Quarterly No. 134, May 2016

FoMRHI Quarterly

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The next issue, Quarterly 135, will appear in August 2016. Please send in Comms and announcements to the address below, to arrive by August 15th.

Fellowship of Makers and Researchers of Historical Instruments

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BULLETIN 134 **Christopher Goodwin**

This is the second *Q* of this subscription period (nos. 133-136). Members from last year who have not yet renewed their subscriptions will receive this in PDF form on a benefit-of-the-doubt basis, but to receive the printed copy too, you must pay the subscription. Reminders will shortly be in the post, though most of you have renewed.

Many thanks to all the contributors, whose efforts combine to make this a more or less 'perfect' *Q*, combining scholarly research with practical advice and experience that can be put to use in the workshop, and with a balance between plucked, bowed and blown instruments. Long many we so continue!

One point to mention is that the committee has now made a decision with the aim of keeping a balance between giving people an incentive to subscribe to something which will later appear freely available on the website, and the desirability of making authors' contributions known to the world beyond the readership of subscribers. Henceforth each *Q* will be posted to the website a year after publication, rather than putting everything (including things perhaps published in December) on the website on 1st January.

Donald Gill (1919-2016)

Readers will be sad to hear of the passing of Donald Gill, after a long and full life, on Thursday 12h May. A keen amateur maker of plucked string instruments, whose magnificent collection he recently donated to the Lute Society, he did important research untangling the history of lute-family instruments, and was a pioneer of the early music revival. Details of the memorial service will be circulated in due course.

Welcome (or welcome back) to new members

We welcome several new members this quarter: Peter Kempster, Colin Hamilton, Yoshio Shimada, Judith Sohl, Emanuele del Verme.

De Bouwbrief 159 and 160

This is an attractive colour A4 Dutch language magazine full of practical materials aimed at the instrument maker. Issue 160 has an article on the making of a cello from the fallen bough of a pear tree(!), devices for measuring the temperature of solders, varnishing violins from authentic recipes, building regales, and making different historic keyboards. There is also Jan Bouterse's chapters on ivory; the original Dutch of the Comms 2053 and 2054 which appear here.

The bagpipe map

At the International Bagpipe Conference in Glasgow Feb 26th- 28th Pete Stewart and Julian Goodacre officially launched a new website www.thebagpipemap.co.uk .

This is an interactive map to list all the representations of bagpipes in publicly accessible buildings in Britain. This map is an ongoing project which relies for its growth on a community of contributors. If you know of, or happen to encounter on your travels, a carving, stained glass window or painting of a bagpiper that is not yet included on the map then you are welcome to make a contribution.

It is fascinating to watch the map develop. In the first month we have listed a total of well over 120 pipers, mostly in England and more than 40% of these pipers are playing double chanters. Also clear regional styles of carvings are slowly emerging; do visit the site.

Cambridge Woodwind Makers

Cambridge woodwind makers continues to have a very full cared of events; see www.cambridgewoodwindmakers.org, email: information@cambridgewoodwindmakers.org.

It is also worth checking the website of their cousin company (Stapleford Granary) for other related concerts and courses.

Courses include Brass Pop-up-Shop, Cornetto Making with Michael Münkwitz, Sam Goble, & Andrew Hallock, Clavichord Making with Johann-Gottfried Schmidt, Oboe Reed Making with Adam Shapiro, Baroque Oboe Making with Jacob Denner, Oboe D'amore with Paul van der Linden, Wooden Flute Making, with Robert Bigio, Flute Headjoint Making with Robert Bigio, Recorder Making with Tim Cranmore, Recorder Knowledge with Jacqueline Sorel, Classical Clarinet Making with Daniel Bangham, Long Trumpet Making with Robert Barclay, Richard Seraphinoff and Michael Münkwitz, Repair and Care Days with Daniel Bangham, Woodland Whistle Making, with Daniel Bangham and more.

STANDING CALL FOR PAPERS

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

In naming your Communication, remember that people will search for it online using keywords. So if you are discussing, say, a Ruckers harpsichord in Paris, call it 'Observations on a Ruckers harpsichord in Paris', rather than 'Observations on a curious old instrument.'

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

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

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

If your interests have changed, and you don't now want to be a member of FoMRHI, please let us know, to save postage costs.

FoMRHI Comm 2046 **Eric Franklin**

An attempt to reconstruct the bagpipes depicted in Peter Breughel the elder's 'Peasants' Wedding'

When I trawled the 'net' for modern 'Flemish pipes,' I found 'reinterpretations' aplenty but few that seemed to resemble the painting closely (1). The Breughel chanter is definitely robust. (If you look at my photographs you'll see that because of my inexperience as a turner mine isn't throughout its length).The drone stock is often interpreted as a rectangular block with incised decoration, both drones being set into it such that the tenor drone terminates well short of the bass drone. In the Breughel

painting the tenor drone is mounted on a short tube which brings the drone tips much closer in overall length.

Scale: The chanter length seemed similar to the piper's elbow to little fingertip distance which measures 40cm on my forearm (for your comparison, my height is 1m 65cm), so I scaled the plans accordingly and, with six fingers down, the chanter plays at approximately 'd'.

Fingering: Purely for my convenience, laziness and familiarity I added a thumbhole that is thought to be absent in the originals (2). I'm not sure I could play a chanter without one but I presume that in the original the top fingerhole serves this function and the bottom little fingerhole becomes the fundamental. As with setting up all wind instruments, holes need to be placed and enlarged until they work – my suggestions are but a guide.

Bore tapers: I used the outside bore of the chanter profile to suggest a taper and built a reamer from steel bar purchased from my local ironmonger. Hubert Kwisthout suggested that the drone bores needed to be tapered, also so I used my chanter reamer to taper just the top sections of each drone. I don't notice much change in the tone, volume or behaviour so this taper might well be unnecessary.

The drone stock: As already noted, on the 'net' most drone stocks of modern 'Flemish pipes' bear little resemblance to the Breughel painting which seems to show a slim block of 'figure of eight cross' section. For ease of maintenance and in line with the painting, I have split the unit into a true stock tied into the bag, and a part which, on the plans, I call a divider. It is possible to combine the two and mount the combination directly into the bag. My (woodworking) lathe headstock can be fitted with a toroidal disc (like a POLO mint) with four screw holes which allows me to mount the 'divider' blank with the bass drone axis along the main axis of the lathe. Thus, I was able to turn the bottom tenon and drill the bore on the same setting. To interconnect the bass and tenor drone bores I drilled two 6mm bores, one down from the tenor drone centre to a depth just short of the chamfer, and a cross bore to meet it taken through to the bass drone bore. Temporarily, I put a length of brass tube down this first bore to act as a depth stop for the side plug when glueing it and completed the job by boring the tenor drone socket to a suitable depth. External shaping of this divider was done by eye with ruler, saw, block plane and gouge.

Bag: This is enormous in the painting; held in front and squeezed by both arms. A later painting from 1632 (3) shows a more conventional bag (and the lower tenor drone position). After several failed attempts to make such a bag, I Emailed Jonathan Swayne, borrowed his plan (with permission) and persuaded Jackie Boice to fettle it for me. I had some correspondence with Richard York who agreed that the bag appeared to be turned inside out and that he had asked Jonathan Swayne to do this for his large Flemish pipes. When I mailed Jonathon Swayne he commented that the operation was possible but involved a lot of effort. Having attempted it in one of

my experiments and punctured the leather in the process I have left Jackie's new bag without prolapse. Whatever bag plan you choose the shape is a veritable challenge to the Cerne Abbas giant albeit on a smaller scale, and if you want to use Jonathan's plans, please ask him first.

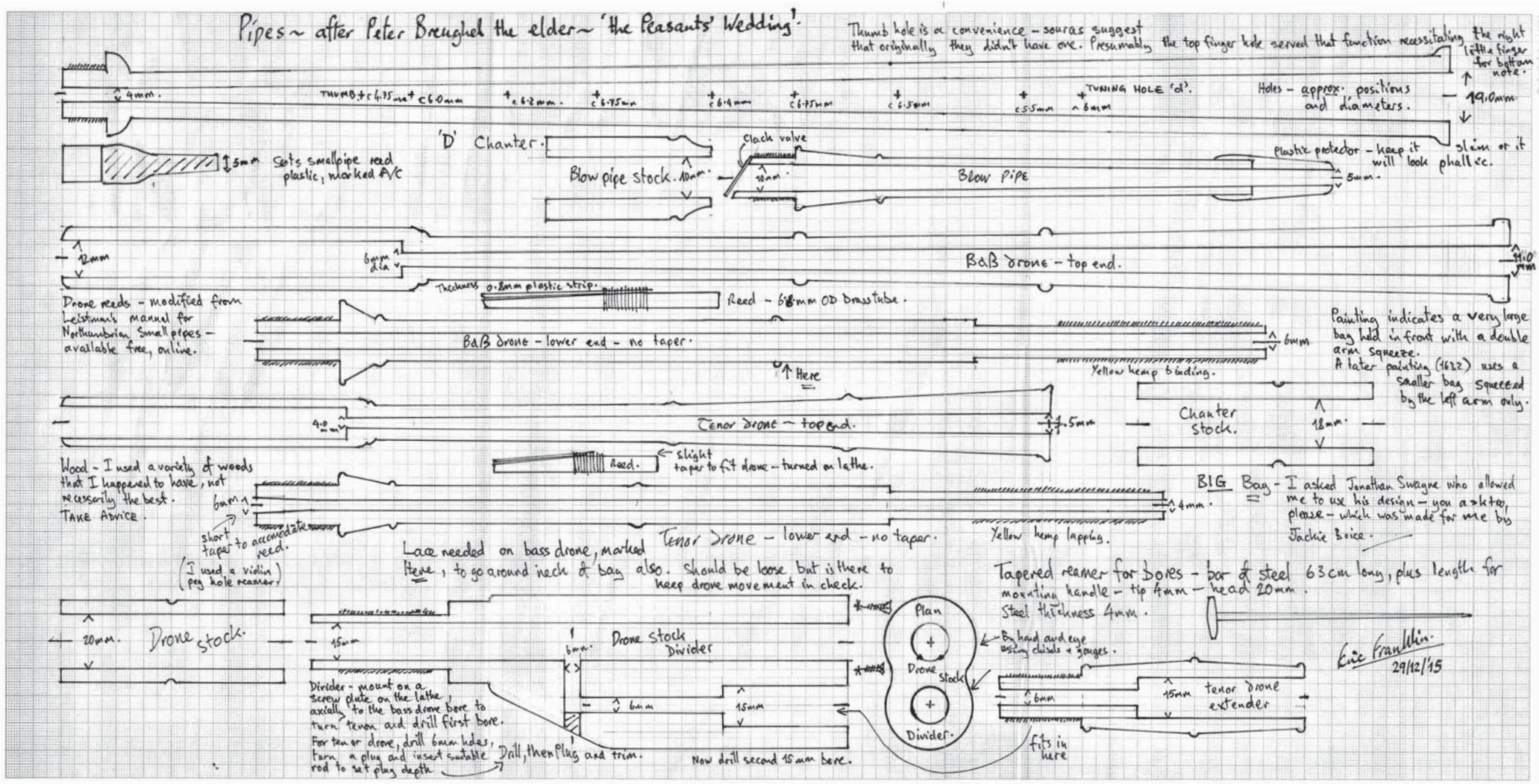
Swaying drones: Both paintings show a lace tied around the lower section of the bass drone and the bag neck presumably to provide necessary discipline. I concur as, in my hands, the drones have a tendency to swing to the left in use and need to be brought firmly to heel.

Reeds: These should, of course, be made of reed, absorb lots of moisture and give any self respecting piper plenty of trouble but I took the safe route and made the drone reeds from brass tube with a plastic tongue (4). I file the tube to a taper of half the thickness at the tip, take out the corners, bend the tip upwards, solder and clean up. The tongue, unlike Liestman's, isn't tapered but a plastic strip of constant thickness, shaped by lying the brass base on the plastic, drawing round it and cutting accordingly. The chanter reed was that for a Scots smallpipe which I just happened to have handy.

Both volume and pressure of air are substantial.

References:

1) http://www.hotpipes.com/fhbr2.jpg
2) https://en.wikipedia.org/wiki/Doedelzak
3) https://upload.wikimedia.org/wikipedia/commons/thumb/6/65/Musician_Holding_Bagpipes_1632.jpg/457px-Musician_Holding_Bagpipes_1632.jpg
4) http://www.northumbrianpipers.org.uk/index.php?page=Links appears not to be accessible at the moment. Please enquire of the NPS. You want to see pages 109-118.


Pipes ~ after Peter Breughel the elder ~ 'the Peasants' Wedding'.
Thumb hole is a convenience – sources suggest that originally they didn't have one. Presumably the top finger hole served that function necessitating the right little finger for bottom note.
4mm.
THUMB, c f 6.75mm, c 6.0mm
e 6.2mm.
c 6.75mm
c 6.9mm
c 6.75mm
c 6.5mm
c 5.5mm
TUNING HOLE 'd'.
c 6mm
Holes – approx. positions and diameters.
19.0mm
slim or it will look phallic.
'D' Chanter.
Clack valve
Blow pipe stock. 10mm.
10mm.
Blow pipe
Plastic protector – keep it
5mm.
5mm
Sets smallpipe reed plastic, marked A/C
12mm
6mm dia
Bass drone – top end.
11.0mm
Thickness 0.8mm plastic strip.
Reed – 6.8mm OD brass tube.
Drone reeds – modified from Leistman's manual for Northumbrian Small pipes – available free, online.
Bass drone – lower end – no taper.
6mm
Here
Yellow hemp binding.
Painting indicates a very large bag held in front with a double arm squeeze.
A later painting (1622) uses a smaller bag squeezed by the left arm only.
Tenor drone – top end.
4.0mm
7.5mm
Chanter stock.
18mm.
Reed.
slight taper to fit drone – turned on lathe.
Wood – I used a variety of woods that I happened to have, not necessarily the best.
TAKE ADVICE.
6mm
short taper to accomodate reed.
(I used a violin peg hole reamer)
BIG Bag – I asked Jonathan Swayne who allowed me to use his design – you are later, please – which was made for me by Jackie Boice.
Lace needed on bass drone, marked Here, to go around neck of bag also. Should be loose but is there to keep drone movement in check.
Tenor Drone – lower end – no taper.
4mm.
Yellow hemp lapping.
Tapered reamer for bores – bar of steel 63cm long, plus length for mounting handle – tip 4mm – head 20mm.
Steel thickness 4mm.
20mm.
Drone stock.
15mm
Drone stock Divider
6mm.
Plan
By hand and eye using chisels + gauges.
Drone stock
Divider.
6mm
15mm
tenor drone extender
Divider – mount on a screw plate on the lathe, axially to the bass drone bore to turn tenon and drill first bore.
For tenor drone, drill 6mm holes, turn a plug and insert suitable rod to set plug depth
Drill, then Plug and trim.
Now drill second 15mm bore.
fits in here
Eric Franklin.
29/12/15

