

popular temperament could be seen to be one of the easiest of all these early restricted equal temperaments to be tuned without any mechanical aid, on account of its helpful equal-beating IIIrds/Vths parameters. Where a monochord *would* have been especially welcomed would have been in the tuning of the more sophisticated unequal temperaments, such as the 'Tempérament Ordinaire' which d'Alembert originally described in 1752 (in part erroneously but then was corrected in the 2nd Edition), and which was subsequently incorporated in Hall's *New Royal London Encyclopaedia* for 1791 as 'that which is now in practice'.

So, despite all this intriguing investigation, it can only really be claimed that, at the most, no more than half of the mystery surrounding this monochord has been solved. Although the intended temperament is now more obvious, it still remains less than obvious how these relatively large inaccuracies could co-exist with such generally fine 18th-century craftsmanship. Had the machine suffered great wear and tear through constant use, the results would still have been frustrating, whilst understandable.

The authors, somewhat ironically, can only concur with the particular wording on the label:

'Longman & Broderip's Patent Tuning Machine, so peculiarly constructed ...'.

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APPENDIX

Any tabular depiction of temperaments relies, for its efficacy, upon the correct choice of the most suitable units of measurement for representing the 'size' or extent of the various musical intervals. Also, the number of units involved needs to be kept strictly within comprehensible limits. What is appropriate for the most accurate measurement of the relative pitches of the notes of the scale, is not necessarily equally appropriate for the simple representation of the intervallic relationships they collectively create.

Cents, with 1,200 equal units to the 8^{ve} are, unequivocally, the ideal unit for most accurate measurements of relative pitch, although they were devised in 1832, long before electronic tuning-machines had been even dreamt of, by Gaspard

Riche, Baron de Prony (1755–1839)—as revealed by Dominique Devie, in his, 'Le Tempérament Musical', 1990—, and not, as is popularly believed, by Alexander J. Ellis, who, nevertheless in the late 19th Century was the first to set the misguided trend of using them in comparative tables. This use, as already pointed out in the text, is analogous to using a microscope where only a decent magnifying-glass is required, and has the same unfortunate effect in rendering not only the composition of the total picture, but also the more essential relationship of its component parts, far less intelligible. However, a much more practical unit for this purpose was proposed by another Frenchman, F. Savart (1791–1841), although his 301.03 units per 8^{ve} are plainly awkward for arithmetical manipulation. However, by using modified Savarts, with exactly 300 equal units to the 8^{ve}—which was the particular unit chosen by Alexander Wood, as he was careful to explain in his ground-breaking study, *The Physics of Music*, first published in 1944 (although subsequent editors unfortunately saw fit to 'up-date' the text by changing these 'Savarts' to Cents)—this problem is immediately solved. Here, indeed, is the ideal tabular unit, 'as it represents approximately the smallest pitch interval that the average ear can appreciate' (Wood, op. cit., p.52). Hence, the use of Cents for this particular purpose only clouds the issue.

The following little illustration speaks for itself. Using Cents:

- The Mean-tone chromatic 'semitone' is represented by 76.2: the diatonic by 117.

The precise relationship here is by no means immediately clear or obvious but using Savarts:

- The Mean-tone chromatic 'semitone' is represented by 19.05: the diatonic by 29.25.

Compared directly with the use of Cents already illustrated, the relationship between the two intervals now at once becomes much clearer, by reference to the more obviously suggested approximate whole numbers of 20 and 30, either side of 25, respectively. Hence the relative proportions of the two can be easily grasped, and thus the more-readily appreciated. Since, in any schemes of tuning, it is the *proportional relationships* between the various intervals which is of paramount importance, it is necessary to represent these in the most effective and simple way.

It is for this reason that the tables in this paper, representing all degrees of the notes of the scale, and the resultant intervals, are shown in terms of these modified Savarts.

PHILIPPE ALLAIN-DUPRÉ

Renaissance and Early Baroque Flutes: An Update on Surviving Instruments, Pitches and Consort Grouping

In this Journal in 1988, Filadelfio Puglisi published 'A Survey of Surviving Renaissance Flutes'.¹ The present article updates his Table and discusses issues of pitch and consort grouping associated with the flutes in question.

Around fifty cylindrical flutes from the sixteenth and seventeenth centuries are preserved in museums and collections (see Table 1). I have arranged the flutes in increasing order of sounding length. Because of the recent debate about Praetorius's pitch,² I have also grouped those flutes that can be considered Renaissance or early-seventeenth-century consort flutes by pitch. In the case of flutes, where pitch is shown in the table, pitches were measured when the flute was cold. i.e. the very first notes blown in the museum. When playing an exact copy for a long time, the pitch is raised by about 5 Hz. The actual pitches are thus rather 410 Hz and 435 Hz. There

are similarities of construction among all of them, as described by Puglisi: cylindrical bore, tiny mouth-hole, thin walls and one-piece construction for all the tenors (except the Rafi flute in Bologna) and some of the basses. I have omitted mentioning the pitches of the other kind of flutes, such as military flutes or late-seventeenth-century flutes, for example Nuremberg MIR 280 or Vienna SAM 176, which were probably not consort instruments.³

From the flutes in modern collections, we can group tenor and bass flutes into consorts from France, Germany and Italy:⁴

- The two Rafi pairs were probably made in Lyon before Claude Rafi's death in 1553.⁵
- The trefoil flutes preserved in the Accademia Filarmonica, Verona and Milan could be of south German origin (they match the Bavarian foot). They were made between 1570 and 1600 according to the

¹ *Galpin Society Journal* XLI (1988), 67–82. He has since published *The Renaissance transverse flutes in Italy* (Florence, S.P.E.S. 1995).

