



English (Canterbury), *Passionale of Augustine* c.1100 (detail of initial T from British Museum, London, MS Arundel 91, fol.218v).

Note the four strings clearly detailed by the artist. Other parts are sketchy, such as bridge, tail piece and finger board. There appears to be a hint of a finger board but these details are again, sketchy. The nut is suggested in sketchy form like the fingerboard. Elevation of the bridge and other setup details are not determinable. The form of the body and the sound holes are clear in this picture.



The same picture, full view. It is important to get the best picture one can find of the original or wrong conclusions can be made – this picture looks to have only three strings, yet the more detailed reproduction of the same manuscript – from another source – clearly shows more detail including four strings and a hint of a finger board.



Southern English, "Tiberius" Psalter, c.1050 ("Musician from King David's suite" in British Museum, London, Cotton MS.Tib.C.VI, fol. 30v).

Other period icons of similar instruments are worth examining before starting the final work on the above recreation of the English (Canterbury), Passionale of Augustine c.1100 fiddle



French, Gradual of Nevers c.1060 ("Musician dancing, with legend Consonancia cuncta musica" from Bibliotheque Nationale, Paris, MS. lat.9449

The artist has shown us a line hinting at a finger board. Later instruments have longer fingerboards of two shades – the half closer to the nut being dark and the other half, closer to the bridge, being light and colored as the instrument. It is clear that some artists abridged many details only giving us the form and hint but not construction plans.



Spanish, Catalan Psalter, c.1050. ("King David and musicians tuning their instruments" in Bibliotheque Nationale, Paris, MS Lat. 11550, fol. 7v)

Again – a line where a fingerboard should be is clearly seen. No obvious bridge on this instrument – yet we know it had to have one. Details omitted by the artist must be taken into account when reconstructing a musical instrument that is functional. Note the backward turned hand allowing the instrument to be better shown.



English, Psalter, c.1125-1150 (St. John's College Library, Cambridge, MS B.18, fol.I.).

These English fyddles, ranging about the time period, 1050 – 1150, seem to favor the same shape – this one with three strings, the others with four. Note – bridge is shown but absence of fingerboard. Interesting trifol pegbox in this illustration.

The Medieval Fyddle and Rebec family of instruments enjoyed a popularity with the court and the nobility. Depictions of King David playing and minstrels playing for him are a theme in a number of period images as well as knights dressing in armor for battle while their fyddler plays suitable music for the occasion. Bowed instruments of all kinds were very popular in the 11<sup>th</sup> - 13<sup>th</sup> centuries royal society. Large groups were maintained by the courts in various regions, such as Alfonso the Wise in Castile, and Manfred of Hohenstaufen in Sicily, although this does not appear to be the norm. Having musicians was a sign of status and wealth, a tradition carried into the 14<sup>th</sup> century by the rising burghers and "middle class" who often employed minstrels as part of their households.

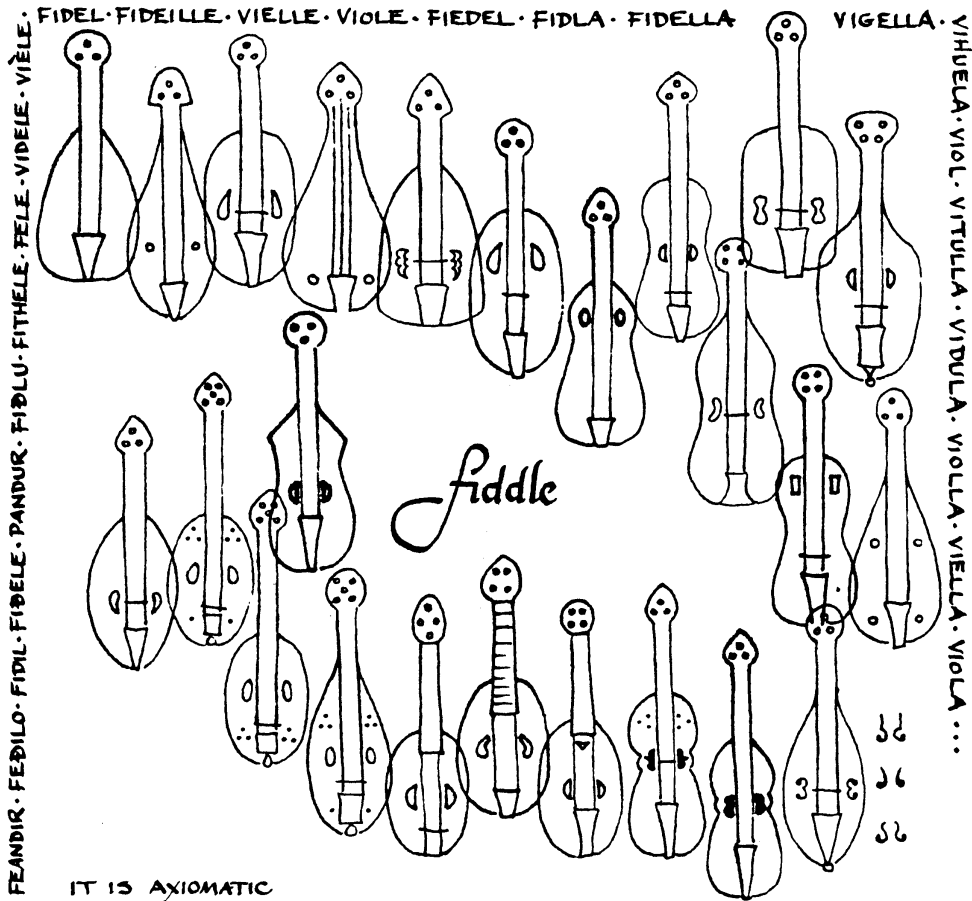
The only medieval type fyddles surviving from archeological digs are the two Mary Rose fyddles dating 1536 (Renaissance in time but medieval in type and construction) and the Kiev fyddle remains of the 13<sup>th</sup> century from a dig. The evidence is less than complete but several things are clear – the instruments were carved out of the solid (from whole blocks of wood - not pieced on a mold or form from bent wood strips). The walls of the lip where the table attaches is thickened to support the table - about 1/4 of an inch. The walls and back being about 1/8 of an inch in thickness or 2 mm. The table was also about 1/8 of an inch in thickness or 2mm. *Early Music January 1983 in the article Musical instruments of the Mary Rose, a report on work in progress by Frances Palmer*

Construction of this recreation (English (Canterbury), Passionale of Augustine c.1100 fyddle) has behind it many years of instrument building, experimentation and research by this author. Western luthiers have resisted constructing instruments using the methods clearly indicated by example and manuscript – techniques employed during the Middle Ages. As a result, this author has broken new ground in the academic fields related to musical instruments of the past. Recreation based on available research has been refined and brought to a level of perfection to arrive at museum quality – **some of my instruments have been displayed in museums - the History Museum or Seoul South Korea has ordered an instrument for their collection.**

A knowledge of the luthier arts is required as a starting point. Study of the materials, tools and methods are necessary as well as stepping backward through history with the craft, arts, and science or the luthier to learn of the changes, losses, and retained knowledge of the past. Examination of instruments from other cultures, where the instruments have not changed or changed little since the Middle Ages, is the next step toward unveiling the hidden guild secrets of musical instrument making. The luthiers of the Arabic culture in the 9<sup>th</sup> century give us some details of construction that European luthiers held dearly secret. Only through much research and long experimentation and matching example with manuscript and illumination has a finished product been reached with such authenticity.

Every aspect of material authenticity has been taken into account – maple wood was used in the 7<sup>th</sup> and 8<sup>th</sup> centuries in England to make rottas (a musical instrument). Maple is chosen as a known historical instrument making wood in English luthier tradition. Other woods were most likely to have been used but this wood is documented and used in this application, proving authenticity.

