



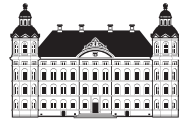
**WOODWORKING**  
**TOOLS & TECHNIQUES**  
**PAST, PRESENT & FUTURE**

**Stockholm 16-19 September 2022**



This symposium was made possible through the generosity of our sponsors, for which we are extremely grateful.

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# Foreword

The 3rd Swedish Symposium on Furniture Technology & Design was held in Stockholm the 16th through the 19th of September 2022, this time arranged by Malmstens Alumni in collaboration with the Swedish History Museum, Skokloster Castle and LiU Malmstens.

Cultures worldwide have since ancient times employed a vast number of tools and techniques when it comes to woodworking. Cabinetmaking is one of the last manufacturing trades to be industrialized. We find workshops as late as the 1930s operating mainly with hand tools and traditional techniques which is one of the reasons why we still have a fairly unbroken chain of craft knowledge and skills.

Conservation and restoration projects confront us with problems where at least part of the solution is hidden in the actual craft procedure. However, technical documentation on historical techniques and tools is scarce. One reason is the reluctance among craftsmen to participate in “academic” events but also the difficulty to find proper means of recording and documenting craft procedures. This is also one of the explanations why only twelve of the eighteen presentations are included in these postprints.

A number of the presentations brought new findings to light. They also showed ways to further deepen our knowledge in historical techniques. Not least did they show how to use them as a source of inspiration for new devices relevant to sustainable woodworking, cabinetmaking and furniture production of today.

The aim of the symposium was to bring together both art historians, cabinetmakers, artisans, conservators and designers. The interest in the symposium was far beyond expectations and gathered speakers from ten different countries and some hundred participants from no less than four continents.

Malmstens Alumni and our co-organizers strongly believe that a better understanding of historical aspects is crucial not only for conservation purposes but also for the development of innovative technologies and modern design.

Even if the symposium, as intended, covered both historical and modern applications we conclude that presentations of contemporary tools and techniques were in minority.

Maybe the time is ripe for a symposium focusing on modern techniques and contemporary design influenced by historical sources? Another interesting theme for future symposiums would be how to re-establish opportunities to learn advanced craft skills and also how to set an international standard for excellence in different wood-related crafts such as carpentry, joinery and cabinetmaking. One option would be an international journeyman’s exam that takes into consideration cultural traditions and conditions.

I would like to conclude by quoting one of the speakers: Technological development is too important to be left for the technological engineers to develop on their own and the artistically informed craftsman could have an important role to play here in this next step of the technological revolution.

Finally a word of thanks to Elise Andersson, Lauri Vaher and Robin Helgesson whose stamina, dedicated work and expertise made it possible to publish these postprints from the symposium *Woodworking Tools & Techniques – Past, Present & Future*.

*Knowledge shared is knowledge doubled!*

Ulf Brunne  
Chairman, Malmstens Alumni

*Knowledge shared is knowledge doubled*



# Woodworking Tools and Techniques

## - Technical and Aesthetical Aspects of Furniture Design and Cabinetmaking

Johan Knutsson

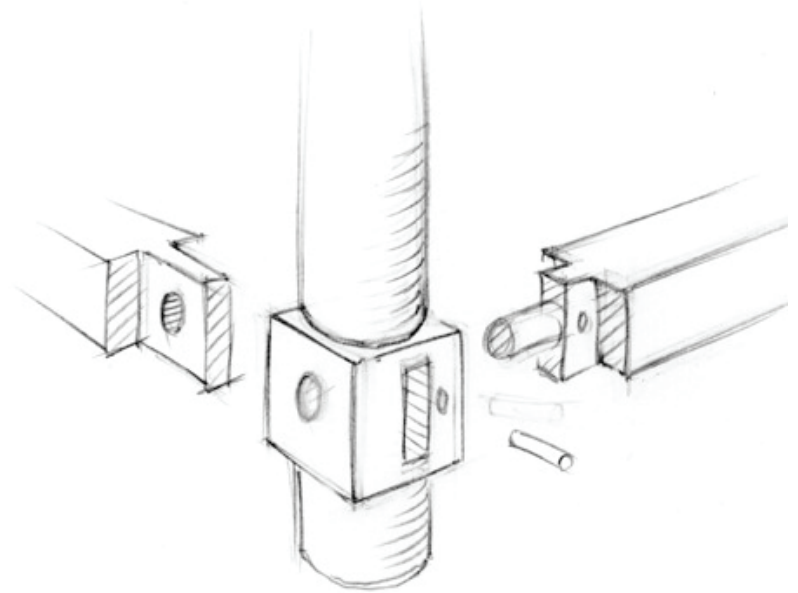


Fig. 1 Tenon cheeks interlocking each other in their meeting at the same level, as on this seating furniture of the 17th century. Bokenäs church. Drawing Johan Knutsson.

Over more than forty years I have met hundreds of antique pieces of furniture and interiors in museums and churches and other historic buildings from the middle ages to our times. And in many cases I have had the opportunity to study them at a very close distance.

After thirty years in the museum field I was appointed professor in Furniture Culture at Linköping University, Malmstens, where three parallel bachelor programs in Cabinetmaking, Furniture Design and Furniture Upholstery are offered.

### Introduction

As a museum curator my focus was mainly directed towards documentation and research in the field of applied art, with special attention to renaissance and baroque furniture<sup>1</sup> and later on, in the 1990s, on vernacular furniture and interior decoration.<sup>2</sup> In my teaching at the university my focus has expanded to the Arts & Crafts movement since the idea of this movement corresponds to the ideas within the Malmsten sphere – craft closely interacting with design and art.

I am still focused on bringing new knowledge about – but now not only for the purpose to enrich the stock of knowledge but to see it as a source of inspiration for new

devices, relevant to sustainable woodworking, cabinetmaking and furniture production of today.

My point of departure is that the objects are not only illustrations confirming what is already known or stated, but that they are in themselves sources of information opening up for new perspectives and questions.

The objects may indicate something unexpected, something which is outside or against the norm.<sup>3</sup> Objects, when investigated with open eyes, and an open mind, and a multitude of investigating methods, both scientific and humanistic, contribute to the history of things in a very decisive way, making history more diverse, and even more interesting.<sup>4</sup>

Approaching the objects this way requires basic knowledge about the making processes, skills and tools and a feeling and comprehension of the qualities of different materials and how to handle them. We also need knowledge about the situation in the place and in the age where the item was made. Such material culture analysis requires in turn access to a large number of objects, a quantity wide enough to make statistically reliable conclusions.

Furthermore these objects must be accessible for investigation in close-up contact, from all sides, both inside and outside.<sup>5</sup>





Fig. 2 In the manufacturing of this 16th century chest the craftsman seems to have taken the direction of the wooden fibers in consideration when distributing and allocating the carved chip ornaments. Sörmlands museum. Photo Johan Knutsson.

Knowledge about materials, crafts, and manufacturing Some construction devices have through the ages proved to be especially well suited, and repeatedly used, in the making of furniture and wooden interiors in carcass joinery and frame joinery: tenon-and-mortise joints, tongue-and-groove joints, dovetail joints, dovetail housing joint and frame and board joints.<sup>6</sup> All of them are developed, adopted and fitted to the requirements of wood as material.

#### *Construction systems adapted to wood and its qualities*

The most ancient way of joining wooden parts together, is tenon-and-mortise. Well dimensioned and exact in size, a tenon cheek may be tightly fitted in the mortise.

If the tenon is somewhat dryer than the mortise piece, the connection will be even more tight and stable when the humidity level will adapt evenly in each piece. As the mortise dries out it shrinks around the tenon locking it steady in place. Within vernacular furniture making it is easy to find varying solutions to the problem of connecting wooden parts together, always without glue. Tenon cheeks meeting or crossing each other on the same level, tenon cheeks meeting or crossing at different levels, tenon cheeks interlocking each other in their meeting (fig. 1).



Fig. 3 Obviously the craftsman behind this vernacular cupboard from the 18th century considered it more important to keep the joining of the molding parts together than to achieve a perfectly regular shape of the framing outline. Sörmlands museum. Photo Johan Knutsson.

#### *The shaping and distribution of ornaments*

To make an adequate analysis of the shape and allocation of ornaments on the surface of a wooden object we need more than an eye for aesthetics, styles and the history of styles. We must also consider and understand how the material in question acts and behaves and how the craftsman operates with the requirements of the material, not against it. Chip carving as a technique and as a pattern has been developed according to what is suitable in terms of carving technique, carving tools, the direction of fibers and the density of the wooden material.<sup>7</sup>

The direction of the wooden fibers may even be decisive in the distribution of the carved chip ornaments on the surface. The carvings have been executed in the same direction as the fibers and they have been omitted in places where they would have been executed against the directions of the fibers, and therefore difficult to make without risking undesired damage (fig. 2).

In other words: When analysing the ornamental design of a wooden object, the distribution and shaping of ornaments we must consider the design not only on the aesthetical ground but also on a material and technical basis. This may seem an obvious fact, but it needs to be stated repeatedly.

### Knowledge about the authentic situation

We tend to interpret history through the mind of our own time and culture. We are instinctively guided by the mood and attitudes prevailing in the age and in the context in which we live and have been brought up. Our conception of what deserves to be considered adequate, rational and perfect, our conception of ideals worth striving for, may differ from the ones that prevailed in another time and in another place.

### *Adapting to skills and tools*

Precision in the joining of varying angles of the mitred frame in the framing mouldings of a door panel construction was hard to achieve for anyone except the most advanced and skilled cabinetmakers. To avoid any gap between the parts forming the frame around the decorative board, the joiner could put the sections of the framing mouldings in place first, and then add the board whose shape thus had to be tailored according to the outline of the framing mouldings (fig. 3). This tells us something about the production process, perhaps also something about preferences among the joiners. Obviously the craftsman considered it more important to keep the joining of the mitred moulding parts tight together without gaps than to achieve a perfectly regular and accurate shape of the outline of the framing.

Throughout the history of design there are many examples of how to rationalize the production of decorative parts, to be offered to furniture makers on demand as semi-manufactured readymade articles. Nevertheless in an age and in a place where making every single piece one by one was considered to be the norm, the furniture maker may also have considered it convenient to make decorative parts piece by piece, thus adapting each and every detail to individual measures. Advantage of making the decorative elements one by one is that it is easier to make them fit in precisely on the surface which is about to be decorated.

An exclusive chest in renaissance style might be adorned with wooden pieces imitating ashlar of limestone, put in place on the front to form architectural arches (fig. 4). These ashlar pieces have been individually carved one by one, in an improvising manner, to make a perfect match, filling up the space. This way of manufacturing decorative details has obviously been considered the most rational, although it does not seem so to us. Probably we would have preferred to make all these pieces in advance, before applying them on the surface, according to a regular pattern and taking it for granted that they would all fit in.

Before the industrial age, the acceptance of a less regular shape was generous. The panels surrounding the baptism font in the Västerås cathedral have been highlighted as one of the most outstanding pieces of cabinetmaking,



Fig. 4 The ashlar pieces of this renaissance chest have been individually carved one by one, in an improvised manner to make a perfect match, not made as ready-made pieces in advance in a rational process which we today would have conceived more convenient and labor-saving. Sörmlands museum. Photo Johan Knutsson.

conceived by skilled north German craftsmen at the beginning of the 1630s. But on closer inspection of the inlay work, you will not find one single right angle or one single regular pattern (fig. 5). A strict application of order and regularity was only to be the norm later on in the 18th century and in the 19th century, in competition with industrial production.

### *Attitudes and evaluations*

These three examples, boards with mitred framing, the ashlar ornamented chest and the inlay work of the baptism font in Västerås cathedral, reveal attitudes and evaluations prevailing in another age and in another place far from ours. This is also the case with the interiors of such masterpieces as the cabinet cupboards of the 17th century or the chest of drawers of the 18th century. The hidden interiors were not supposed to be inspected by anyone.

They were left rough and seemingly unfinished in a way that may surprise me today. The acceptance and tolerance for deviations from the regular and perfect were a result of, or a compromise to, the standard of competence and tools and the cost of labour. This together with the rational considerations initiated by the economy of material and cost of labour, resulted in works of applied art

which we today may estimate to be incomplete, and even of minor quality.

The quantity of objects – within the norm, rationally conceived and confirming the expected  
Identifying the norm in furniture construction and manufacturing takes a large number of objects. Most of the devices, forming the norm, are easily explained with reference to rational or conventional behaviour and decisions.

It takes a number of chairs of varying ages and origins to map the way in which furniture makers have practised, carried out and developed the tenon-and-mortise joints in new ways. After studying hundreds of chairs within the vernacular sphere it is obvious to me that most craftsmen were skilled in both through-tenons and stopped mortises and that they combined them in a creative way. They preferred the through-tenon of the side rails to get all the way through the back poles. This is what could be logically expected since it is well known that the weakest part of the chair is the joining of the side rails to the back pole and that the through-tenon construction offers the safest joint.

It is within the expectations that the pins of a dovetail joint in drawers and chests are directed sideways, at right angles in the front of the drawer and in the gables of

the chest. The reason for this is obvious. The dovetail joint pins directed that way make it impossible for the front of the drawer to get loosened when pulled. As the handles of a chest are placed on the gables it is important that these gables of the chest are safely fitted to tolerate the stress and force when the chest is lifted or pulled from a carriage platform.

Through studies of a large number of objects, we may also conclude that the dovetail joint and the rabbet as box joint occur side by side for a very long period and still do so. The rabbet may seem less advanced. But in most cases it has proved to be good enough, being less time-consuming to make.

The quality of objects – outside the norm and finding the unexpected

Among the pieces of furniture kept in museum storerooms and in churches or homestead museums, there are several objects that do not fit within the norm, objects revealing unexpected qualities and features. Such items encourage us to take up a humble attitude towards people in other cultures and in other ages. In addition, they remind us to take up a critical attitude towards the established canon communicated through the written history of furniture and furniture making.



Fig. 5 On closer inspection of the inlay work of the baptism font from the 1630s in the Västerås Cathedral you will not find one single right angle although this piece of art is considered one of the most praiseworthy and outstanding one of its kind. Photo Peter Segemark.



Fig. 6 In this cupboard of vernacular origin the inner cuts of the dovetail joints have been made with drill and a thin sawblade. Nordiska museet. Photo Johan Knutsson.



Fig. 7 The pins of a dovetail joint are normally put at right angles to the pushing and pulling direction of a drawer. This might however not always be the case as in the construction of a drawer in this vernacular cupboard from the early 19th century. Nordiska museet. Photo Johan Knutsson.

The inner cut of the tail of a dovetail joint is normally made with the edge of a sharp chisel. But in some rare cases, the cabinetmaker has made it otherwise. In the drawers of a cupboard of vernacular origin from the late 17th century small traces of a drill in the corners of the tails may be observed (fig. 6). Thus the inner cut seems to have been made with the saw blade. This technique may today be practised in fine woodworking. But it is surprising to find it here, in such a vernacular furniture-making context and such a long time ago.

As declared above the pins of a dovetail joint are normally not directed in depth, in the pushing and pulling direction of a drawer. This would have increased the risk that the front of the drawers will collapse when pulled. Still, this way of constructing a drawer is sometimes to be



Fig. 8 This 18th century cupboard from the northern part of Sweden is provided with door constructions of two kinds, the lower ones "the right way" and the upper ones "the false way" as a massive timber construction imitating a technically more advanced system. Nordiska museet. Photo Peter Segemark.

found, both in the cabinetmaking of the most exclusive kind and in the vernacular furniture tradition. When it comes to the exclusive cupboards of 17th century origin this may have been the result of a very rational and conscious decision, a desire to limit the exposed crosscut end of timber as much as possible, to offer a homogenous ground for the glued front veneers. This seems logical and rational. More difficult to explain is why this occurred in the construction of a drawer in a vernacular cupboard from the beginning of the 19th century, where no veneer was attached to the outer surface (fig. 7). Even more confusing is the fact that other drawers in the same cupboard are constructed with the pins of the dovetail joints directed the "right" way.

