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THE 1531 TRASUNTINO HARPSICHORD IN A UNIVERSAL EUROPEAN PITCH SYSTEM

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In an article that I published five years ago (the *Galpin Society Journal* 1995) I took the evidence of the surviving 16th century woodwind and brass instruments and, integrating it with the evidence of the printed and manuscript music of the period, I came to the conclusion that there was actually a common pitch system in use virtually everywhere during the Renaissance. The wide variations of pitch standards that appear to have existed are illusory, since they are connected to one another by easy transpositions accessible to players of wind, string, keyboard and brass instruments alike. In the light of further research since, I have not altered my view, and the recent work of Grant O'Brien and Denzil Wraight has revealed evidence that confirms this system. Where I beg to differ from their analyses is that the typical long scaled virginals or harpsichord of the 16th century such as the Trasuntino of 1531 was tuned to a low pitch of 348Hz (a major third below modern pitch) as opposed to the 415Hz or thereabouts generally thought by them to have been the standard for these instruments.

The method that I used was to work out the way in which music of apparently different pitch systems could be aligned. I used as a fixed base the clear evidence of surviving renaissance woodwind instruments, especially the recorders. The picture that emerges is of a standard musical layout of Cantus, Altus, Tenor and Bassus, which can be played on a quartet of instruments of three sizes: the treble in G, the Tenor in C and the Bass in F. The Tenor would play the Altus and Tenor parts. This type of recorder consort goes back to Virdung in 1511 and continues to Praetorius in 1619. Such instruments, which typically play at 466Hz, can cover almost the entire secular repertoire when it is in the conventional low clef configuration or *chiavi naturali*. (See table 1, which indicates these clefs against the highest three pitches.) But madrigals are often notated in the high clef configuration or *chiavetti* (see the clefs in table 1 for the lowest three pitches used). If the recorders imagined the music transposed down, they could play this music quite easily with the same three types of instrument.

With viols, however, the process is reversed: they can play music in high clefs directly, but to play the low clef music that suits the recorders, they need to transpose upwards. Both processes are possible without rewriting the parts, but often in manuscripts one finds vocal low clef music transcribed up a fourth without text, presumably for viols. We know the woodwind pitch, so we can infer that the viols were pitched a fourth lower than the recorders - at 348Hz. The large size of viols illustrated in Praetorius' *Syntagma Musicum,* and also indicated by later English writers such as Talbot and Simpson, tends to confirm this. Also the surviving instruments seem to have been of such a size. The modern viol consort, which plays at modern pitch or a semitone lower, was an invention of Arnold Dolmetsch. Small treble viols were not found until the 18th century with the *pardessus de viole.*

The second stage was to compare church music with the secular madrigal. Church music is notated a tone lower than secular music, and, to bring it into alignment in performance, a pitch at a tone higher than 466 must have been employed, namely 524Hz. This is a real sticking point in the history of pitch studies, since Praetorius, our major authority, tells us the complete opposite - that church pitch is a tone lower than chamber pitch. Many studies in this field have started from this point and found no correlation between Praetorius' assertion and the evidence of the instruments and music. If one discounts this and argues that in fact Praetorius was describing the notation of church music rather than the actual performance pitch (and ignoring such red herrings as his description of a pitch pipe) one can see that Praetorius was advocating a uniform pitch of 466Hz, which became a standard for much sacred and secular music of the 17th century. The only way to understand the evidence of the 16th century, however, is to accept a high choir pitch of 524Hz.

The next aim was to clarify the idea that there was a common pitch system throughout Europe. An investigation of the instruments and history of the Bassano family shows that their pitch system was accepted everywhere, and it creates an identity between the English system, where many of the instruments were made, and Venice, from whence the Bassanos came. The export of all types of instrument started with a small group of people in Venice in the 1520s, amongst whom must have been Alessandro Trasuntino. The earliest viols also seem to date from this period.

