COMMUNICATIONS

1873  Lute peg shank taper
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1875  Every musician an instrument maker, or Bach’s *viola pomposa*
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1882  A keyboard instrument in a painting
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The next issue, Quarterly 114, will appear in November 2009. Please send in Comms and announcements to the address below, to arrive by November 1st.
A recent email appeal for papers has prompted a goodly amount of interesting material for the present Q, and as this is the fifth issue since the revival, it is reasonable to suppose that the revival will continue. A mad summer has further delayed the establishment of the website, and accounts for the August issue being printed in September, but we hope to be back on track with a November issue that actually appears in November.

We have produced five issues of the Quarterly, including this one, since the revival began last year, so we have discharged our debt to those who paid a full year’s subscription in before the six-year hiatus in publication. Our accumulated funds are gradually running down, so with this issue we begin to ask for subscriptions, for the moment set at the princely sum of £18 per year. This may be adjusted up, or even down, depending how things turn out. Payment by cheque in Euros or US dollars is also acceptable. We are being forced to set up a new bank account, so utterly chaotic and incompetent is the bank we currently use, and when this has been done, in a matter of weeks, we will be able to supply bank details to those who wish to subscribe by bank transfer. Also, it should be possible to set up a website facility for those who wish to pay by Paypal account or credit card.

From the experience of running another music organisation, I think it is realistic to send members two quarterly issues on a ‘benefit of the doubt’ basis, while waiting (six months) for them to renew; so you will get this issue and the November Q come what may. But if you don’t renew you by February 2010 you will start to miss Qs, and eventually drop off the database. Please find a subscription form herewith.

It only remains to remind you again that as the evenings draw in (in the Northern hemisphere at any rate) you have the perfect opportunity to mull over any organology questions you have had in your mind for a while that might be turned into a Comm. Only YOU can make FoMRHI continue to prosper.

Members’ announcements are always welcome – if using a computer, please send these as plain text emails, rather than attachments.

Keep those Comms coming!

Where are they now? Over six years our address database has got a bit out of date. Does anyone know the whereabouts of Bernard Edwards? He paid his subscriptions along with everyone else, and is entitled to receive FoMRHIQ; recent correspondence has been returned by the Post Office. Many thanks to all of you who have given information so far, including news of those who have gone to mix their music with that of the angels.

Email addresses, please! If you haven’t received any emails from us this year, that means we don’t have your email address. It makes communication so much easier if we have it. We promise not to send out any spam, or pass it on to anyone else. Please send a brief message to Lutesoc@aol.com, and we can add you to our list.
STANDING CALL FOR PAPERS

The Fellowship of Makers and Researchers of Historical Instruments welcomes papers on all aspects of the history and making of historical musical instruments. Communications or ‘Comms’ as they are called, appeared unedited (please don’t be libellous or insulting to other contributors!), so please send them EXACTLY as you wish them to appear – in 12 point type, on A4 paper with a 25mm or 1 inch border all round, or to put it another way, if you are using non-European paper sizes, then the text area must be 160 x 246 mm (or at least no wider or longer than this). Our printers usually make a reasonably good job of scanning photos.

You can send contributions EITHER on paper, OR as a Word-compatible or PDF attachment. If you really do not have access to a word processor of any kind, we may be able to retype typed or handwritten submissions.

NOTE OUR NEW ADDRESS:

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United Kingdom

and the email address for Comms sent as attachments (and other email correspondence) is
Lutesoc@aol.com

Non-members will be given a year’s free subscription if they send in a Communication to the Quarterly.

If you ever sent in a paper (in the last 6 years) for the Quarterly, and it never appeared, please re-send it, to the new address.

There are plans to scan back issues of the Quarterly and make them downloadable from a website, to be set up; in the meantime you can obtain back issues for the princely sum of £3 per issue, including postage; send a cheque payable to FoMRHI, at the above address, or write with your credit card details.

If your interests have changed, and you don’t now want to be a member of FoMRHI, please let us know, to save postage costs.
Lute Peg Shank Taper?

Some lute and oud makers successfully use tuning pegs with a peg shank taper of 1:30 – standard 1:30 taper violin reamers being readily available commercially. German tool maker ‘Herdim’ can also supply a violin peg hole reamer with the old standard 1:20 taper as well as a ‘Lute peg hole reamer’ with a 1:25 taper.

Modern Syrian oud makers Bashar Halabi of Damascus and Ibrahim Sukar of Aleppo use pegs with a shank taper of 1:16

Curious to find out what peg shank tapers were employed on early lutes, a measurement of pegs detailed in selected museum drawings and photographs was undertaken. Although this method may be subject to cumulative dimensional errors compared to making direct measurement of a peg, it was felt that the results should give a reasonably accurate representation of the range of tuning peg shank tapers to be found in the instruments under examination.

This limited investigation found that peg taper was 1:14 for the smallest instruments (mandolinos) and in the range 1:16 to 1: 24 for lutes. Peg taper appears to be independent of peg material and, in the case of the lutes, instrument size.

The peg shank taper is defined as the measured shank length divided by the difference between the maximum and minimum peg diameters at each end of the measured shank length – that is L /Dmax – Dmin.

The data was obtained from full-scale instrument drawings in which a peg or pegs are drawn to scale and fully or partially dimensioned. Where available, museum photographs of peg boxes also provided supporting data.

In the absence of detailed drawings, museum photographs of peg boxes alone provided the required data.

Maximum shank diameter noted below is the largest diameter of a peg shank measured just below the peg head.
Mandolinos (in the Charles van Raalte Collection, Dean Castle, Kilmarnock, Scotland).

Cat# 37 – Michel Angelo Bergonzi, Cremona, 1755.
Peg taper 1:14
Peg material – Mother of Pearl, maximum shank diameter – 7 mm.
Measured from a museum photograph.

Cat# 41(?) – Barnia Milanese, Venice, 1767.
Peg Taper 1:14
Peg material – hardwood, maximum shank diameter – 6mm.
Measured from a museum photograph.

Cat# 42 – Branded ‘D.E.’, late 17th C.?
Peg Taper 1:14
Peg material – ivory, maximum shank diameter – 7 mm.
Measured from a museum photograph.

Lutes

Chitarrone – Magno Tieffenbrucker, Venice 1608.
Peg Taper 1:16
Peg material – hardwood, maximum shank diameter – 8 mm.
From a dimensioned drawing by Ian Harwood, 1974. Cat RCM 26, Royal College of Music, London.

Lute – Wendelio Venere (a.k.a. Tieffenbrucker), Padua 1592.
Peg taper 1:17
Peg material – hardwood.
Measured from a museum photograph. Academia Filarmonica, Bologna.

Lute – Michielle Harton, Padua, 1602.
Peg taper 1:18
Peg material – hardwood, maximum shank diameter – 8 mm.
From a dimensioned drawing by Stephen Murphy, 1974. Cat# MI 44 Germanisches National Museum.

Lute – Maker Unknown, Late 17th C.?
Peg Taper 1:19
Peg Material – ivory, maximum shank diameter – 8 mm.
Measured from a museum photograph (see Fig 1). Cat# 33 Charles van Raalte Collection, Dean Castle, Kilmarnock, Scotland.
Tiorbino – Maker Unknown, Italy, mid 17th C.
Peg taper 1:20
Peg material – hardwood.

Liuto Attiorbato – Christofolo Choc, Venice, 1630.
Peg taper 1:22
Peg material – ivory, maximum shank diameter – 7 mm.
From a drawing by Stephen Barber, 1978 and a museum photograph. Cat# 7756.1862, Victoria & Albert Museum, London

Lute – Georg Gerle, Innsbruck, 1580.
Peg taper 1: 24
Peg material – hardwood, maximum shank diameter – 6 mm.
From a dimensioned drawing by Stephen Murphy, 1975 and a museum photograph. Cat# A35, Wien Kunsthistorisches Museum.
MORE ON MAKING RECORDER BLOCKS, comments on FoMRHI Comm. 1867

The method for making recorder blocks, as offered in bulletin 112, is one which I support as I have used this method for many years but, because I prefer to use hand tools, avoid the router.

When making a block, there are two differences I employ and would offer them here:-

When cutting the channel in the cedar block (by hand), it is stopped about one quarter of the length of the block from the top end. This allows for a neat and unobtrusive positioning of the second piece of timber.

If the wind way is tapered, this second piece can be cut and shaped first to fit the wind way exactly before fitting it to the main block.

Fit the second piece onto the cedar channel and try it in its final place before gluing it. This allows for the top end to be shaped to fit perfectly. Always use a two-part epoxy.

The second difference I offer is this. While it is essential that the main block be made from cedar, the piece of timber which is fitted to the channel need not necessarily be from the same (cedar) material.

The thought of changing to a different material may come as a surprise, but organ builders do just this when making pipes. But they do not have the moisture problems.

In my blocks, I use maple. Because European maple is not available here, I use American maple. This material cuts and shapes well, does not produce furry fibres provides an extremely fine, sharp and stable chamfered edge at the wind way exit, and absorbs moisture most satisfactorily. It’s worth trying. This together with my modification – see Bull 110 – makes for an easy-to-play, beautiful-sounding instrument.
Every Musician An Instrument-Maker

Or

Bach’s Viola Pomposa

‘All makers must be players, and all players, makers.’

Carl Dolmetsch

The twenty-first century has seen the chasm between performers of music and instrument-makers widen greatly - so greatly in fact that in the west it is rare to find a professional musician performing on an instrument of his making.

Evidently, this has mostly to do with the fact that many of the modern instruments of today require not only specialist knowledge to make and repair but also large-scale machinery in many cases, which restricts or impedes the performer from attending to his instrument. In the case of pianists, very few even tune their own instrument, whereas an earlier keyboard instrument (for example the clavichord or harpsichord) is easily adjusted, and its mechanisms are much more accessible to the performer.

The practical approach encouraged by earlier instruments is merely an echo of an epoch when, as Albert Schweitzer states in his book on J.S. Bach, ‘every artist was still to some extent an instrument maker and every instrument maker to some extent an artist.’

What greater artist, one may ask, than J.S. Bach, in the epoch that Schweitzer speaks of? And indeed, not only did Bach keep his instruments in excellent repair (according to Johann Nicolaus Forkel (1749-1814), the first Bach biographer: ‘No one could ever quill his Flugel to his satisfaction; he always did it himself. He also tuned both his Flugel and his clavichord, and was so expert at this work that it never took him more than a quarter of an hour.’ but he also had the invention of at least three instruments attributed to him: the lute-clavier, the pedal glockenspiel, and the viola pomposa.

Of these three, the viola pomposa is most certainly the instrument for which the reasons of its invention in terms of its practical value outweigh those of the others.

As the photograph in the Appendix illustrates, in essence, the viola pomposa was a little larger than the viola, and held in the same fashion as a violin, having five strings tuned C', G, d, a, e (the same tuning as a Violoncello but with an extra string tuned a fifth above its highest note).

Our only apparent contemporary information on the instrument comes from Ernst Ludwig Gerber (1715-1840), who served under three ruling princes of Schwarzburg-Sondershausen as jurist and court organist, and whose father was a pupil of Bach in Leipzig from 1714 to 1717. In the following passage, Gerber explains the reasons Bach had for inventing the instrument: ‘The stiff way in which the violoncello was played in Bach’s time compelled him to invent, for the animated basses in his works, the so-called viola pomposa, which was a little larger and deeper than a viola, and was tuned like a violoncello with a fifth string, e, and was laid on the arm; on this convenient instrument very high and rapid passages were easier.’

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* From the essay ‘Music and Craftsmanship’ (Fifteen Craftsmen on their Crafts, P. 31)
† From ‘J.S. Bach’, Vol. 1, P. 204
‡ From the biography of Bach, P. 17
# The photograph is of Ulrich Koch performing on the Viola Pomposa. (APPENDIX)
\* From Gerber’s Dictionary of Musicians, co. 1744
The last of the six suites for solo violoncello by J.S. Bach bears the title 'A Cinq accords' in a transcript made by Anna Magdalena Bach. This instruction suggests the possibility of at least three bowed string instruments: a 'cello with five strings, a violoncello piccolo, or a viola pomposa.

The suite was written during the period Bach spent in Cothen, between 1716 and 1723, but Gerber first reported Bach's invention in about 1724, and mentions Leipzig. Schweitzer suggests that as the viola pomposa was never specified on Bach's scores, but the violoncello piccolo was, the two instruments were identical, in which case Bach simply used the name of the latter instrument on his scores. This does not necessarily imply that the composition was for a violoncello with five strings, however, as Bach may have started his experiments with a five stringed viola in Cothen, and culminated them with the invention of the viola pomposa in Leipzig. This explanation would account for the slight discrepancy in dates.

In any case, the relevance of the viola pomposa in the context of this paper is primarily that it demonstrates the interest shown by one of the greatest composers and organists in the art of instrument making (although it should be noted that the actual construction of the instrument was effected by the Leipzig court instrument maker, Hoffmann), and that shortcomings in the performance of musical instruments were met with practical solutions in musical instrument making.