A cupboard of vernacular origin, late 18th century, is provided with door constructions of two kinds. The door in the lower part is constructed the “right” way with a loose board kept within a frame. The upper part or section of the cupboard is provided with double doors of massive timber construction (fig. 8). Unexpectedly the one and same craftsman have practised two different kinds of constructions on the same piece of furniture. Probably there must have been some rationally made decision behind – leaving us today to speculate about.

Forming the back pole of a chair in the lathe may not cause any trouble as long as the back pole does not deviate from the strictly vertical direction. But if the furniture maker wants to make the back pole lean backwards from the seating level – which is often the case from the late 17th century and onwards – this will be more complex to achieve, demanding more advanced technical skill and equipment of a higher level.



Fig. 9 Turning the chair's back pole in the lathe is not complicated as long as you will not make the back pole leaning backwards from the seating level. It is surprising to find a vernacular chair from the 18th century made this way. Nordiska museet. Photo Peter Segemark.

Turning such a back pole at its full length in a lathe takes more than an ordinary lathe. It is surprising to find a vernacular chair from the 18th century made this way (fig. 9). To join a tap into a leg of a circular cross-section without any gap in the joining is a challenge. This problem was normally solved by carving and flattening out the leg's surface on the spot where the joining rail was to be put. Another, more sophisticated way was to carve out a concave hollowing around the tenon cheek in the endings of

the rails. One early example of this is to be found on a chair of north German origin, dated 1821 (fig. 10).

#### Investigating authentic objects by slow observation – in isolation and together with others

Throughout my career, it has been obvious to me that the research in material matters the way I have described requires continuous and generous access to authentic items. It may seem obvious but in times of digitalization of museum collections, this must be stated over and over again.

This has become even more clear to me since I transmitted my attention from the museum visitor perspective to the crafts and design students. Museum digitalization and pictogram may be instrumental in offering new ways to broader contexts, outlines and overviews. That is true.



Fig. 10 To carve a concave hollowing of the neck of the tenon cheek to match the surface of a leg of circular cross section demands skill and a sense for accuracy and detailed perfection. Nordiska museet. Photo Peter Segemark.

But a designer or craftsman does not find much inspiration, input or creative instruction by studying mere illustrations. You do not experience any tactility, any expression of material, colour or form, any traces of tools and traces of hands, by mere photos. And you will not detect any damage risks or be able to discuss the weakest parts of a chair unless you study it in real life. Museums with generously exposed collections such as the Museum of Furniture Studies, founded by the furniture designers

Kersti Sandin Bülow and Lars Bülow, are extremely important to meet such desires among students and all people interested in furniture design and cabinetmaking. The art, or more precisely, the method of drawing has always gone parallel to my research activities and my attempts to describe and analyze what I am looking at. For me, it is important to be left alone with an object, to have time to sketch and draw, to contemplate, to reflect and eventually to put down my description in words, then and there, in front of the object – not afterwards. After becoming aware of what I have seen, it is time to proceed together with others, and share my experience and insights with students and colleagues at both museums and universities, confirming or rethinking what I have discovered and experienced. In my situation as a teacher and researcher at Malmstens, the most effective way is to develop and perform courses and activities where a close-up investigation of old pieces of furniture is of great importance. Teaching and research go hand in hand.

### Conclusion

Antique furniture as well as other objects may be studied from a number of different perspectives: the antiquarians/collectors/connoisseurs; the craftsman/designer/producers; the furniture conservators and conservation scientists; the design historians and the civilization historians.

Of these perspectives, I have highlighted the first, the second and the third ones. Knowledge about an object regarding its origin, materials and manufacturing and the restrictions set by the requirements of the materials, techniques and production conditions provides the information on which you can proceed with the contextualization, stylistic, artistic- and design-related analyses as well as the historical analyses of civilization and ideas.

One basic condition to make the expansion of such knowledge possible is to keep collections in rooms accessible and well-suited for studies.

Johan Knutsson  
Professor in Furniture Culture  
Malmstens Linköping University  
johan.knutsson@liu.se

### Notes

<sup>1</sup> See for instance Knutsson, Johan, articles about furniture in the Renaissance and Baroque periods, in *Signums svenska konsthistoria*, Signum, Lund, 1996 and 1997; Knutsson, Johan, articles about furniture in the "Middle Ages", "Renaissance" and "Baroque" periods, in *Svenska möbler under femhundra år*, (ed.) Nyström, Bengt, Natur & Kultur, Stockholm, 2008.

<sup>2</sup> See for instance my dissertation in art history, *Folkliga möbler – tradition och egenart*, Nordiska museets förlag, 2001.

<sup>3</sup> The examples of observations and analysis presented in my lecture and in this article are based on a wide range of objects which I have investigated in detail at Nordiska museet, Historiska museet and in the Sörmlands museum. The opening up of store rooms to the public, as they recently did at the Sörmlands museum, is a progressive idea meeting a long-felt desire among people interested in the field of material culture, craft and design.

<sup>4</sup> See for instance Knutsson, Johan, "Nya vägar till gamla föremål. Tankar kring föremålsforskning och slöjdekunskap," in *Den vackra nyttan: om hemslöjd i Sverige*, (ed.) Lundahl, Gunilla, Gidlunds förlag 1999.

<sup>5</sup> I stressed this fact already in a conference held at Nordiska museet in 2002. See Knutsson, Johan, "Experiment, konnässörskap och kulturhistorisk kontext," in *Föremål för forskning. Trettio forskare om det kulturhistoriska museimaterialets möjligheter*, (ed.) Svensson, Birgitta, Nordiska museets förlag 2005.

<sup>6</sup> For a summarizing of these methods and techniques – see Knutsson, Johan. *Hantverkarens val. Material, Teknik och form genom möbelhistorien*. Nordiska museets förlag 2019, and the sources and references mentioned and referred to there.

<sup>7</sup> Techniques of carving are well described in a multitude of guiding and instructive manuals within the handicraft sphere. See for instance Sundqvist, Jögge, *Karvsnitt. Skära mönster I täljda föremål*. Natur & Kultur, 2021.

<sup>8</sup> These aspects, with references, even to other crafts such as tailoring and gardening, are discussed in Knutsson 2019.

# From Tool Marks to Work Practices

Hans Piena



Fig. 1 Traces of splitting on a prison stock (1600-1800). Collection Rijksmuseum, Inv.nr.: NG-2019-502.

These days, when people want to know more about an object, they read books, stare at pictures or try to find a video clip about it. Even when they are in the same room with the object, I often see people swiping their phone instead of looking at the object itself. During my PhD research on Dutch painted furniture (1600–1930),<sup>1</sup> I had to do the reverse.

When I started there was little reliable literature and pictures of this simple furniture often showed hardly any datable features. So I put all the existing theories aside and only studied the chairs, cabinets and cupboards themselves. Technical details like tool traces proved very helpful. Moreover tool traces show:

- a. Which parts of the furniture item are not original.
- b. Whether the piece is a forgery.
- c. Whether it was made in another country.

This article presents an overview of the tools, their marks and the workshop practices.

## Production of planks

Many marks on furniture do not originate from the workshop of the furniture maker but from the original production of the beams and planks.

## Splitting

Before the wind-powered sawmill facilitated a revolution in sawing from about 1600, trunks were often split or riven (fig. 1). The resulting planks were pie-shaped in cross-section: they were then smoothed with an axe and a frame saw. However, none of the furniture shows such marks. This makes it likely that all the furniture examined was manufactured after about 1630. After that, the wind-powered sawmill became so common that furniture produced in the West Netherlands, almost without exception, shows wind-powered sawmill marks.

## Single bevel broad axe

Marks made by axes have been found on the oldest furniture, mainly cabinets from 1650–1730. The marks are located on parts that are normally out of sight, such as the back of drawers, skirting boards and cornices at the back or bottom (fig. 2 and 3). An axe was used by many woodworkers to square logs, to level planks after splitting or to remove sapwood. In Utrecht, for example, the carpenters, chair makers, furniture makers, wheelwrights and ships builders were organized in the axe workers' guild.<sup>2</sup>

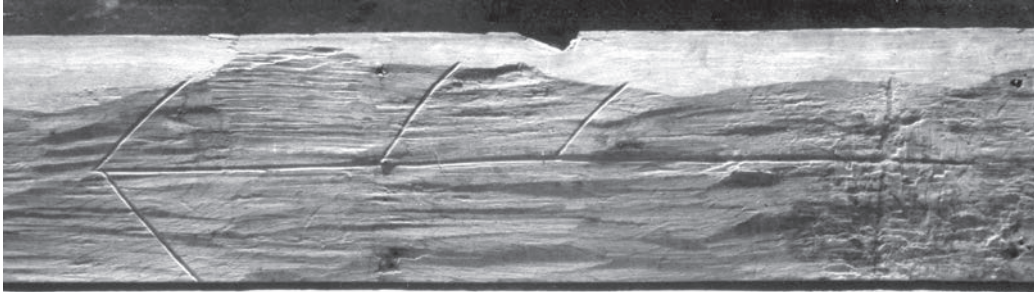


Fig. 3 Regular rows of axe traces made by a single bevel broad axe to remove the irregular surface of splitting. On top a hand mark is applied with a race knife. Back board of a cabinet (1530). Collection Elisabeth Weeshuis, Culemborg.



Fig. 2 Traces of a single bevel broad axe on a prison stock (1600–1800). Collection Rijksmuseum, Inv.nr.: NG-2019-502.

### Frame saw and pit saw

The planks in the furniture studied are almost without exception produced in wind-powered sawmills. Only a few pieces show the traces of a frame or pit saw (fig. 4). Examples are a desk (1853–1854), designed by a farmer Eimert Papenburg and a linen cabinet (1892), made by his son and carpenter Hendrikus Papenburg, both in Zieuwent.<sup>3</sup> Farther away from the industrialized west and outside the large timber trade, these craftsmen used archaic techniques for that period. In Amsterdam, by contrast, the hand sawyers' guild went bankrupt in 1627, as a result of the introduction of the wind-powered sawmill 30 years earlier.<sup>4</sup>

### Wind-powered sawmill

Most of the furniture studied has traces from wind-powered sawmills. As a rule, these marks show on out-of-sight surfaces such as drawer bottoms. They consist of a regular groove pattern, perpendicular to the wood grain. The distance between the grooves can go from narrow to wide and back again for instance because of changes in wind speed. Regularly there is a single deep groove, occurring when the saw runs stationary, for example to move the clamps backwards. In addition, there are sometimes diagonal ridges over the saw marks, because of insufficient

tension on the saw blades or the wrong saw setting causing vibration (fig. 5 and 6).

### Staples and pliers

When sawing oak trunks in windmills, large wrought iron staples were used. The sharp points were hammered deep into the wood to hold the trunk in position. Due to the combination of iron and tannin this produced a black discoloration around the square holes. In addition, large pointed iron pliers were used to produce quarter sawn planks.<sup>5</sup>

### Steam sawmills

In the course of the 19th century saw marks become more regular, and the end result smoother. Firstly, mills with iron mechanisms have less play. Secondly, windmill sails (wind power) were gradually replaced by steam engines. Due to their continuous drive, these provide more even saw tracks. In Leiden, the conversion to steam of a sawmill, previously powered by horses, started as early as 1837.<sup>6</sup> These first steam saw mills were often wind saw mills from which the sails have been removed, after which a steam engine took over. Sawmills built entirely from iron are known from 1850 onwards. In 1856, the Gebroeders Horrix furniture factory in The Hague was the first to



be granted a permit for a steam engine.<sup>7</sup> The makers of painted furniture did not have steam sawmills but bought their sawn wood from these steam wood sawmills.<sup>8</sup> The oldest painted furniture with traces of such machines date from 1860.

### Bandsaw

Between 1800-1850 the bandsaw was perfected. It has a wide and flexible saw blade that runs over two wheels.

The tree trunk is passed through the saw on a trolley or sled. A bandsaw produces marks perpendicular to the grain, in a recurring pattern, caused by one or more protruding teeth and the thicker weld in the blade. In 1867, factory Damlust in Utrecht bought a bandsaw from

Powis, James & Co. (London) for the production of railway equipment.<sup>9</sup> Until 1900, in the Netherlands, planks were only sawn with a bandsaw on a modest scale. In addition, the machine was too expensive for most furniture makers. Only a few pieces of furniture with bandsaw marks were found. Among them is an 18th century type linen cabinet, which must date from the early 20th century partly based on the band saw marks. Another linen cabinet, stylistically dating from the early 19th century, appears to date from around 1900 for the same reasons. In addition, band saw marks are helpful in detecting later additions to furniture such as the plinth of a 17th century cabinet and the drawer bottom in a 19th century table.

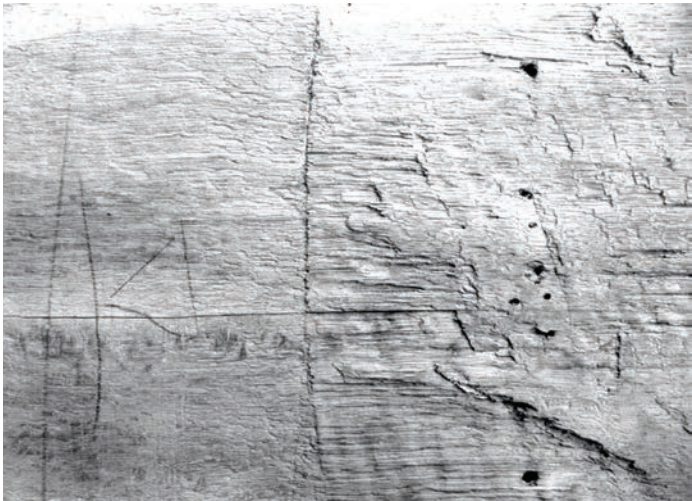


Fig. 4 Traces of splitting partly removed with a frame saw. Back board of a cabinet (1530). Collection Elisabeth Weeshuis, Culemborg.



Fig. 6 Traces of a windmill (right) and traces of a scrub plane (left). Back board of a grocery cabinet (1820-1850). Collection Dutch Open Air, Inv.nr.: Museum NOM.32437-61.



Fig. 5 Traces of a wind saw mill with vibration (right). Bottom of a bureau (1780-1800). Collection Dutch Open Air Museum, Inv.nr.: NOM.5754-46.

### Traces produced during trade

#### *Race knife*

Lumberjacks, sawmillers and traders made hand marks with a race knife during the production, transportation and trade to indicate ownership of logs, beams or planks.<sup>10</sup> Hand marks by a race knife can frequently be observed in furniture up to circa 1600 on planks produced by splitting, a frame saw or axe. Only two cabinets, dating from the second half of the 17th century, have marks of a race knife. After the introduction of the wind-powered sawmill, planks were no longer marked with a race knife. On the surface of tree trunks however, this remained common until the 20th century.

### Traces produced in the workshop

#### *Handsaw*

Traces of a handsaw are hardly ever found on the furniture, certainly not from lengthwise cutting. Furniture parts are more frequently hand-sawn to the right length cross grain. However the cross grain end of boards or legs are usually hidden, smoothed or worn.

#### *Framesaw*

Up to the end of the 19th century the concave side of curved parts often show irregular saw marks, oblique to the grain, caused by a frame saw with a narrow saw blade, for example on the inside of the skirt of an early 19th century table.

