch or sounding lengths are unknown at the moment (like some of the instruments in St Petersburg) are listed under 'unknown'. Both tenor and bass-size instruments have been included. Incomplete basses have been included only when their sounding length could be reconstructed. I have not included any of the instruments marked "\$" or the Altenklingen flute (A-V: KHM SAM 1028), which are likely to be military instruments and hence irrelevant to the question of instruments used for 17th-century concerted music.¹⁰

As table 1 shows, the largest group of instruments is pitched at roughly $a' = 408$. There is a smaller group of instruments a semitone higher, at about $a' = 430$, two smaller groups a tone higher and a semitone lower, and two very small groups as high as $a' = 480$ and as low as $a' = 360$. The most surprising fact is that, despite what is commonly believed, some surviving instruments are higher than $a' = 430$, although they still comprise only a small portion (12 per cent) of the total number of surviving instruments.

In his recent book about the history of pitch Bruce Haynes produces convincing evidence to support the theory that several pitch standards were employed in 16th-century Europe, particularly in Italy and Germany.¹¹ According to Haynes, there were three pitch standards in Venice and North Italy at the time: *mezzo punto*, *tutto punto* (a semitone lower) and *chorista* (a whole tone or a minor 3rd lower than the first). As Venice was one of the main centres for instrument making, the pitches of the instruments made and bought there influenced pitch standards in other countries in Europe. Haynes gives nominal pitches for these levels at A+1 (about $a' = 465$) for *mezzo punto*, A+0 (about $a' = 440$) for *tutto punto*, and A-1 or A-2 ($a' = 415$ or 392) for *chorista*. The pitches of surviving transverse flutes show these levels to be slightly lower than Haynes indicates, by about a quarter tone,

Table 1 Surviving Renaissance flutes grouped according to pitch level

Pitch level (semitones to 408 Hz)	Pitch (Hz)	No. of instruments	Makers
+3	480	2	'!!' (Bassano)* anon. (A-Vienna: KHM C218)
+2	460	4	Lissieu Nani 'r' anon. (R-Saint Petersburg: 438 (ex Snoek))
+1	430	10	Rafi Schnitzer† (3) Vasel Bassano (3) '[eagle]' anon. ¹ (I-Verona: AF 13278)
0	408	20	Rafi (3) Rauch (9) Vits Bassano (4) anon. (3: I-Rome 714 & 715; A-Vienna: KHM C186)
-1	380	5	Rafi Schnitzer anon. (3: I-Bologna: MC 1833; B-Brussels: descants 1062 & 1063)
-2	362	2	Rafi (2)
—	other	4	'HF' anon. (3: D-Berlin: 2663 & 5422; NL-Amsterdam: NG NM 7692 (Nova-Zembla flute))
	unknown	4	anon. (4: I-Verona: AF 13280 & 13282; R-Saint Petersburg: 437 & 463)

* The connection between the "!!" mark and the Bassano family of woodwind makers has been shown by several authors, although there is not yet indisputable supporting evidence. See D. Lasocki, 'The Bassanos' maker's mark revisited', *Galpin Society journal*, xlvii (1993), pp.114–19 and M. Kilbey (Lynden-Jones), 'A checklist of woodwind instruments marked !!', *Galpin Society journal*, lii (1999), pp.243–280.

† For a full discussion of the association of the different makers marks: 'AA', '!!' ('trefoil'), with 16th-century families of woodwind makers, see B. Berney, *Renaissance transverse flutes*, pp.61–5.

at $d' = 460$, 430 and 408 or 380 respectively.¹² The German equivalents of these pitch levels are Praetorius's *CammerThon* ($d' = 460$) and *ChorThon* (a whole tone lower, $d' = 408$).¹³

Each of these pitch levels had its own function: *mezzo punto* or *CammerThon* was used mainly as an instrumental pitch, while *chorista* or *ChorThon* was used for vocal music as well as for performances of mixed instrumental/vocal (concerted) music.¹⁴ What exactly the function of *tutto punto* was is not clear: Peter van Heyghen suggests that it was a compromise between the ideal instrumental and vocal pitch, as well as being useful as a whole tone above

the lower *chorista* level.¹⁵ Zacconi wrote in his *Prattica di musica* (1592) that all instruments, without exception, are higher than the voices, and therefore when playing together the instruments have to transpose down between a 2nd and a 4th.¹⁶ In Praetorius's *De organographia* (1618) there is an interesting discussion about *Cammer* and *ChorThon* pitch levels. Praetorius mentions the situation in Prague and other Catholic churches elsewhere, where there is a distinction between choral and instrumental pitch, as being ideal: instrumental high pitch, or *CammerThon*, is used only for court dinners and other entertainments, while *ChorThon*,

which is a whole tone lower, is employed only in church.¹⁷

As we can see, there are surviving flutes at all these pitch levels, with the largest group of instruments pitched at *chorista* or Praetorius's *ChorThon*. Was this the norm, or an exception? A possible explanation for the existence of low-pitch flutes is presented in chapter 2/II of *De organographia*:

Und ist anfangs zu wissen/ daß der Thon so wol in Orgeln/ als ander Instrumentis musicis offft sehr varijre; dann weil bei den Alten das concertiren und nur allerhand Instrumenten zugleich in einander zu musiciren nicht gebräuchlich gewesen; sind die blasende Instrumenta von den Instrumentmachern sehr unter schiedlich/ einz hoch/ das ander niedrig intonirt und gemacht worden. Dann je höher ein Instrumentum in suo modo & genere, als Zinken, Schalmeyen und Descant Geigen intonirt seyn/ je frischer sie lauten und resoniren: Hergegn/ je tieffer die Posaunen/ Fagotten, Bassanelli, Bombardoni und Baßgeigen gestimb[t] seyn/ je gravitetischer und prechtiger für ander prongen.

At the outset it is to be made clear that the pitch of organs and other musical instruments frequently varies widely. This is because in earlier times it was not the practice to play all kinds of instruments together in ensemble [= *Concertieren*] and thus, instrument makers built wind instruments quite differently, tuning some high, others low: for certain instruments, such as the cornett, shawm and descant violin sound fresher and better when constructed to a higher pitch, while instruments like the bassoons, bassanelli, bombardes and bass viols sound more grave and splendid the lower they are pitched.¹⁸

Elsewhere Praetorius discusses the pitch of instruments made in England and the Netherlands. These were apparently pitched a minor 3rd lower than his *CammerThon*:

... wie denn auch die Flöten und andere Instrumenta in solchem niedern Thon lieblicher/ als im rechten Thon lauten/ und saft gar eine andere art im gehör (sintemahl sie in der tieffe nicht so hart schreyen) mit sich bringen.

... but also recorders and other instruments [as are harpsichords] are lovelier at this lower pitch than when sounding at the usual one, and produce an almost entirely different sound (since they are not so harsh as this).¹⁹

This could explain the existence of consorts of flutes at low pitches. It is also my experience that, pitched lower than $a' = 415$, a Renaissance flute consort sounds fuller and warmer, and is also surprisingly easier to play in tune.

The flutes shown in plate IX of *De organographia* seem to be a low consort such as this. Their lengths, as well as that of the other instruments in the plate,

can be calculated from the scale at the bottom of the drawing, combined with the Braunschweig *elle* presented on the first page of the series of plates corresponding to this scale (see illus.1).²⁰ The calculation is accurate enough, as various factors such as paper shrinkage and thickness of the engraved lines would change the results only slightly (within about $\pm 2-3$ per cent).²¹ The consort of flutes is drawn very carefully, with the instruments having sounding length relationship of 3:2 between the bass and tenor, and the tenor and descant. The tenor flute (calculated at a scale of 1:13.4 mm) has a sounding length of 629 mm, which would place it a whole tone under the tenor recorder, which has a sounding length of 556 mm. The pitch can be calculated to be $a' = 373$ and 460 (in C) respectively.