The former point is amply illustrated by the existence of one of Bach's other aforementioned inventions, the lute-clavier. It is unclear what Bach intended to do with the lute-clavier, as, according to Jacob Adlung, it was only useful for playing lute music on a keyboard instrument. From this point, we can see that Bach's interest lay not in merely solving technical performance problems, but was a manifestation of his love for music, and, for him, part of being the great musician that he was.

Schweitzer tells us that Jacob Adlung, a composer and theorist of Bach's time 'built claviers in his leisure hours' which gains some further insight for us into a world where there was a close and widespread affinity between instrument making and performance.

The conclusion of this somewhat short and incomplete study of Bach's interest in instrument making is twofold. Firstly, that musical fulfilment and understanding apparently encompassed the art of instrument making, at least for J.S. Bach, if not for many of his predecessors and contemporaries — although not his ancestors, and today's musicians. The second point of the conclusion conjoins with the purpose of this paper — to illustrate the unnatural divorce between two strands of what should be closely bound. We must therefore leave behind the complexity and unapproachable nature of modern instruments when playing early music, in order that a balance of 'poetry and practicality may be re-established. It is my contention that when the playing and making of instruments are united this surely must come about.

From 'J.S. Bach' Vol II P. 154, footnote 2.

\( \text{\textit{\textsuperscript{XV}}} \) From ibid Vol I P. 104

\( \text{\textit{\textsuperscript{XVI}}} \) From ibid P. 104

\( \text{\textit{\textsuperscript{XVII}}} \) From 'Far from the madding crowd.' By Thomas Hardy.
English Guittar Makers in 18th Century Britain: A Directory
Compiled by James Tyler

The following list comprises known makers of an instrument that most modern reference works refer to as “cittern” or “archcittern,” terms that seem not to have been used when the instrument was new. During its own time, one source called it “cetra” and one other, “citra,” but it was generally known as “guitar” or “guittar,” with both spellings equally common.

Contemporary advertisements used the qualifiers, “English,” “Anglois,” “Englische,” and the like to distinguish it from the German and Spanish instruments. The French publisher, Le Duc, for example, in his Journal de Harpe, No. 21, ca. 1780, includes “Guitares Angloises, Allemandes & Espagnoles” in his list of the instruments for which he has music. For the same reason, I have opted to call it the “English guittar,” even though the same instrument was also played in Scotland, Ireland, North America, and British-influenced Portugal.

As most readers know, the instrument has ten iron and brass wire strings usually arranged in six courses, the top four double and the lower two single.

Its most common tuning by far was c-e-g-c'-e'-g' (from lowest note to highest), although there were some larger instruments that required an ‘a’ tuning, a minor third lower, and other tunings are also found.

The strings either were plucked with the bare right-hand fingers or, toward the end of the eighteenth century, struck by piano-like hammers operated by a small keyboard mechanism. (For further details see Claus and Preston below).

For tuning the strings, some guittars had a traditional peg box with ten (or sometimes more) lute-like pegs, however, John Preston (see below) invented a very efficient "watch-key" mechanism ca. 1778, which is seen on the majority of guittars. The "worm-gear" mechanism, which somewhat resembles modern machine pegs, was also used by a few other makers. Further construction details can be found in most standard reference works.

The origin of the English guittar is probably the earlier German instrument of similar characteristics as illustrated in J. F. B. C. Majer’s Neueröffneter theoretisch- und praktischer Music-Saal (Nuremberg, 1741). It is a large metal-strung instrument, which Majer calls, “guitarre,” with six double courses and a low ‘d’ choral tuning. This German type has lasted into the twentieth century as a folk instrument with few fundamental changes.

It will be noted in the inventory below, that there are several German makers on the list. In the Georgian period (Georges I to III), the kings of England were Hanoverian Germans. As shown by Handel’s emigration to London during this time, Germans found England a rather fruitful place to be, especially for music.

The English instrument, as well as music for it, first appeared shortly after 1750, and it remained popular through the early nineteenth century.

The French version, which was based on the German, was called the “Guitarre Allemande,” and appeared a little later; it became obsolete a few years after the French Revolution.
The following inventory of instruments by known makers is far from comprehensive, as there are undoubtedly many dozens more that have gone unrecorded in private collections. I would be very pleased if those with knowledge of other such instruments would add them to this list.

INVENTORY

Barry, [A.]  London, late 18th-early 19th C
Probably a violin maker but known mostly for the harp guitars or harp lutes made for the inventor Edward Light and this one undated guittar.

Extant guittars: Edinburgh University Collection, No. 321.322 (306), "arch cittern", undated
References: Macaulay 1982, p. 8; Armstrong 1908, p. 25 and illustration facing p. 30

Beck, Frederick  (ca 1738-ca 1798)  London, mid to late 18th C
A German piano-forte maker working in London from ca. 1756. This instrument was probably made by Preston (see below) and only retailed by Beck.

Extant guittars: Location unknown: Sotheby’s, London auction Nov 18, 1993, lot 34, watch-key tuners, dated 1764

Buckinger [Joseph?] [Buchenger or Buckinger & Sharp]  London, ca 1805-06
Advertised as 'Musical instrument makers to his Royal Highness the Duke of Clarence, music sellers and publishers, 443 Strand'. The firm published a considerable amount of sheet music, which included arrangements for guittar. Buckinger was the successor to Michael Rauche in 1785 (see below)

Extant guittars: Edinburgh University Collection. No. 321.322 (307), "arch cittern", undated

Claus, Christian  London, late 18th C
The maker invented and patented his internal keyboard mechanism for guittars on Oct. 2, 1783. Both of these instruments have them, and therefore they were made sometime after this date.

Extant guittars: London, Victoria and Albert Museum, No. 240-1881, with keyboard mechanism, undated
Brussels, Museum of Musical Instruments No. M 261, with keyboard mechanism, undated

Dickinson, Edward  (fl. 1759-1760)  London, mid 18th C
Violin maker. One violin label reads: 'At the Harp and Crown in the Strand/Near Exeter Change/London'.

Extant guittars: London, Victoria and Albert Museum, No. 222-1882, peg box with ten pegs, dated 1759
References: Baines 1968, No. 11/2, p. 49, Fig. 71; Harvey 1995, p. 332
Elschleger, J. C.  
England, third quarter 18th C

Nothing is known of this maker apart from this instrument

Extant guittars:  
- London, Royal College of Music, No. 21, worm gear tuners, undated

References:  
- Baines 1966, No. 255, with illustration

Gibson, William  
Dublin, mid to late 18th C

The entry in Humphries & Smith reads: ‘Musical instrument maker, music teacher and publisher, Dublin; College Green, 1766-74; 6 Grafton Street, 1774-1790. Gibson was in partnership with the piano-forte maker Robert Woffington from 1775 to 1778.’

His instruments tend to be of a larger size suitable for an ‘a’ tuning, and they usually have a characteristic pear shape with shoulders.

Extant guittars:  
- London, Victoria and Albert Museum, No. W.7-1919, large size, worm gear tuners, dated 1765
- Vermilion, South Dakota, National Music Museum, No. NMM 2627, dated 1782
- Location unknown: Great Britain, Private collection, large size, worm gear tuners, dated 1788

References:  
- Baines 1966, No. 257 with illustration [London, V&A]; Baines 1968, No. 11/3, p. 49, Fig. 70

Harley  
London, early 19th C

Nothing is known about this maker beyond this instrument

Extant guittars:  

References:  
- Baines 1968, No. 11/15, p. 53, Fig. 76

Hintz [Hinds], Frederick  
(fl. 1740-1786)  
London, mid to late 18th C

Violin, viol and guitar maker. Excellent workmanship. The Mortimer's Directory of 1763 lists him as 'Guitar-maker to her Majesty and the Royal Family; makes Guittars, Mandolins, Viols de l'Amour, Viols de Gamba, Dulcimers, Solitaires, Lutes, Harps, Cymbals, the Trumpet marine, and the Aeolian Harp'. His instruments are usually finely made. He also published *A Choice Collection of Psalm and Hymn Tunes set for the Cetra or Guittar ...* (London: R. Bremner, ca. 1762) and *A Choice Collection of Psalm and Hymn Tunes set for the Cetra or Guitar ...* (London: 'Sold at his Music Shop', ca. 1765). Toward the end of the century his instruments were apparently also retailed by Preston and Son (see below) as some of them have the Preston stamp in addition to Hintz's.

Extant guittars:  
- Edinburgh University Collection, No. 321.322 (1066), peg box with ten pegs, dated 1757
- Vermilion, South Dakota, National Music Museum, No. NMM 1286, dated 1761
- Edinburgh University Collection, No. 321.322 (1114), watch-key tuners, undated
- Oxford, Hill Collection, No. D.1.5, shoulders, watch-key tuners, dated 1786
- Location unknown: Sotheby's, London auction, Nov 18, 1993, lot 32, peg box with ten pegs, undated

References:  
- Baines 1966, No. 254, p. 43 with ill. [London, V&A]; Baines 1968, No. 254, p. 43, Fig. 72

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Hoffmann  
London, mid 18th C
Nothing is known of this maker apart from this instrument

Extant guittars:  Location unknown: Great Britain, Private Collection, lute shape, peg box, dated 1758


Liessem, Remerijus  
London, mid 18th C
Violin maker about whom nothing is known.

Extant guittars:  London, Victoria and Albert Museum, No. 230-1882, festoon shape, watch-key tuners, dated 1756
Boston, Museum of Fine Arts, No. 253, “Syrion” (?), peg boxes, dated 1757
Edinburgh University Collection, No. 321.322 (1070), peg box with nine pegs, dated 1758


Longman & Broderip  
London, late 18th C
Important firm of music publishers and merchandisers founded ca. 1767. Under the name of Longman and Broderip, they traded from 1776 to they went bankrupt in 1798. They retailed the instruments of many important violin makers and makers of harps, guittars, piano-fortes, etc. The guittars with their stamp are anonymous, but some have the characteristics of Preston and some of Hintz; still others have a distintinctive oval shape very different from the instruments of either of these two makers.

Extant guittars:  Brussels, Museum of Musical Instruments No. M 1552, peg box, keyboard mechanism, undated
London, Museum of London [ex Boosey & Hawks?], watch-key tuners, undated
Location unknown: [formerly] Scarsdale, NY, Rosenbaum Collection, No. 251, watch-key tuners, Claus keyboard mechanism, undated


Lucas  
London, late 18th C
Nothing is known of this maker. His labels read: ‘Lucas at Ye Golden Guitar, Silver St., Golden Square, London’.

Extant guittars:  Oxford, Hill Collection, No. D14, shoulders, peg box with ten pegs, undated
Boston, Museum of Fine Arts No. 251, shoulders, watch-key tuners, undated

References:  Boyden 1969, N. 38, p. 43[Oxford], Plate 38; Bessaraboff 1941, No. 251, p. 240, Fig. 43, Plate IX [Boston]

Perry, Thomas (ca. 1757-1818)  
Dublin, third quarter 18th C
One of the best British violin makers of his day, Perry is listed in Dublin directories from 1787 as ‘Maker of Violins, Guitars, Tenors, Salters, Violoncellos’. A six-string treble viol made by him is dated 1767 (Baines 1968, no 2/8).

Extant guittars:  London, Victoria and Albert Museum, No. 223-1882, large size, worm gear tuners, undated

References:  Baines 1968, No. 11/4, p. 49, Fig. 70 [London, V&A]; Harvey 1995, p. 374
Preston, John (b.? – d. Jan. 1798) London, ca. 1774-1798

By 1774, Preston was established in London as a guitar and violin maker, and based on surviving instruments, he appears to have been better known for the former. A 1778 advertisement announced his claim to the invention of the familiar watch-key tuning mechanism that bears his name and which was also used by other makers. He does not seem to have taken the trouble to patent it. He was also well known as a music publisher and merchandiser. In 1789, his son Thomas entered the business and the firm became known as ‘Preston and Son,’ located at ‘97 Strand and Exeter Change’.

There seems to be some confusion as regards Preston’s given name. Information in violin reference works from the 19th century (and still copied to the present day), usually give his first name as James or J. N. or John Preston; however, I have found no evidence for a ‘James Preston,’ and all of the instruments (violins or guitars), are, to my knowledge, labeled or stamped simply, ‘Preston Maker, London’, and do not give a first name. A fair amount of bibliographical information linked to the guitar indicates that John was the maker Preston’s actual given name.

Several Preston instruments used the Smith Patent Box, an external keyboard device with felt hammers, which, unlike the 1783 Claus internal mechanism, could be fitted to any guitar. There does not seem to be a patent record for Smith’s device and nothing is known of Smith himself.