#### *Small bandsaw*

From the late 19th century, the frame saw became less popular. We more and more find an ever-repeating pattern of saw marks, perpendicular to the grain direction (fig. 7). They can be found on the inside of curved drawer fronts and table skirts and on the inside of curved seat rails. These traces come from small bandsaws. It has a stationary table on which to maneuver the workpiece. From about 1860 they were used in the Dutch woodworking industry. In 1863, for example, there was a model maker in The Hague with three bandsaws<sup>11</sup>, and a year later one in a carpentry factory.<sup>12</sup> From 1880 small bandsaws made their appearance in furniture manufacturing.<sup>13</sup>



Fig. 7 Traces of a bandsaw on the back of a clock.

#### *Circular saw*

Twenty-one pieces show circular saw marks, produced by the round blade (fig. 8). In Germany veneer was produced with a steam-driven circular saw from 1828.<sup>14</sup> In the Netherlands, the circular saw was used in a steam driven barrel factory from 1841.<sup>15</sup> Only after 1880 do we find circular saws in furniture factories. A late 19th century wash basin with circular saw marks may have been made in such a large mechanized factory. Later, around 1905-1920, the introduction of electricity made the use of a circular saw more affordable.

Some pieces of furniture, which stylistically appear to date from the middle of the 19th century have circular saw marks: examples include a potty chair and two linen cupboards. Partly based on these marks, this furniture must be from the late 19th century or later. Some pieces lack stylistic features and cannot be dated easily. The circular saw marks however show that these pieces must date from the late 19th or early 20th century. Some furniture predating the introduction of the circular saw nonetheless have parts with circular saw marks. These parts, such as the back boards on two grocery cabinets must have been added later. Finally some items that were purchased allegedly as 17th or 18th century pieces, must date from the early the 20th century based on the circular saw marks.

#### *Scribe lines*

In the 15th and 16th centuries doors were often made with a couple of vertical boards, with two stretchers nailed onto the back to hold the boards together. To position the nails a diamond-shaped pattern of scribe lines was applied.

At each intersection a hole was drilled with a nail drill, to position the forged nails (fig. 9). Among the furniture studied such diamond-shaped patterns were only found on one mid 17th century cabinet on stand and on a two-door cabinet from 1650-1670. This method therefore seems to have been abandoned on furniture after 1650. Almost all cabinets from the late 17th and early 18th century with two, four and six doors and cabinet on stands show horizontal scribe lines on the back exactly at the height of the shelves inside the cabinet. These scratch lines helped to mark where to nail these shelves through the back board.

#### *Marking gauge*

Around mortise and tenon joints scribe lines can be observed, probably made with a marking gauge. These scribe lines were found on a serving table and a cot from the mid-17th century. In the 18th century, the use of the marking gauge continued, as can be seen on gate leg tables, tilt top tables, tea tables and lecterns. Joints were still marked out with a marking gauge on 19th century furniture such as a kitchen table and on early 20th century furniture such as a bedside table. This tool remained in use from 1650 to 1920 in the workshops of Dutch furniture makers.



Fig. 8 Traces of a circular saw on the back board of a cupboard. Collection Zuiderzeemuseum, Inv.nr.: 4094 ZZN.

#### *Writing utensils*

From the late 17th century onwards Dutch furniture makers used red-brown chalk for lines, numbers, initials and indications such as 'upper' and 'middle'. Although a wide variety of coloured chalk was available from around 1750<sup>16</sup> other colours such as blue are rarely used and only occur from the late 19th and 20th centuries. Furthermore I have not found proof for the use of stylus pens entirely made of lead/tin as markers on wood although they were widely found. Perhaps from the late 18th century, but certainly from the early 19th century, pencils made of graphite and clay were used for marking. The earliest examples can be seen on a late 18th century bedside table and on an equally old four-poster bed. From the early 19th century, this pencil type became commonplace in furniture workshops and remained so until the early 20th century.

#### *Scrub plane*

Among the traces produced by planes those of the scrub plane are the most common. They were found on 233 pieces of furniture. These marks can be seen on out-of-sight surfaces such as the backs and bottoms of cabinets and drawers. These traces are deep and narrow on 17th and early 18th century furniture (fig. 10). As the 18th century progresses, the traces become wider and more shallow. In the last quarter of the 19th century the scrub plane was replaced by the jack plane. The fact that, as time went on, workshops could use scrub planes, gradually with flatter soles and finally simply a jack plane reflects increasingly perfect and flat sawing coming from the transition from wooden wind-powered sawmills to iron steam-driven saw mills.



Fig. 9 Scribe lines on the inside of a cabinet door. Collection Metropolitan Museum of Art Inv.nr.: 1988.21.

#### *Jointer plane*

A jointer plane with a flat sole was used during the entire period of research on visible surfaces to remove wind-powered sawmill marks. By contrast, jointer plane marks on out-of-sight surfaces are very unusual, certainly in the 17th century. Partly on this basis, a tilt-top table bearing the year 1672 was exposed as an early 20th century imitation or forgery. Until the end of the 19th century, the jointer plane was used almost exclusively to perfect the visible surfaces. Because these surfaces were often also sanded, most traces of a jointer plane have subsequently disappeared. From about 1850 the saw marks become so smooth that a scrub plane became unnecessary as, more and more, a jointer plane sufficed. From then on, jointer plane marks are also seen on out-of-sight surfaces.

#### *Wood planer machines and thicknessers*

From 1860 it was customary in the Netherlands for modern carpenters and furniture factories to have wood planer machines and thicknessers.<sup>17</sup> In both cases, the rotating bits create a regular shallow pattern of ripples across the entire width of the plank. These traces were found on 21 pieces. Without exception they date from the late 19th or early 20th century and are often made by large companies, such as a kitchen table (1910–1920) from furniture factory Erven & Co. in Oirschot. A number of pieces in museum collections that were believed to be from the 17th or 18th century, appear to date from around 1900 based partly on wood planer machine marks. This includes a four-door cupboard, a gate leg table, and a matchstick box.



Fig. 10 Scrub plane traces on the back board of a late 17th century cabinet. Collection Zuiderzeemuseum Inv.nr.: ZSM 13183.

### Work methods

Based on the tool marks discussed we can reconstruct the work methods of Dutch furniture makers. As a rule, they bought their wood from wind-powered sawmills. This was cut to size as much as possible, to keep work to a minimum. However, curved parts were made in the workshop with a frame saw and after 1880 with a small bandsaw. The parts were smoothed by planing. On surfaces not in sight, over time an increasingly shallower scrub plane was used.

The visible parts were finished with a jointer plane. Once the parts were smooth, they were cut to length with a handsaw. Then the mortise and tenon joints were marked with a marking gauge, the tenons were sawn, the mortices cut out with a chisel, and the peg holes pre-drilled with spoon bits. Shelves for a table top or a drawer bottom were often joined with tongue and groove, which perhaps indicates tongue and groove planes. However, planks with tongue and groove were often bought ready-made from the sawmill. All parts were joined into one piece of furniture with split pegs, glue, forged nails and after 1860 with wire nails. In the period of research (1600–1930) furniture types, styles and decorations changed rapidly.

Much of this period, 1650–1880, the working methods however hardly changed. Even the abolition of the guilds hardly altered things. Only after 1860 the largest furniture factories started to mechanize in combination with steam engines. After 1880 the steam engine was increasingly replaced by smaller and cheaper gas, diesel, and petroleum engines,<sup>18</sup> which from 1900 were also used in smaller workshops.<sup>19</sup> Shortly afterwards, around 1900, the final innovation announced itself: the electric motor.

Prof. Dr. Hans Piena  
 Professor and Curator  
 Dutch Open Air Museum Arnhem /  
 Vrije Universiteit Amsterdam  
 h.piena@openluchtmuseum.nl

### Notes

<sup>1</sup> This article is based on: Piena, Hans, “Afgezaagd is leuk. Typochronologie van zaagsporen op Nederlandse meubels.” *Vierde Nederlandse Symposium Hout en Meubelrestauratie*, 1999, p. 13-31; Piena, Hans, “Twee kasten, duizend sporen”, Cr: *Interdisciplinair vakblad voor conservering en restauratie*, jrg. 2 zomer, 2001, p. 32-42; Piena, Hans, “Werkwijze van witwerkers aan de hand van gereedschapsporen op hun meubels”. *Gildebrief, Magazine van de Vereniging Ambacht en Gereedschap*, 2014, p. 36-43; Piena, Hans, *Kleurrijk Nederland: beschilderd meubilair tussen 1650-1930. Part I, II and III*. 2020. Universiteit Leiden. PhD. All references to actual pieces of furniture can be found there.

<sup>2</sup> Utrecht Archief: Toegangsnr.: 708-1, Inv.nr.: 79; Toegangsnr.: 820, Inv.nr. 644, p. 3 nr. 4.

<sup>3</sup> Piena, Hans. *Het Dagboek – Eimert Papenborg – Zieuwent*. Zutphen: Achterhoek Uitgevers, 2021.

<sup>4</sup> Dillen, J.G. van *Bronnen tot de geschiedenis van het bedrijfsleven en het gildewezen van Amsterdam, deel 2*. 's-Gravenhage: Martinus Nijhoff, 1933, p. 633, art. 1123.

<sup>5</sup> Natrus, L. van, J. Polly en C. van Vuuren. *Groot Volkomen Moolenboek; of nauwkeurig ontwerp van allerhande tot nog toe bekende soorten van moolens, deel 1*. Amsterdam: J. Covens en C. Mortier, 1734, plaat IV.

<sup>6</sup> *Tijdschrift ter bevordering van Nijverheid*. Haarlem: V. Loosjes, deel 4 (1837), p. 468.

<sup>7</sup> Eliëns, Titus M. en A.J. van Scherpenzeel. *Koninklijk goedgekeurd. Horrix en Mutters. Twee Haagse meubelfabrikanten*. Zwolle: Uitgeverij Wbooks, 2010; *Verslag over den jaren 1856 gedaan door de Gedeputeerde Staten aan de Provincie Zuidholland in de gewone zomervergadering geopend te 's Gravenhage, dinsdag den 7den julij 1857*, p. 276.

<sup>8</sup> *Nieuwe Rotterdamse Courant*: 30-08-1867; *Leydse Courant*: 30-08-1867.

<sup>9</sup> Brouwer-van Hogendorp, F.X. de, *Een woord aan de aandeelhouders van de Maatschappij tot exploitatie van de staatsspoorwegen*. 's Gravenhage: Gebroeders Giunta d'Albani, 1867, letter K.

<sup>10</sup> Blaas, Jan. "Ritsmessen voor verschillende ambachten." *Gildebrief. Magazine van de Vereniging Ambacht en Gereedschap*, 2013, p. 4-7.

<sup>11</sup> *Statistisch jaarboek voor het Koninkrijk der Nederlanden*. 's Gravenhage: Van Weelden en Mingelen, volumes 10-11, 1863, p. 301.

<sup>12</sup> *Nieuwe Rotterdamse Courant*: 27-04-1864.

<sup>13</sup> Voorst tot Voorst, J.M.W. van. *Tussen Biedermeier en Berlage. Meubel en Interieur in Nederland 1835-1895, deel 1*. Amsterdam: De Bataafsche Leeuw, 1992, p. 60.

<sup>14</sup> Finsterbusch, E. & W. Thiele. *Vom Steinbeil zum Sage gatter. Ein Streifzug durch die Geschichte der Holzbearbeitung*. Leipzig: Fachbuchverlag, 1987, p. 217-218.

<sup>15</sup> *Algemeen Handelsblad*: 3-08-1841; *Oprechte Haarlemsche Courant*: 17-08-1841.

<sup>16</sup> Verly, P.J. *Verhandeling van de schilderkonst in miniatuur. Waar by men gevoegd heeft Eene kleine verhandeling van de schilderkunst met crayon, mitsgaders de manier om de crayons te maken*. Utrecht: Arnoldus Lobedanius, 1744, p.111-124.

<sup>17</sup> *Handelingen der vier en tachtigste Algemeene Vergadering en van het Vijfde Nijverheids Congres van de Nederlandsche Maatschappij ter Bevordering van Nijverheid*. Haarlem: De Erven Loosjes, volume 84, 1861, p. 12-13.

<sup>18</sup> Bos, J.M. & C. Soederhuizen. "Kanttekeningen bij de geschiedenis van het houtzagen." *Bijdragen en Mededelingen van het Nederlands Openluchtmuseum*, jrg. 38, 1975, nr. 2, p. 65.

<sup>19</sup> Piena, Hans. "De productie van Neorenaissance

Meubilair door de Firma Van de Fliert in Barneveld." *Care*, 1998, nr. 3, p. 39.

# The Characteristics of Japanese Hand Tools

## - Tools Born Through the Partnership of the Users, Craftsmen and Connectors

Kenji Komatsu  
Yuko Komatsu

Artisans involved in Japanese wooden architecture and cooking have used a variety of blades, depending on the material and type of work. Blade sharpening has been crucial for carpenters and woodworkers who believed that it leads to the beauty of the wood grain and the accuracy of the joinery, as well as for chefs who believed that the ability to cut the ingredients precisely creates delicious dishes. This paper focuses on woodworking tools such as planes and chisels and describes the process of making tools through the partnership between the user, craftsmen and connoisseurs, as well as their structural and aesthetic characteristics. It will then propose a method for preserving these characteristics.

### Introduction

The characteristics of Japanese woodworking tools have already been studied from various perspectives, such as research on excavated items, changes in historical uses and their relationship with wooden architecture techniques.<sup>1</sup> One of the most notable features of Japanese woodworking tools is cutting done by pulling saws and planes.

On the other hand, this article first introduces the cultural background of Japanese people's obsession with the beauty of the cut surface of materials and the ingenuity used to sharpen the blades' edges. The article will then describe how the tools are made through the partnership of the user<sup>2</sup>, the blacksmith and the connoisseur<sup>3</sup> of the tools that connect the three parties. It will then describe the customizability of the tools by the user and the



Fig. 1 A dish of beautifully cut sashimi, 2022, photo Kenji Komatsu.

aesthetic beauty of the tools, highlighting the characteristics of Japanese tools. The article will lastly discuss ways to convey the techniques and the appeals of hand tools to future generations.

### Cultural background of the commitment to sharpness

The artisans of *soba* noodles, a staple of Japanese cuisine, spend considerable time sharpening their dedicated knives. They do so believing that the sharpness of the edge of the *soba* knife determines how delicious the noodles will be. As for sashimi and sushi, the basic expectation for chefs is that they must always keep their knives sharp, as the freshness of the fish and the beauty of the cut surfaces affects the deliciousness (fig. 1).

Furthermore, the wood finishing method with a plane is still used for the interiors of standard Japanese homes. The beautiful mirror-like surface that has been shaved is believed to be graceful and desirable. Although some may apply a transparent impregnation coating<sup>4</sup> on the surface to make the wood grain stand out, they rarely apply concealing coating.<sup>5</sup> A reconstruction project is carried out using beautiful plain wood materials every 20 years for Ise Grand Shrine<sup>6</sup> in Mie Prefecture and every 60 years for Izumo Taisha Shrine<sup>7</sup> in Shimane Prefecture. This comes from the spiritual culture of respecting the natural beauty of materials and coexisting with nature to keep the dwelling of the gods clean.<sup>8</sup> The artisans who use the tools spend an enormous amount of time sharpening and adjusting the blades to have them bring out the beauty of



Fig. 2 A processing sample where steel is forged to the base metal. Image by Kenji Komatsu.

the plain wood. Naturally, they are very particular about the selection of whetstones they use and the design of the space to conduct the sharpening.

#### Ingenuity for sharpening blades keenly

The blades of planes and chisels are forge welded with a base metal of soft iron and steel containing a large amount of carbon<sup>9</sup> (fig. 2). When the whole blade is made of hard steel, thin steel is forge welded to a base of soft iron that is soft and easy to sharpen as it takes time to sharpen it with a whetstone. The blacksmith also carves an indented area on the surface of the steel called *urasuki*.<sup>10</sup> This ingenuity was devised for the following reasons:

- a) It sticks to the whetstone and is difficult to move when the entire steel surface hits the whetstone.
- b) To make it easier for the tip of the blade to touch the whetstone.

