An Important Case Study: The Augsburg *Futteral*

Herbert W. Myers with Boaz Berney and Adrian Brown

FIGURE 1

FIGURE 2

In the Maximilian Museum in Augsburg, Germany, resides a most fascinating object: an instrument case or *Futteral*, unfortunately now empty, that once housed twenty-eight woodwind instruments. Consisting of a number of wooden tubes – one for each instrument – fastened together and covered with black leather, the case resembles a huge set of panpipes of the sort known to ethnologists as "bundle pipes." (See Figs. 1 and 2.) Painted on one side is the coat of arms of the city of Augsburg (consisting of a green device like a pine cone on a red and white shield) and the date 1603, suggesting that the case was once the property of the Augsburg civic musical establishment near the turn of the seventeenth century. (See Fig. 3.) Considering its age, the case is remarkably well preserved, having suffered just a few chipped corners. Although the lid is missing, most of its brass hinge and all of the brass hasp remain, and from these the original dimensions of the lid can be reconstructed. Other than what can be surmised from the painted emblem, there is no known historical record of the case's provenance and use, leaving us to glean what we can from its physical characteristics to solve some of its mysteries.

I made the acquaintance of this case in the winter of 1968, when, as a fortunate recipient of a DAAD[1] grant, I was measuring Renaissance instruments in German museums. It seemed clear from a cursory examination of the open ends of the tubes that they consisted of two types: sixteen of the tubes, ranging in size from the largest to the smallest, have flared ends, while the rest exhibit no such flaring. (There are in fact three types of tubes, as I shall explain presently, but this is a more recent discovery. For a key to the numbers I assigned to the tubes, see Figure 4.) It seemed obvious that the most likely inhabitants of the flared-end tubes would have been recorders, and of the straight-end tubes, flutes. Taking some basic measurements of each tube (the depth and the diameter of the mouth – just

FIGURE 3

FIGURE 4 - Key to compartments

before the terminal flare, if any), I was easily able to assign plausible sizes of recorders to the flared tubes, and plausible sizes of flutes to six of the non-flared ones. The remaining six (nos. 20–25), however, remained difficult to account for. Thus stymied in my attempt to answer the question of exactly what instruments are missing, I eventually returned home with my measurements and turned my attention to what I could discover about instruments that *do* still exist from that period. From time to time I would run across my notes about the case and make another attempt at solving the puzzle, with little result. Meanwhile, the case took on new significance as a document of performance practice. What had seemed at first a question of rather localized interest – what instruments had been available to the Augsburg *Stadtpfeiffer* in the early seventeenth century – acquired a new and more generalized importance for what it could tell us about matters of pitch.

It should be understood that in the late 1960s – and for several years after that – the interest of performers in playing at historical pitches was in its infancy. To be sure, several Baroque groups in Europe had found A = 415 Hz to be a satisfactory compromise "low pitch" for professional use, but that approach had not yet caught on in America. Regarding earlier music, on the other hand, the wisdom of the scholarship of the day was that chaos had reigned in the pitch world of the Renaissance, and it followed that our best solution was to re-scale our reproductions of Renaissance winds to modern pitch and enjoy the benefits of a commonly agreed-upon standard. Eventually, however, inspired by the successful model of Baroque performance that had so clearly demonstrated the effects of pitch on the perception of timbre, as well as frustrated by some of the difficulties experienced in the re-scaling of instruments, many performers have become interested in using reproductions at historical pitches, and a number of builders have begun to make them. Then, too, more recent research into early pitch practice has shown there was perhaps more organization to the chaos than had at first been perceived.[2] Still, the problems and questions are quite complex, and there is no simple answer (such as A = 415 Hz for Baroque music[3]) that even begins to suffice for Renaissance music.