Sometime after 1516 Hieronimo Bassano escaped Jewish persecution in Bassano in Northern Italy and set up business in Venice. He may have converted to Christianity since his youngest son, born in about 1523, was called Baptista. He had six musical sons who were all virtuosi and makers of wind instruments. In 1531, (the date of the manufacture of Alessandro Trasuntino's harpsichord), four of the brothers made their first visit to England as *The King's Sackbuts,* where they played at the court as minstrels. They returned to Venice and five of the brothers are celebrated on the frontispiece of Ganassi's *Fontegara* of 1535, a treatise on the playing the recorder (Illustration 1). They are clearly depicted performing a piece that involves singing with recorder accompaniment from part books. The consort of viols and the lute on the wall and the treble and tenor cornett in the foreground all indicate the compatibility of the process and the integration of these instruments. Note the large size of the viols - the same types are illustrated a hundred years later by Praetorius. He also used wind instruments made for the court in Kassel by descendants of these Bassanos and illustrated some of them in his *Syntagma Musicum.* In 1539 four of the Bassano brothers left Venice for good to set up workshops in London under Henry VIII's patronage.

Ganassi wrote a treatise for the viol in 1542 - and Henry VIII imported Italian instruments and players. Venice, as a centre of printing as well as of instrument manufacture, can be identified as the source of the unifying of pitch standards and musical practice throughout Europe, carried out by players, printers, makers and composers who must have known each other and who understood the commercial possibilities of the compatibility of pitch standards. The monopoly based on the Venetian system continued up till the end of the century. There are no surviving examples of Florentine, Neapolitan or Roman harpsichords before 1600 and the Milan tradition is confined to Annibale Rossi and the Antegnatis. The earliest Hans Ruckers instrument is dated 1581, indicating also that the Flemish tradition started much later than the Venetian. Earlier Flemish instruments are rare. The same scenario is found in the Renaissance brass world - the few families that made trombones and trumpets in Nuremberg monopolised the manufacture of these instruments for an even longer time. The Venetian standard was thus one that had to be adopted by anyone who wished to purchase a musical instrument fifty years after the manufacture of the Trasuntino harpsichord.

One can see the wide distribution of this pitch standard by investigating the clients of the Bassano family who, between the 1530s and the 1620s, bought instruments with the **!!** marks which probably represent the letter B. It is disputed that the **!!** marks were exclusive to the Bassanos, but it seems likely that it indicated the production of their workshops. Since the Bassanos moved to England permanently in 1539, while still keeping the business going in Venice, we can identify Venetian with English pitch practice, and it also seems that many instruments that were made in England were passed off as Venetian, or at least sold in

Venice. These instruments were found in Rome, Bologna, Brussels, Verona, Catajo, Oxford, Schloss Ambras, Kassel, Munich, Norwich, Modena, and Salamanca. Documentary evidence indicates that English (probably Bassano) instruments were exported to France, as well as the cathedrals at Rodrigo, Burgos and Huesca. Since these instruments, especially the recorders, are in one piece and admit of no retuning, it is thus certain that the pitch practice that goes back to the 1520s in Venice was carried through to the rest of Europe.

A contract of 1559 establishes that Jacomo and Santo Bassano's cornetti were in one of two pitches - *mezo ponto* and *tuto ponto*. This means that they were at 'half pitch' or 'complete pitch'. The surviving Bassano cornetts seem to be based on a semitone above modern pitch (466Hz) or a whole tone higher (494Hz). In my original article, I detected that the most common pitch used would be accessible to a cornett at 466Hz (marked ** in Table 1) and that certain other types of music (mainly church music from Spain, Antwerp and Munich) could be played on the 494Hz type (marked * in Table 1). This latter pitch, being halfway between the two highest pitches used could justifiably be called *mezzo punto* or half pitch. In general, therefore, there were four pitches at *tutto punto*, with, in the cracks as it were, two pitches at *mezzo punto*. Only two types of cornett are needed for all the six pitch standards in table 1.

