

Gansars, Catlines, Pistoys and Lyons – Those Silken Lute Strings?

O, had the monster seen those lily hands
Tremble, like aspen-leaves, upon a lute,
And make the silken strings delight to kiss them,

Titus Andronicus, Act II Scene IV 44-46

There are no surviving examples of lute mid range and bass strings from the 16th and 17th C so it is not known exactly how they were made or from what material. Modern historical string makers have assumed that they were made from animal intestines twisted like a rope in order to overcome problems of inharmonicity due to the inherent stiffness and relatively low density of these larger diameter strings.

This Comm. briefly explores an alternative possibility – that mid range and bass lute strings were made from flexible braided silk cords with a 'weighted' core of spun gold or silver thread.

As strings of the Arabic oud were made either from silk filament or the intestines of sheep, felines and canines since the time of Ziryab (8th/9th C) and as it is generally believed that the European lute was a direct development of the oud, it seems reasonable to assume that at some time in its history the lute also was strung with silk or a combination of silk and gut.

The first records describing ouds with six courses date to the 14th C. and the seven course oud in the early 16th C - coincidental with the first mention of seven course lutes. So by the beginning of the 16th C there had been some kind of development in string technology that allowed gut or silk strings to function acoustically beyond the pitch of a lute sixth course by at least two semitones (down to a 4th below the sixth course pitch according to some contemporary writers). However, further significant lute bass string developments did not take place until around the beginning of the 17th C – strings known as Gansars, Catlines, Pistoys and Lyons.

Having measured the diameter of bridge string holes on a number of surviving lutes, historical string maker Mimmo Peruffo has concluded that the bass strings of these instruments must have been constructed from a denser material than gut in order for the strings to be small enough in diameter to fit through the holes. His solution is to 'weight' roped gut strings with heavy metal powders such as copper. (Note 2)

By the end of the 17th C a new type of loaded string became available (that may have slowly replaced the older type of bass string) - made with copper or silver wire wound around a core of silk (or gut) either as an open spiral winding or close wound (like modern wound lute and guitar strings).

It has been suggested that the Catline string was so named because these strings may have been made in the Catalonia region of Spain. If this is the case then the Catline string might just as well have been made from silk filament rather than gut – Catalonia being one of the major silk producing regions of the Iberian Peninsula, an industry established by the governing Moors around the 9th C.

What is striking about the sparse descriptions dating from the 17th C of lute mean and bass strings is that their names are all associated with some of the predominant silk production centres of Europe. In Italy, the silk industry was established by the Arabs and Jews between the 9th and 11th C, and by the late 14th C the main centres of production were Genoa, Venice, Bologna, Lucca and Florence in the North to be joined later by Pistoia and Livorno and other cities by the 16th C. In France, Lyon was established as the main centre for the French silk industry in 1536. During the second part of the 16th C Nuremberg and Frankfurt became two of the centres of the German silk industry. (Note 3)

The Historical record

So what is known about the lute mid range and bass strings from the historical record? Not a lot!

Robert Dowland, 1610 “ there is a kinde of strings of a more fuller and larger sorte then ordinary (which we call Gansars). These strings for the sizes of the great and small Meanes are very good. Yet also there is another sorte of the smaller strings, which are made at Livornio in Tuscanie “

“For the greater sorts or Base strings, some are made Nurenburge The best strings of this kinde are made at Bologna in Lumbardie and from thence are sent to Venice: from which place they are transported to the Martes and therefore commonly called Venice Catlines.

“ the string makers bring their best strings which were made in the Summer to Frankfort and Lypzig Martes”

“Some strings there are which are coloured, out of which choose the lightest colours, viz among Greene choose the Sea-water, of Red the Carnation, and of Blew the Watchet”

Dowland has nothing to add about the material from which his lute strings were made.

Michelangelo Galilei, 1617 – writing from Munich to his brother – asked him to obtain “four thick strings from Florence for his own and his pupil's needs” Clearly Galilei considered that the Florentine strings were superior to the bass strings made in Munich (contrary to Adrien LeRoy's assertion in 1574 that the best basses, made from gut, came from Munich).

Mary Burwell, 1676 – states that her (treble?) strings were made from “Sheepes and Catts gutte” and were made “at Rome or about Rome and none that are good are made in any other place - except the great Strings and Octaves that are made in Lyons at France and nowhere else”.