Both devices became quite popular toward the end of the century and the guitar that had them were designated as ‘piano-forte guitars’ in such works as Ghilini di Asuni’s New and Complete Instructions for the Piano-forte Guitar, ... (London: Longman & Broderip, ca. 1788)

Extant guitars:

Boston, Museum of Fine Arts, No. 250, Preston watch-key tuners, undated
Brussels, Museum of Musical Instruments, ex Boomamp Coll., watch-key tuners, undated
Edinburgh, Royal Scottish Museum, No. 1908/251, watch-key tuners, Smith patent box, undated
Edinburgh University Collection, No. 321.322 (1067), watch-key tuners, undated
Edinburgh University Collection, No. 321.322 (1068), watch-key tuners, undated
Hyogo, Japan, private collection of S. Murai, watch-key tuners, undated
London, Horniman Museum, N. 15.10.48/61, watch-key tuners, Smith patent box, undated
New York, private collection of Andy Rutherford, watch-key tuners, Smith patent box, undated
Oxford, Hill Collection, No. D.11, watch-key tuners, undated
Oxford, Hill Collection, No. D.12, pegbox with ten pegs, undated
Pasadena, California, private collection of James Tyler, watch-key tuners, undated
Toronto, Royal Ontario Museum, No. 913.4.59, watch-key tuners, Smith patent box, undated
Vermilion, National Music Museum, No, NMM 1292, watch-key tuners, Smith patent box, undated
Washington, DC, Smithsonian Institution, No. 95.475, peg box with ten pegs, undated
Location unknown: Sotheby’s, London auction, Nov. 25, 1976, watch-key tuners, undated
Location Unknown, former R. Spencer Collection, peg box with ten pegs, undated (see Galpin 1986)
Location Unknown, Private collection, GB, restored by A. Robb, watch-key tuners, undated
Location unknown: former R. S. C. S., New York City, watch-key tuners, undated

References:

Prior, William
London, last quarter 18th C
Nothing is known of this maker apart from this one instrument.

Extant guitars:
- Vermillion, South Dakota, National Music Museum, No. 1515, bell shaped, watch-key tuners, scroll finial, undated
  Location unknown: Sotheby’s, London auction Nov 25, 1976, lot 70, bell shaped, watch-key tuners, scroll finial, dated 1727 (sic!) in catalogue. This must be the instrument now in Vermillion

References:

Rauche, Michael (d. ca. 1784)
London, mid 18th C to ca. 1784
Rauche was a lute and guitarr maker, who, like John Preston, was also a music publisher and musical merchandiser. Some of his instruments are of the very finest quality, made on his premises in Chandos St., ‘at the Sign of the Guittar and Flute’. The extraordinary player, Ann Ford, in the introduction to her Lessons and Instructions for the Guitar. (London: s.n., ca. 1761) says the guitars with the best tone are those made by Rauche.

As a publisher, Rauche produced some of the best of the guitar repertoire with items such as Frederick Schuman’s Thirty Eight Lessons, ... Opera 1st [1763], the anonymous Six Divertimentis or Lessons for the Guittar with a thorough bass for the harpsichord or violoncello. compos’d by a Gentleman ... [ca. 1765] and Rudolph Straube’s Three Sonatas for the Guittar with accomanyments for the harpsichord or violoncello ... [1768]. An advertisement of Jan. 20, 1785 stated that ‘Buchinger No. 443 Strand ... being the only successor to the late Mr. Rauche, whose Guittars ever justly bore the preference, he continues to make them of the same pattern, having purchased his stock and utensils’ (see Buckinger above).

Extant guitars:
- Birmingham, Birmingham Conservatoire, No. 11.2, peg box, dated 1779
- London, Horniman Museum, No. 257, peg box with ten pegs, dated 1763
- London, Horniman Museum, No. 15.10.48/54, lute shape, watch-key tuners, dated 1789+
- Oxford, Hill Collection, No. D.13, bell shaped with indentation, ratchet tuners, dated 1770
- Pasadena, California, private collection of James Tyler, watch-key tuners, dated 1778
- Location unknown: Christie’s, London auction Dec. 16, 1975, lot 23, lute shape, dated 1761
- Location unknown: Sotheby’s, London auction Nov 25, 1976, lot 68, peg box, dated 1766
- Location unknown: Sotheby’s, London auction Nov 25, 1976, lot 69, peg box, dated 1768
- Location unknown: Sotheby’s, London auction Nov 17, 1977, lot 71, peg box, undated
- Location unknown: Sotheby’s, London auction March 14, 1978, lot 331, peg box, dated 1764
- Location unknown: Bonhams, London auction June 23, 2009, lot 22, peg box, dated 1768*
  * probably same instrument as at Sotheby’s Nov. 25, 1976
  + probably made by Buckinger

References:
Rudiman, [Ruddiman] [Joseph] (1733-1810) 
Aberdeen, third quarter 18th C
Rudiman was a highly regarded Scottish violin maker. This is his only known guittar.

Extant guittars: London, Victoria and Albert Museum, No. 375-1882, pegbox with ten pegs, undated
References: Baines 1966, No. 250, p. 43 with ill. [London]; Baines 1968, No. 11/7, p. 51, Fig. 73 [London]

Simpson, [James and John] 
London, late 18th C
On the death of the well-known music publisher, instrument maker, and engraver, John Simpson senior, in about 1749, his son, James took over the business and in 1767, James's son John joined the firm. The Simpsons continued to trade until about 1795. It is not known if the guittars they sold were actually made by them or if they were just the retailers of instruments that were made by others.

Extant guittars: Montreal, Museum of Fine Arts, No. 957.Dv.4, watch-key tuners, undated
References: Young 1980, No. 203, p. 166 [Montreal]

Zumpe, Johannes [John] (1726-1790) 
London, mid to late 18th C
Zumpe was one of the foremost English harpsichord and piano-forte makers of his time. He emigrated to London in about 1750 from his native Germany and in 1761 established his shop 'at the Sign of the Golden Guittar' near Hanover Square. Thus, his only known surviving guittar is one of his earliest instruments made in England, along with a mandora (Glasgow Art Gallery and Museum) dated 1764.

Extant guittars: Frankfurt-am-Main, Historisches Museum, No. Epstein 53, lute shape, peg box, dated 1762
References: Baines 1966, No. 251, p. 43 with ill. [Frankfurt]

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Armstrong 1908: Robert Bruce Armstrong – *English and Irish Instruments, Parts I and II* (Edinburgh: 1908)


Smithsonian 1961: *Plucked String Instruments* (a typewritten checklist by Cynthia Hoover (?) dated 8/7/61)


A wooden ocarina

Introduction (mainly from Wikipedia)
The ocarina is a very old family of instruments, believed to date back some 12,000 years. Ocarina-type instruments have been of particular importance in Chinese and Mesoamerican cultures. For the Chinese, the instrument played an important role in their long history of song and dance. The ocarina has similar features to the Xun, another important Chinese instrument. Different expeditions to Mesoamerica, including the one conducted by Cortés, resulted in the introduction of the ocarina to the courts of Europe. Both the Mayans and Aztecs had produced versions of the ocarina, but it was the Aztecs who brought the song and dance that accompanied the ocarina to Europe. The ocarina went on to become popular in European communities as a toy instrument. Its common use in Western countries dates back to the 19th century in Budrio, a town near Bologna, Italy, where Giuseppe Donati transformed the ocarina from a toy, which only played a few notes, into a more comprehensive instrument (known as the first "classical" ocarinas). The word ocarina is derived from Bolognese dialect meaning "little goose." The earlier form was known in Europe as a gemshorn; which was made from animal horns of the Gemsbok.

Ocarinas are duct flutes, windway instruments, to be blown and fingered as a recorder. But there are some important differences: the ocarina has the unusual quality of not relying on the pipe length to produce a particular tone. Instead the tone is dependent on the ratio of the total surface area of opened holes to the total cubic volume enclosed by the instrument. This means that, unlike a flute or recorder, sound is created by resonance of the entire cavity and the placement of the holes on an
ocarina is largely irrelevant - their size is the most important factor. Instruments that have toneholes close to the voicing/embouchure should be avoided, however, because this weakens tonal production since an ocarina is a Helmholtz resonator. The resonator in the ocarina can create overtones, but because of the common "egg" shape, these overtones are many octaves above the keynote scale. In similar Helmholtz resonator instruments with a narrow cone shape, like the Gemshorn or Tonette, some partial overtones are available. The technique of overblowing to get a range of higher pitched notes is not possible with the ocarina because of its vessel shape, so the range of pitches available is limited to a 12th. Some Ocarina makers increase the range by designing double- or triple-chambered ocarinas tuned 1 octave apart.

Different notes are produced by covering the holes, and by opening and closing more or less of the total hole area. The tone is then produced through the sound hole/embouchure. The tone can also be varied by changing the strength with which one blows through the instrument (pitch bending).

The Menkveld wooden ocarina; total length 250 mm, internal height 24 mm, external height 36 mm. Fundamental: about c. The instrument has two thumb holes and is made of beech wood.

A wooden ocarina
The Donati type ocarina has an oval-shaped enclosed space with four to twelve finger holes and a mouth tube projecting out from the body. It is often ceramic. But ceramic instruments are difficult to make, because it is often uncertain how the clay will be deformed in the oven. Gerrit Menkveld (Amersfoort) designed a wooden ocarina which is much more reliable to make and which has a very good sound. He used hard-
woods as beach and maple, but didn't change the common pattern of fingerholes, found on most Donati ocarinas. One of his observations: the parts of a wooden ocarina must be glued very tightly, leakage has a severe effect to the sound. The position of the fingerholes is not critical, but they must not be place too close to the labium.

Inspired by the Menkveld instrument, I have made a rather more simple wooden ocarina, which can be made in one afternoon. Two parts around the windway (labium and upper side of the windway) are made separately and are attached with screws. That means that these parts can be changed easily. To avoid leakage, I have put very thin double-faced self-adhesive strips (normally used for photos) between the screwed wooden parts. The wood (a tropical hardwood) was bought in a DIY-shop, I think it is *meranti* (with FSC-certification). Advantage: this wood is already finished straight and smoothly, for most of the parts there was no need for planing or sanding (I used the original width of the strips).

The main problem with all ocarinas: it is very difficult to predict the pitch of the fundamental: that pitch depends on the volume of the enclosed space and the size of the window. There is a formula to calculate that pitch, but that is practically rather unusefull. I have made a wooden ocarina with the following internal dimensions (in mm): length 187, width 39, height 25. The window: length 8, width 12.5. The fundamental is e-flat. Somehow I didn't succeed making another ocarina with the fundamental d just by enlarging the internal dimensions of the e-flat instrument with 6%.

Two photos with details of the construction of my wooden ocarina.

Some voicing tips: the bottom of the windway is simple: it is the surface of the lower piece of wood. Sanding makes the surface smooth. The windway itself is cut out (using chisels and files). After some playing the wood surfaces will become a bit rough, you must re-sand them. I have filed small chamfers at both exits of the windway. The bottom of the windway is exactly on line with the lower edge of the labium. I have left
this edge rather thick, as on wooden organ pipes (and much thicker than on recorder edges), and chamfered the labium edge at the lower side. The height of the windway depends on what you like: if by accident too much wood was removed, you can file or sand some wood at the left and right side of the windway. It is just very easy to do corrections, the wooden ocarina is much less critical to make than a recorder.

My ocarina, complete.

New fingerings
For my wooden ocarina, I have experimented with a new - but in fact very old - fingerings. With four front holes for the right hand and three for the left, it is possible to have fingerings as they are used on recorders (on Donatio ocarinas you must learn quite different fingerings). And just as Hotteterre advised for his recorders (in his Principes de la Flûte from 1707) I am keeping the hole for the ring finger closed for most of the tones. That has the important advantage that it gives more stability of the instrument when you are playing the higher notes.

Regarding the fundamental as a c, the fingering table is (0 = thumb hole):

<table>
<thead>
<tr>
<th>Note</th>
<th>0 1 2 3 4 5 6 7</th>
<th>0 1 2 3 4 5 6 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>c</td>
<td>0 1 2 3 4 5 6 7</td>
<td>d: 0 1 2 3 4 5 6</td>
</tr>
<tr>
<td>e</td>
<td>0 1 2 3 4 5</td>
<td>f: 0 1 2 3 4 6</td>
</tr>
<tr>
<td>f#</td>
<td>0 1 2 3 4</td>
<td></td>
</tr>
<tr>
<td>g</td>
<td>0 1 2 3 . 5</td>
<td>g#: 0 1 2 3 . 5 6</td>
</tr>
<tr>
<td>a</td>
<td>0 1 2 . 5</td>
<td>a#: 0 1 2 . 4 5</td>
</tr>
<tr>
<td>b</td>
<td>0 1 . 5</td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>0 . 5</td>
<td>c#: . 4 5</td>
</tr>
<tr>
<td>d</td>
<td>. . 5</td>
<td></td>
</tr>
</tbody>
</table>
wooden ocarina

4 + 3 front holes

1 (or 2) thumb holes

Adding another thumbhole gives some more tones, but on the ocarina the quality of the sound is decreasing by adding more holes (each new hole must be considerably larger than the previous one). For my e-flat ocarina the size of the holes is (going from hole 7 to 0): 3.5, 3.7, 5.4.
More on Young’s modulus.