The oldest Hummel (a folk instrument) from Germany identified

Translation: Christa Farnon, Pennsylvania / USA

By 2011, on the occasion of the Hummel exhibit in the museum Cloppenburg , Wilfried Ulrich (master instrument-builder in Norden / East-Frisia) had finished his extensive research of the musical instrument Hummel from the Middle Ages up to the 20th century. In fact, he thought that he knew all the Hummels in Germany. In the meantime, he learned that there is stuccowork on the ceiling of the entrance hall in the *Manor Damp* (on the Baltic Sea near Eckernförde) containing the image of a Hummel. On a trip to Denmark, he had the opportunity to make a

detour to the said manor in order to see this image and to photograph it. In four areas on the 7m high ceiling, eight nearly life-size, lightly clad young ladies could be seen in three-dimensional stucco work, each playing a musical instrument: harp and violin, flute and chalumeau, fanfare and singing, drums and a Hummel. It was immediately apparent that these instruments were not made from gypsum, but that real instruments had been used. The depicted Hummel, however, is not shown in the typical playing style of lying on a table, but the instrument is held only at the peg head, and is bowed in viola da gamba fashion. This depiction led, in a 1976 description, to the erroneous conclusion that it was based on an Icelandic Langspil. *1 However, the Langspil, which is much slimmer, is played lying on a table, or more infrequently, lying on the lap. Also, the Langspil usually has only three strings. The stucco work was created in **1698** by the Northern Italian stucco craftsman Joseph Mogia (and his workshop). He would not have had any knowledge of the Icelandic Langspil since it was only by 1789 that a first, brief report about the Langspil existed. In 1810, Sir George Mackenzie of Scotland described it in detail on the occasion of a trip to Iceland.*2. The Italian stucco craftsmen considered themselves artists and as such were also better paid than ordinary construction workers. They created a "beautiful work of art," regardless of the typical way the instrument was played. These stucco artists were not necessarily musicians and therefore they added instruments to create a "beautiful appearance." In this fashion, artists around 1800 depicted beautiful young society ladies with a lyra guitar which attested to their "classical education." However, the instruments simply cannot be played in the depicted posture. Also, medieval pictures of hurdy-gurdies (symphonia) in Spain and England show rows of keys over the entire length of the sound box, which is also technically impossible. Artists have their very own view of things, so the results must not be mistaken for reality!

Taking a closer look at the Hummel instrument from the *Manor Damp*, one can see from the number of the metal pegs, that there were originally thirteen strings rather than four heavy strings. A drill hole of a missing peg can still be detected. At the end block, one can recognize the indentations which the strings pressed into the wood where they turned around behind the bridge. Above the finger board ran two double strings of the same pitch, with a wider space between each pair of double strings. This suggests the likely playing method: with the thumb on top of the noter, one presses on the first pair of double strings and glides across the frets to create the melody, while the left index finger below at the edge of the instrument ensures a constant distance of the noter. The second pair of double strings then sounds together with the drone strings. The second variation results from fingering, using the index finger or the thumb for the first pair of double strings, and creating subsequently a lower accompanying third (or a fourth or fifth) by using another finger on the second pair of double strings. The plucking of the strings with the right hand was most likely accomplished with a goose quill – or perhaps with a piece of whalebone. The third fret is missing on the finger board . However, one can still recognize the holes of the fret staple as well as as the longish pressure mark, which the fret left on the finger board. The fret spacing is somewhat imprecise, but that is the case with all old Hummels. The spacing of the frets was determined by trial and error, via a simple song. The mathematical

calculation of the fret spacing was unknown – also the fret spacing on the monochord by *Guido of Arezzo*, which is comparable to the Hummel, was not familiar to the folk in the villages. In the Damp-Hummel, the *Do* of the beginning of the scale (relatively solmisation) is produced by the open melody string. Most Hummels have the *Do* at the third fret so that the open string sounds a fourth lower.

If you adjust the photo on the PC screen to a darker image with more contrast, a peculiarity can be noticed: the soundboard of the instrument was damaged – a piece between the sound hole and the bulge was broken out, and the stucco craftsman pasted here over it a strip of linen, which meets the lower side frame in a wavy manner, resulting in an uneven arc of the outer frame. Furthermore, the glued joints between the thin boards of the side and the sound board as well as the back are loosened. From all this one can see that in **1698** an old, dilapidated Hummel without strings was used, which maybe was found by chance in an attic. The stucco craftsmen, who certainly knew the cello, thought: "Let us turn it into a sort of cello, and add four heavy strings with extra drill holes at the end block." A Hummel with many strings on a flat straight bridge can hardly be played with a bow. That would result in a "cats' concert" since not all strings can be bowed with the necessary even pressure of the bow.

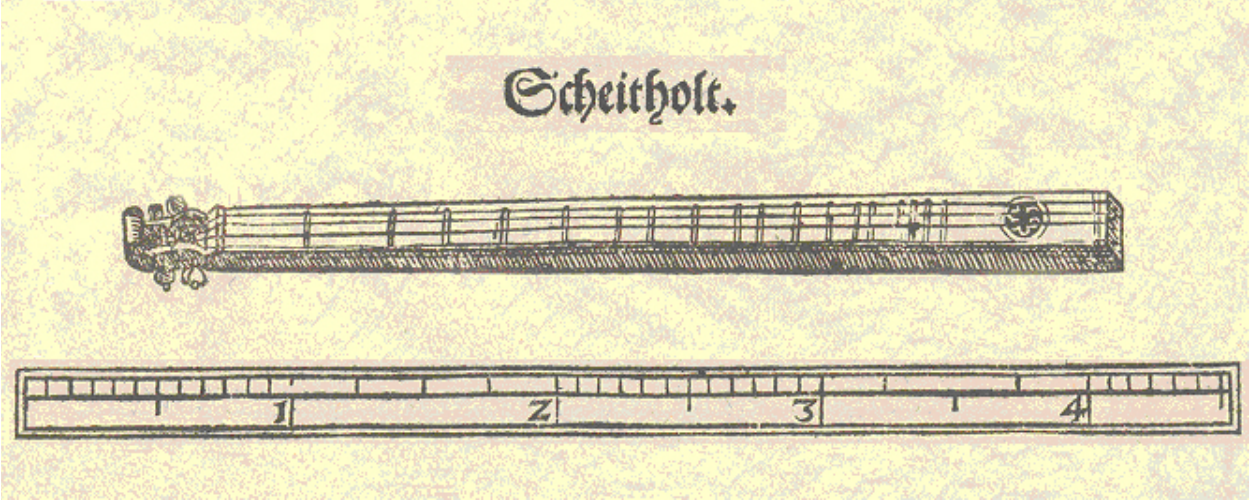
But there is a **1699** report of playing the Hummel with a bow:

"Het speelen wort van sommige gedaan met twee pennetjes / met de eene schrabbense over de snaaren / en met de andere strijkense langs de voorste snaare over de toonen: Andere strijken met een strijkstok op de snaaren / en met de nagel van de slinker duim strijkense op de voorste snaare over de toonen / en speelen alsoo de voysen". *3

"Some play with two noters / with one they scratch over the strings / with the other they glide over the frets on the string at the very front: others play the strings with a bow / and with the left thumb nail they glide over the frets of the first string and thus play the melodies."

The instrument's name *Noordsche Balke* (Nordic Beam) indicates a beam shaped instrument – a rather slim, straight instrument with few strings. The oldest original from **1608**, which is 6 cm wide, is in the *Gemeente Museum* in Den Haag. One can indeed make music on its three strings with a bow by mainly bowing the melody string and in-between bowing the few other drone strings as a simple bass accompaniment – as drones. The small width of the instrument, however, makes it awkward! The later instruments with a bulge on one side *4 retained the old name *Noordsche Balke* although they did not have the shape of a beam. They also have only three or four strings.

How long had the dilapidated *Damp*-Hummel been lying in the attic **before 1698**? How long before that was it still in use, delighting the farm hands and maids during barn dances ("*Danz op de Deel*") when it was still playable? Perhaps sixty years? Maybe more? Surely, this Hummel was built during the first third of the 17th century. This puts the instrument close to the Scheitholt of *Michael Praetorius*.



The court Kapellmeister of Wolfenbüttel described for the first time in **1619** how to play the Scheitholt, which can be transferred exactly to the Hummel. So, is it by pure chance that Michael Praetorius described a Scheitholt and not a Hummel in his description of contemporary musical instruments? Is the Scheitholt not at all the remote ancestor of all fretted zithers as so far commonly thought, but just a very simple variant? A Hummel is mentioned already in **1508** in Cologne since it was played together with other instruments in a procession. Critiques of this text, which point out that it does not necessarily refer to the string instrument since there existed the *Hümmel**chen*** – a small bagpipe – are not valid, because bagpipes are mentioned separately in the text. There is a woodcut from Augsburg (Schema monochordi) *5 from **1516**, showing more beautiful instruments than the Scheitholt. However, they are still described as monochords. There is a well preserved *Langeleik* (Norwegian Hummel) from the year 1524 which is still played even today (privately owned). Praetorius described the instrument as an "*Instrument for Beggars*". But the noble masters (von Ahlefeldt) of *Manor Damp* had included a Hummel in a prominent place in the entrance hall and the music hall and thus dignified the instrument. Was the instrument conceivably not only for farmhands and maids, but also a musical toy for the leisure-time entertainment of the nobility? Did Margarethe von Ahlefeldt (1613/4-1681) or one of her daughters play the Hummel, just as a short time later the Queen of France and her daughters played the folk instrument hurdy-gurdy? Surely, Bendix von Ahlefeldt would not have considered an "instrument for beggars" worthy to decorate the ceiling of his manor house next to important instruments of his time.

Besides the eight lady musicians, there are two allegorical female figures holding banners, depicted next to the staircase. One text reads in translation, "This orchestra brings forth in competition celebrated joys." The other reads "MUSARUM NUTRIX PAX OPTIMA EST RERUM" -- "Peace, the nurse of the muses, is the most splendid of things."

Not a bad slogan - also for today!

The next step is obtaining permission to carefully measure the instrument in order to recreate it. Ulrich is curious to hear how it will sound.

The fact that the Hummel was not considered an "instrument for beggars" by the nobility of Schleswig-Holstein is also evident in another stuccowork of the former summer residence of the Duke of Mecklenburg in *Ratzeburg* (Adolph Friedrich IV. of Mecklenburg-Strelitz). The original castle of 1660 was demolished in 1764 and replaced by a lavish new building. Various musical instruments were sculpted in the festive Rococo hall. One figure consists of a Hummel and a bagpipe. Since the sound hole of the Hummel is outlined only by scratched carving work and the fingerboard shows a rather peculiar arrangement of the frets it is possible that this instrument is simply a decoration.

All the same - here again the Hummel was ennobled!

Ulrich will undertake a precise analysis with all measurements of the instrument during a future trip to Schleswig-Holstein.

The book “The Story of the Hummel” – History of a Folk Instrument from the Middle Ages to the 20th century is available from Ulrich. (Engl. ed., 22,- €, + 7,- € postage)

www.ulrich-instrumente.de , Mail: ulricus.norden@t-online.de

*1 Stocks / Schütz, *Adeliges Gut Damp,* München + Zürich, 1976

*2 Sir G. Mackenzie, *Travels in the Island of Iceland During the Summer of the year MDCCCX* (1810),
In: http://www.musik.is/Paelingin/Langspil_and_Icelandic_Fidla.pdf (Sept. 2013)

*3 *Claas Douwes*: Grondig ondersoek van de toonen der musijk (1699) ,
Hoofdstuk XIV, *Van Noordsche Balken*.

*4 Instruments in *Fries Museum*, Leeuwarden and *Museum W. van Haaren*, Heerenveen

*5 Johannes Aventinus, *Musicae Rudimenta*, Augsburg 1516,
Bayr. Staatsbibliothek, München, Sig.: 4 Mus. Th. 44

© Wilfried Ulrich, Okt. 2013

PS.:

Measurements were taken in July 2015.

	Gut Damp – Hummel	Ratzeburg - Hummel
Total length :	80,0 cm	85,5 cm
Head	14,2 cm	15,5 cm
Width	22,4 cm	16,5 cm , 10,0 at head
Height of soundbox	7,3 cm	5,0 cm , 4,5 at head
Stringlength	63,5 cm	66 cm
Strings	2 + 2 + 9	2 + 6
Frets	*Do* at open string, diatonic	Curious !

Hummel Manor – Damp

Hummel : Castle Ratzeburg (changed with Mandolin pegs)

FoMRHI Comm. 2048 **John Downing**

Further to Comms 1944 and 1948 – Napoleon and a Seven Course Oud – an Update

Comm1944 refers to an engraving of a seven course 'Egyptian' oud and its case published in the monumental work 'Description de l'Égypte' in the years that followed Napoléon Bonaparte's late 18th C 'Egyptian Campaign' and scientific expedition. The campaign was a military and political failure but the scientific expedition was of significant importance giving rise to a renewed international interest in all things ancient Egyptian (the 'Egyptomania' phenomenon), resulting in the deciphering of hieroglyphs through the discovery of the 'Rosetta Stone' and leading to other important discoveries such as the Tomb of Tutankhamen etc.

The Egyptian musical instruments depicted by the engravings are described by Guillaume-André Villoteau, French scholar and member of the expedition to Egypt, in the text of 'Description de l'Egypte' – 'Première Partie, des Instrumens a cordes connus en Égypte' (Note 1) The first chapter, pages 221 to 246 deals with the oud in general and Article IV page 229 provides details and dimensions of the oud and its case represented by the engravings. The instrument has seven double courses of gut. The sound board is a single piece of pine, unvarnished extending 18 mm on to the fingerboard. The bridge is made from nut wood (walnut?).The bowl is made from 21 maple ribs separated by rosewood fillets (bois de Sainte-Lucie). The sound board edge is reinforced with a 14 mm wide strip of blue cotton glued half on the soundboard and half on the bowl. Other lute like features are the slanted neck joint and straight sided pegbox. The plectrum guard is of green fish skin (i.e. isinglas – from the swim bladder) glued to the sound board. Overall length from the extremity of the pegbox to the bottom of the instrument measures 726 mm. Length of the neck is 224 mm, width at nut is 49 mm (nut 47mm wide) and at the neck joint 65 mm. Maximum depth of the bowl is 162 mm. Sound board length from neck joint to bottom of the bowl is 433 mm and maximum width 350 mm. No vibrating string length is given by Villoteau or relative bridge position that would allow string length to be calculated from the other dimensions provided.