² See especially Nicholas Mitchell, 'Choral and Instrumental Pitch in Church Music 1570–1620', *Galpin Society Journal* XLVIII (1995), 13–32; Ephraim Segerman, 'Praetorius's Cammerthon Pitch Standard', *GSJ* L (1997), 81–108; Segerman, 'A Survey of Pitch Standards before the Nineteenth Century', *GSJ* LIV (2001), 200–218.

³ Mersenne in his *Harmonie Universelle* p.243, makes clearly this distinction: 'Le fifre est pour chanter toutes sortes d'airs et de chansons, son étendue n'est que d'une quinziesme' (the fifre is to play all kinds of airs and songs, the range is only 2 octaves) and '[le fifre]C'est le propre instrument des Suisses...on ne fait pas ordinairement toutes les parties de musique avec les fifres, comme on fait avec les flûtes d'Allemand que l'on met au ton de chapelle pour faire des concerts' (it's the proper instrument of Swiss [soldiers?]..., it doesn't usually play consort music, like the flutes which are tuned to choir pitch for concerts.)

⁴ Unfortunately, although flutes seem to have been praised in England during the reigns of Henry VIII and Elizabeth I, no original cylindrical flutes from England survive, except perhaps the Jacopo Neri bass formerly owned by Eric Halfpenny (See 'Two rare Transverse Flutes', *GSJ* XIII (1960)).

⁵ In *GSJ* XXXIV (1981) Puglisi proposed an Italian origin for Rafi's descendants who emigrated; this seems unlikely as Rafi had no male heirs (see Georges Tricou, 'Claude Rafi, "Fleustier"', in *Documents sur la musique à Lyon au XVIe siècle d'après des notes de M. le Dr. Coutagne* (Lyon: Imp. Vve Mougin-Rusand, Waltener et Cie, Succrs, 1899), 43–48; reprinted in *La vie musicale dans les provinces françaises* III (Geneva: Minkoff Reprint, 1974) and in Georges Tricou, 'Claude Rafi, "Fleustier"', in *Revue musicale de Lyon*, 27 October and 3 November 1903.

Renaissance and Early Baroque Flutes: An Update on Surviving Instruments, Pitches and Consort Groupings

Maker	Puglisi no.	Location	Stamp	Sounding length (mm)	Pitch (Hz)	Remarks.
		Descants				When material is not indicated, the flute is made of boxwood
Anonymous	P39	B-Brussels: 1062		317		Fife in c" or d"?, plumwood
		<i>Praetorius, plate IX of Syntagma Musicum (1620)</i>		396		<i>Cant in a': 1.39 Brunswick feet = 396 mm</i>
Mahillon		B-Brussels: 1093		407		Facsimile by Mahillon of a 17th century fife in Graz, now lost
?		A-Vienna: SAM 1028	H	418		Military "Schweizerpfeiff" from Schloss Altenklingen, yew.
Anonymous		B-Brussels: 1063		429		Descant in g, a' = 400, stolen in 1978, plumwood
		<i>Praetorius, plate IX of Syntagma Musicum (1620)</i>		473		<i>Schweizerpfeiff in g': 1.66 Brunswick feet = 473 mm</i>
		Tenor/alt in d' at high or unknown pitches				
Anonymous	P27	R-St Petersburg 437 ex Snoeck		?		Length overall is 60 cm. Data missing for St Petersburg flutes
Anonymous		R-St Petersburg 463 ?ex Snoeck		?		Inscription: Dum vixi tacui mortua voce cano/1601
Bassano?	P30	A-Vienna: SAM 174 was A(mbras) 185	!! !!	491	a' = 470	High-pitch tenor, a' = 470 Hz
Anonymous	P28	R-St Petersburg: 438 ex Snoeck		493		High-pitch tenor?
Lissieu	P32	A-Vienna: SAM 176 was C(atajo) 187	LISSIEV	505		A late 17th century french flute in two parts (Lissieu 1625-1695)
Anonymous	P36	D-Berlin: 2663 ex Snoeck		511		Crudely made in maple.
		<i>Mersenne, Harmonie Universelle (Paris 1636)</i>		522		<i>1 5/6 pieds du roi minus 3 pouces = 522 mm</i>
H[urlacher], F		D-Nuremberg: MIR 280	pine cone/F. H.	531		Two-part 17th century flute, pine cone = Augsburg?
\$ master	P35	A-Graz: Landeszeughaus M2	\$ monogram	532		In a case for 4 military flutes, \$ = J. Schnitzer?, yew.
Anonymous		NL-Amsterdam: Rijksmuseum NG NM 7692	+/+	535,5		Nova Zembla expedition, 1596 (probably military)
		Tenor/alt in d', Chor Thon + 1/2 ton				Praetorius (1618) : Some people, then, took it upon themselves to raise our current pitch by a semitone
?	P5	I-Verona: Biblioteca Capitolare 5	AA	538,5	a' = 430	Maple, poor condition. AA is not gothic, but latin script
?	P6	I-Verona: Biblioteca Capitolare 6	AA	540	a' = 430	idem. According to Puglisi, early 17th century
Anonymous	P1	I-Verona: Biblioteca Capitolare 1	crowned eagle	540	a' = 430	Crowned eagle = Frankfurt?
Bassano?	P3	I-Verona: Biblioteca Capitolare 3	!! !!	544,5	a' = 430	
Bassano?	P2	I-Verona: Biblioteca Capitolare 2	!! !!	545,5	a' = 430	Biblioteca Capitolare flutes acquired 1631
Bassano?	P37	CH-Basel: HM 1907.1980	!! !!	547	a' = 430	Brass ferrule at both ends.
Rafi, C.	P4	I-Verona: Biblioteca Capitolare 4	C.RAFI/shield	549	a' = 430	Many cracks
		Tenor/alt in d' at Praetorius Chor Thon				2 Brunswick feet = 570mm, 2 Bayern feet = 576mm
Anonymous		D-Berlin: 5422		566	a' = 410	One-piece tenor in ivory!
Bassano?	P41	B-Brussels: 1065	!! !!	569	a' = 410?	Mouthhole undercut for left-handed player. Many cracks
Bassano?	P40	B-Brussels: 1064	!! !!	572	a' = 410?	Unplayable due to cracks
Schnitzer?	P25	I-Rome: Museo dSM 0715 (was 2791)	A or AA	573	a' = 405	Leather covered, ?signed A ²⁰
Anonymous	P24	I-Rome: Museo dSM 0714 (was 2790)		573,5	a' = 405	Leather covered
Anonymous	P31	A-Vienna: SAM 175 was C(atajo)186		573,5	a' = 405	Very similar to Bassano (?) flutes
Trefoil master	P9	I-Verona: Acc. Filarmonica 13282	trefoil above mouthhole	574,5	a' = 405	
Trefoil master	P10	I-Verona: Acc. Filarmonica 13283	trefoil above mouthhole	575	a' = 405	Acc.Filarmonica flutes acquired 1570-1600.
Trefoil master	P11	I-Verona: Acc. Filarmonica 13284	trefoil below mouthhole	575	a' = 405	Trefoil with left stem, thin leaves, different from Schratzenbach (right stem, thick leaves)
Trefoil master	P12	I-Verona: Acc. Filarmonica 13285	trefoil below mouthhole	575	a' = 405	
Trefoil master	P13	I-Verona: Acc. Filarmonica 13286	idem [erased]	575	a' = 405	
Rafi, C.	P19	I-Bologna: Museo Civico 3288	C.RAFI/shield	576	a' = 405	The only two-piece Renaissance tenor
Rafi, C.	P23	I-Rome: Museo dSM 0712 (was 2789)	C.RAFI/shield	577	a' = 405?	Cork in wrong position, impossible to move