Figure 3 visualizes the distribution of pressure applied to the *urasuki* surface using the pressure measurement film. This allows people to see how the blade's edge is firmly in contact with the whetstone. When the *urasuki* surface is excessively sharpened, the shape of the indentation gradually becomes smaller, making it harder for the edge to hit the whetstone. The masters instruct their apprentices not to overly sharpen the side with the *urasuki* as it is vital to use the plane so that the *urasuki* effect can be maintained even if the blade of the plane becomes worn and shortened.

Let us take a look at the *urasuki* of the chisel. A chisel is

a tool used for carving and cutting by tapping the head of the handle with a hammer. It undergoes considerable wear because the repeated use and sharpening of the blade's edge. The *urasuki* of the chisel is not a simple indentation. In fact, the deepest part is closer to the base. Therefore, as shown in figure 4, the shape of the indentation is maintained even if it becomes shorter.

One might think that when *urasuki* is applied on the surface of the steel, the steel at the deepest indentation becomes thinner. However, as shown in figure 5, the indentations created by the *urasuki* are made in advance during the forging stage, creating uniformly thick steel.

It is hard to imagine that a blacksmith invented such a device on his or her own. The last sections discuss how tools have been created with their users.

#### The users' orders and blacksmiths

Swordsmiths making Japanese woodworking tools include blacksmiths specializing in manufacturing limited tools such as chisels or plane blades and tailored blacksmiths making anything according to the user's orders. *Edokaji no Tyumoncho* (Edo Blacksmith's Notebook)<sup>11</sup> written by Takanobu Ikegami, a tailored blacksmith who has been in business for three generations since 1923, is a record book of orders from various users such as carpenters, leatherworkers, joiners and paperers. It records complex and unusually shaped knives, duplicates of favorite tools, orders particular about beautiful forms, and the enthusiasm of blacksmiths who have responded to these requests.



Fig. 3 Visualization of invisible pressure. Image by Kenji Komatsu.



Fig. 4 Appearance of the urasuki remaining on the back even if it was worn out from left to right. Image by Kenji Komatsu.



The book shows a glimpse of the real relationship between the user and the blacksmith during that period. Unlike in the past, anyone today can purchase industrial products through mail-order sales on the Internet and mass retailers. The relationship in which the user goes directly to the blacksmith to place an order and the blacksmith responds to the order is disappearing.

**A tool shop that connects the users and the craftsmen**  
In addition to the method in which the user goes directly to the blacksmith to place an order, the tool store plays the role of listening to the user's request, conveying it to the blacksmith, making the order, and handing it over to the user.

Let us look at an example, a knife used to hollow out the inside of spoons and bowls. This all-steel knife the author got when he stayed in Sweden as a researcher in 1990 (fig.6).<sup>12</sup> Although I ordered the production of a forge welded blade using this as a reference after returning to Japan, I was not satisfied with the result. Since then, until 2020, I placed five more orders to improve it until I was satisfied with the tool as it is today. Figure 6 shows the process of the improvement.

Underneath the knife is a drawing I gave to them when I placed an order. As shown in figure 7, I sometimes placed an order after showing them an elaborate chisel model. The user makes a diagram or model of what needs to be improved and places an order with the tool store, the tool store communicates the intentions to the blacksmith.

The blacksmith responds to that request by demonstrating his or her skills. It can be said that the characteristic of Japanese tools is that behind a single tool, there is a partnership between the tool store that acts as a bridge between the user and the blacksmith. Tool stores provide the blacksmith with carefully selected, high-quality iron and steel and sometimes guide them on how to maintain the quality. On the other hand, they also play a role in teaching users how to use and sharpen the blade. In addition, they sometimes check where and how the tools sold were used and gather the evaluation of the users.<sup>13</sup>

In the following two sections, I would like to discuss how the users can customize the tools and the aesthetic beauty regarding improvements that cannot be tailored-made.

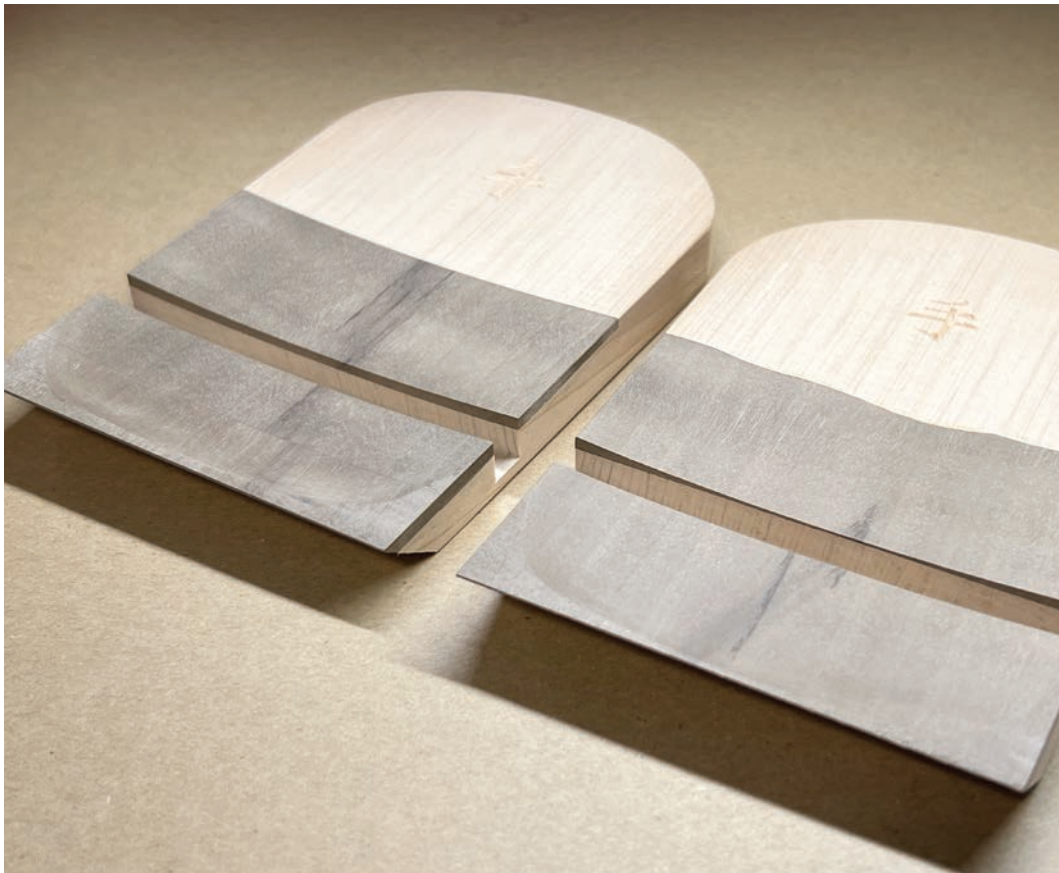


Fig. 5 Models with (left) and without (right) indentations at the time of forge welding. Image by Kenji Komatsu.



Fig. 6 Tools that have been improved (from left to right) and order drawings, 2018. Image by Kenji Komatsu.



Fig. 7 A model of a special chisel and its finished product. Image by Kenji Komatsu.



Fig. 8 Three customized planes. Image by Kenji Komatsu.

### The freedom for users to customize

Most of the plane's blade is made of soft base metal, which makes it easy to sharpen it with a grinder. It can also be machined into the desired shape as the base that holds the blade is made of wood (oak). Figure 8 shows how the author, who is the user, have modified the bases of the three flat planes into outer round planes by cutting each of them to a different curvature.<sup>14</sup>

In addition, the widened cutting edge can be filled in to restore cutting ability. The lower end can be planed off and tailored for rough, medium, or finish sharpening. In this manner, Japanese hand tools are characterized by a high degree of freedom in that they can be processed and adjusted according to the purpose of the use by the user.

### The aesthetics and playfulness of the tools

I earlier in this text described the ingenuity of the *urasuki* of blades and forge welding of thin steel. In this section, I would like to touch on the molding elements inseparable from this function. It is about the beauty of forms.

I once got hold of a chisel that a blacksmith had discarded as an unsatisfactory item and tried to file it myself. It was a challenging task to finish a complex curved surface so that it would form a continuous and beautiful ridgeline without breaking. There is something appealing about the shapes that make up the surface, lines and volume, although it also adheres to the size and functional



Fig. 9 A 375-gram sledgehammer, Inoue tools shop. Image by Kenji Komatsu.

conventions. One can see the blacksmith's sense of beauty, conscious of visual beauty beyond functional beauty. That is different from excessive decoration. The chisel, called a *kotenomi*, is used to flatten the bottom of the indentations. It has a beautiful long, curved handle that reaches the blade's edge. The hammer in figure 9 has a quiet beauty with a rich and heavy bulge inside an extremely simple cylinder. A tool called *sumitsubo*, used to draw marking lines on the material, is carved with sculptural elements in addition to the necessary functions, giving a sense of the craftsman's playfulness. Japanese tools are characterized by their ability to express visual beauty and individuality.

### The current status of hand tools

As prefab homes become more popular in Japan, on-site work using hand tools has plummeted. *Syoyan*<sup>15</sup>, a popular YouTuber carpenter, testified that electric tools have been replacing hand tools in carpentry work. Meanwhile, the workers practicing the traditional wooden frame construction method are aging, causing a shortage of successors. As a result, blacksmiths who made hand tools lost their jobs, forcing many to close their businesses. Furthermore, as I mentioned earlier, the number of tool shops that act as links has decreased.

In 1976, there were nearly 60 sawsmith stores in Wakino Town, Niigata. However, only a few remain today. Industrial saws with replaceable blades are available in many

tool stores, which are now the mainstream. On rare occasions, blacksmiths create saws and chisels that retain their traditional meaning and beauty that are pleasantly sharp. However, they have become expensive, like artwork. This negative spiral related to Japanese hand tools has already passed the stage of being able to stop it.

### Connecting hand tools to the future

In response to this situation, the government and administration are focusing their efforts on education related to forestry, carpentry and fittings. Each prefecture hosts vocational training schools and private study groups. Among them, the *Kezuroukai*, where people compete in shaving skills using a plane, is a place of study aimed at handing down and developing the skills to use a plane.<sup>16</sup> *Kongō Gumi*<sup>17</sup> a group of carpenters specializing in shrines and temples, still undertake construction, reconstruction, and repair work for shrines and temples today, using Japanese hand tools, and are working on training young technicians. In addition, the Takenaka Carpentry Tools Museum<sup>18</sup> systematically collects carpentry tools and exhibits so that you can see and touch.

However, an apprenticeship-like method is continued in many educational and instructional settings. I believe there are some problems in leading to understanding:

- a) The instructors have believed that it is the responsibility of the learners if they do not understand the content of the instruction.

b) It is difficult to see the structure and adjustment of the tools.

c) There are few teaching materials from which the learners can learn by themselves when they have questions.

One solution to these issues would be to visualize the invisible details and hidden parts so everyone can use them. Let us take a look at the key points of visualization:

a) Make it visible.

b) It must be possible to touch it and disassemble it according to intellectual needs.

c) The visualized teaching materials should be displayed daily at the place of learning.

Let us take the plane as an example. The plane has a blade called *uragane*. By bringing the tip of the *uragane* to the tip of the planer blade, the occurrence of reverse grain can be suppressed.

This crucial element, which is difficult to see and understand, can be modeled by deformation (fig. 10). Visualization and daily exhibition of tools and skills, in other words, the aggressiveness of the environment, responds to the learners' willingness to learn on their own.<sup>19</sup>

In recent years, anyone can stream videos and watch them. Now that the world is connected to the Internet, a method of recording skills and techniques in videos can be expected to have a great effect. However, to do so, instead of simply showing the state of the work in the video, it is necessary to use a process model that shows

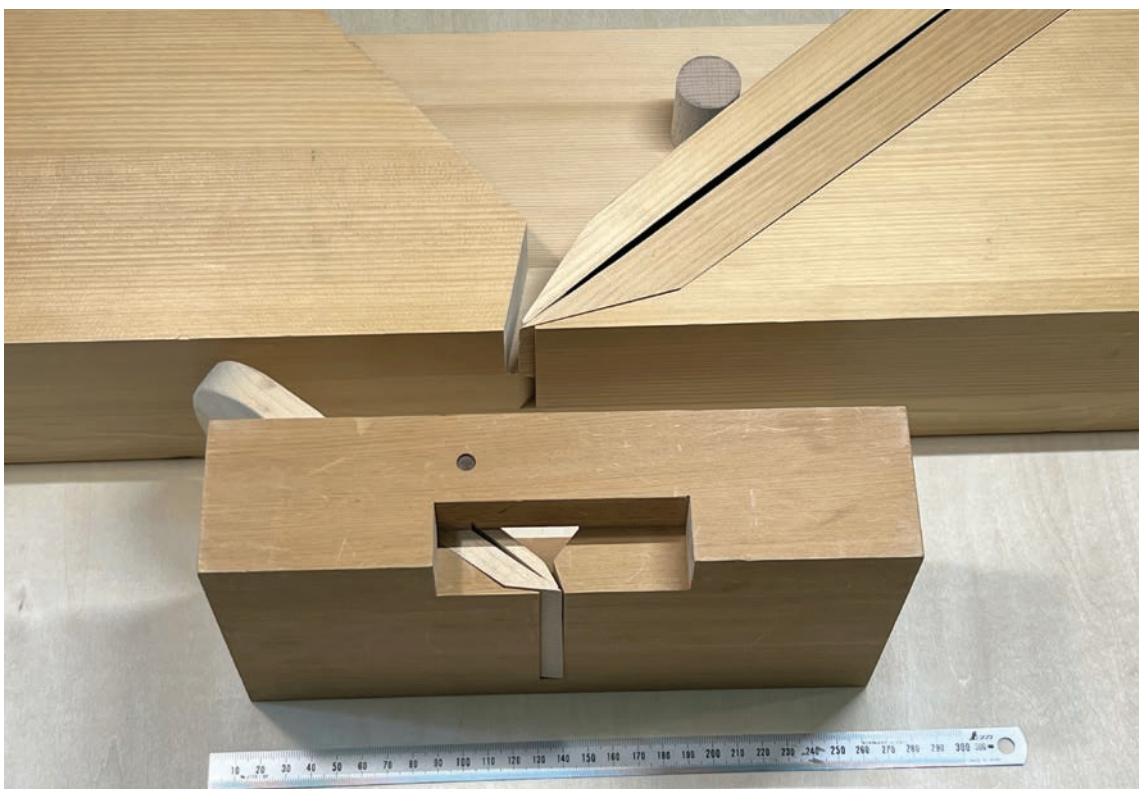


Fig. 10 An enlarged model showing the blade's edge of the plane. Image by Kenji Komatsu.

the work separately, a model that shows the direction and force of the action with traces, and a magnifying glass that visualizes tacit knowledge. Efforts should be made to explain as if they were in the same space.<sup>20</sup>

## Conclusion

In this article, I have looked in detail at blades in planes and chisels, which represent Japanese tools.

Japanese hand tools are packed with wisdom that has been improved and improved over generations. Behind the formation of this wisdom is the partnership of the users, craftsmen and connoisseurs. This circulation is considered to be a characteristic of Japanese tools. And one of the sources of this characteristic is the obsession of the user who cuts and cuts the material beautifully. I also mentioned the degree of freedom the user can customize and the beauty of the form.

In addition, as an effective method of handing down the skills of using hand tools in the future, I described the visualization of skills and the ingenuity in producing educational materials for Internet video distribution.