This relationship contradicts Praetorius's own statement at the beginning of the book that all instruments and voices in his work are referred to according to *CammerThon* and that in modern times all the instruments, both winds and strings, are tuned to it.²² It is not clear whether lower-pitched flutes were a norm for Praetorius and hence an intended example, or whether those were just the instruments his engraver was able to use for the drawings.

Coming back to the complete stock of surviving Renaissance flutes, we must remember that they cover a time-span of about 150 years of flute making, the earliest datable instrument being the Schnitzer bass in Vienna (GdFM 88), stamped 1501, and the latest instrument probably being the Lissieu flute (Vienna, KHM 176; see illus.2), which can be dated to the 1660s.²³ The instruments were also made in at least four different countries of origin: Italy and possibly England (Bassano), Germany (Schnitzer and Rauch), France (Rafi) and the Netherlands. As we are trying to determine at what pitch flutes were played in the late 16th and early 17th centuries, looking at this data as a whole is problematic. For instance, the large consort of flutes made by Rauch (Verona, Accademia Filarmonia) comprises eight instruments, and is 15 per cent of the total number of surviving instruments. If this group of instruments had not survived, or, for example, if the six instruments belonging to the now empty Augsburg case (see below) had survived, the picture would have looked different, with nearly



1 The flutes surviving in the collection of the Kunsthistorisches Museum in Vienna represent three of the pitch levels: the highest, SAM 185, stamped “!!” is at $a' = 480$, the Lissieu flute, SAM 175 at $a' = 460$, and an anonymous flute SAM 186 at $a' = 408$.

equal numbers of instruments at $a' = 408$ and 430 , and a higher percentage of them at 460 .

The total number of surviving Renaissance flutes, about 50 (not including military instruments), is actually too small to be able to draw solid conclusions. Compared to about 200 surviving Renaissance recorders and over 300 cornetts, it seems very small indeed.²⁴ I feel that many of us, myself included, have been misled about the pitches at which Renaissance flutes were used, because our ideas were based only on the situation represented by the surviving instruments. Therefore I shall now look at other sources that may shed more light on this issue.

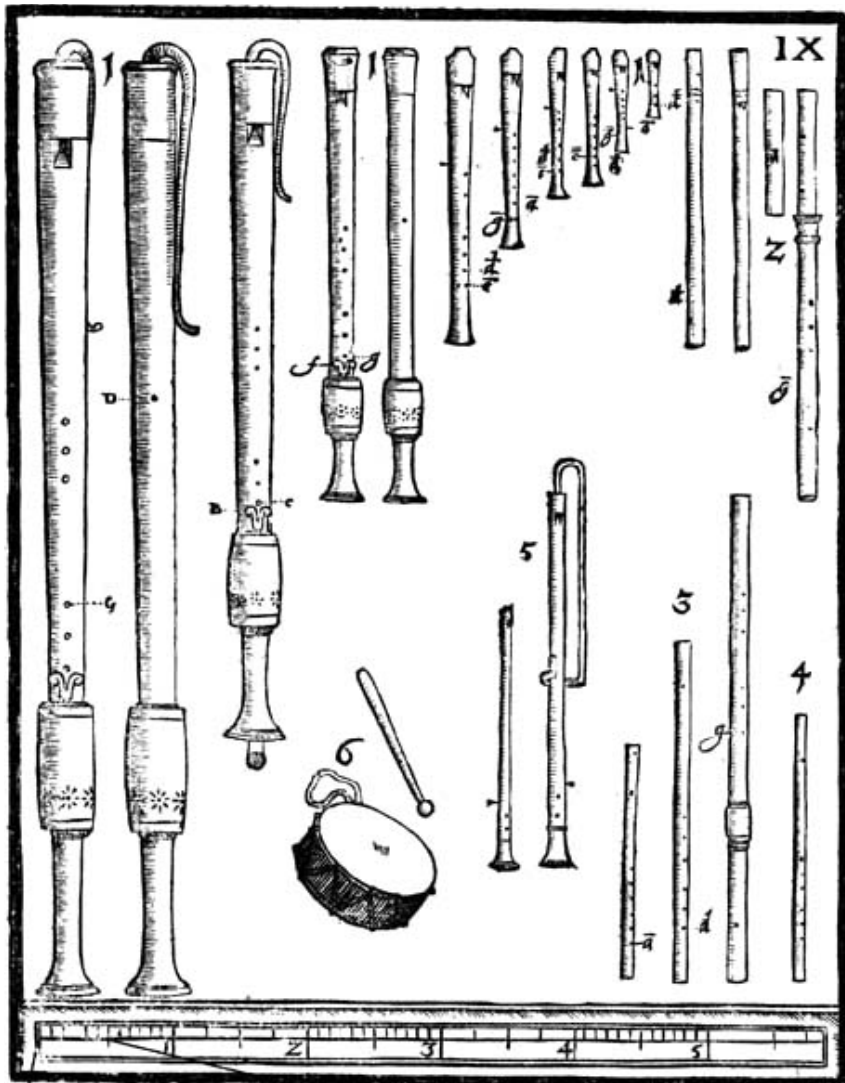
Flutes made at the same pitch as other instruments

Flutes were not always made at a pitch different from that of other instruments. Towards the second

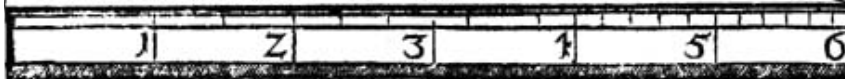
half of the 16th century, as the practice of combining instruments of different families with voices became more fashionable, a common pitch became much more important.²⁵ Contemporary inventories list hundreds of instruments, including flutes, sometimes with an indication of their pitches. These inventories, especially when compiled by an expert author, are an uncommonly rich source of information. They help us better understand pitch relations by presenting a picture of what a complete collection of instruments of the time may have looked like, rather than telling us only which instruments survived to the 21st century.

The inventory of Schloss Ambras in Tyrol, compiled in 1596, lists several groups of flutes:

[item 229] *Instrument per concerta, 6 stuckh, als 2 grosse flauten, 2 cordali und 2 zwerchpfeifen.*



Half a Braunschweig foot = 140mm (scale 1:13.08mm)



Dieses ist die rechte Länge und Maß eines halben Schuhes oder Fußes nach dem Maßstabe
 welches ein viertel von einer Braunschweigischen Ellen: Und nach diesem sind alle Abrisse nachge-
 setzt: In welchem auch fünf kleinen Maßstab so allein mit darben gesetzt/gerichtet.

2 Michael Praetorius: *Syntagma musicum II, De organographia* (Wolfenbüttel, 1619; R/1959), plate IX

Zwerchpfeifen von fladernholtz sein 11 stuckh: 2 pasz, 6 tenor, 3 discant

Weisse alte zwerchpfeifen, 4 stuckh, als 2 pasz und 2 tenor.

[item 230] *Pfeifen von fladernhloz, so in Franckhreich gemacht worden sein 17 stuckh, als 2 grosse pasz, 5 tenor, mer 4 pаз, 4 discant und 2 claine discant.*

und noch darzue 2 zwerchpfeifen per concer.

[item 229] Instruments for concerted music, 6 articles, being 2 big recorders, 2 curtals and two transverse flutes.