A breakthrough in the understanding of pitch systems in harpsichords came with Grant O'Brien's book on the Ruckers tradition. Since these instruments were built to almost exactly the same specifications for seventy years, he was able to detect a fourfold pitch system based on a reference pitch with a c2 scale of 355mm. The instruments were all either at this pitch (R), or a major second higher (R+ 2), a fourth higher (R+ 4) or a fifth higher (R+ 5). Table 1 gives the scaling of these variants and the pitches that I believe they represent. The Ruckers transposing double harpsichords had an upper keyboard at R and a lower keyboard playing the same strings, but set a fourth lower, at R- 4 or, by transposing up an octave, R+5, a fifth higher. I am sure that the complex variations of scaling found in Italian harpsichords merely represent the same system. The differing practices of individual makers can cause confusion, but I have assembled a table of Renaissance pitches and scales in table 1. This is to show that the varying pitches employed in the Ruckers tradition were also found in Italian instruments.

It would be helpful to assemble the grid of pitches thus achieved, while giving a rough indication of the scales employed in harpsichords and virginals. They are only a guide, since there are considerable variations in the practice of individual makers. The proposed pitches are identical to the layout that I derived from my original examination of woodwind instruments and written music.

TABLE 1

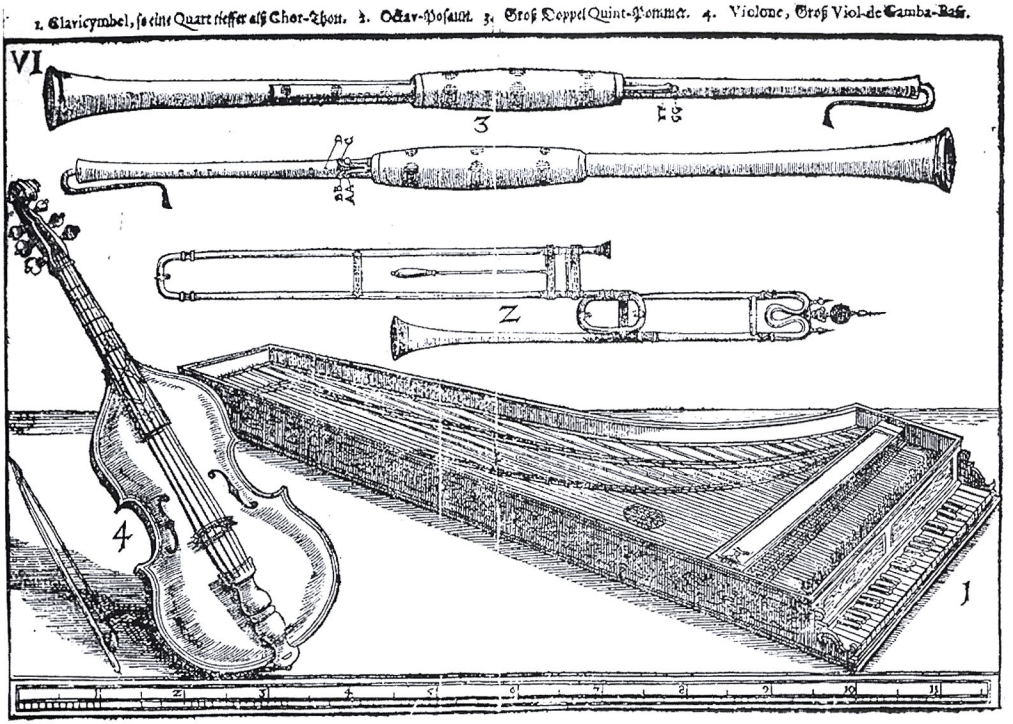
Pitch in Hz	Tutto Punto,** ('corista') Mezzo punto *	tones above and below modern pitch	c2 scale (mm)	f2 scale (mm)	Ruckers reference O'Brien's layout	Ruckers f2 scale (mm)	Pitch name, compass	Clefs to be used
524	**	a'+3	235	180	R+5, i.e. R+a perfect 5th	180	Choir pitch. C/E-c3	C2, C3, C4, F4
494	*	a'+2	255	190	N/A	N/A	C/E-c3	C1, C3 C4, F4
466	**	a'+1	275	215	R+4, i.e. R + a perfect 4th	207	Chamber pitch C/E-c3	C1, C3 C4, F4
392	**	a-2	310	235	R+2, i.e. R+a major 2nd	235	*Alla quarta bassa* C/E-f3	G2, C2, C3, F3
369	*	a'-3	330	255	N/A	N/A	C/E-f3	G2, C2, C3, F3
348	**	a'-4	340+	265	R, Reference pitch	265	*Alla quinta bassa* C/E-f3	G2,C2, C3,C4