Belgian musicologist Françoise- Joseph Fétis (1784 – 1871) – knowing of Villoteau's instrument collection sought to acquire a collection of instruments similar to those illustrated in the 'Description de l'Égypte' (Note 2). Fétis purchased the instruments in 1839 collected on his behalf and according to his instructions, by the Belgian consul in Alexandria, Etienne Zizinia. This collection included 'du luth (é oud) avec son étui arabe' (see Fétis 'Histoire de la musique', vol. 2, p37n). Following the death of Fétis his instrument collection and extensive library were purchased by the Belgian state in 1871. The oud #0164 and the remnants of its case are now in the Musical Instrument Museum, Brussels.

In Comm 1948 I expressed a thought that this oud and its case were in fact the original models for Villoteau's engravings - given some practical simplifications, such as single courses, made by the engraver – assuming that the engravings were made in Egypt during the expedition period. Villoteau returned to France with his instrument collection but the whereabouts of the oud and its case today is not known (Note 3). Did Villoteau return to France with the oud and its case or were they, for whatever reason, left behind in Egypt only to be purchased years later by Zizinia? This idea is now proven false by the details and dimensions provided by Villoteau when

compared to those of oud #0164. The MIM oud is quite a bit larger than the one described by Villoteau with sound board length of 516 mm and width of 401 mm. String length is 637 mm. so proportionally Villoteau's oud might have had a string length of about 600 mm? Furthermore the soundboard of oud #0164 is made from 4 pieces and does not have a reinforced edge. Also the bowl of Villoteau's oud is flattened in section whereas oud #0164 has a proportionally deeper section than semicircular. The rosettes are set in flush with the sound board surface.

The images of oud #0164 in Comm 1944 are low resolution so fine detail is not visible. Some more detailed images are posted on a new website 'oudmigrations' (Note 4) and clearly show that the string layout, oddly, does not conform to the geometry of the fingerboard with the first and seventh courses lying outside the fingerboard boundaries. This impractical arrangement (Note 5) suggests that the original bridge may have been replaced by one with wider overall string spacings. Scaling of the images posted on the oudmigrations website indicate that the width of the nut measures about 48 mm and about 66 mm at the neck joint - sufficient for seven double courses - yet overall seven course string spacing at the bridge is about 126 mm when a perfectly reasonable spacing of about 90 mm is required if all of the strings are to be positioned over the fingerboard area. Perhaps the bridge of this original seven course oud did not have the specified exact appearance of the one in Villoteau's engraving so was conveniently replaced by one that did – possibly by a hired local artisan skilled in making decorative but unplayable 'wall hanger' instruments sold to unsuspecting and wealthy Europeans caught up in the 19th C. 'Egyptomania' craze?

Notes

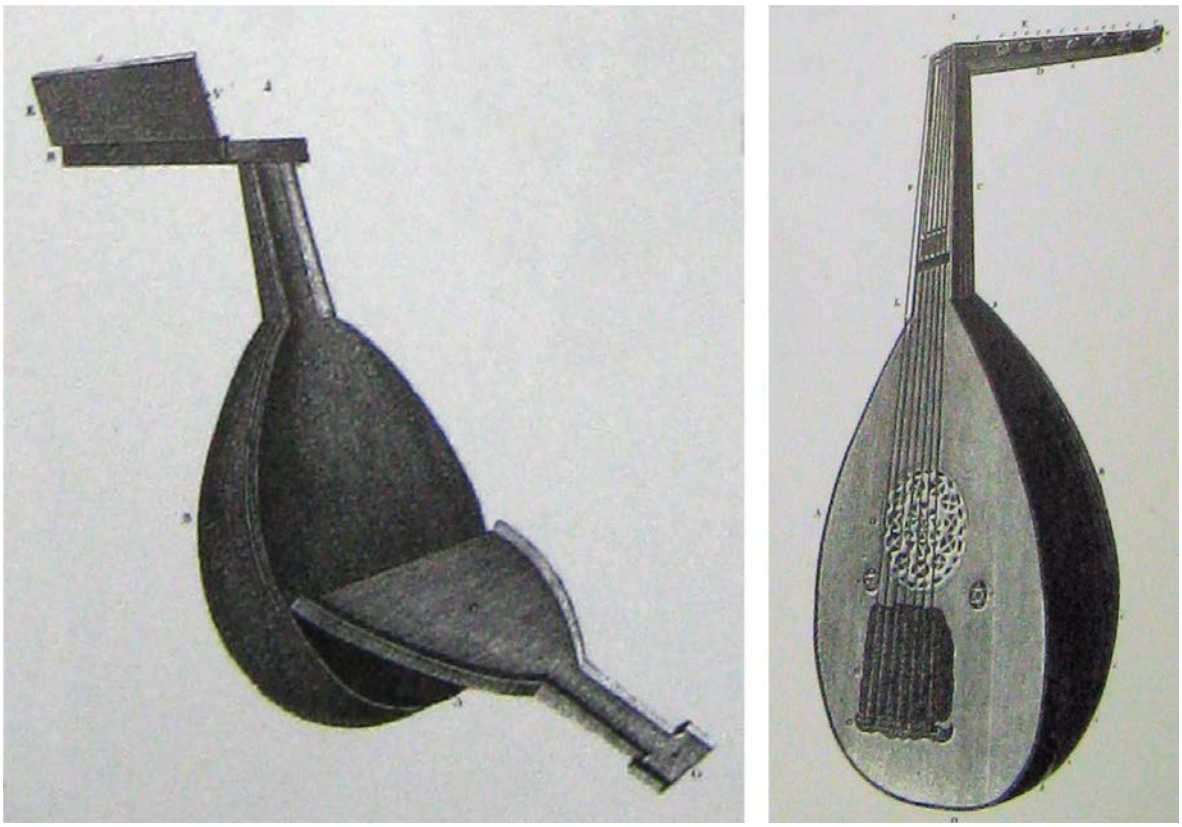
1) 'Description de l.Égypte – recueil des observations et des recherches', Tome Treizieme, seconde édition, published 1823 is available for free download from the Bibliotheque national de France link:-
gallica.bnf.fr/ark/12148/bpt6k28010m/f226.item.r =Description historique villoteau

2) Fétis certainly had access to Villoteau's descriptive accounts according to curator at MIM, Saskia Willaert who notes that there are three copies of Villoteau's publication in the Fétis fund in the National library including one German translation. The 'Catalogue de la Bibliothèque de F.J. Fétis' acquired by the Belgian State in 1877 for 152,000 francs (plus 3,500 francs for shipping and preparation of the catalogue) has been digitised by Google and is freely available online from various sources including Google eBooks. It makes interesting reading.

3) Many of the instruments in Villoteau's collection were purchased by Adolphe Sax. Some were later purchased by then MIM curator Mahillon for the museum at the auction of Sax's instrument collection in Paris 1877 but the oud was not listed among this collection.

4) See **oudmigrations.com** – a new website devoted to early Ottoman oud history by Rachel Beckles Willson.

5) It has been suggested that the first and seventh courses do not need to lie over the fingerboard as these strings are rarely played on a seven course oud! It might be acceptable for the seventh course to lie outside the boundaries of the fingerboard if only used as a drone bass but surely not the first course.



Villoteau Oud

Fétis Oud #0164

FoMRHI comm. 2049 David Z Crookes

A musical passage from *Hamlet*, act II, scene 3

Detail from Maurice Bouval, *Ophelia*

Most of us are familiar with the following passage of Shakespeare.

Enter Players with recorders.

HAMLET. O! the recorders: let me see one. To withdraw with you; why do you go about to recover the wind of me, as if you would drive me into a toil?

GUILDENSTERN. O! my lord, if my duty be too bold, my love is too unmannerly.

HAMLET. I do not well understand that. Will you play upon this pipe?

GUILDENSTERN. My lord, I cannot.

HAMLET. I pray you.

GUILDENSTERN. Believe me, I cannot.

HAMLET. I do beseech you.

GUILDENSTERN. I know no touch of it, my lord.

HAMLET. 'Tis as easy as lying; govern these ventages with your finger and thumb, give it breath with your mouth, and it will discourse most eloquent music. Look you, these are the stops.

> GUILDENSTERN. But these cannot I command to any utterance of harmony: I have not the skill.
>
> HAMLET. Why, look you now, how unworthy a thing you make of me. You would play upon me; you would seem to know my stops; you would pluck out the heart of my mystery; you would sound me from my lowest note to the top of my compass; and there is much music, excellent voice, in this little organ, yet cannot you make it speak. 'Sblood! do you think I am easier to be played on than a pipe? Call me what instrument you will, though you can fret me, you cannot play upon me.

Most Renaissance consort music was written in four or five parts, so we probably have here at least a quartet of musicians, playing cantus, altus, tenor and bassus recorders. (A quintet might employ an extra tenor.) The instrument which Hamlet borrows is a 'little organ', and therefore most likely a cantus in C, about twelve inches in length (what today we call a 'descant' -- the familiar instrument used in schools).

'There is much music, excellent voice, in this little organ': although the cantus is the smallest recorder in the consort, it is the top-line instrument on which the tune or melody is nearly always played. Hamlet selects the cantus as being the lightest recorder in weight, the one which requires least breath, and so the instrument that Guildenstern will find easiest to play.

There are some differences between the instrument of Shakespeare's time and that of today. Writing in 1618, Michael Praetorius tells us (let me try to make my own published translation a bit less formal):

> All sizes of recorder (Latin, *fistula* -- the Italians call the instrument '*flauto*', and the English call it '*recorder*') have seven fingerholes on top, and one underneath. Although the lowest hole of the ones on top is drilled in two places which are very close to each other, each member of the hole-duo does exactly the same job in terms of pitch. The only reason for the duplication is that some players use the *right* hand, while others use the *left* hand on the lower part of the instrument. One of the two holes must therefore be filled up with wax.

Most modern recorders are made with only one bottom hole, slightly offset on the right side, so that the *right* hand has to be used on the lower part of the instrument. Furthermore, recorders are normally made today in two or three pieces, whereas the recorder of Shakespeare's day was a one-piece instrument. The narrower bore of the modern instrument allows a greater compass, but produces a thinner and less interesting sound than that of its ancestor.

'Govern these ventages with your finger and thumb' relates to the phrase 'recover the wind of me'. 'Recover the wind' normally means 'get to windward [of another ship]', and signifies the approach made to Hamlet by the two courtiers. In the present context it has to do with covering over again the stream of player's breath, or wind, which has been opened by holes drilled in the recorder's body. It also carries the sense of 'go back to my strange behaviour and analyse it'. The

inarticulate stream of musical 'wind' stands for that active expression of Hamlet's mind which doesn't explain itself in words.

'Drive me into a toil' normally means 'drive me into a netted enclosure', like a hunted animal, by blocking all but one path. In terms of the recorder, it denotes sending the air-stream out through a single opening (the end of the instrument's bore) by covering the thumbhole and all the fingerholes. As Hamlet asks the question, 'Why do you go about to recover the wind of me, as if you would drive me into a toil?', he covers the recorder's holes completely, as if preparing to play bottom C. By so doing he represents Guildenstern's attempt to 'sound me from my lowest note'.

When Hamlet tells Guildenstern to 'govern these ventages with your finger and thumb', he is not being general, or else he would say 'with your fingers and thumb'. He is showing Guildenstern how to play one specific note.

'These are the stops' means, Look, I'm using my index finger and thumb to stop, or cover, *two particular holes*. Perhaps in order to make the lesson as easy as possible, Hamlet is requiring Guildenstern to cover only two of the recorder's eight holes -- the top fingerhole, and the thumbhole behind it -- so as to produce the note B (an octave and a seventh above what we call 'middle C' on the piano). A cantus recorder can be supported between forefinger and thumb while this note is played. The note B, seventh note of the white-note scale of C, may be regarded as close to 'the top of my compass', since in much of the period's four-part dance-music the range of any one part was often an octave or less. Some of the eight-holed instruments which recorder-players used for variety, like crumhorns, had a range of only a ninth.

'.....give it breath with your mouth': put the beak of the instrument between your lips, and blow. No special embouchure is required to play the recorder, which has always lent itself to amateur use. Hamlet is a competent player of the instrument. We may presume that he is unable to play the much more difficult hautboy, or shawm (a double-reed instrument of the oboe class, used only by professionals). Hautboys played for the entrance of the dumb-show, and are still at hand if Hamlet wants to hear them. Instead he sends for recorders, but when the players arrive they are not asked to perform. Hamlet uses one recorder as the basis of a virtuosic verbal display. (Something similar happens in *Romeo and Juliet*, act IV, scene 5, when Peter exhibits his musical knowledge before three musicians who don't get the chance to perform onstage.)

'Why, look you now, how unworthy a thing you make of me. You would play upon me.....you would sound me.....' Make of *me*, play upon *me*, sound *me*. The names of our modern solfa syllables *doh*, *ray*, *me* go back to the medieval names *ut*, *re*, and *mi*. *Mi* was the syllabic name for the note B in the major mode of G. We recall how Bianca reads 'the gamut of Hortensio' in *The Taming of the Shrew*, act 3, scene 2.

Gamut *I am, the ground of all accord*,
A re, *to plead Hortensio's passion*;
B mi, *Bianca, take him for thy lord*.....

The first note is G ('gamut' = first three letters of the Greek letter-name *gamma*, concatenated with the syllable-name *ut*). The second is A (= *re*). The third is B (= *mi*, pronounced 'me'). Hamlet's reiterated pronoun 'me' may stand for *mi* = the note B.

In addition, B is the middle note of the G major chord G-B-D, and it may be encrypted in the phrase 'the heart of my mystery' (that is, the middle note of my chord). But the instrument is a lute this time, since it has to be *plucked*. Why 'mystery'? The word 'mystery' stands not for the preceding mysterious play ('mystery-play' is a modernism), but for Hamlet's private world, which the two courtiers are trying to penetrate. Now 'pluck' is an obviously musical word. Is there anything musical about the word 'mystery'?