Transverse flutes made of maple, 11 articles: 2 basses, 6 tenors, 3 descants.

Old white transverse flutes, 4 articles, comprising two basses and two tenors.

[item 230] *Pfeifen* made of maple, as are made in France, being 17 articles, comprising 2 big basses, 5 tenors, 4 basses, 4 descants, 2 small descants

and in addition to these 2 transverse flutes for concerted music.²⁶

The terms *per concer* or *concerta*, in this context, mean that the instruments are used in mixed ensemble together with voices.²⁷ It is interesting that the instruments *per concert* are listed apart from the consort instruments, not only for the flutes but also the dulcians. Having the instruments listed in one group of two big recorders, two dulcians and two flutes probably means that they were all made to the same pitch in order to play together. The Ambras collection is one of the main sources of the Renaissance instruments in the collection of the Kunsthistorisches Museum in Vienna. It is tempting to identify one of these flutes as A-Vienna: SAM 185 (illus.2), which is one of the highest-pitched surviving Renaissance flutes, being pitched at about $a' = 480$. Unfortunately, of the 17 flutes mentioned in the inventory it is also the only one surviving from this large collection, so it is impossible to identify this instrument with the *instrument per concert* and so know at what pitch this concerted music might have been performed.

A similar case is the inventory of the Graz instrument room, made in 1577. Among other items the following are listed:

Item ein copia zwerchpfeifen, zwen basz und siben tenor; it est neun stuckh.

Zwo grosse zwerchpfeifen, so zu den concerten gebraucht worden; it est zwai stuckh.

Item: a set of transverse flutes, two basses and seven tenors, which is nine instruments.

Two big transverse flutes to be used in concerted music, two pieces.²⁸

Once again, the flutes meant for use in concerted music are listed separately from the consort instruments. There is no way of knowing, however, at what pitch these may have been played, and whether these 'big flutes' were bass flutes or just large tenor instruments, perhaps similar to the low-pitched ones made by Rafi.

A later source that mentions flutes as well as other instruments with a common pitch is the catalogue of Manfredo Settala's museum, compiled in 1664.²⁹ Settala was a true collector in the spirit of the 17th century, interested in science, medicine and mathematics.³⁰ He was also an able instrument maker and invented several instruments such as the *armonia di flauti*.³¹ Among other instruments are:

Vn concerto corista di flauti opera del Sig. Manfredo, ch'in tutto volle di se farproua. . . .

Quattro concerti di Trauerse, ò vogliamo dire Piffari all'Inglese, vno de'quali è di Corista vn'altro di legno Indiano, liscio, & odoroso con i bassi spezzati, & armati in lama d'argento, il terzo con tutte le parti spezzate di voce con tuono più basso; l'ultimo è di voce più alta. Tutti mano del Graffi Artefice insigne. . . .

Vedesi vn'altra di mano del Sig. Manfredo, à Contrabassi, e contrabattitori in busso.

A recorder consort at *corista* made by Mr Manfredo, who shows his skills in everything. . . .

Four consorts of Traverse or Piffari all'Inglese, one of which is in corista, another in smooth and fragrant Indian wood with the basses divided and decorated with silver, the third with all parts [= instruments] divided, pitched a tone lower; the last pitched a little higher. All signed by the hand of the [Englishman] Graffi, an excellent craftsman. . . .

Another [consort] made by Mr Manfredo with contrabassi and contrabaroni in boxwood.³²

According to the catalogue Settala had four consorts of flutes, three of which are noted for their pitches: one at *corista*, one a tone below, and one a little higher, or a tone above. All these instruments were made by the Englishman Graffi (or Grassi in the Latin version). These could have been instruments made by one of the members of the Rafi family. The low-pitched instruments in two parts with silver rings mentioned in the catalogue certainly brings to mind the C. Rafi flute in Bologna (I-Bologna: MC 3288). One of the versions of Claude Rafi's stamp reads: 'Cl.Rafi/(gryphon)'. In this

version the 'Cl' is connected, and could be easily confused for a 'G'. Additionally, 'F' in the old roman font is similar to an 's'. Terzaghi could easily have transcribed 'Cl. Rafi' as 'Grassi'. The only explanation why he identifies this Graffi/Rafi as an Englishman is that by the time the catalogue was compiled, the Rafi family had not made any flutes for over a hundred years. (Claude Rafi died in 1553, leaving no instrument-making descendants after him.) So by the time of the catalogue, the real origin of the instruments was probably no longer known.³³

Flutes are not the only instruments at *corista* in the collection. There is also a recorder consort, a trombone and a dulcian. Settala also had an organ that played at the pitch of 'all the instruments'. *Corista* was a pitch level often associated with the performance of music for mixed ensembles, and was at least a whole tone or a minor 3rd lower than the pitch of cornetts, possibly as low as $d' = 408$ or 380.³⁴ Apart from these instruments Settala also had transverse flutes a semitone higher and a semitone lower than *corista*. Another interesting item in the catalogue is the consort of flutes made with *Contrabassi* and *Contrabaritoni*, presumably bass flutes lower than the usual *g* bass. Although unrelated to our research into pitches, this entry is interesting as it is one of the few sources that mentions the existence of such large bass flutes.³⁵

An inventory from 1589 lists hundreds of instruments belonging to the Baden-Württemberg court in Stuttgart, including many transverse flutes. Although most entries in the list have no reference to pitch, some do:

Mehr in einem fuether vier buxbömin zwerchpfeiffen, darunder drey tenor vnnd ain baß, seindt zu Anttorff gemacht, stehen aber nit zum chor, sonder seyen vmb ein tonum niderer.

Weitter in einem fuether drey geschrauffte zwerchpfeiffen so tenor seindt, vnnd ein zweygeschrauffter baß, steen auch nit zum chor, sonnder seindt vmb ein tonum gröber. . . . Zwen buxbömine corneten mutae, umb einen ton zum chor nider, von Bastian Gansen witib erkaufft Xbri anno etc. 86. . . .

Sachzehen krummer cornetn, so Venedisch genannt werden zu dem chor gepraucht.

Vier krummer corneten, umb ein tonum niderer. Seindt durch Melchior Billigkheim gemacht.

Also, in a case, four boxwood flutes, three tenors and a bass, made in Antwerp; they are not tuned to the *chor* [in *chorton*], but rather a tone lower.

Further, in a case, three tenor flutes with decorated turned rings and a bass with double decorated turned rings, which are also not in Chorton but a tone higher. . . . Seven boxwood mute cornetts, a tone lower than Chor, bought from Bastian Gansen in December [15]86. . . .

Sixteen curved cornetts bought in Venice to be used in *chor*.

Four curved cornetts, a tone lower. Made by Melchior Billigkheim.³⁶

It is unclear whether a *tonum* in this context means a semitone or a whole tone, as the term is ambiguous. We can assume that the term means a semitone in this context, in the light of the mute cornetts mentioned as being *drey tonus* lower than *Chor[Thon]*, which is more likely to be a minor 3rd rather than a 4th higher than that pitch level. In any case, the court had at least one or two sets of flutes at the same pitch as cornetts, either a semitone or a whole tone lower than *Chor[Thon]*.³⁷

Flutes were even made at higher pitches, as mentioned in an order for a large group of instruments approved by the city of Genoa in 1592. These included:

E prima sei cornetti muti, tutti in una cassa, di tuono di tutto punto, di legname di busso; sei cornetti chiari, il tuono loro ha da essere di mezzo punto giusto, tutti in una cassa di legname di busso, parte dritti e parte mancini; sei fiffari, il tuono loro sia di mezzo punto giusto, di legno di busso, tutti in una cassa; otto flauti tutti in una cassa, le qualità loro saranno due sopranini piccoli, quattro più grossetti e due tenolotti, seguenti alli quattro però senza chiave in fondo, il tuono loro sia di mezzo punto e di legno di busso. Tutti le detti instrumenti siano di legname piuttosto massiccio secco e non fresco, di tuono soprattutto giusti, e per averli in tutta perfezione si potrà far capo a Venezia a Gianetto da Bassano, o vero Gerolamo degli instrumenti, o Francesco Fabretti e fratelli, perché tutti questi sono molto intelligenti di questi instrumenti.