This entire instrument is a wood carving, both inside and outside. The shape is just what the project called for in order to be historically accurate. Nothing extra could be or should be



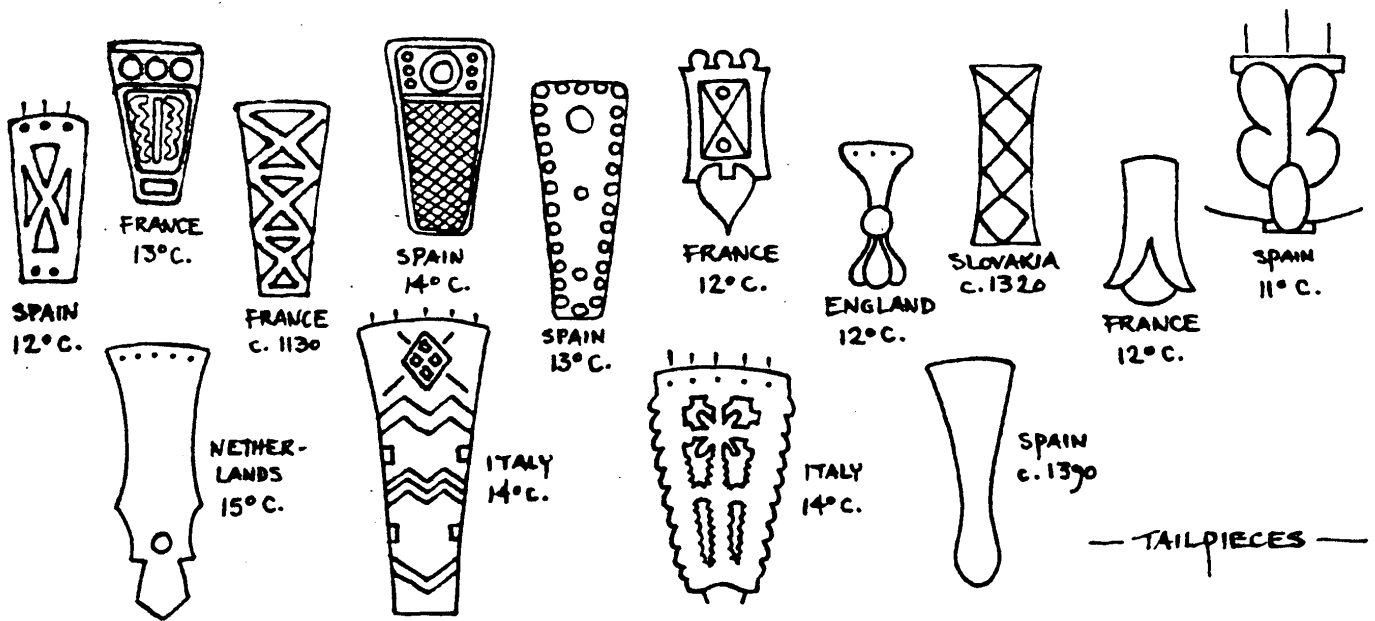
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 VIHUELA · VIOL · VITULLA · VIDULA · VIOLLA · VIELLA · VIOLA ...

IT IS AXIOMATIC  
 THAT IN THE MIDDLE AGES THERE WERE NO COMPLETELY STANDARD  
 FORMS OF ANY INSTRUMENTS .  
 THOS. BINKLEY

added.  
 The project aims at historical accuracy – nothing else is acceptable.

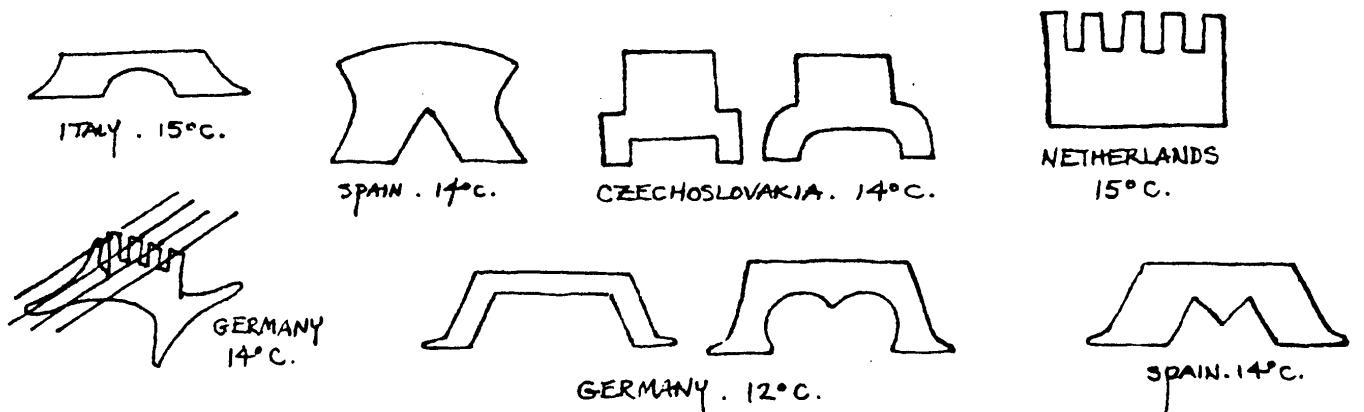
The fiddle had many names and many shapes, sizes, and tunings in the Middle Ages. It should be noted that the name viol is here exclusive to the medieval fyddle and the later viols of the Renaissance is an entirely different instrument developed from the gigue (not the fyddle). The violin (vedeloped about 1511) is a marriage of the fyddle and rebec with attributes of both.





— TAILPIECES —

— FIDDLE ACCESSORIES —



— BRIDGES — (note many flat tops!)

The major decorative feature of this fyddle is the tailpiece. In keeping with the time period, a pierced design is chosen that fits and balances the overall instrument. No design can be detected in the manuscript but it was a common practice to decorate and would be unusual if the original did not have this ornamentation. Creativity points.

### Construction Notes:

Finding a large enough, clear of knots and splits, piece of suitable instrument quality wood was difficult. This fyddle is a large instrument with a ten inch span across the belly. I have to wait and search until the right piece of hard rock maple was available. I could not get a large enough piece in any other tone wood, so maple had to be it or I could not make the instrument. Maple is an ancient luthering wood – 6<sup>th</sup> and 7<sup>th</sup> century rottas have been found made of maple as well as oak. (Oak is unstable and not a good instrument wood)

Eighty to one hundred year old, aged instrument quality, quarter sawn spruce was selected for the top (expensive but worth the result). Sometimes a piece of spruce is very soft and very hard alternating in a flamed pattern. This poses no problem to a modern luthier who uses modern equipment to sand and finish a top but when the top is hand finished with scrapers the rare piece that does this poses a problem. Luthiers in the Middle East finish the top as I did this one – it is called rustic and has its own charm and is not detracting from the final result -- in fact many think it to be quite beautiful. When you pay sixty to one hundred dollars for that piece of wood, you work with it.

What would be the string length and tuning of this fyddle? The sound of the instrument is generally described as high pitched and sharp, sometimes as shrill. Its voice was described like that of a woman's: Aymeric de Payrac speaks of a minstrel who "bowed the rebec as if imitating a female voice." The Archpriest Juan Ruiz de Hita in his *Libro de Buen Amor* in 1343 comments about the rebec that "con sua alta nota." Tinctoris in *De Inventione et Usu Musicae* grants the rebec a higher but pleasant tone. This instrument is shaped in the typical rebec form yet very large and fyddle like. With four strings, we must search for a period match and we find the closest fit in rebec tuning. The rabab is noted constantly in its "classical" form to have its strings tuned to 5ths. Jerome of Moravia notes that these notes are middle C and the G above it. That would give the instrument a fairly high voice, much like the two middle strings of the modern violin (which are D and a). The three stringed variant has two possible tunings mentioned in several sources. Virdung (1511) notes the rebec as having three strings tuned in fifths. Agricola's *Musical Instrumentalis Deudsch* again mentions that the rebec is tuned in 5ths with a bridge allowing the sounding of the strings individually and having no drones. The 1545 edition of Agricola gives these notes a G,D,A - the LOWER three strings of the violin. Gerle's *Musica Teusch* also describes the instrument as being tuned in 5ths, and that it has no drones, but does not mention any notes. Other sources from the renaissance show a tuning of D, A, E or the upper 3 strings of the violin.

Moravia, A Dominican monk who lived in Paris c. 1250 wrote *Tratctatus de musica* where we find 3 medieval fyddle tunings. The danger here is to assume these to be the only tunings - there are many different fyddles and many different tunings. The three string and 4 string variety designed to take the strings individually is an ancient form and tuning of the fyddle that survives and is documented in the Renaissance. The instrument changes little – its tuning changes little or not at all – a good instrument is handed down from father to son. A good clue to a medieval fyddle tuning is the presence of frets or not. The presence of frets argues in favor of a modal tuning such as Moravia suggests. Absence of frets, as is clearly indicated in this project and in many medieval illustrations, argues for tuning in fifths.

