FOMRHI Quarterly

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FELLOWSHIP OF MAKERS AND RESEARCHERS OF HISTORICAL INSTRUMENTS

Hon. Sec. J. Montagu, c/o Faculty of Music, St. Aldate’s, Oxford OX1 1DB, U.K.
Here we are, late as usual. A bit more excuse than sometimes: we're in the holiday season, so there are large numbers of visitors in the Bate, which mean that I have to leap up from the typewriter and go into the museum (they can't be left to wander by themselves, and anyway a fair number are specialists who want to get at the instruments).

Also, I've been working flat out on the Catalogue of the Handel Exhibition at the National Portrait Gallery next November. They have entitled the exhibition Hallelujah! Handel (don't blame me for that) but if you are within reach of London between 8th November and 23rd February, it'll be worth seeing. Not only will there be most of the known portraits of Handel (and relevant contemporaries, a number of them with instruments visible) but there will also be music and (which is what I've been doing) instruments. Keyboard enthusiasts will be unlucky (chiefly for reasons of space); the only harpsichord will be the Warwick Tabel. String players won't be much better off; a couple of good viols (Norman and Jaye), a Barrett violin, an Ungarini tenor and a Smith cello; the only important (really important, I mean) string is the newly discovered Stainer in original state, and that of course might make the trip worth while even if you know all the others. What's more, there won't be any bows (I tried, but to no avail), nor a tiorba nor a harp (it was space again, blast them; they even turned down an unmarked but almost certainly Stradivarius mandolin, which would have been rather exciting to have). Plenty of wind, though; woodwind doesn't take up much space (I'm not sure they realise just how much space the Dublin Stanesby contra will take up) so there'll be a lot of Stanesby sen & jun and the York Bradbury oboe and the Boosey & Hawkes Wietfelt bassoon as well as both the Stanesbys and a Haka flauto piccolo (from Edinburgh). Brass looks pretty, so there'll be a fair amount of that, too; four Hofmaster horns (the Hellier and the Sharp pairs) and two Leichamschneiders, a couple of Harris trumpets and a Hofmaster and a Winkings (Hellier again). The only percussion will be the Hellier timps, side drum (not on show at Warwick) and tambourine; no room for my double drums even though they are the only known surviving pair.

One quick note re the Stanesby contra (in advance of the catalogue, which will be worth having since everything will be illustrated in it): Galpin, for once, was wrong when he said that the 1739 newspaper advertised a concert including new contras by Stanesby senior; Langwill corrected him, and Langwill was right (we've checked), so that all later references trying to sort out how senior made contras five years after he died were wasted ink; it was junior all the time, and since the Dublin instrument has London / 1739 on it, it's certain that it was one of the instruments referred to. I'll try to find time to do a formal note for GSJ, because this has caused so much confusion over the years.

LIST OF MEMBERS: I owe at least two members (Peter Berg and Graham Wells) an apology. Although they had sent in their renewals, their names weren't in the List. It looks as though one of the lists of renewals that Maggie sends me as they come
in to her may have gone astray. If so, there are doubtless some others to whom I also owe an apology because they also are not in the list. Would they please let me know as soon as possible. Partly because I, and I hope you, like to have the list as complete as possible, and partly because I do sometimes give copies of the list to people who'd like to send you notices of publications or whatever, which might be something that will interest you; mainly, though because the list is the check against the mailing list for the Qs and there is always the risk that if you're not on the list, you might not get the Q.

FURTHER TO: Comm.590, line 8: Friedrich von Huene writes: "There was a newly-made Geigenwerk at the 1985 Boston Early Music Festival Exhibition, and most of the notes worked. The instrument was not yet completely finished. I was impressed by the effort and execution. The instrument was made and exhibited by One Accord, P.O.Box 127, Morral, Ohio 43337. I heard also that Kurt Reichman made one for the Frankfurt Fair 1985."

Various on Varnish: Reinhard Bachofen says he "recently found a reprint on varnishing string instruments with a lot of recipes. Maybe a reader of the Q is interested in this collection". He sent me a xerox of title page: Anleitung zum Lackiren von Streichinstrumenten sowie zur Herstellung der dabei zu verwendenden Beizen, Firnisse und Lacke, von Alexander Rebs. Zweite Auflage. Joachimstal Publishers, Utrecht, 1972. See also the next section.

Bull.59, p.6: Dave way writes:
A mild correction to your remarks on p. 6 of No 39 half a dozen companies or persons are supplying 'real' strings for harpsichords and fortepianos, among them Gug and Rose. As I point out in one of the squibs, I don't 'market' wire—I allow the companies who develop the wire for us to sell it to all comers, and those that can't afford to buy the quantities the wire-makers demand as minimum I will reel off small quantities at cost. You'll find his 'squibs' as separate Comms elsewhere in this Q.

RESPONSE TO A QUERY: Wesley Wadsworth sent a copy of his Comm. 616 direct to George Bowden, who had asked the question, and got a very grateful letter back from George, who is now sorted out (apparently his real problem was the driers) and is now varnishing guitars that he made back in 1983; the trouble that he'd been having had really slowed down his production. It's always good to hear that we have been useful in this sort of way.

MATERIALS AVAILABLE: Wesley also told me that he thinks that a lot of the trouble is that people don't know where to get materials from. He goes on:

There is a company, Wood Finishing Enterprises, 1729 North 68th Street, Wauwatosa, Wisconsin, 53213, which carries the most complete line of wood finishing products and ingredients that I have ever seen. I purchase all of my supplies from them. I will send them a letter requesting they send Mr. Bowden a copy of their 1985 catalog.

I was given the 1984 Bone price list from Nelson Woodworking, Little Compton, RI 02837, USA, which I'll send Eph to print if
there's room (I've had to reduce it a bit because it was on an impossible size of paper). I can't remember who gave it to me (but thanks, anyway; such lists are very useful), but whoever it was spoke well of the quality. Bone is, of course, essential if you don't like plastic and if you are either American or export to America (or anywhere else that won't allow ivory in).

Philippe Joannes is a wood carver who specialises in scrolls and decorative peg-boxes for bowed strings; also carved tail pieces, pegs, pins etc, and harpsichord cheeks. David Van Edwards gave him our name and address. He's sent me a brochure, with photos, which is here if anyone wants to see it. He's not cheap; a plain viol or violin peg box with a woman's head finial would cost £116.80 + for the wood £4.33 for violin and £21.65 for the viol, just to take a couple of examples. If you are interested, his address is 4 rue Moulinto, F-88300 Neufchateau, France.

HARMONIUM: E.J. ter Meulen of Kerkstraat 45, NL-6811 DM Arnhem, Netherlands writes that he has a Merklin-Schutze harmonium in the Belgian-French tradition of around 1856. As he understands that it is a fairly rare instrument (he has sent me photos; it looks quite large and handsome) he thought that some of you might be interested, and if you are he says "my house is open for someone who wants to make an investigation".

PLANS AVAILABLE: There is another Bate plan (drawing herewith as usual), this time of the Bressan Fourth Flute, drawn and kindly presented to us by Heinz Amman. The full size drawing is a two times enlargement of the instrument, and there is of course also a bore measurement sheet. Price is £2.00.

Also elsewhere here is a drawing of one of the two Terton recorders in the Hague Gemeente Museum. This comes from Charles Stroom, and his letter shows such goodwill and willingness to share information with everyone that you may like to read it:

Enclosed you will find a set of drawings, which I have made of one of the two E. Terton alto recorders in the Den Haag Gemeente museum. Although not an engineering drawing, it does contain all information necessary for the maker. Anybody interested could obtain a copy from me and I would be glad to do so for about one pound. Because I do some rather frequent travelling in Europe for my work, I don't care in what currency and if people have real difficulties getting such a small amount of money transferred to me, than 'tant pis' as the French say, I will send them anyway. I have had so much pleasure from drawings made by other people, in particular Fred Morgan's drawings and the Galpin article by Bob Marvin, that I am glad to share whatever I have. Maybe you could publish the first sheet, as you did for the Bate collection drawings. I have also no objection whatsoever, if you copy them for anybody interested and passing by at Oxford. And, please, keep the fee you would charge, as a contribution for the Bate collection.

Also enclosed is a Comm on some of the methods I used for these measurements. It covers, I believe, part of the questions raised by Danny Hathaway in Q39.

As a last point, may I also join the choir of people singing: 'No change, please'? I enjoy the Q's very much as they are, not only the Comm's, but also the Bulletins.
The Royal College of Music are still selling the plans at the prices listed in Q 35, April last year, and Elizabeth Wells reminds me that they still have stock of the excellent Catalogue of the Wind Instruments by Edmund Ridley at £4 plus 70p (UK & Europe), £1.90 (Americas) or £2.10 (Australasia & Far East) for postage. You'll find a review of it in Q30, Comm. 446. See Book News here for the latest RCM production.

While I was in New York, Laurie Libin gave me a copy of the Metropolitan Museum List of Technical Drawings. Do note that title; they are not makers' plans, though there is a good deal of information there.

TOOLS AVAILABLE: When Heinz Amman came here to measure the Fourth Flute, he had all metal tools. More and more museums are banning these (not that this is the answer, either; as Cary Karp said once, there are no safe measuring tools, only less bad ones, and for that matter a clumsily handled plastic tool can do as much, or even more damage, than a metal one). However, he talked to the Lichtenstain firm PAV, who have recently produced a digital read-out caliper gauge, the PAV electronic. This measures, and reads out like a digital watch, to 0.01mm or, at the touch of a button, 0.005 inches. What's more, you can reset the zero to any point if you're working round a certain size. The only thing is that they don't give the size, but it looks like the usual 6" (15cm) (they do also do a 30cm and a 50cm size). This, of course is steel, like most calipers. However, Heinz has commissioned a plastic version (it looks from the photo like plastic guards welded on to the steel jaws external only — I can't see signs of plastic on the jaws for internal measurements, but then there are other tools for that, and in fact he also sent a photo of a beautiful set of plastic ovals for bore measurement). The price of these will depend on the number ordered, and unfortunately someone at the CIMCIM meeting lifted that page of his letter, so I can't tell you how much they are, but I remember that there was an appreciable difference between the cost for 10 and that for 25, and that even 25 came to more than I could afford. If you are interested, write to him. His address is Heinz Amman, Bergstrasse 63F, CH-8712 Stäfa, Switzerland. It certainly looks a lovely tool, and if you have one, you'll never need to read a vernier again (how long since you checked your dial caliper against a standard? When I bought a plastic dial caliper, I took a standard with me — Ken Williams' advice, and boy, was he right — and rejected the first three as inaccurate).

QUERIES: Most of you who go in for flutes should have had a questionnaire from Peter Spohr on what, if anything, makes instruments change their dimensions. If you've not had one, and would like one, write to him; he's in the List of Members. He is always happy to receive visitors interested in seeing his collection of flutes, which is a good one.

PAYING FOR BATE PLANS: (I should have put this in earlier; Peter's letter reminded me). The University's bank is incompetent and the result is that they will not accept Eurocheques even though they say GIRO at the top. I'm sorry, but there's nothing I can do about it; the University is a massive organisation and goes its own way, and so does its bank.
REQUESTS: Danny Hathaway (see p.5 in the last bull.) says that what he needs most are plans for uillean pipes, transverse and duct flutes. He is also looking for a copy of Rockstro's Treatise on the Flute. Does anyone know if the Musica Rara reprint is still available, and if so where one gets it?

MEMBERS' NEWS: Bernd Deja has sent me a list of all the Heinrich Schütz quatercentenary concerts that he and his ensemble Banchetto Musicaie are doing.

MUSEUMS: Elizabeth Wells tells me that the Royal College of Music is open again at last, on Wednesdays in term time from 11.00 am to 4.30 pm, admission 60p. Special visits by appointment with her.

Reinhard Bachofen tells me that there is an exhibition of Swiss musical instruments which is now on in Zürich at the Landesmuseum and will move to Bulle from mid-September to the end of November. There is a good, detailed catalogue in German and French, copies of which are available from Schweizerische Musikforschende Gesellschaft, Musikwissenschaftliches Seminar Universität, Florhofgasse 8, CH-8001 Zürich, and he says that Tony Bingham has copies also. The exhibition covers instruments of all sorts from 1685-1985 (it's part of the European Music Year), and the museum in Bulle is Musée Gruérien.

The CIMCIM American meeting was a great success. We were in Washington to start with, mostly at the Smithsonian Institution, but also at the Library of Congress (Strads and the Dayton Miller), and then in New York at the Metropolitan. We also saw a number of other collections, such as the Selch and Rosenbaum. It was an occasion to see a great many superb instruments, meet a lot of old friends and make a number of new ones, eat many excellent meals (their hospitality was really something), exchange a great deal of gossip, and have a little serious discussion. One quite important discussion was on computerisation, including how we should catalogue, even if not spelled like that. We agreed, and it is hoped that all CIMCIM, ie all instrument museums, will also agree that however we may wish to catalogue in detail, we will all use the same first nine fields for all our entries:

1 COLLECTION (ie the museum it's in)
2 NUMBER (accession / catalogue)
3 LASTNAME (of maker, as one word)
4 FIRSTNAME (ditto)
5 MIDDLENAME (ditto; presumably if he's one of those awkward characters that have four names, like me, you run them into one, eg PETERSAMUEL)
6 DATE (specific or guess, but if the latter 1835c and not c.1835; you want all the the 1835s together in the print out; not all the c's.)
7 ORIGIN (place where made, in order: country, town, since again you want all the German together)
8 TYPE (eg piano)
9 COMMENTS (eg upright)

after which you're on your own and do whatever you like, but this will be a good minimum of basic information.
It would, of course, be nice if uniformity stretched further than these nine fields, but the general feeling was that this was not likely to be practicable; we all have our own ideas of what is important to note about any instrument. Still, if the keyboard boys could get together, and the woodwind and the brass and the bowed and plucked string people, there could be advantages for all of us in the long run.

We have also got one new museum as a member from the meeting; Margaret Birley, who is number two in the instrument section at the Horniman Museum, joined. The Musikhistorisk Museum & Carl Claudius Samling in Copenhagen is back with us, too. And would you please note a change of name (and status – Peggy Downie has got married, on which we all congratulated her) for the contact at the Shrine to Music Museum; she is now Margaret Banks. Also please note the slight change of address; the post office insists on a street number instead of a POBox. There was also another curator there who has been one of our members for quite a while but whom I'd never met before, Eszter Fontana, who is very nice and I’m sure would be very helpful for any enquiries about instruments in her museum in Budapest.

BATE NEWS: The advent of a complete Javanese Gamelan, both slendro and pelog (ie both the Javanese tuning systems) as a most generous gift from the Indonesian Minister of Forestry was quite a surprise. Also very exciting. We are playing it already and it's a superb set. If any of you are interested (it is not what one would think of as FoMRHI main-stream material) I've done one of our usual little 20p catalogues on it, and I should have a complete table of the pitches and intervals by the time you get this (about another 30p at a guess). Thank heaven for the Korg, which makes such a job dead easy when it's combined with a pocket calculator.

You've already been told about our next Weekend. This will be on Recorder tuning, voicing, improving etc. Alec Loretto will be running it. The Saturday, starting at 10.30, will be mostly on voicing, with the evening probably on maintenance. Sunday morning, again from 10.30, on tuning and simple repairs. Then in the afternoon and early evening (until people get fed up and need to get home), instead of the usual concert, we are planning a session for playing Alec's and yours, for any of you who want to bring instruments, and comparing them with each other and with the originals which we have in the Collection. We shall have Alan Davis with us for that session, which means that we can have a top professional playing any or all of the instruments, and thus eliminate any bias in technique and make comparisons more interesting and more significant. It should be interesting, and I hope that you will support it. We have always had a strong FoMRHI presence at these Weekends (much more FoMRHI than Oxford), so we thought that we might slant one very specifically in the FoMRHI direction and make it more a making Weekend than a playing one. The cost is the usual £15 for the weekend or £10 for either day. And I'm not sure that we have any room left to offer sleeping space, I'm afraid.

OTHER SOCIETIES: NEMA was due to launch its report Early Music in Education at the House of Commons a month ago; I assume that it did, but I've not heard anything more about it. I will try to keep you posted on this because, if we get strong early music in schools, there's both our next generation and your customers.
Certainly the NEMA presentation on early music in school at the ISM Annual Conference was very successful and raised a lot of interest. It was valuable especially because the majority of those who turn up to the ISM Annual do are the teachers, both school and private (it's always held in the school holidays, so they're usually free, whereas the majority of the professional musicians are busy, a good many of them belting round the country doing the Easter Messiahs and Passions).

The GULD OF MASTERCRAFTSMEN, about whom I wrote some years ago, have sent me another leaflet. They publish a guide, and if you want to appear in it as a Restoration Expert, all you have to do, as far as I can see, is to send in your name etc with a cheque (1!). If you're one of their members, you pay £11.25 plus VAT; non-members pay £15 plus VAT. To become a member you need someone who will say that your work is wonderful and that he or she has known you for at least a year. Their guide is in libraries and so on, so it could be a worthwhile advertisement, though I must confess that I wouldn't choose a restorer from it.

The Australian Association of Musical Instrument Makers seems to be going from strength to strength; their latest Journal has just arrived here. Their new National Secretary is Graham McDonald, 68 Margaret Street, Petersham NSW 2049.

The American Musical Instrument Society is holding a joint meeting next May, 8-11th, with the Midwest Chapter of the American Musicological Society, at the Shrine to Music Music, Vermillion South Dakota. For further information contact André Larson at the address in our List of Members for Margaret Banks (in the Supplement herewith).

EXHIBITIONS: All of you in the UK, at least, know about the 7th London Exhibition of Early Musical Instruments at the Horticultural Hall, at least I hope you do, and I hope that anybody interested from abroad may be inclined to come over for it. It runs from 8th November (Friday) to Sunday 10th. As usual it's a good opportunity to show your work (and sell it), or else to see what everyone else is doing, meet your friends, renew your FoMRHI subscription (you'll find Maggie Lyndon-Jones on her and Graham's stand), I shan't have a stand this year, but I hope I'll be there; anyway on the Saturday and Sunday, and on the Friday too if I can find anyone willing to sit-in here. If you are coming from abroad for the Exhibition, and want to come up here before or after, I look forward to seeing you. Try to let me know, though, as I can get booked up with teaching etc.

It's probably too late to tell you, at least as an exhibitor, but the Utrecht Early Music Festival is on from August 30th to September 8th, and it includes an Early Music Fair with instruments, records, music and books. Write to: Utrecht Early Music Festival, Nieuwegracht 48, NL-3512 LT Utrecht or telephone 030-313737 in Holland. The only thing they don't say is where the Fair is going to be (it's in the foyer of the small and big halls; what halls?).

PUBLICATIONS: (see also BOOK NEWS) John Hanchet has produced a little pamphlet on Early Bassoon Playing from French sources, with reproductions of historic fingering charts for 4-7 key instruments, and a transcription of them for comparative purposes. Also Ozi's instructions on reed making (1803). If you want a
copy send John the nearest bit of paper in your currency to £1. His address is in the List of Members.

I mentioned in Book News of Q38 (p.9) that William McBride was bringing out a series of books on French instrument makers, starting with Buffet Crampon. Due to computerisation, there's a delay (you know, a better machine appears, so you hold on till tat's ready) and a change of plan; the first one will now be on Selmer and should appear before the end of this year. It does sound like a worthwhile series for any of us interested in the 19th century instruments (whether he's going to go back further than that, I don't know). I hope we'll get review copies, and anyway I'll keep you posted. He is now planning (this was a good deal of the cause of delay) to publish in three languages, French, English and German, so you'll have a choice. His address is in Q 38, p.9.

MY MOVEMENTS: I'll be in Italy September 2nd to 9th on a conference in Trento for the last part and, I hope, with Marco Tiella the first part. Perhaps I'll get the chance to meet some of our growing number of Italian members.

Before that maybe some holiday, with any luck. However, I hope that the Bate will stay open; a student has appeared who is interested in helping and is willing to sit-in most afternoons anyway, if not all. She won't have keys, though, so if you want to get at any instruments, do ring first to see if I'm here.

I'll be here from September 10th onwards; it's still vacation but the diary is already pretty full. Some of it is things like the Jewish Holy Days and meetings, so again do check if you need to get at things, in case I'm out for the day.

DEADLINE FOR NEXT ISSUE: October 1st, and let's hope that things are less hectic than they've been this month so that I can get down to it.

That's it for now, but I'll keep this open while I do the Members' List Supplement in case anything else comes in.

POSTSCRIPT: Nothing has come in that is at all urgent. However, we are even later than expected because Eph has been running a course, and I've had a bereavement in the family; not unexpected, but it has produced a certain amount of chaos as these things always do. The net result is that we are a week further behind than expected.