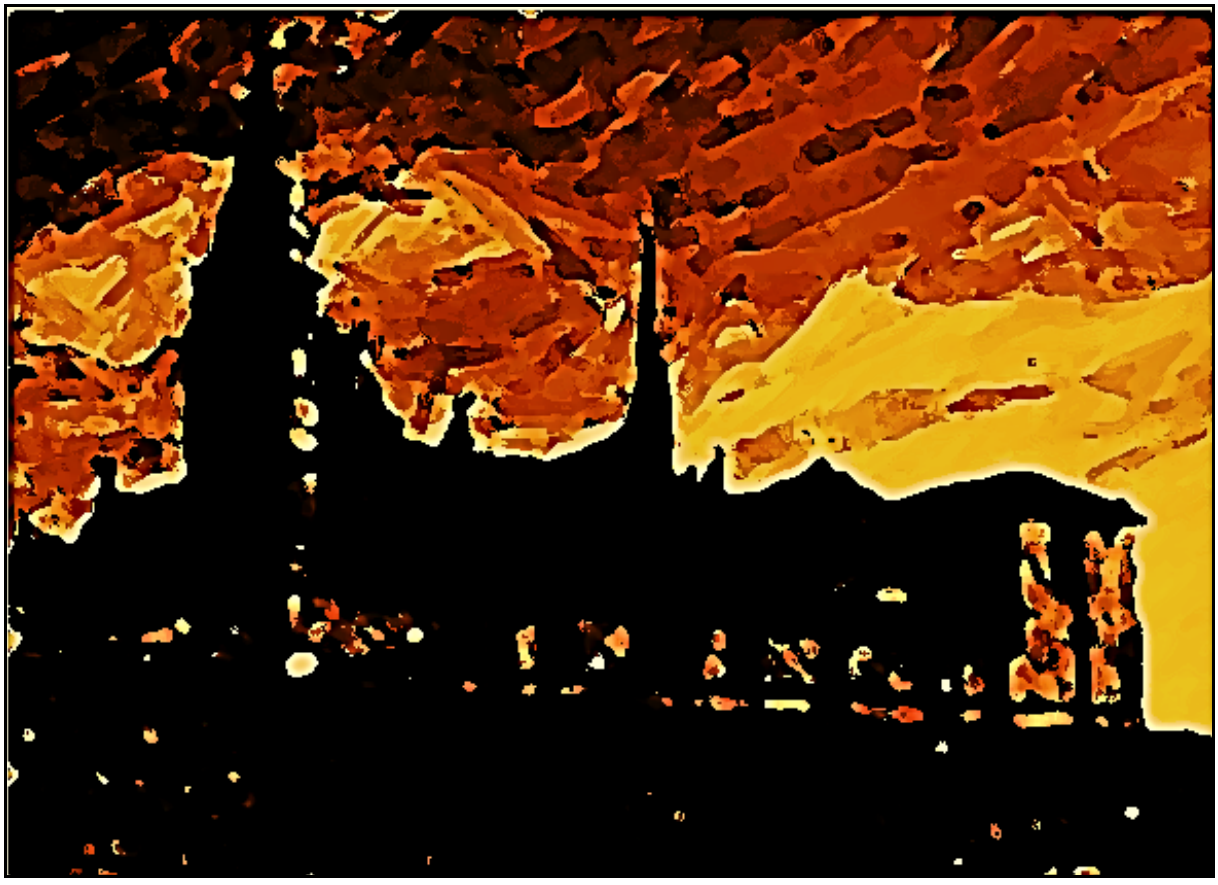
Perhaps. The words *heart*, *pluck*, and *mystery* may have their genesis in verses 3 and 4 of Psalm 49: '.....the meditation of my HEART shall be understanding.....I will open my DARK SAYING upon the HARP'.

Whatever the case, once Guildenstern has plucked the *heart* -- one of the middle letters, the T -- out of Hamlet's *mysTery* (the exact original orthography is unimportant), he will leave behind only *mys ery*, or *misery*. In chordal terms, the triad G-B-D sounds bright and rich. If the 'heart' or middle note, B, is plucked out, removed, the thirdless chord G-D which remains will sound unglad and deficient.

The words 'Call me what instrument you will' expedite the transition from a wind to a stringed instrument ('though you can *fret* me'). 'Fret' means first 'annoy', and secondly 'furnish with frets' (in the manner of a viol, lute, or guitar). How does a musician who 'plays upon' a violin or rebec vary the sounding length of a string? By applying to that string the fingertips of his left hand at exact points, whose whereabouts he has learned by assiduous practice. On the viol and lute, the fingerboard is 'fretted', or crossed at the requisite points by tied-on loops of gut: on the guitar, the frets are little bars of metal. In either case the frets mark the points behind which a player must apply his fingers. Since the player of a fretted instrument can rely on his frets to produce good intonation, a fretted instrument is much easier to play than an unfretted one. When Hamlet says 'though you can fret me, you cannot play upon me', he means: you can set bars across my fingerboard in the form of leading questions that you think will produce particular answers, as indeed you 'seem to know my stops' (the word 'stops' can denote the fingering of both wind and string instruments), but I'm not going to cooperate with you, I'm not going to be manipulated.

'Give it breath with your mouth, and it will discourse most eloquent music.....' You imagine that if *you* say the right things, then *I'll* tell you what you want to hear. Hamlet perceives each of the two courtiers as trying to 'play upon' him, like a hack psychiatrist armed with a clipboard and a questionnaire.

'.....there is much music, excellent voice, in this little organ, yet cannot you make it speak.' People as intelligent as Hamlet are not suitable instruments for investigators like Guildenstern, who -- like many tame courtiers -- can't actually *do* anything.



Elsinore (a dreadful painting by DZC)

Fomrhi Comm 2050 **Andrew J. Bull**

Inferring the placement of a bardic school in 13th to 15th century Lennox, Scotland, through harp wood types.

Taking as its basis the recent work done on two of the oldest extant medieval harps (the Queen Mary and Lamont harps) by Karen Loomis, Ticca Ogilvie, and Lore Troalen in Early Music[1], this paper attempts to use the wood type information given by Loomis et al to strengthen Keith Sanger and Alison Kinnaird's postulation of a bardic school in the area around Loch Lomond in Scotland[2], known as the Lennox. Whilst Sanger and Kinnaird concern themselves with evidence of bardic existence, I wish to ascertain the potential evidence of bardic instrument making in the area.

Loomis, Ogilvie, and Troalen's work disproved earlier (controversial) claims that the Queen Mary and Lamont harps were made from European Hornbeam, a wood not normally associated with the making of this style of Irish harp. Their recent work at the National Museum of Scotland showed that the soundboxes of both harps are in fact made of willow[3], whilst the forepillars and necks are still yet to be conclusively matched, though likely matches are whitebeam or apple. It is the willow classification that concerns this paper. Willow is known to prefer damper conditions, usually being found on the side of bodies of water – and one of the foremost places one can find waterside in Scotland is the area surrounding Loch Lomond, with its large number of lochs and rivers.

The Lennox

During the medieval period, the land around Loch Lomond and further to the east was known as the Lennox. The Lennox was a wide area, said to embrace the entirety of Dumbartonshire and much of West Stirlingshire[4]. The parishes of Rosneath, Arrochar, Row, Luss, Cardross, Bonhill, Dumbarton, Kilmaronock, New Kilpatrick, Old Kilpatrick, Baldernock, Buchanan, Drymen, Killearn, Balfron, Fintry, Strathblane, Campsie, and Kilsyth were all ruled over by the Earls of Lennox[5], with the boundary including Loch Lomond as well[6] (see Figures 1 and 2. Figure 2 labels several of the listed parishes in an attempt to show the rough area contained within the Lennox boundaries).

Sanger and Kinnaird posit a bardic school existing in the Lennox area from the 13th century onwards. They start their argument with the existence of 'Adam, a native of Lennox' at Melrose Abbey in 1260, who spent his winter nights 'playing upon the harp and singing songs which are called "Motets"'[7]. The implication here is that Adam filled out the other parts of the polyphonic motets upon the harp, but what Sanger and Kinnaird find most interesting is that he is from Lennox, and go on to point out several factors that make this area appear to be a hub of bardic tradition and training.

Firstly, the bard Muireadhach Albanach Ó Dálaigh and his descendants are found in Lennox from the early 13th century onwards[8], Muireadhach having originally been a member of the Ó Dálaigh Irish bardic dynasty that had begun in the 12th century. After this, a 'Donnachadh Mor' from Lennox appears, probably from the late 13th to early 14th centuries[9], noted in the Book of the Dean of Lismore as the only Scottish poet worthy of having his place of origin remembered[10]. The Lennox was also the territorial home of the Mac a' Bhreatnaich (or Bretnach) clan, who we find in the 15th and 16th centuries providing a number of harpers to the court of James IV of Scotland.

There is written evidence, then, of a tradition in Lennox of bardic training. Whilst training appears to be mainly passed on through families, its location as a meeting point and cultural 'hotspot' between Scots, Picts and Bretons suggests the potential of more than just familial passing-on of knowledge. What we have lacked, however, is any physical evidence to tie these people to this place – until now. The conclusion by Loomis et al that the 15th century Queen Mary and Lamont harps have soundboxes of willow gives us another method of reinforcing Sanger and Kinnaird's theory. If there was bardic schooling happening in the area, then those being trained would need instruments, and it would be far easier for instruments to be made nearby. I posit that the Lennox was not only a centre of bardic schooling, but also a hub for the creation of instruments necessary for the bardic arts – harps.

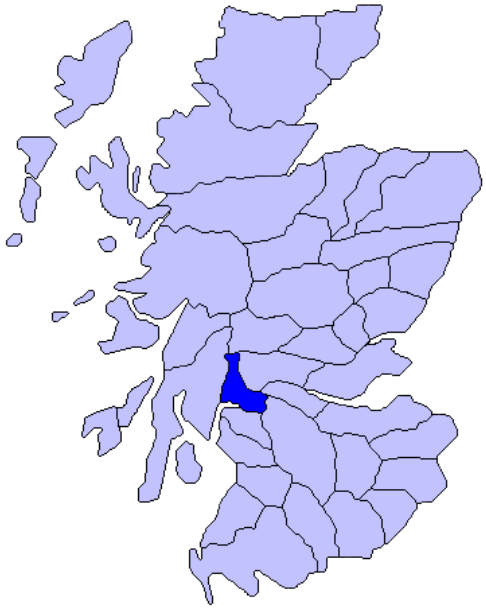


Figure 1: The Lennox area in relation to Scotland.[11]

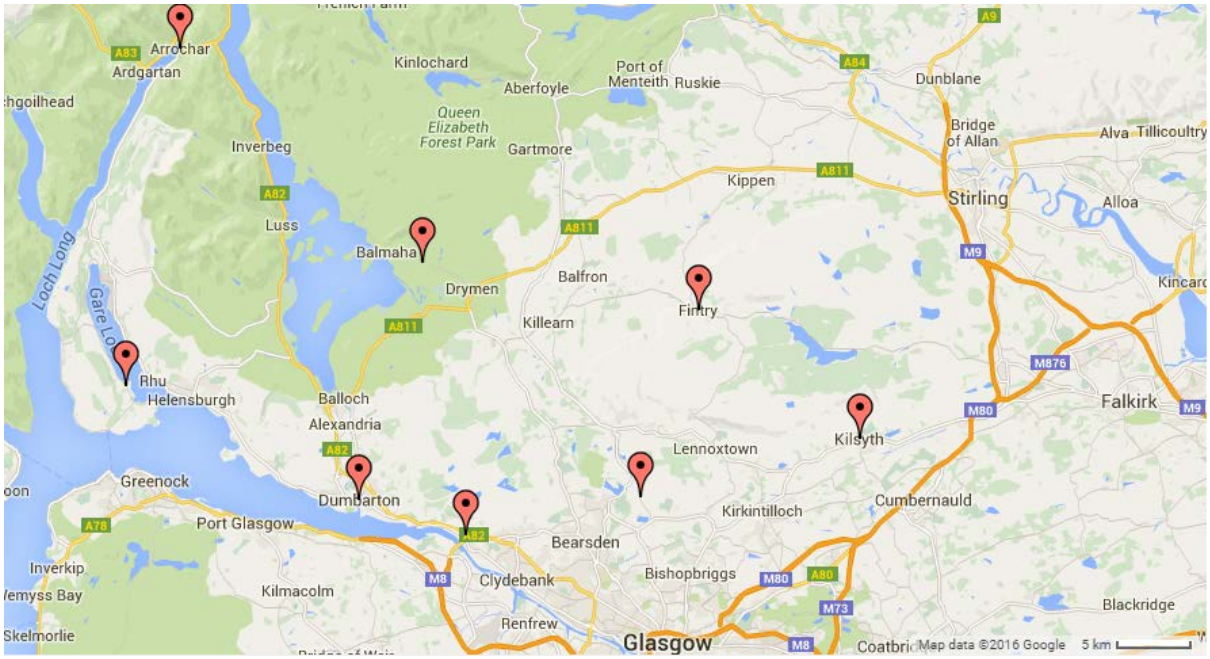


Figure 2: Rough outline of the area encompassed by the Lennox, courtesy of Google Maps.

Willow in the Lennox

A look at the flora of the Lennox area, paying particular interest to instances of willow, strengthens this claim. Unfortunately, no one was writing down detailed forestry information during the medieval ages – or if they were, it is stored in manuscripts unknown to this author. However, there is information of logging at this time. It is only in the 12th and 13th centuries that the primeval forests dating from at least 3500 B.C. were truly exploited[12]. Before this time, willow appears to have been quite common throughout the forests of Scotland[13]. After this period, the next local reference to willow that I have been able to source comes from the diary of the naturalist James Robertson, in 1771[14]. This willow is spotted along the banks of the River Lyon, in between Meggernie and Cashlie, an area north of the Trossachs and Loch Lomond. Whilst there is an admittedly large date gap here, the willow has clearly survived in this area, and was most likely flourishing in the well-suited environment.

After this, one is reliant upon modern information, which at least provides us with more evidence of the Lennox being good for willow growth. A recent survey of the area mentions the River Leven, upstream of Dumbarton, as having crack willow[15]; the Campsie and Fintry hills as having dark-leaved willow[16] and notes the general existence of grey willow within the Loch Lomondside woodlands[17]. This appearance within forests will have been shaped by the willow's preference for damper conditions[18], i.e. lochside and riverside regions, but this hardly limits the potential for willow growth. The Loch Lomond and Trossachs National Park contains 22 lochs and approximately 50 rivers and burns[19], whilst the more easterly side of the Lennox area has several large rivers along with a large number of tributaries and burns.

There is also evidence of willow plantations around the Endrick Water[20] – though cultivated for far more recent basketwork, the receptiveness of the Lennox area to create such a plantation cannot be ignored. The inflowing river mouths around Loch Lomond itself are also found to be good willow-growing areas[21], as are the banks of the River Teith[22], though this is past the likely northern limit of the Lennox.

Clearly, the willow's preference for damp conditions to grow in seems a perfect fit for the Lennox area. The usage of willow in 15th century harps, coupled with the existence of a number of bardic families in Lennox (and the potential of larger bardic schools occurring at such a cultural meeting point), points a high likelihood that harps were being created in the Lennox area, as it had both the physical resources and the knowledge from the bards. Within the 13th to 15th centuries then, one can propose that not only was the Lennox area a likely site of bardic training, but also of instrument creation.

This article is very much a work-in-progress project, so any queries, comments, or sources of information would be gratefully received, and can be sent to: a.bull.2@research.gla.ac.uk

Endnotes

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[1] Loomis, Karen; Ogilvie, Ticca; and Troalen, Lore. (2015) 'Reidentifying the wood of the Queen Mary and Lamont harps'. *Early Music.* XLIII, No. 4 (2015), pp. 623-634.
[2] Sanger, Keith & Kinnaird, Alison. (1992) *Tree of Strings / Crann nan teud: A History of the Harp in Scotland.* Midlothian: Kinmor Music, pp. 43-44.
[3] Loomis et al, p. 629.