The tuning of the violin G, D, A, E is chosen for the English (Canterbury), *Passionale* of



Augustine c.1100 c.e. fyddle reconstruction. The vibration string length cannot be more than 13 inches from nut to bridge (fact dictated by the laws of physics).

Armed with this decision about the tuning and string length we can approach the physical drawing and design of the instrument.

Care in proportion and artistically keeping true to the manuscript picture were primary concerns in preparing the plans for the fyddle. The end result must be a playable instrument that faithfully recreates the 1100 manuscript depiction of a medieval large rebec fyddle.

Other than mentioning it here for sake of time and brevity the subject of golden circles and magic numbers will not be followed except to say that it is an ancient part of the luthier craft in respect to design and was consulted and followed in the production of this instrument design.

Cutting and shaping of the wood was done in the traditional manner ending with hand scraping the inside dimensions to achieve 1/8 of an inch in thickness for the walls and back as seen on the surviving original pieces listed above.

**Not every conceivable question that could be answered will be here – The volume of material and data necessary to do so would and does fill large books on the subject of the luthering craft. I have two books on just varnish. If wood could have been worked with period mill power tools such as water, wind, or muscle-mechanical (foot powered treadle lathe or bow drill) modern equivalents were used as appropriate substitutes. If the work warranted hand tools or required them, I used them – the list includes:**

**Hand finger-powered twist drills, scrapers (made by me), some hand saws (coping, fret, hack, and finishing and jewelers), hammer and chisels, planes, knives, gouges, files, reamers, and calipers. In all cases, hand tools are used, when finishing inside the walls and back of an instrument – *this is done with hand tools* – hammer and chisel, scrapers and such. Power tools are too rough and split and ruin the very thin wood when carving. One must feel the proper amount of flex and bend to the instrument to know when the tolerances are correct and tap for tone and response. This is a hands on process.**

**Authenticity is the all guiding principal with construction – Materials, tools, and methods of construction – which includes carving from the solid block for fiddles and other similar instruments. All these items are as close to period as can be determined. The examination of construction techniques from either period or as early as one can find examples (only a hand full of luthier class instruments exist and all but one is from a dig and only one is complete in its original form so that it may be played -- a fourteenth century harp from an Irish bog). Study of luthier techniques from the Middle East and Eastern Europe also are windows to the past for authenticity.**

**Several items were purchased for the project - tuning pegs, gut strings.**

**These items are purchased due to speciality skill or equipment I do not have or due to time – I can make gut strings and have but this is a specialty requiring much time and effort that would detract from the making of instruments**

### **The wood for musical instruments:**

before you start making anything you must choose the proper wood. Archeological remains and documents from the period, as well as luthier tradition give us a list of proper

instrument woods. Fruit and nut woods, box wood, maple (English sycamore) and occasionally some exotics imported from Africa and India, black wood, rose wood, and related available exotics from these areas (saz bodies were made from mulberry wood in Turkey -- Turkey is a known supplier of wood to Italy -- documented during the Renaissance and extending back to earlier times). Woods from the Americas is not available until the late Renaissance -- such as birds eye maple, mountain mahogany, yellow box wood, palasander, kings wood, and pernambuco. The hard woods are for the box, neck and furnishings. The top, or table, is made of **Spanish cedar** (not red cedar) or **spruce**. **The top wood needs to be quarter sawn.** Thickness depends on the instrument being built, however, most are one eighth inch thick, not getting any thicker than three sixteenth of an inch on some larger instruments. The issue with using oak (surviving two rottas found out of oak) is that oak survives well due to the high tannin levels in the wood, but, is unstable -- changes radically with humidity and climatic changes resulting in breakage, inability to keep in tune, and other undesirable results. Many rotta bridges have been found but the instruments were constructed of other woods that did not survive the ravages of time (some pieces of maple have been found). Oak is not the only wood these instruments were made of and is not a good instrument wood -- unless you intend on preserving it in a grave for a thousand years, then yes, by all means, use oak.

**Burl -- Luthiers do not use burl -- period -- the end. Burl is brittle, prone to cracks when thin, stiff and unresponsive to sound vibrations, and the grain does not run straight as is desired when quarter cut.** Burl is a carver's wood -- not luthier.

**Flamed wood** -- Use of flamed and decorative wood grain in the luthier craft dates to the mid 16<sup>th</sup> century. The use of the decorative woods, seems to be assumed to be a time out of memory type of material for use in constructing musical instruments -- **NOT SO!** The history of how, when and why this decorative wood came into use is known and well documented. In the Renaissance, 16<sup>th</sup> century, with the push of the Ottoman Empire, wood from Turkey (the major source of maple and other hard woods for Italy) was selected by the Turks for its wavy pattern -- so the oars for Italy's war galleys would be weak, and more likely to break. This wood with the wavy grain was also the source for the Italian luthiers. The Italian instruments had the highest esteem and reputation influencing luthiers in other countries to emulate the choice of wood for the wavy grain and decorative wood. The use of these woods earlier than 1550 is not common -- only accidental. **It is completely unhistorical and unwarranted to use these decorative woods for instruments of the Middle Ages.** (E.D. Heron-Allen VIOLIN-MAKING: AS IT WAS AND IS (Ward, Lock & Co. Limited London and Melbourne 1885 sec ed. 1861 first ed.) (Book in private collection of the author).

These are not furniture woods, nor are they woods for any other purpose in general. Luthier woods are in a class by themselves using species atypical to any other use (yes there is some crossover usage but consideration of cut and clarity coupled with some types not used by others at all, justify the statement). One cannot assume, for example, that the advent of cherry wood use in furniture in the Middle Ages is a sign post for when it was used for musical instruments. Since a Fyddle uses much less wood than, let's say, a chair, or bed, a small supply of the precious wood would be secured by the luthier first -- the carpenter would only gain access to it for his larger projects as the supply grew. To assume that cherry wood, for example, did not enter into use in the Middle Ages until the 14<sup>th</sup> century because existent artifact furniture made of

cherry does not predate the 14<sup>th</sup> century would show flawed logic. **First**, not all furniture from the Middle Ages has survived, in fact precious little. **Second**, because artifacts from the 14<sup>th</sup> century, that have survived have cherry wood do exist does not mean the cherry wood started use in furniture in the 14<sup>th</sup> century, only that some artifacts made of the wood survived from that period. **Third**, artifacts from earlier periods are increasingly rare, and furniture using cherry might have been made but, not survived. **Fourth**, we are talking furniture artifacts here not musical instruments – luthiers have always sought out and obtained the best wood. **Since cherry, maple, and walnut, are the most suitable instrument making woods readily available, and they match reasonably close the European medieval woods available in period, it is reasonable to use them for authentic recreations of medieval musical instruments.**

**The above list of woods are good for recreations of medieval musical instruments and available equivalents in non European varieties (American cherry, maple, walnut) are in many cases all the American luthier can get.**

**Patching, when necessary is done with a mixture of glue and very fine sawdust made into a paste.** Mix powder scrapings of the finest saw dust (use the same dust from the wood to be patched) with glue into a paste and apply, let dry, and scrape smooth.

**The design must withstand the pressure of 4 strings tuned to pitch pulling constantly on the neck and pressing on the top.** This means the top must employ some form of bracing inside the table, or the table will buckle and break under the pressure.

### **Bracing:**

Bracing is used on the underside of a top (table) to strengthen it and keep it from caving in from the pressure of the strings pressing down on the bridge. Some scholars believe luthiers of the Middle Ages used no bracing so the first instruments i experimented with had none. The tops caved in. The tables bowed inward and split. Clearly, these schollars were wrong. I used traditional bracing to stabilize the top and it works well. Bracing from the luthier class instruments of the Middle Ages does not exist in the artifact record. Since no tops have survived in any form (excepting Rotta tops which are quite different than later instruments), all we have to go in is luthier tradition and construction of folk instruments in cultures where the instruments have not changed or have changed little in the last one thousand years. Examination of bracing used by luthiers in the Middle East show much the same techniques an experienced luthier might expect -- "T" brace, Bar brace, Fan brace, and Bass bar. My fyddles use bar and bass bar brace. My guitarra latinas use a bar brace. This is a luthier skill and art that is very important to the success of the instrument and the finished tone as well as the instruments ability to hold up under tension. How each luthier applies bracing and the details is a closely guarded secret and represents their scientific endeavor for perfection.

The top is made of European Spruce (bought from a luthier wood supplier -- aged 100 year or more costing \$100.00) one 3/16 inch thick -- all quarter sawn.