It has sometimes been suggested that we should dateline these Qs by the month of issue, rather than the month of compilation, ie that this should be August, not July. What do you think? My own feeling is that I write the Bulletin in July, and therefore it's the July Bulletin; when we are lucky, it does actually go out before July is finished, but we're not often as efficient as that. I feel that to date it August would mean, in the end, that it might not go out till September — you know by now what we're like. Think about it and let me know if you are sending anything in, and otherwise try to remember to comment when you renew your sub (I'll try to remember to put the question again on the renewal form).

Enjoy what's left of the summer by the time this gets to you (if in your country there's been a summer; ours comes a couple of days at a time and then goes away again).
Exhibitions: There are still free places available for makers to exhibit at the Northwest Early Music Festival on the 12 - 13 weekend of October and at the Early Music Competition at 2 November. Contact me (061-831 8134).

Symphony: Jeremy’s Comm 96 “A Hypothesis on the Symphony” suggested that the mechanism was like that of a clavichord, with dog’s-leg key levers. I incorporated this into a prototype design with the key plane lying diagonally in the box. In this way it plays in all the positions seen in the pictures. An instrument-making student made it and it worked a treat mechanically. It was not a complete success though because bridge adjustment was very awkward. I postulated that the lid was the soundboard, and my design had it sliding in through slots. The student left the class before we could modify the design so that the soundboard-lid would be fixed to the parts of the box that include the wheel and strings, with access for adjustment by sliding out the two sides involved with the keyboard. In conclusion, the problems were all with my design of the soundboard; I am convinced that Jeremy’s idea was spot-on.

Comm 608: This was one of the two April Fools in 0 39. But Comm 608 was poking fun with purpose. The main serious point, as I read it, is that analysis using the apparatus of scholarship (logic and principles) is not necessarily convincing. In the short term this is clearly true. Most people have little training (or joy) in spotting the fallacies in apparently logical arguments and so, lacking the confidence that they can (or will bother to) distinguish between the valid and invalid, mistrust them all. These people rely completely on intuitive feelings of truth, and these can only be changed if someone offers an alternative insight which is clearly more attractive on an intuitive level. The potential attractiveness of an alternative decreases with the length of time that the particular truth has been believed in. Even the most disciplined of scholars suffer from such problems to some extent. The history of scholarship is dotted with examples of problem solutions which were not appreciated by most practitioners in the field at the time, but were accepted later when a new set of practitioners could consider the merits of these solutions without the burden of long-held beliefs.

Policy: For the previous 0, a member sent an old article from a defunct publication as a Comm. In it a violin maker wrote about instrument quality. I didn’t include it then because of possible copyright problems. After assurance there was no such problem, I’ve decided not to include it anyway. There is a new aspect of policy here, and members should have the opportunity to discuss it. The position I’ve taken is that I will include any normal-length Comm written by a member if it is consistent with FoMRHI’s purposes, regardless of quality as I see it. If it is rubbish, members have a limited right to make fools of themselves and take the consequences. When an article or reprint by a non-member is offered as a Comm, I will only accept it if I think it is really useful. That non-member does not have the same rights, and he or she is not around to take the consequences if it is rubbish. Some quality criteria should apply to very long Comms from members, but I haven’t yet had to make such decisions. I am not married to this policy and will seriously consider arguments for alternatives.

Crookes: Every organization is better off by having a trouble-maker like D. Z. Crookes around. Such a rebel is successfully ignored by most, but he can be stimulating to those who are open to having their assumptions questioned and are willing to discover how well these can be defended. This is all constructive stuff, even if the rebel is not similarly open. Even insults can be constructive if it activates someone into a reasoned defense. Unfortunately the Latin saying at the end of Comm 637 was not presented so that it could work this way. I will counter with another saying; ‘people in glass houses shouldn’t throw stones’. (continued on p.16)
Some of this ought to be reviewed (and maybe it will be) but for this Q, we're far enough behind that I don't want to hold things up any further. So no Grove Instrument Dictionary from me this time.

Royal College of Music Museum of Instruments, Guide to the Collection by Elizabeth Wells. A very useful 16 page Guide, well illustrated, covering the history of the RCM Collection and giving a surprisingly comprehensive overview of what's in the Collection, mentioning most of the most important instruments. Well worth the £1 (plus 30p postage inland) that it costs.

Kevat Publications have produced a Diary, Catalogue and Directory of Crafts in East Anglia, for £3. It lists craft fairs and that sort of thing; there is a directory of craftsmen and the craft they craft, and an index of crafts. More useful to be in, if you're in that area, than to read as far as any of us are concerned, I think. If you're not in (and most of you aren't) and live in that area and want to be, the man to write to for future issues (this is their second) is Kevin Hickford, Kevat Publications, 'Shallcotts', Poslingford, Sudbury, Suffolk CO10 8QY.

The Hurdy-Gurdy Society has produced a 'new-look Journal' in A4 size, word-processor produced (I think) with a good deal of illustration. Copies cost £3.00 + 50p p&p to non-members. Members get it free (I imagine) twice a year, and membership costs £6 for UK, £6.50 abroad surface mail, £8 by air. Judging by what's appeared so far (they're up to no.5), most issues consist mainly of useful practical material, though those for this year seem to be mainly reprints of other material (Chris Page from GSJ 35 — don't hurdy-gurdy people read the basic literature such as GSJ? —, translations of Canteloube & Gauthiez on Bourrées from the Auvergne — useful for those who don't read French —, and extracts from Henry Mayhew. There is, however, a good deal of practical material as well. If you're in that line of instruments, you probably ought to see it (you probably ought to join their Society anyway); their address is Pipers' Croft — opps, no it isn't; that's the Muskets. The chap to write to is Richard Smith, 'Farthings', 25 Leith Road, Beare Green, Dorking, Surrey. And I've spotted a note which says that it is free to members and that back issues cost £1.50 to members, £2.50 to non-members. One point: I'm not impressed with a production of something that inevitably has a lot of French material in it and which cannot be bothered to get a typewriter, printer or what you will, which does not have accents. Either you do it properly, or you don't bother, to my mind.


Klang-Dokument: Claus Bressan, 17 Blockflöten; F. C. Dieupart, Suite c dur; Telefunken 635063 EK / B. Bopp, Sonate a moll; Telefunken 635073 EK.

Kernspalt gewölbte Laubum geöffnet auf 1 1/8 - 1 1/2.

Geöffnungen: T: leicht oval in Längsrichtung, Unterschneiden, fast stark unterschneiden, Bruchschenkel auf allen Teilen.

Gemessen im Juli 1983 / Zeichnung
Boxwood, dark stained, original colour visible in sockets.

- All larger turnery nugs rather sharp (see no. 4), not shown in drawing. (Drawing made by my made from light source)
- Each in head/nut channel from N to S (west)
- Annual rings E-W
-南北 straight
- Nearly straight
- Total length 1910
- Total length = 243.9

- Fingerholes made on very clean, rather soft wood
- Small bore point, possible additional hole for all holes (except 1)
- Foot back length 103°
- Foot back length 103°

WARNING Turnery nugs not drawn to center of bore in foot
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<th>Accession number</th>
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<td>06.194</td>
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<tr>
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<tr>
<td>&quot;M&quot; (18th century)</td>
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<tr>
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<td>89.4.3133</td>
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<td>13-00234-0 M0234</td>
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All drawings are printed on paper in full scale. They are intended mainly for organological research, hence some internal details and measurements needed by builders may be omitted.

Please order drawings by indicating the order number and mailing a check or money order payable to the Metropolitan Museum of Art to: M.M.A. Mail Order Department; Box 255 Gracie Station; New York, New York 10028. (X-rays and photographs of these instruments may be ordered by accession number from the Museum's Photo Sales Department, Fifth Avenue and 82nd Street, New York, New York 10028.) Please include postage and handling fees as follows: Orders of $10.00 or less: $2.25. New York State residents should add the appropriate sales tax.
BONE PRICE LIST 1984

TERMS: ADVANCE PAYMENT. Foreign payments should be made in U.S. funds payable at U.S. banks or U.S. branches of overseas banks, or by international money orders.

MINIMUM ORDER: $25.00

SHIPPING: Shipping is prepaid and insured EXCEPT for overseas AIRMAIL. Please add to the cost of your basic order (before discounts and added percentages) 8% for Europe, and 10% for Japan, Australia and New Zealand. Excess will be refunded. Shipping time on standard items is usually within one week from receipt of order.

METRIC: We will cut metric dimensions.

EXTRAS: Extra pieces will equal 3% of your order.

SHARP TOPS 1/2" x 1/16"

Price in dollars per hundred:

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<td>4 1/2</td>
<td>1.00</td>
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NATURAL STOCK 3/32", heads 15/16", and tails 5/8"

Please state head and tail lengths. Also state whether you want heads and tails separately or contiguously (with the latter you must cut your own sharp space).

Total length in inches up to:

Price in dollars per octave:

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<td>6 1/4</td>
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Contiguous stock is available up to 5E" only and in standard and antique grade only. The longer lengths are not as clear of bony characteristics as the shorter. Antique grade contiguous stock is in short supply, especially in the longer lengths longer than 5E" should be ordered two
ANTIQU MARK: Looks like the antique keyboards. Last year was the first year that the antique grade was officially offered. It became popular and by year's end accounted for one third of my sales. I am now having trouble keeping enough of it in stock.

STANDARD GRADE is selected to have very few of the large pores characteristic of bone and is grease free.

TOP GRADE looks most like ivory and is without large pores.

SAMPLES sent on request.

RAM AND CATTLE HORN: Please inquire.

ENGRAVING BLANKS: 1/8" by up to 1 3/4" x 5", .70 per square inch.

STOP KNOB FACE DISCS: State diameter. $1.70 each.

ARCADE or nosing stock, state size wanted and ask for quote. This stock does not have arcades cut into it.

SOLID BONE SHARPS: $4.00 each or less, depending on complexity and quantity. Send side and front profiles.

GUITAR AND LUTE NUTS AND SADDLES: State size wanted and ask for quote.

VIOLIN BOW FROG BLANKS and other odd shapes. Please inquire.

MACHINING is accurate, flat, parallel, and except for sharp tops, ends are ground square in both dimensions. Filing, sanding and polishing after gluing down is still necessary, however.

TOOLS: Bone is harder than ivory but works well with hand saw, file, cabinet scraper and sand paper. Use good furniture glues.

1984 IS OUR 10TH YEAR!

BULLETIN SUPPLEMENT (continued)

Crookes sent along a reprint of an article he published in the March '85 issue of "Music Teacher". It is about a D I Y music stand he designed for schools. It is not FoMRHI stuff (though I would love to have some Comms on historical music stand designs). If interested, write for the article and a rough working drawing to him at Ballymena Academy, Ballymena, Co Antrim, Northern Ireland.
I must remind readers that the critical comments here are intended to correct errors and to suggest improvements for future editions, and should not be construed as a general condemnation of the publication. The vast majority of what is there-written is very good, and that is not being discussed here.

Acoustics

1. String Instruments (by J. C. Schelling and C. M. Hutchins)

1. Foundations! This section claims to be relevant to all bowed and plucked instruments but it is strongly biased towards the violin family. The discussion of the function of the back is not relevant to any other instrument.

2. Bowing! Hutchins has really let stand Schelling’s 1973 speculation that the all-gut violin G string was inherently unsatisfactory. Such a speculation itself is a historical absurdity—people would not bother to acquire and use an unsatisfactory component in a creative art. Schelling hadn’t imagined that the elasticity of gut strings can be varied by amount of twist and rope construction.

b. The Plucked String! This section is somewhat confused in several comparisons between plucking and bowing. It is stated that the movements of kinks in opposite directions after the pluck "are identical to the modes of motion described for the up-bow and down-bow action in the bowed string”. While it is a mathematical sum of the two modes, this is apparently not what is said. It would have been helpful if it were stated that the envelope of the kink motion is a parabola (on each side of the resting string) in the bowed string and a parallelogram (with the resting string a diagonal) in the plucked string.

Another confusion has to do with a comparison of the content of higher harmonics in the tone of a plucked and bowed string, and how this varies with the position of plucking or bowing. For this comparison they introduce the Helmholtz approximation of the bowed string where the flyback (or slip of the stick-slip sequence) is instantaneous. It is stated that this is independent of the position of the bow on the string. This does not approximate the real situation (except for bowing on the bridge), as is obvious from material elsewhere in the article. Though there is no argument with the conclusion that "a wider range of timbre is possible by changing the point of plucking than by changing the point of bowing" it does not seem to follow from the argument.

A most astonishing comparison is that inharmonicity due to string stiffness occurs in plucking but not in bowing. In Schelling’s classic paper “The bowed string and the player" (reproduced in Hutchins’s book “Musical Acoustics Pt 1”), inharmonicity in the bowed string is well discussed (including the above-mentioned speculation that inharmonicity made the all-gut violin G unsatisfactory).

7. Current Research! Written in the discussion on the New Violin Family is “those instruments provide consistent quality of string tone covering the musical range and bring to fruition a concept of Praetorius”. The concept of such a consistent set of instruments developed a century before Praetorius, and applied to sets of a wide variety of instruments in the 16th century. It applied just as well to the family of viole da braccio as to the viols (which Hutchins is referring to, as is apparent in her previous publications). The 5-part fiddle dance-band tradition which extended from the late 16th
century onwards (exemplified by the "24 Violins of the King") is another historical example which is more relevant than viols for Hutchins's purposes. I haven't noticed a specific enunciation of this concept in Praetorius's writings.

II Keyboard String Instruments (by D. W. Martin)

1. Foundations: This section claims to be relevant to harpsichords and clavichords as well as pianos, but is strongly biased towards pianos. The contribution of inharmonicity to the characteristic timbre is only relevant to the piano (on the level of superficiality expected in a Dictionary article).

2. Clavichord, and 3. Harpsichord: My knowledge concerning early keyboards is not wide, but I suspect the author's is less so. In his Table comparing instruments, he has no entry under the clavichord for overspun strings while I know that large 18th century instruments used them. The corresponding entry under the harpsichord has "fine guage". He was probably considering modern instruments of a generation or so ago. For string materials he gives "brass/steel", neglecting copper and not realizing that wrought iron was used rather than steel. For number of strings per key, he neglects unison ranks for both clavichord and harpsichord. He seems to be under the impression that a spring is involved in harpsichord damping. I was surprised by his statement that unfretted clavichords give better tuning than fretted ones. I would expect this to be the case only with more than one string per note and no angling of the tangent.

4. Piano: The statement that "Cast iron plates to support string forces and steel piano wire of higher tensile limits permitted larger wire diameters and higher-tension strings..." should not include stronger steel wire. This only allows longer strings for the same pitches. One doesn't need greater tensile strength of the wire to make it thicker and increase tension.

Air Column (by P. Bate)

Since energy lost in heat is mentioned, it would have been useful to include the point that the energy lost in friction at the walls is greater than that emitted as sound.

Amati (by C. Beare)

It would have been good to mention that Nicolo made excellent double basses.

Angel Lute (by I. Harwood)

I would have expected a discussion of Mersenne's 1636 writings on the subject in Proposition XI of the Second Book of String Instruments. Mersenne seems to have described taking an ordinary 15-string 8-course lute and separating the courses having one string per note in a diatonic scale. There would then be an open-string range of an octave and a seventh. Only the highest three strings were fingered.

Archlute (by R. Spencer)

The article mentions a metal-strung archlute in the Paris Conservatoire Museum, and explains the purpose of the bend in the soundboard at the bridge (like a Neapolitan mandolin) as "to withstand the extra tension of metal strings". It is rather more likely that the opposite is the case, and that the bend is to decrease the angle the strings make as they pass over the bridge and thus increase the downbearing of the bridge on the soundboard. This will improve the sound of the strings, especially at low string tensions.
Points that would improve the article are:

(1) Piccinini mentioned three sizes.

(2) The iconography shows three styles of pegbox for the long strings: the folded swan-neck Italian style, the reverse-scroll French style with the nut directly on the neck, and the style mostly seen in Flemish paintings where the strings go over a nut at the end of the neck and down again along its back to a cut-out pegbox just above the one for the fingered strings.

(3) The change of musical function in the second half of the 17th century where the archlute successfully competed with the theorbo in continuo playing (as mentioned in the article) can be associated with a doubling in length of the neck extension. This was probably the result of the introduction of overspun strings on the lowest courses of the fingered strings, keeping the same tone transition from the short to the long strings as before. How overspun strings could have improved the situation then is not clearly stated in the article.

**Arpicordo** (by D. Wraight)

Amongst the speculations as to what this instrument was, not included was one that it had the arpichordum string-buzzing system as described in the just previous entry in the Dictionary. There may be good reason for this possibility to be ruled out, but that needs to be stated because the juxtaposition of the two entries seems to make this the obvious choice.

**Aulos** (by J. W. McKinnon and R. Anderson)

In speculating about how the aulos was used, the article hints at but does not directly mention the practice of heterophony - the simultaneous playing of unembellished and embellished versions of a tune.
Review: John Barnes, Making a Spinet by Traditional Methods, Mac & Me, Welwyn, 1985, 52pp, 24 figs., £4.50.

Jeremy briefly reviewed this booklet in the last issue, and suggested a further review might be useful.

In the Introduction to the booklet there are two possible uses of it which John anticipates: firstly he mentions using "the booklet as a source of general information on the constructional methods used by makers ... during the 17th & 18th centuries" (one could add 16th here) and secondly he suggests that the booklet "be used in conjunction with the full sized drawing and photographs" by someone actually wishing to make a copy of the bentside spinet by Keene and Brackley. In this regard he says he wants "to enable anyone with a knowledge of basic woodworking techniques and tools to make an instrument even if he has not previously done so".

As for the first of these objectives, this booklet is a mine of information, within the limitations of 50-odd pages. Even the most experienced builder will find much of interest here. The second objective, however, is surely too ambitious for a booklet and a plan, (there isn't even room for a glossary of the technical terms), and I think the novice would need to start with the bibliography.

The more experienced builder will, as I say, surely find a lot of interest in both the booklet and plan, and I hope they will take up John's suggestion to share any further insights they may have. To start the ball rolling, I conclude with some samples of what John has to say, together with some observations of my own which have been prompted by studying this work.

The first chapter is on the bentside and baseboard. One of the omissions on the plan is the grain direction of the timbers (particularly the soundboard, lid and registers). The booklet acts as a useful supplement in this respect. Concerning the bentside, John describes a cold soaking method: what is new over Malcolm Rose's methods is that the long soaking and drying times are found to be unnecessary; even at a cool 15°C a couple of days drying suffices. I can add that the hot iron method proved considerably trickier on my thin plank of walnut than it does on Flemish bentsides! John's method may well have the edge. John mentions that "the result will be good so long as your curve does not deviate from the original by more than about 5 mm". One wonders if this is an observation about the old instruments (i.e., that the maker regularly aimed for a consistent bentside to within that tolerance, as evidenced by the extant examples conforming to this), or whether it's John's experience that variations larger than this would call for compensatory variations in other features (e.g., soundboard thicknesses, soundbar positions, etc).

Concerning the marking out of the bottom, John suggests that the position of the spine was determined by measuring back from each end of the keywell perpendicular to the keyboard, to find two points which connected up and extended give the line of the spine. This idea is weakened by John's observation that the bottom was made up economically by cutting up a long board at a sharp angle - the angle, in fact, of the spine to the front of the instrument. This angle turns out to be a quarter of a right angle, so it would seem more likely that geometrical means were used at least in the original design. I say in the original design because it seems likely makers often simply traced parts out from the previous instrument. How else to explain why some of the Ruckers instruments have just the bare bones markings of the 1644 'Vleeshuis instrument, while others have 2 bridge and nut and each half-octave (c and f# strings) marked onto the baseboard? The quarter right angle also turns up in the Rucker's 1644 original design, as the angle between treble strings and nut for the spinetten (the muselaars having 1/5th of a right
I angle. John's method of working by measurement would have it that the taper of the wrestplank is the result of the measurement to the back of the keywell being slightly greater in the bass than the treble. If one follows the implications of this through, one finds that, because the register blocks are parallel to the spine, and because the line of slots in the blocks is parallel to the back of the wrestplank, then those measurements on the baseboard have in fact determined the geometry of the register blocks. In particular they give the angle 26.5° for the register blocks which John quotes. Only when you realise that this angle means that the separation of the slots along and across the blocks is then precisely in the ratio of 2:1 (that is 26.5° = tan 1/2) does it become apparent that the measurements John quotes must have been the result of a geometrical approach on the part of the original maker.

