



ADVANCED VIOLIN RESTORATION TECHNIQUES



Simon Daly

ISS Institute /DEEWR Fellowship

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Executive Summary

Music and the instruments that produce it are an important part of Australia's culture. Music has played a large part in modern Australian history as a reflection of fashion and style, and as a vehicle for social commentary. The violin was known as 'the King of instruments' in the 19th century, and today maintains much of this popularity and mystique. There is a fascination with the violin, and a wonder that such a small box can produce such a big sound. Violin-family instruments are unusual in that they improve with age and playing; a well-preserved instrument is more than a musical tool, it is a part of history, appreciated by generations past and by generations in the future.

The violin trade in Australia is typically run from small businesses, frequently owner-operated, and often by self taught luthiers or those with limited relevant training. Many repairers have had to rely on instructional books to undertake complex repairs, or have spent limited time in the workshops of more experienced makers. While the situation is improving as more Australians attend Violin-Making schools overseas, not all these Australian graduates choose to return home to practise their trade.

Due to the small size of most shops there is no tradition (such as can be found in Europe) of training and education through apprenticeships. Australia also lacks the violin making schools that exist in more populous countries. Australia lacks a Guild or Association which could be a useful structure in facilitating the sharing of knowledge. The relative lack of formally qualified violin makers in Australia has added to a culture in some quarters of guarding one's 'trade secrets'.

While the reluctance of some makers to pass on knowledge learnt through years of study is understandable, the preservation and correct maintenance of instruments is the common goal of all those in the industry. Fortunately this secretive culture appears to be diminishing as more overseas trained makers return and the skill level improves.

The skill level of the average Australian luthier must be raised to best international practices. There are many competent and capable artisans who could attain this with further training and experience. Poor repair work is the bane of the luthier; to undo previous repair attempts and to redo a job is far more complex than to do it right the first time. With an adequately skilled workforce valuable instruments will remain assets to future generations.

The aim of this fellowship is to acquire the skills necessary to undertake repairs and restoration of a complex nature, and to complete work to the highest professional standards. In addition to practical skills, knowledge will be sought on issues such as assessing pieces for repair and restoration and making decisions as to which repair techniques should be applied to a given situation. In addition, dissemination of this knowledge is of high priority, with the ultimate aim being to raise the standard of workmanship in Australia.

A review of the skills required by luthiers identifies the following as areas in need of particular attention:

- Making plaster casts to aid in patching and arching corrections
- Matching old varnishes to a high standard
- Same grain peg hole bushing
- Neck grafts, and
- Rib repairs.

Europe has a long tradition of violin making, repairing and restoration. As it was impractical to attempt a traditional apprenticeship in the allocated time, intensive instruction from

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some of Europe's top restorers was the most efficient means of gathering information for dissemination.

In 1995 the British Violin Maker's association advertised its' first Violin and Bow Restoration Course, to be held from March 31 to April 9 at West Dean College in Chichester. While the framework of the course had been decided, the content was open to discussion. Daly was therefore able to request instruction in techniques he was not familiar with, specifically plaster casting, neck grafts and rib repairs. The course offered particularly thorough attention to these and many other repair techniques.

Daly decided to visit the Ashmolean Museum in Oxford to examine the Hills collection of musical instruments, which includes many famous violins in excellent condition.

Being in Europe presented an excellent opportunity to visit Cremona in Northern Italy. Cremona is arguably the world's premier violin making centre, and has been since the 17th century. Eric Blot, a highly regarded historian, author, restorer and dealer is based there, and had agreed to a visit from Daly should he ever travel to Italy. Daly had met Blot in Australia when he came to lecture at an Australian Violinmakers Convention.

Daly left Australia on the 29th March, and arrived jetlagged and weary at West Dean College after a long flight and train journey. Two weeks were spent in England and he then flew to Milan and stayed in Italy for another three weeks.

In order to optimise the outcomes of this fellowship it is essential to ensure that the knowledge obtained is shared with others. A series of recommendations have been made at the conclusion of the report regarding a range of initiatives and activities that the Fellow identifies as central to furthering the fellowship opportunity. Recommendations are also made for government bodies, professional associations, education and training providers, industry, business and the community.

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I would like to thank the following individuals and organizations who gave generously of their time and their expertise to assist, advise and guide me throughout the Fellowship program.

Awarding Body - International Specialised Skills Institute (ISS Institute)

We know that Australia's economic future is reliant upon high level skills and knowledge, underpinned by design and innovation.

Since 1989 International Specialised Skills Institute Inc (ISS Institute), an independent, national organisation, has provided opportunities for Australian industry and commerce to gain best-in-the-world skills and experience in traditional and leading-edge technology, design, innovation and management.

Carolynne Bourne AM, ISS Institute, CEO, uses her formula to illustrate the links, skills + knowledge + good design + innovation + communication = competitive edge • good business

Based on ISS Institute's initial market research in 1990, an important category emerged, that of 'skill deficiency'.

Skill deficiency is where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the job, gleaned from published material, or from working and/or study overseas. This is the key area targeted by ISS Institute.

Other ISS definitions are:

- Skill shortage is when there is an unmet and recognised demand for labour.
- Innovation Creating and meeting new needs with new technical and design styles. [New realities of lifestyle.]
- Design is problem solving. From concept to production, through to recycling. Design involves every aspect from the way the receptionist answers the phone, when invoices are sent out, where a machine sits on the factory floor, what trees are grown in the forest suitable for furniture or flooring, to whether the product is orange or blue, round or square, flat packed for export, displayed in a retail outlet and the market research to target customers' needs and wants - creating products or services.

Overseas Skill Acquisition Plan (Fellowship Program)

Skill deficiencies are filled by building global partnerships through our Overseas Skill Acquisition Plan - Fellowship Program. Australian Fellows travel overseas, or overseas Fellows travel to Australia.

Upon their return to Australia, Fellows pass on what they have learnt through education and training activities such as workshops, conferences, lecturers, forums, seminars and events developed and implemented by ISS Institute, therein ensuring that for each Fellowship, many benefit - the multiplier effect.

ISS undertakes research, marketing, policy and advocacy.

The findings from the Fellows reports and those acquired through our research and education and training activities are made available to firms, industry, commerce, learning institutions and public authorities through ISS Research Institute's consultancy services – again, the multiplier effect.

ISS Institute operations are directed towards bringing skills (traditional and leading-edge technologies) and knowledge to Australian industries, education and government and, in turn, the community in general - new ways of thinking, new ways of working so as to create innovative products and services for local and global markets.

Our holistic approach takes us to working across occupations and industry sectors and building bridges along the way. The result has been highly effective in the creation of new business, the development of existing business and the return of lost skills and knowledge to our workforce, thus creating jobs - whereby individuals gain; industry and business gain; the Australian community gains economically, educationally and culturally.

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Fellowship Sponsors

I would like to thank the Department of Employment, Education Science and Training for providing financial assistance to undertake this Fellowship. Without this support this study trip would not have been possible.

Fellowship Supporters

In Australia

Thanks to the following people who provided support with the Fellowship application:

- Alex Grant of Grant Violins,
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- Charlotte Winslade of the Casals Academy of Music,
- Rodney Hayward from the Australian National University,

Woodwork Department

- Michael Lea from the Powerhouse Museum,
- Nick Fyfield of Bows For Strings

In England

- Roger Rose, head of Musical Instrument Making at West Dean College
- The tutors of the British Violin Makers Association (BVMA) restoration course at West Dean College

In Italy

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Qualifications

Studied acoustic theory, Australian National University 1997

Memberships

British Violin Makers Association

Guild of American Luthiers

Over a career of more than twelve years Simon Daly has become well acquainted with the violin Trade in Australia. Simon studied classical guitar from the age of eleven, and was soon performing a variety of styles of music around Canberra. This brought him in contact with a range of musicians and instruments, and started a fascination with the violin. Subsequent work as a restorer of antique furniture provided Simon with woodwork and varnish techniques.

After initially receiving training in Canberra, Simon started undertaking basic repairs. Subsequent instruction interstate coincided with his move to Canberra's major violin shop 'Strictly Four Strings' as principal repairer.

While initially focusing solely on repair work, Simon branched into making and dealing in violins which has given him a better understanding of the subtleties of design and construction.

Currently Simon operates his own violin business, 'The Violin Shop', selling antique, new and second hand string instruments, and providing a full range of repairs to the Canberra and district string-playing community.

Simon is committed to promoting the crafts of violin making and repairing, and encouraging emerging artists through sponsorship of the Australian National Eisteddfod.

In addition to this, Simon's interests include his family, surfing and playing music.

There are two key objectives to be achieved as a result of the Fellowship opportunity:

- a) acquire violin restoration and repair knowledge of the highest quality to apply in one's own daily professional practice
- b) provide knowledge transfer opportunities to share what has been learnt with luthiers and other interested parties

Aim of the Fellowship

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There have been two Violin Makers Conventions held in Australia in the past six years, both of which provided excellent forums for education and the exchange of ideas. At both conventions guest lecturers from overseas shared their expertise with the violin making community from Australasia.