Kenji Komatsu

Wood Workshop BY HAND/Woodworker  
kenwood3588@gmail.com

Yuko Komatsu

Wood Workshop BY HAND/ICT Supporter  
byhand.wood@gmail.com

## Notes

<sup>1</sup> The titles of the books are: Akira Watanabe, *The History of Wood-building Techniques in Japan - The Development of Carpentry-*, Chuokoron Bijutsu Shuppan, 2004.

Tejiro Muramatsu, *History of Carpentry Tools*, Iwanami Shoten, 1973.

Tejiro Muramatsu, *Tools and Handicrafts*, Iwanami Shoten, 2014. *Axes, Chisels, and Planes; Research on the History of Japanese Architectural Technique; History of Carpentry Tools; and Tools and Handicrafts.*

<sup>2</sup> Refers to someone who uses woodworking tools, such as carpenters and furniture.

<sup>3</sup> Refers to shops selling woodworking tools.

<sup>4</sup> Surface coating that soaks into the wood and hardens inside of the wood.

<sup>5</sup> Surface coatings consisting of opaque pigments and solvents that hides the grain of the wood.

<sup>6</sup> A shrine renowned for having over 2000 years of history located in Ise City, Mie Prefecture.

<sup>7</sup> A shrine built 1360 years ago located in Izumo City, Shimane Prefecture.

<sup>8</sup> Yosio, Akioka. *Sinwafuu no susume*. Mono Mono,

1989, p. 74-83.

<sup>9</sup> A bonding method in which soft iron and steel are brought into close contact, and heat and pressure are applied with borax sandwiched between them.

<sup>10</sup> A slight indentation on the steel side of a single-edged blade.

<sup>11</sup> Takanobu, Ikegami. *Edokaji no Tyumoncho*, Traditional Technique Study Group in Woodworking School, 1992.

<sup>12</sup> Capellagården School of Craft and Design and Carl Malmsten CTD.

<sup>13</sup> Kenji, Komatsu. et al. "The Process of Creating Custom Designed Implements." *Bulletin of Takaoka National College*, vol. 6, 1995, p. 127-137.

<sup>14</sup> A plane with a convex roundness on the underside of the plane base used for cutting concave surfaces.

<sup>15</sup> Carpenter Shoyan. "Show all carpentry tools to build a house", [www.youtube.com/watch?v=P596VMfaPDA/](http://www.youtube.com/watch?v=P596VMfaPDA/). Accessed 10 July 2022.

<sup>16</sup> The largest competition and training organization in Japan with 3,000 members, founded in 1997.

<sup>17</sup> With a history of over 1,400 years since its founding, it is the oldest company in the world where processing with hand tools is still done at the actual site.

<sup>18</sup> This is the only museum in Japan that exhibits carpentry tools established in 1984. Special exhibitions, lectures, seminars, and hands-on classes are held.

<sup>19</sup> Kenji, Komatsu. "Kogou, Naokoto. Successful Professional Skill Transfer - Inspired by Performances of Magicians." *University of Toyama Faculty of Art and Design Bulletin*, vol. 6, 2012, p. 72-87. Kenji, Komatsu. Kogou, Naokoto. "Introduction to Traceology - What the traces tell us." *University of Toyama Faculty of Art and Design Bulletin*, vol. 7, 2013, p. 70-85. Kenji, Komatsu. Kogou, Naokoto. "The aggressiveness of the environment - As an example the practice of woodworking machine room environment." *University of Toyama Faculty of Art and Design Bulletin*, vol. 11, 2017, p. 110-119.

<sup>20</sup> Kenji, Komatsu (YouTube channel name: Tracestudy). "Kanna Project", [www.youtube.com/channel/UCm7tn5wrZUXrYcuNEyu1Liw/](http://www.youtube.com/channel/UCm7tn5wrZUXrYcuNEyu1Liw/). Accessed 15 August 2022.

## A Reconstruction of an Early 16th Century Tondo Frame

Iskander Breebaart



Fig. 1 *Paradise*, Herri met de Bles, (inv. SK-A-780), c.1541 – c. 1550. Tondo painting, walnut wood (oil on panel) 46.6 x 45.5 cm. Rijksmuseum Amsterdam, the Netherlands. © Rijksmuseum.

The Rijksmuseum paintings collection possesses a large collection of panel paintings from the early 16th century. One of these paintings stands out in its composition and form. It is a round panel, painted around 1540 by the artist Herri met de Bles, titled *Paradise*, a so-called tondo (fig. 1). The painting is representing a landscape in paradise with forests and mountains showing episodes from the story of Adam and Eve (SK-A-780). The panel had lost its original frame and over time the panel has warped considerably, as a result of uneven shrinkage of the panel itself.

In 2007, Mr. Peter Klein, who was doing dendrochronological research on panel paintings for the Rijksmuseum at the time, suggested that the panel and frame were originally made from one piece of walnut. It's quite unusual to see a painted panel in such dimensions (60 cm) with frame as one piece. Whatever the reason might be why the panel was cut out of the frame is unclear. There is still an unpainted edge visible around the border of the panel, which was probably a part of the original frame. Traces of woodworm holes at the border of the panel might indicate that the frame was heavily damaged by woodworm infestation.

The original painted panel has not just warped in time, it has also considerably shrunk perpendicular to the woodgrain direction. Therefore it has become slightly oval in shape instead of a perfectly round circle. The backside is covered by a brownish red paint and has a wax layer that is not original.

Since 1970 the tondo panel had an oak frame which did not fit correctly along the borders of the panel and was no longer considered suitable (fig. 2). The inappropriate appearance made the distortion even more evident. The recent discovery of the original status of the tondo stressed the importance of recreating a suitable replacement for the frame. The curator of early paintings and the conservator of picture frames department in the Rijksmuseum (Matthias Ubl and Huub Baya) decided a reconstruction had to be made for the tondo frame.

In consultation with the author of this article the conservators discussed the possibilities of making a historic reconstruction of the tondo frame. Several options for making planed or turned moulding frames were considered. A list of requirements was made for the reconstruction of the frame:

- A contemporary tondo frame had to be found as a reference for the mouldings.
- The frame should preferably be made out of walnut, which is the same as the panel but also a wood type that is suitable for making carvings and mouldings.
- There should be a slight convex deformation in the frame, just like the panel itself. This would create a better fit of the panel in the rebate of the frame.
- The frame should have a slightly oval shape because of the shrinkage of the painted *Paradise* panel.
- The surface finish should be a black paint for the flat parts and gilding on the mouldings.



Fig. 2 Panel with reconstructed oak frame, c. 1970.  
© Rijksmuseum.



Fig. 3 *Portrait of René de Chalon, Prince of Orange*, (inv. SK-A-4462), c. 1519-1544. Oil on panel, diameter 15 cm. Rijksmuseum Amsterdam, The Netherlands. © Rijksmuseum.

- The frame should preferably be made using a historical method in order to rediscover the traditional technique.

All of these requirements made the reconstruction quite a challenge. Since very little documentation was found in how these tondo frames originally were made, a search for other comparable painted panels with frames was undertaken to obtain this information.

Another tondo with a frame in the Rijksmuseum collection was selected as a good example for the reconstruction since this frame originated from the same period and surroundings (fig. 3).

With the exception of the size (this one was considerably smaller), the proportion and shape of the moulding were considered suitable for a tondo frame from the late 16th century. The painting, *Portrait of René de Chalon* (c. 1542) by Jan van Scorel, had its original frame (SK-A-4462). But, unlike the painting by Herri met de Bles, this frame and panel were not made from one single piece of timber. The frame has an inscription in the recessed part of the moulding with references to the Prince of Orange, which confirms the origin of the painting. This frame however has a transparent wax layer, whereas other tondo frames are mostly carved and gilded.

Handmade profile mouldings in a round frame can be made in different ways. Depending on the size and accuracy of the mouldings it is either possible to make the mouldings on a lathe or to scrape the mouldings in

a circular movement. A handmade moulding was usually made using a moulding plane. The blade, or iron of this kind of plane is slanting backwards, like most regular hand planes. But, when the planing blade is going round over a piece of wood, you cannot plane off material because your blade will damage the surface wood grain when you go across the grain or against the grain. To avoid this damaging of the grain it works better if your blade is standing perpendicular to the wood or even slanting slightly forward. In that case, the scraping blade or iron will just scrape off very thin scrapings, resulting in better control.

Turning a wooden disc on a lathe is certainly possible, but for the size of this panel (60 cm diameter) it is fairly risky to make this on a machine driven lathe, if you do not have a lot of woodturning experience. Modern techniques for machine made tondo frames were not considered for this reconstruction, since a traditional method was much more interesting for the rediscovery of the original techniques.

Making a moulding with a scraping blade that is mounted onto a pivoting system seemed to me more manageable. With the experience I had several years ago with reconstructing the missing parts of round shaped moulding parts of a frame from a triptych painting (*The Worship of the Golden Calf* by Lucas van Leyden, SK-A-38410), I considered the possibility of scraping a circular moulding with a rotating system.

Scraping a particular profile into a straight piece of wood is mainly a job requiring great patience, where sharp

scraping blades are of great importance. A steady guiding system for the scraping device is also essential whether the moulding has a straight edge or a rounded shape.

#### Reconstruction of the frame

To start the reconstruction, I made a template in cardboard of the inner and outer dimensions of the frame. The cardboard ring with the right dimensions was cut into six pieces to serve as a template for tracing the lines on the wood.

Making the frame out of one piece of walnut would have been desirable since the original panel (with frame) also consisted of one piece of walnut. However, the availability of such a wide piece of walnut did not seem very realistic, given the large diameter (60 cm). Therefore I chose to assemble the frame from 6 separate pieces cut out of one longer piece of walnut. This was not just done for economical (thrift) reasons, but also to be able to manipulate a convex deformation of the frame in a later stage. The vertical grain direction of the panel was also applied on the frame. The separate pieces of the frame were positioned in such a way that the panel would have a natural tendency to warp (fig. 4). As cabinetmakers know, tangential cut planks will always show some warping in time, due to uneven shrinkage of the wood.

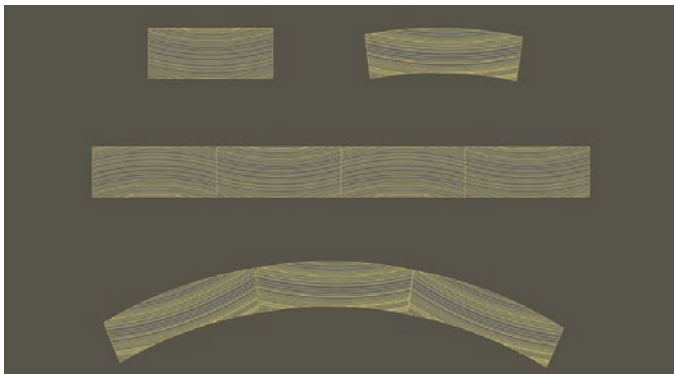


Fig. 4 Positioning of the separate parts of the frame, with woodgrain in the same direction, will result in a slightly convex position. © The author.

The conventional method to construct a stable flat panel is by assembling the boards with the grain in opposite directions. While the unevenly placed planks will warp against each other in this way, the panel as a whole remains more or less flat. However, in the case of this tondo frame we needed to have a constructed frame that would have a tendency to warp in time in a convex manner, more or less to the same extent as the warped panel. Therefore the separate parts were positioned with the woodgrain in the same direction and therefore the parts will gradually bend in the same direction, in a slightly convex position (fig. 4).

All of the separate parts of the frame were glued together by using ordinary clamps. The little corners around the frame were deliberately left uncut. This made it easier

to clamp the pieces together while glueing. A water-resistant PVA was used for extra strength in damp conditions. Furthermore, the corners were also useful as temporary fixing points, when the frame was screwed onto a plywood board for the rotating scraping device. In a later stage the corners could easily be cut off, when they were no longer needed (fig. 5 and 6).

For making a copy of the moulding from the reference frame, a silicone dental paste was used. The paste was pressed down across the width of the moulding (fig.7). When the paste hardened, the imprint of the paste had the exact negative shape of the moulding. After it hardened, the piece was taken from the moulding and cut lengthwise with a knife, in order to get the exact crosscut shape of the moulding. The trimmed edge with the profile of the moulding functioned as a template. The crosscut section of the moulding was transferred with this template onto a paper (fig. 8).

Since the moulding of the reference frame was considerably smaller, the pattern of the moulding was enlarged to the right size on a copying machine. The pattern with the exact measurements was cut out of the paper to use as a template again. The tracing from the paper template was transferred to the steel blade of the scraping device. The steel blade was an old blade from another plane.



Fig. 5 The separate pieces of the frame with corners for clamping. © The author.



Fig. 6 Clamping the separate pieces of the frame. © The author.





Fig. 7 The crosscut section of a hardened silicone dental putty was used as a template for the moulding. ©The author.

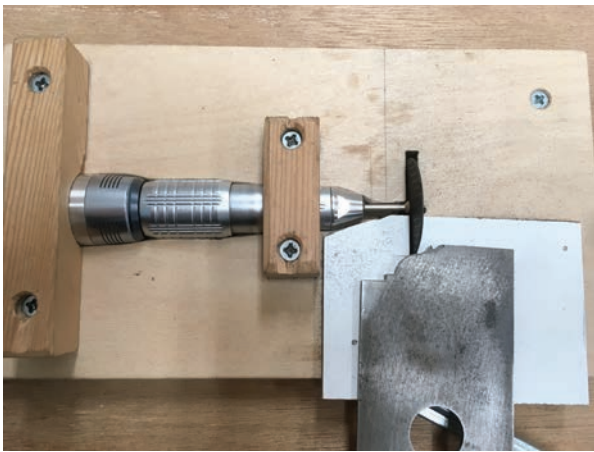


Fig. 9 A micromotor was used to serve as a grinding machine for shaping the blade. ©The author.

In order to cut out the tracing of the profile, a micromotor or Dremel was used. A very small grinding disc was mounted on the micromotor. When the drill was fixed onto a base of plywood, the drilling device could be used as a precision grinding machine (fig. 9). The negative shape of the profile could be roughly grinded out of the steel blade. The exact shapes of the corners and curves for the scraping blade were made with small diamond files and sharpened with tiny whetstones.

The rotating middle shaft of the device was constructed from the holder of a modern caster wheel. In the past this was probably done with a similar system with a rotating wooden or iron shaft. The great advantage of this flexible rotating shaft was that it could be used with different kinds of tools. In order to plane off the biggest part of the wood an electric router was used, mainly for time saving reasons, but it could have been done manually as well. The router was fixed with an iron rod onto the rotating caster wheel. The pivoting router could be adjusted to remove the material in many different steps. The rebate for the panel was milled out separately at a later stage.