A more practical point raised by this chapter concerns the technique used to glue the register blocks together. I ran into difficulty with John's method so instead I worked the grooves into rectangular blocks, and then glued them up by pushing them against each other between two solid 'walls', whose separation was adjusted to force the blocks to the correct angle. This method had the advantage that all the blocks could be glued straight after each other. I don't suppose that my method was inherently better, but (perhaps because I thought it up) it 'worked' for me. It is generally the case that there are a lot of factors involved in an apparently simple technique which reside in the craftsman's unconscious. Before leaving the section on the register, I should note that the suggestion to position the middle slot of the register according to the drawing seems somewhat contrary to the spirit of the book — it would seem that the original method was to position the register so that the first and last slots fell nicely in the keywell. One last point about the register blocks: John mentions that they 'vary considerably' — it would have been nice to have had a few typical measurements, since then one could check that one's own work was within Keene's standards of accuracy.

The chapter on the case sides is very well done, with evidence from glue runs etc being adduced to suggest a plausible procedure. One small omission concerns details of the nails (iron or wood?) — perhaps no x-rays have been done. The construction of the keyboard is also well covered. One problem I've encountered working with ebony naturals is the difficulty in seeing the marking out on the black wood. I've tried filling in with chalk and papering the ebony first, but perhaps someone can suggest a better way. One thing only briefly touched on, is the gluing of the sharps: with ivory sharps and animal glue, these need only to be rubbed in situ, while the alternative of ivory coloured resin that John suggests would presumably need some special technique.

In the chapter on the soundboard, John does not waste any time creating an aura of mystery over soundboard thicknesses; you will find no mention of tapping the planks or judging the weight of wood to work to by the 'feel' that you have acquired after long occult initiation into the secrets of the luthier's art. He simply assumes that you will make the soundboard to the same thicknesses in the same places as the original, and gives details of what is surely not intended to be a traditional method of doing this. There is a very good reason why he should do this: the one thing above all that has detracted from the quality of sound of modern harpsichords is the attempt by makers to run before they can walk. This can be seen in attempts to improve jacks, registers, bridges (if you laminate this spinet bridge you increase its stiffness in the treble enormously...), etc. In this spirit, makers try to thickness soundboards following all sorts of theories and fancies, frequently ending up with dimensions that bear no relation to the sort of thicknesses encountered on old instruments. That is not to say that it is enough to copy the dimensions of an old soundboard (John mentions that this particular one is thinner than most), but most makers would benefit greatly by making the old dimensions their starting point, getting themselves into the right ball park, so to speak.

The discussion of marking out the bridge pins is perhaps the weakest part of the booklet. John suggests that "it is probably safer nowadays to copy the bridge pins from the full-sized drawing". From the evidence of the knife cuts on the bridge it seems clear
that Keene had a ruler one end of which he aligned with the spine edge of the soundboard, and he simply slid it along marking out the mean position of the pairs of pins as he went. This need only roughly be done since the pin positions themselves can be evened up by eye – the purpose of the knife cuts is to stop you getting out of step. One omission here is the diameter of the pins – it is mentioned that there are two sizes but no more details. There is also here no mention of how to determine the correct shape of the bridge, or where to position it on the soundboard. One possible approach is to draw in the nut (so that it straddles the wrestplank by some rule of thumb, say) and then to arrive at a bridge shape by string lengths (a equilateral right angled triangle has its sides in the ratio of the c to f# strings, or perhaps another ruler was used). The nail holes may have been made in the soundboard at this stage to enable the bridge shape to be transferred to a plank of wood for the bridge to be cut out.

The chapter on jack making should do much to encourage people to take the plunge in this matter. It is a shame that the original jacks don't survive with his instrument, since a quantitative discussion of the variations in slot size and jack size would have been most interesting (one can approach the question of wear by comparing the rarely used with the most used slots).

The chapter on stringing and quilling is the longest in the booklet, and here again there is much food for thought. One point that is not mentioned is that the nut pins shown on the drawing are in fact the positions of plugged holes in the nut – that is the presumed original nut pin positions. John wrote to me telling me about this when I queried the eccentric positioning of the nut pins, it seems that the instrument has distorted somewhat, so that the drawing shows the instrument in its present state rather than as Keene left it. John notes the irregular tuning pin positions, such irregularity seems to be the norm on old instruments; one possibility is that the positions of these pins was determined by eye – firstly every 9th pin to give a fair angle over the nut, and then the rest filled in at half, quarter, eighth position. No mention is made of marking out the hitchpins which are even more vexatious. Quilling with quill is a subject about which the most contradictory notions abound; one hears reports of instruments in continual use with negligible maintenance, and of quills breaking every few hours. John finds that quills work well without oil, whereas I find that roughness can start to build up on the top of the quill, causing loud plucks and rapid wear.

In conclusion, even if you are not interested in spinets, and can't afford the plan, this booklet is a must for the historically oriented harpsichord builder.
Since the publication of Frank Hubbard's Three Centuries of Harpsichord Making, his explanation of the extra, elevated string for each upper manual E♭ on Ruckers transposing double harpsichords has generally been assumed to be correct. On page 66, after crediting Gustav Leonhardt with the suggestion, Hubbard explains that the normal meantone sequence of semitones (C, C♯, D, D♯, E, E♭, F, F♯, G, G♯, A, B♭, B) presumably used on the upper manual would produce on the lower manual, which plucks the same strings, the same sequence of apparent semitones (upper C corresponding to lower F, C♯ to F♯, etc.) with one exception. The lower manual would have an A♭ rather than a G♯. The extra string provided an apparent G♯ on the lower manual making the sequence on both keyboards identical. It then appears that the lower manual is a transposing device. However, years of searching for 17th century musical applications for such an elaborate contraption have not proven very fruitful.

Let us suppose that the tuning of the E♭-D♯ pairs of strings were reversed. Then the semitone sequence of the upper manual becomes C, C♯, D, D♯, E, E♭, F, F♯, G, G♯, A, B♭, B with C, C♯, D, D♯, E, E♭, F, F♯, G, A♭, A, B♭, B on the lower. Good major triads on the upper manual would occur on C, D, E, F, G, A, B♭ and B and the lower manual would provide good major triads on C, D, E♭, F, G, A♭, A and B♭.

I suggest that these curious two manual harpsichords were not transposing devices after all but instead were conceived as an ingenious extension of the tonal resources of the meantone tuning system. The upper manual was meant for sharp keys through A major including leading tones in A and E minor. The lower keyboard was for flat keys as far as E♭ Major and provided leading tones in D, G, C and F minor.

I will welcome all ideas and evidence that might support or contradict this hypothesis.
After reading Richard Shann's Comm 501, I hastened to call Richard Repham, Curator of the Yale Museum of Musical Instruments. I knew he would be interested in the news that his 1770 Taskin, perhaps the most interesting survivor of that master's work, was not authentic—at least not completely so. For no less an authority than Richard Shann had proclaimed that "Obviously it is impossible to make a completely authentic instrument."

But I could console him with the further news that he had in his office an authentic Taskin in the instrument made by Rutkowsky, because according to Shann, "Authentic means 'like' the original," and his Rutkowsky had many features that were like the Taskin. So while his Taskin was not authentic, he had an authentic Taskin after all.

I also informed Richard that this upside-down usage of the word authentic was the "commonly accepted meaning in the Early Music field", something that neither of us had known, even though we have been mucking about in the Early Music field for twenty five or thirty years. Live and learn.

If it is really true that in the Early Music field the word authentic is used to mean what in all other fields would be called a copy, or a fake (if the intention of the copy is to deceive), I wonder if we should not abandon our special, upside-down meaning of the word and join the rest of the world.

Authentic would then mean: "of the authorship or origin reputed; of genuine origin", an enormously useful concept that we can scarcely do without. To the true scholar, the true connoisseur, the word authentic is a sacred one. It is not something 'like' the original, it is not a copy of the original—it is the original, the touchstone of our understanding. It is worth much effort, thought, study and searching to distinguish the original from copies, school pieces, student pieces, fakes, imitations, etc.

Copying is not reprehensible. When one works in a tradition, one copies many things, unavoidably. It is only when copying becomes the central intention that it becomes absurd—and unprofitable. The work of past masters is valuable to us because it allows us to avoid re-inventing the wheel with every generation. If we are wise, we will study our tradition as deeply as we can, steal everything we can from the Old Ones—even as they did in their day.

But when we take our tools in hand we must pride ourselves not on how exactly we have copied, but how well we have acquitted ourselves of the same charge that the Old Ones accepted—the making of an authentic instrument of our own, the finest musical instrument we can make, not the closest copy we can make of someone else's work.

It is when we try to sell our work as 'authentic copies' instead of because they are valid musical instruments that we come close to dishonesty. How many times have I been told that I ought to praise a maker for an instrument because it was an exact copy—and never mind whether it was useful for the music. How many faults in such instruments have I been
asked to excuse because the copy was exact, and therefore the faults 
must belong to the Old One instead of to the copier? In what other field 
of human endeavor is a copy of an original considered worthy of praise?

Skowroneck put it neatly, "Eine sklavische Kopie eines Kunsterwerkes is 
niemals ein Kunsterwerk, aber eine Nachschöpfung kann sehr wohl eines sein."

So let's stop bragging about our 'exact copies', our 'authentic copies', 
stop claiming that 'authentic' means only 'like' the original. You only 
copy what you do not understand—once you understand you cannot be 
bothered with copying—you are doing your own thing, making your own 
authentic instruments—just as the Old Ones did.

While you are slavishly making your 'authentic copies' you are avoiding 
the task accepted by the Old Ones—which is to use all your wits, ears, 
knowledge, skill, and understanding to make a musical instrument. Because 
the Old Ones were not idiots, you will copy many of their techniques, use 
much of the knowledge they have left us—as much as you can. But if you 
fail to make a musical instrument, you will not blame them, and if you 
succeed you will not brag about how closely you copied, but take the 
credit that belongs to you.

An authentic instrument may be good or bad. The only authentic instrument 
you can make is your own. Let's give up the oxymoronic and tautological 
locutions which attempt to bestow virtue upon ourselves for reasons that 
would only earn us scorn in any other field.

I spent a disturbed weekend trying to discover where I had ever said I 
had made an exact copy of anything, and finally found what Shann was 
talking about in an ad by The Early Music Shop, and Richard Wood will 
say three Hail Marys for having committed the sin. The vice was in the 
word 'exact' as a modifier of 'copy', which is, of course, beyond mortal 
means. But a minor thing compared with claiming to make 'authentic copies'.

One has little trouble with the case becoming deeper on the small Flemish 
instrumets. With only two choirs to get off in the key dip, there is 
plenty of room, and the touchrail avoids the drastic increase or decrease 
in key dip one encounters in a French double with a jackrail stop on the 
action. It is stopping on the jackrail that makes the problem, and 
shimming under the keyboards is the remedy for case movement. Soundboard 
movement requires other remedies.

I now use threaded rod up through the bottom, to move the backrail on the 
lower manual, thus saving having to take the keyboards out.

One occasionally finds makeshift end adjustments on old jacks, but they 
are (so far as I have seen) cobbled by someone other than the builder 
long after construction, and if one searches one can usually find the 
reason for the cobbling. One finds many pentimenti in the old instruments— 
nut and bridge pins that have been moved—in the lovely little ottavina 
at Yale it seems very clear that Taskin himself plugged and redrilled 
the tuning pins. But the normal standard of workmanship seems to have 
begun to cut the jacks to fit, and not to depend on shims glued to the
bottom of the jack. The idea seems to have been to make things right in the first instance and then leave things alone.

Hubbard gives the quotation from Blankenberg in full, so let us read it and stop pretending that he said something he didn't. He says not to mess up the scaling of a Ruckers harpsichord because you are apt to break the wire, and hurt the sound of the instrument—the Ruckers brought a whole host of factors into a critical balance—strength of case, soundboard bearings, thickness of soundboard, etc., etc. But no where does he way that he feels sorry for the Ruckers because they couldn't obtain wire strong enough and that their design was limited by the tensile strength of the wire. The standard tables of tensile strength obtainable from iron with as little as .2 percent carbon give 239,000 psi, which will accommodate (with a 35 percent reserve for friction, making loops, bending around pins, etc.) a pitch well above A 440, or a considerable increase in scale length.

At no time have I ever tried to 'market' harpsichord wire. The idea that modern piano wire was perhaps not the best thing for harpsichords goes back to Dolmetsch, and dozens of harpsichord makers since then have tried hundreds of experiments. Hugh Gough had several kinds of wire made, and Frank Rutkowski was using a secret special wire in the '50s. For a while there was a flurry of interest in 'high carbon wire' (before research proved that the Old Ones used iron remarkably low in carbon—remarkably low because elimination of carbon from wrought iron is labor intensive and expensive). In 1970, the best harpsichord wire we could obtain was the Schütze wire; his 'red' wire was drawn too close to the theoretical tensile strength, without enough margin for friction, but his 'blue' wire was very good indeed.

This fall Martha Goodway of the Smithsonian Institution promises to publish the results of her long continuing research into samples of old wire. We all look forward to this with eagerness, even though the main gist of her conclusions has been discussed among us for some time.

Schütze's wire had convinced William Hyman and myself that a lower tensile strength was desirable for the instruments we were making then. On most harpsichords being made at that time, you could not hear any difference between 'hard' and 'soft' wire. Hyman's Law was in operation: "Until you get enough things right, nothing makes any difference; once you get enough things right, everything makes a difference."

Schütze's wire had one serious drawback for me—it was not protected against acid in the air, and against that small percentage of the population who have so much uric acid in their hand-sweat that the touch of a finger causes the wire to etch.

After several years of experimentation, National Standard succeeded in making a relatively low-tensile, tinned 'mandolin' wire for me. Soon after we began using it I had a call from National Standard asking me if I minded their selling the wire to Frank Hubbard; they felt I had the right to refuse since I had paid for the research and development.

I gave them the permission to sell to Frank, and Frank sold the wire in turn to Dowd. When harpsichord makers all over the world asked me for the wire, I reeled it off for them and sold it at cost—selling wire was not our business, and the whole thing of supplying wire to other makers was a nuisance.
Malcolm Rose will tell you that I strongly encouraged him to take over supplying the wire needs of the harpsichord industry, and bought enough of his wire to test it.

We have all discussed the Rose wire, and experimented with it. Willard Martin has told me that he is very enthusiastic about it. He likes the sound it makes, and is willing to put up with the problems involved. The problems, both tonal and practical, that other makers have with the Rose wire I leave them to report directly. I hope that Rose will do his marketing research, talk to the makers, and correct, if possible the problems they perceive.

For myself, I pass on the observation of Al Velč of Little Falls: "You can work-harden your wire on the instrument—in which case you will wait quite a while to hear your instrument. Or you can work-harden it in the die, which comes to the same result tonally and lets you hear your instrument sooner."

My other problem with the Rose wire has to do with the acid problem mentioned above. In portions of Europe and Northeastern America the acid rain problem (something the Old Ones did not have to contend with) is not only killing our forests, but also rotting the wire off our instruments. I feel that I must have something like the tin coating or give my customers endless grief.

The original Zuckermann wire was drawn to a tensile strength of 220,000 psi, comfortable for A440 pitch with French-Flemish scaling. The carbon content was in the upper range of what we found by microanalysis of what scraps of old wire we could find, about .45 percent. Now that we make transposing keyboards for the instruments, I have been experimenting with reducing the tensile strength, and also the carbon content. We should know the results in about three months.

I should be very happy indeed if I could avoid the expense and inventory problems of having wire made for my own use, but I am forced to be practical, and to use my own ears about the sound. I have great reverence for true research, and for the Old Ones, and I think we should steal everything we can from them. But I must make instruments for the time and the world I live in. And to please my ears.

Which is what I believe the Old Ones did. It is not clear to me whether such an attitude meets with Shann's approval or not, but I think he means to contrast it unfavorably with what he thinks Malcolm Rose is doing. Malcolm Rose will not be researching harpsichord wire by looking at old pianos—they needed (and used) a wire considerably lower in tensile strength than harpsichords. A number of us have had our shippets of wire from old instruments analysed, and we await Goodway's publication. And we test our theories on instruments.
AXIOMS FOR ARCHAEOLOGY

1. The Old Ones were as smart as we are. There has been no demonstrable increase in the intelligence of homo sapiens in the past 10,000 years.

2. Their technology was adequate for their needs (and if it wasn't they soon made it so). Therefore we cannot assume that they did what they did from inadequacy, or that they were hampered in doing what they wanted to do.

3. We can share almost every one of their preoccupations—western civilization is a continuum.

4. However, conservation of energy was something so necessary to them (and of so little importance to us), that we must see everything they did in the light of this poverty of energy. That which did not need doing was not done.

5. This conservation of energy (enforced at times by guild rules) does not mean that they were slovenly or uncaring. When we make things smooth or exact due to our great wealth of energy and its low cost, we will often make things less good for their purpose.

6. In looking at old instruments, nothing should be isolated from its context. Instrument making is a matter of bringing into exquisite balance a whole host of things, and no one thing is the 'secret of it all'. Soft wire won't make a bad soundboard sing, and rounding off a few frames will not give you a Taskin box.

7. If your 'exact, authentic copy' sounds like nothing at all (and that is exactly what it will sound like), don't blame the original, truly authentic instrument.
Ephraim Segerman makes a most acute and important observation in Comm 606: He suggests that by making passes of small reduction wire can be brought to maximum strength.

It would also lead to wire of consistent diameter, and answer Gug's contention that old wire was inconsistent in diameter because of wear on the dies. The wire-maker's rule-of-thumb for reducing iron wire is 18 percent of the area of the cross section per draw. It would thus take 7 draws to reduce the diameter by a half. This is consistent with modern practice using dies considerably harder and more wear-resistant than those of the eighteenth century.

As each pass makes the wire harder (up to a point, beyond which it gains no strength in a practical sense because it becomes too brittle), one would expect that the Old Ones did even as modern drawers do--decrease the percentage of reduction as the material becomes harder. So about twelve draws to make the finer wire is a very reasonable idea, but would also lead to a high degree of uniformity in both tensile strength and diameter.

Gug's article discusses the feeler gauges which were used almost within living memory to monitor wire sizes, even after micrometers were available. Gug also describes the ingenious plate gauge which turned percentage of reduction in cross sectional area into a linear figure of surprising accuracy, one of those strokes of simple genius that make us stand in awe of the Old Ones.

But having demonstrated the simple means by which the Old Ones achieved control of their product, Gug romantically extrapolates a world in which nothing was in control.

We ought to observe as a fundamental proposition in our research on old technologies that "The technologies of the past were adequate to the ends then sought." In other words, technology solves problems. When, around the turn of the present century, the piano makers wanted stronger and stronger wire, the wire makers responded, bringing 'music' wire to 360,000 psi.

When I said to Eph that our recent problem with harpsichords was to get the wire soft enough, I was speaking in terms of the most recent past--the wire makers had forgotten how to make softer wire, or found it difficult with their modern machinery.

Another fundamental idea we should adopt in our research, one that will save us a lot of time, is the law of restriction on the use of energy. We have enormous amounts of energy available to us, and we waste about two-thirds of it. The Old Ones had a very limited amount of energy at their disposal, and considered it even immoral to waste any of it. So when we look at old objects we should remember that nothing is done that does not need to be done, nothing is stronger than it needs to be for the purpose at hand, nothing is smoother than it has to be for the object in view.

But this does not at all mean that they were frustrated in achieving their ends, that they made their scalings shorter than they wanted to because they could not make wire stronger.

This business of pitying the Old Ones because they did not enjoy our advantages is nonsense.
I would like to thank Ephraim Segerman for having reviewed my booklet, "The Pitches of 18th Century Strung Keyboard Instruments, . . .", in such great detail in Fomcomm 606. There is however one what I feel to be important point made in my text, which Segerman does not mention. Since I am at least indirectly criticized for not having made the point at all, and it is relevant to the general line of discussion in his review, it might prove useful to reexamine the question here.

To quote from the review: "From our knowledge of pitch standards we have good reason to believe that some harpsichords played at a semitone higher than the pitch Karp calculates [max. A-405]. How can that be? These instruments could have been shorter in scale, or used stronger (and perhaps more brittle) strings, or they could have been strung in brass in place of iron and tuned at a fourth or fifth lower than the required pitch (the player then transposing)."

To quote from my booklet: "A number of early and mid-18th century authors from various areas in Europe report the pitches of keyboard instruments in absolute numerical terms. There is general agreement among them that these pitch levels were near A-390. It is possible that the maximum pitch of A-405 [derived from the string scaling and tensile strength data] was associated with the instruments tuned to a working pitch of A-390, although one author gives a harpsichord working pitch of A-405. A brief examination of non-Swedish keyboard instruments [and an extensive examination of Swedish ones] suggests a widespread occurrence of the A-405 maximum pitch. If such an instrument is known to have been used in an ensemble tuned to a higher pitch, there is little alternative to concluding that the harpsichord was tuned to a conveniently lower pitch from which the harpsichordist then transposed."