In Comm. 1872 Jean Louchet presents a method for determining the Young’s Modulus (E) of musical strings. I question the usefulness of his approach. To start with, the values for E for various materials that he gives are incorrect. The correct values, confirmed in three sources, are:

- 204 GPa for steel
- 80-150 GPa for gray cast iron, depending on grade
- 100 GPa for brass
- 110 GPa for copper

First, let us note from the outset that gray cast iron is unsuitable for drawing into wire. Second, in the context of metal musical strings, “iron” refers to, essentially, very low carbon steel, that is, an iron-carbon alloy with less than 0.05% carbon. Those who have a stash of old FoMRHI Quarterlies are referred to Remy Gug’s excellent Comm. 452 from April 1983, wherein he describes the manufacture and properties of old brass and iron wire.

Since E for steel is does not vary significantly with carbon content, or, for that matter, with other trace alloying elements, a measurement of E cannot yield useful data on the composition or age of ferrous musical strings.
Another Useful Free ‘On-Line’ Resource.

For those not aware of it, “Internet Archive” is a very extensive source for researchers – a huge collection (literally millions of items) of out of copyright books, film archives, audio files, computer software archives etc. – in a variety of languages and variety of formats, including Pdf – all for free download.

For example, those interested in acoustics and the theory of sound can find, among others, the important classical 19th C works “On Sensations of Tone” by Hermann Helmholtz and The Theory of Sound” by Lord Rayleigh. A search for ‘Musical Instruments’ reveals dozens of titles including ‘Syntagma Musicum’ by Praetorius, ‘The Irish and the Highland Harps’ by R.B. Armstrong as well as works by Carl Engel, Curt Sachs, A.J. Hipkins and Galpin as well as 19th C. Catalogues of Instrument Collections etc.

Best explored with a High Speed Internet connection but patience and a ‘dial up’ connection works just as well for the smaller files.

An alternative way to download files that appear not to start is to click on “All files HTTP” in the “View the Book” window on the top left of the page and select the required file from the list.

Well worth exploring at:

http://www.archive.org/index.php
Recorder research: windway design

Introduction
Making a recorder is not too difficult, with the right tools (and with some experience using them), some good pieces of wood and - which is important - having some knowledge about the design, acoustical properties and playing characteristics of these instruments. Making a really good recorder is much more difficult, because you have to know and master the many difficulties which lie between a mediocre and an interesting instrument. But you can get quite a good result, if you are working accurately, your finishing capacities are far above average and the wood is cooperating. Then you will find that another difficulty is making two or more recorders with exactly (or almost exactly) the same properties; that is major problem for all of us who try to produce >hand made= instruments. Even within series of factory made recorders (which are made with the most sophisticated copying machines and tools) I have seen variations in playing characteristics in such a range, that some of these instruments were excellent, and others I should never buy. These differences - which are often hardly visible, and sometimes only audible for professional players only - are perhaps a consolation for amateur woodwind makers, who are working more or less with traditional techniques, using much more simple tools. But they give us also a problem, because these professional players are often very critical about their instruments, and they are very sensitive about the smallest peculiarities (which are sometimes called >faults= by them). How to cope with such instruments (and such players)?
Making >the perfect instrument< is the dream of many of us. But what is perfect? That might be an really exact copy of a very good historical instrument. Or maybe a less exact copy, but made with all the knowledge and inspiration from the maker of that famous recorder? At least you must know about his intentions and ideals, and how a such a recorder should sound in the hands of a very skilled player. And here, there are several problems. How many of us - and especially the younger generations - have ever played an original renaissance or baroque recorder (and playing is just more than blow a few notes to establish their pitch, for instance)? And next: do we know if the recorder in its present condition has the same characteristics as for 300 or more years, when it was made?

Irregularities in historical instruments
Some months ago, I had a conversation with Heiko ter Schegget, recorder player and teacher at the conservatorium in Utrecht. He also makes some instruments for himself and knows about the problems of producing exact copies. His opinion is that our modern ears are spoiled and not good enough for really understanding the sound of the historical instruments. There is so much noise around is, we are hearing every day the sound of all types of loud modern instruments, and so it is for instance difficult for us to hear subtle differences between tuning systems (equally tempered, mean tone, etc.). Heiko did a test, playing behind a screen some very good copies of recorders and their originals. His students chose every time the original instruments as the better ones. What is it, that makes those old recorders so particular? It can't be just their age (wear and tear) or, if so in some degree, there must be something else. But what then?
One of those famous sounding historical recorders is the soprano by Engelbert Terton (in the collection of the Gemeentemuseum, Den Haag/The Hague, Netherlands). Many players who had the chance to blow this instrument, are enthusiastic about the playing qualities: sound, attack, flexibility, stability (and so on; there are some more qualities to be discerned). But why is this soprano so good? On the photo (see left) of the head of this recorder, you can see that the labium edge is chipped in the centre. As on all recorders by this maker, the side walls of the labium are not symmetrically cut, the >west wall= diverging a bit more than the >east wall=. On the soprano, the windway is not perfectly placed as well. Seen from the upper end, the windway goes a bit too far to the left (east). The soprano is well known for its silver mounts; the block too is edged in silver at the beak (maybe because the player was sensitive to the cedar wood of the block?) and the beginning of the windway, and fixed their with a nail. That gives a small irregularity as well, which, however, doesn’t have a negative effect on the sound, just as the other items I noticed. I have never seen a copy of the Terton soprano with all these >faults=. And you will need some courage to include these irregularities whilst making a copy. Did Terton apply them deliberately, or are they indeed minor faults, not having a negative effect on the playing properties of the recorder?

There are more recorders with some oddities or irregularities. Heiko ter Schegget has seen (and he has great admiration for them) several renaissance recorders made by (or in the workshop of) Rauch von Schrattenbach and discovered that all of them had an irregular spot at the labium edge. The questions is: do those irregularities belong to the world of secrets of the old woodwind makers from the past, or is it something else which is mystifying us - such as the many secrets of Stradivarius? Or is at all about our ears - who can’t tell us what exactly they are hearing in the old instruments?

**Windway measurements**

There is one important requirement if you want to make better or more exact copies of historical recorders: making an exact copy means not in the last place that you must copy their windways accurately. That means that you must have or take comprehensive measurements, preferably of good (or promising) instruments. And because it is so difficult to measure original instruments yourself, we must rely on existing drawings and data. And here we met a huge difficulty: most technical drawings of recorders give only limited information about this very important part of the instrument. One of the reasons: windways are very three-dimensional, they have very rarely the shape of a simple square box. Often they are curved lengthwise (N-S) as well as in cross section (E-W). Windways can have a rising, axial or descending direction. It is not easy to give this information in simple two-dimensional drawings.
For understanding the problems with measuring windways, you must know how it is done, or can be done. It isn’t a simple job, just because of the curved internal surfaces (also of the block) block is not easy, unless the most modern technical CT-scans are applied. Some experiments were done some years ago in Neuremberg with a recorder by Hieronymus Kinsecker (see the article by Klaus Martius and Markus Raquet in the proceedings of a symposium, held in 2006 in Michaelstein in Germany - Konferenzberichte No. 74, see www.kloster-michaelstein.de for more information).

On the best quality of the scans (see phot to the left), even the grain of the wood is visible, which shows us how the windway must have been made: with a >pushing< tool (and not by pulling the tool from S to N). Let us hope that more collections will produce these CT-scans; they are so much better than the old-fashioned X-rays. The problem is (apart form the costs) not to make these scans, but how to present the results. I think the best thing to do is to print several cross- and length sections.

A more easy and faster way to get an impression of a windway, is measuring vertical (front-back) and horizontal (east-west) dimensions of the bore with traditional tools, and making drawings and describing what you can see - of course after knocking the block out of the head.

Two solutions for measuring bores: a pair of compasses with soft plastic tips, and an adjustable telescoping gage (with a smoothly polished surface of the tips). Be careful using that gage: the safest way is to to fix the tips in advance to a specific length, and then moving it gently in the bore, measuring the distance to the point where the tips touch the wood.

With this method, another problem must be solved: measuring the bore at the top end of the recorder head is hampered because of its beak, the piece of wood cut out at the upper back side. The problem is that, using the techniques with fixed telesco-
ping gages, two opposite points are required to assess their distance; and in the beak section one of these points is missing. Fred Morgan had a solution: he gave on some of his drawings (such as from the recorder collection of Frans Bruggen) a >table line< measurement: the distance from the windway opening to the surface of the table on which the head is placed (see drawing). That gives at least some information with which you can execute some calculations to discover the slope of the windway: is it rising, axial or descending.

To the drawing: 1- windway opening; 2- windway roof; 3- block surface; 4- north face of the window; 5- window length; 6- 'table line'; 7- top chamfer; 8- 'step'; 9- block chamfer; 10- labium edge.

As mentioned above, many baroque recorders have N-S curved windways, which means that the general direction is (more) rising in the top section, and less rising or axial or even a little bit descending in the middle and lower section of the windway. On most recorders, you can see these curvatures more or less clearly (of course, again, after removing the block) and you can check it by putting a short ruler over the windway roof. Some recorders by Willem Beukers have the most strongly curved windways I have seen, his alto in the Gemeentemuseum with in the middle a space of 0.70 mm between wood and ruler. How do I know that so exactly? I have not measured this recorder myself, but you can see all the data in the catalogue of Dutch baroque recorders of the Haags Gemeentemuseum, published in 1991 by Moeck. More about this catalogue later on in this article.

First example: the alto recorder by Van Heerde, Leipzig
Three generations of the Van Heerde family worked as woodwind maker. I presume (but I cannot prove it) that the second generation (Albert van Heerde) made in the first quarter of the 18th century the alto recorder which is now in the Grassi Museum in Leipzig (inventory no. 3244, see the catalogue with the title >Flöten<, by Herbert Heyde, from 1978; the museum was then called Musikinstrumentenmuseum der Karl-Marx-Universität Leipzig). In this catalogue, there are only limited data about the bore profiles and windways of the recorder. So I had to go to the collection myself (in 1991), discovering that the recorder was temporarily on loan to the town museum of nearby Weissenfels. In that museum I have taken measurements of the instrument, and I also could knock out the block for a better view of the windway (which was maybe not permitted in Leipzig...). But I had only a short time to do my research (not knowing that I wanted making a copy of this recorder, 18 years later), and I have written down only a few remarks: slightly rising windway, very narrow entrance (0.5 mm) and also a small >step< (difference in height between windway roof near the window and the edge of the labium). I have also taken only a few
horizontal and no vertical bore measurements of the head.
And there is a further problem: the wood (boxwood) of the head is rather warped,
which means that on cross section there is a clear difference between maximum and
minimum diameter at the turned elements of the head. At the south end of the head
(near the socket) this difference is about 0.2 mm, close to the window I measured a
difference of 0.6 to 0.8 mm. The result of this irregular shrinking of the wood is that -
as the radial face of the wood is positioned at the front - that all diameters from front
to back are smaller than those from east to west. That means that we can expect
that the windway is now narrower (but how much?) than it was 300 years ago. And
as we know that a difference of only 0.1 mm in the heigth of the step can result in
the difference between a bad and a good recorder, you might understand that there

is a problem. Shrinking and warping percentages are also much higher than the in-
accuracies of measuring bore diameters.


Conclusion: if you want to make a copy, you must at first thinking about a recon-
struction of the original dimensions of the old recorder (even when that instrument
has now very good playing qualities). Also: it is wise to see more instruments by the
same maker, to discover similarities in design and finishing. I have tried to make a
copy of this Van Heerde alto, and in order to get a good sound and all tones speak-
ning well I had to open the windway clearly more than the 0.5 mm of the original.
At the other side, I can give also the conclusion (or observation) that it is possible to
make a recorder after a historical instrument, using only a small number of measure-
ments and other information. But in that case, you must be a quite experienced
woodwind maker and you must have a good idea about what you are doing.
However, here comes a warning: your experience with making instruments might be
an obstacle to make a more accurate copy of an instrument, especially when you
want to make an instrument with a complete different sound or other playing charac-
teristics. It is important to forget what is in your head, to become as receptive as
possible for the historical instrument you are playing or copying.

cross section through
recorder; R = radial side,
T = tangential side of the
wood.

a is shorter than b.
The effect of irregular shrinking of the wood. On most historical recorders, windway and labium are situated at the R-side of the wood. Some remarks about shrinking and warping of the wood: boxwood will shrink from freshly cut to >air dry= about twice as much as other woods (such as ebony, or fruit woods). And we do not know how well the wood of the old instruments was dried before it was used by the makers. And also we do not know if some of the instruments were re-reamed after a while, resulting in a bore which is less oval in cross section than the exterior at the same place. Ovally warping can be seen on many recorder heads, but also of the tenons of the middle joint. Not only of boxwood instruments, very often also on bass recorders which are made of maple. An further phenomenon on recorders is that the labium edge has lowered a bit, with the result that the step has become too big. We see this especially on ivory recorders (ivory is a heavy, but not so stable material as many people think). I do not quite understand what causes this warping, and it can only be signalled by taking accurate bore measurements. See also the remarks to the third example below.