Maker	Instruments	Groups or Consorts	Stamp	S.L. ratio	Pitch	Remarks
Rafi, C.	P42	B-Brussels 1066	C.RAFI/shield	612	a' = 383	
Anonymous		I-Bologna: Museo Civico 1833		626?		Cut in two and shortened
		<i>Praetorius, plate IX of Syntagma Musicum</i>		630		<i>Tenor/Alt in d'. 2.22 Brunswick feet = 630mm</i>
Rafi, G.(or Cl.)	P14	I-Verona: Acc. Filarmonica 13287	G [Cl?]. RAFI/shield	640.5	a' = 360	Plumwood
		Tenors (?) in a				
\$ master	P34	A-Graz: Landeszeughaus M1	\$ monogram	691		P34 and P35 in a case for 4 military flutes, \$ = J. Schnitzer?
Anonymous		A-Vienna: SAM 207 was C(atajo) 218		720?	a' = 430?	Body only of a tenor in a, called Bassanello by Schlosser
		Basses in g				
\$ master	P26	I-Merano: Museo Civico 6857	\$ monogram	755		Military flute?, \$ master = Jobst Schnitzer?, maple.
Anonymous	P29	A-Linz: Mu3	lv	759		17th century turnery
		Basses in g at Chor Thon + 1/2 ton				
Neni, Jacopo	P38	J Hamamatsu ex Rosenbaum ex Halfpenny	IA.NE/6-pt star	764	a' = 415?	Halfpenny pitch. I suggest a' = 430 Hz
?	P8	I-Verona: Biblioteca Capitolare 8	AA	795.5	a' = 430?	Maple, active woodworm, bad condition, 17th century turnery
Anonymous	P18	I-Verona: Acc. Filarmonica 13278		808	a' = 430	One-piece bass, plumwood
Vasel, B.	P20	I-Bologna: Museo Civico 3289	B. VASEL	815.5	a' = 430	
Bassano?	P7	I-Verona: Biblioteca Capitolare 7	!! !!	816	a' = 430	
[Anonymous]		I-Verona: Acc. Filarmonica 13280		827?	a' = 415?	Body only; holes 3 and 6 double, for RH/LH playing.
		Basses in g at Praetorius Chor Thon				3 Brunswick feet = 855mm
Vits, H.	P43	B-Brussels: 2695 ex Snoeck	H.VITS	848	a' = 410	
Bassano?		B-Brussels: 1088	!!	853?	a' = 410?	Headjoint only of a bass, for P40 or P41
Trefoil master	P21	I-Milan: Conservatorio 6752	trefoil below mouthhole	855	a' = 405	
Trefoil master	P16	I-Verona: Acc. Filarmonica 13279	trefoil above mouthhole	855	a' = 405	
Trefoil master	P17	I-Verona: Acc. Filarmonica 13277	trefoil below mouthhole	855.5	a' = 405	
Trefoil master	P15	I-Verona: Acc. Filarmonica 13276	trefoil above mouthhole	856	a' = 405	
Rafi, M.	P22	I-Rome: Museo dSM 0713 (was 2788)	M. RAFI	860.5	a' = 405	One-piece bass, plumwood
		Basses in g at deeper pitches				
Schnitzer?	P33	A-Vienna: GdM 88	1501/A(erased)	906		? Albrecht Schnitzer if 1501 is the date of construction ²⁰
		<i>Praetorius, plate IX of Syntagma Musicum (1620)</i>		915		<i>Bass in g. 3.21 Brunswick feet = 915 mm</i>
[Rafi]		I-Verona: Acc. Filarmonica 13281	Griffon in shield	964?	a' = 360?	Body only of a bass
		Groups or Consorts				
?	TTB	I-Verona: Biblioteca Capitolare 5, 6, 8	AA (latin)	B/T=1.48	a' = 430?	Maple, active woodworm, bad condition, 17th century turnery
Bassano?	TTB	I-Verona: Biblioteca Capitolare 2, 3, 7	!! !!	B/T=1.495	a' = 430	Bass unplayable owing to cracks, 17th century turnery, flutes acquired in 1631
Bassano?	TTB	B-Brussels: 1064, 1065, 1088	!! !!	?	a' = 410	Headjoint only of bass
Trefoil master	TTBB	I-Verona: Acc. Filarmonica 13276, 13279, 13282 and 13283	trefoil above mouthhole	B/T=1.485	a' = 405	Can be played together with the following consort
Trefoil master	TTTB	I-Verona: Acc. Filarmonica 13277, 13284, 13285, 13286 (erased)	trefoil below mouthhole	B/T=1.486	a' = 405	Can be played together with the previous consort.
Rafi, M.and C.	TB	I-Rome: Museo dSM 0713 and 0712	M. RAFI, C.RAFI/shield	B/T=1.495	a' = 405	Acc.Filarmonica flutes acquired 1570-1600.
	DTB	<i>Praetorius, plate IX of Syntagma Musicum (1620)</i>		B/T=1.45, T/D=1.6		M Rafi supposed to be Claude's father, Michaud.
						<i>Querflöten/ganz Stimwerck (full consort)</i>
Rafi, G.(or Cl.)	TB	I-Verona: Acc. Filarmonica 13281 and 13287	CL RAFI/Griffon in shield	?	a' = 360	Body only of bass, flutes acquired by Acc. Filarmonica in 1546 in Lyon