The body is of hard (rock) maple. This instrument was much more difficult than one with a flat back and straight sides. The whole instrument is a carving out of a single block or hard (rock) maple.

Gut strings are used as indicated from original sources and tradition.

**Wood:**

Select hard (rock) maple wood (like English sycamore) was chosen for the body and neck.

The bridge, finger board, and tail piece are all made from hard (rock) maple. The nut is ebony. The period style pegs (purchased) are of boxwood -- pegs have changed little in eight hundred years. These are very much like some pegs documented in the Middle Ages.

**The model** – one needs plans to construct an instrument. I make only medieval musical instruments. In the past I have made some Renaissance and Baroque instruments but their construction is completely different than that of the Middle Ages. My interest and speciality is in instruments of the Middle Ages, therefore my information here is **only** for that time period.

Choose the instrument you wish to construct – get the manuscript picture or pictures – study as many variations of that instrument as can be found. Using knowledge of tuning and string lengths allowable for those pitches, get a max and min string length for the instrument. Now you are ready to measure the instrument in the drawing and enlarge it in proportion to the human figure holding it and matching the string lengths needed for a working instrument. I am always amazed that the dimensions I arrive at match the limitations of physics in string length requirements for a working musical instrument. The medieval artist draws the instrument in proportion to the human body -- so one can use the average five foot four to seven inch height to proportion the drawing and divine a size for the instrument.

I draw my plans first on large white or brown butcher paper, sold for wrapping packages for shipping and art etc. Once these plans are finished they are copied to poster board and a stiff template is made. Some times I also make the outlines in 1/8 inch plywood.

The template will be used to draw the body on the single block of wood chosen to become the new musical instrument body. The neck may be included in this or the neck may need to be attached separately to the body (always carve the neck attached to the body unless there is some reason – like the pegbox rises above the plane of the top of the ribs).

Once drawn the outline is cut. The body is ready to be shaped and finished to final couter on the outside. **Forms are N/A in medieval instrument building for instruments of this type – carved from the solid.** Forms are late 16<sup>th</sup> century and later luthier methods, except for large instruments, such as lutes, not cut from the solid block.

After the outside is completely finished, it is time to carve out the interior. The sides (ribs) and back should have a final measurement of 1/8 of an inch (2 mm) with a 1/4 inch lip (4 mm) for attaching the table on the top of the ribs. **The whole instrument is a wood carving!**

**Mystic numbers, magic and golden circles** – We have drawings from the luthiers of the 16<sup>th</sup> and 17<sup>th</sup> century indicating their use of golden circles and magic numbers in regard to designs. Numerology and mystical significance in numbers is well documented from the 11<sup>th</sup> century on. This tradition in the luthier arts is ancient and meaningful. Certain aspect ratios yield inner volumes of the body that produce a more resonant response to certain frequencies and balance over primary frequencies. String lengths are also absolute in nature – a certain pitch

within a given register must be achieved with just the right string length and string diameter. There are limits of physics in dealing with strings and the luthier must know these and work with them in the model.

The following Table is from Craig H. Russell phd, Music of the Spheres: Love, Chivalry, and the Universe in the Twelfth Century M11404: Medieval Music – California Polytechnic State University San Luia Obispo

<b>4 Seasons</b>	<b>Spring</b>	<b>Summer</b>	<b>Winter</b>	<b>Fall</b>
<b>4 Elements</b>	<b>Air</b>	<b>Fire</b>	<b>Water</b>	<b>Land</b>
<b>4 Winds</b>	<b>Meridiano (South)</b>	<b>Poniente (West)</b>	<b>Levante (North)</b>	<b>Tremontana (East)</b>
<b>4 Ages</b>	<b>Child</b>	<b>Youth</b>	<b>Maturity</b>	<b>Decrepit</b>
<b>4 Body Fluids</b>	<b>Blood</b>	<b>Cholera</b>	<b>Phlegm</b>	<b>Melancholic</b>
<b>4 Qualities</b>	<b>Hot &amp; Humid</b>	<b>Hot &amp; Dry</b>	<b>Cold &amp; Humid</b>	<b>Cold &amp; dry</b>
<b>4 Modes</b>	<b>Dorian</b>	<b>Phrygian</b>	<b>Lydian</b>	<b>Mixolydian</b>

<b>7 Planets</b>	<b>Sun</b>	<b>Moon</b>	<b>Mars</b>	<b>Mercury</b>	<b>Jupiter</b>	<b>Venus</b>	<b>Saturn</b>
<b>7 Days</b>	<b>Sunday</b>	<b>Monday</b>	<b>Tuesday</b>	<b>Wednesday</b>	<b>Thursday</b>	<b>Friday</b>	<b>Saturday</b>
<b>7 Metals</b>	<b>Gold</b>	<b>Silver</b>	<b>Iron</b>	<b>Mercury</b>	<b>Tin</b>	<b>Copper</b>	<b>Lead</b>
<b>7 Organs</b>	<b>Heart</b>	<b>Brain</b>	<b>Gall Bladder</b>	<b>Lungs</b>	<b>Liver</b>	<b>Kidneys</b>	<b>Spleen</b>
<b>7 Qualities</b>	<b>Good, Noble</b>	<b>Melancholy</b>	<b>Ardent, Fiery</b>	<b>Variable, Inconstant</b>	<b>Benevolent, Natural</b>	<b>Creative, Good-Deeds</b>	<b>Distant, Cold</b>
<b>7 Virtues</b>	<b>Fortitude</b>	<b>Temperance</b>	<b>Justice</b>	<b>Hope</b>	<b>Faith</b>	<b>Love</b>	<b>Prudence</b>
<b>7 Note-Names</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	<b>G</b>

Music played an integral role in medieval philosophy and daily life. The concepts of love and chivalry are bound up in medieval philosophy and thus bound with music. Musical instruments are an embodiment of medieval philosophy and are instruments of love and chivalry. They must therefore be perfect, embodying the mysteries of the universe.

**Tolerances – carving – musical instrument tolerances for tone**– This is, for a master instrument, nothing less than high art – something one does not see, only hears. This is the dividing line between master and hack, yet people only see the outside. Some recent discoveries have shown that the 17<sup>th</sup> century masters use the sun to disclose unequal density in the wood and marked and scraped to even the density out. (Scientific American July 1989 - Stradivari's Secret (Redux) Did baroque artisans "X-ray" wood with sunlight?.) There is no reason to suspect this technology developed with the baroque masters since examination of existent renaissance instruments show the same knowledge of density mastering. Indeed, we have every reason to suspect that it reaches back to the medieval master luthiers. The problem is the lack of existent artifacts. Also certain areas are thinned for better response and others left a little thicker for strength and controlled responsiveness. The technology is as advanced as a high tech speaker system and a lot less quantifiable – relying on the art of the luthier master to get it right. This method of mastering an instrument is not born or originating in the 17<sup>th</sup> century – just carrying on a long tradition stretching back into the Middle Ages. This knowledge and master work is what you are paying for in a new master instrument of the violin family that costs over \$10,000.00. In general, the back is one eighth of an inch thick and the ribs are one eighth of an inch thick. These are starting points for the master, not finishing points.

Asymmetry is an important point to bring up here. The master luthiers of the sixteenth and seventeenth centuries give us a glimpse into the genius of the past. Bass strings require a different amount of wood density for response than treble strings. Surviving bridges with lopsided cuts and other asymmetry aimed at evening and quickening the response of the different strings are in existence – asymmetry in bridges, body, thicknesses, and cuts, all leading to a better instrument are techniques of the ancient luthiers. Modern luthiers have lost this art and it is only now being rediscovered with the interest in early music and research into the original setup and outfitting of old instruments. I use some asymmetry in my luthering intentionally. This is part of the secret craft.

The top of this instrument must withstand a constant twenty pounds per square inch of pressure pushing down trying to cave it in. Bracing is necessary to avoid disaster and deterioration of the table. This top has traditional cross and bass bracing.

### **The Making of the Bridge**

If one examines the bridge on this instrument a number of differences from modern violin family bridges will be found. **All these differences are intentional!** The top of the bridge is not rounded as is done on modern violin family bridges – it is sharp angled (90 deg.) As is found on pre 19<sup>th</sup> century surviving bridges of the violin family. Some surviving 16<sup>th</sup> and 17<sup>th</sup> century bridges clearly have this flat, non curves edge over which the string passes. Experiments in the Galpin society as well as my own, show this to be a superior design producing greater sound. The edges at the V angle are softened and rough to avoid breakage from stress. This is the second bridge on this instrument – the first broke due to the sharp V angle – so that is why surviving bridges from the 16<sup>th</sup> century appear crude – the luthier knew what he was doing.