[4] Laing, R. M. (1974) 'Local History' in: Tippett, Roger; Idle, Edward T.; Laing, Ranald M.; MacDonald, James G.; Mitchell, John; Morrison, Alexander; Nicholls, Derek C.; Richmond, W. Kenneth. *A Natural History of Loch Lomond.* Glasgow: University of Glasgow Press, pp. 86-95, 88.
[5] Anderson, John (1908) 'The Celtic Earls of Lennox' in: Paul, James Balfour (ed.) *The Scots Peerage.* Volume V (Edinburgh, 1908) pp. 324-343, 324. [Online] Available at: http://archive.org/stream/scotspeeragefoun05paul#page/324/mode/1up Accessed 30/04/2016.
[6] Laing, p. 88.
[7] Sanger & Kinnaird, p. 42.
[8] Ibid., pp. 43-44.
[9] Ibid., p. 229, note 8.
[10] Ibid., p. 44.
[11] Reproduced from Wikipedia under the GNU Free Documentation License. Available at: https://en.wikipedia.org/wiki/File:Lennox_(district).PNG Accessed 01/05/2016
[12] Proctor, J. (1993) 'Vegetation and Flora' in: (eds) Corbett, L., Dix, N. J., Bryant, D. M., McLusky, D. S., Elliot, B. J., Tranter, N. L. *Central Scotland: Land - Wildlife - People.* Forth Naturalist and Historian. Stirling: Stirling University, pp. 43-56, 44.
[13] Ibid.
[14] Henderson, D. M. and Dickson, J. H. (1994 *A Naturalist in the Highlands: James Robertson - His Life and Travels in Scotland 1767-1771.* Edinburgh: Scottish Academic Press, p. 186, August 26th 1771.
[15] Mitchell, John. (2001) *Loch Lomondside: Gateway to the Western Highlands of Scotland.* The New Naturalist Library. London: Harper Collins Publishers, p. 128.
[16] Ibid., pp. 179-180.
[17] Ibid., p. 152.
[18] Knowlton, Derrick. (1974) *The Naturalist in Scotland.* The Regional Naturalist. Newton Abbot: David & Charles, pp. 132, 146.
[19] Loch Lomond & The Trossachs National Park (unknown date) *Freshwater Lochs and Rivers.* [Online] Available at: http://www.lochlomond-trossachs.org/learning/freshwater-lochs-and-rivers/menu-id-304.html Accessed 30/04/2016.
[20] Mitchell, p. 75.
[21] Idle, E. T. (1974) 'Botany' in: Tippett et al, pp. 24-35, 32.
[22] McLusky, D. S. and Lassiere, O. L. (1993) 'Aquatic Life' in: Corbett et al, pp. 90-106, 97.

Nickel Plating Brass Keys

I know that many amateur makers of early woodwinds have used brass sheet to fashion keys for their instruments. Brass is easy to work and looks quite nice when polished. But what about silver instead? —surely that would add a nice touch to the finished instrument. Trouble is, it's expensive.

Here's an interesting alternative that produces a semi-bright silvery finish without incurring great expense. I have recently obtained excellent results by electroplating brass keys with nickel using the following recipe:

Nickel sulphate.6H2O 150 grams/litre
Nickel chloride. 6H2O 60 grams/litre
Boric acid 40 grams/litre
Sodium saccharin 5 grams/litre (brightening agent)

The first three of these reagents, a pure nickel anode and 1.5mm titanium wire can be purchased cheaply from a company called YouPlate which sells its products on eBay. (see below) Sodium saccharin is found in the shops under the name 'Sweetex' – 600 tiny tablets, each weighing 0.02 grams.

The most important point to note is that the brass article must be extremely clean to obtain a good finish. Using rubber gloves I dissolved some sodium hydroxide in water (ASDA caustic soda drain cleaner - £1.98) to make a strong cleaning solution. Still with gloves, the key was immersed for five minutes then washed well with tap water.

My keys are quite small so my plating bath volume is normally 100ml. Each key has a 1.5mm pivot holewhich conveniently accepts the titanium wire. A slight bend of the wire with needle-nose pliers keeps the key in place during the plating process. Titanium is used here because it is not affected by the electrolytic action of the current.

The bath temperature must be between 55 and 65 degrees centigrade. This is a bit tricky. I managed by heating the solution to 65 degrees in the microwave and then placing it in my wife's food warmer set on high. Over ten minutes the temperature stayed above 55 degrees. The bath should be stirred constantly while the nickel is deposited, which can be done by hand because a decent finish can be obtained in ten minutes. (about 20 microns)

The power source is provided by two 'D'-cells which can be tidily held in an appropriate holder (RS components) . Using connecting wires with crocodile clips (RS components), the positive terminal is attached to the nickel anode and the negative terminal to the titanium wire. The keys are completely immersed in the plating bath and the plating begins. The final product can be buffed to a semi-bright finish.

For those of you who want an easier approach, I noticed that YouPlate sells nickel-plating kits. I had more fun putting the bits together in order to keep costs down, but the choice is yours.

http://www.ebay.co.uk/sch/i.html?poi=&adpos=1s1&ul_noapp=true&geo_id=32251&MT_ID=10&crlp=93816379874_807&keyword=bright+nickel+plating+kit&rlsatarget=k-wd-44787276029&_nkw=bright+nickel+plating+kit&device=c&crdt=0&treatment_id=7&clk_rvr_id=978480704669

VACUUM AND PRESSURE OIL TREATMENT OF WOOD.

I have been enthralled by all the recent and exhaustive Comms by Jan Bouterse on instrument measuring and making. I wonder if he has plans to turn them into book form? If, by some magic, I had been able to read this book 35 years earlier, my life as an instrument maker might have been less fraught with difficulties, challenges and mistakes!

In Comm 2044 he writes that he will give us his experiences of impregnating and sealing wood with oil in a later article. Here I offer my own practical account of the treatment that I have been using for over 20 years for all the turned wooden parts on the various types of bagpipes that I make.

A concern that all instrument makers must surely have is that once a new wooden instrument leaves the workshop it may be subjected to a variety of temperature, humidities and other unsuitable conditions, so it makes sense if one can find ways to increase the stability of the wood.

My vacuum and pressure oil impregnation process involves submerging each completed part of the instrument in a container filled with linseed oil and turpentine. The container is then sealed and the remaining air is removed with a vacuum pump. This causes the air in the wood cells to be drawn out. The next step involves reversing the action of the pump and pressurising the container, while gently warming the oil to reduce its viscosity. Finally the pieces are removed from the container and the oil is allowed to dry. Once the oil has hardened in the surface wood cells it should prevent the wood from absorbing any moisture. That is the intention, anyway!

My oil container consists of a strong vertical steel tube with a welded bottom. Around this tube is coiled a heating element (similar to an electric blanket element), which is fitted with an adjustable thermostatic control. The entire tube is encased in an insulated box. The steel lid for the container has a rubber seal and can be tightly bolted in place. A flexible tube is attached to this lid which is connected to an air pump that can operate either as a compressor or a vacuum pump.

Over three decades ago I was advised by Dave Armitage to use two thirds of boiled linseed oil to one third of genuine turpentine. In practice, when topping up the oil, I never accurately *measure* the quantities, but rely on the traditional and non-specific Scottish measurement of liquids known as a s*coosh*. (as in "*I'll just take a wee scoosh of milk in ma tea, thank you kindly*"). So I always pour in two scooshes of oil to every one of turps and it seems to work..... Of course it is not beneficial to seal an undue amount of humidity into the cells of the wood so it is essential to ensure that it is as dry as possible.

My oil container is large enough to accept several pieces at once, depending on their size. I bind them together into a bundle with wire and take considerable care that they are all secure, leaving one piece of thicker wire protruding from the top of the bundle and bending the top of this wire to form a hook. This wire ensures that all the parts stay submerged in the oil and that I can fish them out after treatment. Initially the pieces will be buoyant, but after treatment they may have absorbed enough oil to make them sink. I have not fully emptied my oil container for about 15 years and sometimes wonder if there are any stray pieces of pipes that have somehow broken free and lurk there in the primeval depths.... (*Memo to self;* I <u>must</u> drain the oil container someday).

It is essential to leave an air gap of about four inches above the oil level as it forms an impressive amount of froth during the initial vacuum stage, and it would be disastrous if this was sucked into the pump. The pump just happens to produce a maximum vacuum pressure of 90 kPA, and once it has achieved this I isolate the container with a valve and switch off the pump. Ideally I would leave it at this vacuum pressure for about half a day. However in practice for the last few years there has

been a slight a leak in the vacuum valve which I have not yet taken the time to locate, so my tactic is the bring it up to maximum vacuum several times over a period of a few hours). (M*emo to self;* I must sort that leak someday).

The second stage involves compressing the air up to 75 psi and isolating the container with the valve. (My pressure valve actually works). I then switch on the heating element to warm the oil to about 35 degrees Centigrade. (I am not clear how I arrived at choosing that temperature, but it works for me). I usually leave the container at this maximum pressure for at least a day. Then I switch off the heater and allow the oil to cool to room temperature before decompression.

I lift the bundle of pieces out and leave them hanging above the container so the oil on the surface of each piece can drip back. It is exciting to see each piece as this treatment can change the appearance of the wood considerably and the initial thick coating of oil makes each piece look rather luscious! In a few hours the majority of the surface oil has drained back and I unpack the bundle, wipe away the surface oil from each piece and leave them in the cool room for a few days, giving them a daily wipe. If I omit to wipe them regularly at this early stage the oil may sweat out in patches and congeal into gooey areas *on top* of the surface of the wood. This can be tricky to remove. Once I am confident that the oil on the surface wood cells has begun to dry I transfer them to a warmer place to speed up the drying process.

How long to leave them? Basically; the longer the better. The drying process begins at the surface of the wood and it has been interesting to observe how this occurs at considerably different speeds with different woods. In my experience pear and apple wood absorb a lot of oil and they certainly take the longest to begin to dry on the surface; I try to leave them for well over a month. Plum and boxwood can achieve a hard outer surface in a couple of weeks.

How deep does the oil penetrate? Some of my chanters have a wall thickness of about 1/8”and in these pieces I assume that the oil penetration is almost complete and it will harden sooner. Other pieces may be over 1” thick and the penetration is less likely to be complete. Inevitably on thicker pieces of wood the oil contained deeper within the cells will take a lot longer to harden. There have been occasions when I have left a chanter for over a year after the oiling process and yet I can still observe little beads of liquid oil emerging from the wood around the area when I am drilling the finger holes. This will be caused by the slight heat and disturbance made by the drill bit and is clear evidence that the oil contained within the wood has not hardened. I wonder if the oil that is contained deep within a thick piece of wood will *ever* harden, as it will never be in contact with the air? I am not clear how the depth of penetration could be researched. To be honest I am not sufficiently clear about the mechanics of the drying process of the oil and if it ever actually fully dries/ hardens. (Discuss)

In my ideal world (Bagpipe Heaven) I would leave each piece for months or even years before assembling the pipe. However in practice there comes a time when I judge that they can be assembled without this affecting the outer finish. I then re- ream all the bores and spin each individual piece on the lathe to give them a friction coating of beeswax. This is not essential, but it adds a pleasing sheen. It is equally possible at this stage to start building up more thin layers of oil on top of the oiled wood, to create a layer similar to a varnish. However the tactile satisfaction for me with oil impregnated wood is that you can *feel* the actual surface of the wood, rather than touching a thin protective varnish balanced on top of it.

The treatment highlights the wood grain and gives it depth and lustre, which will darken and mellow over the years. It can also dramatically darken any areas of wood that may have been affected by a fungal attack. I assume that the action of the fungus will have broken down the cell walls and the affected area acts like a sponge in oil. In my experience it is best discarded as I find that this wood, though it may look splendid, is never stable as the oil can still stream out of it for years after the treatment and it is once again prone to being affected by moisture. Once, as an

experiment, I made a chanter out of some very dodgy box wood which emerged out of the oil process looking almost black. But even after years of allowing it to dry I still do not have any confidence in this chanter's stability. Recently I used a batch of holly, which seemed fine, but had slight grey markings in certain areas. I did not detect any weakness in these areas when I was turning it, but after the oiling treatment these areas took on a striking dark brown colour. More firewood...

The one wood I have found does not respond well to this treatment is yew wood (taxus baccata). *I love yew,* but the treatment sometimes tends to leave dry looking patches on the surface. My approach with yew is to submerge it in the oil container and leave it at atmospheric pressure for a few days with the oil heater on. The oil seems to penetrate quite deeply and the results are very satisfactory. This does lead me sometimes to question if there really is a need to use the vacuum and pressure treatment on wood at all…

However I do believe that this treatment undoubtedly adds to weight, stability and resilience to the wood and it suits me to believe it improves the tone of the instrument. It would be fascinating however to do some experiments to analyse what effect it actually has on the sound of the instrument and whether it alters over the years as the oil within the wood continues to harden.

The result is that my instruments seem to prosper in various countries and very contrasting climates. I have no idea how many other instrument makers use this treatment. Undoubtedly there are possible modifications and improvements, but I have not pursued any as the process works for me... and life is short. Certainly if I had a more scientific mind, and an accurate set of measuring scales, I might derive pleasure from doing tests to determine the quantity of oil that is actually absorbed by weighing of different types of wood before and after treatment.

One of the outcomes of using this wood treatment is that it creates organisational and economic challenges for a professional instrument maker as one always has to plan production *months* ahead. When I am assembling a set of bagpipes and at the last moment find that there is a defective piece I cannot rush over to the lathe and create a replacement part that will be ready on the same day. It only takes finding one dud to delay the completion of an instrument by a couple of months.... and the dreaded email to the customer explaining the unexpected delay.

This is a practical account of what I do. Writing it has been enlightening as it has helped me to focus on aspects that I had taken for granted and others that I had not even considered. I now realise how little I know about the mechanics/physics of oil 'drying' or 'hardening'. I hope this Comm stimulates more discussion and clarifications from others. Jan has promised to give us his. Meanwhile I wait with anticipation to read about Jan's experiences of impregnating or sealing wood with oil.

FURTHER VIEWING

There are a few colour photos of my oil tank in action on my website in an article in the *My Writings* section entitled *Pipes Progress* that can be seen at
http://www.goodbagpipes.com/goodbagpipes/pipes-progress.html

There is also a tantalising short video snippet on Vimeo https://vimeo.com/54528497 that can be seen on *The Bagpipe Maker.* If you blink *at* 1.30 minutes you will miss it.