One of the perplexing issues surrounding Renaissance pitch concerns the pitches of surviving flutes. Of some forty extant consort flutes,[4] there are no examples at the pitch found to be the one most common among surviving instruments of other kinds from the

period – recorders, trombones, cornetti, shawms, curtals, crumhorns, and rackets (to name those that have playing pitches which, I believe, can be determined with comparative certainty).[5] The level of this pitch is around a semitone above modern, or about A = 466 Hz. It has been identified with the pitch standards referred to in early sources as *tuon del cornetto di mezzo punto, CornetThon, CammerThon* (as used by Praetorius for his reference pitch), and *ChorThon* (as it was most commonly understood in north Germany in the seventeenth and eighteenth centuries). (Confusingly, southern Germans persisted in calling by the name *ChorThon* a pitch a tone below that – about A = 415 Hz, then – which Praetorius says had been the original level of *ChorThon* in his own area, as well as the pitch for which he himself would prefer to reserve that term. Also confusingly, *CammerThon* became a term in the Baroque for that same low performance pitch.) It should be borne in mind that in all these discussions of early pitch, one of the most important words is "about." Because of various factors, such as differences in playing technique, the deteriorated condition of instruments, different approaches to restoration, and local variation within the period itself, the determination of early standards is far from absolute. A margin of error of a quarter-tone *in either direction* is common in the "fine print" caveats of researchers, at least as far as any one particular piece of evidence is concerned. Thus when we find there are two extant tenor flutes at about A = 480 Hz, we might see them as being on the upper edge of this quarter-tone margin for *mezzo punto* – but they are far from its accepted average and therefore probably not at *mezzo punto* at all.

Of the remaining Renaissance flutes, all are at pitches below *mezzo punto* (ranging from about a semitone to about a major third below it). There have been various explanations for this apparent discrepancy of pitch between flutes and the majority of other surviving instruments. One is that flutes did not share the same pitch-world as the high-pitched instruments, and that any rapprochement between the two worlds would have involved transposition, either by the flutes or by the other instruments. Another explanation is that the survival of early instruments is not necessarily in proportion with their original use, and that the flutes at *mezzo punto* that would have once existed simply have not endured. The Augsburg *Futteral* thus represents a new source of information to be injected into this debate, of importance not only for the additional data it provides concerning flutes *per se*, but also for the light it might shed on the pitch relationship between those flutes and other instruments used at the same time and by the same players. Also of interest is what it might tell us of the pitch relationships among the members of an extended family of recorders.

Issues of flute and recorder pitch are central to the researches of Boaz Berney and Adrian Brown as presented in the present proceedings. Adrian's article, in particular, draws upon knowledge of extant cases for what they can tell us about the makeup of consorts of recorders in the Renaissance. Somewhat surprised that the Augsburg case seemed unknown to both Boaz and Adrian, I informed them of its existence and nature. (It is easy, in retrospect, to see why the case has slipped "under the radar" of most researchers: it has remained unexhibited, since its significance was not understood by the conservators of the museum.) It seemed obvious that the case warranted a thorough re-examination. Thus in early December 2003, Adrian, Boaz, and Liane Ehlich converged upon Augsburg for that purpose.

Using Adrian's state-of-the-art equipment, they were able to measure it in far greater detail than I had thirty-five years before. Perhaps their most significant discovery concerns the true nature of the six inexplicable tubes mentioned above: they are not cylindrical (as I had assumed, without probing deeply enough) but conical.[6] (Unfortunately, the leather seems to have deteriorated since my visit, and part of it has come loose, exposing the wood underneath; the museum conservators have kept the detached piece, with restoration in mind.)