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Violin family instruments are constructed using techniques dating to the 17th and 18th centuries, yet have to survive in extremes of temperature and humidity, particularly in climates such as Australia's. Within the context of restoration and repair, issues for consideration include:

- The use of hide glue which is hygroscopic (absorbs water).
- There is substantial cross grain gluing (which contributes to cracking as wood expands and contracts).
- Timbers of different densities and rates of expansion and contraction are used (again contributing to cracks).
- Many instrument parts are very thin.
- The instruments are under tremendous pressure from string tension and are easily damaged.

As a result of these factors string instruments require regular maintenance and repair.

There are many 19th century (and earlier) instruments still in circulation in Australia, and the better examples are highly prized. Even cheaper 'trade' (factory made) instruments are desirable as better quality student grade instruments.

Violins usually improve with playing and age, and keeping these older instruments in good order is important to musicians, audiences, collectors, conservatorium and museums.

In any restoration work, conservation must be the primary consideration. No work should be done that is irreversible, and where possible no original material should be removed. One of the major problems facing the restorer is dealing with old, poorly executed repairs. Mismatching varnish must be removed, poorly repaired cracks re-opened, cleaned and re-glued, and occasionally the geometry of the instrument needs correcting. Poor repair work significantly reduces the value of an instrument both tonally and financially.

While Australia may not have as long and demonstrated a history with regard to the profession of violin making; there are luthiers currently practicing whom, given knowledge and opportunity, can participate as leaders in their field and develop world best practice.

As established previously, within the context of this Fellowship report, skill deficiencies occur where a demand for labour has not been recognised and where accredited courses are not available through Australian higher education institutions. This demand is met where skills and knowledge are acquired on-the job, gleaned from published material, or from working and/or study overseas.

The Skills / Knowledge Gaps

Due to the lack of any available formal training in Australia, there are many gaps in the knowledge and skills of the average luthier. These gaps are compounded by the fact that within this field particularly complex repairs may not be frequently encountered and as such there is little opportunity to become proficient in some techniques, particularly when adequate guidance is not readily available. A review of the skills required by luthiers identifies the following as areas in need of particular attention:

- Making plaster casts to aid in patching and arching corrections: due to the fragility and thinness of violin tops and backs and the forces they are subjected to by string tension, they do in time become distorted. This distortion can affect the performance of the instrument and must be then corrected. When tops or backs suffer structurally compromising cracks, they often need repair by carving away some inside wood and accurately fitting a patch. Without a cast to support the top or back, this would in itself distort the part being repaired.
- Matching old varnishes to a high standard: In most repairs some varnish must be added to the instrument, either clear to seal a repaired crack or coloured when new wood has been fitted. In either case the new varnish should be difficult to detect.
- Same grain peg hole bushing; violin pegs and the holes they are fitted to wear with time; the peg holes become enlarged and out of round. Many older violins have these holes filled then re-cut smaller (bushed). While the easier method of doing this is easily spotted, maple which matches the pegbox can be used for a near-invisible repair.
- Neck grafts; neck grafting is the replacement of the neck of an instrument through cutting off the head, 'grafting' a new to it and re-fitting to the body. Necks can need replacing on violins because they wear out, they are the wrong length, or they may not be an appropriate size for the player.
- Rib repairs. The ribs or sides of the violin are typically around 1.2mm thick. Providing a long lasting repair is difficult as these thin pieces of wood flex in and out as notes are played on the instrument.

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West Dean College, Chichester



Workshop

Nine-day Workshop at West Dean College

The main part of the fellowship comprised a nine day workshop at West Dean College, near Chichester in England. While West Dean manor is listed as far back as the Domesday book, the current flint based mansion (the largest flint building in England) was built in 1804. In 1892 the James family acquired the estate which passed to Edward James in 1912. Edward became a patron of the arts, inviting several prominent artists to stay, most notably Salvador Dali. Edward established the Edward James Foundation, a charitable trust to support artists. The house was converted to a college of manual arts in 1971.

Today West Dean offers short and continuing courses in subjects as diverse as stonemasonry, silversmithing, tapestry, conservation and painting, along with many others.

The Violin and Bow restoration course was a mixture of formal and informal lectures, demonstrations, and personal instruction on projects brought by the participants. Daly took a viola belly to cast along with two violins, one of which needed a new neck; the other

having damaged ribs.

The lecturers in violin restoration were John Dilworth, an experienced maker and restorer who worked for 12 years at J. & A. Beare Ltd (one of the world's premier violin shops); Mark Robinson, Andrew Fairfax both currently a restorer at Beare's; John Topham, trained in Mittenwald Germany, an excellent maker, restorer and expert in dendochronological research (dating wood by tree growth rings); Jean Jacques Fasnacht from Switzerland, maker, restorer and teacher at the Swiss school of violinmaking in Brienz, and Gudrun Kremeier from Holland, specialist in restoration of severely damaged instruments, and violinmaker.

Tim Baker, Derek Wilson and Peter Oxley, all from the U.K. provided instruction to those doing the bow restoration course.

Sessions included:

- Assessing an instrument for repairs
- Opening instruments to minimize damage
- Cleaning and reviving varnishes
- Using uv light for assessment
- Repairing corners and edges
- Cleaning and repairing cracks
- Bow assessment
- Plaster casts
- Worm damage
- Peg hole bushing
- Crack repairs and stud reinforcement
- Neck grafts
- Peg box repairs
- Varnish retouching
- Button grafts
- Rib repairs
- Bridges, sound posts and bass bars

All course notes supplied for the above sessions are included in the attachments.

The course was very well structured, with a mixture of more formal lectures and demonstrations and impromptu mini-lectures based on particular problems encountered with the student's projects. Forty one students attended, coming from England, all over Europe, America and Australia. The level of enthusiasm was high – the course started at 9am, had a break for lunch and finished around 5:30pm. The majority of students were still in the workshop when the security guard came to lock up at 10 o'clock.

Living together, working such long hours and sharing meal times fostered a real sense of community and provided excellent opportunities for forming friendships and networking.

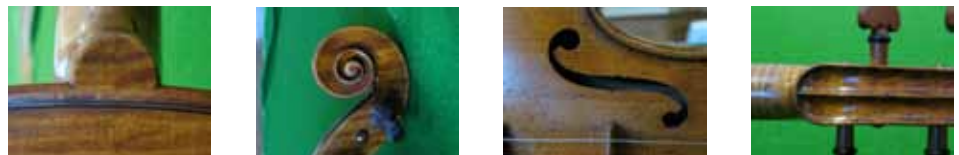
Coming from such a geographically isolated country as Australia, Daly found the experience of being with so many fellow enthusiasts particularly stimulating. Daly recommends this course to anyone able to make the journey.



Ashmolean Museum in Oxford

The Ashmolean Museum in Oxford was visited in order to view and photograph violins from the Hill's collection of musical instruments. Violins in this collection include those by Stradivari, da Salo, Amati, and Stainer. These instruments are all in excellent condition and provide a valuable record of how historically important instruments can be restored and maintained.

While the 'Messiah' Strad is not brought out of its glass cabinet, it is in an absolutely original and untouched state and is therefore particularly useful in noting the qualities of classic Italian varnishes and workmanship. Many of the other instruments may be viewed individually in the map room whilst wearing cotton gloves. One of the most enchanting of these was the small violin pictured below made by Antonius and Heironymous Amati, in Cremona 1618.



Some views of a small violin by Antonius and Heironymous Amati, Cremona 1618



*Looking across the Piazza
to the Duomo in Cremona*



*Alceste Bulfari's workshop
In a 15th century church
outside Cremona*



*Typical workshop in the
old part of the city*

Cremona in Northern Italy

A visit was made to Cremona in Northern Italy in order to visit local workshops. Cremona is the violin centre in Italy and has been for centuries. Major violin making families were based there in the 17th and 18th centuries, including the Amatis, Guarneris and Stradivaris. A violin making school is located in Cremona and there are over 200 workshops in the city. Additionally, the Stradivari museum is located there which displays a range of tools, forms and instruments, and an excellent violin bookshop, Cremonabooks.

Visiting Cremona also offered an opportunity to view instruments belonging to Eric Blot, historian, author and violin dealer. Blot has a substantial collection of Italian instruments in excellent order, and a busy workshop and office employing several people. Blot has an extensive collection of Italian instruments from the 19th and 20th centuries, which display a wide range of expression and stylistic individuality. Blot very kindly took time out to show these violins to me and to discuss their merits. In addition to his showroom and offices for publishing and administration of the business, Blot has a large workshop at the top of his premises which at the time of the fellow's visit had five employees (one of whom attended the course at West Dean College) at work on restoration projects. This business appeared very well organised, and was the largest workshop visited.

It is estimated that in Cremona there are around 200 established workshops, and possibly another 200 makers working from their apartments. During his one week stay Daly visited approximately twenty different workshops and had many discussions about the violin trade. The workshops that have diversified and undertake repairs and restoration are generally prospering better than those solely making new instruments. This is due in part to the high quality and low price of modern Chinese-made violins emanating from small workshops run by European trained makers.