Thomas Mace, 1676 – notes that there are three sorts of strings – Minikins (trebles), Venice Catlines for the 4th and 5th courses and Lyons for the basses. He also mentions another sort of string called a Pistoy bass that he conceived was none other than a thick Venice Catline - these strings being “commonly dyed with a deep dark red colour. They are indeed the very best, for the Basses, being smooth and well twisted Strings, but hard to come by; However out of a Good parcel of Lyons Strings, you may (with care) pick those that will serve very well”.

He also mentions several kinds of strings coloured green, red, blue and yellow.

Like Dowland, Mace makes no comment about string materials.

Both Dowland and Mace caution against strings that are 'rotten'. Mace recommends storing the strings, close wound together, in moisture/light proof packages to avoid deterioration.

The so called 'gansar' kind of lute string mentioned by Dowland was also used by Italian lutenist

Vincenzo Capirola (circa 1520) – its name suggesting some kind of roped construction or more literally a braided cord not made of gut but from silk filament. This string – assuming that it was used on the sixth course - was acoustically efficient enough to be tuned a full tone lower when required.

The following definitions of 'ganse' are from L' Encyclopédie by Denis Diderot, 1762

* **GANSE**, (*Manufact. en soie*) petite poignée de gavassines auxquelles les lacs sont arrêtés, & que la tireuse attache avec une corde. *Faire les ganfes*, c'est arrêter la même poignée de gavassines, afin que tous les lacs ne tombent pas sur la main de la tireuse.

GANSE, f. f. (*Rubanier*) espèce de petit cordounet d'or, d'argent, de soie ou de fil plus ou moins gros, rond, & même quelquefois quarré, qui se fabrique sur un oreiller ou couffin avec des fuseaux, ou sur un métier avec la navette.

Les *ganfes* servent de boutonnières pour arrêter & boutonner les boutons; on en décore aussi les habits, sur-tout aux environs des boutonnières.

Les Chapeliers s'en servent pour retrousser les chapeaux, & les femmes pour lacer leurs corps & corsets.

On fait un commerce assez considérable de *ganfes* en France: les marchands Merciers les vendent; mais ce sont les Tisutiers-Rubaniers & les Passémentiers-Boutonniers qui les fabriquent.

CORDE, (*Gazier.*) Le gazier ayant à-peu-près le même métier que l'ouvrier en soie, a presque les mêmes cordes. *Voyez ci-après CORDES (Manufact. en soie.)*

In the dialect of the Southern (silk producing) regions of France, 'ganse' is pronounced with emphasis on the final 'e' (i.e. 'gansa' phonetically not 'gans').

The Early European Silk Industries

The silk industry in Europe was made up of groups specialising in silkworm farming and cocoon processing, reeling and spinning of the silk filament into thread, dyeing of the thread and weaving of the thread into varieties of silk cloth and fabrics, the primary product.

The silk spinning operation also included specialised production of gold and silver threads that were incorporated into the higher value silk fabrics. These metallic threads were made by wrapping a thin, narrow tape of pure gold or silver around a core of silk filament. Sometimes close wound thin round wires of gold or silver were used in place of metallic tape.

A secondary but nonetheless significant product of the silk industry was the manufacture of silk trimmings for clothing - haberdashery (or passementerie in France that included round braided cords or 'ganse' that often incorporated gold or silver threads - so popular among upper class V.I.P's and the military). The manufacture of these products in Italy was generally a family affair – a specialised cottage industry involving skilled female spinners and weavers. (Note 3)

Braided Cords

Hand made braided cord is an ancient tradition that is still popular today among craft weavers. The Chinese produced silk braided cord in two diameters measuring about 0.8 mm and 1.5 mm for making into decorative knots and buttons. The Japanese made complex decorative braided cords of silk (kumihimo) for tying together plates of Samurai armour as well as for other clothing applications. Although fibres other than silk were used for making braided cords, animal gut is not listed among them.

Hand braiding the Japanese way employs very simple apparatus – a wooden stool like work table with a hole in the centre for the woven braid (and any core material) to pass through and with weighted bobbins to carry the individual strands of silk – the weight of the bobbins providing the required tension of the braided strands.

The braid may be made incorporating a central core of any fibrous material, woven around a short metal mandrel to make a more elastic hollow braid or woven as a 'solid' braid.

The simplest round braid is made of four strands – more complex braids must be made in units of four strands – 8 strands, 12 strands, 16 strands and so on.

A skilled 'kumihimo' hand braider can work quickly and efficiently when making a basic 8 strand round braid of small diameter – with or without a core.

Wire Drawing of Gold and Silver

The production of fine wires of soft ductile materials such as pure gold and silver is ancient technology - the technique essentially unchanged to this day. Rods of the metal were pulled through a succession of holes of reducing diameter drilled/reamed in a soft iron die plate - the wire on each pass reducing in diameter and increasing in length. The soft iron die plate allowed wear of the holes to be restored by hammering them closed followed by re-reaming to size. By this method gold and silver wires as fine as 0.1 mm in diameter or less were made.