Various types of instruments have been proposed as the original inhabitants of these conical tubes, the most plausible so far being some form of straight cornetto (either mute cornetti or straight cornetti with separable mouthpieces). There are still difficulties with the identification of the conical tubes as housings for cornetti. While the longest of them (the two with a depth of 580 mm) are appropriate for cornetti at *mezzo punto*, the lengths of the remaining four are oddly proportioned to them. (Two would appear to be about a tone above the longest, and the other two, a major third – relationships which do not seem to fit a known pattern of early pitch practice.) In addition, as pointed out by Adrian Brown, the small ends of the tubes are still rather large in comparison with the upper ends of mute cornetti, leaving considerable "rattling around" room – out of keeping with the need to protect the delicate and vulnerable "mouthpiece" edges of these instruments. While the few extant examples of the straight cornetto with separable mouthpiece (a type apparently peculiar to Germany) show an enlargement at the top end to strengthen the mouthpiece socket, the enlargement is still not great enough to fit tightly in the small end of the tubes of the Augsburg case. Two other possibilities have been proposed as candidates for the conical tubes: tabor pipes and drumsticks. The most typical shape of the tabor pipe, however, was similar to that of the recorder (and would thus have warranted a shape of tube more like those housing recorders). Drumsticks typically had a large ball end that approached or equaled the diameter of the handle, so that they would have required cylindrical (or almost cylindrical) housings. They also would not generally have been of the length of the tapered compartments of the Augsburg case.

While the discovery about the conical nature of the "mystery" tubes has given us a new problem to solve, it has at least eliminated the possibility they were associated with flutes. At the time of this writing there is still about a quartertone discrepancy between the pitch estimates for the recorders (about A = 475 Hz) and for the flutes (about A = 460 Hz) that originally inhabited the case. Perhaps this discrepancy can be resolved eventually, and perhaps not. At least it seems clear that there once were flutes built to play at *mezzo punto*, and that we cannot rely solely on the record of surviving instruments for our knowledge of early pitch practice.

Adrian Brown adds:

As mentioned already, sixteen compartments of the case seem to have been intended for recorders, as the first couple of centimeters of their entrances have been flared out in a manner to take the flared form of the bells of these instruments. With the five longest compartments, a recess has been turned out to accommodate the beaded form of bell typical of Renaissance recorders with keys and fontanelles. This case is highly important for both recorder players and recorder makers, because it provides specific indications of original size distribution in what is effectively the largest known original configuration of Renaissance recorders. (Although large combinations of instruments are documented in contemporaneous inventories and references,[7] information on the precise number of each present in a given consort is rare, and the intervals between the sizes can only be guessed.) The sixteen missing recorders can be broken down into the following nominal sizes: 1 bass, 4 bassets, 4 tenors, 3 altos, 2 sopranos, and 2 garklein (sopranino). A calculation using the lengths of the compartments reveals that the ratios between adjacent sizes are as follows: bass/basset 1.56, basset/tenor 1.53, tenor/alto 1.43, alto/soprano 1.49, and soprano/sopranino 1.51. Since the ratio for an interval of a perfect fifth is 1.5, and that of a perfect fourth (which, after all, would be the only other conceivable possibility) is 1.33, it is quite clear that this case was made for six separate recorder sizes, each sounding a fifth apart from its neighbors.

One of the problems in having no surviving instruments from this case is that it is difficult to estimate the length of any free space there may have been in the compartment, or, in other words, the difference between the tube length and that of the recorder that was intended to fit. A quick comparison of the extant cases where we do have surviving recorders reveals that this free space was relatively consistent among sizes. For example, Vienna SAM 170 gives us the following "free space" measurements from the largest to smallest compartments: 10.5 mm, 9 mm, 3.7 mm, 2 mm, 4.5 mm and 3 mm. On the other hand, the compartments of the large case in Frankfurt (inventory number X/4266) seems to have been cut much more finely, as the equivalent measurements of the compartments having surviving recorders are 1mm, –1 mm, –0.8 mm, 0.9 mm, and 1.5 mm. (The figures with a negative value suggest that the case has shrunk a little with age, or at least that it was made to an extremely precise fit with the instruments.) Another unknown that prevents us from making an accurate pitch estimate of the original instruments is their windway lengths or, on recorder sizes with caps, the combined lengths of windway and cap. Whereas the former seem to be fairly consistent over the range of extant recorders, the latter show a lot of variation, as makers would appear to have used different cap lengths and depths for both aesthetic and technical reasons. It is possible, however, using data from surviving instruments and experience with modern reproductions, to guess that the pitch of the original recorder sizes would have been as follows, using a pitch standard a little more than a semitone above modern pitch, or around A = 470–480 Hz: bass in *B♭*, bassets in *f*, tenors in *c′*, altos in *g′*, sopranos in *d″*, and sopraninos in *a″*. Using the recorders alone would allow the nominal FCCG combination in four different positions: *B♭–f–f–c′*, *f–c′–c′–g′*, *c′–g′–g′–d″*, and *g′–d″–d″–a″*, with enough instruments at hand to double, triple, or even quadruple the sizes, as required by larger-scale pieces.