A second example: alto recorder by Bressan
Frans Brüggen, former recorder player and now conductor of the orchestra of the 18th century, has still his collection of historical woodwind instruments (they are not sold to Japan, or where ever). The recorders of this collection were measured by Fred Morgan, the drawings with measurements were published in 1981 by Zen On in Tokyo (now out of print, but maybe, on internet, you can find and buy these drawings). These drawings by Morgan are small pieces of art themselves, but they are not so easy to understand if you are not familiar with measuring recorders yourself. And some information is always missing: the ovality of the bore (interior) and turnery (exterior) of the instrument parts. As far as I can see (there is no introduction with explanation to the drawings), Morgan gives always the widest (or thickest) of two measurements. But you are not getting an indication of the warping and shrinking of the wood.

In the Brüggen collection there are two boxwood alto recorders by Bressan. The instrument for this article has the number XI, it is the recorder with a repaired part at the upper end of the middle joint; the block is also new (by Hans Coolsma, 30-40 years ago a famous Dutch recorder maker; Coolsma recorders are still be made, in the Aafab factory in Utrecht). This Bressan alto has ivory mounts, and the windway goes partly through the ivory. That means that we can see in the windway roof the transition from the ivory to the wood section; visible as a minor step. Morgan gives a series of vertical measurements, from the beak corner to the labium edge. Because of the fact that the bore profile in the upper section is conical, you cannot draw simply a conclusion from these data about the direction of the windway.

To the graph:
A = the vertical distance from windway roof to other side of the bore; B = horizontal diameter of the bore; C = distance from windway roof to axis of the head (C = A - 1/2 B)
Alto recorder No. XI, by Bressan, Collection Frans Brüggen - Amsterdam. Part of a drawing by Fred Morgan (see text for more information).

There is only one way to do that: subtracting the half of the horizontal diameter from the vertical measurements, which gives us the distance from the windway roof to the axis of the head. Now we have a set of data, from which we can see the direction of the windway roof: this is in this section almost axial (surely not rising), also parallel to the axis; see the lowest line in the graph. There is also no N-S curve visible.

Morgan gives also a measurement for the step, which he indicates on the drawing as W.W/U.E (windway - upper edge). He measured 0.95 mm, quite a big step, as far I can see. On most of the Brüggen recorders, Morgan has drawn the curves of both labium edge and windway roof (at the N-end of the windway). However, the drawing of the labium edge curve is missing. But there is a compensation: there is a picture of the new block, also with a cross section at the lower end, and we might assume that the E-W curvature of the block and the labium edge are about the same.

Conclusion: with the measurements by Morgan, we have a quite good picture of the dimensions of windway, block and labium. But his drawings are not so easy to understand (for instance the way he measured the size of the topchamber of the windways), and there is very little information about the condition of the instruments. But as it is, the >perfect= drawing with measurements of a recorder doesn=t exist, just as the perfect copy of that instrument. Some members of the Bouwerskontakt have started making a copy of a Bressan alto recorder. I looked through the drawings (of 4 or 5 different instruments) and measurements (about 8) I could find of Bressan altos. Most of them give not enough information about their windways. That is a problem. I have played - for a very short time - 3 or 4 Bressan altos, and I know that it is very important to get the right feeling of these instruments, what makes these recorders so particular. The best way to understand the instruments is having an original one in your own workshop. And look at it, play it every day...

Third example: the alto recorder by Van Heerde, Gemeentemuseum Den Haag

The Dutch recorders in the collection of the Gemeentemuseum were measured by Hans Schimmel; Vincent van den Ende made the drawings. Here we find the most complete sets of data of recorder windways. However, also here the understanding of the tables and drawings is not so easy. Some years later, I discovered a few problems, too late to ask Hans Schimmel (who stopped making recorders) what exactly he had done. My task was to make descriptions of the instruments (and to write a part of the technical introduction). That was in the very late stage of the project, on that moment all the work for the measurements and drawings was already finished. About the alto recorder by Van Heerde: the first thing you must know is that the foot in the catalogue is the wrong one, made for an other instrument by Thomas Boekhout (of which only the middle joint exists).
Some additional measurements of the foot by Van Heerde: L 108.6; socket L 15.4, D 18.8 to 19.4; fingerhole D 4.6 x 5.0; bore (D, L): 13.3 - 16; 13.2 - 21; 13.0 - 26; 12.8 - 37; 12.6 - 43; 12.4 - 46; 12.2 - 59; 12.0 - 69; 11.8 - 70; 11.6 - 72; 11.4 - 81; 11.2 - 89; 11.0 - 93; 10.8 - 94 and through.

In 1993, the original foot was discovered (in a chest in the Rijksmuseum in Amsterdam) and added to the other parts. The alto is in all parts shorter than the instrument in Leipzig, the pitch is also sharper (not far from a=415 Hz). Characteristic for several altos by Van Heerde: they have thin walls in the head, the windows are quite long (4.5 mm or more). This in contrary with the alto recorders by Terton, which have generally thick walls and short windows. The Bressan altos have window and wall dimensions which lie between those of Van Heerde and Terton. Is that a part of the Bressan secret? That his instruments are not extreme, and that is why they are so good, and/or because of their excellent finishing?

The table >windway top-side< in the catalogue shows us the depth of the N-S curvature, being .37 mm at its maximum, halfway the windway. But we still do not know its general direction. Therefore we must make a calculation, just as we did with the Bressan alto above.

Again, in the top section of the windway there are no vertical bore measurements. At L 27 the height from windway roof to the axis is 10.03 mm, slightly rising to 10.07 at the S-end. That is a difference of only .04 mm. That means that this section of the windway roof is almost axial. But in combination with the data from the table, we must conclude that in the top section (from L 0 to L 27) the windway roof is there clearly rising. Now we have a better idea of the direction of this windway, we must consider the possibility that the windway of the Bressan recorder in the second example might also be rising in the top section (from L 0 to L 24); it is just that we have no data about its curvature.

Do we know now everything about the windway of the Van Heerde alto? No, there are one or two serious problems. The first problem is the ovality of the bore. See the other table, with horizontal (left) and vertical (right) bore measurements. Down in the
bore, they differ only about 0.1 mm. Halfway between labium edge and socket this difference is about 0.3 mm, under the labium even a staggering 0.8 mm. That is so much that we must consider the effects of this warping on the data of the windway roof. But we do not know the ovality of the bore in the top section of the head. Therefore, we need additional information, the ovality at the exterior of the instrument. But I am sorry to say: this part of information is missing in the drawings in the catalogue. The diameters of the smallest details of the turned profiles are measured by Hans Schimmel (even with an accuracy of .05 mm), but there are no data of maximum and minimum values. We do also not know whether the ovality of the bore is also visible at the exterior profile of the head. And we must know that, because of an other phenomenon. On old recorders it sometimes happened that the labium edge has lowered a bit, with the result that the step has become too big. We see this especially on ivory recorders (ivory is a heavy, but not so stable material as many people think). It is quite possible that this is also the case with this Van Heerde alto, the step being now 1.1 mm. Making a copy, I should go not further than about 0.8 or .85 mm. Or is that perhaps one of those obstacles which lie between my experiences with making recorders and the understanding of historical instruments?

There is a second serious problem with the windway measurements in the catalogue of Dutch baroque recorders. I have made some more calculations and drawn many graphs, discovering that it was not always possible to combine the vertical bore measurements with the curvature data. In fact, some the windways of some instruments appeared to be >impossible<, their roofs cut not in the wood, but much too low, >in the air<. I still do not know what causes these problems. I just discovered them many years after my work to the catalogue, it was too late to do all measurements again.

A final remark about the bore measurements in the catalogue: the data suggest that they were executed with an accuracy of 0.01 mm. Well, the data are very accurate, but they are the result of calculations. The bores of the recorders were assessed using a specially devised angle measuring instrument, the angles being converted to diameters. I discovered a similar thing in the lists of old world records in athletics: in the old times some distance (long jump) were measured in feet and inches. Later on they were converted in (centi)meters, which gave rounding off problems, some of the old records now listed with an >accuracy< of 0.5 cm.

**Conclusion:** at the end of this article, you might think that trying to measure recorders more accurately causes only more problems, and does not give all the necessary information. Well, that is only partly true. I am a rather critical person and am always mistrustful for people who are too ambitious and who are not critical enough to check (and to put in perspective) their working methods and results. Nevertheless, I can say that I have great admiration for what Fred Morgan and Hans Schimmel (and others) have done: it is a quite difficult job to measure so many instruments so accurately.

The important question for me is: how can we come closer to the instruments, closer to their souls, to their secrets. Is it possible for us to make better copies, and/or can we improve our hearing? Or must we be happy with the many fine instruments, produced in recent times by dedicated and skilled woodwind makers? It is not only about measurements, it is also about the playing characteristics such as the feeling, the resistance that the instrument gives. It is so difficult to describe, and even more difficult to measure.
A FORTEPIANO made by SEBASTIAN LENGERER, KUFSTEIN 1793

Nothing is known about where the instrument came from, except that it was removed from the Piomarta mansion in Rovereto (TN, Italy) in 1960, where it had obviously been for a considerable amount of time. When it was found in that year, the lid, the legs and damper-unit were missing, but its body as well as most of the action – including the knee levers – was still preserved, although the coverings of hammer heads had been irregularly replaced with various kinds of skin.

The case, too, which is finely veneered with cherry-wood, was in reasonable condition although it was impossible to correctly read Lengerer’s name which appeared as Leutherer on the mouldy label.

Fig. 1. Labels. (Left): “Finchcocks” Lengerer; (right): “Piomarta” Lengerer

The builder
Up to the present time, it has been impossible to get any information about Sebastian Lengerer from the Kufstein Cultural Institutions. According to Michael Cole, Sebastian
Lengerer (Lenger) was born in Kufstein, Tyrol, (birth date unknown). He was thought to have been a pupil of Johann Andreas Stein and to have been resident as an instrument maker in Vienna in 1799 where he died on 06.11.1809. We have some indications as to where he spent periods of his life.

Presumably the layout of the case frame and the layout of the bars under the soundboard in “Piomarta” Lengerer piano. Old repairs are visible on the bottom.

Fig. 2. “Piomarta” Lengerer action (left: C; right: c ")

At the beginning of my investigation, I did not understand why Lengerer's moderator works in reverse when compared to the normal Austrian moderators of that time. He apparently built bare hammers striking the strings through strips of cloth or skins as a normal "default" setting (with the moderator “on”) and bare hammers striking the strings directly when the moderator was withdrawn by pressing the knee lever.
Fig. 3 “Piomarta” Lengerer action. (Top) the moderator “on”; (bottom): the moderator “out”.

Fig. 4. Details of the mutation stops in the “Piomarta” Lengerer piano (moderator “on”). What is still unknown, is Lengerer’s use of a strip of horn to move the wooden bar carrying the moderator cloth or leather strip (no traces of the bar with the strip of cloth or leather have been preserved).

In the centre of the figure the return spring can be seen, being the wooden square under the strip of horn. The little hole C in the horn strip shows that the wooden square pivoted in it. The end of the pin P, protruding through the horn surface, holds the horn strip forward in the “on” default position with the cloth or leather strip interposed between the strings and the hammer. When the wooden square rotates, counteracting the spring action, the cloth or leather strip moves towards the tail of the piano (stroke = 14 mm) and the hammer freely strikes the strings.
Having studied a lesser-known Späth u. Schmahl’s Tangentenflügel kept by a private owner in Milan (A. J. Gobbett, “Fortepiano a tangenti di Späth & Schmahl Regensburg 1790”, Strumenti per Mozart, Longo, Rovereto (TN, Italy) 1991, pp. 161-191) the idea came to me that Lengerer had been influenced by the fashion of imitating the Tangentenflügel tone colour.

When trying to find out if someone knew of any other piano-makers who made the moderator to remove the cloths or skins from the hammer striking points instead of inserting them, I was told that a Schiedmayer fortepiano with a reverse moderator is housed in the Erlangen University Museum.

Most piano makers and restorers think that the hammers were leathered; that is, that the hammer heads would always have been covered with a strip of leather. If this was the case, it is a matter of argument how thin the leather layers would have been, although the hammers usually appear to have had a rather thick layer. In most, if not all, of the instruments these leather layers had been replaced, presumably more than once. (I saw only one Viennese piano in Coira Castle (Churburg, Schluderns, BZ, Italy) which had leathered hammers in pristine condition with no traces at all of grooves on the leather surfaces).

Fig. 5. The screw holes ⬤ on the case left side (from a drawing by Christopher Nobbs).

In the “Finchcocks” Lengerer there had been an early attempt at updating the action and the moderator had been discarded, leaving only the screw holes each side, from which a mechanism was reconstructed to enable the instrument to be “restored”.