This table gives the wide range of pitches that, I believe, were employed in the 16th century, and shows how harpsichords could have scales ranging as widely as for example for a c2 scale - the length of the upper C string - from 235mm to over 340mm. The first column gives the pitch in Hz produced by these scales. The second shows the four (**) that were probably referred to as *tutto punto* at the time, and the two (*) that were at *mezzo punto*. In the third I have shown their positions in semitones above and below modern pitch, as I originally indicated in the *Galpin Society Journal* 1995. The third and fourth columns give the scales either for c2 or f2. They are, of course, very approximate, given the differing makers with their

varying styles of workmanship. A domestic virginals would probably be built to a shorter scale than a large harpsichord. The strength of construction would allow a variation in scale. The sixth and seventh columns show that a similar variation in pitch is found among the Ruckers instruments. They are all accessible by simple transpositions from the longest scale (f2=265mm). This longest scale, both in the Ruckers and Italian traditions, is by far the most common, and O'Brien rightly identified it as a reference pitch for 16th century harpsichords and virginals. In the pitch name and compass column, one can see that the shorter scales generally avoided the extension to a top note of f3. This is because the upward transposition of a fourth was not needed at these higher pitches. Against the three highest pitches, one can see in the last column the normal low clefs, with F4 for the bass part, and C1 or C2 for the Cantus. The lowest three pitches, with their long scales, are for music in high clefs, characterised by a G2 clef for the Cantus, and either an F3 or C4 for the bass. When *alla quarta bassa*, or *ad quartam inferiorem* is found in bass parts, it seems usually to imply 392Hz, or a fourth below the highest choir pitch of 524Hz. Praetorius suggests that this pitch is found when there is a flat in the key signature.

I have included the f2 scale since, according to Denzil Wraight, most 16th century instruments were measured on their *f* rather than *c*. This is confirmed by the comment of Banchieri, who, in *Conclusione nel suono dell'organo*, when talking of tuning an organ or '*strumento da penna*' (i.e. a harpsichord or virginals) says that, starting on F, " you set it at the natural pitch of the instrument, whether at choir pitch ('*voce corista*'), or a tone lower or a 4th higher or lower". The Ruckers harpsichords were set at '*corista*', just as Banchieri recommends, and we can see that the *tutto punto* system is all at this same pitch. We also see in Banchieri that organs worked to these four pitches as well. The organ at Worcester Cathedral was at 348Hz in 1613 with its longest pipe at 10 feet, a major third below a' = 440Hz. This standard organ pitch was found all over Europe, not just in England. Schlick in Germany in 1511 talks of a 10 foot standard (R) as well as an 80", which is a fifth higher (R+5). The Antegnatis of Brescia also used it. This size was also found in France at the beginning of the 15th century.