Given a harpsichord tuned to the neighborhood of A-390, surely it would not have been particularly difficult for a harpsichordist to transpose up one whole tone to be able to play in a circa 415 ensemble. This kind of "safe" tuning and transposition of normally-scaled iron strung harpsichords may possibly have been commonplace enough for it not to have been worth mentioning in any of the written sources on keyboard practice. In any case, accepting the likelihood of there having been such a practice would seem to be at least as convenient a way of interpreting the evidence as are any speculative suggestions about short-scaled and/or all brass strung instruments having been required in certain ensemble contexts. Nor would it seem necessary to protract the discussion of the possibility of some type of stronger "steel" wire having been used on harpsichords. The reader interested in this aspect of the discussion may refer to Comms 548, 440, 439 and others, or to the booklet itself, which is available from the museum in Stockholm (Musikmuseet, Box 16326, S-103 26 Stockholm) for SEK 65.00 (payment in Swedish crowns only, no Eurocheques), including packing and airmail postage.
The Case of the Unknown Scholar and the Missing Lute

It's a good job that all periodicals don't give a right of reply to disgruntled authors else, I suspect, there'd be precious little room left for much else. Nevertheless, it is one of PHNHL's great strengths that space is made available in the Quarterly for contributions like Mark Lindley's (Comm. 609). Perhaps he could be persuaded to take up membership? The principal advantage of this catholic approach is that non-specialists can obtain expert help and advice with their research. It is a pleasure to have stimulated Mr Lindley to reinterpret some of his observations and, in particular, I welcome his recognition of the 'baroque' Lute and that many of Gaultier's pieces might sound better in a meantone temperament. In such the same spirit, I hope it will be of even more help to comment on some of the matters he raised.

Subjectivity of aural perceptions

Jeremy Montagu got the thing about right in his review of Lutes, viols and temperaments (Comm. 555). When referring to the analysis of musical works from the point of view of what temperament the frets should be set for, he writes that this 'does, of course, depend on subjective preference .......'. I'm afraid there's no easy way round the problem, and the best way to reduce such bias is by the sort of statistical survey suggested in my review. It is, indeed, most affecting to be told by Mr Lindley that 'It has been beyond my resources to do this ...' since clearly it would add weight to his own subjective conclusions.

However, he's being a little unfair on the Man with No Name: the book makes it clear that it wasn't Mr Lindley's ears that were the source of complaint, but rather the methodology he adopted ('A certain type of Scholar will complain — indeed has complained — that the method is too subjective .......'). It's surely irrelevant to quibble over whether the 'Scholar' heard the tunings; he may still comment on errors in the methodology. After all, a Judge doesn't actually have to break into a house in order to have the qualifications to sentence a burglar to a period in jug.

Temperament and the new Lute tunings

The point I was trying to make about the new Lute tunings, was that these became pretty much the norm (excepting Italy) by the early decades of the 17th C. (say, 1630/40) — by 1636 Mersenne in Harmonie Universelle is already referring to the earlier tuning as the 'vieil ton'). If Mr Lindley prefers to believe otherwise, I'm sure we'll all understand. One of the new tunings
to emerge (the A d f a d' f' tuning) was used for as long a period as the old tuning. To discuss Lute temperaments without any reference whatsoever to these tunings was, and remains, an astonishing omission, which I hope will be rectified in any future editions of the work. Incidentally, it does not, of course, follow that work done on the old tuning is automatically applicable to music in the new tunings. Actually, the only reason I could think of for omitting these other tunings was a certain unfamiliarity with the later repertoire. Mr Lindley now allows that he '....might have raised the question whether some significant part of the music in the historically transitional tunings may accommodate a meantone fretting'. This was, of course, one of the very points I was trying to get over and I'm delighted he appreciates that more work is required in this area.

The belated recognition of the 'baroque' Lute and the reluctant acceptance of the possibility of meantone temperament for some 17th C. French Lute works ("I might agree for many of Gaultier's pieces in a major key ....or in some of the relatively new-fangled minor keys of the day") is tempered by concern over using the same fret for flat as well as sharp notes. It is extremely penetrating to draw our attention to this, but, of course, it's precisely this that is crucial: if we were not obliged to use the same fret for different notes it would hardly need a book to deal with the question of fret tempering. Clearly, the point here is essentially subjective: how much are we, or were the Old Ones, prepared to sacrifice tuning in some part of a piece in order to gain in other parts? As was suggested in my review, if a composer restricts himself to relatively few modulations, as is not infrequently found in the work of many 17th C. French Lutenists, then a meantone may well be preferred to equal temperament.

The significance of thirds in the A d f a d' f' tuning and a possible relation to meantone temperament perhaps requires some degree of intimacy with the repertoire. In particular, the frequency of occurrence and context of certain notes, chords and their duration. For example, when employing unisons as in the ubiquitous F major chord found in many sources:

Livre de tablature, p.10

or the D:

Pièces de Luth, p.13
A useful exercise would be to take a particular tuning and analyse works in the same key from similar sources so as to determine statistics like relative frequency, context, duration of such features as unisons, major and minor chords, diatonic and chromatic notes, etc. Mr Lindley would surely find it helpful to undertake such a study and complete his work.

A portion of the following passage from the Purcell Lute tutor (c. 1679) also seems to have been overlooked: 'Draw make use of a Compass made for the purpose that one may have from the Lute makers to place the frets at the right distance but the best way is to place them by the Eare singing the Gamut as was said even now for you must sometimes remove a fret if a string sing too high or too low'. Naturally, this probably refers to fret adjustments to take into account irregularities in string diameter (as Naeo also mentions in Musicae Monumentum, 1670), but it also suggests that frets could be positioned quite satisfactorily by ear alone perhaps depending on the tonality, rather than by some predetermined rule (whether it be equal or some other temperament).

The comprehension of tablature

Actually, it was Mr Lindley's grasp of Lute tablature I was questioning in my remarks about the interpretation of Bartolus and not whether he should necessarily be given any credence. The reason I was reluctantly obliged to mention this unfortunate howler, was that the example was specifically quoted in the book with the intention of showing how familiar (or rather unfamiliar) Bartolus was with fretted instruments. I doubt if any Lutenist would have made the mistake of quoting this example.

Displacement of the octave fret and the 18/17 method

The effect on pitch of increasing the tension by depressing gut strings is a lot less than Mr Lindley believes. Accordingly, the 18/17 method does not give acceptable results for gut strings, although it might just do for some metal strings. Astonishingly, the emendation compounds the error by supposing that the effect is even greater! If he won't believe me, perhaps he'll take Franz Jahnel’s word for it (after all he’s cited). In his book Die Gitarre und ihr Bau (Frankfurt, 1962) on page 152, Mr Jahnel considers a Guitar with an open string length of 630mm and writes ‘dann sehen wir, dass der Octavbund bei der Stahlsaite 312.128mm, bei der Nylonsaite aber 314.610mm von Sattelbund entfernt ist’. These figures give an octave fret displacement from the mid-point of about 2.9mm for steel strings and only 0.4mm for nylon. The enormous difference (a factor of 7) is, of course, directly related to the Modulus of Elasticity of the string material (for this Jahnel gives: steel 21000 Kg/mm²; nylon 500 Kg/mm²; gut 600 Kg/mm²). The 18/17 method does not, of course, discriminate
between the obvious observable differences of gut and metal strings. It may be that Mr Lindley has failed to grasp the distinction between these strings: certainly the effect with steel would be 'comparable to twice the width of a double fret' (say, a fret of around 0.7mm diameter), but anyone who employs frets of only 0.1mm, as might seem to be recommended, is in for an interesting time. Naturally, it should be taken for granted that the true open string length will be used for fretting calculations (i.e. the distance from the nut to the point where the string passes through its own loop, a little in front of the bridge).

Now, all this is not just some theoretical quibble: there's not a lot of point in being terribly pedantic about selecting a particular temperament, if one gets the sums wrong.

Observation and analytical discipline

On page 52 of _Lutes, viols and temperaments_ it is stated that 'Occasionally he (Luis Milan) used the first fret for $\text{F}$, but — as Example 10 shows — always alone....'

Milan's book (Libro de musica...., Valencia, 1536) contains the following passage in Pavana 2:

```
\begin{array}{cccccccc}
\text{G} & \text{D} & \text{G} & \text{D} & \text{G} & \text{D} & \text{G} & \text{G} \\
\hline
1 & 0 & 8 & 2 & 3 & 2 & 0 & 3 \\
2 & 2 & 7 & 1 & 2 & 3 & 2 & 0 \\
\end{array}
```

In this example, the $\text{G}$ on the first fret is played simultaneously with a $\text{D}$ on the second fret.

The analysis of Lute shapes

I'm sorry Mr Lindley is in hot water for telling his publishers, Diana Foulton and others that Bernard O'Hare's appendix is the best part of his book; I regret it's not possible to offer much consolation. The difficulty is that Mr O'Hare simply does not make out his case. Of course, his is one of the various possible explanations amongst others and will certainly add to the corpus in this field. However, in all fairness, it would be a mistake to credit the work with the degree of significance attributed to it by Mr Lindley.
To repeat the review, Mr Söhne's appendix 'is, in essence, another exposition of the, by now, well known geometric method of approximating to the outline of a Lute belly by scribing various tangential arcs'. The reason I did not dwell on his 'novel use of elliptical curves' also stands: 'I'm not at all convinced that the accuracy is significantly improved (over using circular arcs), especially since he gives no indication of a measure of goodness of fit'. Indeed, I recall a conversation a number of years ago with Lph Segerman on this very subject, which concluded that it was really an unnecessary complication to introduce any shapes more complex than the circle. Of course, anything is possible, but even so....

Numerous examples of how circular arcs can be successfully employed to describe various shapes may be found in the recent book by K. Coates (Geometry, Proportion and the Art of Lutherie, Oxford University Press, 1985), and I would seriously urge the authors to consult this work. Mr Coates relates proportions familiar to the Old Ones with the construction of a variety of Lute shapes using only circular arcs, to within a general marginal error of a mere 0.5mm (he also includes the side and cross-sectional shapes in his analysis and not just the belly profile as hr Söhne).

This matter of accuracy is also touched on by Mr Lindley in Comm. 60). He gives us a few more dimensions and the interesting observation that 'The curves fit comparably well,....'. Nevertheless, since the implication of the statistical term 'goodness of fit' has evidently escaped him, perhaps I should try, as simply as possible, to explain the sort of thing that is really required.

Now, various combinations of curves may be conceived, which would touch some given shape at a number of discrete points. In the present context these could be, for example, the points of greatest width, the bottom edge of the belly, etc. If the number of points is relatively low compared to the total arc length (as in Comm. 600), then the given shape may not be sufficiently described and what becomes of rather more interest is precisely what happens between such points. It is at this stage in the analysis that some test of goodness of fit will be required. Such a test could be by eye alone, but this is open to objections of subjectivity, or it could be some more sophisticated statistical test. One possible approach would be to take sample deviations of the hypothetical to the actual shape at intervals of, say, 5mm along the curve and then to apply the $\chi^2$ test to validate the hypothesis.
At the risk of labouring the point, let me illustrate the problems involved in taking just a few points by using the following idealised ('geometrical') example:

\[ \text{Geometrical design of a Lute} \]

\[ \text{PUNCTUATE top of belly} \]
\[ \text{pragmatic max width} \]
\[ \text{pragmatic base of belly} \]

\[ \text{N.B. 'Pythagorean' right angle not integrated into this analysis} \]

It will be seen that the triangle touches the external circle at three discrete points and at these it fits exactly, whereas the internal circle only fits exactly at one point. Nonwithstanding the fact that these figures are indubitably 'purely pragmatic' and, even more telling, 'apparently not integrated into any 'Pythagorean' reckoning', it would be pretty difficult to conclude that the triangle was the better approximation to the larger circle.

In lieu of any direct evidence, it will be necessary for Mr Söhne to demonstrate that his hypothesis consistently gives a better fit than others before it can be accorded much more credence. Further, the sort of generalised statistic which is offered ('.... the front profile lends itself readily to this sort of analysis in about one out of three cases'), not only fails to give an adequate measure of fit, but could be considered a rather two edged sword: it might also be said to indicate that the hypothesis is not really a particularly good one.
Nevertheless, one thing should be made quite clear: it is not Mr Söhne's skill at drawing or measuring that is questioned, but the analysis of his observations. It is good to see, incidentally, that he has now taken up the suggestion of reconstructing the shape of the mould, rather than the finished external shape.

It certainly is 'penetrating' to be told that a Venetian maker employed Venetian units ('modules') of measurement (\( \frac{2}{3} \) mm), but I'm not so sure about what some of the other makers are supposed to have used; multiples of (47 mm) or (37 mm) perhaps? Actually, I'm a bit perplexed by these 'modules': according to Söhne, the Venere and Burkholzter Lutes have the same 'module' of 47 mm and a maximum width of 7 'modules'. The resultant figure of 327 mm is tolerably close to the actual width of the Venere Lute (Lindley gives 331.5 mm, Pohlmann Lute Theorbo Chitarone 1775 gives 331 mm, Stephen Murphy measured 1775 gives 331 mm), but it would appear to be significantly different to that of the Burkhlzter Lute (Pohlmann gives 293 mm).

Apropos Lutes with tilted necks: perhaps Mr Lindley is unaware that many such instruments have rather different profiles on the treble and bass sides of the belly, particularly at the upper end towards the neck. In this case, he might be excused for failing to grasp the significance of ignoring such a feature, even in a 'geometrical' design. I did not conceive that Mr Söhne could be referring to such an instrument; hence my remarks.

It might be thought that my enthusiasm for Mr Lindley's work has, perhaps, dimmed somewhat. Well, notwithstanding Mr Söhne's contribution and the many reservations expressed here and in my earlier review, this is one of the very few books, which all players of the Lute and Viol should read. It must not be regarded as the last word on the subject, but rather as the first modern work of scholarship in this field.

There is one final matter, which should not be allowed to pass unremarked: I believe that dismissing the pioneering work by Edwards (1973), Abbott and Segerman (1976) and Samson (1931) with the phrase 'any old geometrical device', is as ill-advised as it is ungenerous.
McCormack's Comm 610 could be just what FoMRHI is for. He disrespects authenticity because what it seems to offer does not serve his practical needs. I hope to offer him more historical information which, if he gives it a chance, could well go far to serve these needs.

**Holding the lute**

The wrist leans against the edge of the lute's soundboard, and part of this force presses the lute's back against the player's body. Two more points of support are needed for stability. Illustrations show the edge of the soundboard sometimes leaning against a piece of furniture, or pressed into both thighs or locked against a crossed leg and a thigh underneath it. The last of these should be particularly acceptable to most guitarists. Folk guitarists who use straps and like to be able to play standing up can use another authentic means of support: that is to have a string tight around the back of the lute between pins into the neck block and into the end clasp (at the bottom of the lute). This string has a loop tied into it at the balance point near the neck block pin. The lute can then be supported with the loop either on a clothing button or attached to a strap around the neck. (See Spencer's article on this in *Early Music*.) With this type of support, the little finger on the soundboard is particularly essential for stability.

**The lute as a guitarist's second instrument**

McCormack is quite correct about how guitarists were discouraged from playing the lute a few years back by the Lute Society's lutanists. The guitarists were misled. They were given the impression that authentic lute-playing style required thumb-under technique and no nails. It is true that thumb-under technique was usual in the 16th century, but players of larger lutes and/or those who held the neck up at an angle (and not horizontal) used thumb-over technique. This included most vihuela players. A contemporary reference indicates that Dowland changed from thumb-under to thumb-over during his career. After 1600, thumb-over was usual. Those modern lutanists use thumb-under technique for everything, including inappropriately the baroque lute, theorbo and even 19th century guitar. One cannot pluck with the nails in the thumb-under technique. So when Robinson (1603), a thumb-under man, wrote that one should keep one's hands clean and nails short, he was not writing about playing technique. Where thumb-over was used, Fuenllana (1554) argued that playing the vihuela without nails was best. As discussed below, the vihuela was an aristocratic instrument with no attempt at sound projection. As for the Renaissance lute when played thumb-over, there is no direct evidence either way about the use of nails. A 1566 inventory seems to include "a mean lute of figured wood with black fillets and four ivory finger picks". Lute players who played in dance bands had more need for nails than soloists. In the baroque the French lute was normally not played with the nails but Italian lute players and theorboists (all over) normally played with nails. Those modern lutanists play all of these instruments without nails. They also play over the rose while the authentic position is rather closer to the bridge. Playing over the rose is more appropriate for plectrum and nail-playing. In summary, a guitarist playing the total lute repertoire with thumb-over technique and nails is not being less authentic than the modern lutanists who have discouraged them.

**Differences between the 16th century lute, the 16th century vihuela and modern "copies"**

The vihuela flourished in the middle two quarters of the 16th century. All courses were unison pairs, including a double 1st course. The lute (and Italian viola da mano) had a single 1st course, unison pairs for the 2nd and 3rd courses and octave pairs for the 4th.
5th and 6th courses. All strings were of gut without any metal winding, and while the vihuela seems to have used catline basses, only very rich lute players elsewhere had catline basses. By 1500, catlines were much more easily available, and at least English and Italian lutes were strung like vihuelas were earlier, with perhaps octave stringing on extra bass courses. Fully authentic stringing can very rarely be found on modern "copies". Nylon stringing with metal-wound basses is still common with the professionals, and we can't expect the novice to be ahead of them in pursuing authenticity.

Concerning the effect of string availability on the history of the vihuela, I have nothing to add to my speculations in Comm 94 (FoMRHI 0 10).

Tone quality depends strongly on soundboard barring. Renaissance lutes were heavily barred giving a brittle metallic sound. Vihuelas seem to have had no bars other than those bracketing the rose, leading to a warmer flabbier sound. The rose was high on the soundboard, leaving most of it unbarred, accentuating this effect. Baroque lutes often had bars of less height than Renaissance lutes, and so tend to be less bright. Barring on modern lutes is reasonably authentic, but modern vihuelas tend to be inventions, probably because there is no appropriate model to copy. There are no carefully drawn realistic illustrations, and the one surviving vihuela is the wrong size for the solo music. It was probably made as an examination piece in craft training and some would argue that it was not made to be played. It is certainly too large for most of the repertoire, but it probably is the 5th-lower bass size written for in Valderrabano’s duets. The neck is not long enough for the specified tied ten frets, but a relatively longer body for the string stop could have been standard on bass vihuelas. The fingerboard appears too narrow for the strings and technique we would use on a bass lute, but lower-tension (thinner) stringing and plucking nearer to the bridge would probably work. Modern vihuelas are often patterned after Baroque guitars and sometimes use 19th century guitar barring (including fan barring at times). An authentically-barred vihuela sounds more like a muted modern guitar than like a lute. It would probably not be considered a good concert instrument because of lack of projection. The hardwood decorative tiles usually inlaid into the soundboard probably reduced projection but added some sustain. The vihuela was never intended to be a band instrument like the Renaissance lute was.

There seems to have been two waist shapes on vihuelas. A long shallow waist exists on the one surviving example and on the Bermudo illustration, while the two illustrations in Milan show a shorter deeper waist, rather like modern guitars. A body depth much shallower than the baroque guitar is characteristic of the surviving vihuela and is consistent with the illustrations of vihuelas and the late 15th century instrument it developed from.

Plans for the surviving vihuela have been made by Maish Weissman some years ago and Pierre Abondance recently. For more information on vihuelas see "The Lute" (published by the Lute Society) 1984.

The vihuela and the viola da mano

In the 16th century, the viola da mano was almost as popular as the lute in Italy. It seems to have been more popular than viols and fiddles because the word ‘viola’ then meant the plucked instrument and qualifying words such as ‘da gamba’ ‘da braccio’ or ‘da arco’ were needed for the bowed instruments. The viola differed from the vihuela in having the rose lower on the soundboard, having a viol-like pegbox (instead of the vihuela’s peg-plate like the baroque guitar) and by the mid-16th century the viola body was sometimes deeper (like the baroque guitar). Also by then, the viola’s neck length (in proportion to the body) was also often like the lute’s, allowing 8 free tied frets (while the vihuela had 10). This allows a bigger body for a particular string stop and a rounder sound than the vihuela. Since the viola shared the lute’s repertoire, it is possible that
it tried to duplicate the lute's acoustics by using lute barring. There are no surviving violas (to my knowledge) to test this speculation.