First, six mute cornetts, together in a case, at the pitch of tutto punto, made of boxwood; six light [coloured] cornetts, the pitch of which has to be exactly mezzo punto, together in a case of boxwood, partly right-handed, partly left-handed; six flutes, the pitch of which should be exactly mezzo punto, made of boxwood, all in one case; eight recorders, all in a case, the kinds of which will be two small sopraninos, four larger, and two tenors, following the four [previous] but without keys at the end, the pitch of which should be at mezzo punto and made of boxwood. All the above instruments should be of rather solid, well-seasoned wood, and above all correctly pitched, and to have them in perfection one



3 The Augsburg *Futteral*

Table 2 The flutes in the Augsburg *Futteral*

No. of slots	Length (mm)	Diameter (mm)	Matching instrument, sounding length	Possible pitch
4	599	25	A-Vienna: KHM C185, 578 mm	D, $a' = c.460$
2	867	34	A-Linz: Mu3, 871 mm	G, $a' = c.460$

could turn to Venice to Gianetto da Bassano, or else Gerolamo 'of the instruments', or Francesco Fabretti and brothers, because all of them are most skilled in these kinds of instruments.³⁸

As we have seen, *mezzo punto* was a common pitch standard for instrumental music and was at roughly $a' = 460$.³⁹ It is not a pitch we would readily associate with Renaissance transverse flutes, yet the order states that they should be made exactly at

that pitch, the same pitch as the recorders and curved cornetts.

Interesting evidence for the existence of high-pitched flutes also comes from an instrument case surviving in the Maximilian museum in Augsburg.⁴⁰ The case—which in German inventories of the time would have been called a *Futteral*—is composed of 28 tubes of various lengths and

thicknesses (illus.3). There are three types of tubes: flared, cylindrical and conical. They were probably meant to house three groups of instruments: a recorder consort of 16 instruments, a flute consort of six instruments (two basses, four tenors), and three pairs of mute cornetts in different sizes or pitches, six in total. The pitch of the instruments in the case can be estimated, based on the lengths of existing instruments. For the flutes, the bass slots in the case, with a length of 867 mm, would fit the bass flute at Linz (A-Linz: Mu3), which is at about $d' = 460$ and only 4 mm longer than the slots in the case (see table 2). The tenor slots have the length of 599 mm, slightly longer than the total length of the Lissieu flute (A-Vienna: KHM C174, 595 mm, $d' = 460$).⁴¹

Based on the above calculation, we can say that the case was made for a six-part consort of Renaissance flutes probably around $d' = 460$.⁴² The recorder consort was estimated by Adrian Brown to be at around the same pitch or slightly higher.⁴³ The Augsburg crest—a pine cone—can be found drawn on the front of the case, above the year '1603'. The case along with the instruments it contained must have been the property of the city of Augsburg, and was possibly used by the *Stadpfeiffer*, although no documentation has been found to prove this. In any case, the Augsburg *Futtermal* demonstrates that early in the 17th century transverse flutes were indeed made in high pitch to match the pitches of other woodwinds, and that all of them could have been used in the same musical event, possibly even together.

Original compositions and performance practice

Let us now look at the 17th-century pieces that call for the transverse flute and other wind instruments together, and try to find some possible solutions for the performance of this music. The first question to be asked is at what nominal pitch or pitches these pieces should be performed.

As all the repertory in question is vocal church music, we should, ideally, follow Praetorius's instructions, performing it at his *ChorThon*, a whole tone lower than *CammerThon*. We could even

consider performing some pieces a minor 3rd lower than *CammerThon*, as he mentions was common practice in Italy and in Germany during his time. He gives the examples of pieces in F Hypoionian transposed to D, as well as G Hypodorian transposed down to E. Pieces in these modes are often very high for the singers, especially considering that the upper parts would have been sung by boys or male falsettists. The singers would sound much better singing these pieces a 3rd lower, and the text can be more clearly understood at the lower pitch.⁴⁴ Praetorius mentions that organists and instrumentalists find such transpositions quite difficult, but that they can be achieved with a little practice. We should be careful with this transposition, however, as in some cases it may result in parts being too low for the voices, especially for the basses. Bass parts in Praetorius's own piece in F Hypoionian sometimes go down to low C' , which is in agreement with his conception of the bass range as represented in table IV of the *De organographia*.⁴⁵ However, as the ranges in the table probably relate to *CammerThon*, transposing these pieces a third lower (from $A = 460$) would put them outside the range discussed by Praetorius himself and would require exceptionally low basses.⁴⁶ It can also be inferred from his direct statement about the range of tenors in *CammerThon*, which is exactly the range shown in the table. In any case, transposing these pieces a 3rd lower would put them outside the range he discusses, and would require exceptionally low basses.

Although it is not within the scope of this article to discuss the issue of *chiavette* versus *chiavi naturali* transpositions in depth, as they are not directly related to the pitches of flutes used, I would like to mention this in passing, as it would imply a third transposition possibility. In some cases a transposition of a 4th or a 5th lower is indicated by using a set of high clefs or *chiavette*.⁴⁷ This was common practice, especially when singers were singing alone or accompanied by an organ. It was sometimes extended to concerted music, as in the case of the *Magnificat* from Monteverdi's *Vespro della Beata Virgine* (1610) as discussed by Andrew Parrott.⁴⁸ Based on 16th- and 17th-century practice as well as on the ranges of voices and instruments, Parrott advocates a transposition of a 4th lower for the

sections of the work that are notated in high clefs. Judging from the famous nine bars in the *Quia respexit* scored for *fifarra* or *pifara*, such a transposition would certainly work well for the flutes. The original *fifarra* parts are notated in the G₂ clef, which is very uncommon for flutes in a mixed ensemble.⁴⁹ The ranges are *g'–f''* and *g'–g''* (sounding an octave higher), which are quite high, but not without precedent in 17th-century flute parts.⁵⁰ They can be played as they are, but are much more comfortable a 4th down, with a range of *d'–d''*.

CammerThon might eventually be the most practical overall choice, as it may well have been in Praetorius's time, especially for larger ensembles, very low pieces, and when dealing with less experienced instrumentalists.

The second question we have to answer is whether we have flutes at the same pitch as the other instruments or lower. According to what we have seen so far, we can approach performing concerted music with flutes in two ways: (1) the flutes used are at the same pitch as the other instruments; or (2) the flutes are lower than the other instruments with which they play, either by a whole tone or a minor 3rd.

The first possibility obviously leaves us with an ideal situation where all the instruments play at the same sounding pitch; none has to transpose its part; and the music can be played as written. This could be Praetorius's *CammerThon* or Italian *mezzo punto* at *d' = 460* as well as *tutto punto* at *d' = 430*. This possibility is supported by the evidence we have examined above: the surviving high-pitch flutes, the Augsburg *Futteral* and the sets of different families of instruments mentioned in inventories and playing at the same pitch.