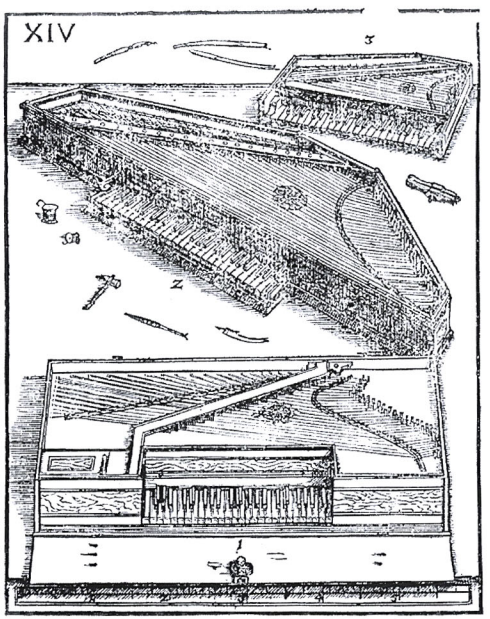
The use of long and short-scaled instruments is revealed in the plates of keyboard instruments in Praetorius' *Syntagma Musicum*. In illustration 2 (Praetorius' plate VI) we see a harpsichord very much like the Trasuntino. It is described as *so eine Quart tieffer als Chor-Thon,* (a fourth below choir pitch) and if, as is generally agreed, Praetorius is referring to his standard woodwind pitch of 466Hz, this instrument is at the reference pitch of 348Hz. The compass is the same, C/E-f3 with an 8' and a 4' register typical of



illus. 2

Venetian instruments of the 16th century. Its longest bass string is about 7 Brunswick feet long, (roughly 1.9 metres). The Trasuntino has a longest bass string of 1.880m. It is fairly clear that we are not dealing with one of the four surviving Italian harpsichords (two by Baffo, one by Franciscus Patavinus and a newly discovered Celestini) set to a longer scale than this. It is a typical long scaled Italian harpsichord with a c2 scale of about 355mm set at the same pitch as the Ruckers instruments.

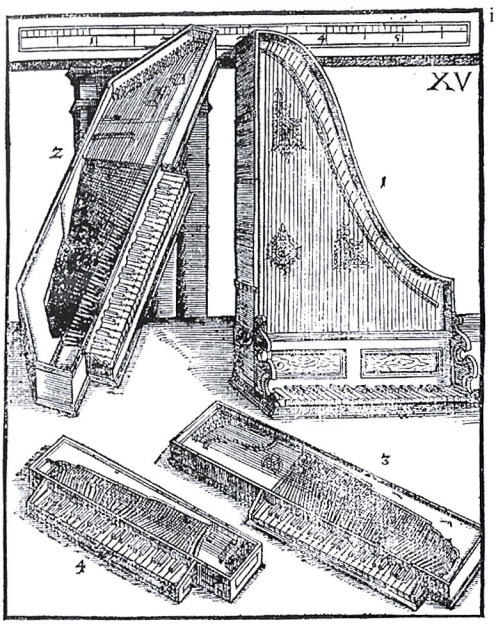
illus. 3



1. 2. Spinetten; Virginal (in gemein Instrument genant) so recht Chor-Thon.
3. Octav Instrumentlin.

The low pitch of Italian instruments is further confirmed when we inspect Praetorius' other illustrations of keyboard instruments. His picture of spinets or virginals (Illustration 3, Praetorius' plate XIV) shows a square Flemish style virginals and an Italian polygonal virginals above it. The Flemish instrument has a compass of only C/E-d3, and it is much shorter than the Italian instrument. It also has a split E*b*/D# key. This latter feature was characteristic of later short scaled instruments, to assist transposition, especially into sharp keys. Praetorius' label says *1.2.Spinetten: Virginal (in gemein Instrument genant) so recht Chor-Thon.* i.e. "1 and 2 are spinetts, the virginal (commonly called an Instrument) is at proper choir pitch". It does not necessarily imply that the Italian instrument is at the same pitch. The Flemish virginals has a longest bass string of 4'6" (Brunswick) which is 1.270m. The Italian's longest string is 5'8" or 1.710m. which might easily match a pitch a fourth lower. Thus the Flemish instrument is at 466Hz, while the Italian is at reference pitch a fourth lower, just like the harpsichord.