### **Other Materials:**

After the body is cut and shaped outside, the inside is carved out. Holes are drilled to

honeycomb the interior, then, it is hammer and chisel time. The work is time consuming but progresses over time. The inside is then scraped with scrapers to dimension and work the instrument into a responsive state that hands and ears of the luthier are looking for.

**Components: All are period - glue, varnish, strings, everything.**

**Time to construct:**

Estimated hours to complete this project – 300 -- 400 hours or more. Time is hard to keep track of when you work on an instrument off and on for over two years. Keeping this in mind, the times are only guessed at. We must not forget the time to design the instrument from the original sources. Drawing of working drawings and making jigs or template models.

The body or the instrument is carefully hand dimensioned for proper tolerances using hand scrapers and chisels. Many, many hours of work goes into this process to get it right – this is a master luthier art.

The instrument should hang in the sun for six month to a year before varnish is applied to get the wood to oxidize and change color – this bring out the wood grain and natural beauty of the wood.

About three to six weeks of on and off time are required to properly finish the instrument in an authentic period style with period materials. (100 hrs at least). Varnish from period recipes must be made (time here is unknown but perhaps 30 hours to make varnish) and applied – not as is done with furniture which would spoil a musical instrument – but, with knowledge of the luther craft and arts.

Varnish is made from period recipes and required extensive research and development to execute, and learned skills to properly apply. Boiled linseed oil, turpentine (from pine sap), pine resin (best source is pure violin rosin), and saffron, are the component of the varnish I prefer.

The over all instrument is seen as an art object as well as a functional musical instrument. The level of decoration is in accord with a noble or royal house.

**The finish is an oil based period musical instrument quality varnish.** About thirty coats of varnish are required to achieve the high luster and polish. **No modern plastic or resin finishes are used.** Modern violins, violas and cellos are the only instruments commonly found using oil varnish today, and only the most expensive of those in the \$10,000.00 and up price range. The labor, in such a finish, greatly adds to the price of an instrument. Thirty coats of oil varnish with drying time between each coat and hand rubbing of each results in a nice but labor and time intensive finish.

**Finishing – surface prep sealer, oil varnish, and polish** – The arcane art of finishing a luthier family instrument and the mystic surrounding this process is legendary. This process is not the same as for finishing furniture. A musical instrument wood must remain unspoiled and untainted so it can develop. The cells of the wood contain pitch. As this pitch dries it crystalizes and leaves the cell nearly empty. This is why instrument makers pay large prices for aged wood, and is one of several reasons that in instrument gains tone and voice as it ages. This process takes about seventy to one hundred and fifty years to achieve. Certain treatments enhance and strip the pitch from the cells – wood allowed to soak in the bay of Verona for two to ten years

allowed tiny microscopic sea animals to eat the pitch out of the cells. Some wood cut a century ago in Michigan, sank into the great lakes and was rediscovered recently. This wood, from the lake, also has the property of empty cells and is drawing a big price from luthiers. If you pay a big price or not, one does not want to spoil the potential of an instrument by gumming it up with oils or other foreign substances. **The surface of the wood must be sealed, to prevent contamination of the cells.** Sealing is done in one of three ways:

1. Coating the surface with a thin coat of instrument making glue.
2. Using a shellac. (Spirit based component that seals and does not sink in the wood)
3. Using sizing.

I prefer the shellac sealant over the other two options – the glue is not as good at preserving a clear vision of the wood (gets cloudy or dark) tends to be brittle and hard too – the sizing does not stick well to the oil varnish and it tends to sluff off or become gooey over time. The protective coating of sizing, shellac, glue, must be nearly removed after being applied until just enough remains to seal the instrument and provides a base for the oil varnish.

Once the surface is sealed, the oil finish can be applied. Here is a listing of period recipes for instrument grade varnishes along with the source. I have experimented with some of these and have developed what I find to be a good varnish for musical instruments out of this information and some other source books I have on 16<sup>th</sup> century violin varnish. These are as early as the documentation on varnish gets.

**The following is from VIOLIN-MAKING: AS IT WAS AND IS by E.D. Heron-Allen (Ward, Lock & Co. Limited London and Melbourne 1885 sec ed.)  
THE VARNISH.**

All the data we have to go upon are the printed works of some few individuals, who have written pamphlets on the various varnishes in common use for various purposes, and it is not unreasonable to suppose that the varnish used by the luthiers or fiddle-makers, was, to a certain extent, familiar to them ; again, the reading and proper construction of these formula is rendered more difficult by the fact that many of the gums, resins, and solvents mentioned, no longer exist under the names by which they were then known, and some would seem almost entirely to have disappeared. I will now recapitulate a few of the most likely formula enumerated in these ancient brochures. The first I have been able to obtain is a treatise called "Secrets of the Arts," first published in 1550, by one Alexis, a Piedmontese. He gives the following recipes:—

1. Place some powdered benzoin (a) in a phial and cover it with two or three fingers depth of pure spirits of wine, and leave it thus for two or three days. Into this ~ phial of spirits, put five or six threads of saffron (b) whole, or roughly broken up. With this you may varnish anything a golden colour, which will glitter and last for years.
2. Take white resin (vide note ) 1 lb., plum tree gum 2 ozs., Venetian turpentine (c) 1 oz., linseed oil 2 ozs.; break up the resin and melt it. Dissolve the gum in common oil and pour it into the resin, then add the turpentine and oil, and placing it on a light fire, let it thoroughly mix; remove and keep for use; apply slightly warmed. This is a good picture varnish.

Under this head would come a kind of copal, known variously as "Indian copal," "dammar," and "gum animi," which flows from a Sumatran tree called *Vateria indiccz*, which was, in former times, known as "white amber" or "white resin," or "white incense," which names were also given to a mixture of oil and



Grecian wax, sometimes used as a varnish.

As the names of many of these gums, etc., may be unfamiliar to lay readers, I have placed an Appendix, descriptive of them, at the end of the book (Appendix A.), and the reference letters in the text refer thereto.

D. Alexii Pedemontani de Secrets Libri Septum. (Basle, 1603.)

3. A quickly drying varnish. Take frankincense (d) and juniper gum, powder them and mix them finely. Take some Venetian turpentine, melt it in a little vessel, and add gradually, mixing thoroughly, the aforesaid powders. Filter through cloth and preserve; apply warm, and it will dry very rapidly.

4. Take gum-mastic (e) 2 ozs., Venetian turpentine 1 oz., melt the mastic on a light fire, adding the turpentine, let it boil for some time, mixing them continuously, but not long enough for the varnish to become too thick. Put it away out of the dust. To use it, warm it in the sun and lay it on with the hand.

5. Boil 3 lbs. of linseed oil till it scorches a feather put into it, then add 8 ozs. juniper gum and 4 ozs. aloes hepatica (~, and thoroughly mix them; filter through cloth, and before using, warm in the sun.

6. Gum-mastic 2 ozs., gum-juniper 2 ozs., linseed oil 3 ozs., spirits of wine 3 ozs., boil in a closed vessel for an hour.

The author cites as colouring matters, sandal wood (g), dragon's blood (h), madder (i) steeped in tartaric acid, log-wood (j), Brazil wood (k), all dissolved in potassa lye, and alum, and boiled. Also saffron (b), cinnabar (l), and orpiment (in). He says, "Linseed oil will dissolve mineral and vegetable colours, but kills others."

Fioravanti in a brochure called "The Universal Mirror of Arts and Sciences," published at Bologna in 1564, gives the four following formula

1. Linseed oil 4 parts, spirits of turpentine 2 pts., aloes 1 pt., juniper gum 1 pt.

2. Powder, benzoin, juniper gum, and gum-mastic, and dissolve in spirits of wine. This varnish dries at once.

3. Linseed oil 1 pt., white resin (vide note, p. 173) 3 pts., boil together, and colour as you will.

4. Linseed oil 1 pt., resin 2 pts., pine resin ~. pt., boil till it thickens. Juniper gum must never be added to the linseed oil till it boils, or else it will be burnt. The oil should be boiled till it scorches a feather dipped into it.

He gives the same directions as Alexis, as to colours, and the solvent powers of linseed oil.