As a lute substitute for guitarists the viola is much more attractive than the vihuela, the repertoire for which is much more sombre with very few dance tunes. A good viola model to copy is the one depicted by Praetorius as No 4, on Plate XVI. It is a small one with top string at a' but it can easily be scaled up to the larger size. Praetorius mistakenly called it a guitar.

Finally, a bit of modern history to set against McCormacks's philosophy. It is true that the "glute" gave "a recognizable and popularly acceptable sound to most of his [Bream's] listeners". Also it is perfectly authentic to use any instrument one can make music on "as a tool of the musician's trade". The trouble is that we can't maintain this authentic approach in public without deception. The modern early music audience is not just authentically expecting entertainment and the joy of good music played well. It also unauthentically expects authenticity. As its knowledge of authenticity grows, its expectations are more exacting. Rubio's "Glute" was a triumph of the instrument-makers art, but it is now out of fashion because the audience knows better historically. There is still plenty of non-authenticity in today's professional performances of early music, but this will probably decrease as both performers and audience learn more. We can't be sure about which of the unauthentic factors which are acceptable today will still be acceptable in ten years. This, of course, only pertains to professional music making. What consenting adults (or children for that matter) do to enjoy music making in private is nobody else's business, and they can be as authentically pragmatic as they like.

I here disagree with Smith (GSJ XXXIII (1980) 36-44) who translates 'Negeln' as pegs. Ivory is an awful material for pegs, but ivory colouring is a possibility. Smith cites a harpsichord entry with gilded 'Negelen' where he assumes the word means tuning pins. There are many places on a 16th century Italian harpsichord where gilded nail heads could have been used for decoration. Hellwig (LSJ XVI (1974) 36) cites a German record of 1555 where a silver lute nail was purchased. This evidence Smith ignores. Finger picks are obviously a means by which people with weak nails or who normally played without nails can play, when appropriate, like people who always used nails.
1985 FoMRHI List of Members - 1st Supplement as at 15th July 1985

* in left-hand margin = change of address or other change.

Christopher Allworth, 36 Milsom Avenue, Halifax, Nova Scotia, Canada B3N 2B9.

Juan Carlos Alonso, Isla de Flores 1942, Montevideo, Uruguay, (recrdr; M).

AMIS - see Peggy Banks

Museum of Applied Arts & Sciences, Sydney, NSW, Australia.

Anthony Baines, 8 Lynette Avenue, Clapham, London SW4 9HD, UK; t: 01-673 8389.

Margaret Dowrie Banks, Shrine to Music Museum, 414 East Clark Street, Vermillion, SD 57069, USA; t: (605) 677-5306.

Bob Barclay, 1030 Innes Road, Ottawa, Ontario, Canada K1A 0M8; t: (613) 998-3721 & 737-3397 (brass instrs, M; all instrs, C).

Josep Bartomeus, Dr.Esteve 29, Manresa (Barcelona), Spain.

Peter Berg, 46 Gt Percy St, London WCLX 9QR, UK; t: 01-278 3196 (nyckelharpa; M,P).

Margaret Birley, 133 Sydenham Hill, London SE26 6LW, UK (all instrs; C).

Bernard Brauchli, Av. des Cerisiers 19A, CH-1009 Pully, Switzerland (clavchd; P).

Adrian Brown, La Taillade Mejannes le Clap, F-30430 Barjac, France; t: (66) 60 42 31 (recrdr; M).

Kate Cullen, Ground Floor Flat, 4 Clare Road, Clifton, Bristol BS6 5TB, UK; t: 0272-48103 (cpd reeds,crtl,shwm,rcrdr,gmba,vln; P).

Mathew Dart, 16 Vauxhall Grove, London SW6 1SY, UK; t: 01-735 0479 (flute, ob, fag; M).

Clive Du'Mont, 51 Lakewood Cresc, Henleaze, Bristol BS10 5HL, UK; t: Bristol 622000 (str instrs; M).

Michael R. DuPree, 12517 Sunset Blvd, Los Angeles, CA 90049, USA (oboe; P, constr).

Bruno P. Gire, 9 rue Jean Clouet, F-17138 St.Xandre, France (bar recrdr, flute, reeds, lute; M,P).

Dominic Gwynn & Martin Goetze, 5 The Tan Gallop, Welbeck Abbey Estate, Worksop, Notts S80 3LW, UK; t: 0909-485635.

Haags Gemeentemuseum, Postbus 72, NL 2501 CB 's-Gravenhage, Netherlands; t: 070/514181.

Francis R. Harlow, 32600 Alvin, Garden City, MI 48135, USA (ppte, vin fan; R).

Bruce Haynes, Ty Napper, Ste-Anne la Palud, Plonévez-Porzay, F-29127 Plomodiern, France.

Friedrich von Huene, 65 Boylston Street, Brookline, MA 02146, USA; t: (617) 277-8690 (flute, recrdr; M).

David Kerr, 1424 S.E.Oak, Portland, OR 97214, USA; t: (503) 239-9460 (bar vin, M,C,R,P; gut strings, M).

Günter Mark, Neumühle 28, D-8520 Erlangen, West Germany; t: 09131-42669 (lute, gmba; M).

Lukáš Matoušek (med instrs; P,R,M).

Ernst Meyer, Haupstr. 77, CH-9052 Niederteufen AR, Switzerland; t: 071-331063 (recrdr; M,R,P).

Daniel Morgenstern, 18681 South Miles Road, Cleveland, OH 44128, USA (hpschd, virgln, snrt, M,R; flute, P).

Michael Morrow, 9 Aberdare Gardens, London NW6 3AJ, UK; t: 01-624 5747 (all instrs, med/ren iconog, mss, perf pract).

Museu de la Música, Avda. Diagonal 373, Barcelona 8, Spain; t: 2171157.

Musikhistorisk Museum & Carl Claudius Samling, Råbenrå 30, DK-1124 København K, Denmark; t: 01/ 11 27 26.
Musikinstrumenten Museum, Staatliches Institut für Musikforschung, Preussischer Kulturbesitz, Tiergartenstrasse 1, D-1000 Berlin 30, West Germany; t: (030) 254 81-0.

Patrick J. O'Riordan, 7516 Avalon Drive, Fort Wayne, IN 46819, USA (flutes, whistles; M).

Terence M. Pamplin, Little Critchmere, Manor Crescent, Haslemere, Surrey; t: 0428-51158 (gmba, mus.instr.technol, pft, tempaments).

Robert Reid, Department of Slavonic Studies, The Queen's University of Belfast, Belfast BT7 1NN, UK; t: 245133 x 3676 or 3679.

Carsten Rosbæk, Hovegaden 19, DK-5932 Humle, Denmark (lute; P).

John E. Sawyer, Department of Music, University of British Columbia, Vancouver, BC, Canada V6T 1W5.

John & Linda Shortridge, Meeting House Pond, Star Route 3, Box 490, Phippsburg, ME 04562, USA; t: (207) 389-1475 (keybds, M, R; gmba).

Charles Stroom, Gerrit van der Veenstraat 169 hs, NL-1077 EB Amsterdam, Netherlands; t: 020-725533 (recrdr; M).

Marco Ternovec, Via Moreri 7, I-34135 Trieste, Italy.

John Watson, 1612 Burnley Drive, Cary, NC 27511, USA; t: (919) 362-8369 (keybds; M, R).

Graham Wells, Musical Instrument Department, Sotheby Parke Bernet & Co, 34/35 New Bond Street, London W1A 2AA, UK; t: 01-493 8080.

Paul White, Amsteldijk 89, NL-1074 JB Amsterdam, Netherlands; t: 020-739532 (early fag & contra, M, C, R, P; reeds, res).

Lynda J. Hunter 13680 US Highway, 285 South Conifer, CO 80433, USA (hpschd; M).

Again my apologies for those omitted in April, and to Carsten Rosbæk for spelling his name wrong in previous years. JM.

Museums:

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København: Musikhistorisk & Carl Claudius (Mette Müller)

London: Horniman (Maggie Birley)

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Vermillion: (Peggy Banks)

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Ivo van Dael
John Watson
David Kerr

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- David Kerr, OR

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- Juan Alonso
Pitch Notation: A Plea to End Confusion

Musicians have for centuries agreed on names for notes within the octave: C, D, E ... B. Identifying octaves, however, has been remarkably confused. The Helmholtz notation employing upper and lower case letters with super- and subscript primes (C, d", e"”) has been used in many books on musical instruments. Piano and organ makers have used a variety of systems, none of them helpful to players and makers of other instruments. Musicians have tended to resort to cumbersome relations to the staff ('E on the fourth space of the treble clef').

A much simpler and less error-prone nomenclature was proposed by R.W. Young in 1939(1), and this has since been adopted by the U.S.A. National Standards Institute (2). Each note in the whole range used in practical music can be identified by two symbols – the familiar note letter and a single digit to specify the octave.

Thus many typesetting and proof-reading problems are eliminated, and one is left with notation very easily pronounced ('E6' rather than 'lower case E with three dashes'). The standard notation is easily learnt: one merely needs to remember the pitch standard A4 = 440 hertz or that the usual piano keyboard runs from A0 to C8.

The standard specifies a subscript digit (B3) but in typewriting and computer entry the digit can be on the same level as the letter (B3) without risking loss of definition.

This notation applies to musical pitch rather than frequency and often a pitch standard or a transposition will be stated or implied (eg. A4 = 415 hertz or 'C5 for clarinet in A').

There are, of course, some instruments whose compass extends below C0: notes lower than this are designated by negative subscripts. However, as in most people the pitch threshold of hearing is close to C0 (16.352 hertz at A4=440 hertz) only the overtones of these lower notes are heard – the fundamentals can only be felt as vibrations.
I propose the general use of this standard notation by musical instrument scholars. Acousticians have already largely adopted it and we would all benefit if the musical world at large followed.


Donald Gill

Comments on Comm. 610

I have enjoyed Bulletin 39, especially the element of uncertainty as to which contributions were composed for April 1st.

I decided that Comm. 610 was essentially serious, and the final paragraph is a sad commentary on how slowly information spreads. The vihuela revival certainly started in the same way as the harpsichord, viol and lute revival, but surely nobody takes the 'guihuela' seriously now? I thought that researchers had reached a good deal of agreement on the main characteristics of the Spanish and Italian instruments, even if we cannot be certain about soundboard barring on present evidence. If two bars are used the central area of the soundboard below the rose needs to be left thicker than elsewhere.

Jeremy's suggestion that the Latin American 'vihuela' making tradition should be looked at is fair enough but I suspect that the phenomenon noted by Eph in Comm. 613, para. 2 would apply. Names may persist but techniques tend to drift with mainstreams.

If Len McCormack bases his instrument on the Paris vihuela, with the waist curve smoothed out a little, the neck/body joint at half the string length, the body not more than three fingers deep, and one sound hole, he should be quite happy with the result, provided he does not use heavy strings and high tensions. For the internals, no liners except paper or parchment, a Spanish heel and two, perhaps three soundboard bars, the latter choice depending perhaps on whether he is an optimist or pessimist by nature.

It will not sound like a lute, not even one with a cold in the head, to use Tony Rooley's description, based presumably on hearing 'Guihuelas'. It will have to be played with the right technique, about which the vihuela books have much to say, and not as an easy way out for a guitarist welded to his hard learnt technique.

I have not faced the matter of string materials in this Comm. as I think that this would be better dealt with by those who have actual experience of all-git on vihuelas. Or perhaps Eph would lend me some outlines?
A CLOSER LOOK AT PITCH RANGES OF GUT STRINGS

Introduction

This Comm explores how the highest and lowest pitches of gut strings vary with the vibrating string length (or string stop) and gut properties. Aesthetic and economic judgements are involved here and the theory assumes consistency in these judgements. These limits are then explored by reference to historical data on highest pitch where frequency and string stop are known simultaneously. The lowest pitch is derived from the highest pitch combined with the open-string ranges historically used. While much of this is ground we have covered before, the theory here is more complete, resulting in somewhat different conclusions (e.g., the range is not independent of string stop), and the historical information is more thoroughly discussed.

The Highest Pitch of a Gut String

Gut properties

When a gut string is tuned up very near to breaking, it will usually stretch for some time and then break. The higher the pitch it is kept at, the shorter will be this time. Similarly, the lower the pitch it is kept at, the longer will be that time (all gut strings kept at playing tension will eventually break, though this could take many years for thick strings). So a specification of a highest pitch includes an implied judgement of satisfactory working life for the string. It also must include a safety factor to take into consideration the expected variation in strength from string to string. Consequently it is more appropriate to determine the highest pitch from actual practice than from individual experiments.

Contrary to the expectations of many, the pitch at which a string of any material breaks depends only on vibrating string length and not on diameter and tension. This can be demonstrated both theoretically and experimentally. Comparing a thicker and thinner string, the thicker one can stand a higher tension before it breaks, but the pitch at breaking is the same (subject to random variations from string to string). This generalization depends on both strings having the same material properties, i.e., the hardness of drawing of metal wires (see Comm 606) or the amount of twist in a gut string. For a gut treble string maximum tensile strength is traditionally insured by putting in the minimum twist necessary to make the string uniformly round in cross-section.

As one shortens the vibrating part of a string by pressing it against a fingerboard, the frequency of vibration is inversely proportional to the vibrating length. This is equivalent to saying that when the frequency is multiplied by the vibrating length, the result is constant wherever the string is fingered. That constant depends on the physical conditions of the string, primarily its tension and its ratio of weight to length. Breaking is such a condition since whether a string breaks or not does not depend on where it is fingered.

So the highest pitch for a string multiplied by its vibrating length is equal to a constant, assuming a particular average string life before breaking. For different times, places, instruments, and even playing environments, the judgement of acceptable average string life can vary, and so will this constant. Variation in the string quality available is another factor. We shall be concerned here with historical values of this constant.
The constant for any particular circumstance is simply given by the frequency of the highest string multiplied by the string stop. If the frequency is expressed in Hz and the string stop expressed in meters (m), the product is a number which has the units of m/sec. It happens to be half the velocity of transverse vibrations on the string. Let us call it the 'pitch-length product'.

Twenty-first and nineteenth century information

Earlier this century, gut violin E strings were commonly used. Carl Flesch in 1923 praised a metal E but assumed a gut string was used when he recommended string diameters. Fritz Kreisler was the last great virtuoso to consistently use gut E strings (and some claim that the beauty of tone he achieved with it has not since been matched). The pitch standard used was usually a' = 440 Hz, and with a string stop of about 33 cm, the pitch-length product calculates to be 216 m/sec. No other gut strung instrument in use at the time had a higher pitch-length product.

In the second half of the nineteenth century there was pressure to raise pitch standards, presumably to increase orchestral brilliance. This did create problems with violin E strings, and largely because of these, the pitch came down again. The highest it went was a' = 460 Hz in New York in 1880, 3/4 semitone higher than modern. Violin string stops then were generally the same as now and so the pitch-length product for this maximum pitch is 227 m/sec.

At that time, there were some special techniques for making stronger violin E strings which seem not to have been used in the previous Classical period and seem also not to have been used in the twentieth century. The usual technique for making strings has been and still is as follows: After all superfluous material in the sheep's intestines has been cleaned away from the final membrane, that membrane (of hollow cylindrical shape) is cut into ribbons before final cleaning, selection, combining and twisting to make the string. Though the original gut from the sheep will vary in diameter along its length, the ribbon cut out can be more even and can thus lead to a truer string. Since the fibres in the membrane lie in a criss-cross fashion, cutting the membrane into ribbons cuts the fibres, and thus weakens the string. The wet ribbons are then laid back and forth between two hooks until the appropriate string thickness is built up. One hook is then turned, twisting the ribbons together to form a roughly cylindrical string. When dry, the string is then polished to make a uniform cylinder. This is necessary to make it really true. Polishing breaks the fibres on the surface, thus weakening the string.

According to Maugin and Maigne, who wrote in the 1860s (English translation without attribution is in A. Bachmann's "Encyclopedia of the Violin"), many of the violin E strings produced then were made from the whole gut without being cut into ribbons, and they were not polished. This leads to stronger strings but a much greater tendency to be untrue. The trueness situation can be improved by careful selection for uniformity in the lengths of gut to go between the two hooks, and by rejection of the large fraction of strings which do not meet reasonable standards of trueness. This would lead to much greater cost than polished strings, with a lower standard of trueness most likely.

Before the nineteenth century, pitch standards varied widely and scholars have not yet agreed as to what these standards were. Different standards were often simultaneously followed in the same city. Adherence to a standard then was only considered when there was practical need. There was not the compulsive generalized pitch comparability of today. An instrument made at one place could very easily have been designed for the pitch needs of a customer elsewhere. It is therefore very hazardous to guess what absolute pitch a particular surviving stringed instrument of known date and place of origin was designed for. Such instruments don't help us here, but whatever conclusions we are able to arrive at can help making such guesses.

Praetorius
A unique place where we can simultaneously know instrument dimensions and pitch standard is Praetorius's "Syntagma Musicum", Vol II. "De Organographia" includes a Tabella Universalis giving tunings and ranges of a large number of instruments. The introduction to the Tabella assures us that the tunings are all in Cammerthon and not in Chorthon. A few pages earlier Praetorius explained how he preferred the Chorthon used in Prague and other Catholic Chapels which was a tone lower than the universal Cammerthon, and that in his German provinces Chorthon was unfortunately and unalterably the same as Cammerthon. At various points in the book, Praetorius distinguished between the Chorthon he preferred and his own North-German one by calling the latter 'rechtchen Chorthon', and using no adjective when (as in the introduction to the Tabella) he was referring to the former. At the end of the book he presented full-scale drawings of a set of pitch pipes intending to define 'rechtchen Chormass' or 'rechtchen Thon', which clearly is his 'rechtchen Chorthon' or Cammerthon. As shown in Comm 342, this set of pipes leads to a standard of \( a' = 430 \) Hz with an error limit of \( 5 \) Hz either way.

In "Theatrum Instrumentorum" Praetorius published woodcuts of all of the musical instruments he knew about, with scales (in Brunswick feet - one of these equals 285.4 mm) along the edge of each Plate which included instruments drawn from life (and not copied from books). His method of drawing apparently was to transfer measurements made on the instruments to equivalent miniature rulers for the scale of the drawings. For fingerboard instruments these measurements included widths and lengths of soundboards, total lengths and string stops. The result of transferring soundboard dimensions was to present the soundboard undistorted, although an oblique-view effect was achieved by showing one of the instrument's sides as well. That the total length and string stop were also transferred is indicated by his mixing up the two in the drawing of the Gross Sechs Chorische Cither in Plate 5, necessitating a correction in the text of "De Organographia".

In consequence, we can measure the apparent string stops from the Plates and scale them up to full size without any correction for perspective. This we have done for the 19 gut-stringed instruments which were also included in the Tabella. The pitch-length product for each of these instruments was calculated for the highest pitches given in any of the tunings in the Tabella, assuming equal temperament at \( a' = 430 \) Hz.

Table I gives the results listed in order of decreasing pitch-length product. Two instruments have products of about 235 m/sec. Then there is a gap equivalent to two semitones of pitch difference on the same string stop till we get a group of 5 instruments with pitch-length products of about 210. Then there is another gap equivalent to 1 1/2 semitones till we get three instruments with products about 192, after which instruments continue downwards fairly continuously. The two gaps could well represent real differences in strength of the strings used, or differences in toleration of the rate of string breakage, or differences in willingness to tune down the highest strings when instruments are not being played (which leads to the necessity of more tuning as the string settles when tuned up again). Concerning the last point, Robinson wrote (in "The Schools of Musick" of 1603) that "when you have done placing upon it [i.e. the lute], put it up into the case, putting the trebles [i.e. the strings of the first course] a little down".

Let us first consider the two instruments with pitch-length products of around 235 m/sec, the lute and mandora. This product is significantly higher than the 227 m/sec reached with the violin at the highest nineteenth century pitch standard, as if that standard were raised another half a semitone. The fact that these instruments were so isolated at such high tuning pitches for their string stops is a strong indication that they were coping with higher pitches than they were designed for. It is likely that Praetorius's size name for the lute he depicted 'Chor Laute' implied that it usually played in Chorthon - a tone lower than Cammerthon.
How the 'Chor Lute' (or 'mean lute' in English) coped is a matter of speculation. The same problem existed around 1700 when for a short time at some places in Germany, violins were expected to play at a different Chorton, a tone higher than Cammerthon. One possibility is that normal polished highest strings were used and musicians tolerated rather less than a dozen hours of expected string life at pitch. The other possibility (which I prefer) is that unpolished but less true highest strings were used. Tuning down between playing sessions would be essential in either case.