Accademia's inventories.⁶ They have been attributed to Hans Rausch von Schratzenbach (in Bavaria), since a trefoil mark can also be found on two recorders signed by him.⁷ But the two kinds of trefoil are different: left stem and thin leaves for the flutes versus right stem and thick leaves for the recorders. As the old French adage says: 'Des trèfles à trois feuilles ne sont pas rares' (trefoils with three leaves are not rare). Marcello Castellani has proposed a Veronese origin for this maker.⁸

• The two groups of flutes marked !! !! seem to date from around 1600. According to David Lasocki's theory, all such marks belong to the Bassano family, who worked in Venice and London.⁹ Maggie Lyndon-Jones's recent survey of these marks places the flutes in group B (which she dates 'circa 1559–1608') or group I ('1604') (she omits one included by Puglisi).¹⁰

The reader who is not familiar with the Renaissance flute may be surprised that no descants (trebles) are listed here. A primary reason may be that they are much easier to slip into a pocket unnoticed and be stolen. I propose two other reasons: firstly, the descant flute in a¹¹ has very thin walls and is very fragile, and so may not have survived for four centuries. Secondly, the tenor/alto flute in d has a large, easy compass up to g" or a" and can play the role of a descant, except in late compositions with a higher range (Praetorius, Scheidt, van Eyck).¹² So consort flute players, unlike their recorder-playing colleagues, had no need of a smaller flute than the standard tenor/alto. This 'discant' flute is nevertheless described by Agricola (*Musica instrumentalis deudsch*, 1529 and 1545) and Praetorius (*Syntagma Musicum*, 1618) along with the tenor and bass, whereas Philibert Jambe de Fer (*Epitome musical*, 1556) mentions only tenors in d (for the three top parts) and bass in G. Zacconi

(*Prattica di musica*, 1592) and Virgiliano (*Il Dolcimelo*, c.1600) both mention only tenors in d. Paulus Matthyszoon, in a set of playing instructions that is bound with two surviving copies of Jacob van Eyck's *Der Fluyten Lusthof I* (Amsterdam, 1649; 2nd ed., c. 1655), mentions only a descant in g.¹³

I have had the opportunity to play and measure almost all these flutes. Most of them still sound magnificent, in tune with themselves, particularly the two leather-covered flutes in Rome, the two !! !! tenors and the crowned eagle in the Biblioteca Capitolare, Verona, all the trefoil flutes in the Accademia Filarmonica Verona, and the Rafi flutes in Bologna, Brussels, Rome and Verona. Only two consorts are not in playable condition. The two tenors and bass signed 'AA' in the Biblioteca Capitolare, Verona are in maple, a softer wood than the hard boxwood generally used; they have many wormholes, and the tone holes have been badly tampered with. This group has been attributed to Arsazius or Sigmund Schnitzer from Nuremberg (mid-sixteenth century), but the maker's mark is very different from all the signatures observed on Schnitzer instruments, the main difference being that the A is in Roman rather than gothic script, i.e. there is no line above the A. Also, the turnery of the bass is in a mid-seventeenth-century Italian style, and the pitch also indicates a northern Italian origin. Of the !! !! flutes in Brussels, the two tenors are cracked in many places, the tone holes seem to have been carelessly enlarged, and the bass is missing its body. I have nevertheless indicated their supposed pitch, according to their sounding length, because they are definitely of Renaissance consort type.