Beyond these two authors, formulae become rather scarce, being chiefly brought from China. All these last, and the coming, formulae are not to be taken as invented at the dates given, for they are from works in the nature of Encyclopedias, and consequently post-dated.

A priest of the name of Anda, in a pamphlet entitled "Recueil abrégé des Secrets Merveilleux," published in 1663, gives the following recipe:—Oil of turpentine 2 ozs., turpentine 1 ox., juniper gum ~ dram; to be mixed over a slow fire.

One, Zahn, in 1685, in "Oculus Artificialis," vol. iii., p. 166, gives two recipes:—

1. Elemi(n), anime (o), white incense, and tender copal (p),

2 drains each; powder and dissolve in acetic acid in a glass vessel, adding 2 drains of gum tragacanth (q) and 4 drains crystallized sugar; dry off this mixture and powder finely. Take 1 lb. of oil of lavender (r) or turpentine and 6 ozs. Cyprian turpentine (s), and boil them on a water bath. When the turpentine is well dissolved add the powder and mix thoroughly; boil for three hours.

2. Oil of lavender 2 ozs., gum-mastic 1 oz., gum-juniper 1 ox., turpentine ~ ox.; powder the mastic and juniper, and boil the oil, then add the turpentine, and when dissolved add the powders and mix thoroughly.

The Rev. Christopher Morley in 1692, in "Collectana Chinictea Lydensia," gives under the name of "Italian varnish," the following recipe

Take 8 ozs. turpentine and boil on a fire till it evaporates down to 1 oz.; powder when cold, and dissolve in warm oil of turpentine. Filter through a cloth before use.

And, lastly, a Jesuit, named Bonanni, in his "Traité des Vernis," published at Rome in 1713, gives a list of substances used, in which he includes—1, Gum-lac in sticks, tears, or tablets (i); 2, Sandarac (u) or juniper gum; 3, Spanish or American copal, hard and soft; 4, Amber (v); 5, Asphalte (w); 6, Calabrian resin or pitch; 7, A little-known gum which flows from the wild olive-tree, resembling red scammonium.

Besides these he mentions as gums not used for varnishes, elemi, anime, arabic (x), pear-tree, cherry-tree,

azarole—tree (vide p. 131), and other tree gums. He also alludes to gamboge (y), incense, myrrh (z), oppopanax (a a), ammonia, oils, such as turpentine, copaiba (b b), etc. It will be observed that he omits benzoin, and mistakes when he classes amongst useless gums elemi and anime, which (especially the former) are much used for violin varnishes on account of their tender qualities, otherwise his list is practicably one of the modern ingredients of varnishes for all

I Sandarach, or rather what is sold as such, is a mixture of the resin described in note s~, Appendix A, with dammar and hard Indian copal, the place of the African sandarach being sometimes taken by true gum juniper. These gums are insoluble (or nearly so) in alcohol, and consequently the sandarach (or pouucé~ of the shops) is useless to the violin-maker. True sandarach is the pure gum of the common juniper, and appears in the form of long yellowish dusty tears, and such you must see that you get. And for this reason I have always in this chapter made use of this term gum juniper in preference to the better known term sandarach purr~,~t a. He gives many formulai, the bases of which are principally mastic, juniper gum, copal, linseed oil, and oil of lavender. It would be easy to multiply these old formula, but space forbids it; the foregoing arc doubtless the most important and useful of them, as giving us a good idea of what materials the old Cremona varnishers had at hand; their varnishes, of course, had to be most carefully suited to their peculiar requirements, and properly to ascertain this it is necessary to find. (a) what part it plays in the construction of a fiddle, and (b) what qualities it must consequently necessarily possess. L Abbe Sibire in "La Chelonomie" thus sums up its 'raison d être

"IL faut que ces pates, parfaitement délayées, plus légères que massives, nourrissent los matériax sans masquer leur vertu, et adoucissent les sons sans les obstruer. Ce no serait pas la peine d avoir pris tant de pr-cautions avec le compas [du violon], pour les annuler avec les drogues. Emaillez tant qu il vous plaira, mais n assourdissez pas. Quand je vous commande un violon, je souhaite qu il soit joli, mais j entends qu il soit hon ; et mon oreille, indignée et jalouse, ne vous pardonnerait pas d avoir, a ses dépens, travailld pour mes yeux.

Translation of the French (" La Chelonomie " thus sums up its ' reason d ?tre " IT is necessary that this pates, perfectly diluted, lighter than massive, feeds los materials without masking their virtue, and eases sounds without blocking them. This no would be not the punishment(effort) d to have set so much pr-cautions with the compass [of the violin], to cancel them with drugs. Enamel so much that he(it) will please you, but n dim(deafen) not. When I command(order) you a violin, I wish whether he(it) is beautiful, but j listen whether he(it) is hon; and my }

Before beginning to consider the matter we must get rid of all notion of colouring the wood before varnishing, or staining it with acids and other corrosives to give the appearance of age and all such inventions of the Evil one, which acids sink right into the unprotected wood as into blotting-paper, and invading the innermost heart of the fiddle~ where they have no business to be, destroy its most sovereign qualities without performing any of the proper functions of varnish. Its first and great function is, of course, the preservation of the wood without it no fiddle could attain an age of more than a very few years, and the tone would lose sweetness and power after a very short existence of harmony. On its nature also a great La1 depends: it must be tender, in a manner soft; that. Is, it must yield to the movements of the wood, and not encase the fiddle like a film of rigid glass. It is well known that in hot weather the wood expands, and in cold weather contracts on a violin, imperceptibly perhaps, but none the less actually, and the nature and quality of the varnish must be such as to allow of its following these movements of the wood to which it is applied, without checking them in any way, as it certainly would if it were too hard. It is this that gives the oil varnishes such a vast superiority over spirit varnishes, though the former are more difficult to compound and apply, and take weeks, months (nay, years), to dry properly. Gum-lao has this same hardening effect upon varnishes, though it has been most freely and disastrously used, in the recipes given below I have specially excluded all such, and all spirit varnishes. To obtain this suppleness, the gums must be dissolved in some liquid not highly volatile like spirit, but one which mixes with them in substance permanently, to counteract their own extreme friability. Such are the essences of lavender, rosemary, and

turpentine, combined with linseed oil.

If these conditions are borne in mind, a glance at the above formula will show that they are all adapted for application to musical instruments in a greater or lesser degree, though most of them would require, at any rate, diluting. For instance, among those of Alexis, the Piedmontese, No. 1 is hardly more than a stain, and would require the addition of gum mastic and juniper to give it consistency. No. 2 would be tender, but too heavy; the same remark applies to Nos. 3 and 4 ; they all require diluting with essence of turpentine, and so on throughout. A moment's consideration of each will suggest the dilution or alteration required to make it useful for the purposes of the fiddle-maker. Again, by a looseness of diction the old masters have been cited as covering their fiddles with an "oil-varnish," without stating whether the oil employed were an oil properly so called (as linseed oil and the like) or an essential oil (such as oil of turpentine). It has appeared in the foregoing remarks that the old varnishers used to begin by boiling their oils to an extent sufficient to render them siccative, and then after cooling they mixed in the necessary powders, having re-heated the oil to a lesser degree, otherwise the high temperature necessary to boil the oil would burn the delicate resins and gums which they employed. And in this they differed from the manner in which the hard glassy spirit varnishes of to-day are made.

M. Savart has made the extraordinary mistake of preferring a hard spirit varnish of gum-lao, but it is difficult to imagine by what circuitous route he can have arrived at such an erroneous conclusion. It has been said that Stradivarius and his predecessors varnished with amber, but strong evidence against this is brought by the fact, that the secret of dissolving amber and hard copal was not known until 1744, when Letteis patent for the discovery were granted to one Martin. His operation was to fuse amber and hard copal by dry heat, and dissolve it in boiling oil, which was diluted with an essence raised to the same heat before it was added. This operation was, indeed, invented in 1737, but as this was the year in which Stradivarius died, he could never have used it, much less his predecessors, as stated by Otto, and besides, a varnish so compounded would be much too hard to use on violins for the reasons before stated.

**Setup the art of making the instrument playable** – Now we consider the height of the bridge, the fit of the nut and cutting of the grooves in the nut and bridge. The relationship of the strings to the fingerboard, frets, tailpiece and end-pin. Again, we are faced with art as well as knowledge. The tolerances differ for differing types of instruments and whether it has frets or not, bowed, or plucked. (I have a medieval bell cast from the original 13<sup>th</sup> century mold that plays a perfect D pitch A440) Pitch is established at A440 from medieval source in the author's collection. I use a tuner to tune the instrument once strung and then carefully place each fret in perfect tune (medieval tuner is called a monochord). Frets are not inset as they are on modern instruments – some are tied gut, others are strips of wood, metal, ivory, or horn, glued to the fingerboard.