The second possibility obviously requires some kind of transposition, either by the flute players or by the rest of the ensemble. Examination of surviving music shows that such transpositions are possible, although each piece has to be dealt with separately to find the best possible solution. When considering such transpositions we must take into account the limitations of the other wind instruments and singers as well as those of a mean-tone organ. I shall now examine some transposition possibilities, presuming that we have flutes which are

either a tone or a minor 3rd lower than the other instruments and according to the modes of the pieces.

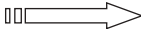
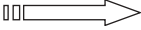
Pieces in G: There are several pieces by Schein and Schütz in this mode. These cannot be transposed on the flute to A, as it is a very awkward key for the Renaissance flute, involving F#s, which are tuned very low on the instrument. However, it is entirely possible to have the other instruments (pitched a tone higher than the flutes) transpose the piece down to F; this would work well both for the other winds as well as for the organ.

Pieces in F: Many of the polychoral motets by Praetorius are in this mode, as are all the pieces by Tobias Michael. These are often large-scale works involving many instrumentalists and singers, so the idea of having the entire ensemble transpose the piece down for the sake of two or three flutes is not practical. On the other hand, having the flutes (a tone lower than the other instruments) transpose the piece up a tone (to G) could work quite well. Such transposition would also be necessary in Praetorius's polychoral motet *Wenn wir in höchsten Nöten sein* from his *Musae Sionae*.⁵¹ The piece is scored for five choirs, among which is a *Chorus di Flauti* that includes a singer (C₂ clef), two recorders or transverse flutes (*Flauto vel Fiffari* in C₃ and C₄ clefs) and a dulcian. The flute parts are quite low (*c–c'*), and even include several low *cs*, which are below the range of a D tenor. The piece could be easily transposed up a tone on the flutes, to G, thus solving both pitch and range problems at the same time.

Pieces in c: A similar transposition may be necessary in Sebastian Knüpfer's cantata *Ach Herr strafe mich nicht*.⁵² The piece, which is in *c* (two flats in the key signature), is scored for a pair of transverse flutes, in addition to trumpets, timpani, strings and singers. The part could be played on the flutes as it is, although it is not very comfortable as it includes many E_bs that have to be half-holed on the Renaissance flute. Here the apparent solution would be to transpose the flute parts from *c* to *d*, and thus avoid the E_bs in the flute parts as well as solving the pitch problem.

Pieces in g: These form the majority of 17th-century pieces calling for transverse flute, and this

Table 3 Possible transpositions

Composition in	Flute plays	Other instruments		Situation
G (Schütz, Schein)	G	F		Flute one tone lower than the rest ($a' = 460/408$)
F (Praetorius, Michael)	G (#)	F (b)		ditto
c (Knüpfer)	d	c (b b)		ditto
g (Schütz, Schein, Knüpfer)	g (b)	e (#)		Flute a minor 3rd lower than the rest ($a' = 460/380$)

mode is also one of those where the use of flutes is recommended by Praetorius. The solution for these pieces is less apparent, unless flutes at the same pitch as the other instruments are used. A downwards transposition to *f* would not work for the other instruments, and having the flute transpose the piece up to *a* would be suitable in only a few of the cases. Works such as Schütz's Psalm 133 *Siehe wie sein und lieblich ist*, for instance, has a notoriously difficult flute part with a range of $c''-f''''$, and fits the instrument perfectly as it is.⁵³ Transposing the part a tone higher is possible, but would render it even more difficult. Many of Schein's pieces from the *Opella nova II* have a similar range and are equally difficult to transpose on the flute.

Indeed, the most practical solution for these pieces would be to have all instruments at the same pitch ($a' = 460$ or 430). Another possible solution for these cases is the transposition of a 3rd down suggested by Praetorius and discussed earlier. Presuming that all other instruments are at high pitch, $a' = 460$, and that the flute used is a minor 3rd lower, $a' = 380$, the whole ensemble can transpose the piece down a minor 3rd to a level comfortable for the singers, while keeping the flute in the original mode.

Table 3 summarizes the different keys in which these pieces are found and the possible solution in each case.

Conclusion

To reiterate, it is impossible to find a single solution applicable to all cases. The most important thing to bear in mind is that in the 16th and 17th centuries, pitch was often related to the function of the music,

the event and the forces involved, as is demonstrated by Praetorius in his description of the situation in Prague. Inventories show that large musical establishments such as courts, cathedrals, academies or even private collections owned a large number of instruments which often included several complete sets of the same type of instrument in different pitches, designed for use on different occasions. Original instruments in large museum collections that survive as a single group—the Correr-Contarini collection in Brussels, the Ambras and Catajo collections in Vienna, and the instruments in the Accademia Filarmonica in Verona—also show this tendency. All these collections include sets of recorders, cornetts and transverse flutes at different pitch levels, sometimes with up to a minor 3rd between the lowest and highest set. I believe that musicians in the 17th century chose the instrument at the right pitch or the right transposition for each occasion and context, and were less attached than we are to a certain pitch level within the semitone system.

Given the choice, I would perform concerted music based on Praetorius's principles, making pitch decisions based on the instruments available and the ranges and abilities of the singers. When playing instrumental pieces with other winds, and without singers, I would choose transverse flutes at a high pitch, $a' = 460$ or higher, to match the pitch of the other winds. When making a flute consort to be used alone, I would use chose a pitch in which the instruments sound best, which is, in my opinion, $a' = 408$. This is probably the lowest pitch for a bass flute of manageable size, and at this pitch the instruments have a round, warm sound, while retaining their clear speaking quality.

Appendix 1 Recently discovered pieces using the Renaissance flute

Composer	Work	Instrumentation	Mode	Source
Antonio Brunelli Sebastian Knüpfer	Various diminutions and cadences <i>Ich freue mich in dir</i>	fl/gamba/rec & other instruments SSATB, 2 fl, 3 trbn, 2 vn, 2 va, violone, bc	various g	<i>Varij Escitii</i> (Florence, 1614; R/1977) MS, Berlin SB
Tobias Michael	<i>Das ist ein köstlich Ding</i>	S, fl, bc	F	<i>Musicalischer Seelen-Lust</i> (Leipzig, 1637), no.25
Tobias Michael	<i>Kommer Herr zu mir alle</i>	S, T, vn, fl, dulcian, bc	F	<i>Musicalischer Seelen-Lust</i> , no.34
Tobias Michael	<i>Wie lieblich zind auf dem Bergen</i> <i>Lasset fröhlich sein und miteinander</i> <i>rühmen (ander theil)</i>	S, T, vn, fl, trbn grosso, bc	F	<i>Musicalischer Seelen-Lust</i> , nos.35–6
Tobias Michael	<i>Wo der Herr nicht das Haus bauet</i>	SSATB, rec+vn, fl, 2 trbn, dulcian, bc	F	<i>Musicalischer Seelen-Lust</i> , no.41
Tobias Michael	<i>Gott, schweige doch nicht also</i>	SSATB, 2 fl, 2 dulcians, bc	F	<i>Musicalischer Seelen-Lust</i> , no.50
J. H. Schein*	<i>Lamentatio ecclesiae et consolatio</i> <i>Jehovae</i> (Leipzig, 1629)	SATB, vn, fl, 2 trbn, dulcian, bc	g	Occasional composition celebrating 1629 city council election [†]
J. H. Schein*	<i>Psalmae ecclesiae christianae</i> a5, 6, 10, 11, 16 (Leipzig, c.1620)	Incomplete, includes SAB, gamba, fl, trbn, bc	?	Undated vocal concerto for election of new town council
J. H. Schein*	<i>Votum pro pace, Frieden Wunsch</i> (Leipzig, 1621), a9, 14	Incomplete, includes: Chorus 1: B Chorus 2: SATB, fl, trbn bombardon	?	Undated piece for town council [‡] election [‡]
Daniel Selich	<i>Jubilate Deo</i> a4 / 8 / 9	SATB, 2 cornetti, fl, trbn, trbn maj, 2 vn, 2 va, dulcian, bc	?	<i>Opus novum</i> (Wolfenbüttel, 1623–4), no.3

* I am grateful to Stephan Rose for supplying me with the list of pieces including transverse flutes found in Schein's occasional work, and for his references to their current locations. As these pieces have recently been rediscovered, I have so far been unable to obtain copies.