Spinning Gold and Silver Thread.

The incorporation of gold strips or wires into clothing fabric is described in the Old Testament, (12 -13th centuries B.C) – the narrow strips being cut from thin plates of beaten gold (gold leaf). Gold threads were made by winding the narrow ribbons, spiral fashion, around a core of silk or other fibrous yarns or alternatively by close winding fine wire around a fibrous core. (like a modern wound instrument string). Typically the width of the hand cut ribbons might be only 0.2 to 0.3 mm and the wire 0.1 mm in diameter. (Note 4)

A technical improvement was to make the ribbon from round wire flattened under pressure between metal rollers. This method was still being practiced in Persia in the second half of the 20th C using rudimentary tools. (Note 5)

Application of the tape onto the core was accomplished with a spinning head carrying a spool of the gold tape rotating around the core thread and set to advance in a precise way so that the tape covered the core without gaps or overlap. The 20th C. Persian gold tape in this case – after flattening – measured about 0.8 mm wide by 0.1 mm thick.

The Early Oud Strings

So, if Capirola's 'da ganza' and Dowlands 'gansars' were of silk braided cord construction, were these an invention of the 16th C or from an earlier date?

The Ikhwan al-Safa (Brethren of Purity) a group based in Baghdad during the 10th C recorded information about the four course oud of their day in the 'risalat al-musiqi' including details about the strings - all made from silk strands. The strings – tuned a fourth apart - increased in diameter from treble to bass 'in the most excellent proportions' of 4:3. The number of strands making up each string, from treble to bass, is given as 27, 36, 48 and 64 (so also increase by the sacred 4:3 ratio). (See Comms. 1945 and 1990)

(In the 14th C Persian work 'Kanz al-Tuhaf', details of the silk strings for an oud of five courses is described the strings being 'white, smooth, of equal gauge and well finished'. The twisted strings were finished with 'a glue of moderate consistency together with a little essence of saffron rubbed on to the strings with a piece of linen until it has penetrated into all parts of the string when dry'. Here the number of silk strands given for each string from treble to bass is 16, 24, 32, 48 and 64. Again – with the exception of the additional treble course – the numbers of strands increase by a 4:3 ratio).

The Brethren do not say how the strings were twisted. However, assuming the silk strands were consistent in diameter, just simply twisting the strands together according to the numbers given will not result in string diameters increasing by 4:3 ratio. So were the Brethren in error by being perhaps over anxious to prove the importance of the 4:3 ratio or are they telling us something about how their strings were twisted? They tell us that the treble string should be tensioned as high as it can go without breaking. They also understood the relationship between string diameter, length and tension as it related to pitch (but make no mention of the effect of density of the string material).

Assuming an oud of string length of 67.5 cm (see Comms 1935 and 1936) and silk treble of say 0.40 mm diameter, made with minimum twist and tuning f' 329 Hz, c' 247 Hz, g 185 Hz, and d 139 Hz (A415 pitch standard) with equal string tension. The second course string diameter given maximum twist then would be about 0.49 mm diameter (instead of 0.53 mm diameter). The third course string diameter made with maximum twist would be about 0.57 mm (short of the required 0.71mm diameter) and the fourth course string diameter made with maximum twist only about 0.67mm (should be 0.95mm diameter).

In order to conform to the required 4:3 ratio diameter increases, the third and fourth course strings at least would have to be made in a fashion other than being simply twisted. A roped construction would not achieve the required diameter increase and the strings so made would not be smooth but bumpy like all ropes. A string of braided silk construction on the other hand might not only meet the required diameter increases but would be glassy smooth in its finished, glue coated state. (Note 6)

Note that with the exception of the 27 strand treble string (that would have been simply twisted with minimum twist for maximum tensile strength) the remaining strings have strand numbers divisible by 4 – a requirement for braided construction.

The silk oud strings of Zyriab (9th C) were dyed yellow, red, white and black.

Braided Lute Strings?

Could lute bass strings made from braided silk be a practical historical alternative to roped gut, the fourth and fifth course strings being plain braid, the sixth and lower course strings being silk braided around a soft solid metal core or core of gold/silver thread?