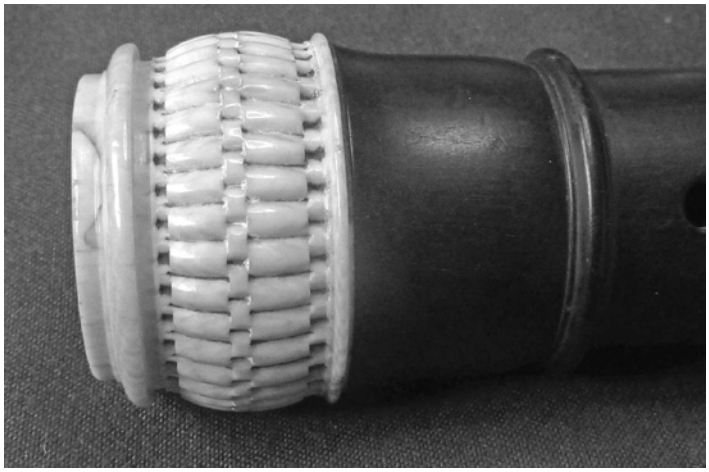
Julian Goodacre Feb 2016.

Making woodwind instruments 5a:
Ivory and natural ivory substitutes

The beauty of ivory

Ivory from elephants is a highly priced luxurious material which was used many times for woodwinds: for ornamentation or even for complete instruments. I have seen ivory recorders (from sopraninos to basses), traversos, oboes and cornetts (cornettos). Ivory is a heavy material: its specific weight is 1.9, which makes it about twice as heavy than boxwood. That means that ivory instruments become rather heavy. To compensate you can them make with thinner walls, but that has acoustical consequences, for instance for the size and the shape of undercutting of the tone holes. Giovanni Maria Anciuti made some oboes with a partly octagonal profile, maybe to reduce the weight. On the photo (right) we see an oboe by Anciuti in the Musée de la Musique in Paris; I recently saw another octagonal oboe by the same maker in the museum of musical instruments in Milano; that instrument was made in 1722.

But ivory lends itself perfectly - perhaps better than any other material – to carving. The photo below shows one of the ivory rings on an oboe (from a private collection) by Hendrik Richters (Amsterdam 1683 - 1727). This type of carving was not done with knives or other hand tools, but on a special ornamental lathe (French: tour à guilloche).



Cecil Adkins wrote about the oboes of Hendrik Richters and his brother Fredrik, and their ornamental turning in his extensive article ‘Oboes beyond compare’ in *the Journal of the Americal Musical Instrument Society* (1990,Vol. XVI).

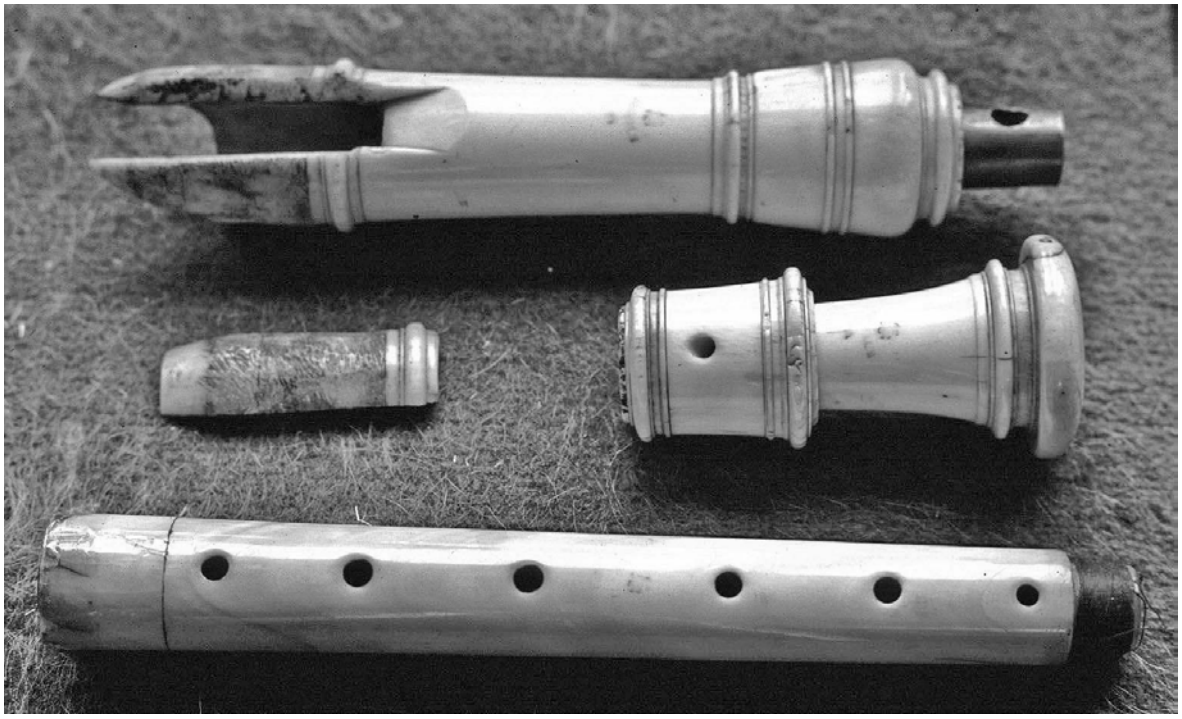
The website of Richard I. Miller (www.ivoryturningsculptures.com) gives concise information about ornamental turning (OT). About this craft he writes: OT is accomplished with a very specialized lathe that has a variety of chucks and cutting frames adapted specifically for the OT lathe. Small tools such as fly cutters and drill are used to create a pattern as the work is arrested at various points on the lathe. A variety of chucks allow the work to be placed in an offset position; a dome to be decorated; or an oval shape to be created on the work piece - all shapes that are mostly out of the realm of ordinary or plain turning. The highly sharpened tools impart a finish that leaves the work piece with no further need for polishing or finishing. The work takes a great deal of patience, but the reward of an attractive piece is well worth the time spent to create it.

Some history: OT dates back to the early 1700's when artisans were patronized by royalty and were commissioned to make exceptionally complex pieces, many of which survive today in museums, mostly in Europe. 'Modern' Ornamental Turning is said to have begun with an Alsatian immigrant to London, John Jacob Holtzapffel who produced his first OT lathe in 1795. There followed three generations of Holtzapffel OT lathe makers until the early 1900s when interest in OT by the mechanically inclined gave way to interest in the automobile! The elder Holtzapffel's son, Charles Holtzapfell wrote the first three volumes of the epic OT classic, *Turning and Mechanical Manipulation*. Upon his death the last two volumes were written by his son, John Jacob Holtzapffel II. Some 2,500 OT lathes were built by the Holtzapffels during this period and perhaps another 1,000 by other lathe makers. Today, there are only a few hundred original OT lathes in existence, of which a limited number are used by modern enthusiasts.

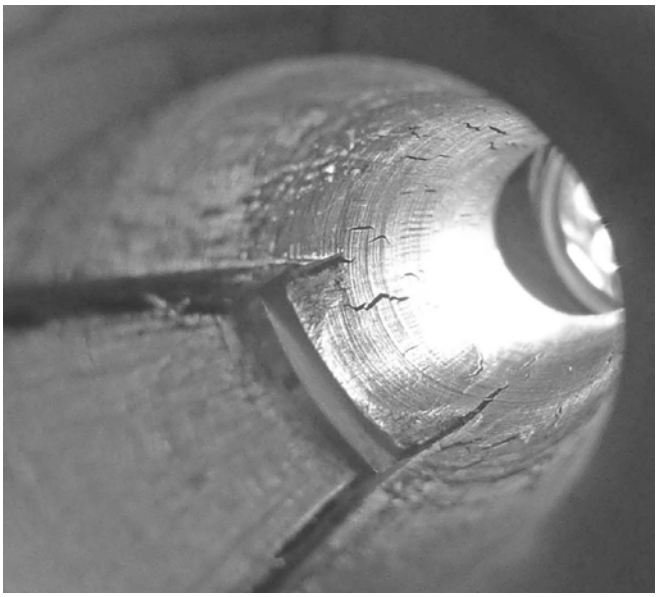
This photo shows the ornamental lathe of queen Sophie Magdalene of Brandenburg-Kulmbach (1700 -1770), who was the wife of King Christian VI of Denmark and Norway. This lathe can be seen in the Rosenborg Castle in Copenhagen, together with many ivory artefacts (but no musical instruments) which were made on it: the results of the (expensive) hobby of the queen.

The problems with ivory

Ivory is a hard and dense material, but it is vulnerable to microbiological attacks. I have seen quite a lot of woodwind instruments with internal cracks, triggered by enzymes in the saliva of the players.



The photo above shows a dramatically damaged alto recorder by Engelbert Terton (private collection). Two cracks resulted in the ‘roof’ of the windway becoming loose (which - by the way - gave me a chance to investigate its strong longitudinal curve); an attempt was made to fasten this piece of ivory with a metal ring, for which construction some ivory at the surface of the mouth piece was cut off. There were also problems with the upper tenon and the foot. That part was apparently made in two sections which were screwed together, but this connection was damaged.



This photo (left) shows internal cracks in the head of an alto recorder (private collection) by Klenig, a probably German woodwind maker from the first half of the 18th century.

Ivory rings were used to strengthen the sockets of woodwind instruments. But ivory can also be more or less flexible; I have seen rings on oboe bells which have warped more or less into an oval shape, together with the underlying wood.

The big problem nowadays with ivory is the poaching of elephants and the illegal trade in tusks, especially into countries in the Far East. It is not allowed to bring instruments with ivory parts into several countries, unless you can prove that these were made before 1947. And that is often very difficult.

Some instrument makers still use real ivory, especially for restoring instruments, but I have also seen recently some completely new flutes or recorders made of (old?) ivory. I do not know where you can buy legal ivory, I couldn't find information on internet.

And what should I do if somebody offered me a nice piece of ivory, even with the guarantee that it is old enough to be legal? I know that I am easily tempted buying pieces of beautiful wood; but I believe that in the case of ivory and some of its natural alternatives (see below), we have to be firm and must reject it.

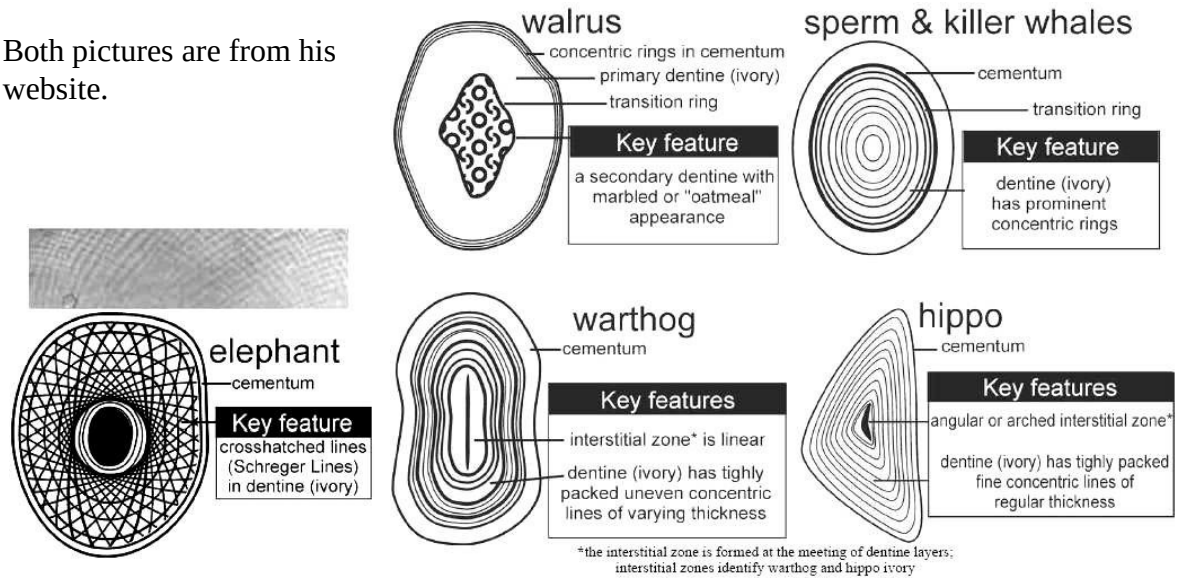
Alternatives for elephant ivory

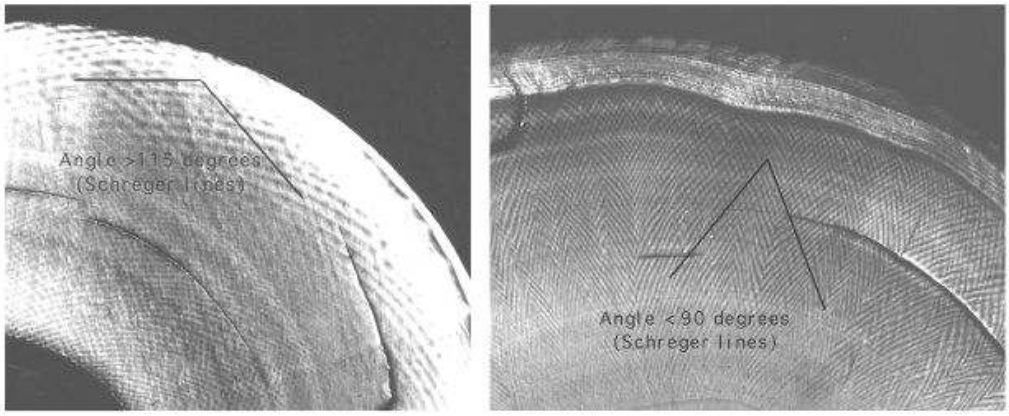
Mammoth tusks has been used for several centuries as replacement for elephant ivory. There seems to be a lot still buried in the permafrost soils of the Siberian tundras, and with the recently rising temperatures we may expect a rising supply of these tusks in the next years. It is not so easy to see the differences between the two types of ivory (and it is even harder to do that between ivory of African and Asian elephants) and I saw an article about the danger that traders of illegal ivory may use the mammoth variety to deceive the investigators.

Mark Chervenka writes on www.realorrepro.com/article/Ivory-genuine-fake--confusing about recognizing several types of natural ivory.

Using black light is an important first step because it saves time by ruling out artificial materials. Virtually all plastics and resins fluoresce blue or blue/white under long wave 'black light' regardless of the surface color in ordinary light. Genuine ivory usually fluoresces white but this can vary depending on whether the ivory has a patina. Most natural old patinas fluoresce dull yellow or brown. Be very suspicious of any brightly-coloured fluorescence such as yellow fluorescence as this indicates artificial ageing in dung, urine or animal fats. Use black light as your first test, not your only test. Black light is useful for eliminating artificial materials but cannot alone prove a piece is ivory. Bone, vegetable ivory (cellulose) and glued together ivory dust, for example, all react like genuine ivory under black light.

Both pictures are from his website.