Although the restorer was originally hesitating about how to explain the existence of three old unused screw holes, the restoration work was modelled on J. A. Stein’s instruments. According to the restorer, the result did look a little awkward but it was the best that could have been done: even in those days a “reverse” moderator was very unconventional, as it seems to us today.
It is interesting to note that the main difference between the original parts of the “Piomarta” Lengerer action and those of the “Finchcocks” Lengerer are limited to a few details concerning the hammershanks, while the hammerheads seem to be very similar.

It is indisputable that the hammer shanks of the former have a very small transverse section of 1.4 mm (base) x 5 mm (height) over the whole compass of the instrument. Those of the latter were cut in two ways: the part holding the head – which is 70% of the shank length – is cylindrical with a diameter of about 5 mm whereas only the part which pivots inside the Kapsel has a rectangular form.

The wood of the former is walnut.

Evidently, such a moderator makes sense only when the hammers were not leATHERED, as was the case with earlier models of pianos. Leathering, as J. A. Stein definitely did in his later models, made the old traditional moderator redundant.

Trying to find an explanation of why Lengerer adopted his reverse moderator, I put forward my opinion that he was influenced by the relatively new taste for the tangent piano sound. It is well known that tangent pianos were supplied with one or preferably two slightly different moderators designed to attenuate and change the brilliant but harsh sound produced by unleathered wooden hammers hitting the strings. Due to the fact that Lengerer’s unleathered heads of hard pear wood are very tiny and shaped like tangent heads, the sound would not have been dissimilar to that of a tangent piano when the moderator was disengaged.

Lengerer made his two surviving pianos when most contemporary Viennese actions were being made with much more robust heads and hammers (see the action of pianos attributed to A. Walter and others). The same J. A. Stein made slightly bigger leATHERED hammers in his mature instruments, having abandoned the hollow heads and unleathered heads of his earlier pianos long before.

If Lengerer, one of Stein’s pupils, moved to Vienna in the later years of his life and introduced his instruments of the kind discussed here, should we argue that he was an elderly maker eager for the old-fashioned light piano tone of his past or an inventive pupil, taking his master’s model but renovating it by adding the now fashionable tangent piano sound?
Evidently, we must not forget the many unleathered square pianos both South-German and Italian as well (I am sending my thoughts on this subject in a future article). As far as I know, the tone of such squares, and particularly the Italian ones, belongs to a quite different aesthetic taste. It seems to me that a “primitive” action such as that of the so-called “einfachste Prellmechanik” (very simple down-striking action—‘flip action’) comes from a different musical trend in which players and listeners had to put up with various mechanical noises and a rather rude tone colour for the sake of simplicity and presumably the low cost of such actions.

Other opinions on this subject are welcome, as well as any information about other existing instruments like Lengerer’s piano with its “reverse” moderator.

Here is Bill Jurgenson’s thoughts on the matter: The idea of the moderator being taken off in pianos after say 1785 would seem to me to be the order of the day so as to bring them up to date while keeping the advantage of the earlier clearer tone which I am sure the builders and probably most musicians preferred.

And some by Chris Nobbs: Not much is known about the style of the original hammer-heads. I modelled the restoration of the “Finchcocks” Lengerer on Stein’s instruments because the surviving components and overall design seemed clearly of that school.

(Other observations come from private communications sent to me by Bill Jurgenson, Sabine Klaus, Christopher Nobbs and Klaus Martius).

3 Not having taken off the soundboard, it was impossible to see the inner case construction clearly in the “Piomarta” Lengerer piano and state whether it is the same as in the “Finchcocks” Lengerer. It is possible that both structures are not only very similar if not identical to each other but also to the Stein type.
A keyboard instrument in a painting.

An unsigned portrait with a keyboard instrument: an attempt to ascribe a painting.

A while ago, several Moscow friends visited us at our house in Galilee. Among them was a young lady—an art historian and Senior Researcher at the State Tretyakov Gallery, Moscow. We talked about painting and music; suddenly, she asked me whether I could assist her with ascribing an unsigned portrait with a keyboard instrument, at least regarding a very common point: could it belong to a European or a Russian artist? I answered I would try, and in a short time I got a digital photograph of the painting. Its size was sufficient for the preliminary assumption though some details were still not recognizable. My further attempts to get a more 'readable' photograph ended with no success. After a period of hesitation, I decided to write down my preliminary conclusions as a hypothesis based on 'extant ethnography'.

At first glance, the painting (fig. 1) contains neither signs of a certain school of painting, nor national accessories in the dress of the model or in details of the interior portrayed. It is a typical interior portrait of the late 18-century. However, a detailed analysis of the musical instrument painted, as well as of a sheet of printed music on the stand and a pose of a young man sitting near the keyboard—this in its entirety may lead to a very interesting assumption concerning the national belonging of an artist.

Let us start with the instrument. The keys are portrayed with genuine exactness; they look as those of an Italian spinet of the 17th century but their order is completely wrong—a sequence of three keys (natural-natural-sharp) is repeated throughout the range (fig. 2). The compass of the painted keyboard is only about two and a half 'octaves'. The wooden case painted in a green color is reminiscent of that of a Flemish harpsichord but it has a 'strange' shape: its boards are much thicker than those of any harpsichord; they are rather similar to a fortepiano; the music stand shelf also resembles part of an early grand.
One could assume that the musical instrument was portrayed from memory, on the basis of different sketches that were made earlier. Thus, a sketch of the keys might include a succession of only three keys—say 'b-c-c sharp'—to be reduplicated throughout the whole range. Such a situation might occur when there was no keyboard instrument to hand in order to check details, and when the painter had only a vague idea of key order. This situation could be imagined in the context of late 18th century Russia.
In the era of Catherine the Great (she reigned as Empress of Russia from 1762 until 1796), keyboard instruments were still not widespread in Russia, even amongst the aristocracy. The rare examples of these instruments appeared exotic or were, instead, a sign of the European education of their owners. During the same period, a tradition arose of sending gifted peasants—both musicians and painters—to European countries to undertake professional studies in both fields. In this case we seem to encounter the following situation: a young Russian peasant was sent to Italy to study painting; when he came back, he is required to portray his landlord’s son with something that would symbolize the European tenets of his educated family.

Other details of the painting contribute to this assumption. Thus, the music on the stand is written in only G clef, with no text lines; there is also a recognizable double repeat sign, as in most instrumental pieces of the 18 century, with a golden ratio between the parts. This music sheet might have been brought from abroad. But what could do with it the young person whose left hand is still playing something on the wrong-ordered keyboard and whose dreamy look is directed to the coming century when Russia will indeed say her word in painting and, of course, in music composition and performance?
On Lute Sizes

Introduction

This paper was offered for publication in the Lute Society's *The Lute* ten years ago. A request for specific objections to it was not granted. My guess is that it was felt that a challenge to convictions about the early relationship between vibrating string length and pitch frequency that lute specialists have had since the beginning of its modern revival must be wrong, even though what was wrong about the scholarship was not immediately apparent. I hope that in the decade since, they have become more relaxed about the importance of historical justification for the success of their modern culture.

The original sizes of lutes can be observed in paintings and surviving examples, and we have occasional measurements in early written sources. A useful measure of the size of a lute is the vibrating string length. To find the string length from a depiction, one needs to scale the image using an assumption about the original size of another object in it at the same distance from the viewer. I use the player's head and assume that the distance between the eyes or the distance between the line between the eyes and the mouth (whichever the view allows) was about 6.2 cm, expecting an uncertainty of perhaps 10% (distortion by the artist can lead to more uncertainty). Here we do know that the neck was at its original length at the time of the depiction.

On surviving examples, most necks have been altered. They have been restored (either physically or conceptually) to some presumed early state using assumptions of the appropriate bridge position and of the number of frets needed to be tied around the neck for that state, with the obvious uncertainty about how typical the original was. The surviving instruments are rarely those originally played by serious musicians. A high level of use leads to a higher probability of accidents, and serious musicians are more prone to discard an instrument if it cannot be converted to an up-to-date state when fashions change. The size distribution of surviving instruments is strongly biased towards those sizes that could be used in altered states in more recent times.

The few actual measurements given in early sources give the most useful historical information because it is most likely that the measured instruments were particularly respected at the time. Thus, any theory about lute sizes must include the lute size shown in Praetorius's scaled drawing and the sizes given in the Talbot manuscript.

There is another approach that is very useful in approaching the question of typical lute sizes. The string length can be related to pitch range via the properties of gut strings. That is what most of what follows discusses and uses.

In the Renaissance, it appears that popular makers produced lutes in large batches of fairly standard sizes for a Europe-wide market. Most players used their lutes for solo performance or to accompany their voices, so the main criteria for size choice seem to have been vocal range and technique aspirations (larger instruments sound more impressive with simple technique, while smaller instruments allow more musical inventiveness because of more possibilities in fingerboard navigation). A minority of lutes played primarily in ensembles, and their sizes had to be compatible with the other instruments. So at least some of the standard sizes produced needed some consistency with commonly used pitch standards. In the baroque, the market was much smaller and converted old lutes were preferred to new ones, leading to more potential diversity in sizes, but there was more playing with other instruments, making conforming to a pitch standard more important.
Basic Theory of Ranges of Gut Strings

The Mersenne-Taylor Law is an accurate relationship between vibrating string length $L$, pitch frequency $f$, string tension force $T$ and mass per unit length $m_L$. It can be stated as $4f^2L^2 = T/m_L$. When the string is made of one uniform material of density $\rho$ and cross-sectional area $A$ (equal to $\pi D^2/4$, where $D$ is the diameter), then $m_L = \rho A$, so $4f^2L^2\rho = T/A = S$, with $S$ defined as the force per unit cross-sectional area on the string. It is called 'stress', and with good reason. The stress on a string has strict limits: with stress too high the string breaks. Thus the string stress can be calculated from the pitch frequency, the string length and the density of the string material, without knowing the string diameter or tension.

We are interested in comparing stresses between strings, and the actual figures do not have any particular meaning to us. So comparing the square roots of the stresses would be just as useful. For that matter, comparing the square roots of the stresses divided by twice the square root of the gut density (which can be safely assume to be constant), is just as useful. This latter quantity, according to the Mersenne-Taylor Law, is simply the frequency that the string is tuned to multiplied by the string length it is stretched over ($fL$). This frequency-length product $fL$ comes out as sensible numbers if we define frequency in Hz and string length in metres. The units that product comes out in is m/sec, which reflects the fact that it happens to be half the velocity of wave propagation along the string.

If one increases the stress enough on a string, it will break. Breaking stress is the definition of 'tensile strength', which is reasonably constant for most materials$^1$. Doubling the stretching force while doubling the amount of material to resist that force (i.e. doubling the cross-sectional area) does not change how near to breaking the string is. With materials like gut, when near breaking, the string stretches inelastically over time (i.e. some of the stretch does not recover when one relieves the stress), and keeps doing so until it breaks, so to properly predict breaking, one needs to consider time as well as stress. Practically, the highest working stress one will use on a gut string depends on the shortest but still tolerable time (on average) that one can expect it to last before breaking. This is a judgement that musicians make, and can (and did) vary with changing culture. Only evidence from the relevant musical culture gives an historically valid highest working stress for gut in that period.

Fortunately, when studying historical stringing practices, the highest working stress that people actually used is what we are really interested in, not the stress for immediate breaking (which we now can't measure), nor how many semitones away from the immediate breaking pitch that the lute player judged was close enough (which we now can't ask).

As one lowers the stress in a string, the inharmonicity in the sound it produces increases. Moderate inharmonicity involves higher harmonics getting out of tune with the fundamental frequency of a note. This occurs in the sound of a piano, and is an essential characteristic of it. When inharmonicity gets large, most of the harmonics drop out of the sound completely, leaving it dull, devoid of richness and focus. How dull a sound can get and still be worth having is another judgement that the musicians in each culture decided on, and can change as the culture changes.

The maximum tolerable inharmonicity cannot be expressed purely by a minimum stress. At a constant maximum inharmonicity, the frequency is proportional to the string diameter divided by the square of the vibrating length. If we consider families of instruments, the tension-length principle (where the tension is roughly proportional to the string length) tends to be followed. Combining these relationships with the Mersenne-Taylor Law leads us to conclude that the frequency is proportional to the string length to the $4/5$ power$^2$.

Only those instruments with the maximum open-string ranges reach the limits of toleration of rate...
of string breakage on the highest string and inharmonicity in the bass sound acceptable in that
culture. Instruments with a smaller open-string range tended to back off from these limits.

The Praetorius Evidence

Praetorius\(^2\) is a marvellous early source to tell us about the limits of gut strings. He drew the
dimensions of an octave set of pitch pipes from which (as he intended) we can determine his
Cammerthon pitch standard. It was about \(a' = 430 \text{ Hz} \)\(^3\). From this, given the nominal pitches
given in his pitch table, we can calculate the pitch frequencies of his strings, and from his scaled
drawings, we can calculate their string lengths.

All of the bowed instruments depicted by Praetorius on scaled drawings and included in his table of
string pitches were studied in FoMRHI Comm. 1545\(^5\), and all of the similarly represented plucked
instruments in Comm. 1593\(^6\). Three of the plucked instruments included were in Praetorius's tone-
lower preferred south German Chorthon standard. This was usually indicated by a 'Chor' or 'Chorist'
in front of the name. The lute was one of them.