The string distance from the fingerboard at the nut is variable, depending on the type of instrument, but runs about 1/32 of an inch in general (this is simplistic but I am trying to give some reference tolerance for beginners to work from). The cut of the nut should not be too tall with deep grooves, but only tall enough to allow the strings to fall into a groove and hold. Too much nut above that can cause buzzing and poor appearance as well as breakage of the strings.

The strings must not be too close to the fingerboard or sounding board, nor too far away, and travel evenly along the board only widening the space slightly by the end toward the bridge. If too close, they buzz. If too high, they are difficult to play and cause the performer to slow, fumble and have pain. A good instrument is easy to play. This relationship is achieved by adjusting the nut, bridge and fingerboard. It is an art and craft that takes time to master. If at first you have difficulty, keep working with it. First discover what needs to change to make it right. Care and patience will reward you with a fine playable instrument.

The use of gut strings changes a set up greatly – increased space for more elastic and vigorous vibration must be considered to prevent the string from hitting the sounding or finger board.

Setup on the Fyddle is perfect for use of gut strings and proper playing technique.

Finger boards are shown to be for all intents and purposes flat with very little curve if any – this practice of curving the board is late Renaissance and only in mild amounts – we do not see curvature on finger boards as in the violin family until the late 18<sup>th</sup> century. Existing baroque finger boards on these instruments are nearly flat and very different than the modern setup. Seeing an early violin does not help unless it remains unchanged from the original short straight (non slanted neck) along with the wedge finger board. The finger boards on my fiddles are correct and do not show my lack of craftsmanship (I have made the curved finger boards on Baroque gambas). The surviving instruments in traditional cultures today are also constructed in similar fashion and this evidence must be considered.

The luthier craft is a complex one, requiring a knowledge of many special skills and concepts. In light of this, a carpenter, wood carver, or cabinet furniture maker does not have these skill, and cannot have them without years of person to person apprenticeship such as I had with Mr. Johnston (age 89 in 1972) 1972-1974, Mr Peterson (age 92 in 1984) 1982-1984) and Mr. D. Jones 1992-1993. The choice of the wood, the cut of the wood, the feel, bend, tone tap response, as well as the proper set up and tension are all highly guarded craft secretes. These things are also not easily imparted to words in a book or and not able to be imparted due to the hands on complexity of the subject.

As to choice of woods – again – the most reasonable match to period types -- that are *available* – are used for my instruments. Just because one does not see cherry wood in medieval furniture til the 14<sup>th</sup> century does not mean it is not used earlier in musical instrument building. Woods not seen at all in furniture are used in instrument building including ebony.

### **Authenticity:**

Medieval musical instruments made by me have been displayed in several museums and are in the collections of several major universities early music departments including San Diego State University and Stanford. They are regarded as the most accurate reconstructions of these instruments in the world. My work is accepted and known in academic circles including two presentations at the Kalamazoo Medieval Congress.

### **Playing This Instrument:**

**This is not a guitar nor is it a mountain dulcimer!** Neither, Guitar, Renaissance lute, nor mountain dulcimer technique can be used to evaluate the playability and the sound of this instrument. The period illuminations all show use of plectrums. The maker also objects to unskilled (in this instrument) musicians trying to demonstrate the instrument for judging. Someone who can play a mountain dulcimer (for an example) or the harp (another example) is not skilled in this instrument, or any other I build except that of a harp, and cannot be used to demonstrate or give input on the playability of this instrument. The instrument requires study in medieval fyddle style and technique and only someone with that skill can play the instrument properly for evaluation. It is possible for an unskilled (in this instrument) musician to actually

damage the instrument or break strings. One would not ask a trumpet player to demonstrate the cello or a piano player to evaluate a harp. The setup is for an 11<sup>th</sup> century gut strung medieval fiddle and it plays wonderfully well.

It is critical that the instrument be held, as in the illumination, taking care not to rest any part of the body against the back. The back is the primary sounding board and must be unmuffled, unhindered, for the instrument to speak properly. Two playing styles may be used – gamba (legs) or arm (at the shoulder). The bow is used to excite the string and make it speak. The musician may be surprised to find the optimal sound much closer to the bridge than on a modern violin.

Cherry wood - chosen for lack of knots and clear of splits and defects, cured and aged so the wood is stable – for the box and neck.

The top wood is Spanish cedar - quarter cut - from old stock approx. 100 years old.

Strings are natural gut high twist instrument quality.

The pegs are boxwood with ebony collars after Spanish and French designs.

Rose is hand cut from English Sycamore and elephant ivory (from old piano keys).

Finger board is cut from walnut.

The bridge and nut are carved out of ebony.

Ivory and horn marquetry are inlaid on the face

Oil varnish (made from a period reconstructed recipe)

**Finishing – surface prep sealer, oil varnish, and polish** – The arcane art of finishing a luthier family instrument and the mystic surrounding this process is legendary. This process is not the same as for finishing furniture. A musical instrument wood must remain unspoiled and untainted so it can develop. The cells of the wood contain pitch. As this pitch dries it crystalizes and leaves the cell nearly empty. This is why instrument makers pay large prices for aged wood, and is one of several reasons that an instrument gains tone and voice as it ages. This process takes about seventy to one hundred and fifty years to achieve. Certain treatments enhance and strip the pitch from the cells – wood allowed to soak in the bay of Verona for two to ten years allowed tiny macroscopic sea animals to eat the pitch out of the cells. Some wood cut a century ago in Michigan, sank into the great lakes and was rediscovered recently. This wood, from the lake, also has the property of empty cells and is drawing a big price from luthiers. If you pay a big price or not, one does not want to spoil the potential of an instrument by gumming it up with oils or other foreign substances. **The surface of the wood must be sealed, to prevent contamination of the cells.** Sealing is done in one of three ways:

1. Coating the surface with a thin coat of instrument making glue.
2. Using a shellac. (Spirit based component that seals and does not sink in the wood)
3. Using sizing.

Once the surface is sealed, the oil finish can be applied. Here is a listing of period recipes for instrument grade varnishes.

All decoration is appropriate for Spain ca 1260. Although the details of

decorations are not clear on the Cantigas miniatures one can see that the instrument has a carved head and pegbox, with pegs off the sides. Also one can clearly see a rose and inlays, the rose used here comes from a more detailed painting of the period where the rose is clearly depicted.

One such example from Monasterio de Piedra 1390.

### **Wood:**

Select cherry wood body carved out of the solid – basic tolerances 2mm (1/8") back sides and top. Master tolerances vary from 2mm to 1mm in various patterns on the back to accommodate tone production.

Spanish Cedar – quarter cut from old stock approx 100 years old. 2mm thick with inset hand cut rose out of English Sycamore. (Spanish Cedar -- one of the period luthier woods for tops).

Bridge and nut are of ebony.

Pegs are of boxwood with ebony trim after Spanish and French designs.

Finger board is cut from walnut

Ivory and horn marquetry are inlaid on the face

Oil varnish (made from a period reconstructed recipe)

**Components: All are period - glue, varnish, strings, everything.**

### **Time to construct:**

Estimated hours to complete this project – 400 hours or more. Times are estimates. The inside dimensions and tolerances are achieved with hand scrapers, hammer and chisels, and small gouges. The instrument was worked on for the last six years, just being finished recently.

The rose is cut with a jewelers saw, and small files. Holes are drilled with tiny hand drill (no moving mechanism), and the entire rose takes about 40 hours. We must not forget the time to design the instrument from the original sources. Drawing of working drawings and making jigs or models.

The ivory and horn inlays are hand cut (piano key ivory) totaling 40 or more hours to make and inlay. All inlay work is hand cut with period hand woodworking tools.

The body of the instrument is carefully hand dimensioned for proper tolerances using scrapers and chisels. Many many hours of work goes into this process to get it right – this is a master luthier art.

Carving of the figure head and peg box are also very time consuming as well as hand reaming the pegs for a perfect fit.

Set up is as much as 40 hours involving angle adjustments on the finger board, nut making and fitting, bridge adjustment (not to mention carving the bridge) and placement of the ivory frets which all had to be hand cut. Fine adjustments to make the instrument playable – here is another master luthier art.