Boaz Berney adds:

The tubes of which the case is comprised were made on the lathe very much as the instruments would have been made. The wall thickness at the top is very thin (2–3 mm) but is probably thicker further in. The tubes were then glued together and covered with leather, and the gaps at the top were filled with wood and paper mache.

All the tubes seem to have been made separately on the lathe, but there is a clear distinction in the bores of the three types. The cylindrical tubes were just bored through with an auger. The flared tubes were usually made with two sizes of auger, and the flared end opened up by hand on the lathe. The conical tubes were made just like a conically bored instrument, using reamers. In the cylindrical and flared tubes, the auger marks are clearly visible, betraying some lack of care; the bore is very rough and irregular. By comparison, in the conical tubes, the bore surface is very smooth and regular – good enough to be the inside of any conical instrument. (This in itself seems to call into question the idea that the conical tubes might have housed tabor pipes, since their carefully achieved conical profile would not have come close to fitting such instruments.[8]) The tubes all have cork at the bottom end, probably to protect the top part of the instrument from being damaged.

The pitch of the flutes in the case can be calculated from the total length of the tubes as well as deduced from comparison with surviving instruments. For the four tenor-sized tubes (nos. 8–11), the only comparable surviving instrument is the Lissieu flute (A-Vienna, Kunsthistorisches Museum C178), which has a pitch of A = 462 Hz and a total length of 600.8 mm. Although this flute was probably made about fifty years after the Augsburg case, and despite the fact that it displays some later features, such as a two-part construction and decorative turning, it is still essentially a cylindrically bored Renaissance flute, with proportions similar to much earlier surviving originals. Therefore, I believe that it gives us a good idea of the pitch of the flutes in the case.

The problem with calculating the pitch of the instruments according to the total length of the tube is that this length also includes the part between the top of the flute and the embouchure hole, which has no influence on pitch. Although the length of that part is always in proportion to the rest of the instrument, there are slight variations in that proportion among originals made by different makers.

The table below shows the possible pitches of the tenor flutes in the Augsburg case, calculated from three different surviving originals. As can be seen, the variation stemming from different proportions in the originals is limited to about 5 Hz, placing the pitch of the missing tenors at A = 460 ± 3 Hz.

Instrument	Stamp	Total length (mm)	Sounding length	Pitch	Pitch of instruments re-scaled to length represented by tubes (598 mm)
B-Brussels MIM 1064	!!	672	572.8	408	458
A-Vienna KHM A174	!!	577	490.6	480	463
I-Verona AF 13284	(trefoil)	682.5	575	405	462

The two remaining cylindrical tubes (nos. 16 and 17), in the proportion 1:1.145 to the tenor tubes, would probably have housed two bass flutes pitched a fifth below the tenors at the same pitch. The only surviving bass with a similar length is A-Linz Mu3, which has a total length of 871 mm and a pitch of about A = 456 Hz, slightly longer and therefore probably slightly lower than the Augsburg basses.

In sum, the case contained a six-part flute consort at about A = 460, with two basses in G and four tenors in D.