† Quoted in S. Rose, 'Schein's occasional music and the social order in 1620s Leipzig', *Early music history*, xxiii (2004), p.260.

‡ The two pieces survived as incomplete copies in the Königlichen und Universitätsbibliothek Königsberg until 1939; see J. Müller, *Die musikalischen Schätze der Königlichen- und Universitäts-Bibliothek zu Königsberg* (Bonn, 1870), p.317. According to G. Dümnhaupt, *Personalbibliographien zu den Druckern des Barock* (Stuttgart, 2/1990–93), these copies are believed to be in the Rossiyskaya Natsional'naya Biblioteka, St Petersburg, although recent correspondence with the library has turned up no such works.

Appendix 2 Surviving Renaissance flutes

Maker	Material	Mark	Sounding length (mm)*	Bore (mm)	Pitch (Hz)	Date†	Location	Provenance	Notes
Anon.	boxwood, brass rings	[gothic] 'r'	759.0	23.5	456		A-Linz: Mu3	Stift Kremsmunster?	
Anon.	yew, bone rings		418.0	13.5	466 in F/ 415 in G		A-Vienna KHM: SAM 1029	Schloß Altenklingen (Switzerland)	descant \$ style in case of four flutes
Anon.	boxwood		574.0	17.2	404		A-Vienna KHM: 175 (C186)	Catajo (Padua)	
Anon.	boxwood		720?	21.0	481?		A-Vienna KHM: 218	Catajo (Padua)	body only
Anon.	maple?		305.7	9.0	380?		B-Brussels: 1062 (lost)	Correr-Contarini (Venice)	descant in g
Anon.	maple		428.0	14.0	380?		B-Brussels: 1063	Correr-Contarini (Venice)	small descant in d?
Anon.	ivory		578?	17.0	403?		Cz-Prague Narodni		shortened?
Anon.	maple, horn rings		511.0	17.8	454		D-Berlin: 2663	ex-Snoek	unusually thick walls
Anon.	ivory		566.0	17.2	410		D-Berlin: 5422		
Anon.	boxwood		626?	19.9	371?		I-Bologna Museo Civico: 1833		shortened?
Anon.	boxwood?		573.0	17.5	405		I-Rome Museo SM: 0715	Alessandro Marcello	leather covered
Anon.	plum		807.5	23.0	429		I-Verona AF: 13278		single-part bass
Anon.	boxwood, brass ring		827?	27.0			I-Verona AF: 13280		body only, double III and VI offset
Anon.	boxwood	(crowned eagle)	540.0	17.7	430		I-Verona BC: 1		
Anon.	plum?	7+	535.5	17.5	433	pre-1596	NL-Amsterdam: Rijksmuseum: NG NM 7692	Nova Zembla expedition	thin walls

Anon.									R–St Petersburg: 437	ex–Snoeck
Anon.	Inscription: Dum vixi tacui mortua voce cano/1601	?							R–St Petersburg: 463	ex–Snoeck
Anon.		496.0	16.0	468					R–St Petersburg: 438	ex–Snoeck
Bassano?	boxwood	490.6	16.5	477	pre-1596	A–Vienna KHM: 174 (C185)			Ambras	
Bassano?	boxwood	569.0	17.2	408		B–Brussels: 1065			Correr–Contarini (Venice)	
Bassano?	boxwood	572.0	17.2	408		B–Brussels: 1064			Correr–Contarini (Venice)	
Bassano?	boxwood	853.5?	24.5	408?		B–Brussels: 1088			Correr–Contarini head only (Venice)	
Bassano?	boxwood, iron rings	558.0	13.5–19.5	c. 420		CH–Basel: HM 1907.1880			bought 1907	reverse conical bore
Bassano?	boxwood	545.5	17.2	430		I–Verona BC: 2			donated in 1631 by Alipandi to be used in services in the cathedral	
Bassano?	boxwood	544.5	17.2	430		I–Verona BC: 3			Alipandi 1631	
Bassano?	boxwood	816.0	23.0	430		I–Verona BC: 7			Alipandi 1631	
F.H.	plum, brass ring	531	15.5	437	17th century	D–Nürnberg GNM: MIR 280			Augsburg?	very thin walls, ornamental turning
I.S./S.I	yew, bone rings	527.0	20.5	466	in D	pre-1581	A–Graz:Landeszeughaus: M2			wide bore, thin walls, ivory rings
I.S./S.I	yew, bone rings	693.0	24.4	466	in A?	pre-1581	A–Graz Landeszeughaus: M1			wide bore, thin walls, ivory rings
I.S./S.I	maple	755.0	23.5	459		I–Merano MC: 6857				thin walls, no external tapering

Appendix 2 Continued

<i>Maker</i>	<i>Material</i>	<i>Mark</i>	<i>Sounding length (mm)*</i>	<i>Bore (mm)</i>	<i>Pitch (Hz)</i>	<i>Date[†]</i>	<i>Location</i>	<i>Provenance</i>	<i>Notes</i>
Lissieu	boxwood	LISSEV	503.6	15.8	461	c.1660	A–Vienna KHM: 176 (C187)	Catajo (Padua)	two-part instrument; 17th-century style turning
Neni, Jacopo	boxwood	IA.NENI/(star)	764.0	26.0	453		J–Hamamatsu	ex-Rosenbaum ex-Halfpenny	
Rafi, [C]?	boxwood	?	795?	24.0			D– Cologne: HM 1274 (lost WWII)		
Rafi, C.	boxwood	C♣RAFI/(gryphon)	612.0	18.2	379	1515–53	B–Brussels: 1066	Correr–Contarini (Venice)	
Rafi, C.	boxwood, silver rings	C♣RAFI/(gryphon)	575.0	18.3	403	1515–53	I–Bologna MC: 3288		two-part
Rafi, C.	boxwood	C♣RAFI/(gryphon)	577.0	17.5	402	1515–53	I–Rome Museo SM: 0712 (2789)	Alessandro Marcello	
Rafi, C.	boxwood	C♣RAFI/(gryphon)	549.0	18.0	423	1515–53	I–Verona BC: 4	Alipandi 1631	
Rafi, Cl.	plum	CL.RAFI/(gryphon)	640.5	18.8	362	1515–53	I–Verona AF: 13287		
Rafi, M.	maple	M.RAFI/(gryphon)	860.5	24.5	402	1506–23	I–Rome Museo SM: 0713 (2788)	Alessandro Marcello	single piece, very thin walls
Rafi?	plum, brass ring	(gryphon)	964.5	25.3	359		I–Verona AF: 13281		body only
Rauch	boxwood, brass ring	(trefoil)	855.0	25.0	405		I–Milan Conservatorio: 6752		
Rauch	boxwood, brass ring	(trefoil)	856.0	24.8	405		I–Verona AF: 13276		
Rauch	boxwood, brass ring	(trefoil)	855.5	24.8	405		I–Verona AF: 13277		
Rauch	boxwood, brass ring	(trefoil)	851.0	24.8	405		I–Verona AF: 13279		