Grafting the neck, selecting inlaying or overlaying trim all are time consuming.

About three to six weeks of on and off time are required to properly finish the instrument in an authentic period style with period materials. (100 hrs at least). Varnish from period recipes must be made and applied – not as is done with furniture which would spoil a musical instrument – but, with knowledge of the luther craft and arts.

Making of period varnish – the research, and development as well as the skill to apply it,

are all special skills and knowledge within themselves.

**Everything – All materials are as close to the Middle Ages as can be, making the instrument not only look authentic but, be so in materials and workmanship as well.**

## The Bow

Artists who are non musicians have faithfully drawn musical instruments in some detail and then simply drawn fanciful sticks and crude representations that could never be functional for a bow. This practice is well documented even in the Renaissance where accurate artistic representations abound. One such proof is of a musician artist who did accurately represent a



bow in the 16<sup>th</sup> century giving detail not guessed at in comparison to those from other artists depictions. The point is, the bow shown with the English (Canterbury), Passionale of Augustine c.1100 fyddle is much more detailed than the others shown above. Some amount of conjecture must be allowed within functional limits to reproduce this early bow.

The wood is carefully chosen for its suitability as bow material as well as authentic to the time and place of the original. Decoration is minimal but some carving on the knob is in keeping with the time and period.

The area under the hand, of course is hidden but the angle of the bow hair as it approaches the knob on the back side of the musicians hand gives clues to the shape that is masked. The hair is tied in the front

and the knob in the rear offer a point for the hair to tie. Although a lot of factors are in the air as to exactly how the hair was attached to the bow, an educated guess can me made. The hair must stay in the same playing plane, therefore there are only a very few limited options on how that could be done. My solution is period and a very reasonable assumption based upon functionality and knowledge of the craft, as well as examination of folk bows around the world.

### Construction notes:

The hair is not pushed into the bow with a wedge as it is on a modern bow – the hair is not controlled by pressure to a bow surface so the hair is more unruly than on a modern bow. This is common on traditional bows found in the Middle East and north Africa today. The bow plays well. There is plenty of tension on the bow – loose hairs may eventually break and trim up the bow but this is expected. This is a fixed tension bow – one in which the tension is set once when made and cannot be adjusted. Adjusting bows do not arrive until early experiments with

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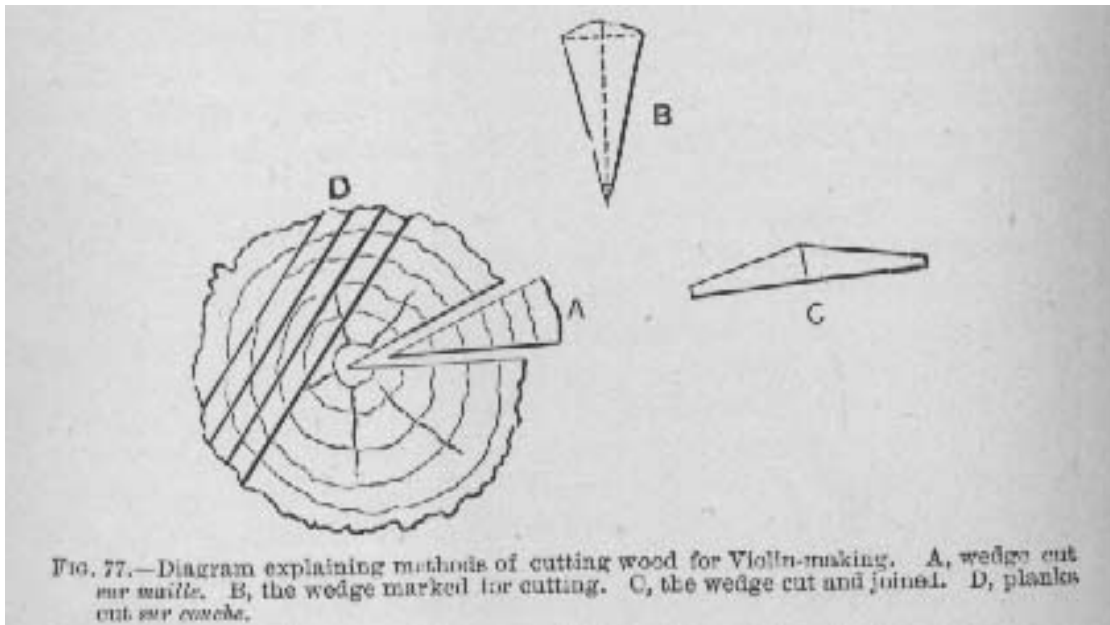


FIG. 77.—Diagram explaining methods of cutting wood for Violin-making. A, wedge cut sur maille. B, the wedge marked for cutting. C, the wedge cut and joined. D, planks cut sur coupe.

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the hair was attached. Maple is the wood of choice for this English bow since historical artifacts (6<sup>th</sup> and 7<sup>th</sup> century Anglo Saxon rottas) were built with maple. The wood is strong, bends enough for a bow in the correct thicknesses and makes a good bow. Finishing is the same as the fyddle.



Wood grain issues – the table (top or sound board) is quarter cut. Quarter cut instrument quality wood for tops is a very costly item. The better quality wood is aged – some as old as sixty or more years. The grain appearance from the surface is straight – this must be – and very little can be done to dress this up. One later solution was inlays of ivory, wood, and horn. This is not done on any instruments of this early time period. The ripple flame effect is a traditional enhancement that may be achieved and this was done to enhance the instruments appearance. The above illustration from is from Allen’s book on luthering, considered the bible of luthering. (E.D. Heron-Allen VIOLIN-MAKING: AS IT WAS AND IS (Ward, Lock & Co. Limited London and Melbourne 1885 sec ed. 1861 first ed.) (Book in private collection of the author).

## Appendix A

Course	Note	Length	Tension Kgs	Gut String
1	e'	33 cm	2.67	.400 mm
2	a	33 cm	2.21	.460 mm
3	d	33 cm	2.01	.600 mm
4	G	33 cm	1.92	.900 mm

Total Kgs Tension = 8.81 – 19.382 pounds pressure

Few strings does not mean simple to construct. If the top is not properly braced and the bridge not adjusted just right, the top will bow inward , crack and cave in, destroying the instrument. The effect of placing a 20 pound weight on top of the bridge and leaving it there is sufficient for the construction of this instrument and represents knowledge of the luthering arts and skills to properly make such an instrument that does not show any stress.

## Appendix B

Although European maple is available from luthier suppliers it is only sold in precut sheets for guitar or violin making (unsuitable for my needs) and the wood is very expensive. Since the project requirements for this fiddle demanded a large block of wood not sold by the luthier suppliers, other sources were explored for a suitable authentic wood. The hardness and qualities of hard, sugar maple, along with its close similarity in all respects to English sycamore and European Maple, made it the best choice due to its availability in the proper size and quality for the project.

TRADE NAMES: Hard Maple, Sugar Maple

SIMILAR WOODS: Sycamore (European), Maple (European), Swiss Pear, Alder, sliced Birch

ORIGIN: North America

RANGE: Eastern area of North America, from Newfoundland to the Gulf of Mexico. Exploited commercially mainly in the north of the USA. Apart from its use as wood also significant as the source of maple syrup. Special forms of Hard Maple are the Curly Maple, Quilted Maple, Fiddleback Maple and the Bird's Eye Maple.

USES: Hard Maple is one of the most used furniture woods in the USA. Over the last two years Hard Maple has established itself in Europe as a furniture wood, above all as a "substitute" for Pear, Alder or European Sycamore in unsteamed white or steamed pink color shades. Due to its resistance to friction it is also suitable as hard-wearing parquet in gymnasiums, etc. Turned into bobbins, loom shuttles and billiard cues.

PROPERTIES: So-called "sugar" occurs in Hard Maple veneer - small, brown stains spread over the surface. These can be diminished by steaming or staining.

MACHINING: More power is required for machining Hard Maple wood but smooth surfaces and profiles can be produced by using hard metal-tipped tools. There is a risk of burns when using dull tools.

SEASONING: Kiln drying in particular must be carried out very slowly and carefully because the wood tends to easily check or warp.

FINISHING: Hard Maple can easily be stained and can be surface-treated with any finish with no difficulty.

JOINTING: Glue joints hold well and pre-drilled screw joints are preferred over nail joints.

<http://www.chpi.com/pages/species.html>

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