illus. 4



1. Clavicytherium. 2. Clavichordium, Italianischer Mensur.
2. Gemein Clavichord. 4. Octav Clavichordium.

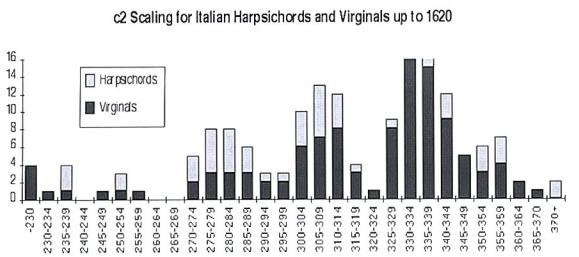
Illustration 4 shows Praetorius' plate XV which reveals the same phenomenon. The polygonal clavichord (no.2) is at *Italienische mensur*, or the Italian scaling, while no. 3 is a *Gemein Clavichord* (a common clavichord). They are not at all the same size. The smaller instrument has a short compass of C/E-c3, indicating its higher pitch. Its bass string is 3'6" long, whereas the Italian instrument is 4'6", again indicating a difference in pitch of a fourth. Thus Praetorius' *recht Chor-Thon* is a fourth higher than typical Italian instruments, implying that Italian instruments were set at 348Hz.

It is appropriate to make some observations about the typical Ruckers format and compare it to the Italian. Firstly, it is clear that the Ruckers system confines itself to the *tutto punto* system (see Table 1). This is more common for secular music, and two thirds of surviving woodwinds are in keys that are suitable for *tutto punto.* The upper keyboard of the Ruckers transposing doubles is at R, whereas the lower keyboard is at choir pitch, or R+5. This highest pitch with its short scale is known in Italian instruments, but by far the most common are instruments of the longer scales (c2 being longer than 300mm), and having the extended compass C/E-f3, which allows for an upwards transposition of a fourth. The most common Italian scales are at R and R+2 (R + a major second). They are all single manual

instruments. Why is there this difference? The obvious answer is that the Italian instruments, set at two scales a tone apart at 340+mm and 310mm had no need of the Ruckers R+5 pitch. The transposition conventions were thus different. The player on a Ruckers could access 392 by transposing down a fourth from his lower (R+5) keyboard, while he could transpose down a fifth from the upper (R) to access the woodwind pitch of 466. Of course not all Ruckers instruments were doubles, the vast majority of the single manual harpsichords and virginals were at R or 348Hz, since from the lowest pitch one could transpose into any of the *tutto punto* keys by playing in C, D, F or G major. The Italian player, on the other hand, would have two instruments, normally at 392 and 348. He could then simply transpose down the conventional fifth or up a fourth in order to access 524 and 466. The treatises of the period focus on transpositions of a fourth or a fifth, and the two main sizes of Italian instrument would allow the four *tutto punto* pitches to be accessed by these transpositions alone.

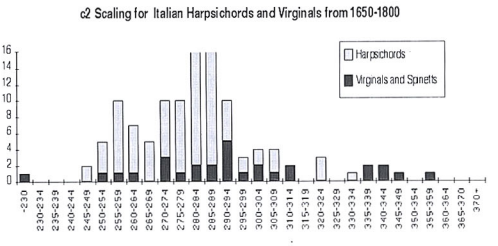
The following two charts will show how the scaling of Italian harpsichords and spinets changed between the 16th and 18th centuries.

GRAPH 1



I have taken the information here from Denzil Wraight's thesis on Italian harpsichord scaling (see bibliography), and only used instruments that are securely dated. In order to increase the sample I have doubled the scale of octave instruments. The left-hand scale gives the number of instruments surviving and the bottom scale gives the length of their c2 strings in millimetres. From this one can see the preponderance of the long scales in 16th–century instruments. There are relatively few instruments having scales shorter than 300mm, and there are two 'bulges' in the long scales at c310mm and 340mm. These I take to be the two lowest *tutto punto* pitches of 348Hz and 392Hz (R and R+2). The two isolated high pitches at 235mm and 255mm seem to be the highest pitches of 524Hz and 494Hz. The area between 270mm and 299mm is harder to assess. We may assume that some of them would be at 466Hz, but also perhaps they represent the lower pitches 392 and 348Hz, but strung in brass. The longest scales above 340-360mm probably reflect a variation in build quality rather than a lower pitch. The Trasuntino lies in this group.