Cremona is a fascinating city, less geared to the tourist trade than the larger better known destinations. Daly experienced quite a language barrier, particularly with the older residents, and discovered that everything closed down mid-afternoon for siesta. The old part of the town has cobbled streets, a large Duomo which used to lay claim to having the tallest timber church tower in Italy, fabulous inexpensive food (and is famous for its nougat) and a friendly

populace. Visiting Cremona afforded an opportunity to examine a major European violin making and restoring community.

Outcomes

While all course notes and technical information has been included in the attachments section of this report, there is some additional information that should be noted as valuable insights gained as a result of the international experience.

Ethics of restoration

An interesting session on the ethics of restoration was held early in the BVMA course. The main points are outlined below:

Try not to do anything that can't be undone at a later stage. However, the principle of 'reversibility' is false. Any intervention you make will permanently alter the instrument. Work on the assumption that whatever you do will have lasting consequence, so make sure they are good and justifiable ones.

- Do not be tempted to interfere where it is not strictly necessary. Undoing what you might regard as inferior repair work is not necessary if that repair is strong and not compromising the sound.
- Do not overclean. You will end up by having to put back more retouching and natural patina than you have taken off. Natural patina should be preserved as a part of the history and usage of the instrument. Artificial patina that has to replace it in order to homogenise the appearance of a restored instrument is never as good.
- Cutting down an instrument. Avoid at all costs. There are plenty of instruments that are the right size.
- Rethicknessing. Resist the temptation to 'improve' another maker's work

Have the courage to say no. Clients who want their instruments returned to 'as new' condition even if they want to spend thousands are wrong. As repairers and restorers we are responsible for the preservation of instruments for future generations. Daly believes repairers and restorers are also responsible for educating clients as to the historical value of instruments, and the importance of maintaining them in as close to original condition as possible.

New parts in general should 'blend in' but not be undetectable.

Do not use 'UV' matching varnish. It is essential that all repairs should be visible in some way, so that there is no deception about the condition and history of the instrument. Good retouching should blend as imperceptibly with the original varnish as possible without encroaching on it, and should be detectable by Ultra Violet, if not by natural light.

Do not colour-match internal repairs. For the same reasons given above soundpost patches etc should be visible. Painting in grain lines and figure is deception. If an instrument has to have a patch, then subsequent owners and dealers need to be able to see it and decide whether it has been well fitted and is reliable. Repairs that are clearly visible through the soundhole should be blended in to avoid unnecessary and unsightly contrast, but should not be excessively disguised.

'Returning to original state' is impossible and should never be an objective in restoration

Our aim should be to optimise the tonal performance of an instrument within the limits of its designed parameters. 'Invisible repair' for cosmetic reasons is an acceptable goal, but not at the cost of compromising the structure of the instrument.

Plaster casting

For the method demonstrated at the BVMA course, the following materials are needed.

Dental Plaster
40mm thick Styrofoam sheet
latex sheet, as thin as possible
2 x base boards
clamps
plastic sheet

The part to be cast (belly or back removed from the instrument) is placed on the Styrofoam, a 3mm outline is traced around it then cut out. The Styrofoam mould is then cut in half length ways.



The belly is placed on the base board- if there is any distortion or twist the high edge can be supported with plasticine.



The latex sheet is laid over the belly and pulled tight to avoid wrinkles.



The Styrofoam mould is placed around the belly and Clamped to the base board using blocks to spread the clamping pressure.



1 kg of plaster is mixed with 3 litres water (approx) and stirred for at least 2 full minutes. The mixing vessel should be tapped several times to remove any air bubbles.

The mixture is poured into the mould, when the surface of the plaster starts becoming dull setting is advanced and it should be scraped level. Clamps are removed, a layer of plastic, then another base board is placed on top and the whole cast is turned over.



Remove the belly and latex and ease the Styrofoam mould away. The Completed cast! For information please refer to the course notes.

Neck grafts

For detailed instructions on the procedure, please see the relevant attachment.



Block cut for new neck.



Detail of head with old neck removed. Ready for fitting above block.



Preliminary chalk fitting

Knowledge Transfer: Applying The Outcomes

Daly had a wonderful opportunity in participating in the study trip to West Dean College and to Italy, and upon his return has been sharing his knowledge and learning experiences with many people. Copies of course notes have been distributed, and are available to anyone who is interested. Daly has also had many discussions with Australian luthiers, comparing ideas for particular repair techniques. Daly will also be submitting an article to the Australian Association of Musical Instrument Makers for possible publication in their quarterly journal. This should expand Daly's network of makers and provide an opportunity to pass on restoration skills that are relevant to other instruments.

There has been some interest by the Australian National University Institute of Arts wood department in providing some specialist teaching in musical instrument making. As is the experience overseas, a repair/restoration component of violin making courses is considered essential. With this in mind Daly shall maintain a dialogue with the wood department.

The next Australian Violinmaker's Conference would offer an excellent forum for dissemination of the repair techniques learnt through this fellowship. Previous conferences have had a greater emphasis on making, so a focus on repair and restoration would be of interest to attendees. There is not yet an organising committee for the next conference; Daly will ensure he has an active role in the next organising committee. It is anticipated the next conference will take place early in 2009.

Government

At government level it is recommended that funding be provided for a specific school of lutherie, with a focus on violin and bow making and repair. This could be part of a technical college or be a tertiary qualification modeled on the furniture-making course at the Australian National University. There is an identifiable demand for Australian based tuition; people wishing to learn the necessary skills must find the means to travel to Europe or America to study. While some potential students are able to do this, many must try to develop their skills largely unguided.

It would be important to have experienced and well regarded staff; head of the school might ideally have taught at one of the major violin-making schools in Europe.

This is the single most important step in raising the standard of craftsmanship in the Australian industry to international levels.

Industry

There is no cohesive body representing or representative of luthiers in Australia. There have been previous attempts at starting a violin maker's professional organization; the divide between those with and those without professional training was one of the hurdles unable to be overcome. Different types of memberships in any future Association could be offered to get around this issue – i.e. full members, associate members, student members and international members. This hurdle needs to be addressed – the bottom line is there is a need for an organised Professional Association – numbers are needed to facilitate opportunities for knowledge transfer in a structured way.

Violin Makers Conventions have been run twice in the past six years; these have been organized by interested individuals rather than an organized guild. These conventions have provided invaluable education through lectures by invited overseas guests and an excellent forum for an exchange of ideas.

It is recommended that similar conventions be held on a regular basis and with greater frequency, though this is dependant on willing parties providing their time and energy.

Business

Some of the violin makers attending the course at West Dean College had been sent by their employers, who recognized the value in having better trained staff. While the cost of sending staff overseas from Australia may be prohibitive, businesses are to be encouraged in paying for employees to improve their skills wherever possible. Should a similar course be set up in Australia, it is recommended that all relevant businesses be informed directly.

Professional Associations

As previously identified there is currently no Professional Association for luthiers in Australia. It is recommended that an initial Working Group be established to investigate models of best practice both nationally and internationally in order to identify a suitable model.

Education and Training

As outlined earlier, there is no formal training available in Australia. Violin makers wishing to improve their skills are dependant on the willingness of more experienced makers to provide help and information, must travel overseas to study or make do with written material.

The form that any new course takes would need consultation within the Lutherie community and willing educators to provide a model to present to the Department of Education for funding. This again affirms the need for a Professional Association to undertake such a task.

It is recommended that education be tailored to a range of skill levels; at those wishing to embark upon a career in violin making, as a post graduate diploma for furniture makers and also to experienced makers wishing to brush up on skills.

It would be advantageous if the course could extend to teaching some small business skills as well. Violin restoration is often complex, delicate and solitary work, and the temperament required does not necessarily translate to operating a small business in a competitive environment. There is a need for comprehensive professional development opportunities if Australians are to become identified as leaders and best craftsman within the field.

How ISS Institute can be involved

The International Specialised Skills Institute can assist by lobbying government for funding to run occasional workshops/conventions with visiting overseas lecturers; initiate a musical instrument making course at a technical college; initiate a post graduate diploma in violin making. The ISS Institute's extensive European contacts could be utilized in bringing overseas tutors to Australia.

The following attachments are the course notes provided at the BVMA Violin and Bow Restoration Course. These notes were provided by the individual tutors, therefore there may be some differences of opinion as to specific repair techniques. While the restoration of bows is a separate discipline and outside the scope of this report, notes were provided and are included as they may be of interest.

West Dean Course Notes West Dean Repair Course

Opening instruments to minimise damage.

1.The necessity to open an instrument, removing either back or front.

Can the damage be approached from the outside?

Can a crack be clean from the outside?

If the instrument has a buzz, is it coming from the inside or outside? purfling, etc...? Is it cost effective to remove either front or back? i.e. is the instrument worth it?

2.Decision made to remove the front, with neck still present.