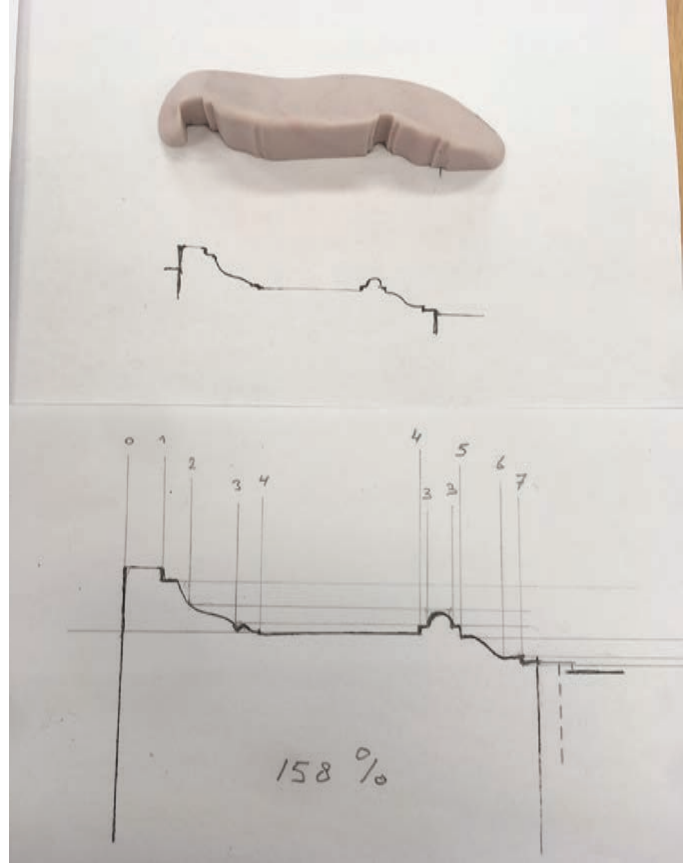


Fig. 8 The negative shape of the moulding was copied from tracing. ©The author.

After having removed most of the material with the router, a sharp blade with the desired profile was positioned in an almost perpendicular position in a wooden lever. The blade was fixed with a small clamp (fig. 10).

For marking the lines of the moulding in the frame, a knife was used on the rotating device to ensure precise markings of the different steps in the moulding. A small Teflon piece was fixed under the lever in order to slide over the outer edge of the frame, so that it could function as a guiding block.

The whole width of the moulding had to be scraped in separate parts, otherwise the handling of the scraper lever would be too heavy to handle. The adjustment of the blade needed to be done very precisely. For the ogee profile on the outer edge, the blade had to go around the same step at least 20 times in order to achieve the right shape in the moulding. The blade had to be sharpened quite regularly because of the pressure on the scraping blade. During the whole process it appeared to be very important to have the blade well fixed to the lever and the rotating middle point should not have any slack, otherwise the moulding could be ruined in an instant.



Fig. 10 The rotating pivoting system with scraping blade fixed to the lever. © The author.



Fig. 11 The scraping in action with the end result, before applying the chalk ground. © The author.



Fig. 12 The scraping in action with the end result, before applying the chalk ground. © The author.



Fig. 13 Scraping the chalk ground layer to recover the crispness in the moulding. © The author.



Fig. 14 A gap is clearly visible between the panel and the frame, due to the warped panel. © The author.



Fig. 15 Sealed climate chamber with thermostatic humidifier. © The author.

All in all, the scraping took much more time than I expected, but the final result was even more crisp than one would have achieved with a machine made moulding. During the scraping of the wood I discovered that moistening the surface did have a very positive effect on the result of the scraping. The fibers on the surface of the wood swelled a little after moistening the surface. This resulted in a better abrasion of the material in the final strokes of the process of modelling the moulding (fig. 11 and 12).

Since the frame needed to be painted black with gilded borders. The next step was to give the surface an overall thin layer of a rabbit skin glue dissolved in water.

After drying the grain swelled up and the surface was gently sanded to get it smooth again. For the next step, several layers of chalk and hide glue dissolved in water (a so called gesso layer) was applied as a ground layer for the gilding and the black painted part. Applying the ground layer also had the advantage that the irregularities and small damages in the moulding would be covered by the gesso. After the drying of the chalk ground, the build-up of the gesso layers caused a loss of the sharpness in the moulding. Therefore the rotating scraper turned out to be very useful again to recover the crispness of the moulding. Sanding of the gesso was done very carefully in order not to lose the sharpness of the steps in the moulding again (fig. 13).

Since the panel painting was extremely warped, as we have seen before, something needed to be done to adapt the new frame to the warped panel. Placing the warped panel in the flat rebate of the new frame caused a very disturbing image along the inner edges of the tondo frame. A significant gap occurred between the warped panel and the rebate of the frame, like it was when the panel was placed in the earlier oak frame (fig. 14).

The best possible solution to this problem was to bend the frame in the same position as the panel. The panel would fit better in the rebate of the frame and the adaptation of the frame would give back the original character to the tondo. To achieve the same convex deformation a controlled bending system was needed. This was a very challenging exercise, because the frame had to be humidified and heated without damaging the glue joints and the gesso layer.

Bending fragile wooden panels have always been a rather difficult task in the wood conservation field. Thanks to the research that was carried out by Gert van Gerven (2016) for bending warped wooden doors to a stable flat position, an attempt was made to bend the frame in a concave position, according to the same principle.<sup>1</sup> The method of bending is to gradually humidify the frame to a very limited extent and subsequently heat the backside of the frame carefully, while putting tension on the circular frame.

### Bending the frame

The frame was placed in a sealed climate chamber (fig. 15), to keep it in relatively high humidity (90%) for about one week until it was damp enough throughout the entire thickness of the material to prepare it for the next step. The frame was taken out of the climate chamber and it was then heated from the backside by using 2 infrared lamps (fig. 16).



Fig. 16 Two infrared lamps used to heat the backside of the frame.  
© The author.

The backside was heated for about 30 minutes with a temperature of around 98°C on the surface (fig. 17). The glue joints were covered with aluminum foil to protect it from the heat. The heated backside was moisturized every now and then to avoid the surface to dry too quickly. Monitoring the temperature was very important.

In particular to ensure the heat transfer going through the entire thickness of the wood. When the front side of the frame had reached a temperature of about 60°C, the tondo frame was clamped with sash clamps diagonally, perpendicular to the grain direction. The round frame is gradually pressed into a slightly oval shape. At the same time the backside of the frame is pressed into a concave position (fig. 18). This pressed position of the frame was kept for about 20 days, until the whole thickness of the material reached the same humidity level as the surrounding air. The grain direction of the various parts of the picture frame, as was mentioned earlier, will contribute to the bending of the entire frame. The pressure of the

clamps is also effective in getting the desired slightly oval shape in the frame. After removing the clamps, the frame was monitored for several months in a stable climatized room. The tondo just slightly bended back, but the overall convex position and the slight squeezed oval shape was just right to fit the panel (fig. 19).

After one year the frame is still in a slight convex position, as it should be. It is a little less than the warped panel, but just good enough to fit the panel. The tondo is recently finished with a black painted middle part and gilded mouldings, as you can see on other tondo frames from that period. This was executed by Tess Graafland, picture frame conservator in the Rijksmuseum (fig. 20).



Fig. 17 Temperature was monitored during the whole process. © The author.



Fig. 18 The backside was gradually pressed into a slight concave position. © The author.



Fig. 19 Painted panel fitted into its new frame. © The author.

### Conclusion

Since many of the traditional historical techniques are lost nowadays it is important to rediscover the old crafts in practice, especially when so little is documented. Even though the publications by Roubo (1769–1775)<sup>2</sup> and Diderot (1751–1772)<sup>3</sup> are still considered to be the best resources for fine carpentry and cabinetmaking, they are nevertheless to a certain extent limited. Many manufacturing techniques in cabinetmaking and fine carpentry are mostly described following the latest standard of high class furniture in the late 18th century in France. Earlier historical resources are rarely documented. As Herman den Otter mentioned in his publication (2016): “Used with due prudence, Roubo’s work can be consulted to resolve questions surrounding objects from other periods and localities”.

In the past when traditional techniques were naturally transferred from the older generation to the younger, it was kind of self-evident that it was done that way. Certain craft techniques can only be transferred through hands-on practice.

The search for these traditional techniques should be rediscovered through creative ingenuity and manual practice. This will result in a better understanding of how these techniques were done in the past and therefore it is important to preserve (and transfer) the knowledge of these historical techniques. Maybe that is the reason why YouTube tutorials are so popular nowadays.

### Acknowledgements

Huub Baija, Tess Graafland, Matthias Ubl, Paul van Duin and Jan Dorscheid

Iskander Breebaart

Senior Conservator of Furniture  
Rijksmuseum Amsterdam

## Notes

<sup>1</sup> Van Gerven, Gert. "A controlled method to straighten warped wooden panels." *Studies in Conservation*, Volume 61, 2016, pages 125-135.

<sup>2</sup> Roubo, A.-J. *L'Art du menuisier*, Paris: Academie de Sciences, Vol. 1-4, 1769-1775.

<sup>3</sup> Diderot, Denis. *L'Encyclopedie*, L'Academie de Sciences Royales des Sciences, 1751-1772.

<sup>4</sup> Den Otter, Herman. *Naar inzicht en vakmanschap, A.-J. Roubo's L'Art de menuisier over interieurbouw en meubelmakelarij in de achttiende eeuw*, Badhoevedorp: Herman den Otter, 2016, p. 250.



Fig. 20 Tondo frame completed with panel. © Rijksmuseum.

## Wave Mouldings and Ornamental Lathe

Josephine Erckrath

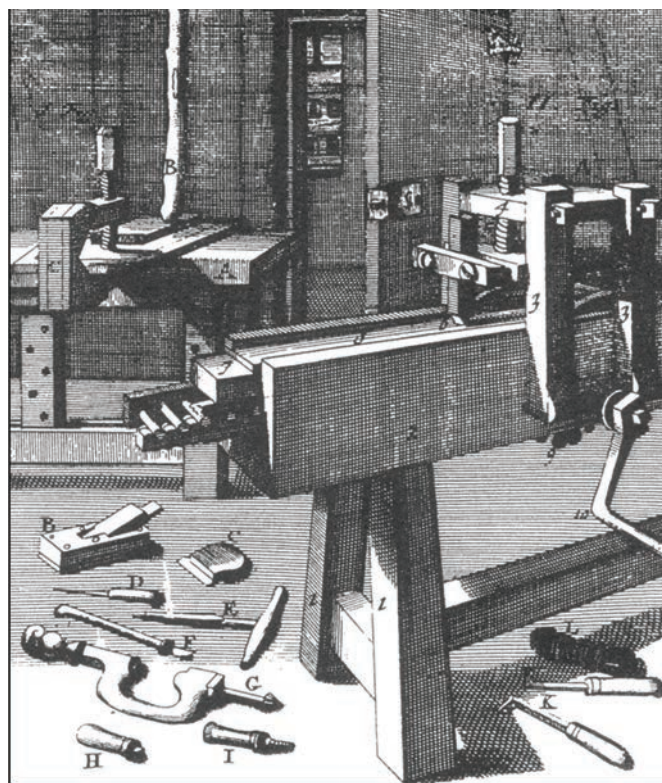


Fig. 1 Manufacturing techniques by André Félibien (1676).

The production of wave mouldings and ornamental turning are heritage craftsmanship. Here, two projects are presented. The first project is a wave moulding machine, developed during a bachelor's degree at Malmstens, and the second an ornamental lathe (rose engine) reconstructed as a master's degree project at the Royal Danish Academy of Fine Arts in Copenhagen. These machines are reconstructions and rebuildings of machines from the 17th and 18th century, and both have been built in cooperation with Malmstens Linköping University.

### Wave mouldings

The research at Malmstens in collaboration with Linköping University was driven by the question how to produce wave mouldings if they were needed for restoration projects. A craft historical perspective was taken, studying written sources from the 17th and 18th century to figure out how the machines were constructed.

There are two kinds of mouldings the reconstructed machine was supposed to form: ripple and wave mouldings. They differ in the movements required in the producing process: wave mouldings need a movement from side to side and ripple mouldings a movement that goes up and down.

The focus was on mechanical devices using the scraping technique. Mainly written sources and copper plates from the 17th and 18th Centuries were analysed. The starting point for the reconstruction was a copperplate from Félibien<sup>1</sup> published in 1676 (fig. 1). Another source was the work of Roubo<sup>2</sup> who further developed the machine one century later. He already reports the loss of complete and functioning moulding machines in the late 18th century. His plates therefore must be seen as an approximation to the original machines – his work was only abstract.

The copperplate of Félibien shows the general composition of the machines. They are built on a wooden frame, the scraping tool is fixed in the centre of the machine and pressed on the workpiece by springs. The workpiece is mounted on a slide which is moved by a crank mechanism.

The development work was carried out in collaboration with Ulf Bengtsson, research engineer at IEI, Linköping University. The close collaboration made it possible to combine the knowledge of the ancient times with modern modelling techniques like CAD and 3D modelling.

The aim was to construct a moulding machine for both rippled and wavy mouldings (fig. 2 and 3). For a better functionality of the machine, modern materials and techniques were used, like the iron lifting arm, hydraulic spring pressure, as well as a mechanism for lifting the scraping tool by passing it back to avoid unnecessary abrasion on the edge of the iron. A cogwheel transmission was placed underneath the slide. For easier operation of the driving system, a gearbox was placed to the crank.

To produce wave mouldings a sideways movement of the slide is needed. Two adjustable screws are placed on the sides of the machine to control and scan the wave cutting progress. The metal parts have been produced by engineers at the Linköping University metal workshop while the wooden parts were constructed with professional cabinetmaking skills.

The testing showed that in practice the wave moulding machine works quite well, the result of the produced mouldings is satisfactory. It is possible to adjust the scanned pattern to the wooden mould, both for wavy and rippled mouldings. That also works well with other materials like bone. Additionally, the machine is also able to produce straight mouldings.



Fig. 2 Manufacturing ripple moulding.

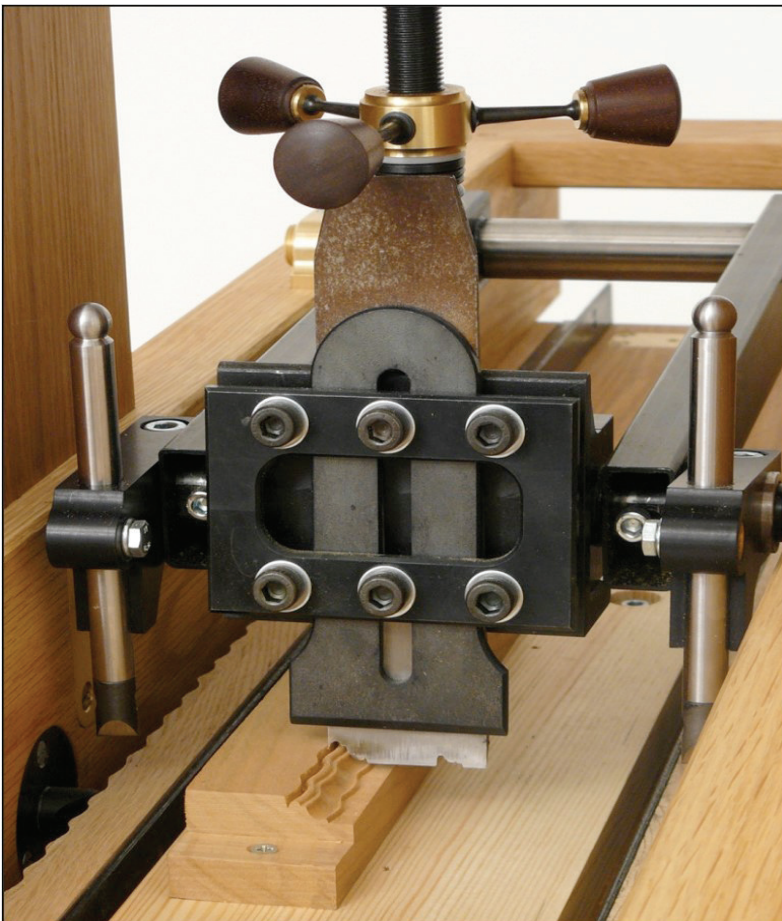


Fig. 3 Manufacturing wavy moulding.