Chamber number (Myers)	Length (mm)	Form of chamber	Diameter (minimum	Diameter (inter-mediate)	Diameter at rim	Instrument	Example	Actual length of instrument
1	597	flared	40–41		43.9	recorder (tenor)	Frankfurt X2462	598.8
2	1425	flared	82	92 at 450	113.5	recorder (bass with crook)	Verona 13245	1413
3	597	flared	40–41		44.9	recorder (tenor)		
4	913	flared	66	71 at 430	83.5	recorder (basset)	Frankfurt X2461 (with cap)	904
5	914	flared	66	68 at 190	82.5	recorder (basset)		
6	915	flared	66	71 at 400	80.7	recorder (basset)	Brussels M1033 (direct-blown)	915
7	912	flared	66	70 at 240	82.5	recorder (basset)	Brussels M2345 (direct-blown)	904
8	598	cylindrical	24–24.5		25.1	flute (tenor in d)		
9	597	cylindrical	24–24.5		24.5	flute (tenor in d)		
10	597	cylindrical	24–24.5		24.9	flute (tenor in d)		
11	597	cylindrical	24–24.5		24.8	flute (tenor in d)		
12	272	flared	23		25.5	recorder (soprano)		
13	272	flared	24		25.4	recorder (soprano)		
14	180	flared	18		19.2	recorder (garklein)		
15	180	flared	17.5		20	recorder (garklein)		
16	866	cylindrical	35.5		34.3	flute (bass in g)	Linz Mu. 3	871
17	866	cylindrical	35		35.1	flute (bass in g)		
18	596	flared	40–41		42.5	recorder (tenor)		
19	596	flared	40–41		42.7	recorder (tenor)		
20	509	conical	20.5	25 at 310	29.3	mute cornetto?		
21	508	conical	20.5	25 at 280	29.7	mute cornetto?		
22	455	conical	20.5	25 at 220	29	mute cornetto?		
23	456	conical	20.4	25 at 220	29.7	mute cornetto?		
24	580	conical	23	30 at 330	35	mute cornetto?		
25	580	conical	23	30 at 320	34	mute cornetto?		
26	405	flared	32.5		34.9	recorder (alto)	Frankfurt X4264	410.5
27	405	flared	30		34.8	recorder (alto)		
28	405	flared	31.5		34.9	recorder (alto)		

Notes

[1] Deutsche Akademische Austausch Dienst – German Academic Exchange Service.

[2] See Bruce Haynes, *A History of Performing Pitch: The Story of "A"* (Lanham, MD: Scarecrow Press, 2002), 55–114.

[3] Many would assert that this commonly accepted solution for Baroque performance represents a gross oversimplification, but that is a separate issue.

[4] Researchers of Renaissance flutes differ in their criteria for accepting flutes as "consort" instruments, some rejecting examples that seem too late in style of construction or too fife-like. I have included in my round number of forty those examples about which there seems to be little debate.

[5] While this pitch level can be said to be the "most common" among surviving Renaissance instruments, it is by no means exclusively so. Recorders, in particular, show a great range of pitch variation, as documented by Adrian Brown in his article elsewhere in this volume (see pp. 77–98).

[6] Less explicable (though no less embarrassing) is that I had mismeasured the depth of the longest tube—that for the *Baß* recorder – by some 110 mm.

[7] See David Lasocki's wonderful "A Listing of Inventories and Purchases of Flutes, Recorders, Flageolets, and Tabor Pipes, 1388–1630" in this volume (pp. 419–511).

[8] On the other hand, Maggie Kilbey cautions: "If the person who made the case was also an instrument maker, he would have had a rack full of reamers. If the outside dimensions of an instrument intended for the case were a rough approximation of the inside dimensions of part of the bore of an instrument he was in the habit of making, then it would have been more convenient simply to take a reamer from the rack rather than having to make a new tool for the purpose." (Posting to renaissancewoodwinds@yahoogroups.com, 20 December 2003.) In other words, the rate of taper of the conical tubes may have been merely the result of the tapered reamers on hand rather than a reflection of a deliberate decision on the part of the maker to achieve a custom fit.