Select tools

Thinned and sharpened, but not sharp, kitchen knife or spatula Alcohol, soap block, hot water,

Thin narrow brush or syringe with narrow nozzle

3.Seek an open area or area of weakness, ideally by lower bout near saddle

Gently insert soap coated knife in gap with a little pressure

Add alcohol and /or hot water with brush or syringe along join beside

inserted knife Ideally tiny cracking sounds should heard, this would be the glue losing it strength allowing the join to come apart

4.Proceed along opening join maintaining gentle pressure on open join

Depending on ease of opening join proceed either toward saddle or middle

bout If toward middle bout caution to be taken nearing corner, if at all possible insert knife in join in middle bout and work toward corner

Proceed from middle bout to second corner and then to top bout to neck

Seek an opening on other lower bout and proceed up other side in similar fashion to first side to neck

5.Releasing top and bottom blocks

The trickiest part of removing front or back

Insert thin wedges in lower bout between rib and front to open join enough to see bottom block inside

Insert knife into open join at an angle touch block on inside

Attempt to prise join apart between inside edge of block and front Proceed on other side until join is released

Proceed in similar fashion at top block taking into account neck block

6.Procedure is similar for backs except for top block with button

With neck in, the button has to be released from neck before back can be released from top block Angle knife on outside as well as inside to avoid cracking back working toward button

West Dean Repair Course

Repairing ‘fronts damaged by opening!!

Ideally no damage should have been done when opening front, depends largely on previous gluing, a note for proper gluing at the outset

If damage is new:

If damage was done then make sure all pieces and splinters are kept safe and clean

If splinters remain on rib, take cotton wool or soft tissue paper (toilet paper is useful) and soak splinter until glue is soft and remove and clean with hot water (make clear note where splinter came as position can be easily forgotten)

Glue back all splinters using either small clamps, piece of cardboard and thin strips of wood or plastic sheeting, or pegs and cardboard

If cracks have occurred then glue up in usual way

All areas that had previous damage that was not properly corrected
Fill missing splinters and previously crushed or dented areas with suitable filler
Fillers are many and varied
Plastic wood!, glue and sawdust, commercial wood fillers, those with or with out hardeners. If filler is deemed to inadequate then half-edge to be considered

Half-edging:

Requires support for the front, a plaster cast or thermoplastic mould of the outer surface of front to support edge when new wood is glued to it.

Once cast is in place, select wood to replace damaged inside surface and cut to shape and moderate thickness

Trim inside damaged surface of front to half the edge thickness (dependent on nature of damage) using knife, scraper or file of suitable coarseness making sure surface is flat or slightly hollow

Plane new wood on inside surface, introduce to trimmed surface to see how it fits. If trimmed surface of front runs out in a curve then trim new wood to match curve, fit with chalk if necessary.

Glue with single or multiple counter blocks ensuring new half-edge neatly and snugly fits all trimmed surface, trim new wood to original edge thickness and shape

West Dean Repair Course Notes:

Repairing corners and edges

Decision to be taken whether it is appropriate to replace corners and or edges

When replacing is probably unnecessary:

If edge or corner is worn but does not impair join between ribs, front of back
If the shape of the corner is in keeping with the rest of the instrument shape

When replacing is probably necessary:

Worn edge close to purfling line endangering purfling
Loose, thin or distorted edge or corner which impairs join to rib or reduces strength impairing integrity of body and thus strength of tone (this may need the inclusion of half-edge)

To replace an edge:

Trim old edge back to purfling line, ensuring trimmed edge is vertical and that no purfling is removed. If replacing only a section of edge, say from middle of lower bout to a centimetre from saddle then ensure the ends of the section are parallel to the grain of the front. This usually makes the joins between the old wood and new stronger.

Clamp front onto flat board initially to support front while working on it and to support new piece while fitting and gluing it.

Trim new piece to match grain direction and size to original wood as well as possible (if possible match grain line to grain line as exactly as possible)

Fit new piece into gap left by trimming old edge with knife and file. Glue edge to front using either clamps, or nails in flat board and wedges. Trim edge to shape of original edge

To replace a corner:

Much of this procedure is similar to replacing an edge. Care has to be taken removing the old wood and not damaging the delicate point of the purfling. Often a corner is replaced using two pieces. The first piece is fitted to the middle bout section of the corner up to the purfling corner tip. The new wood is trimmed flat parallel to the grain. The second piece is fitted, to the lower or upper bout part of the corner overlapping the middle bout section. This hopefully ensures a clean join and allows the purfling tip to be clearly seen.

In some cases it may be necessary to combine a half edge with a new edge or corner (or button in other cases) in one piece. This is a more complicated job and requires a lot of experience. The method uses a trimmed cast and the necessity of fitting of two surfaces, the half edge surface and the edge surface.

Varnish and wood preparation.

- 1 Assessing repair wood; match split, grain, and figure by observing original material.
2. Colouring wood; UV, ozone, nitric acid, potassium nitrite, potassium bichromate, ammonia, ferrous sulphate, tannin, baking, water colour and colour wash are all methods I have used, usually in some sort of combination with each other. It is important to be aware of the effects of chemical treatment, and use appropriately. I always use a neutralising agent after any application.
- 3 Retouch varnish; consideration of recipes. Shellac of some type is almost universally used, but it is important to have some admixture which will prevent the shellac from becoming insoluble. Elemi or other oleo-resins will achieve this. Pure shellac will eventually become slightly green in colour, so always use refined, bleached dewaxed flakes. A balanced recipe will allow fast drying and quick overcoating (without disturbing previous coats) but with sufficient softening agents to make it removable in the course of time.
4. Retouching colours and application. The criteria are that whatever colours used must be stable and transparent to some degree. Organic pigments are notoriously unstable, but permanent colours are identified in catalogues. The problems of reflection- the colour appearing too dark or light from different angles of view can be tackled by varying the degree of transparency- not all violin varnishes are as transparent as we might think- by using limited amounts of slightly opaque colours like earths, or very transparent stains and dyes. Where the colour lies within the varnish layer is also important. With some varnishes the colour is concentrated close to the wood, and with others it is evenly distributed or closer to the surface. It is helpful to be able to match this in applying the retouch. The colour itself is often layered, and it is good to reproduce the effects of separate colour layers; a yellow ground beneath a red over varnish for instance. It is also important to differentiate between the original varnish layer and layers of patina, which should be tackled appropriately. In other words, it is not always right to try and get the finished colour on in one go.
5. Texture; blending and finishing retouched areas.
Cracquelure is always a problem. It can be reproduced in different ways, but the principal is generally to apply a strong drying coating over a softer layer, which will shrink and pull the underlayer. The pattern that results is due to the relative strengths of the two layers, and it is always best to experiment beforehand. Some sort of glue or guru is the most common cracking agent.
Avoid bringing everything to a high polish, which necessitates French polishing the original varnish to match. Matting agents are very useful, and by balancing the amount used, it is often possible to achieve a good match between the retouched varnish and the original. I use Jenkins Matt French Polish added to the finishing coats of retouching.

ASSESSMENT OF INSTRUMENT

Use assessment sheet to outline work and record relevant information regarding set up.

- 1 is the work you have decided upon cost effective ?
- 2 What to do, what to leave and what to save.
- 3 Can you improve sufficiently any repair that has already been done.
- 4 Which cracks do you open and which do you clean from the outside.

- 5 The worst thing catches the eye, then once that has been repaired something else will show up.
- 6 Condition of arching. When to correct and when to leave.
- 7 Condition of ribs. Cracks, buckling, twisting etc.
- 8 Condition of head and neck.
- 9 Set up. Can 1 save anything.
- 10 If instrument comes in playing condition what is the sound like ? is there any reason why a standard set up cannot be used, e.g. width of 'C' bouts etc.

CLEANING INSTRUMENT

General clean before starting restoration.

- 1 Removing dirt. Removing unwanted retouching.

SPECIFIC CLEANING DURING RESTORATION

(Making casts and correcting arching)

- 1 Opening cracks and cleaning them.
- 2 Setting up clamping system to glue.
- 3 Choice of studs, straps and other reinforcement.

BOW ASSESSMENT HEAD

1. BROKEN HEAD
Check for:
Dent in front ridge
Glue in throat
Re-filled chamfer or throat Colour variation
2. PIECE TO COVER UP SCREWS FOR BROKEN BEAD
3. NEW NOSE
4. BRICK IN THROAT OR CRACK IN BACK OF HEAD
5. CRACK FROM ,FRONT OF MORTISE
Check both sides
6. CRACK OR VERY SHORT GRAIN NEAR HEAD
7. ANY RESHAPING OF THE HEAD
Slab cut only acceptable if the wood is of high quality

STICK

8. Check down stick, rotating as you go, for any cracks, repairs, glue, large knots or very short grain, burns or 'shakes.
9. Check for splices - Usually under the lapping or towards the head.

Check that the angle of the medullary rays is consistent throughout the length of the stick; especially each side of the lapping.

Check that the octagon runs smoothly under the Lapping.

10. CAMBER AND STRAIGHTNESS

Look down the stick to check that there are no sudden changes in direction, especially where there are knots or short grain or under lapping.