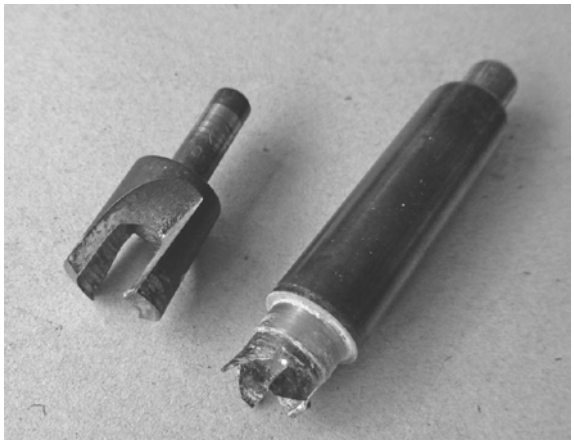
Ivory of elephants and mammoths have always so-called Schreger Lines on cross sections of the tusks at different angles for elephants (> 115 degrees) and mammoths (< 90 degrees). But it is difficult to see those lines - or to establish the angles - on the small ivory rings of instruments, especially where you don't have a proper cross section.

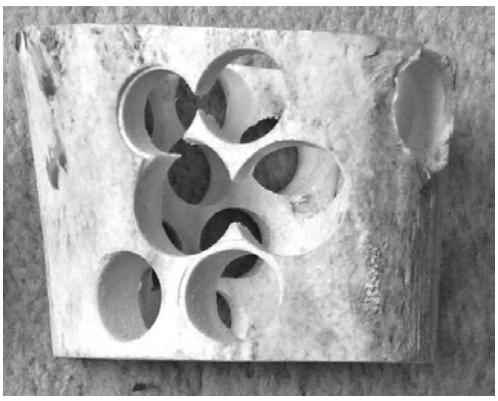
I do not know where you can buy legal ivory from the other animals: whales, walrus, hippo and warthog. If you have this stuff, be careful putting it on instruments if you are crossing borders.

Bone

Bone (from cows or other animals) has a more open structure, caused by the Haversian canals, which are microscopic tubes in the outermost region of bone that allow blood vessels and nerves to travel through them. Bone is harder than ivory. Pieces of bone can be used for rings for woodwind instruments, but as you can see on the picture above, the hole in the centre usually has an irregular shape and there is a job to do first to make the inner space perfectly round.

The best method to do that is to attach the ring firmly with bolts on a clamping plate (photo, left). The clamping plate is mounted on a metal working lathe, the cutting tool of the lathe must then do its work. When the hole is finished, the ring must be mounted on a wooden shaft, after which the exterior can be turned.



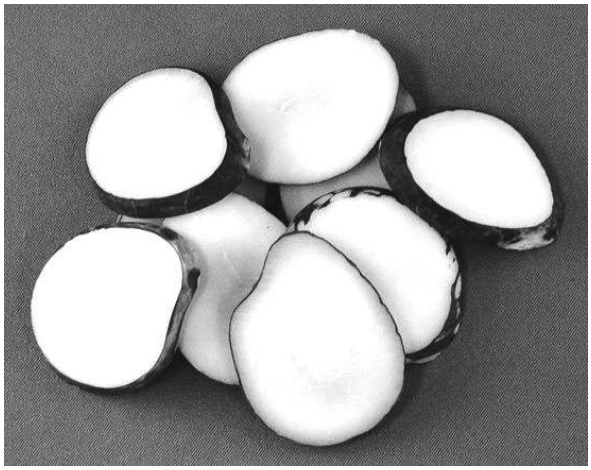


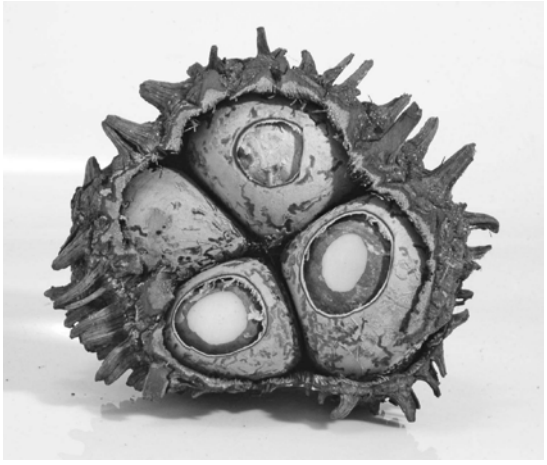
I use smaller pieces of cow bone for the small thumb rings for my recorders (photo, right). It is easy enough to get the pieces out of the side of the bone, I made a special hollow drill to do that. On the photo you can see my ‘ring cutter’ at the right, and a ‘plug cutter’ (which has much thicker cutting walls) from the DIY-shop, at the left.

Tagua nuts

Concerning tagua nuts I found the following information: ivory nuts, which are the hard cellulose kernels from Tagua palms, are frequently confused with genuine ivory. They fluoresce like genuine ivory under black light and show a fine grain under magnification. Although they can grow to the size of a small apple, the majority of ivory nuts are under 2 inches which makes them unsuitable for large carvings.

The most common use of ivory nuts is for new netsuke, but I have read that some bagpipe makers also use them. The definitive test to recognize Tagua nuts is to apply a small drop of sulpuric acid. This will form a pink stain on ivory nuts in 10-12 minutes but will not stain genuine ivory. However, the stain is permanent and not removable.





Slices of tagua nuts, and the Tagua fruit.

FoMRHI Comm. 2054 **Jan Bouterse**

Making woodwind instruments

5b- Artificial ivory

The search for artificial ivory started in the 19th century; the need for substitutes became urgent times of political and economic turbulence, for instance during the First World War, when piano factories were confronted with diminishing supplies of the real thing.

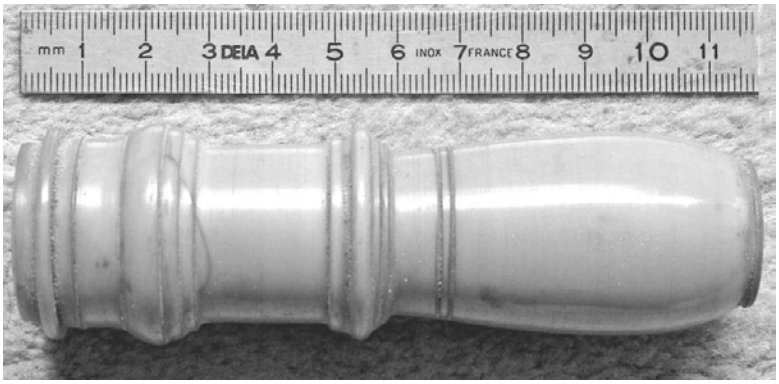
Ivory is tricky to imitate because of its microscopic structure, with its very small pores. It absorbs moisture from the fingers and remains dry to the touch, so you don't feel your fingers grab the surface, which interferes with good piano technique. Ordinary plastic might look like ivory, but under a microscope it presents a very smooth surface that has no ability to absorb moisture whatsoever. The slightest bit of finger perspiration will accumulate until the keys are cleaned. The result is that 'icky' feeling of playing plastic keys.

Experts at the Rensselaer Polytechnic Institute in Troy, N.Y (USA), around 1980 devised a synthetic ivory ('RPIvory') with a feel and a microscopic structure closely resembling those of natural ivory. They added a water soluble powder (polyethylene glycol) and white paint to a polyester resin and managed to create fine micropores by washing out this powder. In an informal blind test of concert grand pianos being conducted by Steinway & Sons, some soloists have chosen those with the new keys for concert performances in preference to those with ivory or conventional plastic.

I don't know if Steinway still uses RPIvory, and also if this material is still produced and available in sizes other than for piano keys. There are, however, various new and also older types of artificial ivory. But there is a paradoxical situation: what we want to have is a material which looks very much like real elephant ivory and which has (most of) its preferred aspects. But it must also be not difficult to recognize it as an imitation: we want to avoid being refused entry to some countries (or even to be arrested) because the custom officers don't recognize what the material really is. What we also have to consider: do we really need artificial ivory for woodwind instruments with as high a specific weight as real ivory (about 1.9)? Heavy instruments are not so pleasant to play for a long time.

There is also the question of the micropores: do we need them or not? For rings on the outside of an instrument it is better to have smooth, dense surfaces. But for a windway of recorder it might be better to have some porosity, to avoid clogging with condensation. But with micropores there is the danger that dirt and microbes settle in and will cause all sorts of problems.

Billiard balls

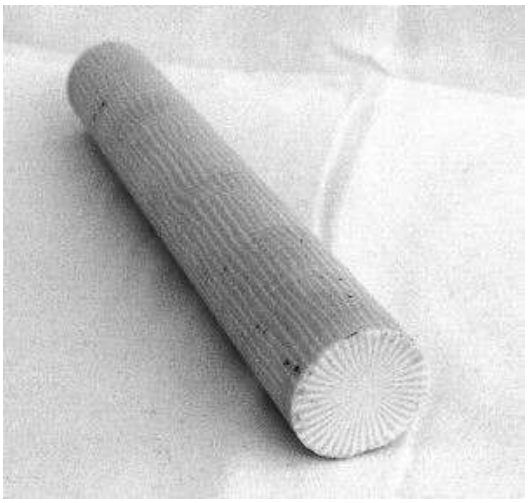


For my first experiments with imitiation ivory I used resin billiard balls. They have the advantage that they are heavy, as they are expected to have the same specific weight as balls made from real ivory. But these billiard balls were not practical for making rings, or for what I did: to make a complete foot for a copy of a Hotteterre traverso (photo above).

I had to use two billiard balls for this foot and had huge difficulties in drilling and turning. The tools became rapidly blunt and the material discoloured to a not very nice yellow.

Casein ivory

Casein ivory is also known as Galalith, is made from milk protein and is a natural material. Unlike any resin it possesses many more of the natural characteristics of, for example, real ivory and horn. It is visually stunning and is ideal for furniture panels and skirting, piano keys, and any high-end item that would have originally used a natural material. GPS Agencies does sell casein, but it is not cheap: for a sheet of 40 x 50 cm and 3 mm thick you have to pay 42 English pounds; thicker sheets (up to 10 mm) are proportionally more expensive, but are of course still too thin to be used for rings for woodwind instruments. On www.scrimshaw.com/casein-new-old-plastic-scrimshaw/ I saw rods of casein with a diameter up to 20 mm (see photo right). The material is described on the website as extremely dense, it polishes beautifully and doesn't 'crater' like typical plastics. It is very hard and the dust is awful – it stays airborne a long time and due to the way it's made, you'll definitely want to upgrade your dust masks. Plain casein plastic is made from milk, as stated. In order to make it resilient casein is subjected to a formaldehyde bath for up to one year, depending on thickness, where the formaldehyde molecules bind with the casein making it harder and more resilient. The casein is finally rinsed and dried, most of this harmful chemical leaving the end product by off-gassing and repeated rinsing. The amount of formaldehyde would be negligible for normal handling, but it is better to be safe and to use this casein with the greatest care if working it.



It is possible to make casein ivory yourself: on www.instructables.com/id/Homemade-Plastic/ with milk and ivory. On www.youtube.com/watch?v=BnXGZKCrktE there is even a video where Robert Murray-Smith explains how he does it. But why did artificial ivory made of casein not become popular? It is not possible to pour it into moulds.

Vigoplas

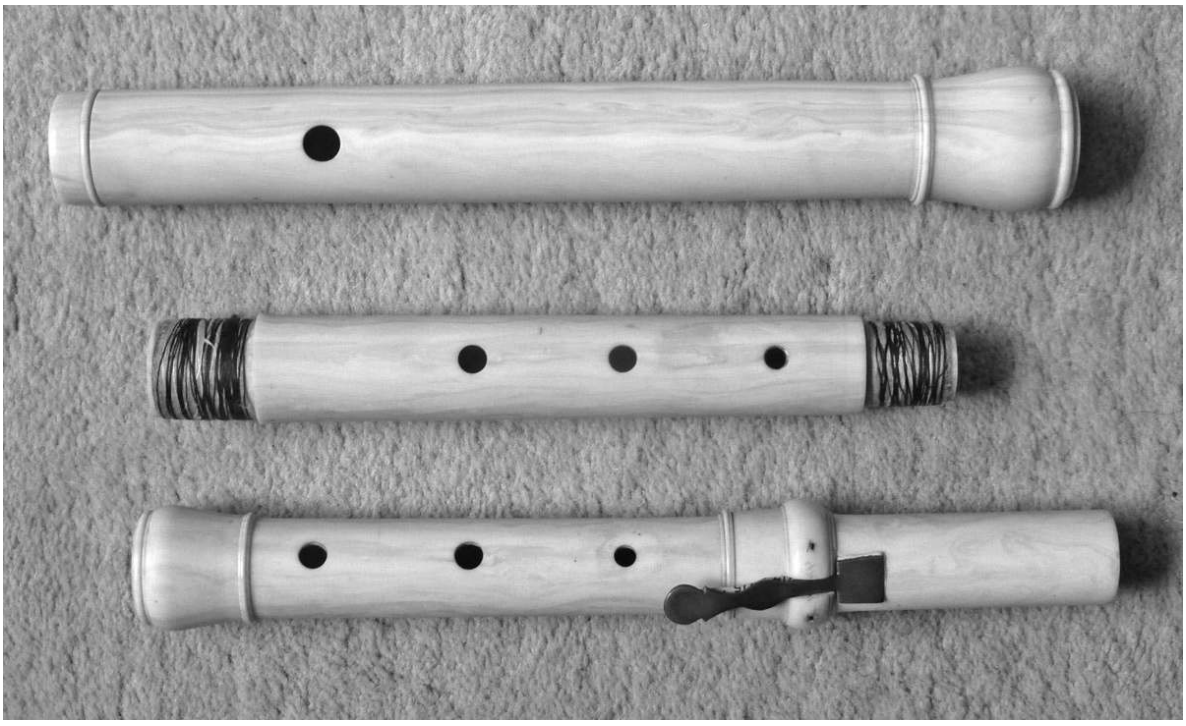
Brian Ackerman wrote in 1993 in the *FoMRHI-Q* (Comm. 1162) an article with the title 'Make your own imitation ivory'. There is a lot of information in this article about imitation ivory which you can - or could - buy. One of these products is Vigoplas, which Ackermann says was one of the first imitation ivories, that it has a good colour in that it has a slight yellow tinge to it; that it does not have any grain pattern, but that this is preferable to a marble effect. He finally states that it has one drawback in that it is difficult to hand-turn, as tools easily catch and destroy the finish. Used with care, it is a good alternative.

I myself have worked quite a lot with Vigoplas and I agree with Brian that it must be used with care. Vigoplas was not very expensive, and you could buy it in the form of massive rods and as tubes, in all sort of sizes. But Vigoplas has vanished completely, I couldn't find any information about this material on the internet. Unfortunately I can't remember where I have bought it, maybe it was produced in Germany. But I still have a reasonable stock of Vigoplas and for rings on woodwind instruments it is indeed a good alternative for ivory.