The testimony about pitch given by all those flutes is very accurate, because of their one-piece construction and good playing condition. Their mouth-holes show similar particularities of undercutting

Only one flute, Vienna SAM 174 is at a higher pitch, 470 Hz,¹⁸ while two French Rafi flutes are at much lower pitches.

I have omitted from the consort groupings three pairs of instruments:

• First, Vienna SAM 174, which is sometimes wrongly associated with the body of a large tenor, Vienna SAM 207. Judging by the position of the tone holes of this flute, they were not constructed at the same pitch (the ratio would be 720/491 = 1.466 only).¹⁹ They also come from different collections: Ambras and Catajo.

• Second, Rome 0714 and 0715, which are leather-covered tenor flutes. They were probably outdoor instruments, and no bass associated with them has been preserved. According to Maggie Lyndon-Jones,²⁰ one of them is signed 'A', with the kind of A found on many instruments attributed to Schnitzer, such as the bass flute GdM 88 and the basset recorder SAM 152, both in Vienna.

• Third, Graz Landesmuseum M1 and M2, which sound a fourth apart. As was demonstrated very convincingly by Gerhard Stradner and Rudolf Tutz at the Renaissance Flute Days held in September 2002 in Basel, these flutes were designed to help soldiers to find a scale of four notes (major full-tone, minor full-tone, diatonic half-tone) with the left hand on one size of flute, then the same scale with the right hand on the next higher size of flute. A third flute was preserved in Graz until the end of nineteenth century since it was copied by Victor Mahillon. His copy (now Brussels 1093) has an overall length of 503.5 mm, a sounding length of 407 mm and a bore of 13.3 mm. It is fitted with two horn rings at each end, of the same style as on Graz M1 and M2. Its sounding length is almost ¾ of M2, which itself is almost ¾ of M1. It could have been one of the shorter flutes for the cases M3 and M4 preserved in Graz.²¹ These cases have four tubes of



Figure 1. Praetorius, *De Organographia* p. 22. Table VIII showing the differences of range between the consort flutes in g, d' and a' and the military flutes in d' and g'.

that seem to me to be original and unaltered, despite Puglisi's comments.¹⁴ If we follow Mersenne's instructions about placing the cork,¹⁵ they give an unexpected range of pitches. The most important group is at 405–410 Hz, which may have been Praetorius's *Chor Thon*. A smaller group is at 430–435 Hz, which may reflect Praetorius's comment: 'Some people then took it upon themselves to raise the pitch by a semitone'.¹⁶ This pitch, slightly lower than our modern pitch, is described by Bruce Haynes as 'tutto punto'.¹⁷ All the flutes at this pitch are Italian except Verona Biblioteca Capitolare 1.

¹⁴ 'The Renaissance Flutes of the Biblioteca Capitolare of Verona: The Structure of a "Piffaro"', *GSJ* XXXII (1979), 24–37; 'Survey', 72.

¹⁵ Mersenne, *Harmonie universelle* (Paris, 1636), 241, remarks: 'Du tampon jusqu'à la lumière il n'y a que huit lignes.... Elle est percée d'une égale grosseur tout au long, et cette grosseur est de huit lignes' (from mouth-hole to cork, 18 mm; the bore is also 18 mm). This is the same rule as for a Boehm flute.

¹⁶ *Syntagma Musicum, II: De Organographia, Parts 1 and II*, translated and edited by David Z. Crookes (Oxford: Clarendon Press, 1986), 32.

¹⁷ Bruce Haynes, *A History of performing pitch: The story of the A* (Lanham, Md., Scarecrow Press, 2002) 62

¹⁸ Boaz Berney's recent measurements provided by the Kunsthistorisches Museum give a' = 480 Hz.

¹⁹ See Allain-Dupré, 'Le bassanello C218': paper read at Journées d'Études SFA-GSAM et AcOMM à Toulouse (2001) and published on website: <http://perso.club-internet.fr/allaindu/fluterenaissance/7-bassanello.htm>

²⁰ Maggie Lyndon-Jones, 'Renaissance woodwind in the Museo degli Strumenti Musicali, Rome', *FoMRHIQ*, 90 (January 1998) pp.21–25.

²¹ Gerhard Stradner, *Musikinstrumente in Grazer Sammlungen*, *Tabulae musicae Austriacae*, 11 (Vienna: Verlag der Österreichischen Akademie der Wissenschaften, 1986), 89–91; Stradner, 'Die Musikinstrumente im Steiermärkischen Landeszeughaus in Graz', in Peter Krenn, ed., *Trommeln und Pfeifen: Militärszelte, Anderthalbhänder, Nürnberger Waffen, Waffenhandel und Gewehrzeugung in der Steiermark*, Veröffentlichungen des Landeszeughauses Graz, 6 (Graz: Landeszeughaus, 1976), 7–36. Especially 8–15.