Check head lines up with frog.

11. HANDLE

Check for excessive wear, mortise through top of stick, cracks from around the mortise area or end of stick.

12. Check for
Brands, identification marks
Length of stick
Weight (Violin usually 58-62gm; viola 68-73gm; cello 78-84gm)
Strength - carefully!
Consistent wear
Balance

FROG

13. Check that frog is original to stick - that the shoe fits and the frog is the same width as the stick. Look for any match. Marks.
14. Check frog has not been shot - both sides. Check for any other new wood in frog.

If shoe is fixed with steel screws, check for rust damage - exploding frog!
Check ferrule is in alignment with frog - look for any breaks or repairs where the ferrule meets the frog. .

Check frog has not been re-shaped - when pearl or silver has been replaced.

Check metal parts are original (gold same colour), and that the solder joints are sound for tortoiseshell frogs, check for beetle damage, cracks and de-lamination. ADJUSTER

16. Check for rust damage and splits in rings.

Mixing proportions Powder-water 100 - 30 1 kg - 3 dl

Time for sprinkling in the powder ca. 10" Absorption time

Total mixing time
(creamy texture that pours well)

Period of time for mixture remaining usable 5' (measured from time of mixing)

Setting time Expansion
takes place after 15', up to 60' ca 270
min. 7.5
after minimum of one hour, but within the next two days

in airtight container, at max. 25°C, with humidity level no higher than 50%

All utensils and containers have to be clean and dry. Use water at room temperature.

DENTAL PLASTER
Moldano blue

Mixing Proportions Powder-water	100-30	1kg - 3 dl
Time for sprinkling in the powder	ca. 10"	
Absorption time	20 " minimum	
Total mixing time	60 "	
Creamy texture that pours well		

Period of time for mixture remaining usable 5' (measured from time of mixing)

- Setting time
- Expansion
- Crystallization
- Solidity/resistance to pressure (kp/cm²)
Hardness (kp/mm²) (measured one hour after mixing)
- Plaster cast corrections Ideal storage
- ca. 12'
- ca 0A5%
- takes place after 15', up to 60' ca 270
- min. 75
- after minimum of one hour, but within the next two days
- in airtight container, at max. 25°C, with humidity level no higher than 50%

The above mentioned proportions are suited to the needs of the dental technicians. For our purposes, that is greater quantities, the mixing ratio is slightly different : 100-37 (kgx0.37)

Proportions for negatives

Violin	3 kg	
Viola (40 cm)	4 kg	1.1 liter
Viola (43 cm)	4.5 kg	1.6 liter
Cello (chest area)	9 kg	3.3 liters

This ratio is calculated taking into account a 3 mm space between the instrument's edge and the styrofoam. Depending on the height of the arching, the amount of plaster required might vary slightly.

For smaller casts, like partial rib cast, peg box cast etc, only the water will be measured. The powder is added to the water until the right consistency is reached.

Violin rib	1 dl - 1.7 dl
Viola rib	1.2 dl - 2 dl
Cello rib	2 dl - 4 dl

PLASTER

Removal from the mould

Smoothing down once the water is absorbed (matt surface) remove clamps and wooden bars. Smooth out the plaster with a stiff ruler. Check the platter consistency regularly in order to smooth it out while still "soft but fine."

Flipping over lay a sheet of plastic over the Styrofoam and plaster, cover with a wooden board and flip the whole thing over.

Removing top lift the board with the clamps carefully (be aware of the possible vacuum effect) and set it on the bench. Remove the top plate and peel off the latex sheet. Leave the latex sheet on the board for later cleaning.

Freeing the edges press lightly on the styrofoam edges, along the outline of the table, to free the plaster from the styrofoam. Be careful not to break the plaster edges.

2nd flipping over cover the plaster and styrofoam with plastic sheet, cover with wooden board and flip the whole thing over. The smoothed out surface is now visible again.

Removing styrofoam open up the styrofoam sides up to the corners without breaking it. Lift up the styrofoam vertically in the CC bouts. Remove plaster residues stack to the styrofoam. Keep the styrofoam to be reused.

PLASTER

Problems and solutions

Cause	mixing container has been washed with a detergent
Solution	always rinse the mixing container with clean water and dry it thoroughly
Cause	water has been left over in the mixing bowl and therefore changes the mixing ratio
Solution	dry the container very thoroughly
Cause	water that is too cold or too warm (40°C or over) has been used
Solution	use water at room temperature
Cause	plaster has not been mixed long enough
Solution	follow the supplier's instructions
Cause	plaster has not been kept in a dry area and may have absorbed humidity
Solution	keep plaster in an air tight container, at an average temperature of 23°C, and a relative humidity of about 50%

Fast or overaccelerated setting

Cause	crystallized plaster particles are stuck in the mixing bowl or on the utensils
Solution	rinse the mixing bowl and utensils thoroughly immediately after use
Cause	crystallization accelerator has been added to the water
Solution	do not add products to accelerate the crystallization
Cause	plaster has not been kept in airtight containers and has absorbed humidity
Solution	keep the plaster well protected from humidity
Cause	water quantity has been underestimated
Solution	keep to the exact proportions
Cause	crystallized plaster particles have been mixed with the fresh plaster
Solution	rinse containers and utensils thoroughly immediately after use

Cause the plaster has been mixed too energetically or for too long

Solution follow the instructions on mixing procedure

Increased expansion

Cause crystallization accelerators have been added to the water

Solution do not use accelerators

Cause plaster has not been stored properly and has absorbed humidity

Solution store plaster in an air-tight container, at an average temperature of 23°C and a relative humidity of around 50%

Cause crystallized particles of plaster are stuck on utensils or in containers

Solution rinse containers and utensils thoroughly immediately after use

Reduced hardness

Cause crystallization accelerators have been added to the water

Solution use only tap water at room temperature

Cause water proportion is increased

Solution stick to the proportions recommended by the supplier

Cause plaster is mixed too long (breakdown of the crystallization)

Solution manual mixing should not extend beyond 60 seconds, mechanical mixing should not extend beyond 30 seconds

Cause water is added during the process of mixing

Solution after the absorption time do not add any more water

Cause plaster is worked on after crystallization

Solution stick to the mixing time specified

Porous surface

Cause plaster is not stored properly

Solution store in air-tight container

Cause manual mixing adds air to the plaster

Solution mix the powder and water vigorously but without beating, scraping the edges of the container with the whisk to free any lumps

Cracks

Cause	plaster breaks when being handled vukeij
Solution	wait for complete crystallization. Category 3 plaster : ei ca 30 hours; category 4 plaster :tea 45 firs W'
Cause	water evaporates too quickly during setting, for example if the cast is resting on an absorbent material or surface like wood, cloth or paper
Solution	a fresh cast should always lie on a plastic covered surface
Cause	mix has not been done with enough water
Solution	follow the specified proportions

Increased expansion and reduced hardness

Cause	after crystallization, the mould had too much contact with water
Solution	once crystallized avoid any contact with water

If a partial positive cast is needed to check the correction done on the negative, lay a latex sheet on the negative and pour plaster over the area to be checked. This will protect the negative cast from humidity.

Positive cast from the negative mould

Smear soapy water over the whole negative mould, including the sides, two to three times. Pour dental plaster or ceramic powder and leave it for a couple hours. Normally it will separate on its own.

PROPERTIES OF CLEANING AGENTS

The reduction of surface tension in a liquid to allow its spread on a surface. The smaller the wetting angle, the higher the degree of wetting ability. Zero equals complete spreading out.

Facilitates the suspension of solid material in a liquid medium. The detergent acts as a wetting agent on the surface of the solid particles and creates a link between the solid particles and the medium. It fixes itself with one of its poles on the solid particles and to the liquid with the other pole.

Also caused by the lowering of the interface tension but in this case between two liquids, where one is dispersed into the other in fine droplets. The emulsifying ability is a property of a surfactant, and is more important than its wetting ability.

By lowering the surface tension, these solutions display the property of forming foam by agitation or admixture of air. The foam extends the action of the active agent on the surface, keeps it on the surface and allows its use on a vertical surface. the re-aggregation of solid particles is prevented, linked with the properties of wetting the solid particles (dirt), to disperse it and to emulsify the fatty solutions. It represents the total wetting, dispersing and emulsifying abilities.

CRACKS CLEANING

Cleaning agent

Triton X100 Tensioactif non ionique (not hazardous to health). Not electrically charged

Proportions 100ml demineralised water 3 drops Triton X100

Shake well to dissolve the Triton in the water. This slightly soapy water might weaken the joints so, after cleaning, rinse thoroughly with water, preferably demineralised water.

Bleaching	hydrogen peroxyde 35%	pH 1
ammonia	24%	pH 11
peroxyde	+ ammonia =	pH 8-9

This mixture loses its properties after 24 hours. It is advisable to prepare small quantities as you need it :

Proportions peroxide 3ml
ammonia 2 drops

Neutralisation white wine vinegar (pH 3). Neutralizes bases with no side effects on the wood color. Rinse with water after use.