Rauch	boxwood	(trefoil)	574.5	17.2		I–Verona AF: 13282	thinner walls
Rauch	boxwood	(trefoil)	575.0	17.2	403	I–Verona AF: 13283	
Rauch	boxwood	(trefoil)	575.0	17.2	403	I–Verona AF: 13284	
Rauch	boxwood	(trefoil)	575.0	17.2	403	I–Verona AF: 13285	mark erased, but very similar to that on the other four
Rauch	boxwood	(trefoil)?	575.0	17.2	403	I–Verona AF: 13286	Rauch tenors
Schnitzer	maple, horn rings	AA	795.5	23.0	435	1520–50 I–Verona BC: 8	shortened? Alipandi 1631
Schnitzer	maple	AA	538.5	17.3	431	1520–50 I–Verona BC: 5	Alipandi 1631
Schnitzer	maple	AA	540.0	17.3	430	1520–50 I–Verona BC: 6	Alipandi 1631
Schnitzer, [Albrecht]	boxwood	A/1501	905.0	26.0	383	1501? A–Vienna KHM: GDMF 88	single-part bass, very wide bore, c.26 mm
Schnitzer?	pear?	A?	573.5	17.5	405	I–Rome Museo SM: 0714	leather-covered Alessandro Marcello
Vasel, B.	boxwood, brass ring	B, VASEL	817.0	?	424	I–Bologna MC: 3289	
Vīts, H.	boxwood, iron rings	H,VITS/(sun)	849.8	25.5	407	B–Brussels: 2695	ex-Snoeck

* The sounding length was measured from the centre of the embouchure hole to the end of the instrument.

† For a discussion of the dating, see B. Berney, 'Renaissance transverse flutes', pp.61–5.

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1 Most of these pieces are listed in A. Smith, 'Die Renaissancequerflöte und ihr Musik, ein Beitrag zur Interpretation der Quellen', *Basler Jahrbuch für historische Musikpraxis*, ii (1978), pp.55–7. Pieces not mentioned in this article are listed in appendix 1.

2 Smith, 'Die Renaissancequerflöte und ihr Musik', p.26; F. Puglisi, 'A survey of Renaissance flutes', *Galpin Society journal*, xli (1988), pp.67–82; F. Puglisi, *I flauti traversi rinascimentali in Italia* (Florence, 1995), p.12; B. Haynes, *A history of performing pitch* (Oxford, 2002), pp.8, 68; A. Powell, *The flute* (London, 2002), p.52; P. Allain-Dupré, *Les flûtes de Rafi* (Courlay, 2000), p.20; P. Allain-Dupré, 'Renaissance and early Baroque flutes, an update on surviving instruments, pitches and consort grouping', *Galpin Society journal*, lvii (2004), pp.56–61.

3 Puglisi, 'A survey of Renaissance flutes', pp.67–82.

4 Allain-Dupré, 'Renaissance and early Baroque flutes', pp.58–9.

5 B. Berney, 'Renaissance transverse flutes: a re-examination of the surviving instruments', *Musique de joye: Proceedings of the International Symposium on Renaissance Flute and Recorder Consort, Utrecht 2003*, ed. D. Lasocki (Utrecht, 2005), pp.61–76.

6 The pitches of the instruments in the Accademia Filarmonia in Verona and

some of the instruments in the Brussels collection were determined by playing the originals. The pitches of the Verona Schnitzers and Brussels Bassano tenors were determined by making copies of the originals. This experience enabled me to calculate the pitches of the remaining surviving originals based mainly on their sounding length, as described above.

7 Both Puglisi (*I flauti traversi*, p.17) and Allain-Dupré ('Renaissance and early Baroque flutes', p.55) state that the Schnitzer instruments in the Verona Biblioteca Capitolare (I-Verona: BC 5, 6 and 8) have had their embouchures and tone holes badly altered. The instruments are indeed in poor shape, as they have been damaged by woodworm. The embouchures, however, with their unusual overcut or 'chamfer' not found on any other original flutes, are probably original and are very well executed. This special feature is an integral part of the instruments' design and sound concept, as I have learned from making numerous copies of those flutes.

8 Puglisi, *I flauti traversi*.

9 Puglisi, *I flauti traversi*, pp.12–13; Allain-Dupré, *Les flûtes de Rafi*, p.20; Allain-Dupré, 'Renaissance and early Baroque flutes', p.57.

10 For a more detailed discussion of the three "\$" instruments and the Altenklingen flute, see B. Berney, *Renaissance transverse flutes*, pp.64–5.

11 Haynes, *A history of performing pitch*, pp.55–103.

12 Haynes sets the tolerance for his study at a quarter tone, so in fact a flute at $d' = 460$ would be for him at the pitch level of A+1, anywhere between $d' = 453$ and 479, with a central pitch at $d' = 464$. While this system is perfectly adequate for a study of Haynes's scale, we can fine tune it using the extant Renaissance flutes. See Haynes, *A history of performing pitch*, pp.li–liii.

13 Haynes, *A history of performing pitch*, pp.76–83. Praetorius's pitch has been the subject of a long scholarly

debate. One of the main points of the discussion comes about because Praetorius uses the term *ChorThon* in two different ways, the one being at the same level as *CammerThon* (as in most German cities in his time), the other being a tone lower, as in Italy and Prague. See A. Smith, 'Belege zur Frage der Stimmtonhöhe bei Michael Praetorius', *Basler Jahrbuch für historische Musikpraxis* (1983), p.341. A similar conclusion is reached in C. Karp, 'Pitch', *Performance practice: music after 1600*, ed. H. M. Brown and S. Sadie (New York, 1990), pp.147–68; this includes a good description of the debate and a resolution of some of the problems.

14 Haynes, *A history of performing pitch*, p.64.

15 P. van Heyghen, 'The recorder consort in the sixteenth century: dealing with the embarrassment of riches', *Musique de joye*, ed. Lasocki, pp.227–322, at p.256.

16 L. Zacconi, *Prattica di musica utile et necessaria* (Venice, 1592; R/1967), p.218v, quoted in Haynes, *A history of performing pitch*, p.65.

17 Michael Praetorius, *Syntagma musicum*, ii (Wolfenbüttel, 1618; R/1959), p.15.

18 Michael Praetorius, *Syntagma musicum*, ii: *De organographia* (Wolfenbüttel, 1619; R/1959), p.14, trans. H. Blumenfeld as *The Syntagma musicum of Michael Praetorius* (New York, 1949) p.14.

19 Praetorius, *De organographia*, p.16; trans. in Karp, 'Pitch', p.154.

20 See also H. W. Myers, 'Praetorius' pitch: some revelations of the Theatrum Instrumentum', *Perspectives in early brass scholarship: proceedings of the 1995 International Historic Brass Society, Amherst MA*, pp.29–45; H. W. Myers, 'Praetorius' pitch standard', *Galpin Society journal*, li (1998), pp.247–67; Karp, 'Pitch', pp.156–9.