GRAPH 2



The radical abandonment of the long scale in Italian harpsichords in the 18th century can be seen by comparing graph 1 with graph 2. The earlier period consists mainly of longer scales. The number of Italian instruments built with scales longer than 310mm in the later period is so low that one cannot accept that there was not a radical rise in pitch standards. Those who suggest that pitch remained roughly the same have to argue that iron, which can tolerate higher tensions, was used in the 16th century, and that brass was used in the 18th. Thus, despite having short scales, they say that the harpsichords of the later period were at roughly the same pitch as those of the 16th. The very spread of scales in graph 1 suggests a multiple pitch system, whereas the concentration of scales between 255 - 290mm in graph 2 shows clearly that there was not such a range. From what we know of pitches in Italy in the 18th century, this range represents pitches probably between 466Hz and about 392Hz. The comparison of the two graphs would thus lead us to conclude that pitches lower than these were used in the 16th.

But, it will be objected, despite the correlation of the model I have suggested for 16th century music and surviving woodwind instruments, the proportions are not right in table 1. The short-scaled Italian instruments, unlike the Ruckers, are not in an exact relation 3:4 that would indicate the upward transposition of a fourth from the longer scales. A ratio of 280mm (a typical short scale): 340mm (a typical long scale) is only 4:5. (To shorten a string by a quarter raises its pitch by a fourth , but to shorten by a fifth only raises it by a major third). It is thought that shorter scaled instruments were strung in brass and played at the same pitch as the longer scaled instruments. However, the short-scaled instruments have only 45 strings (C/E-c3) compared to the 50 strings (C/E-f3) of the long scaled instruments. Thus shorter scaled virginals and harpsichords could be maintained at a higher tension and pitch relative to their length. The total pressure on the bridge would remain the same. Another possible

argument against a constant pitch theory is that there may not have been such a difference in the tensile strengths of brass and iron in the 16th century. It is likely that early iron, with all its impurities, had a potential pitch only just more than a tone higher than the same length in brass, and so 16th century iron scales are closer to brass scales than they were later. If that were the case, the major third difference in scale ratios between short and long scaled instruments would be too large for a transition from iron to brass and would have to imply a transposition.

The second main argument against the constant employment of 415Hz as the reference pitch for all long and short scaled instruments during the 16th century is the question as to why scales were radically shortened from the 17th century onwards if the pitch remained roughly the same. Why should it be necessary to restring and rescale an instrument in brass when it was perfectly capable of standing the pitch in iron? The expense of realigning almost every Italian instrument in the 17th century must have been due to a radical rise in the pitch standard. The Trasuntino was changed in the 17th century from a C/E-f3 instrument to a GG/BB-c3, effectively shortening its scale by a fourth. Often the new keyboards are of inferior workmanship. Why would anyone wish to do this? Brass had been available as a stringing material throughout the 16th century; to change from iron to brass would have been like putting the technological clock back. The reason must be that the change of keyboards and strings derived from a radical change in pitch that would otherwise render these fine instruments obsolete.

The *ravalement* of Ruckers harpsichords was utterly different from the Italian instruments. In the Ruckers *ravalement* the c2 scale was shortened only fractionally, by about a semitone, but since the bass scaling was so much shorter on a Ruckers than on the long Italian harpsichords, the brass strings in the bass could be replaced by iron lower down the keyboard and allow a rise in pitch, while keeping the same scale. The instruments were also strengthened under the soundboard to take the extra tension of the higher pitches. The long scale in the bass and the light build of Italian instruments prevented this, so, as a result, the c2 scale of an 18th century Italian instrument is much shorter than one of a Ruckers *en ravalement* at the same pitch.