This type of cleaning agent can go through chemical changes by oxydation or reduction and can lose its properties. It is recommended to use fresh mixtures only, according to the quantity needed. For instance: 30ml- one drop.

Use demineralised water. Beware of bleach or chlorine in water. A mixture containing chlorine salts is not compatible with the active elements of these cleaning agents.

Even though foam is produced when agitating the mix, the foaming power of this specific cleaning agent is not one of its major properties. (Anionic and amphoteros cleaning agent produce foam). Procedure (using Triton water)

Lay a cotton thread on the varnished side of the crack. Lay a piece of cotton cloth on the crack inside the instrument, folded in half, 5 to 6 mm wide.

Keep the cotton thread wet at all times. It will soften the crack without damaging the varnish. The wet piece of cloth will humidify the crack from the inside.

The properties of the wetting agent will open up the crack without your help.

Once the crack is open, the glue is completely softened. Clean further with a soft brush and Triton water. When this is done, make sure to rinse the crack with clean water or demineralised water.

PEG BOX REPAIRS **Gudrun Kremeler**

Peg box repair is a difficult subject because it is nearly always hard to make an invisible repair, to keep original material and to make the structure stable at the same time. Often there was a colleague did repairs before you and who did enough damage to make the task hopeless.

However, there are various methods. Be conservative in your plans. Do not remove more original wood than necessary. Avoid, if possible, a complete peg box cheek replacement.

VARIOUS METHODS

An ;4 ' peg hole crack: the easiest method is: clean the crack, prepare a clamp for the little space between scroll and peg box, and glue the crack take the peg reamer 1:15, make the hole bigger, but only on the side that is damaged -- usually the treble side make a shaving, rom maple during the whole procedure, hold the crack with a clamp now the crack is really safe with almost all peg hole cracks, the shaving method is a good option because the peg moves in a ring of maple and takes some pressure of the crack

Two alternative methods for an a peg hole crack:

you can insert pieces of wood at the inner side of the peg box, with crossing fibre. You will destroy original material and you will almost always have to make bushings anyway prepare a cone-shaped drill to cone the inner side of the peg box (place a pin in the centre of the cone, make a hole in the pin, put a pin through the pinhole, so that you can turn it front outside the peg box) fit some maple in the inner side cone

- glue

Remake of a peg box flank facing:

- if the, flank goes over the whole side, bush all the peg holes, leave the bushings untrimmed for stability
- remove the old peg box flank facing
- choose perfectly matching wood
- transfer the outline of the peg box onto your new piece of wood
- saw the outline leaving some waste for correction
- fit it roughly
- check the matching
- fix the flank with nails through the unfinished bushings
- fit with chalk
- be careful whilst fixing the clamps, the bushings can be used for a stable situation
- glue
- if you also need to repair the other side, leave the newly-made side untrimmed, you can also use the nails to fix the fitting
- follow the same procedure glue
- retouch

If the damage is so extensive that you need to make a new peg box, I prefer to make a completely new scroll copy and spare the original scroll and return the instrument with 2 scrolls: one. for usage, and the original.

MATERIALS

- see peg hole bushings
- maple wood
- cone-shaped drill, prepared

SUPPLIERS

a good tool-maker in town who prefers a cone-shaped drill Shravins

Mere are two options for filling the peg holes:
fill the holes with solid wood (slab cut or quarter cut)

- make the holes smaller with maple veneer shavings

Jill is necessary to change the position of the peg holes, you have to make bushings from solid wood, but if you only need to make the holes smaller to make a peg hole crack safe, a rolled piece of maple veneer is perfect.

METHOD

To make the maple veneer, take a slab cut piece of maple veneer and shape a piece of veneer to about 0.3mm thick, You will need a piece 12mm wide and 9cm long

- clean the peg holes with the peg reamer that fits the best. Make it smooth and even
- prepare 2 pieces of veneer: both pieces 12mm wide, one 70mm long and one 90mm long
- cut the ends at an angle, then it is easier to roll up
- put the plain (?) reamer in the hot water in the glue poi to warm it up
- place the. first piece of veneer in the warm glue to soak
- put some glue in the smaller peg hole use a small piece of paper to apply it
- put the glue-soaked piece of veneer onto it and start rolling
- take care to make sure that the roll direction is the same as the direction of shaping of the peg holes
- make the roll a little bit smaller than the peg hole
- place it in the glued peg hole
- take the even reamer and roll it out, press the roll into the peg hole

take care that:

- the veneer roll stays parallel
- the roll is really pressing against the peg hole
- don 't press so hard that you damage the veneer - be sensitive!
- use the same approach with the bigger hole, making sure that you don't touch the small piece of veneer
- take care to roll both pieces of the veneer in the same direction
- after gluing, remove excess glue, checking all places that you have touched
- the glue needs to thy overnight, but after 2 hours you can carefully remove the ends of the veneer
- next day you can work on it
- start with the outsides
- fit the pegs
- check the outsides once more retouch

MATERIALS & SUPPLIERS

- one plain and one normal peg reamer with the same taper
- a piece of simple, enflamed maple supplier: DickGmbH: rsvw.dick.biz

PEG HOLES BUSHING - PART TWO

Hole bushings with boxwood

When the peg holes are really too large or in the wrong place, you have to fill the peg holes with boxwood bushings . METHOD

- as always, clean the peg holes with the best fitting peg reamer;
- don 't make it bigger than necessary - prepare the boxwood: saw it and shape it into a cone

- use the peg shaper of the same size as the reamer
- it is the same method as fitting pegs: check the fitting by testing the temperature: it must be the same temperature over the whole =face and both holes
- contrary to the veneer method, you fill both peg holes together
- during fitting: don't press too hard - be sensitive?
- make a mark of the length if it fits
- glue
- prepare for retouch
- lay out and drill the new peg holes

MATERIALS

Normal reamer
Boxwood peg
Shaper

PEG HOLES BUSHING-PART THREE

Peg hole bushings with maple

Filling with solid maple is the most complicated method, but also the most invisible. As it is the most expensive method, you should only do it on an expensive instrument, or if you are changing a 5 string instrument into a 4 string.

METHOD

- as always, clean the peg holes with the best fitting peg reamer
- choose a piece of maple matching perfectly with the original
- prepare the maple (it is the same idea as with the box-wood, only the maple wood is quarter cut which means that the grain of the bushings aren't in the length, but in the width) that is why you use a turning lathe to fit when it fits, soak it with hide glue and let it dry repeat fitting with the lathe if necessary repeat the whole procedure if it fits, check the structure mark the length glue prepare for retouch
- lay out and drill the new peg holes

MATERIALS

- normal reamer
- turning lathe maple wood

SHAVINGS

There are two options for filling the peg holes:

fill the holes with solid wood (slab cut or quarter cut) make the holes smaller with maple veneer shavings

If it is necessary to change the position of the peg holes, you have to make bushings from solid wood, but if you only need to make the holes smaller to make a peg hole crack safe, a rolled piece of maple veneer is perfect.

METHOD

To make the maple veneer, take a slab cut piece of maple veneer and shape a piece of

veneer to about 0.3mm thick You will need a piece 12mm wide and 9cm long

- clean the peg holes with the peg reamer that fits the best. Make it smooth and even
- prepare 2 pieces of veneer: both pieces 12mm wide, one 70mm long and one 90mm long
- cut the ends at an angle, then it is easier to roll up
- put the plain (?) reamer in the hot water in the glue pot to warm it up
- place the first piece of veneer in the warm glue to soak
- put some glue in the smaller peg hole - use a small piece of paper to apply it
- put the glue soaked piece of veneer onto it and start rolling
take care to make sure that the roll direction is the same as the direction of shaping of the peg holes
- make the roll a little bit smaller than the peg hole
place it in the glued peg hole
- take the even reamer and roll it out, press the roll into the peg hole
- take care that:
the veneer roll stays parallel
the roll is really pressing against the peg hole
don't press so hard that you damage the veneer - be sensitive?
- use the same approach with the bigger hole, making sure that you don't touch the
small piece of veneer
take care to roll both pieces of the veneer in the same direction
after gluing, remove excess glue, checking all places that you have touched
the glue needs to dry overnight, but after 2 hours you can carefully remove the ends of the veneer
next day you can work on it
start with the outsides
- fit the pegs
- check the outsides once more
- retouch

MATERIALS & SUPPLIERS

- one plain and one normal peg reamer with the same taper a piece of simple, unflamed maple supplier: Dick GmbH: www.dick.biz

PEG HOLES BUSHING- PART TWO

Peg hole bushings with boxwood

When the peg holes are really too large or in the wrong place, you have to fill the peg holes with boxwood bushings ,

METHOD

- as always, clean the peg holes with the best fitting peg reamer; don't make it bigger than necessary prepare the boxwood: saw it and shape it into a cone use the peg shaper of the same size as the reamer
it is the same method as fitting pegs: check the fitting by testing the temperature: it must be the same temperature over the whole surface and both holes
contrary to the veneer method, you fill. both peg holes together
during fitting: don't press too hard - be sensitive]

- make a mark of the length if it fits
- glue
- prepare for retouch
- lay out and drill the new peg holes

MATERIALS

- normal reamer
- boxwood peg
- shaper

INTRODUCTION

There are various reasons to make a neck graft (new neck):

- the neck is irreparably broken
- the neck is too short
- the neck is too thin or too narrow
- the neck is wrongly fitted and cannot be corrected

You need:

cork-lined counterparts fitted for the sides and backside of the pegbox

- small saw
- new neck of matching wood
- precision knife-edge rule sir.ra.,;3M
- 2 normal rules square
- triangular protractor
- chalk fingerboard
- bridge

First of all, you make a decision: what is the desired position of the future graft? How long does it need to be? (To which peg hole?)