⁶ See Marcello Castellani, 'Two Late-Renaissance Transverse Flutes', *GSJ* XXV (1972), 73–79.

⁷ Bass recorder, Munich BNM 180/43, and basset recorder, Salzburg MCA M244. See Friedrich Von Huene, 'Makers' Marks from Renaissance and Baroque Woodwinds', *GSJ* XXXVII (1974), 31–47. On p.35 he shows the difference between the two kinds of trefoils.

⁸ 'Two Late-Renaissance Transverse Flutes', 75.

⁹ 'The Anglo-Venetian Bassano Family as Instrument Makers and Repairers', *GSJ* XXXVIII (1985), 112–132; 'The Bassanos' Maker's Mark Revisited', *GSJ* XLVI (1993), 114–119.

¹⁰ 'A Checklist of Woodwind Instruments Marked !!', *GSJ* LII (1999), 243–280; she omits Puglisi's P37: CH-Basel HM 1907.1980.

¹¹ I have kept the fundamental note of the flutes as it was considered to be in the sixteenth century: descant in a, tenor/alto in d and bass in G, as in the music they were playing. In reality, as pointed out for the first time by Praetorius, they are 4-foot instruments and play the music an octave higher, with fundamental notes a', d' and g, respectively.

¹² Praetorius gives the same highest note a" for the tenor/alt and the discant. See also Anne Smith, 'Die Renaissancequerflöte und ihre Musik. Ein Beitrag zur Interpretation der Quellen', *Basler Jahrbuch für Historische Musikpraxis* 2 (1978): 9–76, for the extant repertoire of the Renaissance flute and a study of ranges.

¹³ See Philippe Allain-Dupré, *Les flûtes de RAFI* (Courlay: J. M. Fuzeau, 2000), 51, for a complete table of all sizes and pitches of flutes and recorders in sixteenth- and seventeenth-century treatises.

Heinrich Schütz, *Symphoniae Sacrae I*
Venice, 1629

N^o6: Jubilate Deo Omnis Terra, Basso solo con doi flauti o violini SWV 262

N^o7: Anima mea liquefacta est, 2 tenori et doi cornetti o fifari SWV 263

N^o8: Adjuro vos, filiae Jerusalem, 2 tenori et doi cornetti o fifari SWV 264

Figures 2, 3 and 4. Heinrich Schütz, *Symphoniae Sacrae I*, Venice, 1629.

850mm, 670mm and 572mm (two tubes) and could therefore have held M1 (796mm), M2 (640mm) and the original of B-1093 (503.5mm).

The case that was preserved in Schloss Altenklingen (now Vienna SAM 1029) together with the descant Vienna SAM 1028 could also hold four instruments with a length ratio of 4:3.²² It seems to be a particular feature of military flutes to be separated

by fourths, whereas consort instruments are pitched a fifth apart, with a sounding length ratio of 3:2. This is corroborated by Praetorius: in Table VIII (see Figure 1), besides the three sizes of flutes, he mentions two sizes of Schweitzerpfeiff: a small one, range g' to c''' and a larger one, range d' to a''', a fourth below.²³ On the last instrument in d' the third and the ninth (should be tenth?) are described as

²² Gerhard Stradner, 'Musiker und ihre Instrumente', in *Für Aug' und Ohr: Musik in Kunst- und Wunderkammern* (Milan: Skira; Vienna: Kunsthistorisches Museum, 1999), 36–37 and 115–117.

²³ See note 11: Praetorius gives us real notes, while other treatises give the pitch of flutes and recorders an octave lower. See Crookes, 36.

major,²⁴ while the tenor/alt flute in d' (real notes) plays mostly in flat modes.²⁵ He writes: '[The] Schweitzerpfeiff has its own peculiar fingering ... [and] is only played together with military drums'.²⁶ Also, the shorter compass of an eleventh or twelfth indicated by Praetorius is commensurate with the larger bore found on M1 and M2, whereas consort flutes with thinner bores have fingering charts for at least a nineteenth (Agricola 1545, Jambe de Fer and Virgiliano). All these considerations lead me to exclude the military flutes from this study, even if they were played in consorts of four from the same case, since we do not have enough information on what music they played and with which fingerings, although Rudolf Tutz demonstrated in Basel they could play with very simple fingerings, with no forks. Further investigation needs to be made.

Another important feature of Renaissance flutes for our study is that they were considered very limited in transposition. The transpositions of a tone or a third higher or lower that are described in Virgiliano's *Il dolcimelo* for cornetts, sackbuts in A and recorders were not possible for cylindrical flutes, but only transpositions at the fourth and fifth. Owing to their large compass of a nineteenth, transpositions at the octave were also available.²⁷ Moreover, an indication by Praetorius that pieces written in the hypoaolian mode would sound better if transposed down a tone on flutes indicates again the limitation of their modal possibilities.²⁸ Because of these considerations, the pitch of Renaissance flutes should help us to reconsider our concept of a 'high Renaissance pitch', since they were mostly low-pitched and were not able to transpose 'up a

tone' or 'up a minor third' to match the pitches of 460 Hz or higher, commonly observed on organs and other wind instruments.