Thanks to the invention of modern high speed braiding machines, small diameter braided cords

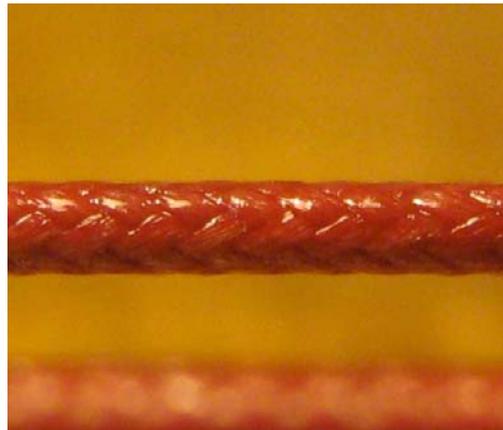
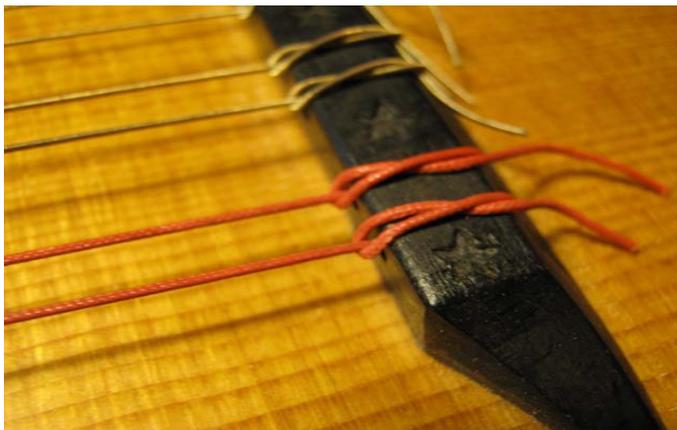
of nylon polymer are today readily available at low cost. Fishing lines designed for trolling are available in various diameters. These lines are made of nylon or Dacron filament braided around a soft lead core.

Currently trials are in hand to test these 'ready made' strings prior to embarking on a more ambitious project to hand braid more historically accurate silk strings should these preliminary tests prove successful. The results of these trials will be reported in a future Comm.

In the meantime here, for information, is the first of the experimental strings - 'smooth and well twisted'. This is made from a lead cored trolling fishing line Dacron braided and varnished to bind the braided sleeve to the core, improve durability and safely seal the toxic lead core from any possible contact with the fingers or the environment. The diameter is 0.78 mm diameter and it is currently mounted for testing as the seventh course (unison pair) on a lute tuned in F at A440 standard (60 cm string length). The seventh course is tuned a full tone below the sixth course i.e. 78 Hz at 2.3 Kg tension Sustain is about 10 seconds – similar in sustain to that of a worn Pyramid wound string equivalent. Sound is free of harsh metallic overtones.

Tuned to F 87 Hz, tension is 2.9 Kg (string test rig data). Tuned a fourth below at C 65 Hz, tension is 1.7 Kg.

Cost per string – about 10 cents - plus a few minutes work to wipe on two coats of varnish!



A downside of silk filament as a string material is its sensitivity to ultraviolet light (in daylight) that causes deterioration in tensile strength over time (as it does for synthetic filaments like Nylon). So, for example, nylon parachute fabric exposed to summer sun experiences a loss in breaking strength of 52% after a week, 71% after two weeks and 94% after three weeks. The degradation of the older silk parachute canopies was even more severe. Sky diving anyone! Dyeing and varnishing of silk filament helps to reduce deterioration due to ultra violet exposure as well as preventing moisture adsorption.

Both Dowland and Mace caution against selecting strings that are 'rotten' and Mace suggests keeping the strings in waterproof (and light tight?) packages to preserve them from deterioration in storage. Silk or gut?

Notes

- 1) See Comm 1944.
- 2) 'The Lute in its Historical Reality', Mimmo Peruffo, 2008 – Aquila Strings website.
- 3) 'The Silk Industry of Renaissance Venice', Luca Molà, John Hopkins University Press, 2000.
- 4) 'Gold Embroidery and Fabrics in Europe: XI – XIV Centuries', Marta Jaro, National Centre of Museums, Budapest. See also FoMRHI Comm. 139 'Metal Covered Threads before 1600', Gwen Montagu.
- 5) 'The Traditional Crafts of Persia', Hans E. Wulff, the M.I.T. Press, 1966.
- 6) Based upon preliminary trials with twisted and braided silk strings. A simply twisted silk strand bundle at maximum twist increases in diameter by about 12% to 18% dependant upon the number of strands. For traditional Chinese strings of roped construction the diameter increase for the same number of strands is about 29%.

For braided cords (without core), the diameter increase is about another 36% more than the simply twisted string diameter at maximum twist.