- Is there an old graft that has to be removed? Old grafts always needs to be removal. How deep? Which direction is the base lying in? How much is it slanting? Are there any other repairs that need to be considered?
- Do you have enough surface for gluing?
- If the peg holes need bushing, do it now.

METHOD

- make the three cork-lined counterparts
- saw off the neck
- remove the peg box wood
- plane the surfaces
- choose a new neck block
- plane the fingerboard surface and the "peg box sides"
- draw the dimensions of the peg box cut-out and the position of the new neck on the new neck block
- the projection of the fingerboard surface never touches the scroll, there is a clearance of 1.5 - 2.5 mm
- this determines the line of the base
- transfer the base of the peg box onto the block

- check all the measurements again and saw firstly the base, secondly the sides fit the block into the peg box by shaping and keep checking the position, length and direction don't use too much pressure with fitting, don't press the peg box so much that it gets wider
- check the fitting with chalk
- use three clamps and counterparts: one, for each side and one, for the base. When you are ready, mark the position
- if you prefer, tape the counterparts
- warm up for gluing
- glue
- remove excess glue
- let dry overnight

MATERIALS, TEMPLATES AND SUPPLIERS,

neck block
cork and lime wood for the counterparts chalk rules, etc

Selected wood suppliers:

Andreas Pahler	www.alyentonholz.de
Dick GnihH	dick biz
David Dyke	www.luthierssupplies.co.uk/violin_cat.pdf
The Hall, Horebeech Lane, Holum, Heathfield, T	
N210HR, UK 01435 812315	

REFERENCES

Hans Weisshaar and Margaret Shipman Violin Restoration: A Manual for Violin Makers (1988)

NECK GRAYT - PART TWO

Fingerboard position Preparing for refitting

When the graft is glued, determine the fingerboard position with a ready-prepared fingerboard

METHOD

- firstly, determine the projection of the fingerboard surface to peg box and the scroll. Keep the projected height above the scroll at 1.5 - 2.5mm, using a rule to check this check the relationship of the scroll-ear level and the peg box level at the nut and the fingerboard surface at the neck foot
determine the nut position: the stop will be at the projection of the peg box end. This is the stop where you now fix the fingerboard
- check the position of the fingerboard: first in the middle of the peg box at the nut, and second check with 2 rules the direction in relation to the peg box at the scroll mark the fingerboard position
now you have the centre-line of the fingerboard
mark the length of 13cm plus 6 - 7mm for the reset space
draw the position of the neck foot: 90° to the centre line of the fingerboard

- saw the width plus 0.5mm each side and saw the length plus 0.5mm
- plane the end-grain wood surface of the neck foot in an angle of 87° (cello 83°)
- soak it with glue
- mark the centre line
- dimension of neck foot: overstand (depends on arching, thickness of the tables, height of the saddle) between 6-.5 - 8mm, plus thickness of the tables, plus height of the ribs mark the width and position of the heel at the smallest end of the neck foot. This is only to orientate yourself) Leave enough room for correction
- draw the position of the nut
- mark the peg box walls and drill as far and as deep as possible
- keep enough wood in the base for stability
- by planning keep the peg box walls in the original style
- glue the fingerboard
- if you like you can start working the thickness of the neck (including the fingerboard) to 19 and 21mm. Otherwise you can do this after resetting the neck into the cut-out of the neck in the body you, fit some lime wood (dovetail model). Fit with chalk

NECK GRAFT - PART THREE Resetting the neck METHOD

Determine neck position:

1. Where is the middle of the instrument?
 2. What height do I need at the tab/estop?
 3. How much overstand at the neck foot, treble and bass side? 4. How deep in the body do you want to set the neck?
-
1. Check the middle at the back Now you know your button position Take the middle of the top table and you know your next position. Looking to the bottom you know how asymmetric your neck foot will be. Make a mark at the middle of the tablestop and mark the bridge position.
 2. The height at the stop (19.5cm) is always 27.5cm
 3. The overstand depends on the type of arching, the thickness of the tables and the height of the lower saddle. The overstand can vary between 6.5 - 8mm. For playing comfort you almost always need 1 mm extra at the treble side. Check this during the fitting with the bridge at the stop.
 4. Usually 6.5mm is the right depth for the mortise. If there is an exceptionally high overstand - 7mm.
 5. The neck length is always 13cm.
 - fitting the neck is then removing wood and checking the position
 - shape the neck foot into a dovetail
 - don't undercut
 - check with chalk check the projection with the bridge
 - make a tight fit to counter against the heat of warming up
 - set only one clamp and use the fingerboard counterpart and the button counterpart
 - put glue on each part and check before clamping

remove excess glue and leave. for 24 hours

MATERIALS, TEMPLATES AND SUPPLIERS

- bridge Suppliers List: Milomir Stamenkovic e.k.: ivw eigenstege.de

WORM HOLE REPAIR Gudrun Kr emeier

Structural questions about worm damage and repair:

where is the worm damage?

what is the influence on the instrument's structural stability? does the violin need patches?

is the main aim to do a big restoration as invisibly as possible?

Do as little as possible. Do not remove more original material than necessary.

VARIOUS METHODS

fill without wood:

- wood filler
 - lycopodium
 - epoxide
- fill with small pieces of new wood from the outside of the table
do a through patch with new or original wood from the inside to the outside

Filling without wood:

- soak the worm holes with glue
- fill the holes with lycopodium or wood filler finish with filler varnish

Filling with new wood:

prepare the worm holes so that they can be filled from the outside: make a groove

- choose matching wood
 - fit one by one and glue one by one
- inner side reinforcements will probably be necessary

Through wood method, original wood from the inside:

if the worm holes are, for example, in the sound post area and need a patch anyway, original wood is available from the patch area less visible method because the colour and structure of the wood are similar be conscious of destroying original parts as little as possible

- make a plaster cast
 - how large does the patch need to be?
 - make a compromise between worm hole requirements and patch requirements
- mark the wood: which wood paring to be used for which worm hole? Draw a diagram fix transparent tape on the patch / chip area
use the super-sharp, flat and wide scroll gouges to make the paring while the table is lying in the plaster cast lay out the parings on your diagram
flatten the edges of the worm hole with the sharp scraper, making them as

- thin as possible flatten the edges of the corresponding paring using a scraper check that they fit together well fix the paring with tape
- prepare a piece of rubber and a piece of hard wood to use to press the paring on the table
- glue with hide glue
- let it dry overnight
- do one by one in this way
- when all the holes are filled, scrape the uneven edges and press some thin lime wood veneer on the patch area
- when dried scrape it again and. fit the patch

Through wood method with new wood:

- make a plaster cast
- make a groove where the worm holes are and flatten the edges of the worm holes, as thin as possible so that you get a canyon-like inside to the violin make a plaster cast of this inner side landscape copy it with a milling machine
- soak it with glue
- copy it again glue with hide glue

MATERIALS SUPPLIERS

- woodfiller: DIY shops
- varnish filler: DickGnzbH: www.dickbiz
- lycopodiwn: Kremer Pigmente: www.kremerpigmente.de
- rubber: Rubber Shop, Canal Street, New York

REFERENCES Weissnar & Shipman.

Andreas Kagi Grolmanstr. 39 10623 Berlin
 Why do you think it's necessary to change the angle? The violin needs specific pressure on the bridge on the table. 3 points determine the pressure:

1. What is the overstand at the neck foot?
2. What is the projection of the fingerboard at the stop?
3. What is the height of the saddle?

To get the best possible acoustic result you have to think about these 3 points in relation to the arching and the thickness of the front and back. The overstand has to be between 6.5 - 8mm and the projection is almost always 27.5mm at the stop. The saddle should be around 27mm.

Why does the angle get lower?

- After a couple of months in use the angle sometimes changes in recently restored or newly built instruments. The arching sinks and / or the back gets rounder, the fingerboard drops and the strings rise the musician complains about greater playing difficulties - decreased attack, too much pressure on the fingers. the cause: if the violinist plays a note, the angle of the string at the bridge has increased so the pressure is too high. It is preferable to take some pressure off the bridge
- If you look at the overstand, there are 2 possibilities: reset the neck change the angle
- If the overstand is OK, then choose option 2. It is easier, cheaper and also works well.