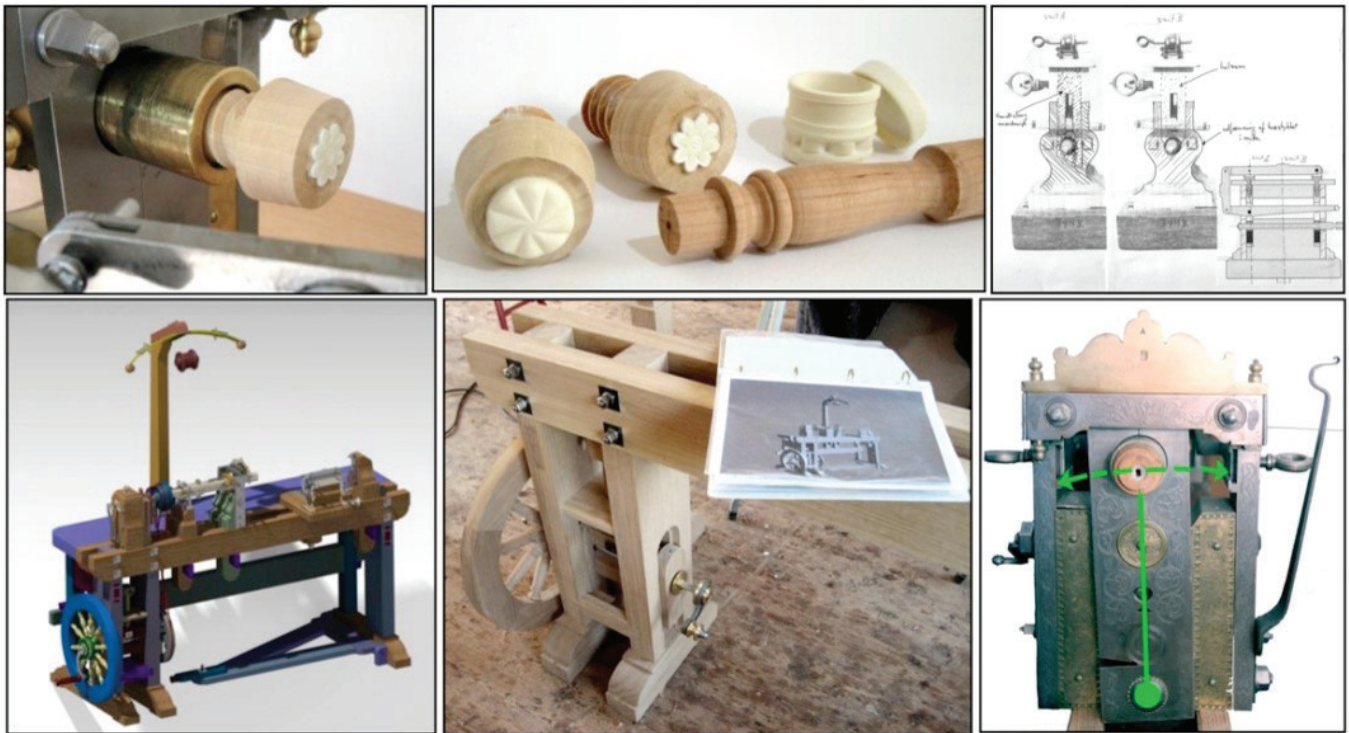


Fig. 4 Ornamental turning.

### Ornamental lathe

The second presented project is a reconstruction of an ornamental turning lathe, also called rose engine. It is based on a lathe from the collection of Skokloster Castle which has been preserved in parts. A craft historical perspective was also taken for this project. This time the focus was to explore the function of the “retired” and incomplete machines restored in museums like in the Skokloster Castle turning room (fig. 5). As a cabinetmaker, one wants to explore them and work with them, but in museum settings these kinds of machines are “retired”.

A Master’s degree project at the Royal Danish Academy of Fine Arts in Copenhagen in collaboration with Malmstens and Linköping University made it possible to do the necessary research.

Skokloster Castle has an amazing collection of lathes, it was a very important place for the research and construction work. The workshop of Carl Gustaf Wrangel was established in the castle in 1673, as woodturning was popular among the aristocrats as a prestigious amusement in the 16th to 18th centuries. The workshop has been moved several times in the castle. It was placed on the 3rd floor in 1940 where it is still today. Today, there are parts from at least 3 or 4 different workshops collected in this room.<sup>4</sup> Some of the lathes exist only in parts, like the ornamental lathe of Nils Brahe. This one served as the base for the studies.

Ornamental lathe turning makes use of complex programmable turning lathes. Opposite to usual woodturning, in ornamental turning, the item is rotating in reciprocal motion, controlled through a complex regulating mechanism. One distinguishes between different techniques: rose turning, spiral turning, swashplate turning and combinations of these techniques.

Johann Kesemacher constructed two ornamental lathes, restored at the workshop. One was owned by Carl Gustaf Wrangel. Unfortunately, the function of Carl Gustaf Wrangel’s ornamental turning lathe is in question.

The speed wheel with a hand crank is for continuous drive and a high speed. For ornamental turning it is necessary to change between continuous and intermittent rotation and various speeds, preferred low rotation speed. His son in law Nils Brahe owned an ornamental turning lathe from 1673, also restored in Skokloster Castle’s turning room. This one is only preserved in parts, the wooden frame is missing, in the turning room at the castle it is exhibited on a simple timber stand. This machine had more functions; therefore, it was the starting point of the reconstruction work. The described machines are very specific, as they are very early lathes and for their time outstanding mechanical woodworking tools.





Fig. 5 Skokloster Castle turning room.<sup>3</sup>

To reconstruct a lathe, literature research and object studies were conducted. Skokloster Castle supported the research project, allowing people to work for days in the workshop and to take photo documentation and measuring of the preserved parts. Part of the reconstruction process was detailed documentation of the research findings and the transfer to the machine that was going to be built. As there were restrictions in place and requirements towards the mobility of the reconstruction, it was not possible to reconstruct the whole machine's environment. For instance, parts of the driving system were certainly originally fixed on the workshop ceiling and not removable as shown in the copperplate of Félibien<sup>5</sup> (fig. 6). A reconstruction always partially consists of interpretation.

Very helpful and essential for the success of the project was the close collaboration with Ulf Bengtsson, an expert on engineering, Prof. at Linköping University. He imported the material into a CAD program and suggested modifications where it seemed to be necessary. On figure 7 you see the reconstructed parts of the lathe owned by Nils Brahe coloured in green.

The frame and other parts are reconstructed, for instance the wooden frame. For the continuous driving system, orientation for the rebuilding was taken at a lathe from Kina Castle in Stockholm. The 3D model shows the reconstruction of the machine before starting the rebuilding process (fig. 8).

The craftsmanship of lathe turning has been investigated through testing on the reconstruction. To ensure that the ornamental turning lathe performs all the functions required, it was tested by prototyping.

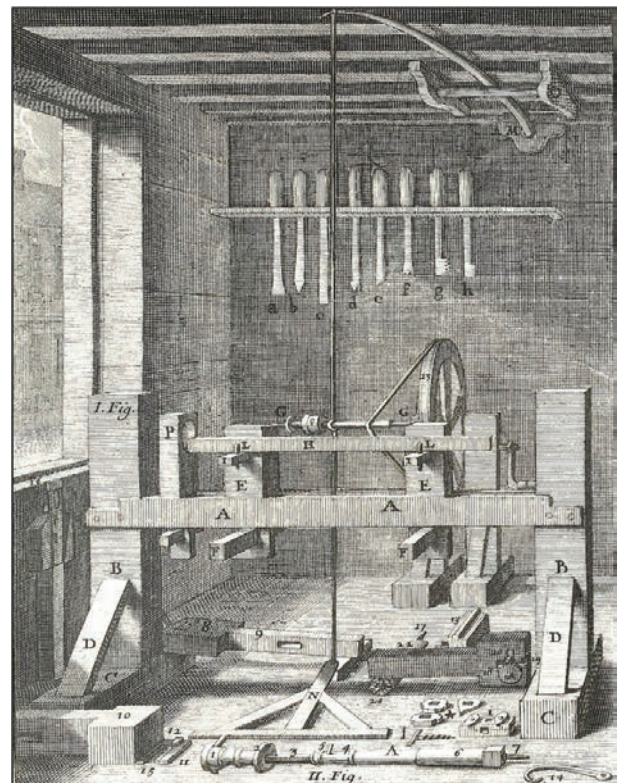


Fig. 6 Ornamental turning lathe, Planche LX (Félibien, 1676).

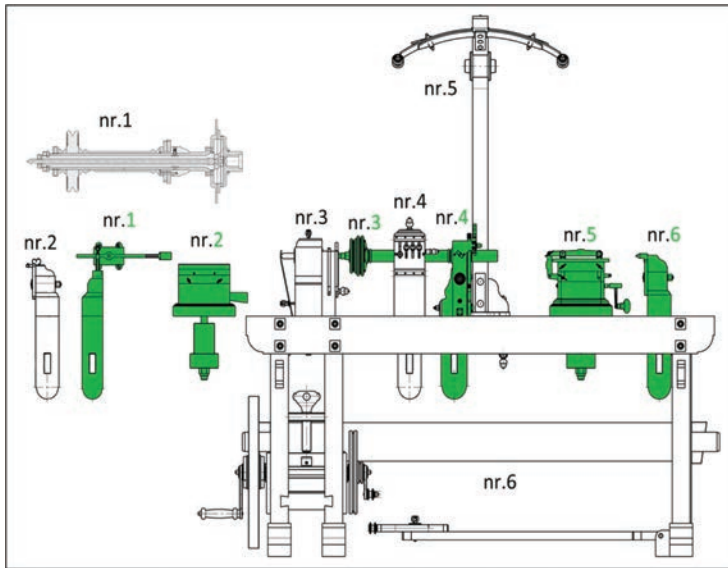


Fig. 7 Reconstructed parts of the lathe owned by Nils Brahe coloured in green.



Fig. 8 From 17th century drawings to computer aided design and reconstruction.

Following turning techniques can be used:

- simple hand turning
- rose pattern turning
- spiral turning
- swashplate turning
- two different screw cutting options
- elliptical turning with a reconstructed elliptical chuck after Plumier
- combination of the above techniques

The results of the tests demonstrate the potential of the machine to create the typical ornamental turning patterns. In order to turn more complex items, basic skills as well as a high professional knowledge is required.

The hope is that this work will be an inspiration for others to investigate historical craft techniques.

Josephine Erckrath  
Cabinetmaker and Furniture Conservator  
josephine.erckrath@gmx.de

#### Notes

<sup>1</sup> Félibien, André. *Des principes de l'architecture, de la sculpture, de la peinture, et des autres arts qui en dependent*. Paris, France, 1676, p. 452, plansch LXV p. 453.

<sup>2</sup> Roubo, André Jacques. *L'art de menuisier: 1. partie, Descriptions des arts et métiers*. Paris, L'Académie Royale des Science, 1769.

<sup>3</sup> Bergström, Carin & Turander, Ralf. *Skoklosters slott under 350 år*. Stockholm, Byggförlaget, 2004.

<sup>4</sup> Kylsberg, Bengt. "1600-talsverktyg på Skokloster – Svarvredskap." In: *Hemslöjden* : 6, Svensk Hemslöjdsföreningarnas Riksförbund, Borgströms Tryckeri, Motala, 1985. p. 15-18.

<sup>5</sup> Félibien, André. *Des principes de l'architecture, de la sculpture, de la peinture, et des autres arts qui en dependent*. Paris, Jean-Baptiste Coignard, 1676, plansch LX.

<sup>6</sup> Plumier, Charls. *L'art de tourner, ou de faire en perfection toutes sortes d'ouvrages au tour*. Lion, Imprimé chez Jean Jombert, près des Augustins, à l'Image Nôtre-Dame, 1706.

# Dutch Moulding Planes from Skokloster Castle, Sweden

Jaap Boonstra  
Pol Bruijs



Fig. 1 The Arendsz tools in exhibition, Skokloster Castle. © The authors.

In this study a set of seventeen Dutch moulding planes from 1663-1664 are described in detail, measured and reproduced in order to make comparisons with mid 17th century Dutch furniture and interior architectural woodwork. The time needed to make these planes and their working properties are briefly sketched. It is attempted to link contemporary names to the planes. The analysed planes are compared to other types of historic Dutch moulding plane (fig. 1).

## Introduction

Planes are tools for the removal of wood with a cutting iron set at a fixed angle in a wooden block, the plane body. There's roughly two categories of planes; finishing and forming. Moulding planes belong to the second group and are usually recognisable by their narrow body and side opening escapement where the shavings can be emitted.<sup>1</sup>

Woodworking tools such as moulding planes generally didn't survive regular use by more than a couple generations of woodworkers completely intact. Their materials and construction make them susceptible to wear; the sole, blade, wedge and mouth of the plane being the most exposed parts. Friction, sharpening, frequent dismantling and setting of the blade all take their toll. Further degradation often occurs due to unfavourable climate conditions that may cause warping and checking of the stock and oxi-

dation of the metal parts. Biological pests such as wood-worm infestation may further damage the wooden parts.

Old moulding planes in poor condition are essentially unfit for use. If, on the other hand, the planes produced forms that went out of fashion rather quickly, it could mean they were put aside before they were used up.<sup>2</sup> This last aspect may have played a role in the exceptional survival of a set of Dutch moulding planes dating from the early 1660's, that has been preserved in good condition, in the lofty surroundings of a baroque castle named Skokloster, situated on a peninsula of Lake Mälaren between Stockholm and Uppsala, Sweden. Here they have been almost since their acquisition, as part of a large collection of other tools, weapons, furnishings, artworks and books that was brought together by the owner of the castle, Carl Gustaf Wrangel (1613-1676).

Wrangel was a wealthy landowner and politician belonging to the Swedish high aristocracy who made a successful military career eventually becoming commander of the Swedish navy (*riksamiral*) in 1657 and army (*riksmarsk*) in 1664. It appears from Wrangel's correspondence that he had seen high quality Dutch tools in the collection of his colleague at the admiralty Claes Stiernsköld. In letters to the Swedish representative in Amsterdam Peter Trotzig, he specifically instructs to buy him the same type of '*Snickare tijgh*' (carpenter's tools)

that Trotzig had earlier sent to Stiernsköld.<sup>3</sup> After some three months, the order was delivered to the satisfaction of the count. On the basis of the itemised bill from the Amsterdam planemaker Jan Arendsz Wissing<sup>4</sup> which was kept in Wrangel's archive, we may conclude that much of the delivery survived and is still present in the Skokloster castle collection.<sup>5</sup>

### Hypothesis

Moulding planes are tools designed to produce a certain range of forms or profiles in solid wood by cutting the excess wood (waste) away. The form of the iron blade (negative) dictates the shape one can achieve in the wood (positive). The most form-specific moulding planes are the so-called dedicated moulding planes. These will produce one single profile only and therefore could be a source of information about the detailing specifically aimed for in decorative arts.<sup>6</sup> Other moulding planes from the Arendsz collection such as hollows and rounds are less specific and are not considered in this study. As this unique set of tools may represent forms fashionable in 1660's Amsterdam, it could give an insight into the Dutch late renaissance and early baroque interior woodwork.<sup>7</sup>

### Method

The historic tools were documented by description, measurement, scanning and photography. The collected information then formed the basis to reproduce them. The traced profile of the sole of the planes was transferred to the replicas by means of templates. These templates later served an additional purpose as gauges of historic wooden mouldings. With the replica planes test pieces of moulding were made.

### Measurement, scanning and photography

During a two day visit to Skokloster in June 2013 the individual planes were measured, photographed (fig. 2) and scanned on a flat bed scanner (fig. 3). The resulting data of plane details and measurements were collected (table 1).



Fig. 2 Arendsz plane, inv. 5210. © The authors.