It has been thought that a harpsichord will only work when its strings are tightened to a point just below when they will break. The pitches that I recommend here are well below that critical point. Joel Katzman reckons that the iron scale on the Trasuntino is three or four semitones below the breaking point of the strings, and yet there are no problems associated with slack stringing. Another element is the strength of the instrument itself. The Italian tradition, with its light barring and framework, is incapable of taking the critical stress on its strings. Anecdotal evidence (usually off the record) from those who have attempted to string these fragile long scaled instruments up to anywhere near 415Hz, suggests that the bridges will become depressed and distorted under such pressure.

The Trasuntino copy by Joel Katzman has a c2 scale of 358mm, and is therefore at the lowest pitch of 348. As such, it is perhaps the first in modern times to be built to the pitch and specifications of the 16th century. I am delighted that it works so well, with a warm sound that is ideally suited to the contrapuntal style of the period. The low tensions associated with this pitch may even allow some curators to re-string original instruments without doing damage to their fragile structures. The effect in concert of the Trasuntino and other instruments matching it is quite remarkable. On its debut appearance in June 1999 with the New London Consort under Philip Pickett, the music took on a glow which I have never before heard in combined instrumental and vocal performances of the Renaissance.

SELECT BIBLIOGRAPHY

The following books and articles are the ones I have found most useful in this area:

Praetorius *Syntagma Musicum I & II*,Tr. David Z. Crookes (OUP 1986). This work, written in 1619, illustrates and discusses the instruments and performance practice just when the integrated system was beginning to change. I do not, however, unlike most commentators, accept his comments on pitch without reservation.

Antony Baines *Woodwind Instruments and their History* (London 1957) Ch X. This gives the best all round account of the woodwind evidence.

Iain Fenlon (ed.) *The Renaissance, From the 1470s to the end of the 16th century* (Macmillan 1989) This offers a broad picture of music making and society in the 16th century. From a pitch point of view, one should note the way in which contemporary accounts describe mixed consorts of strings, keyboards, woodwind and voices.

Andrew Parrott 'Transposition in Monteverdi's Vespers of 1610', *Early Music* Nov 1984. This seminal article explains the main processes of keyboard transposition in the period. I disagree ultimately with areas of his account of how high clef music is to be played, but it is the best and clearest account of the issues.

Maggie Lyndon-Jones 'A Checklist of Woodwind Instruments marked !!', Galpin Society *Journal* 1999 pp.243-280. This is an excellent account of the Bassano family and their instruments, giving their dates and provenances.

Alexander J. Ellis and Arthur Mendel *Studies in the History of Musical Pitch.* Amsterdam, Frits Knuf Buren 1968, pp. 92-103, 158-160. This is the bible of all pitch students. The pioneering work of Mendel investigates the main problems, but in the end is vague as to its conclusions. He does, however, confirm the wide range of renaissance pitch standards.

Grant O'Brien *Ruckers: a harpsichord and virginal building tradition* Cambridge CUP 1990, esp. ch. 3 & 4, pp.292-3. This marvellous study of the Ruckers tradition gives a full account of every aspect of the instruments, their construction and decoration. The consistency of scaling in the Ruckers tradition points clearly to an international common standard between 1580 - 1630.

Denzil Wraight: *'The Stringing of Italian Keyboard Instruments c.1500-1650.'* Ann Arbor UMI 1999. This is a comprehensive catalogue of all known Italian instruments and contains an invaluable account of the subject.

Nicholas Mitchell: Choral and Instrumental Pitch 1570 – 1620, *The Galpin Society Journal* 1995 pp.13-32. This is the original article I wrote on this subject. It contains many arguments not covered here, especially the consideration of brass and woodwind instruments and the link with vocal music. In the same journal 1997 Ephraim Segerman produces an analysis hostile to mine pp.81-106 esp. p.92. Again in 1998 pp.247-267, Herbert Myers criticises Segerman's and my analyses. I have in preparation a further piece to continue the ongoing debate!