The group of instruments at the pitch-length product of around 210 m/sec are at what we consider to be the normal highest pitch for their string stops. Probably most of the players tuned the highest strings down some (perhaps by a tone) when not in use. For how long strings in this condition of stress should be expected to last when played on professionally, see Baron's statement below. The gap between this group and the rest at about 192 m/sec and lower could perhaps be associated with the rest being at pitches that did not require tuning down when not in use.

Eighteenth century

We can estimate what the first-string conditions were for an early 18th century professional lute player, E. D. Baron. He wrote a book "Study of the Lute" in 1727 which has been translated by D. A. Smith. Baron wrote that his first string was tuned to F in Cammerthon. This most probably was the same pitch standard as Praetorius's Cammerthon. Baron's portrait playing his lute is given at the beginning of the book. The bridge is obscured by the hand, but its position can be closely estimated by his instructions to put the little finger (which can be seen) just behind it. The string stop can be scaled by assuming that the distance between the eyes and between the mouth and the midpoint between the eyes are both the typical 63 mm, the result being a string stop of 62 cm. This leads to a pitch-length product of 211 m/sec, a most reasonable value considering the Praetorius information given above. Baron wrote that "there are instances where a Roman string lasted four weeks."

Medieval

The first apparent evidence of polished strings I am aware of is in the book of music by the lute virtuoso, Capirola, written c. 1517. Capirola's methods were given for coping with intonation problems resulting from strings thicker on one end than the other. It was mentioned that strings from Munich caused no such problems. We interpret this to mean that Munich strings were polished. The 16th century seems to have been a transition period between the earlier usage of unpolished strings and the later usual usage of polished ones, with lutes changing over early and viols later. This implies that in medieval times, the pitch-length product could have more readily gone over 210 m/sec, by perhaps up to 2 semitones.

The Lowest Acceptable Pitch on a Gut String

Loudness

The loudness of music played on a stringed instrument depends on its responsiveness, the sensitivity of the ear, the acoustic environment between instrument and ear, and the amplitude of the oscillating force that the string exerts on the bridge. In the following I shall make quantitative estimates of the general conditions for balance in loudness between instruments of different sizes (either to play together or to play separately with equivalent audibility) in the same acoustic environment. The responsiveness of the instrument will be assumed to be the same for the different sizes. The purpose of this exercise is to theoretically disentangle the effect of string material from that of string length.

Hearing is most sensitive in the 2000 to 3000 Hz frequency range, and sensitivity falls off steadily with frequency difference on either side of this range. The
Fletcher-Munson curves of equal loudness represent measurements of many people’s responses to pure frequencies. Our concern here is with low strings on instruments, say in the 50 to 200 Hz region. In this pitch region, for a typical loudness of a stringed instrument of say 60 phons, the Fletcher-Munson curve indicates that the acoustic energy needs to be multiplied by a factor of 2 1/4 for a pitch drop of an octave to keep loudness equal. Higher harmonics are also involved in the sound and they would fall on a flatter part of the Fletcher-Munson curve, leading to a smaller factor. It could be a reasonable approximation, taking the total sound into consideration, to assume that the above factor is 2. This implies that the force amplitude needed for equal loudness is proportional to the reciprocal of the frequency.

Relationship between string tension and length

The force amplitude of the string on the bridge of a bowed instrument is proportional to the velocity of the bow and to the string tension, while it is inversely proportional to the frequency and the distance between bowing point and the bridge. On instruments of different sizes, the bowing velocity tends to be the same, and the fraction of the total string length that the bow-bridge distance represents tends similarly to be the same. Combining these factors with the reciprocal relationship between frequency and force amplitude (deduced above for equal loudness) leads to the string tension on instruments of different sizes being proportional to the string lengths for acoustic balance. A corollary to this is that, amongst the lower strings (at least) of the same instrument, tension is constant.

On plucked instruments, the initial force amplitude of the string on the bridge (before the sound dies away) is simply the same as the force used to pluck the string. Traditional stringing practice has always been, as with bowed instruments, for all of the strings of equivalent function on the same instrument to have approximately the same tension. The increased force amplitude on the bass strings needed to compensate for the ear’s insensitivity is accomplished just by plucking harder there. On the low-pitched bowed string the increased energy comes from a greater resistance to pushing the bow to maintain the required bow velocity. An important factor that seems crucial in maintaining equal tension is that pluckers seem to require that each string "feels" the same, i.e. it moves sideways the same amount for the same plucking force.

The ratio of the plucking force to the string displacement caused by that force is proportional to the string tension and inversely proportional to the string length and a factor which depends on the fraction of the string length represented by the distance between the plucking point and the bridge. Assuming that this proportion stays constant, as does the above ratio, we can conclude that string tensions are equal on one instrument, and that the tension is proportional to string length on instruments of different sizes. This is the same result as obtained above with bowed instruments.

Inharmonicity

If one tunes down a thick gut string (and ignores the loss of loudness), one reaches a point beyond which the sound becomes unacceptable, primarily because it has lost focus. The focus of a sound depends on the number of harmonics associated with the fundamental pitch. The number of harmonics depends on a string property called ‘inharmonicity’ where the harmonics higher than a certain one are so out of tune with each other that they effectively cancel each other out. So the lowest pitch a string of any length or diameter can be tuned to depends on a judgement concerning the minimum degree of focus which, if constant, means the same level of inharmonicity.

Inharmonicity of a string's vibration comes from four causes: the stiffness of the string, the elastic yielding of the bridge, finger or fret, unevenness in weight along the string, and losses of vibration energy. The latter losses can be by internal friction as the string flexes and stretches, by sound absorption of finger or fret or bridge, and by the extraction of energy by the bridge for conversion into sound energy. Stiffness is
the major factor in determining lowest pitch and we shall here ignore the others.

From the formula for stiffness inharmonicity, keeping it at the constant level of minimum acceptable focus, the lowest frequency turns out to be proportional to the fourth root of the tension divided by the $3/2$ power of the vibrating length. One can eliminate the effect of string tension by combining this relationship from inharmonicity with the above one relating tension and length. We then conclude that the lowest frequency is proportional to the inverse of the five-fourths power of the vibrating length.

A consequence of this relationship is that for the lowest pitch to drop by an octave, the vibrating length must be increased by a factor of 1.74, about 2 fret-lengths shorter than double the length. At double the length the lowest pitch is 3 semitones more than an octave lower. Another way of looking at it is that for every 4 fret's-worth of length, the lowest pitch changes by 5 semitones.

Since the highest pitch drops just an octave if the length doubles, the range between the highest and lowest pitch of an instrument increases by a semitone for each 4-fret's-worth increase in length. If one wants to compare different aesthetic or practical requirements governing lowest pitch, or with the same requirements to compare gut of different properties, one needs a measure that doesn't depend on string stop. One possibility is to use the proportionality constant between frequency and the reciprocal of the $5/4$th power of the vibrating string length. A more intuitively useful measure is the number of semitones below the pitch associated with a standard highest pitch, say one with a pitch-length product of 210, with the low pitch converted to what it would be at a standard string stop of say 50 cm. Let us call this the 'normalized' number of semitones below the highest pitch or 'normalized range'. This is a measure of the degree of focus on the lowest string of an instrument. Our Table I of Praetorius's gut-strung instruments lists those ranges for each instrument. For each instrument, before normalization, the range is between the highest and lowest nominal pitches of all the tunings given.

**Historical information**

There are two ways that sets of instruments, each with the same tuning intervals, can exploit this increase in range of string pitches in larger sizes. One way is to keep the highest string at the same closeness to breaking and double the size for each octave in tuning. This would then allow a lower scordatura tuning for the lowest string of the large size. This happened with seventeenth century English sets of viols where basses sometimes tuned their 6th strings down a tone to 'double Cee Fa ut'. Renaissance fiddles similarly often had another string on the bass size. The other approach is to shorten larger sizes to make them easier to play while keeping the lowest-pitched string at the same closeness to the lowest pitch of the range. This happened with seventeenth century German sets of viols as depicted by Praetorius.

**Praetorius and catlines**

The lowest pitches used on viols, as listed by Praetorius are as low for the string stops as any other gut-strung instrument. The F on the treble viol is 31 semitones below the normal highest pitch for gut (i.e., that with pitch-length product of about 210 m/sec). The C on the tenor-alto viol 30 semitones below it and the F on the (small) bass viol 33 semitones below. The 'normalized' range in these three cases is 32, 30 and 30 semitones respectively. With the usual tunings on these instruments (given as tuning 1 in each case by Praetorius), the normalized ranges are 28, 28 and 29 semitones respectively. The treble viol tuning which led to the normalized range of 32 semitones is the top four strings of the bass viol with an added fourth above C — apparently a tuning for a bass-viol player to play tenor parts. Since tenor parts rarely reach below A, the lowest string at F was probably more a formality than for use. At any rate, considering the rest of the data here, the 32-semitone normalized range is anomalous and will not be
taken seriously until more is known about how this particular tuning was used. A normalized range of 30 semitones is a reasonable limit for bowed instruments not requiring much projection.

The violin family requires more projection, and the normalized range for the bass violin Eb string (shown in the illustration, omitted in the Tabella, and included in parenthesis in our Table I) is 27 semitones, with that for the tenor being 28, the treble 25, and the piccolo 26 semitones. As for the lowest pitches for plucked instruments, the normalized range for the depicted lute is 28 semitones in the stated Cammerthon and 30 semitones in Chorthon (the latter is included in parenthesis in Table I). For the mandora the normalized range is 31 semitones. The tunings which have the low pitch at e are not the same as the tuning which has the highest pitch at g', so the low tunings are probably for Cammerthon while the high tuning was probably mainly for Chorthon, with Cammerthon possible when necessary.

Praetorius was somewhat inconsistent concerning the guitar, which he called 'Quin terna oder Chiterna'. In the text he stated that it had 4 courses and that it was illustrated in Plate XVI. He subsequently mentioned that some had 5 courses. The 'Tabella' lists two 4-course tunings a fourth apart. The illustration on Plate XVI labelled 'Quin terna' is of a small 6-course viola da mano of appropriate size for a Renaissance guitar. An appropriate tuning for the viola would combine the ranges of the two tunings in the Tabella plus a 6th course a 4th lower. The range of this tuning is included in parenthesis in our Table I.

Three different approaches to tuning instruments can clearly be seen in Table I. More than half of the entries were tuned as high as they could reasonably go (according to the three different criteria of reasonableness discussed earlier). Then there are the treble, tenor and bass viols, which were tuned as low as they could go. Finally, there is a group which includes the double and contra bass viols and the harp, which were tuned midway between the extremes. The lute, mandora and viola version of the guitar could be in this category as well as the first one. The only instruments that don't fit any of these categories are the tenor violin (which is obviously too small for its musical function) and the lyrone (which is almost in the first category).

In summary, in Praetorius's time, for the type of gut then available for low bass strings, the lowest pitch used on a gut-strung instrument normalized to 50 cm string stop was about 30 semitones below 420 Hz, the normal highest pitch for such an instrument. This applies both to bowed and plucked instruments. The relevant type of gut string here apparently had a very tightly roped construction. It was called a 'catline' in England. Such strings seem to have first become available shortly before 1500, but distribution became very limited after a few decades.

**High-twist gut**

Since lutes expanded their open-string ranges around 1570, we assume that catlines then became generally available again (see Comms 94 and 438). The type of gut string construction that gives the largest range other than the catline is the string with maximum twist of the fibres. We call this 'high-twist' gut.

Using this type of string, Renaissance lutes had an open-string range of 26 semitones. We assume that the size of lute called 'mean' (of string stop about 60 cm) used the full range (with the lowest course a fifth lower than the 5th), and much smaller ones did not. Contemporary instructions say to tune the highest string as high as it will go, and we assume that this means a pitch-length product of about 210m/sec. The resultant normalized range for a high-twist gut lowest string is 25 semitones on a plucked instrument.
The bowed instrument with the largest open-string range during the period of high-twist gut bass strings was the lyra da braccio. Its open-string range was 24 semitones (according to Lanfranco in 1533), but the lowest course was off the fingerboard going to a peg on the side of the pegplate with the string stop about 2 semitones longer. So the equivalent range was 24 semitones. It is assumed that the first string was tuned as high as it could go according to the usual criterion. The string stop was about 35 cm so the normalized range is 25 semitones.

As with Praetorius and catlines, the Renaissance range for high-twist gut apparently was the same for bowed and plucked instruments. Both of the instruments discussed had octave pairs for their lowest courses. We might reasonably expect that since the octave string replaces many of the harmonics missing on the lower string, the pair could go down to a lower pitch than a single low string. In the Praetorius information summarized in our Table (e.g., compare the lute and the mandora) this is shown not to be the case in the early Baroque. It is apparent that musicians then had the same expectations of minimum sound focus for the bass string of an octave pair as they had for a single string. That this was also the case for the Renaissance is demonstrated by the 6-string Italian treble viol of string stop about 50 cm. It had an open-string range of 24 semitones according to Ganassi in 1542. This would also be the normalized range for the lowest string if the highest one was tuned to our normal highest pitch. This is only one semitone short of the 25 semitones for the lyra da braccio.

Low-twist gut

From the pitch range of high-twist gut strings we can deduce the pitch range of low-twist gut strings, i.e., where the twist is just enough for making a cylindrical string. In our experience these strings show an angle of about 45° between the fibres (as seen on the surface) and the string direction. For high-twist gut this angle is about 45°. Using the theory of our first paper on this subject (GSJ XXVII (1974) 43-73), the difference in lowest pitch between these two should be about 7 semitones. So the normalized range for low-twist gut strings should be about 18 semitones.

Medieval

Every degree of twist between the minimum and maximum can readily be put into a gut string. The idea that increased twist can increase range seems to have already been known early in the 15th century with the appearance of the 5-course lute with a maximum open-string range of 21 semitones. It is not clear whether this was known a century earlier when Jerome of Moraria wrote down his 5-string fiddle tunings (see Page’s article in GSJ XXXII (1979) 77-98 and Comm 50). The three tunings and ranges are given in Table II. A larger size of medieval fiddle and our normal highest pitch were assumed. If a smaller size of fiddle was used, one should add one or two semitones to the normalized range. If the fiddle highest strings were tuned closer to the highest pitch for unpolished gut, one should subtract one or two semitones from the normalized range. With our current state of ignorance about these factors, the normalized ranges stated are reasonable estimates.

As seen in Table II, when the sound of a string is not supported by a higher octave string adjacent to it, we encounter the expected normalized range for low-twist gut. Where an octave string is involved, we cannot be sure whether higher twist in the gut was used or whether, contrary to the Renaissance and baroque practice we’ve discussed, the octave string was relied on to provide the focus of the sound of the pair. An argument favouring the second of these possibilities involves Jerome’s description of the notes available in the first tuning. He stated that the notes missing from the ‘bordonis’ string (because it did not go over the fingerboard) can be supplied on other strings. This can only be if they were an octave higher. As Page wrote in his GSJ article, “this reflects Jerome’s indifference to octave transposition...”. The octave ambiguity that Jerome accepted was exploited later in the music for the French
Renaissance cittern and the baroque guitar. Some instructions for stringing the baroque guitar indicated that almost the same string diameter was to be used for each string of a 4th course octave pair, leaving very poor focus as well as low power in the sound of the lower member of that pair.

**TABLE II**

Jerome of Moravia's Fiddle Tunings

<table>
<thead>
<tr>
<th>Number</th>
<th>Tuning Given</th>
<th>More Like</th>
<th>Without Octave Enhancement</th>
<th>With Octave Enhancement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>More Like</td>
<td>Normalized Range</td>
<td>Normalized Range</td>
</tr>
<tr>
<td>1</td>
<td>d'/G g d'd'</td>
<td>d'/g g'd'd'</td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>2</td>
<td>d G d'g'</td>
<td>a d d'a'd'</td>
<td>17</td>
<td>18</td>
</tr>
<tr>
<td>3</td>
<td>G/G d c'c'</td>
<td>a/a e'd'd'</td>
<td>17</td>
<td>18</td>
</tr>
</tbody>
</table>

the string to the left of / is a bordons off the fingerboard

Summary

The quantitative information and speculations in this Comm are summarized in Table III.
TABLE I

Highest Pitch-Length Products and Normalized Ranges for Praetorius’s Gut-Strung Instruments

<table>
<thead>
<tr>
<th>Plate</th>
<th>Instrument</th>
<th>Highest Pitch (Hz)</th>
<th>Highest Stop (cm)</th>
<th>String Pitch-length (m/sec)</th>
<th>Semitones Below 218 Top</th>
<th>Lowest Pitch (Hz)</th>
<th>Lowest Normalized Ranges (Semitones)</th>
</tr>
</thead>
<tbody>
<tr>
<td>XVI/3</td>
<td>lute</td>
<td>g' 383</td>
<td>61.7</td>
<td>236</td>
<td>2 above C(66)</td>
<td>64(57)</td>
<td>28(30)</td>
</tr>
<tr>
<td>XVI/5</td>
<td>mandora</td>
<td>g&quot; 766</td>
<td>30.6</td>
<td>234</td>
<td>2 above c</td>
<td>128</td>
<td>31</td>
</tr>
<tr>
<td>XX/5</td>
<td>lyra da braccio</td>
<td>d&quot; 574</td>
<td>37.0</td>
<td>212</td>
<td>0</td>
<td>d 143</td>
<td>25</td>
</tr>
<tr>
<td>XXI/1</td>
<td>kit</td>
<td>b&quot; 965</td>
<td>22.0</td>
<td>212</td>
<td>0</td>
<td>g' 383</td>
<td>19</td>
</tr>
<tr>
<td>XX/4</td>
<td>viola bastarda</td>
<td>d' 287</td>
<td>73.5</td>
<td>211</td>
<td>0</td>
<td>A1 54</td>
<td>27</td>
</tr>
<tr>
<td>XVI/1</td>
<td>Paduan theorbo</td>
<td>a 215</td>
<td>97.3</td>
<td>289</td>
<td>0</td>
<td>E 81</td>
<td>14</td>
</tr>
<tr>
<td>XVII/3</td>
<td>bass violin</td>
<td>d' 287</td>
<td>72.3</td>
<td>208</td>
<td>0</td>
<td>C(66)</td>
<td>25(27)</td>
</tr>
<tr>
<td>XXI/3</td>
<td>piccolo violin</td>
<td>a&quot; 868</td>
<td>22.5</td>
<td>193</td>
<td>1.5</td>
<td>g' 383</td>
<td>26</td>
</tr>
<tr>
<td>XXI/4</td>
<td>treble violin</td>
<td>e&quot; 644</td>
<td>29.8</td>
<td>192</td>
<td>1.5</td>
<td>g 192</td>
<td>25</td>
</tr>
<tr>
<td>V/2</td>
<td>chitarrone</td>
<td>a 215</td>
<td>88.8</td>
<td>191</td>
<td>1.5</td>
<td>G 96</td>
<td>13</td>
</tr>
<tr>
<td>XVI/4</td>
<td>guitar (or viola a mano)</td>
<td>g' 383</td>
<td>40.8</td>
<td>187</td>
<td>2</td>
<td>c(66)</td>
<td>21(26)</td>
</tr>
<tr>
<td>XVII/4</td>
<td>lyrone</td>
<td>c'## 271</td>
<td>67.5</td>
<td>183</td>
<td>2.5</td>
<td>C(66)</td>
<td>91</td>
</tr>
<tr>
<td>XX/1</td>
<td>treble viol</td>
<td>a' 430</td>
<td>40.9</td>
<td>176</td>
<td>3</td>
<td>F 85</td>
<td>32</td>
</tr>
<tr>
<td>VI/4</td>
<td>double (large) bass viol</td>
<td>f 171</td>
<td>182.6</td>
<td>175</td>
<td>3</td>
<td>D1 36</td>
<td>27</td>
</tr>
<tr>
<td>XX/2</td>
<td>tenor viol</td>
<td>d' 287</td>
<td>57.6</td>
<td>165</td>
<td>4</td>
<td>C 64</td>
<td>36</td>
</tr>
<tr>
<td>XVIII/1</td>
<td>harp</td>
<td>a&quot; 868</td>
<td>18.3</td>
<td>157</td>
<td>5</td>
<td>F 85x</td>
<td>15</td>
</tr>
<tr>
<td>XXI/5</td>
<td>tenor violin</td>
<td>a' 430</td>
<td>35.9</td>
<td>154</td>
<td>5.5</td>
<td>c 128</td>
<td>28</td>
</tr>
<tr>
<td>XX/3</td>
<td>(small) bass viol</td>
<td>a 215</td>
<td>74.0</td>
<td>151</td>
<td>5.5</td>
<td>F1 46</td>
<td>30</td>
</tr>
<tr>
<td>W/1</td>
<td>contra bass viol</td>
<td>G 96</td>
<td>127.6</td>
<td>123</td>
<td>9.5</td>
<td>D1 36</td>
<td>22</td>
</tr>
</tbody>
</table>

* on a vibrating length of 88.7 cm
+ on a vibrating length of 177.9 cm
on a vibrating length of 130.2 cm
### TABLE III

Pitch Limits of Gut Strings

<table>
<thead>
<tr>
<th>Type of Gut String</th>
<th>Century</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14 15 16 17 18 19 20</td>
</tr>
<tr>
<td>Unpolished low-twist gut highest string</td>
<td>x x x 235 x 227 -</td>
</tr>
<tr>
<td>Polished low-twist gut highest string</td>
<td>- - x 210 210 x 218</td>
</tr>
<tr>
<td>Low-twist lower strings</td>
<td>18 x 18 x x x x</td>
</tr>
<tr>
<td>Low-twist lower of octave pair</td>
<td>25 - - x x - -</td>
</tr>
<tr>
<td>Medium-twist lower strings</td>
<td>- x x x x x x</td>
</tr>
<tr>
<td>High-twist lower strings</td>
<td>- - 25 x x x -</td>
</tr>
<tr>
<td>Roped lower strings (catlines)</td>
<td>- - x 30 ? ? -</td>
</tr>
</tbody>
</table>

Notes for Table III:

1. The numbers above the horizontal line, when divided by the string stop (expressed in meters), give the highest frequency in Hz.