METHOD

check the height at the stop
 decide whether or not to keep the old bridge (no reason not to if the height is right and the bridge is OK) If you keep the old bridge, you can use this as your reference point. Otherwise it is 27.5mm at the stop open the instrument between the table and the ribs, to only halfway between the neck and the upper corner. Do this on both sides as well as separating the table from the top block pull the neck back and change the angle
 insert a small piece of ebony veneer between the neck foot and the table. The thickness of the veneer has to be checked and most likely will need adjustment. Fix the neck clamp and the body clamp to take the measurements at the stop (or the old bridge) if the height is OK, you can glue. Be sure that the top block fits well at the table check after gluing remove excess glue

Wolf Notes.

1. Check the tailpiece is accurately positioned- the string tails should be 1/16th of the sounding length.
2. Check thoroughly for gluing, especially around the bridge and post area and centre bout seams.
3. Reduce the tension on the instrument in any way possible; reduce a high elevation, raise the saddle, use softer strings.
4. Increase the internal tension by tightening the soundpost or making a longer one.
5. Move the post closer to the bridge. This has the effect of 'tightening' the plate—restricting the amplitude of the vibration that causes the wolf.
6. Moving the bridge slightly down towards the endpin has a similar effect- it reduces the vibrating area in the lower bouts which is the source of the wolf.
7. Bad wolfs may be due to excessively thin areas in the plates, especially around the edges. These have to be corrected by taking the table off and fitting straps across weak areas.
8. Make a 'woodier' bridge; use softer wood, leave the breast thicker and the legs shorter. Do not open out the heart or wings. A Belgian style bridge will bring out cello wolf notes- use a French pattern instead..

In general, there are four main post movements;

1. Pull outward to improve brightness and projection.
2. Move inward to calm an excessively bright sound and a wolfy bottom string.
3. Tap towards bridge to brighten the middle strings.
4. Move away from the bridge to give more depth and quality or 'darkness', and also improve a wolf on the middle strings.

Discrete adjustments to the top string are made with the upper end of the post, and the lower end seems to affect the lower strings more directly.

Bridge;

A thin, hard bridge will improve brightness, and a thicker, softer one will mute a shrill instrument The New York' violin bridge works in a similar way to the Belgian

cello bridge-it has a high sweep, a small breast and a relatively thick top edge, and provides a strong powerful sound. The 'London' (Beares?) violin bridge and the French cello bridge has a low sweep, thin legs or ankles, and a relatively full, woody breast, but a thinner top edge. This tends to emphasise depth and quality of sound, possibly at the expense of absolute volume.

Sound Adjustment Guide Notes

1. The soundpost should be set absolutely vertical to the rib plane; check through the endpin hole if possible, through both soundholes, and use a pencil or similar on the belly surface to visually extend the post and aid positioning.
2. The starting position for the post should be 2.2mm from the back of the bridge and 0.5-1mm inside the outer edge of the foot (increase proportionally for viola and cello- the bridge foot thickness behind, and 1- 1.5mm inside).
3. Avoid excess tightness; post should fit well enough to allow withdrawal of the setter blade, but should fall if finger pressure is applied across the 'C' bouts.
4. If the sound is hollow and the strings feel soft under the bow with no projection, post is too short. Check by pulling the post outward. If the post has to be moved beyond the outer edge of the bridge it is too short, and you need to make a new one.
5. If the sound is choked, shrieking and brassy, with the strings stiff and unresponsive under the bow, the post is too tight. Improve by moving inward, and then shorten it.
6. If the sound is small, the top string tinny and the lower string rasping, ease the post inward.
7. If the top string is unresponsive and tends to crack in upper positions, and lower string is muffled, pull the post outward.
8. If the sound on all strings is too shrill; loud but lacking in depth and quality with insufficient ring or sustain to a short bowed or plucked note, move the post back from the bridge.
9. If the sound on all strings is dull and unfocussed or dark, move the post closer to the bridge.
10. If the bottom string is weak or cracks in upper positions, pull the bottom end of the post outward.
11. If the top string only is dull, pull the top end of the post outward.
12. If the top string shrieks and cracks, and doesn't improve with post adjustment, look for hairline cracks around the top hole of the treble soundhole, or use softer wood for the post.
13. In general, problems with the outer strings are dealt with by moving the post in or out (loosening or tightening the tension), if necessary giving the post a slight angle to balance top and bottom strings. The middle strings respond to movement towards or, away from the bridge. If the middle strings are dull compared to the outer strings, make a longer post, fitted closer to the centre and nearer to the back of the bridge.
14. To compensate for a weak bass bar, or one that is fitted too close to the centre, fit a long post quite tightly, but equally close to the centre to balance the bar. Also pull the bottom end slightly outward to strengthen lower strings.
15. Higher archings seem to work best with the post relatively close to the bridge.
16. Make only one adjustment at a time; do not try to move the post in two directions at one go, but listen to the result of each adjustment and make a note of each move. If the sound deteriorates, move the post back to its previous position before trying another adjustment. Remember to take a break now and again- your ears get tired very quickly. Well mine do.

A high (Stainer-type) arch responds better to a lower neck elevation (25.5-26mm) and a low, Strad type arch works best with a 26.5- 27mm elevation. Make absolutely sure that everything is centred on the violin. It is impossible to produce an even, balanced sound across the strings if the bridge, neck and endpin are not aligned and centred, and the bass bar is not in the optimum position. If the strings are not perfectly aligned, the tension will be unequal and the response different across the range.

West Dean Repair Course

Baroque Set ups John Topham

What is a baroque set up? Is it necessary? Is it worth doing on an old instrument? Does it affect the value of an instrument? Is the tone of an instrument reduced with a baroque set up?

Some questions arising when considering converting an established violin back to a set up that appears to have been used before and up to the turn of the 19th century. A baroque set up has no specific criteria in general, however a convention appears to have formed which most people adhere to. It is a set up that was generally used in a variety of forms from the time the violin was conceived in the early 16th century to the late 18th century and generally consists of a shorter neck, slightly lower bridge, most often utilising a non-ebony fingerboard, a short light bass-bar, a level small saddle, a thin sound-post and mainly gut string (gut 'e' particularly).

Converting a violin that may itself be 18th century but with a modern set up involves three stages: removing the front (to fit new bass-bar and fit wood into slots left by modern neck and saddle), replacing the neck and fitting new fingerboard and tailpiece.

First remove neck in normal way, then remove front from ribs. It would be an opportunity at this stage to assess if any repairs need to be done on the front or elsewhere as the instrument is open.

Clean out the mortise in the top block and fill the gap with a block of spruce capped with a strip of maple with similar characteristics to the original rib. Smooth down to follow the curve of the top ribs.

Remove the bass-bar and fit a new one with the necessary characteristics. For a general baroque form I use the following dimensions: Length - dependent on requirements, 213 to 415 length of body fitted in centre with respect to length. Width - 4.5 to 5mm. Height - 9 to 10 mm. Position relative to width of bridge, 112 mm inside foot width. The angle at which the bar is fitted is relative to the centre line is variable. Some old viol bas-bars are at quite an angle almost crossing the centre join at the top. Other viols which had fronts made of bent strips had the bass-bar running on top of one of the joins. In general the angle I adopt is not far from modern angle, instead of the Sarconi method, I calculate the angle which displaces the bar a half a bar thickness from parallel.

Fit wood into slots left by saddle and neck block A baroque neck does not cut into the front, rather it is slotted around the edge. A new saddle is re-inserted but it is a lot smaller and is not raised.

A new neck is grafted into the scroll. The type of fingerboard is chosen. Normally I make a maple fingerboard and glue a 1.5 mm ebony veneer just over the top curve, leaving the sides open. The dimensions of the fingerboard are as follows: At nut, width 25mm. and wide end 44mm. variable depending on length. Most musicians cope with a shortened fingerboard but other occasionally require it length allowing them to hit a top 'f' on the 'e' string. This would make the fingerboard about 25.5cm long. Normally I would set the length to 24.5cm, mainly to get the look rather than anything else. Most fingerboards in the past were wedge-shaped and in most cases I allow a thickness at the nut end of about 4.5mm. rising to 8mm. at the end of the neck. The fingerboard edge is then scalloped up to the wide end to a thickness again of about 4.5mm.

Since the neck is not fitted into the top block, it can be cut to the final length of the neck, that is if you want to fit the neck on to the block in the old style, butt fitting the neck end on the ribs and hammering in a few nails to secure it. The difficulty of this method, apart from splitting the block, is that you do not know at what angle the neck will be when you finally glue the front on. The usefulness of the wedge-shaped fingerboard is that you can compensate for any error by planing the wedge to get to the right angle.

To avoid these complications I usually resort to a dovetail system that allows me to fit the neck in without nails and at the angle I wish,

Once the neck is glued in I then re-glue the front on, and then the fingerboard. The neck is shaped to a fuller shape than the modern neck, bearing in mind that musicians tend not to go beyond the first position.

An un-raised saddle is fitted, the whole of it is retouched, sound-post and bridge are fitted and set up with usually top three plain gut strings with a silver covered bottom string.