The main centres of lute making then were in southern Catholic Germany and northern Italy. In
both of these regions, the prevailing pitch standard (called 'Chorthon' in the former and 'tono
corista' in the latter) was about a tone lower than Praetorius's Cammerthon pitch standard.
Praetorius preferred the lower standard but regretted that it was not practical to promote lowering
his own standard to it. In the introduction to his pitch tables, he indicated that all of the pitches
listed were in Cammerthon and not in his preferred Chorthon. What he neglected to include was a
parenthetical proviso that this was only true if there was no indication otherwise. This omission
misled most early lute scholars (including myself), who did not appreciate the meaning of the Chor
in the name Chor Laute, and assumed that the lute was tuned a tone higher than it actually was.

The results for gut-strung instruments were that those with the largest open-string ranges and the
highest frequency-length product for the first course were the viola bastarda amongst those bowed,
with a 29 semitone range and 209 m/sec highest frequency-length product, and the lute amongst
those plucked, with a 31 semitone range and 211 m/sec highest frequency-length product. The
accuracy of the measurements does not warrant considering the difference between these two
figures for the highest frequency-length product to be significant. Thus, at least in the late 16th and
early 17th centuries, the oft-stated instruction to tune the highest string as high as it will go can be
expressed qualitatively by a frequency-length product of about 210 m/sec. Mid-19th century
orchestral violinists, pushed to higher pitches by the desire of wind players for greater brilliance,
had to go up to 7 % higher.

The historical validity of these conclusions depends on the evidence of string lengths, pitches and
pitch standards, and the validity of the scholarship analysing it. Theories that early gut was usually
stronger than implied here (as some lute theorists have been suggesting) can only have historical
credibility if their proponents can objectively show how this evidence has been misinterpreted.

We are interested in the string lengths of all of the lutes Praetorius mentioned, with different 1st-
course pitches and different size names. They were all gut strung, so the same criteria apply. The
left half of the Table at the end of this paper expresses the above relationships between the longest
string length and the highest pitches and the shortest string length for the lowest pitches at
Praetorius's preferred Chorthon pitch standard, which is relevant here.
First let us insist that the highest course of each was as high as it could go. We then get:

<table>
<thead>
<tr>
<th>String Length</th>
<th>First Course Pitch and Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>41 cm</td>
<td>d' Kleinen Octavlaut</td>
</tr>
<tr>
<td>46 cm</td>
<td>c' Kleinen Octavlaut</td>
</tr>
<tr>
<td>49 cm</td>
<td>b' Klein Discant laut</td>
</tr>
<tr>
<td>55 cm</td>
<td>a' DiscantLaut</td>
</tr>
<tr>
<td>61 cm</td>
<td>g' Recht Chorist= oder AltLaute</td>
</tr>
<tr>
<td>73 cm</td>
<td>e' TenorLaute</td>
</tr>
<tr>
<td>82 cm</td>
<td>d' Der Bass Ganant=</td>
</tr>
<tr>
<td>123 cm</td>
<td>g Die GrossOctav BassLaute</td>
</tr>
</tbody>
</table>

The largest size string length indicated is really too large to be practical. If we now insist that all of the lutes used the full 10-course range of the one depicted, the lowest course drifts out of the acceptable range as the lutes get smaller than the one depicted (i.e. the shortest string lengths become longer than the longest). I do not know of any surviving 10-course lutes with string lengths smaller than Praetorius’s 61 cm. As will be seen below, this is a very likely reason for the invention of the baroque lute tunings. The larger lutes though can get smaller and still keep within the range. Their minimum string lengths would then be:

<table>
<thead>
<tr>
<th>String Length</th>
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<tr>
<td>61 cm</td>
<td>g’ Recht Chorist= oder AltLaute</td>
</tr>
<tr>
<td>70 cm</td>
<td>e’ TenorLaute</td>
</tr>
<tr>
<td>77 cm</td>
<td>d’ Der Bass Ganant=</td>
</tr>
<tr>
<td>107 cm</td>
<td>g Die GrossOctav BassLaute</td>
</tr>
</tbody>
</table>

As stated above, the open-string ranges of smaller lutes should be reduced from the 31 semitones of 10 courses to keep the sound of the lowest string acceptable. Such a reduction of open-string range would also reduce the string lengths of the larger lutes to make them easier to play. The most common smaller tuning range of lutes in the late Renaissance was 29 semitones. The string length ranges would then be:

<table>
<thead>
<tr>
<th>String Length</th>
<th>First Course Pitch and Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-41 cm</td>
<td>d” Kleinen Octavlaut</td>
</tr>
<tr>
<td>44-46 cm</td>
<td>c” Kleinen Octavlaut</td>
</tr>
<tr>
<td>46-49 cm</td>
<td>b’ Klein Discant laut</td>
</tr>
<tr>
<td>51-55 cm</td>
<td>a’ DiscantLaut</td>
</tr>
<tr>
<td>56-61 cm</td>
<td>g’ Recht Chorist= oder AltLaute</td>
</tr>
<tr>
<td>64-73 cm</td>
<td>e’ TenorLaute</td>
</tr>
<tr>
<td>70-82 cm</td>
<td>d’ Der Bass Ganant=</td>
</tr>
<tr>
<td>97-123 cm</td>
<td>g Die GrossOctav BassLaute</td>
</tr>
</tbody>
</table>

It must be emphasised that these ranges of string lengths for each lute are not arrived at by applying the judgement of any modern specialist. They are calculated from the pitches of the highest and lowest strings, with players using the same criteria as Praetorius’s lute player had for how close to breaking the first course could be (for the long end of the range), and how much inharmonicity he found tolerable on the lowest string (on the short end of the range).

This set of string-length ranges provides an objective basis for identifying late Renaissance lutes.
with less than 10 courses according to their sizes. Robert Lundberg, in his *Historical Lute Construction - The Erlangen Lectures* listed surviving lutes that he considered to be typical members of the family of Renaissance lutes mentioned by Praetorius. Their string lengths are: 30 cm for the Small Octave, 44 cm for the Descant, 58 cm for the Alto, 67 cm for the Tenor, 78 cm for the Bass, and 94 cm for the Octave Bass. His string lengths for the Alto, Tenor and Bass fit nicely in the theoretical ranges given above. His Octave Bass (the Nuremberg Harton) is somewhat small, so it was probably built as a g lute in Cammerthon (a lute in Chorthon). Lundberg missed Praetorius’s Small Descant, and called one of the larger Small Octave lutes (the Vienna Venere) a Descant, and calling the Vienna Venere mandora a Small Octave lute. This illustrates how judgements of lute historians made without using quantitative methods can sometimes be spot on, and sometimes not.

It may be worthwhile to consider the likely 16th century origins of Praetorius’s names. The top strings of the Alto and Tenor lutes were tuned to the pitches of the highest lines in the alto (C3) and tenor (C4) clefs. It seems that the lute function represented by the name was to play music written in those clefs on their top 4 or 5 courses, with added basses as appropriate. Similarly the Bass would play music written in the baritone (F3) and bass (F4) clef on its top 5 or 6 courses. The Descant would play the soprano (C1) and mezzo-soprano (C2) clefs on its top 3 or 4 courses, using the higher fret positions on the 1st. The Small Descant could similarly play the treble (G2) clef. The Small Octave and Octave Bass sizes could (on their own) play the tune, which in Germany was often in the tenor, an octave higher or lower than written.

### Renaissance lute size names

There was a Europe-wide market for lutes from the German and Italian making centres, and for the services of lute players, so we have reason to expect international consistency in size names. We can associate the name ‘mean’ in English with ‘mezzano’ in Italian. Since these sizes were the most popular in these countries, and the ‘Recht Chorist oder AltLaute’ was the most popular in Germany, that was most probably the same size as the others. In the English and German cases, the pitch of the first course was given as g. The association of ‘bass’ in English with ‘grande’ in Italian and ‘Der Bass Ganant=’ in German is also highly probable, and in each case, the pitch of the first course was a fourth lower than on the mean size.

Similarly, we can associate ‘treble’ in English with ‘picciolo’ in Italian and ‘DiscantLaut’ in German. The first-course pitch was a tone higher than the mean size in the Italian and German cases, but the same as the mean lute in the English case. It thus seems most likely that the English treble lute was the same size as elsewhere, but often was tuned a tone lower. Our evidence for it concerns when it was playing with a mean lute in duets and when it played in a Consorte with a treble viol. In these contexts, its pitch was the usual low pitch for lutes and sets of viols, but it was also likely to have tuned all of its strings up a tone to play at the tone-higher pitch standard used by viols and most wind instruments (including the Consorte when playing with a violin and recorder).

During the period of about 1515 to 1575, the kind of bass strings (apparently made of roped gut) that reduced inharmonicity and so allowed an open-string range on lutes of 29 or 31 semitones, were not used enough to influence lute design. Lutes in this period usually used an open-string range of 26 semitones, using only simply twisted bass strings. There is no evidence relating string lengths with absolute pitches and size names in this period, but is is very difficult to imagine any reason why these should have changed significantly between then and the later period discussed above.

### Mersenne and baroque lute tunings

Mersenne presented the standard old Renaissance tuning (*vieil ton* or *accord ordinaire*) for the 10-
course lute, plus a new tuning (nouveau ton or accord extraordinaire) in two versions, with B flat (b mol) and B natural (h quarre). The relative tunings of the three were, respectively, diatonic basses + ffef, ffed and ffde (this notation gives the tablature letters in unison with the next-highest course). In a Table universelle du Luth, the string pitches were given as:

<table>
<thead>
<tr>
<th>course</th>
<th>10 9 8 7 6 5 4 3 2 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>old tuning</td>
<td>C D E F G c f a d' g'</td>
</tr>
<tr>
<td>Bb new tuning</td>
<td>C D E b F G c f g# c' d#'</td>
</tr>
<tr>
<td>B new tuning</td>
<td>C D E F G c f a c' e'</td>
</tr>
</tbody>
</table>

There is no indication here that could account for the names involving the notes B b and B. The definition of a tuning concerns relative pitches, and Mersenne considered that the actual pitches of each tuning were arbitrary. This is illustrated by his two versions of the Air 'Divine Amarillis' by Boesset, one in B-tuning tablature, and the other in 4-part mensural notation. He wrote that he assumed that D sol re of the lute was Fa ut of the 4-part version. Actually, the first bass note was the open 5th course, which would be a c, but it didn’t matter. In the transcription, the assumed pitches of the lute strings were a 4th higher than those given in his Table.

We can expect that the names came from lutes that were the right size so that the notes in the names were the actual pitches of some course in a popular pitch standard. In the relative pitches of the 1st, the 3rd and the 8th courses, the two new tunings happen to differ by a semitone in the right direction to justify the names. There are two possibilities, that the names referred either to the 1st or the 3rd course (the 8th was 2 octaves below the first). For the B tuning, the string pitches for each possibility would then be:

<table>
<thead>
<tr>
<th>course</th>
<th>10 9 8 7 6 5 4 3 2 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>B 1st course</td>
<td>G A B c d g c' e' g' b'</td>
</tr>
<tr>
<td>B 3rd course</td>
<td>D E F# G A d g b d' f#'</td>
</tr>
</tbody>
</table>

The Burwell lute tutor (c. 1660-1672) similarly called two tunings of an 11-course lute ‘B flatt’ and ‘B sharp’. Both of these tunings were different from either of Mersenne’s tunings with the same names. The relative tunings of these two were diatonic basses plus, respectively, fdefd and fedfe. As reported in Robert Spencer’s introduction to the facsimile edition of the book, Thomas Salmon (1672) discussed these ‘French B flat’ and ‘French B natural’ tunings, and transcribed the latter as D, G, B, d, g, b, associating this tuning with John Rogers (the likely author of the Burwell tutor). Here, it is clear that the tuning names were associated with the pitch of the first course (as in Praetorius’s book). The course pitches then were:

<table>
<thead>
<tr>
<th>course</th>
<th>11 10 9 8 7 6 5 4 3 2 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>B flatt tuning</td>
<td>F G A B b c d g b d' g' b'</td>
</tr>
<tr>
<td>B sharp tuning</td>
<td>F G A B c d g b d' g' b'</td>
</tr>
</tbody>
</table>

When fashions change, old names associated with them can sometimes be reused, but the criteria for the kinds of names used are very conservative within any culture. It is therefore likely that for Mersenne’s tunings, the names indicated the 1st-course pitches that the tunings were developed at as well.

The pitches given above are an octave higher than those given by Salmon in Spencer’s report. The report of a Salmon tuning given by Matthew Spring (Lute News 41, pp. 5-6) is ambiguous about the octave of string pitches. I have not seen the original, so do not know whether the octave...
specification was Salmon's or Spencer's. There is no problem though, even if it was Salmon's. Which octave a tuning is in is usually considered obvious by the person writing it down, and so it was sometimes recorded in the wrong octave purely for notational convenience, expecting that the reader could not possibly be confused. Today, we do find a first string tuned to some B confusing because we expect main-stream lutes to have string lengths of between about 60 and 70 cm, and our experience with main-stream lute tunings doesn't include such a note for the first course.