Ivory Alternative Col.849/TM

GPS Agencies Ltd were in the early 80s approached by a bagpipe maker, called William Sinclair & Sons, and were asked to try and develop an alternative to ivory. After several years of working 'Ivory Alternative Col.849/TM' was born. GPS Agencies says on their website that this possessed many of the qualities of real ivory, in both its appearance and its working properties. The Victoria & Albert Museum, The National Trust, and English Heritage have approved Ivory Alternative Col.849/TM. It is also recommended by Garrards the Crown Jewellers to be used for repairs and restoration of real ivory articles. It has also been used to replace real ivory plaques in Windsor Castle. In 2003 the range was expanded, still promoting conservation, with larger stocks of Horn, Tortoiseshell and Bone Alternatives, along with a Semi-Precious Stone Collection.

Brian Ackermann (see again Comm. 1162) says that he mostly uses this imitation (polyester) ivory from GPS Agencies. It is very easy to turn and produces a good finish. It is quite brittle, and he has seen it crack when the wood underneath has expanded. The graining varies from piece to piece, but tends to be a bit too much like marble. In Comm. 910 Mr. Chiverton said that the formula had been improved, and Brian had a piece of the new stock which was definitely much better in appearance. However, he claimed that recent (1993) stocks have not been as good, and Mr. Chiverton told a colleague of his that the superior type was too difficult to produce. Brian Ackermann suspects that the ease of turning and finishing has resulted in a loss of hardness and a slight stickiness. Jeremy Montagu mentioned this latter point in his bulletin no. 50. Stickiness is not a serious problem unless it is being used on mouthpieces, but it does make it feel like plastic. It would be nice if it were a bit harder though, as it is possible to dig a fingernail into it and leave an impression. It also scratches quite easily.



I have also used GPS-artificial ivory myself, for rings and also for two complete instruments, an alto recorder and a traverso (see photo above, it is a reconstruction copy after R. Wijne). The graining is indeed a bit like marble and I discovered also that the material is a bit softer than Vigoplas. One of the problems is that the tenons are not very stable, they tend

to warp or even shrink and I had to add some thread (see photo). On hot days the flute parts are also sometimes beginning to bend. In the Coolsma-Aura recorder factory (where still instruments are made of GPS-ivory) they had the same experience. The remedy is to put such a crooked piece over a central heating radiator, with some weight at the ends, and after some time you can bend the piece straight again.

There is the same problem when working GPS-ivory on the lathe: at first, when it is still cold, it is brittle. But when it warms up, it becomes flexible. Turning is not so difficult, you have to do that with care, but it takes some time to get a nice polished surface. I use copper or silver polish for the final finish. The sound of the Wijne copy is very nice, but you will always feel that slight stickiness, which Jeremy Montagu has also mentioned.

GPS-artificial ivory is not cheap: about 30 pounds for a kilogram. It is sold as massive rods (from Ø 15 to 125), and square bars. This is information from their previous website, I couldn't find sizes and prices on their recent site. And I am also not sure if GPS Agencies Ltd still sell their products directly to the customers; they mention several stockists on their website.

P1115

The German woodwind maker Fridtjof Aurin uses recently a new type of artificial ivory, which with a specific weight of about 1.5 is much heavier than the usual polyester resins from Vigoplas and GPS, which has a specific weight of about 1.1. It is still lighter in weight than real ivory (SW 1.9), but comes closer to that and it might be expected that the same can be said of the acoustical properties. The new material was made by a German factory called Treplas, but the production is sold to the firm Plast92 in Bergamo in Italy. This type of artificial ivory is called P1115, but there is not yet any information about it on internet. I bought some pieces from Aurin. It looks nice, slighty off-white with faint yellowish to grey stripes. A disadvantage of P1115 is that you need a good hard quality of tools for drilling and turning, because they will easily easily blunt. But turning it is not difficult; I found it less brittle than Vigoplas or GPS.

The price of P1115 is much lower than the artificial ivory from GPS (about 50% cheaper, at about 11 euros per kilo), but you must order at least 40 kilos. It is possible to order smaller quantities, but then the price is higher. P1115 is sold as rods with diameters from 20, 24, 28 etc. to 120 mm. The supplier's address is: REAL STAMPI srl Unipersonale, Via della Molinara 35, 24064 Grumello del Monte (BG), Italy, www.realstampi.it; the email address is commerciale@realstampi.it.

Elforyn

Elforyn is also a heavier quality (SW 1.5) of artificial ivory. It is made by Bachmann Kunststoff Technologien GmbH in Germany. On the website www.elforyn.de (which has English pages) I found the following information: Elforyn is a high-grade raw material for the manufacture of components and works of art with a character and appearance similar to ivory. Elforyn consists of a mixture of different mineral base materials, compounded with a light resistant resin component to provide permanent colour stability, without yellowing. The essential characteristics of Elforyn are:

- excellent mechanical machinability i.e. for drilling, milling, grinding and polishing;
- minimum breakage risk due to high coefficient of elasticity and homogenous structural composition;
- high-quality surface due to high surface hardness and minimal abrasion losses;
- resistant to all conventional substances such as cleaning agents, oils, greases, weak /

medium acids and bases;
- very low water absorption (hydrolysis resistant);
- possibility of thermal moulding in boiling water;
- can be polished or lacquer coated to manufacture polished or matt surfaces;
- can create light-transparent and fluorescent effects;
- pleasant to the touch due to good thermal properties;
- supply of pre-mouldings possible to reduce waste.

That sounds all mainly positive, but I do not understand exactly those 'good thermal properties': does that mean that Elforyn feels - like real ivory - rather cold on the touch, or just the opposite? And how is it for stickiness? I have not yet seen it myself, and I have no information about possible blunting effects on tools.

Elforyn is sold in several shapes, slabs (for piano keys), rods and square rods. But it is not cheap: a rod with length of 305 mm and a diameter of 40 mm costs 60.70 euros, which includes VAT and shipping costs.

Making your own imitation ivory

Brian Ackermann wrote in 1993 in Comm. 1162 about his experiments making imitation ivory. I give here a summary of his observations from that Communication.

Basically this is to cast a coloured resin into a simple mould made from a cardboard tube. When it is set it can be turned in the same way as the other imitations. The resin is initially clear, and can be coloured to match existing ivory.

The advantages are: (1) The material can be coloured to match any colour of ivory. (2) It is harder than other imitations (depending on the resin chosen). (3) I think it is also less brittle (again depending on the resin). (4) It turns well and polishes well. (5) It can be made to any size and in small amounts.

The disadvantages: (1) It can be difficult to get exactly the right colour. (2) There are no grain patterns as it is only possible to make it plain. (3) It is time consuming to make. (4) You may come across air-bubbles unless you have de-airing equipment.

The resins

Polyester casting resin is the cheapest to use. It has similar properties to that available from GPS agencies, which is not surprising as this is also a polyester resin. The best resin to use is epoxy. The only disadvantage is that it is considerably more expensive than polyester. There are literally hundreds of epoxy resins available, they vary in viscosity, additives and setting time. It is best to choose one that is of low viscosity and has a long setting time. Most casting epoxies contain a plasticiser, but this is not required as it reduces hardness and increases viscosity. Araldite resin MY 753 is good because it takes a week to set, and this enables all the bubbles to rise to the surface. Epoxy resins are in two parts and need accurate mixing. After mixing the required quantity, the next stage is colouring.

Colouring

Most resins are fairly clear, and they will need to be coloured to resemble ivory. Earth colours can be bought as powders, but sometimes they can be difficult to disperse in the resin. Tubes of epoxy colour are very good and mix in easily. Polyester pigments can also be used with epoxy, and these are probably easier to obtain. I have found that it is best to start with a good white colour, and then mix in very small amounts of yellow and brown, with maybe a hint of black. It takes a bit of practice to achieve a good match. Thus far with Brian Ackermann.

Additions

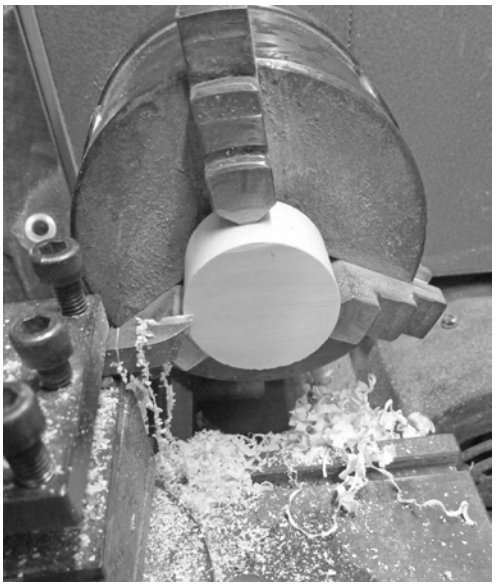
I expect that the weight of this self-made imitation ivory of Brian Ackermann will be close to what GPS Agencies produce. But it may perhaps be possible to add some other components to the mixture to get a heavier outcome. Real ivory consist for the greater part of 'dentine'. Dentist suppliers sell dentine powder (I found it on Chinese websites), but they call it a ceramic product and I am pretty sure that it is quite different from the real dentine in elephant tusks. Maybe that bone meal is a suitable - and inexpensive - altnerative. Bone meal from cows seems to have a good white colour and is sold as fertilizer. At the moment I have no time to do experiments with home-made ivory, but I am interested to know about other the experiences of other instrument makers.

Faux ivory from polymer clay

I found on internet one other way to make imitation ivory, a 'dry method'. On YouTube you can see a video 'How to Make Faux Ivory With Polymer Clay', and on www.wikihow.com/Make-Faux-Ivory-With-Polymer-Clay you will find step-by-step instructions. You have to make thin layers of polymer clay in the colours white, yellow, tan and translucent. Spaghetti machines are used to make these thin layers. After kneading the mixture thoroughly, it must be baked in an oven (110 degrees C.), to get rid of the plasticizers. They say that this process is not carcinogenic; but I should recommend a good ventilation and not to cook dinner in the same room. On the site www.glassattic.com/polymer/faux-ivory.htm are interesting discussions about the best techniques to make this type of imitiation ivory. But I must admit I have not yet seen the results and can't tell anything about the physical qualities of this imitation ivory.

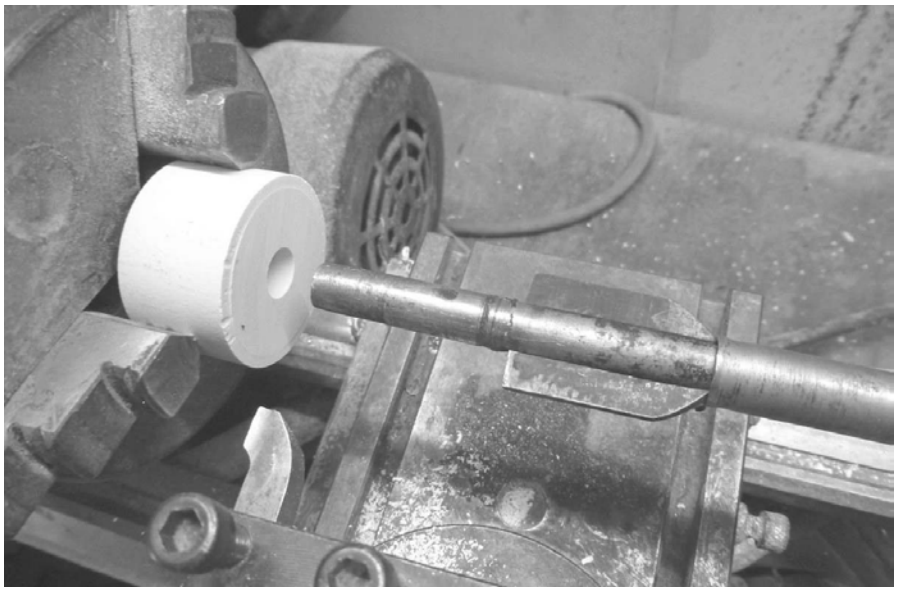
Some practical tips

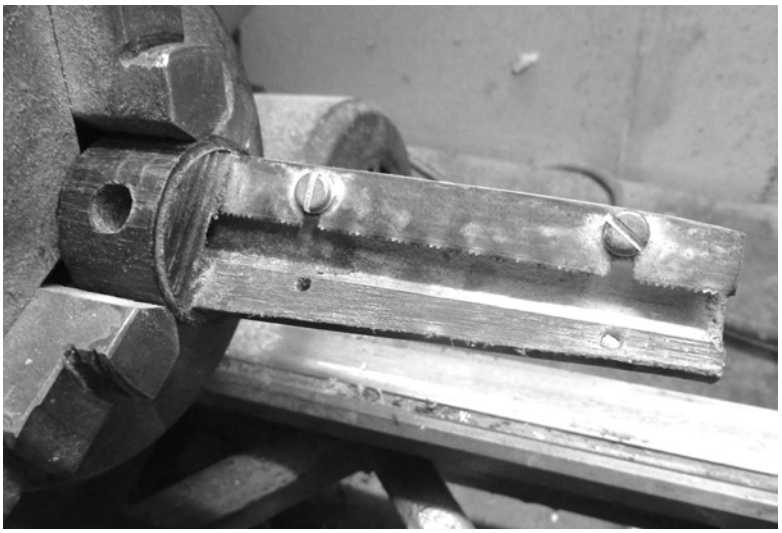
It is possible to make rings from massive rods with simple machines and tools, but the use of a metal lathe (or a self-centring chuck on a wood lathe) makes the process much easier (see photos).



At first you have to drill a hole; I usually make a pilot hole (Ø 10 mm). But you have to be careful, not pushing the drill with too much force: there is the danger that at the end the last bit of material breaks out making nasty chips. It might be therefore better to drill the workpiece from two sides. But then you have to be aware that the hole is perfectly centered: the first millimetre of the hole is most important. I prefer to use a centring drill as a start; the face of the workpiece must also be perfectly flat.

I use a speed drill in a tube construction to make the pilot hole wider. The front tube has the same diameter as the pilot hole. Speed drills are not expensive, sharpening them is easy, and you can also grind the sides into a slight conical shape (for instance from Ø 19 to 20 mm).





Another way to make a conical profile is to use a reamer. The reamer on the photo left is made of wood, with a piece of an iron saw as cutting blade. The advantage of metal lathes is that you can turn on them at much lower speed than most wood lathes. Reaming a small or thin piece of imitation ivory is always a bit tricky: there is the danger that it will crack when you put it in the chuck.

I usually glue the reamed rings to the wooden body of an instrument part, always with some (1 to 2 mm) over-allowance of length.

Turning must be done with care, it is a bit like metal turning. The rings on the photo right are from Vigoplas and that has always the danger of cratering: small chips of the material breaking out. Polishing takes much time: after sanding I use abrasivs hand pads (by 3M, or similar products), before the final stage with copper or silver polish.