As I have indicated in the Table, the length of the foot in different regions was probably responsible for this pitch distinction: 2-foot or 4-foot recorders or organ pipes were made in C, whereas 2-foot flutes were in D.²⁹ Let us take the example of Schütz's *Symphoniae Sacrae I*, nos. 6, (see Figure 2), 7 (see Figure 3) and 8 (see Figure 4) with their obligato parts for 2 flauti (6) and 2 fiffari (7 and 8).³⁰ If we consider that the music was played at *Chor Thon* (410 Hz), then the treble recorders in g' in no. 6, written in the key of A, should play the music up a seventh in G major, since they are pitched a tone higher. That creates better fingerings for them. One has to follow Virgiliano's third line of transposition: 'un tono piu basso',³¹ which makes the music sound up a seventh, since Virgiliano considers the recorder an 8-foot instrument. To play this piece at pitch with tenor recorders in c' would be very awkward: the violin clef indicates a soprano instrument, and the key of A major with frequent use of f# minor would be quite difficult. Pieces 7 and 8 for obligato fiffari, or cornetti, written in the key of d minor, match perfectly the scale of the tenor transverse flute in d', from a' to e''''. Although Schütz has also proposed cornetti for these obligato parts, it seems clear that flutes were intended here, due to the very low range, the use of alto clef and the rhetorical context (the bottom notes of cornetts don't illustrate the words 'Anima mea liquefacta est' as well as soft flutes at 4-foot). The only complaint one might have is for the voice parts, as modern tenor singers would

²⁴ Crookes has wrongly translated this as a fife with the range d#-a''' (Syntagma Musicum, II: De Organographia, Parts I and II, translated and edited by David Z. Crookes (Oxford: Clarendon Press, 1986) 89, note 98.

²⁵ Philibert Jambe de Fer (*Epitome musical*, 1556) 48: 'Le jeu de bémol est le plus plaisant facile et naturel' (playing with b^b is the most agreeable, easy and natural).

²⁶ *Syntagma Musicum II*, 46.

²⁷ See Howard Mayer Brown in Notes (and Transposing Notes) on the Transverse Flute in the Early Sixteenth Century', *Journal of the American Musical Instrument Society* 12 (1986), 5–39. See Allain-Dupré, *Les flûtes de RAFL*, 53–54, for a study of all cases of transposition on Renaissance flutes compiled from original sources.

²⁸ *Syntagma musicum II*, 156: 'Denn ob wol die Querflöten in Cantu duro bissweilen auch gebraucht werden so kömpt es doch nicht durchhaus in allen Modis oder Tonis. Darumb man denn auch Decimum Modum Hypoaolian umb ein Thon niedriger auf den Querflöten zu musiciren pflegt. Und schickt sich keiner besser darzu als Dorius, Hypodorius und Hypoaolius in secunda inferiore'. (Although the transverse flute may sometimes be used in sharp modes, still they are unable to play in all modes. Therefore, one is also accustomed to transpose the tenth mode, hypoaolian down a tone on flutes. And nothing works better than dorian, hypodorian and hypoaolian at the inferior second).

²⁹ Brunswick foot = 285mm. Bavarian foot = 288mm, French pied du Roi = 330mm. It is noticeable that in many collections, not only the flutes but also the recorders or the cornets show sounding lengths which are multiples of the foot. For instance almost all the cornetts in the Accademia Filarmonica are 2 feet long (570 mm), while almost all bassett recorders in f are 3 feet long (845mm). Further research is needed.

³⁰ Bärenreiter-Ausgabe 30, pp. 59–79.

³¹ See Virgiliano *Il dolcimello*, folio 52–55, (Firenze, facsimile SPES, 1979). Note that both fingering charts for cornett and recorder are annotated on this line of transposition 'un tono piu basso' [a tone lower] by hand-written comments. This may indicate that it was the most common transposition. (See Figures 5, 6 and 7).

prefer to sing at a higher pitch those parts which do not go higher than *f*, in order to show off their brilliant technique. But this was probably not the condition encountered by Schütz. Keyboards were probably pitched at *Cammer Thon* and transposed down a tone, while violins could have been tuned at either of the two pitches, 410 or 460 Hz, although Praetorius recommends lower pitching for stringed instruments to avoid too much tension on the strings and the risk of their breaking.

This proposed interpretation also works a semitone higher, with flutes at 435 Hz and recorders (up a seventh) and organ (down one tone) at 490 Hz. But to play up an octave, at a higher pitch (460 Hz or more), the recorder parts of *Symphoniae Sacrae* 6 on trebles in *g*¹ or on descants in *c*¹ seems very unlikely: the first part goes up to high *g*³, unplayable on a treble recorder in *g*, and the second part would stay in the low range and with an impractical key of *f*[#]

minor for the soprano recorder. The example shows that music where flutes were involved was probably often played at a pitch lower than *A*=440 Hz.³²

In conclusion, the surviving Italian and German flute consorts match Praetorius's pitches on the low side, *Chor Thon* at *A*=405–410 Hz and *Chor Thon* raised by a semitone at *A*=430–435 Hz, while many other woodwinds and organs were tuned one tone higher, at *Cammer Thon* (*A*=460 Hz or higher). French pitch, owing to the larger size of the French *ped du Roi*, was even lower, but too few flutes are preserved to demonstrate it.