21 Karp, 'Pitch', p.156.

- 22 Praetorius, *De organographia*, p.19.
- 23 There is an uncertainty regarding the number stamped on the GdFM 88 flute: see Berney, 'Renaissance transverse flutes', p.64. In any case we can safely assume that at least some of the instruments surviving, like I-Rome: Museo dSM 0713, made by Michaud Rafi (1506–23), can be dated to the first quarter of the 16th century.
- 24 A. Brown, 'An overview of the surviving Renaissance recorders', *Musique de joye*, ed. Lasocki, p.77.
- E. H. Tarr, 'Ein Katalog erhalten Zinken', *Basler Jahrbuch für historische Musikpraxis*, v (1981) p.24.
- 25 Haynes, *A history of performing pitch*, p.55.
- 26 The complete list of musical instruments in the inventory is cited in J. Schlosser, *Die Sammlung alter Musikinstrumente* (Vienna, 1920), pp.12–13. The identity of the *Pfeifen* at the beginning of item 230 is not clear. These are probably shawms or recorders because of all the different sizes mentioned and the total amounts of instruments. One could also argue that they are transverse flutes because of the preceding line, listing the flute consort, and the one that follows, stating *und noch darzue 2 zwerchpfeifen per concer*. In that case we have the only known reference to a very large flute consort comprising 17 instruments and five different sizes: big basses, basses, tenors, descants and small descants.
- 27 See for example Praetorius, *Syntagma musicum*, iii, p.4: 'CANTIO, CONCENTUS, seu Symphonia, est diversarum vocum modulatio. Italis vocatur Concerto vel Concerto . . . qua Variæ Voces aut Instrumenta Musica ad concertum faciendum committuntur . . . : Germanicè ein Concert.' ('Cantio, Concentus, or Symphonia: diverse voices singing together. Italian: *concerto* or *concerto* . . . in which various voices or instruments make music together . . . ; German: *ein Concert*.')
- 28 Schlosser, *Die Sammlung alter Musikinstrumente*, pp.19–20.
- 29 The catalogue of Settala's collection was published in Latin in 1664: Paolo Maria Terzago, *Musaeum septalianum Manfredi Septalae* (Tortona, 1664), cited in Schlosser, *Die Sammlung alter Musikinstrumente*, pp.17–19. Terzago's work was translated into Italian by Pietro Francesco Scarabelli as *Museo ò galeria . . . del sig. Canonico Manfredo Settala*. . . (Tortona, 1666). I am grateful to Dr Frank P. Bär for sharing his transcription of the original Italian version with me.
- 30 F. P. Bär, 'Le museo Settala à Milan au XVII siècle: une collection d'instruments à l'esprit français', *Musique-Images-Instruments*, ii (1996), pp.58–87.
- 31 F. Puglisi, 'Signor Settala's *armonia di flauti*', *Early music*, ix (1981), pp.320–24.
- 32 Scarabelli, *Museo ò galeria*, p.333. My translation is a combination of both the Italian and Latin versions as they contain slight variations, but complement each other. For instance, the Latin version has 'Anglici Grassi', while the Italian one just states 'Graffi'. On the other hand 'Vn concerto corista di flauti' is somewhat clearer than 'Choristica fistularum'. The Latin version has: '13. *Choristica fistularum congeries eiusdem Septalij opus. / . . . / 19. Helueticarum fistularum ordo toni magis descenditis constant Indico lingo odoratissimoque: bassi in dua frusta divisi, laminis argenti connectuntur Anglici Grassi Politissimus labor. / 20. Alter Helueticarum fistularum ordo choristicus ex cauo Buxo Grassi opus. / 21. Alter ordo, sed omnes decem fistulae in duas partes diuisae voces à choristica descendente, Grassi ingeniosum opus. / 22. Alter ordo, vocis magis ascenditis / 28. Helueticarum fistularum buxens ordo contrabassis, & contrabarytonis constans, eiusdem [=Septalij] labor.'*
- 33 For dating of the activities of the Rafi family, see F. Bär, 'Faict de la main de Raffy Lyonnois Folgerungen aus einem Sigmaringer Instrumentenfund', *Musik in Baden-Württemberg* (1999/2), pp.79–108.
- 34 Haynes, *A history of performing pitch*, pp.65–7.
- 35 The only other reference to such an instrument of which I am aware is in Marin Mersenne, *Harmonie universelle* (Paris, 1636; R/1963), p.310.
- 36 D. Golly-Becker, *Die Stuttgarter Hofkapelle unter Herzog Ludwig III. (1554–1593)*, Quellen und Studien zur Musik in Baden-Württemberg, iv (doctoral diss., Tübingen, 1992). Translation based on D. Lasocki, 'A listing of inventories and purchases of flutes, recorders, flageolets, and tabor pipes, 1388–1630', *Musique de joye*, ed. Lasocki, pp.474–8.
- 37 I am avoiding a discussion of what *Chor* would mean in this case, as the term could be both the high instrumental pitch standard, called *CammerThon* in most German cities, or Praetorius's *CammerThon*, which was a whole tone lower. For a discussion of this problem, see Karp, 'Pitch', p.155. In any case I would tend towards *Chor* = *CammerThon* = $d' = 460$ or higher in this case, in the light of all the cornetts mentioned which are up to 'three tones' lower than this pitch. As we can see from the surviving instruments (Haynes, *A history of performing pitch*, p.383) there are no surviving curved cornetts lower than $d' = 430$ and no mute cornetts lower than $d' = 408$. It would make more sense if the instruments mentioned in the inventory were a whole tone to a minor 3rd lower than $d' = 460$ or higher than 408.
- 38 M. R. Moretti, *Musica e costume a Genova: tra cinquecento e seicento* (Genoa, 1992); translation based on Lasocki, 'A listing of inventories', p.482.
- 39 Haynes, *A history of performing pitch*, pp.58–61.
- 40 H. Meyers with A. Brown and B. Berney, 'An important case study: the Augsburg *Futteral*', *Musique de joye*, ed. Lasocki, pp.513–22.
- 41 Although the Lissieu is a later instrument, made in two parts with ornamental turning, it is still essentially a Renaissance flute, with typical proportions for these instruments.
- 42 The range of possible pitches based on proportions of existing Renaissance flutes is $d' = 458–63$. See Berney, 'An important case study', p.518.
- 43 Berney, 'An important case study', p.517.
- 44 Praetorius, *De organographia*, cap. II, p.16.



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45 Praetorius, *De organographia*,
cap. II, p.20.

46 The fact that the table (*De
Organographia*, cap II, p. 20) represents
ranges in *chorthon* can be deduced from
Praetorius's own statement that all the
instruments and voices referred to in
his book are at that pitch. Additionally,
it can be inferred by his direct
statement about the range of tenors in
CammerThon, which is exactly the
range shown in the table
(*De Organographia*, cap II, p. 17)

47 For a full discussion of this issue, see
P. Barbieri, 'Chiavette and modal
transposition in Italian practice
(c.1500-1837)', *Recercare*, iii (1991),
pp.5-79.

48 A. Parrott, 'Transposition in
Monteverdi's Vespers of 1610,
an "aberration" defended',
Early music, xii (1984), pp.490-516,
as well as his revision of the subject in
A. Parrott, 'Monteverdi: onwards
and downwards', *Early music*,
xxxii (2004), pp.300-317.

49 The C1 clef is much more common,
found in almost all the flute parts in
pieces by Schein, Schütz and Tobias
Michael.

50 See, for example, the *traversa* part in
Schütz's Psalm 133 *Siehe wie sein und
lieblich ist* noted in C1, with a range
of a-g'.

51 Michael Praetorius, *Musae Sionae*
(Regensburg, 1605-10). Modern edition
in *Gesamtausgabe der musikalischen
Werke*, xvii/2 (Wolfenbüttel, n.d.),
pp.613-43.

52 Modern edition in *Denkmäler
deutscher Tonkunst*, lviii
(Wiesbaden, 1957), pp.60-90.

53 Heinrich Schütz, *Psalmen
Davids* (Dresden, 1619); modern
edition in *Sämtliche Werke*, xiv,
ed. P. Spitta (Leipzig, 1893),
pp.143-55.