2. The numbers below the horizontal line represent the number of semitones in the range between 420 Hz (derived from 210 above the line) and the lowest pitch on a string stop of 50 cm. This range increases (or decreases) by one semitone for each four fret lengths longer (or shorter) than 50 cm that the string stop is. The lowest pitch given here is for a quiet instrument, and the range would be at least several semitones less for an instrument used in larger ensembles.

3. x indicates that evidence for the use of this type of string exists, but it has not been quantitatively analysed.

4. ? indicates that I expect such evidence to exist, but am not aware of it.

5. - means that I have no reason to expect such evidence to exist.
Nicolas’s review of the nature of our controversy in Comm 607 is good. My position could perhaps be clearer if when the ‘English viols played alone’ is mentioned in it, the tuning “a fourth or fifth below Cammerthon” is replaced by “a fourth or fifth below that implied by the nominal pitches”; it could be relative to Cammerthon, but this was not important.

I shall answer Nicolas’s five objections in turn:

1. He finds it strange that in my interpretation, Praetorius should give the pitch of the extraordinary tuning (when the viols are played alone) and say nothing about the ordinary tuning (when playing with other instruments). In my interpretation, Praetorius didn’t need to give the ordinary nominal tuning because it was the same as in the extraordinary case. He was writing about the extraordinary case and he neglected to give the pitch standard of the ordinary case. This neglect could be because the pitch standard was pretty ordinary – English Consort Pitch was the same as his preferred Chorthon, a tone below Cammerthon. The string tension in the ordinary case was also very ordinary as far as he was concerned. The low string tension of the extraordinary tuning was important in creating the special acoustic properties that could not be duplicated by German viols which were already at that tuning with thicker strings.

2. Nicolas is here worrying about Praetorius saying a “fourth or fifth”. My scenario explains this. Nicolas is uncomfortable about this scenario because it “implies some carelessness from Praetorius’s part”. But Praetorius’s ‘hands-on’ experience with English viols was clearly extremely limited because his report of the nominal pitches in the ordinary tuning is inconsistent with all of the other information we have on this subject. Any interpretation of Praetorius’s statement needs to explain this point.

3. Here Nicolas worries about Praetorius describing the extraordinary English tuning in terms of a German pitch standard and not an English one. But why should Praetorius distinguish between the two standards if they were essentially the same? He described the tunings of English wire-strung instruments according to German standards. He wrote (in Bessaraboff translation) “the English pitch for instruments is just a little lower than that of the princely choirs of Germany” (i.e. Cammerthon), as is to be perceived in their cornets, sharms, or hoboys (as they call them) which are made there”. So Praetorius would have expected English viol pitches to have some relationship with German standards.

4. In this point, Nicolas argues that “do sonsten” should mean “while otherwise” and not “in fact”. I accept this. My interpretation would then be “while otherwise, (thinking in Cammerthon) ...”. The contrast is with thinking in nominal pitch. This juxtaposition of Praetorius’s phrases is always the way I’ve thought of it. I don’t think that this does the original German an injustice.

5. Here Nicolas states that “the idea that Praetorius would have tried to define a relationship between English and German [pitch] standards is anachronistic.” Nicolas’s approach here is anachronistic, appropriate for a century earlier, but flying in the face of Praetorius’s own statements, such as the one quoted in 3 above. I do not reject this conviction, saying it is a ‘theory ....’. I would be the last to use the word ‘theory’ disparagingly. It is just inappropriate because it doesn’t fit the historical information.

Of course, Praetorius was no more concerned about absolute pitch than anyone else at his time when it didn’t matter. This would be in solo or small-ensemble playing. But he
was also as interested as anyone else in making pleasant sounds. His specialty was large-scale works and he didn’t want strained voices and breaking strings to upset performances. He wanted the many tone colours of different kinds of instruments in his ensembles, and so pitch standards were very important to him in a practical way. Large-scale musical productions were happening in his time at many places in Europe, so his concern was certainly not unique.

In the discussion following his five points, Nicolas makes several related points that are covered by my replies above. He then presents a new interpretation. If I understand it correctly, he posits that Praetorius was instructing German readers who were playing at Praetorius’s German viol tunings to play music on viols alone the English way by assuming English nominal tunings. This transposes the music down a fifth, and indeed makes a deeper resonance than with the German’s ordinary tuning. The sizes and pitches are essentially the same as in my interpretation. It would be very surprising if German viols differed from elsewhere in the type of repertoire they played. Up to Praetorius’s time, viols in sets generally played music that accommodated the option of vocal performance. Considering the relationship between vocal ranges and German viol tunings, associating the same viol size names with voice names; this downward transposition would not run off the bottom strings. Contrary to Nicolas’s surmise, there is no necessity to use larger-sized viols.

I have no doubt that such instruction could have been a primary reason why Praetorius included this passage in his book. But though he was a propagandist as well as a scholar, Praetorius was not devious. When he wrote “The English ... make everything ... in such a way that they consider the lowest string of the small bass as D, ... ” he was writing about what he understood the English did, and not what a German would do while playing in English style. His understanding seems to have been wrong in the tunings of the tenor and treble viols. This discrepancy cannot be ignored by any hypothesis unless it disappears because some independent evidence for these tunings turns up. When Praetorius ends up saying “And this gives ... a much more pleasant ... harmony than if one remained in the ordinary pitch”, the ‘one’ must still also refer to the English, even though it could refer to German imitators as well.

So we are left with the same problem of Praetorius not clearly specifying the English ordinary pitch, either in nominal or absolute terms. This has been the essential area of difference between Nicolas’s hypothesis and mine. That Praetorius was writing to encourage German imitators can explain why he hadn’t bothered to discuss it. Nicolas’s new interpretation makes it irrelevant. This should leave him free to accept my deductions of what the ordinary nominal and absolute tunings were from the English repertoire and other considerations. We would then have no serious remaining differences concerning the English practice that Praetorius wrote about.

There remain a few more points: I agree with Nicolas “that Praetorius’ contemporaries may not have been much concerned with questions of playing at the ‘right’ pitch”. They were trying only to be both musical and practical. Where pitch standards were practical, they were used. Authenticity is also a practical consideration in today’s early-music scene, because the audience expects it. It is a modern concept, aiming for historical accuracy. This severely limits the authentic attitude of being purely musical and practical. My only difference with Nicolas here is that I am more concerned with the audience’s expectation of authenticity than he is. I would be most surprised if Parrott followed his prescription and did not claim or imply that he was playing at the authentic pitch. I would accept that claim but would reject the associated implied claim of producing an authentic sound.
The "Bohemian" Wing

David Z.Crookes carries in Comm.612 interesting consideration about the appearance of the Bohemian wing - ala bohemica based on both the plates and the contents of Alexander Buchner's Musical Instruments through the Ages, London 1964. Since Buchner's time our knowledge about the wing has significantly enriched. Some of this is offered in the following communication.

While in the case of some instruments we are disposing by direct sources of informations (surviving instruments or their fragments) in the case of the wing we are to make the best of indirect informations. This is available in the form of fine-arts illustrations (as for the wing these are the main source of our information so far) and written records (these are arguable but nevertheless useful.

The pictures of plucked stringed instruments of a psaltery character show that, apart from usual and oft-depicted psalteries (whose outline resemble a trapezium - fig.1a), there were occasionally instruments which had the form of half a psaltery (fig.1b).

These were termed micanons\(^1\). We can suppose that the shape of wings developed from micanons (fig.1v). Though micanons were strung most horizontally (as well as pig-snout-shaped psalteries), wings were strung vertically. Since the most popular medieval instruments (psalteries, harps, fiddles etc.) had a variety of forms, it is fair to assume that instrument of so peripheral importance (as the wing was) had no definite form.
The majority of the so far known fine-arts illustrations of what we may consider the wing evidence the use of two independent sets of strings. Furthermore the position of hands at the instrument indicates the likelihood of the simultaneous use of both sets.

A wall-painting from the Karlstejn Castle (fig. 2 - see note 2c) clearly shows that one of strings' sets (evidently the shorter ones and therefore in a higher pitch) had metal string (most likely their white colour on the painting is indicative of silver) while the other one set (of the longer and consequently lower-pitched strings) has been strung by gut strings (brown-red colour on the painting).

The different pitch of and the use of two materials for strings are further proved by the two ways of string anchoring. Since the metal high-pitched strings had higher tension, they were led across the frets to the tuning pegs. We can make out also frets on the other side of the first three strings where probably these were anchored. Tuning was most likely done with the help of a tuning key to achieve the finest possible tuning, if only because the strings were relatively short (compare with the size of the elder's head). The gut strings ended outright at the hand-operated tuning pegs. Apparently, the anchorage of the other ends of the strings was ensured by pegs, as indicated by the second gut string.

The rest of the wing's pictures known to the writer have no colour discrimination between the strings, therefore the general use of two materials for the strings of the wing cannot be claimed with certainty. Roughly a hundred years later (a period when the use of the wing lacks evidence) Paulus Paulirinus de Praga mentions the wing with metal strings which was played by plucking of a plectrum. However none of the known pictures shows a wing player using the plectrum technique, while this was common on the same pictures in the case of the usual instruments (lute's instruments or psalteries).

Thus, although we lack solid evidence as to what sort of material used for wing's strings, the majority of the known fine-arts illustrations speak in favour of two sets of strings. One of them is mostly half the length of the other (one of the wings on a wall-painting on the vault of the staircase-house in the Karlstejn Castle has the approximate ratio of the lengths even 1:4). This allows us to assume that the difference between the two sets of strings was at least one octave (in the case of the mentioned
fig. 2 - see note 2c

fig. 3 - see note 2e
Karlštejn's staircase wing this could be two octaves). The above mentioned wing from the St. Cross Chappel at the Karlštejn (fig.2) added to the pitch-difference of the string sets that of timbre-difference thanks to the miscellaneous material (silver - guts).

The method of tuning the wing's two string sets in an octave can be substantiated by a Czech translation of the Bible at 13th century and again at the beginning of the 15th century, in which the phrase of Vulgata "in citharis pro octava" (I.Par.15/21) is rendered as "na krzydlech" ("on wings"). The Latin name "cithara" was a wider medieval term for string instruments, but what is interesting for us is the translation of the name 'cithara in octava' as the 'wing'.

The age of the wing can be derived from the known illustrations as well as written records. While all pictures date back to between the beginning and the 70's of the 14th century, written records corroborate the span between 13th and the beginning of the 15th centuries. An exception is the treatise by Paulus Pulirinus de Praga which dates back to the sixth decade of the 15th century. The most frequent occurrence of documents both pictoral an written was relatively short, about 30 years between 40's and 70's of the 14th century. Even if we take into account the earliest and the latest proof of the wing existence, its lifespan comes as short, compared to the these of the rest of the musical instruments - namely slightly more than a hundred years.

The adjective "bohemica" in the name of the instrument, which we find in the Olomouc manuscript from the second half of the 14th century, emphasizes according to Kurfürst its provenience rather than its proper name. This the reason why it is more correct to call the instrument "the wing" (ala), but not 'the Bohemian wing' (ala bohemica) as it has been identified in musicological literature so far. The existence of the Bohemian provenience of the instrument is substantiated by known written and iconographic documents, but we cannot rule out the spread of the wing beyond the Czech Lands. Cultural contacts between Bohemia under the Luxembourg dynasty and the whole of cultural Europe could certainly make this possible.

NOTES

1) Etymological association with the Arabic name canun see Sibil Larcause, A Survey of Musical Instruments, Newton, Abbot, London 1975 pp.210-213
They are mainly the following iconograms:

**a)** Passional of the Abbess Cunegunde (1319-1323) Prague State Library of ČSR, XIV A 17 fol. 18a
   reproduced in:
   - Alexander Buchner, Musical Instruments through the Ages, London 1964, plate 97 (see Comm. 612 fig. 1)

**b)** Velislav bible (about 1340) Prague, State Library of ČSR XXIII C 124 fol. 72a
   reproduced in:
   - Buchner, Musical Instruments... plate 104 (Comm.612, fig.3)
   - Buchner, Colour Encyklopedia... pl. 75

**c)** Adoration of the 24 Elders of the apocalyptic Lamb, Wall-painting in the Chappel of St.Cross at the Karlštejn Castle (Beroun district, Czechoslovakia) (about 1357-9)
   See fig. 2
   reproduced in:
   - Volek-Jareš, The History... plate 25

**d)** An angel playing the wing. Wall-painting on the valut of the staircase leading to the Chapel of St.Cross at Karlštejn Castle (about 1361-3, re-painted in 1897-9.
   There are several documents from the time before re-painting in 1897-9 in Karlštejn-archiv - see fig. 4
   reproduced in:
   - Volek-Jareš, The History... plate 30 and 31

**e)** Other angel playing wing - from the same source as 2d
   See fig. 3 - a primary copy from the time before re-painting (around 1360)

**f)** Tomáš Štítný ze Štítného, Knížky řeholky... (about 1376) Prague, State Library of ČSR, XVII A 6 fol. 158
   reproduced in:
   - Buchner, Musical Instruments... plate 117 (Comm.612, fig. 5)

To Comm. 612, fig. 2 (Buchner pl. 128): it is not certain that the instrument is the wing because we cannot clearly see the two sets of strings. Neither the vertical position of the strings is a dependable indicator for, in Bohemia the holding of psaltories not at the breast with strings in the horizontal position but at the right or left side of body with strings in the vertical position was quite common.

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4) Paulus Paulirinus de Praga, *Libri viginti artium* (1459-1463), Krakow, Library of Jagiellonski’s University, Codex 257, fol. 151*-162*.
5) See Volek-Jareš, The History... plate 30 and 31, see fig. 4

6) The record does not necessarily prove the existence of the instrument in that period since from Paulinus description suggests that he could not probably see for himself someone playing the wing, or he speaks about a different instrument wrongly calling it ala.

7) See note 3. All medieval always speak only about ala, krzydlo (=wing), ele (Machaut, Le Remede de Fortune) and they call the wing player allista. Only one source (Cancellaria Johannis Noviforensis episcopi olomucensis from years 1364-1380, ed. Ferdinand Tadra, Wien 1886, No 128, p.103f) speaks about 'ala bohemica'.

fig. 4 (see note 2a)
A primary copy (a traced drawing) acquired around 1887
A reconstruction of the harpate wing
The picture above is taken from Adam Olearius, *Vermehrte newe Beschreibung der Muscowitischen und Persichen Heyse* (Schleswig, 1656), and shows two skomorokhi playing for two dancers at Ladoga in 1634. The musician on the right is obviously playing gently on some kind of drum (may it be one-sided like the Irish bodhrán?), but I'm not sure what his companion is playing. The friend who brought this picture to my notice took the instrument to be a relation in some degree of the hardate Bohemian wing, with two sets of strings, thus:

The player may be seen as plucking with both hands. I was rather excited at the thought of such a wing in use as late as 1634, so I decided to write up and figure the instrument as an addendum to comm. 612. Then I chanced to look at the wretched picture upside down, and all notions of a wing took flight. It strikes me now that the instrument is merely a roughly drawn rebec (it would be a gudok in this part of the world), that the player's left hand is holding a bow, and that what I took for a double set of strings is nothing more than the hatching used for the musician's coat.
Instruments of skomorokhi cont’d.

Only the fact that no strings are shown on front of the instrument allows a misgiving to linger in my mind. In another of his skomorokh illustrations — see below — Olearius shows a one-man puppet show accompanied by (right to left) players of a large gusli and a fiddle: strings are discernible on the latter.

The quality of depiction in both pictures allows few conclusions to be drawn about playing techniques. The qudok, if that is what it is, appears to have all its strings sounded simultaneously, but the fiddle seems at the moment of drawing to be played only on the bottom string. The positions of the fingering hands (right on the qudok, left on the fiddle) are incredible.

Further to comm. 613

I’m grateful to S.S. for commenting at such length, and regret that I haven’t time to answer him as he deserves. Let two points suffice for now. First, there is an H in FoMRHI, and historicity is as much concerned with discovering and using all the colours of the historical palette as with working out the precise formulae of particular colours. It worries me that very important instruments like the lira da braccio are still being ignored; in comparison with the ignorance of important instruments, matters like whether viola had linings or not are to my mind worse than trivial; and I can accept no relation between historicity and commerciality. C.S. makes instruments for a...
living and I teach classics; he has to make what people want and I don't; but it's not a self-indulgence if I and other researchers (there's an M as well as an F in FoMRHI) tell people what they ought to be making and playing.

For the rest, especially the bits about the ancient kithara, the kindest thing I can say is: ne sutor ultra crepidam.

FoMRHI Comm. no. 638 The New Grove 'Eunuch-flute' article

I make two corrections without comment. The article's last paragraph reads as follows: 'One of the instruments is preserved in the museum of the Paris Conservatoire. It is 88 cm in length and is believed to date from the time of Henri Ill of France. Eunuch-flutes are still made, in several sizes, but only as toys.' This is wrong on both counts. To take the second point first, eunuch flutes are made as serious instruments, not toys, by several modern makers. Richard Baines was reportedly selling them in the Horticultural Hall a year or two ago. Now for the Paris Conservatoire instrument. In 1983 I wrote to the conservator of the instrumental museum, Madame Bran-Ricci, asking for details. I'm sure she won't mind me printing below the letter which she kindly sent in reply.

Cher Monsieur,

J'ai bien reçu votre lettre du 29/08/83 concernant une "flute eunuque", appartenant à nos collections.

Comme vous ne donnez aucune autre précision, je suppose qu'il s'agit de l'instrument portant le n° 422 du Catalogue "Chouquet" 1884 (p.108).

Cet instrument est en réalité une sorte de mirliton pourvu d'un bulbe et, à mon avis, ce n'est qu'une reconstitution du XIXème siècle du modèle que Marpense a représenté dans son traité. Nous n'en avons ni relevé, ni dessin, ni photo pour l'instant.

Croyez, cher Monsieur, à mes sentiments les meilleurs.

Madame J. BRAN-RICCI
Conservateur du Musée Instrumental

David J. Crookes
Some Measurement Techniques for Recorders.

When I submitted this Comm, it got returned by Jeremy Montagu. He asked me to rewrite the first part of it, taking into account his objections against some of the methods described. Rather than rewriting the whole stuff all over, I thought it to be easier, and also more instructive, to cut it in pieces and to paste JM’s comments into it. It may also invite some comments from other readers. As you will see, it is the next part which did JM stagger.

Bore Measurements

Mitutoyo makes what they call ‘telescoping gages’. They consist of a tube of about 5 mm diameter and 90 to 100 mm length, depending on size. At one end, the tube ends in two spring loaded feelers, which can be released or fixed in position by a screw (A) at the other end, see figure 1.

When the screw is released, the feelers can be compressed and fixed in that position. The gauge can be inserted into the hole to be measured, and the feelers can be released. The internal spring will push the feelers, until they touch the wall of the bore. Then they should be fixed in this position by turning the screw, which in fact pushes a long stiff pin inside the tube. The device is then taken out of the bore and its width is measured with a vernier calipers or, more accurately, with a micrometer. Of course, the depth has to noted as well, for which I have covered the length of the tube with graphics paper with millimeter distribution.