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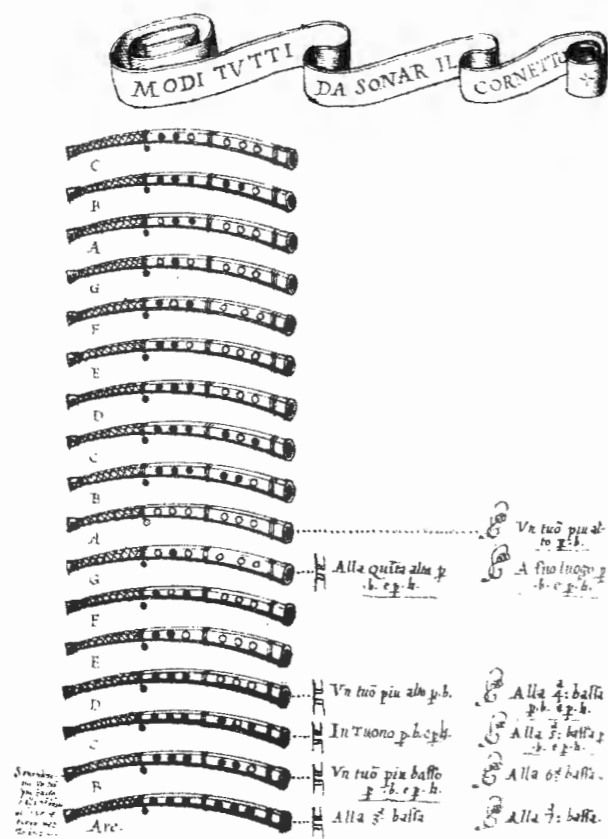


Figure 5. *Virgiliano Il dolcimello*, folio 52 (Firenze, facsimile SPES, 1979). Transpositions for the cornett. Hand-written comment beside transposition 'down a tone'—'If you play a tone lower, or at a 6th down, you need to close half hole'.

³² See also Roger Bowers, 'An aberration reviewed: the reconciliation of inconsistent clef-systems in Monteverdi's Mass and Vespers of 1610', (Early Music, November 2003), 527–538, for an argument to play the Magnificat, where flutes are involved, down a tone (i.e. at pitch for the flutes tuned a tone lower!)

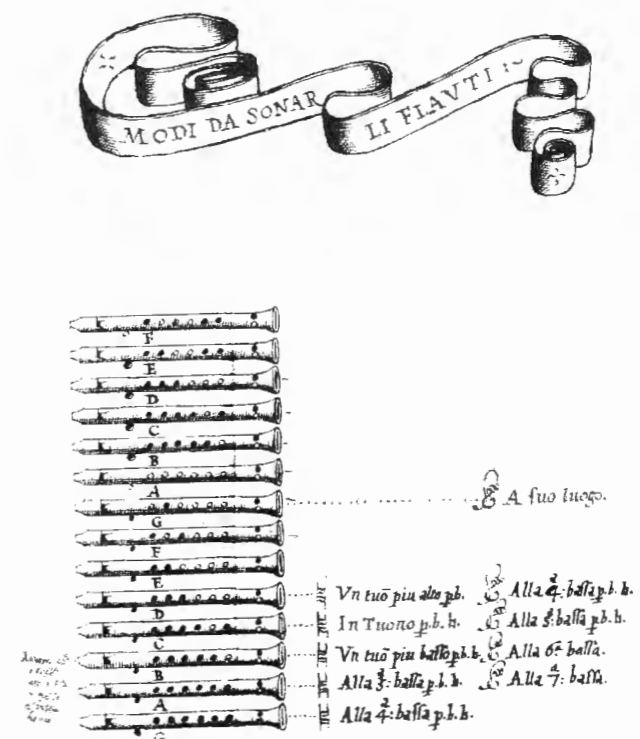


Figure 6. *Virgiliano Il dolcimello*, folio 55 (Firenze, facsimile SPES, 1979). Transpositions for the recorder in *g*. Hand-written comment beside transposition 'a tone lower'—'in this case if you play at the octave, second hole half opened'.

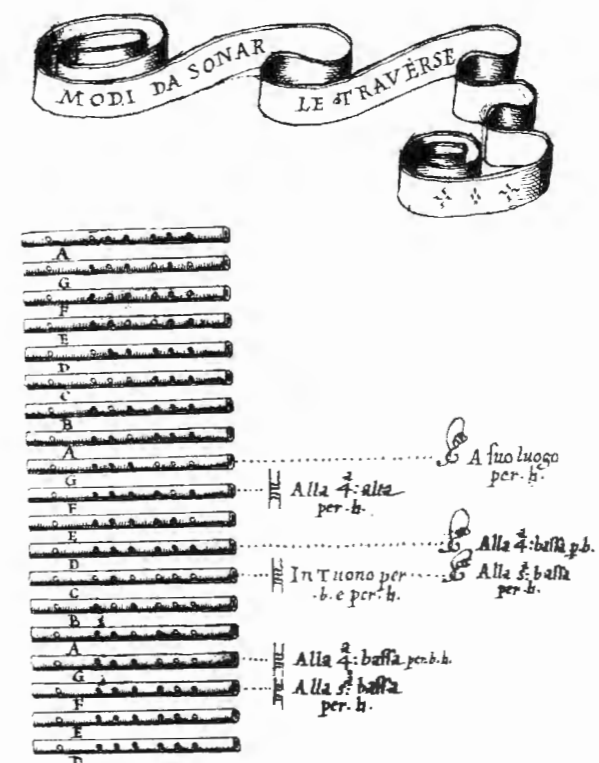


Figure 7. *Virgiliano Il dolcimello*, folio 55 (Firenze, facsimile SPES, 1979). Transpositions for the flute in *d*. No annotation.