We may suspect that this 1st course pitch might be the result of some conventional transposition, such as the C key of English organs before the Reformation being called F for playing in 'Quire pitch'. Organists learned to finger on both pitch assumptions, and since they were expected to be able to transpose up a fourth from the C assumption and down a fourth from the F assumption, they had two fairly-evenly spaced intermediate alternatives within the fifth between the C and the F assumptions to find a appropriate pitch level for the voices they accompanied. There is no evidence that transposition was needed on the baroque lute, nor for any transposition mechanism like that for the organ being used.

That transposition was not an issue becomes apparent in the lute involved in a Bodleian manuscript. In Chelys, Tim Crawford described a mid-17th century set of 5 part books of 'ayres' in the Bodleian Library (Mus. Sch. E410-4), which includes a book for treble (viol or violin), one for 2nd treble or lyra viol (the latter in tablature), one for 12-course lute (in tablature) and two identical unfigured bass parts (one indicating that it was for theorbo). Two tunings were used on the lute part (indicated by tuning diagrams). One is identical with Mersenne's Bb tuning but with the 1st course at G, and the other with Burwell's B tuning with the 1st course at B. In this last case, the lute had a B first course at a pitch standard suitable for a treble viol or violin without transposition. We therefore need to take seriously what sizes such a lute might have.

We can reasonably assume that the criteria for how close to breaking a lute player would tune the first course, and the maximum inharmonicity for the lowest course he would tolerate, was the same as in the Praetorius situation. Mersenne's pitch standard was a' = 375 Hz, and it seems to be the relevant one for the French-dominated 17th century baroque tunings. Praetorius's limits of acceptability are converted to this standard in the right half of the Table. For a first course at b, b, b, and b the longest string length for each pitch would be 105, 99, 53 and 50 cm respectively. The lowest string in Mersenne's B and B tunings was a G, and in Burwell's B and B tunings was an F. We can then conclude that the open string ranges would have been:

<table>
<thead>
<tr>
<th>tuning assumption</th>
<th>Mersenne's B</th>
<th>Mersenne's B</th>
<th>Burwell's B</th>
<th>Burwell's B</th>
</tr>
</thead>
<tbody>
<tr>
<td>high-octave</td>
<td>45-53 cm</td>
<td>45-50 cm</td>
<td>50-53 cm</td>
<td>50-50 cm</td>
</tr>
<tr>
<td>low-octave</td>
<td>79-105 cm</td>
<td>79-99 cm</td>
<td>87-105 cm</td>
<td>87-99 cm</td>
</tr>
</tbody>
</table>

Especially with the Burwell tunings, the low octave implies a string length that is just too long for purposes other than simple continuo with minimum division and ornamentation. There is another reason why the high-octave tunings are much more probable, namely that they offer a reason for the change from the 10-course Renaissance tuning. When a lute is smaller than the mean size, one cannot have a full 31 semitone open-string range because inharmonicity on the lowest string gets worse, so tunings with a smaller open-string range were required. Lutes with a b 1st course needed to be tuned up to b as well, so the lutes which provided the B names were small treble lutes with string lengths of about 50 cm. In the report about the Bodleian manuscript by Tim Crawford, he was properly hesitant when he presented the lute tunings an octave lower than they most probably were.

These four relative tunings were the most popular in the 17th century. From the tuning names, it seems very likely that they were first developed on small treble lutes with about 50 cm string...
lengths. From the surviving instruments, we assume that most baroque lutes were larger and tuned to lower pitches, but the Bodleian manuscript shows that at least some were at the original size for its tuning. John Rogers apparently played on one, and so probably Mary Burwell did also, and perhaps the French lute masters she referred to did as well. In the Appendix, I show how the two different tunings for the lute in the Bodleian manuscript (one being identical to Mace’s15) work on the same lute, implying (with other supporting evidence) that Mace’s lute was apparently also one with about a 50 cm string length. It may be significant that the only evidence for larger lutes in baroque tunings before the 1690’s (the Talbot manuscript16) that I am aware of is Mersenne’s retuning of his 10-course Renaissance lute, with a string length of probably about 63 cm.

Small baroque lutes could have been quite common in the 17th century, and possibly even the most common ones then. Their extremely poor representation amongst the surviving lutes could easily be because of their ready conversion to mandoras in the 18th century, with no subsequent use as guitars.

**Appendix: More on 12-course lutes, and Talbot’s 11-course lutes**

The two lute tunings in the Bodleian manuscript were for a 12-course lute. Such lutes usually had two pegboxes, the bent-back one tuning the highest 8 courses going over one nut, and the straight-on one tuning the 4 lowest courses, with an individual nut for each. The tunings appear to have been:

<table>
<thead>
<tr>
<th>course</th>
<th>12</th>
<th>11</th>
<th>10</th>
<th>9</th>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>C</td>
<td>D</td>
<td>E</td>
<td>F</td>
<td>G</td>
<td>A</td>
<td>B</td>
<td>e</td>
<td>a</td>
<td>c'</td>
<td>e'</td>
<td>g'</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>F#</td>
<td>G</td>
<td>A</td>
<td>B</td>
<td>c</td>
<td>d</td>
<td>g</td>
<td>b</td>
<td>d'</td>
<td>g'</td>
<td>b'</td>
</tr>
</tbody>
</table>

There is a lute made in Padua in 1633 that survives in an apparently subsequently unaltered 12-course state in the Library in Linhöping, Sweden12. The string length on the main nut is 50.0 cm, and on the 12th course nut, it is 70.7 cm. I assume that this instrument is typical of the 12-course version of the original size of lute on which the four baroque tunings discussed here were developed.

From the Table at the end of this paper, we see that the lowest acceptable note on the main nut would be F, and on the 12th course, it would be Bb. Thus with diatonic basses, it happily can be tuned up to 6 semitones lower than the highest string can go (which is a b’). This shows that there would be no problem with using the same lute of that size for both tunings. In the low tuning (with a g’ first course), the tuning is about in the middle of the range of possible tuning pitches with that relative tuning and string length. There should be no problem with using the same set of gut strings, and just tuning them up or down between the two tunings.

The first tuning above is identical in string pitches to the main one used by Mace, which he called the ‘Flat-Tuning’. There are several pieces of evidence which indicate that the string length of his lute was probably much closer to the 50 cm Linhöping lute than to the over 60 cm that is the maximum string length for the 1st course in g’ at the usual pitch standard for lutes and viols, which he called ‘Consort-Pitch’.

One piece of evidence is that he never indicated that the 1st course should be tuned as high as it could go. This is supported by his specification that the highest catlins were on the 4 course, which was only 10 semitones lower than the highest string, while on Dowland’s lute and Talbot’s violin, the highest catlin(e) was 14 semitones below the highest string. Catlin(e)s had a good reputation, and they were generally used for strings with as high a pitch as they would work on without
breaking too often. Then, there is his drawing of the Dyphone, an invention of his which combined the 12-course ‘French’ lute (his usual one in Flat Tuning) with an ‘English’ lute (which was a theorbo that was 3/4 the size of a normal one and didn’t have a reentrant 1st course). Mace specified that the 1st courses of both were tuned to ‘G-sol-re-ui’, but in the drawing, the string length of the ‘French’ lute is about 3 frets shorter than that of the ‘English’ lute. This demonstrates that he expected the string length of his lute to be rather shorter than the longest for its 1st course pitch.

Mace witnessed the change of fashion towards Burwell’s B flatt tuning becoming the favoured later baroque one. He called it the ‘New Tuning’. The version he used on his instrument kept the 1st course at g’ and the 12th course at C, as in his other tuning. As evidenced by the tuning of the 12-course lute given in the Talbot manuscript, musicians eventually insisted that the instrument should play a tone lower in that relative tuning, with the 1st course at f’ and the 12th course another semitone lower, at AA. With this tuning, the 8th courses of a Linhोping-sized instrument would be at the limit of inharmonicity acceptability, and the 12th course a semitone lower. By then, 12-course lute players had become accustomed to the luxury of more focus in the sound of their lowest strings, and so a rather larger instrument was appropriate. I’ll show below that the relationship between tuning and the limits of gut strings on Talbot’s 12-course lute were similar to that of the Linhोping lute with Mace’s tuning, giving more support to the hypothesis that Mace’s lute was that size.

The 12-course lute Talbot measured (and called ‘English (two headed Lute - vulgo)’) had a string length of 23 1/2 inches (59.7 cm) for the 8 courses going over the main nut, and 32 1/8 inches (81.6 cm) for the 12th course. The highest acceptable note on the first course would be g’ (3 semitones higher than the actual pitch, the lowest on the 8th course would be C (4 semitones lower than the actual pitch) and the lowest on the 12th course would be GG (2 semitones lower than the actual pitch). We can see here that Talbot’s version of the 12-course lute was similarly placed in the pitch range for its string stops as Mace’s lute was if that were the size of the one in Linhोping.

The Talbot manuscript also gave measurements of two single-headed 11-course lutes (which he called the ‘French lute’) of a larger size with string lengths of around 70 cm (27 and 27 15/16 inches, or 68.6 and 71.0 cm respectively). Except for the missing 12th course, the string pitches were identical to his 12-course lute. On these 11-course lutes, the highest string was at about as high as was tolerable for an f’ pitch, and the lowest string could go down to BB. It actually was tuned to C, 2 semitones above that minimum. So the range of acceptable string lengths for this tuning would be 63-70 cm. Presumably, serious players would prefer the high end of the string-length range, trading shorter 1st string life for more focus on the lowest string, while less serious players may prefer a shorter string length for easier holding and playing, and less trouble and expense with replacing broken strings.

In the late 17th century the two-headed 12-course and single-headed 11-course lutes converged in actual tuning, and so were in more competition than ever. In the 18th century, the larger 11-course one prevailed. But before then, the smaller 12-course one had its advocates. Talbot quoted Agutter’s description of it as: ‘the 15 Trebles have the (lower) head bearing back as the French lute of which this seems to be an improvement’. 

53
<table>
<thead>
<tr>
<th></th>
<th>Extrapolation of Limits on Praetorius's Lute to Other Sizes</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>at Catholic German Chorthon</td>
<td>at French Ton de Chappelle</td>
</tr>
<tr>
<td></td>
<td>lowest</td>
<td>shortest</td>
</tr>
<tr>
<td></td>
<td>string pitch</td>
<td>length</td>
</tr>
<tr>
<td></td>
<td>at a'=383</td>
<td>(cm)</td>
</tr>
<tr>
<td>c</td>
<td>35</td>
<td>g&quot;</td>
</tr>
<tr>
<td>B</td>
<td>37</td>
<td>e&quot;</td>
</tr>
<tr>
<td>A</td>
<td>39</td>
<td>f&quot;</td>
</tr>
<tr>
<td>G</td>
<td>40</td>
<td>d&quot;</td>
</tr>
<tr>
<td>F</td>
<td>42</td>
<td>e'</td>
</tr>
<tr>
<td>E</td>
<td>44</td>
<td>d'</td>
</tr>
<tr>
<td>D</td>
<td>46</td>
<td>g</td>
</tr>
<tr>
<td>C</td>
<td>49</td>
<td>f</td>
</tr>
<tr>
<td>BB</td>
<td>51</td>
<td>g'</td>
</tr>
<tr>
<td>AA</td>
<td>53</td>
<td>e''</td>
</tr>
<tr>
<td>GG</td>
<td>56</td>
<td>a'</td>
</tr>
<tr>
<td>BB</td>
<td>59</td>
<td>g</td>
</tr>
<tr>
<td>C</td>
<td>61</td>
<td>f''</td>
</tr>
<tr>
<td>F</td>
<td>64</td>
<td>e''</td>
</tr>
<tr>
<td>E</td>
<td>67</td>
<td>g''</td>
</tr>
<tr>
<td>AA</td>
<td>70</td>
<td>d''</td>
</tr>
<tr>
<td>GG</td>
<td>74</td>
<td>a'</td>
</tr>
<tr>
<td>BB</td>
<td>77</td>
<td>g</td>
</tr>
<tr>
<td>C</td>
<td>81</td>
<td>f''</td>
</tr>
<tr>
<td>F</td>
<td>85</td>
<td>e''</td>
</tr>
<tr>
<td>E</td>
<td>89</td>
<td>g</td>
</tr>
<tr>
<td>D</td>
<td>93</td>
<td>h</td>
</tr>
<tr>
<td>DD</td>
<td>97</td>
<td>a</td>
</tr>
<tr>
<td>CC</td>
<td>102</td>
<td>b</td>
</tr>
</tbody>
</table>

References


3 M. Praetorius, Syntagma Musicum II (Wolfenbüttel 1618); facs. ed. (Kassel 1958); Eng. trans. D. Z. Crookes (Oxford 1986).