These gauges come in different sizes, number 155-127 goes from 8 to 13 mm, the next one from 12 to 19.5, then 18.5 to 32.5 mm, but larger sizes exist as well. Because they are not long enough for recorders, an extension is needed, which can be done in various ways. I have made a set of extension tubes, which are sketched in figure 2.

To lengthen the gauges, I take out the original screw with its fixed pin, and screw in the extension tube. For some reason,
only known to Mitutoyo, the thread at A used for the smallest
gauge is M3.5*0.5 (Metric fine), but for the other two this
thread is M4 (Metric standard).

This measurement method goes rather fast, is accurate
(= reproducible) and gives the possibility to measure along
various axes, when the bore is not round. In addition, the
gauges are not very expensive, somewhere around 40 to 50 Dutch
guilders (8 to 10 pound) each.

At this point, JM commented that he (and many other cura-
tors) "would not allow anyone to measure an instrument by this
method. The spring inside the gauge is quite powerful, and if
you push it right into itself, then push it up an instrument,
and then release the spring, the instrument is going to have
lots of little dents in the bore.

The usual method is first to set the gauge, using a caliper,
and then to push it very gently up the bore until it fits, and
then read off the length at which that diameter is found. If
one sets the gauge each time to 0.1 mm less then the last time,
one comes up with a plan of the bore in 0.1 mm steps, which is
just as accurate as a plan based on 5 mm or 10 mm steps in
length, which is how your method would come.

Even this method is not ideal, because it is liable to leave
tram lines along the bore unless very carefully done. Many
makers make their own gauges of a tough plastic (which is
kinder to the bore than metal), which screw on to a rod marked
for length. However, carefully used, the Mitutoyo gauge can be
OK (but remember that many museums are banning the use of any
metal tool)."

So far from JM's letter to me. I would add that JM's method
has an additional advantage for the maker, because it would
give direct readings of the bore diameter in fixed incremental
steps, which is handy when making the reamers. My method (say
method A) gives fixed incremental steps in length.

Let me first admit that JM has of course right. One of the
reasons why I selected method A was that I believed it to be
more accurate. Some quick tests in the meantime have learned
me that both methods are reproducible, thus accurate. I have
two additional comments. Being rather lazy, I measure back-
wards from the smallest bore diameter to the largest one: it
saves me pushing the gauges each time. So in fact the gauge is
only released for a few tenths of a millimeter and that may be
the reason why I have never noticed any denting. The other
remark is that nearly all my measurements are done when I make
my own instruments, to control the bore or check modifications,
and not on old instruments. And in these cases, method A is
still quite acceptable and much faster for the verification of
the bore at specific places.

But again, JM's method is certainly safer and should be applied
in case the instrument may experience damage.
I find JM’s comment on metal or plastic a bit less convincing.

There are very few, if any, dimensionally stable plastics; plastics can have nasty edges as well; and a good designed, metal tool can be made very smooth and highly polished.

I use another set of gauges, which I can borrow, if the bore is expanding and the measurement has to be taken from the smaller end. It is a set of 3-feet gauge feelers with direct micrometer reading at one end. See figure 3.

Turning knob A will push the 3 feet down and out. Knob A is coupled to the micrometer, so that a direct reading is obtained. Their disadvantages are that the exact depth is not known (because the 3 feet are also pushed down) and that they are very expensive. The one I borrow are made by Etalon (Swiss), but Mitutoyo makes something similar (and even better) under series 368. To give an indication of price, one gauge with a range of 16 to 20 mm costs about 570 Dutch guilders, inclusive the required extension to 180 mm, but excluding VAT.

JM’s comments here were lapart on the price that 3 little holes are even less acceptable than 2 little dents, and, again, I tend to agree. However, the feet are not spring loaded and knob A has the usual slip coupling to control the force which is exercised by the flat feet. They are used for optical surfaces as well and do not leave any trace. But once more, I do not want to dispute JM’s responsibilities nor his authority concerning museum pieces.

Step

The step is the difference between the roof of the wind channel and the underside of the edge of the labium, see figure 4.

The step is very important and has great influence on the character of the recorder (surprising enough, it was not included in the long list from Andrew Willoughby). The step can be
measured using the telescoping gages at A and B, but this is not very reliable nor accurate and I would call this dangerous. I have made a series of calibres, based upon an idea I got some time ago from Alec Loretto. At both ends of a brass rod of 12 mm diameter and say 120 mm long, I turned 2 shoulders with a difference of 0.1 mm in diameter. For example, in figure 5, the shoulder at A would be 1.05 mm and at B 1.00 mm.

Carefully remove any sharp edges! To measure the step now, insert the calibre in the head, after removal of the block, as shown in figure 6.

If the shoulder end touches the edge, then the step is larger than the shoulder height. The step is smaller than the shoulder, if the calibre passes or touches only the underlabium. This method is very reliable and reproducible and not dangerous. In addition, the calibres are very easy to make on any metal lathe using a micrometer to check the shoulders.

Cut-up
The cut-up (see figure 4) can sometimes be measured with a vernier calipers, but not always due to the geometry. The marks left by this method can be seen on some of the museum pieces. A safer, and still accurate, method is to take a piece of graphics paper with millimeter distribution and to stick it to some piece of cardboard, see figure 7. Then, with a sharp knife, cut one line straight and the other with a slope of 1 mm per 10 mm. Inserting this piece in the cut-up will tell you the size with 0.1 mm accuracy. Even if you did not cut the cardboard exactly to size, it is easy to calibrate. To be perfect, you would need a left and right hand sloped piece, but I never bothered.
Edge Thickness
I estimate this by comparing the edge thickness with one of the blades of a set of thickness gauge blades, you can buy for less than a pound in any tool shop. Under good light conditions, keeping a blade of the right thickness at the same distance of the edge and very near to it, a reasonable comparison can be made. The clue is to have good visibility, for which I use all kinds of small model train lamps, which can be manipulated at various places in the bore.

I would love to set here some xeroxed text and photographs which would speak for themselves, but the copyright laws prevent this communication from consisting of anything more than a set of references for interested readers to look up. First, the "undera" part 4, chapter 17 of his novel "ert (The Idea is a fascinating anthropological interlude of five pages from which I've learnt a lot that I didn't know before. If you're reading it in English, make sure to get the authorized translation by Michael Heim (Harmondsworth, 1984).

Next, the Belorussian hornpipe, the zhaleyka. Compare the illustration of this instrument given in JSOT (by the way, I suggest we use the abbreviation JSOT in speech and writing from now on) with the hornpipe shown as part of the appurtenances of an archigoate on a relief in the Capitoline Museum (illustrated in ... John Ferguson, The Elgin Marbles, London, 1970, plate 5).

On second thoughts but against my better judgement I include a rather inaccurate line-drawing of the relief from an old school edition of Ovid.
THE MICROWAVE WAY  DRYING BOXWOOD FAST & EASY

It is not nuclear power, it is not ultrasonic sound, it is like radar electro-magnetic radiation you can use for drying wood. The frequency of this radiation is 2.45 Gigahertz, exactly stirring the watermolecules in the wood (or spinach, fish etc.) so that finally the water will escape as steam.

What is the problem in conventional drying wood: the outside of the wood dries too fast, the inside dries slower and a couple of cracks on the outside will occur while the tensions in the wood due to the drying are too high; only drying the wood very slowly can avoid these cracks. Two processes have to be in relation: the escape of water on the surface of the wood (or through a pilote-hole) and the transport of water from the inside of the wood to the surface.

In the microwave-oven the watermolecules in the inside of the wood will be stirred first, and after that also the watermolecules more to the surface are warmed up. The transport of water will start in the inside of the wood, directly after beginning the drying process. No more water will leave the wood as can be transported (as steam!) from the inside of the wood to the surface. This is the main reason that microwave drying doesn't give surface-cracks. But: there are some other new problems you have to realize before you are starting.

- warming up the watermolecules is not enough; a temperature of over 100° C. is necessary to obtain results; you don't like the idea? Well, I have made many beautiful instruments made of boxwood, dried in this way.

- many old boxwood instruments are crooked, due to boxwood that was not dry enough; the same crooking may occur in your oven, especially if you use long and thin pieces of wood with many irregularities like knots. So: use pieces of boxwood as thick as possible, remove all bark and throw away bad pieces before drying. Thick pieces will not crook so fast and if they do you can make a proper straight one of it by turning it in your lathe. You can make a pilote-hole before drying. It is not necessary; a crooked pilote-hole is a nasty thing, you have to make a new bigger straight hole and that is not easy.

- it is very important to seal with glue or varnish the cross-sections of the wood pieces; the water (steam) may not leave the wood there because you will have than there many little cracks; the water transport in the length-direction of the wood goes so fast that the tensions in the wood will be too high. Don't use paraffin wax or other waxes for sealing because it will melt under the 2.45 Gigahertz.

- Very fresh wood up to a moisture-content of 40% can't be dried in a microwave-oven; I have seen inside-cracks due to too fast shrinking of the inside-wood compared with the surfacewood. It may be that coarse-grained wood will crack faster than fine-grained wood, but I am not sure. You can dry your boxwood in your oven 1 to 2 years after cutting.

- it is important to regulate the drying process; on your microwave-oven a regulation is obligatory (not every oven has one) so you regulate the amount of radiation and the speed of drying the wood. 1000 grams of wood take more time (about 2 times) for drying as 500 grams.

- how to control the amount of water that's leaving the wood? I use a good balance (Soehnle, accurate to 2 grams, electric and digital) and I measure the weight of the wood after every 3 or 5 minutes.

For instance: two pieces of wood, 812 gr;
After 5 minutes on position 6 (60% oven capacity) the weight was...812 gr.
(two first minutes all energy is used for warming up the water to 100° C.)
Now I put the oven for 5 minutes on 50%, after that the weight was 802 gr. The oven on 45%, after again 5 minutes, the weight was 786 gr, another 5 minutes later the weight was 768 gr and the wood had loosed 44 gr. in 20 minutes. (more as 5% of its original weight). I take the oven capacity as low as possible that the process will not go too fast; a too low position of the regulator will give no drying results at all.

I have made some research on microwaved dried wood; I did compare pieces of wood under the microscope and I didn't see any difference between this wood and normally dried wood. No microcracks, no cellwall-collapses. Wood that was dried too fast and too long became brown in the inside and burned at last, in the inside black, on the surface normal colour.

There are some other interesting possibilities of your microwave oven. Staining boxwood with nitric acid is not always easy; it is dangerous for your health, so you do it outside the door. And there, in your garden, the temperature is too low and the result of acid-staining depends greatly on temperature. What you have to do is this: go again in your garden, lock up your cat and children, lubricate the wood with acid, put all in a plastic bag, close the bag firmly and put all in your oven. Only 1 minute on position 4 (on my oven 40% oven capacity - 100% is 1300 Watt) will give you very beautiful staining results. After that you have to neutralize the wood with acid; be careful that your oven will not be stained also, use first quality plastic bags.

Another possibility for your oven: I impregnate my flues with linseed-oil, some days. After that I put the impregnated pieces in the oven, 2 minutes on position 4, the oil is very warm through the whole flute and is hardening on the same moment.

I did not invent the microwave way myself; I heard from some people using "radiation"; I did make some research, I couldn't find any literature on this subject (And I am not only a flutemaker but also a forestry engineer, therefore my scientific interest). The advantages of the microwave way are clear: you have not to buy and store boxwood for a very long period, you can dry small pieces like branches you couldn't use before and your instruments will live longer.

Jan Bouterse
Mendelssohnstraat 3
7204 NV Zutphen
Netherlands.
We have to give knowledge about our researches in historical brass-metal, in which we are involved since 1977. The Austrian musician and leader of the Vienna "Concentus Musicus" Nikolaus Harnoncourt asked us to study and copy the two "Friedrich Ehe - corni da caccia" in the collection "Carolino Augusteum" in Salzburg. His and our idea was to create brassinstruments from Baroque- and Renaissance models in the same quality like the old Nürnberg- and Vienna-brass-instrumentmakers. The meaning of this was:

1. to bring back the metallurgic richness of the historical brassmaterial
2. to bring back the old hammerwork technique (that means to come down from tingerthick bars of brass to thin halfmillimeter thick sheets of brass by pounding the bars)
3. to form the instrumentparts especially the belfsection by hammering rough tubes and cones on steelhard mandrels.

Two aspects have to be noticed by the last point:

a) the hammering has to be done by steel-hammers (like a copper- or silver-smith does) to bring the wallthickness of the bell continuously down from 0,4 mm of the corpusparts to about 0,1 - 0,2 mm at the bellend (which then is fixed by the garland)

b) to do the hammering-work on a steel mandrel, which fits exactly and has the innerform and volume of a bell for example.

Or the hammering can as well be done (and it's possible!) on the normal "horns" of an amboss. This work indeed needs high standard of handcraft and experience.

From point 2. and 3. we gave report at the exemple of an importand instrument, the Neuschel-tronebone of 1557 (now collection Wiener Hofburg, Sammlung Alter Musikinstrumente). We described it at the script: "Zur Geschichte der Renaissance-Posaune von Jörg Neuschel (1557) und zu ihrer Nachschöpfung" von Heinrich Thein. Basler Jahrbuch für Historische Musikpraxis V 1981.

Meanwhile we have the experience that "historical brassinstruments" (trumpets, sackbuts, corni da caccia, horns and bells for oboe da caccia) created "with the three points" are excellent in ("baroque") sound, comparable with the qualities of the originals. Especially the sparkling sound, the different "registers" in dynamic and attack and the "Schmettern" beginning in mezzoforte ist enjoyed. Players like Ralph Bryant, Hermann Schober, Richard Rudolf, Friedemann Immer, Don Smithers, Jonathan Impett, Ludwig Gütüler, Malcolm Morton, Andrew Joy and the leaders Nikolaus Harnoncourt and Johann van der Meer have experiences with "our" instruments.
To come down to the "three points" we now have to give report of "point 1)", the researches of historical brass by metallurgic analyses. At the end of this article you will find a list of analyses, which we have let done. Additional you will find further analyses, which we have collected from literature and researchers.

With the advice and help of Rémy Gug, the well known researcher and harpsichord-and stringmaker from Strasbourg (France) we got the help of Mr. Bourhis, Mr. J.R. Bourhis is scientist at the Université de Rennes, Laboratorire d'Anthropologie-Préhistoire-Protohistoire et Quaternaire Armoricains. He analyses by spectography and the quantitativ analyses by elektrolyses. There is naturally the need to describe this method exactly, but my English is not perfect and the method is exactly described in the scientific literature.

The important point for us is to see the richness of the historical brass metals and to start to study their differences and to learn to handle with a lot of new brass material possibilities in a time, where we can only get today-technical brass in three variations with only three components (copper, zinc and lead - Ms 58, Ms 72, Ms 85).

We started three ways from the analyses and had very good results with a modest mixture between Haas' and Hainlein's metals.

So far our report.

Very warm heartily thanks to Rémy Gug and Mr. Bourhis in Rennes!

Max Thein Heinrich Thein

Brass instrumentmakers Max & Heinrich Thein

Heinrich Thein - script.
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- (+) : tr (inférieurs) ; 0 : environ ; tr (supérieurs) ; 0,001 (1) ; - : non décelé.
- < 0.0001.
- pour les infra-normes : 0,001 (2).
## Objects of the metallurgic analyses of Mr. Bouchis, Remmes

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<th>Zeit</th>
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<td>alt?</td>
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Cher Monsieur,

Veuillez trouver ci-joint les résultats des analyses des échantillons de laiton soumis par Monsieur THEIN.

- Les teneurs en cuivre ont été dosées par électrolyse.
- Les teneurs en impuretés ont été déterminées par spectrographie.
- Les teneurs en zinc sont données par différence.

Les échantillons 1, 2, 3, étaient insuffisants, les teneurs en cuivre n'ont pu être dosées par électrolyse. Les teneurs en zinc ont été dosées par spectrographie, elles sont approximatives (+ ou - 3 %).

Les échantillons 3, 4, 5, 12, étaient trop insuffisants. Les temps d'exposition étaient insuffisants, les spectres sont mal venus. Il est possible que les teneurs en zinc et en impuretés soient supérieures à celles indiquées.

Tous les échantillons sont des laitons. Les teneurs en zinc sont comprises entre 20 et 34 %, l'échantillon à 18 % de zinc et les échantillons 3, 4, 5, 12 ont des teneurs comprises entre 10 et 15 %; il est possible cependant que ces teneurs soient plus fortes.

Les teneurs en éléments-traces ne dépassent pas 1 %. Pour que éléments nous avons souligné les teneurs les plus fortes.

Les teneurs en étain sont très faibles. Seuls trois échantillons 7, 9, 10 ont des teneurs comprises entre 0,20 et 0,70 %.

Sept échantillons 1, 2, 6, 7, 9, 11, 14 ont des teneurs en plomb comprises entre 0,15 et 1 %, l'échantillon 10 a une teneur très forte en plomb 4 %.

Les teneurs en arsenic sont faibles. Seuls trois échantillons ont des teneurs notables comprises entre 0,15 et 0,20 (6, 10, 13).

Les teneurs en antimoine sont très faibles et ne dépassent pas 0,015 %.
Cinq échantillons ont des teneurs notables en argent comprises entre 0,10 et 0,30 % (6, 7, 8, 10, 15).

Sept échantillons (4, 5, 6, 7, 8, 9, 15) ont des teneurs notables en nickel comprises entre 0,10 et 0,40 %, l'échantillon 1 a 1 % de nickel.

Les teneurs en fer sont faibles. L'échantillon 7 a 0,30 % et l'échantillon 8 a 0,50 % de fer.

Les teneurs en Sn, Si, Al, Ca, Mg ne dépassent pas, sauf rares exceptions, 0,10 %. Ces éléments ne représentent qu'un bruit de fond sans importance bien marquée.

Je vous prie de recevoir, cher monsieur GUG, mes salutations distinguées. Transmettez mon meilleur souvenir à monsieur THEIN.

J.R. BOURHIS
Ingénieur au C.N.R.S.

REPORT OF THE RESEARCH LABORATORY

NON-DISPERSIVE X-RAY ANALYSIS

Examination No. 71.261
15th Century Buysine, German, 17.1990
Requested by the Musical Instruments Department

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<td>0.01-0.1%</td>
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</tr>
<tr>
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<td>0.01-0.1%</td>
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<tr>
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<td>0.1-1.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Lead</td>
<td>5.0%&lt;</td>
<td>&gt;1.0%</td>
</tr>
<tr>
<td>Iron</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
<tr>
<td>Titanium</td>
<td>0.1%</td>
<td>0.01-0.1%</td>
</tr>
<tr>
<td>Calcium</td>
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<td>0.5%</td>
</tr>
<tr>
<td>Strontium</td>
<td>0.001%</td>
<td>0.001%</td>
</tr>
<tr>
<td>Barium</td>
<td>0.01%</td>
<td>0.01%</td>
</tr>
<tr>
<td>Magnesium</td>
<td>99.2%±2%</td>
<td>99.8%±2%</td>
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MUSEUM OF FINE ARTS
BOSTON • MASSACHUSETTS • 02115

SEMI-QUANTITATIVE SPECTROGRAPHIC ANALYSES
Examination No. 71.261  17.1990
BUYSINE, 15th Century, GERMAN

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KEY:
- VFT - Very faint trace
- FT - .001%
- T - .001% - .01%
- W - .01% - 0.1%
- M - 0.1% - 1%
- S - 1% - 10%
- VS - above 10%
- ND - Not detected

August 25, 1975
Herrn Heinrich Thein
D-28 Bremen
Stavenstr.7

Sehr geehrter Herr Thein,

Die bisherigen Analysen ergaben Messing mit folgenden Gehalten: Kupfer 69 bis 73 %
Zink 30 " 27 %
Blei 0,4 " 0,8 %
Daneben wurden Spuren von Arsen und Antimon gefunden.
In der Hoffnung, Ihnen mit diesen Auskünften gedient zu haben, verbleibe ich mit freundlichen Grüßen

PS. Die Mikrobürteprüfungen an alten Trompeten ergaben einen mittleren Wert von 145 g. Dieser Härtewert dürfte von grosser Wichtigkeit sein.

Finally material to metallurgic analyses:

1) Galpin Society Journal No XVIII S. 39 (page 39):
Spectrographic Analysis of an trumpet of J. W. Haas:
75 % Cu
25 % Ag (Silver)
Decoration ca 1% Au (Gold)
Traces quantities of lead and Nickel of less than 0,1%

2) Dr. Titus Niedermayer
in Fa. BASF Aktiengesellschaft
Ludwigsafen am Rhein

Einige Überlegungen zur analytischen Untersuchung von Trompeten aus dem Deutschen Museum, München.