### Description of the planes<sup>8</sup>

#### Identification

The planes discussed are marked with embossed stamps with plain borders on the toe of the stock with the initials of what were presumably the makers. Three different marks are present on the Dutch planes in Skokloster: IA separated by three dots, HC separated by a cluster of 9 dots and HH separated by a *fleur-de-lys*. The occurrence of the last two marks indicates that Arendsz also acted as a retailer of other makers planes. In addition, the range of tools he delivered is wide; it comprises such varied items as drills, saws, axes, hammers, chisels and measuring instruments, which makes it likely Arendsz subcontracted out more parts of the order he had received. The planes also carry old handwritten numbers and letters in lead (?) pencil and/or red chalk of which the system is not clear. The museum inventory numbers are added at a later date with a modern ink pen.



Fig. 3 Scanned image of inv. 5197. © The authors.

Table 1 Description of Dutch moulding planes in Skokloster collection

Int. nr.	Type ***	name on invoice	max length mm	max width mm	height mm	material	marks body	marks iron	stock type, condition	throat width	throat opening	iron width	iron thickness	bedding angle (to sole)	bedding angle (to side)	breast angle	effective width
5196	moulding plane, quirk bead or astragal and cove with astragal (bolection)	kijste macker beleschav	293	35,9	87,3	beech, iron, steel	I:A, E(?) 7 heart	A	traces of use; inset near mouth (disappeared), deformation of wood, splits	32,4	6-7,3	29,1	4,15-1,85	50°	95,5°	121°	26,9
5197	moulding plane, quirk bead or astragal and cove with astragal (bolection)	kijste macker beleschav	314	43,6	90,5	beech, iron, steel	I:A, EH?4 heart	A	light traces of use	41	6,5-7,5	34,5	4-2 mm	49°	91°	121°	29
5198	moulding plane, quirk bead and cove with astragal (bolection)	kijste macker beleschav	291,5	32,4 (adjusted?)	83,9	beech	I:A, B8	A	iron missing, some traces of use, depth stop adjusted?, deformation of stock	33,2	5,8-7,5	c. 25	-	50°	92°	120°	23
5199	moulding plane, astragal and cove profile/astragal and hollow, compare 5200	aster gal schave	267,5	32 (incl. added strip)	82	beech, iron, steel, pine, ash	I:A, B51 or B5A(?) heart	A	heavy traces of use; altered fence & depth stop, throat widened, new wedge (ash)	32,5	5,8-8,8 (altered)	24	3,8-2	51,5°	92,5°	120°	23
5200	moulding plane, astragal and cove profile/astragal and hollow, compare 5199	aster gal schave	275	25,8-26,2	74,8-75,6	beech	I:A, B314 or B3A	A	iron missing, no traces of use	26,7	6,7-6,8	c.	17,5-18	51°	92°	120°	
5205	sash/door plane, groove and recessed quarter round	en stoffen ploch	263	28,4	80,4	beech, iron, steel	I:A, B4 Ar?	B	some traces of use, tear out around mouth	28,75	5,9-6,3	19,9	3,4-1,85	51°	93°	120°	total: 15,5. Groove: c. 5,5
5206	moulding plane, ovolo with astragal	kor sehr schave	262	28,8	76,5	beech, iron, steel	H:C, B2	B	traces of use; wear on sole, dents on heel, throat opening widened	29,8	7,1-8,4	21,4	4,3-1,7	50,5°	92,5°	118,5°	19,2
5208	moulding plane, (flat) ogee with dropped fillet, depth stop improvised	8 ojjkens oft halve ronkes	243	25,5, incl. strip: 28	72	beech, iron, steel, oak	I:A, 8? scimitar, three notches	B	traces of use; added depth stop - thin strip nailed on the side	24,4	7-7,3	18,2	2,9-2,2	51°	96°	119°	15,6
5209	moulding plane, (flat) ogee with dropped fillet	8 ojjkens oft halve ronkes	247	26,5	72	beech, iron, steel	I:A scimitar, two and four notches	B	traces of heavy use; part of sole cut away, blade of incorrect shape, strip nailed on the side	27,3	7,2-7,4	20,3	3,6-1,7	50,5°	92°	120°	16,9
5210a	moulding plane, ogee and ovolo	?	272	30	83	beech, iron, steel	I:A scimitar	B	light traces of use, esp. tip of sole, rear end	31,5	8	26	4,1-2,2	52°	112°	116°	23
5210b	moulding plane, cove with astragal	hollen kor sehr schave	261	31	76	beech iron, steel	I:A, B3 scimitar	B	few traces of use	29,6	7,1-8,9	22,3	4,3-2,1	51°	94°	120°	19,7
5211	moulding plane, ovolo with astragal	kor sehr schave	278,5	34,5	85	beech, iron, steel	I:A, B3 Ar?	B	traces of use, thin strip glued on depth stop	34,5	8-9,5	25,4	3,8-2,1	52°	94°	120°	23,5
5212	moulding plane, ogee	ojjeff oft karnjiss hobel	305	37,8	85	beech, iron, steel	I:A, B8 Arendz? scimitar, two or three notches	B	heavy traces of use; wear on sole, rear end, left side has nail holes	38	8,9-10,4	29,4	4,2-2	51°	92°	119° (adjusted)	27
5213	moulding plane, quarter round, recessed	8 ojjkens oft halve ronkes, en kral schave	247	25,6	68	beech, iron, steel	H, four notches	B	heavy traces of use; hole through front end of body, ditto in rear end, adjustments to throat, ditto to dept stop	27,2	7,2-7,8	18,4	3,2-1,5	53°	98°	119°	12
5214	moulding plane, cove with astragal	hollen kor sehr schave	255	25,7	75,3	beech, iron, steel	I:A I, four notches, V	B	heavy traces of use; dept stop previously altered with nailed on strips, throat damaged	26,3	6,5-6,8	19,1	3,2-1,5	51,5°	93°	120°	15,3
5215	moulding plane, quirk bead and rebate	en onder attraff schave	260	23,5	72,7	beech, iron, steel	I:A, BA I, three notches	B	few traces of use	25	6,8-7,5	18,5	4-2,1	51°	91,5°	120°	14,5
5216	moulding plane, ogee	ojjeff oft karnjiss hobel	251	24,8	74,5	beech, iron, steel	I:A, 9A H, one notch	B	heavy traces of use; removed improvised depth stop, damaged wedge	25,2	6,1-6,6	17	2,7-0,8	51,5°	93,5°	119°	13

\* maximum height of the stock  
 \*\* diameter = match of profile with circle gauge  
 \*\*\* Wheelan, *The Wooden Plane*, 1993

marks:  
 I:A - in fact: I:3 dots on a vertical line-A  
 H:C - in fact: H:9 dots grouped in roset-C  
 stock type:  
 A = handhold with simple chamfers  
 B = handhold with chamfers, depression in front of chisel, recessed quarter round on toe, stopped chamfer on front

*The plane body*

Type. The Arendsz moulding planes are all side escape-planes of a traditional Dutch type of narrow plane that was produced up until the 1950's. The total length of these planes is on average 30 cm, but there's no standard length.<sup>9</sup> The plane iron and wedge fit in a tapering, through mortise which has been made at an oblique angle. The pitch of the bed for the iron is mostly set at 51°.<sup>10</sup> The pitch of the breast is less consistent; it varies between 116-122°. Most irons are skewed, at an angle that varies between 91-112° measured from the side of the body. The overall length of the planes varies some 7 cm – between 243 and 314 mm. The shoulder is a little lower than modern Dutch moulders, which brings down the centre of gravity and perhaps improves the stability of the plane somewhat.

Form. The plane body has a couple of decorative features – chamfers along the top end and a moulded shoulder. Two types of chamfer are present in de Arendsz delivery: with and without elaborate decor on the handholds. The first group has chamfers along the top and halfway down the heel, a depression of the top right in front of the wedge and a recessed quarter round and a stopped chamfer on the toe (fig. 2). Important to note is that the decoration also has a functional aspect; chamfers make the plane more comfortable to hold. The depression in the front may be seen as a rudimentary form of a front tote that was an integral part of earlier type moulding planes. Similarly, the stopped chamfer so clearly recognisable on the toe of the planes from the 17th and 18th centuries gradually shrunk in later ages until it became little more than three fairly meaningless notches made by a narrow chisel and a gouge. The second, more sober type of chamfer is restricted to the top of the body and continues halfway down the toe and heel (fig. 4). It is present on some of the dedicated planes by Arendsz and on every plane stamped H:C - this is the group of hollows and rounds, rebate- and tongue and groove planes and one ovolo and astragal plane.<sup>11</sup>



Fig. 4 Arendsz plane, inv. 5197. © The authors.

*The iron<sup>12</sup>*

Much of the metal of the irons retains its original manufactured surface: forging scale, pitting, file marks and dents from a hammer. All the irons have makers' marks - heart, scimitar, H or I – on the tangs. The tang is narrow to fit the handhold of the plane body. Tangs are usually irregular in width. They taper in thickness so that they are thinner at the top. The width of the iron blanks has been taken down to fit the profile of the sole and the cove of the shoulder of the plane body. The blades show a different type of metal (steel) forge welded on to the wrought iron lap. The blades are all thickest at the cutting end. They are finished – ground and polished – to varying degrees. More unground areas on the back, where cross-filed surfaces are retained. Most sharpening bevels are single bevels of same fineness as other surfaces, suggesting these bevels are part of the manufacturing process. The irons are marked indelibly by means of file cuts into tangs.

*The wedge*

Although the wedges have suffered from abuse, the characteristic angular 'Dutch' shape of the finials narrowing toward the top is still predominant. Although the finials of the best preserved wedges look similar, they all differ in details and must have been shaped individually.

*The profiles*

Seven of the dedicated moulding planes can be characterised as 'simple'. These are the ogee's and quarter rounds that have been in use for centuries as they are derived from classical Greek architecture (fig. 5). Some remained popular until modern days as can be illustrated by pages from the late 19th century tool catalogue of the Dutch toolmaking firm *Nooitgedagt* (fig. 6).<sup>13</sup>

Some of the names used in Arendsz' bill give an indication of intended use as classical architectural mouldings, such as the '*oijeff oft karnijss hobel*' which translates as 'ogee or cornice plane' (inv. 5216), the '*aster gal schave*' or astragal and cove plane (inv. 5199, 5200) and the '*onder artraffschave*' or 'lower architrave plane' interpreted as quirk bead and rebate (inv. 5215). The other group of ten moulding planes that have more complex profiles are essentially combinations of several classical elements such as cove, ovolo, fillet and astragal, to create a new form such as for instance the '*kor sehr schave*' (possibly inv. 5206) and the three '*kijste macker belechschav*'. The last roughly translates as 'case makers applied plane', indicating these were used by joiners,<sup>14</sup> while the term *belech* may have meant the moulding they produced was usually applied or 'planted' – as opposed to so-called 'stuck' mouldings that are cut into the body of the structural member or piece of furniture.<sup>15</sup> The most likely candidates here are the quirk bead and cove with astragal planes (inv. 5196, 5196, 5197), that produce something called a '*bolection*'



Fig. 5 Templates of copied Arendsz planes. Top row simple, second and third complex profiles. © The authors.

moulding.<sup>16</sup> The condition of the planes varies; some of the more common, simple moulders have obviously gotten a fair bit of use, whereas some of the finer more complex profiles are still very crisp and seem to have hardly been touched at all.<sup>17</sup> Still the appearance of the tools is a little rough to modern eyes. The detailing is evidently done by a type of handwork in which no exact standardisation was considered necessary. The wood is of average quality, the orientation of the grain frequently not ideal (the grain rising up towards the heel, the medullar rays not always perpendicular to the sole). No standard sizes, nor completely identical pitches (bedding angles) are found, yet there is exactness where it matters for the tool to function properly; a narrow mouth, good correspondence between blade and sole and a good fit of the original wedges.

## Reproduction

### *Building planes*

As mentioned before, reconstruction of the dedicated moulding planes was undertaken to get a better idea of the shape of each individual moulding they produced. The attempt at reconstruction also served as a practical exercise in plane making which helps understand what essentially must have been a small scale operation done with hand tools. A plane body was made up according to the outside measurements taken from the originals. The scanned image of the toe of the original plane served to make a template in thin plywood. This template was then used to transfer the shape of the profile to the new plane body.<sup>18</sup> The following steps of making the moulding plane are perhaps best described in the historic account given by J.W. Armour in *Work, The Illustrated Journal for Mechanics*, London, 1898 (fig. 7).<sup>19</sup>

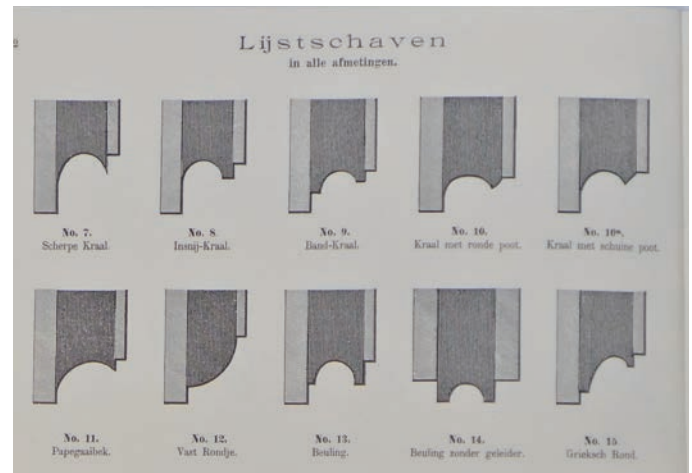


Fig. 6 Anon. *Album van Schaven Beitel en andere gereedschappen voor Timmerlieden, Kastenmakers enz: & Schaatsen van J. Nooitgedagt*, IJlst, ca. 1891, p. 2.<sup>14</sup>

Although some modern tools were used (circular saw, drill and grinding wheel) timing the different steps of making this set give a better understanding of the process (table 2). The varying amount of time spent making the plane will have influenced the price. The bill indeed mentions 10 *stu* for the simple '*onder artraffschave*' while a complex '*kijstemacker belechschav*' is priced at 24 *stu*.<sup>20</sup> Once the replica planes were made, they served as a starting point for experimentation.

### *Cutting mouldings*

Planing test pieces is part of making a plane; one has to make sure the match between the iron and the sole is exact, the shavings do not clog the mouth, the wedge stays put etc. The resulting moulding is then a record of what this plane actually makes (fig. 8). In working with the replica planes, one gets a sense of the rapid hand production they make possible. If these planes are well set and sharpened, any worker with only minimal training can produce an adequate moulding with them. The fact that the dedicated mouldings were limited to the narrower mouldings has a practical reason. The narrow mouldings tend to have the finest detail, which is hard to achieve with planes without guides (depth stop and fence). Larger mouldings like for instance cornices, would be produced in a step-by-step sequence of rebate and grooving planes to achieve a rough shape and guide for the follow-up treatment with several other planes like hollows and rounds or coves and quirks.

Table 2

Work list for building a moulding plane	Minutes
Measure & saw the stock	15
Make a pattern for the plane profile	30
Saw & plane rebate and sole	120-180**
Saw kerfs for wedge, roughing out	30
Drill holes for wedge and iron	15
Knock out wedge slot, fit iron, grind* and sharpen blade to match sole	180-200**
Make wedge	15
Test planing, corrections	30
Chamfers etc.	30-75***
Finish (sanding, oil)	30
<b>Total</b>	<b>495-620</b>

\*Or file, heat treat and temper a soft blank

\*\* The time required for making the sole of the plane may vary according to the amount of detail of the profile concerned. The finer the detail the more time consuming it is to make. A 'mother' plane which has the shape of the desired profile, to form the sole of the new blank in one step would obviously save time but was not available here.

\*\*\*Simple chamfers on a plane body require on average less than half the time to make compared to the more decorated toe with stopped chamfers, a recessed quarter round and depression in front of the blade.



Fig. 7 Replica planes in the process of making. © The authors.

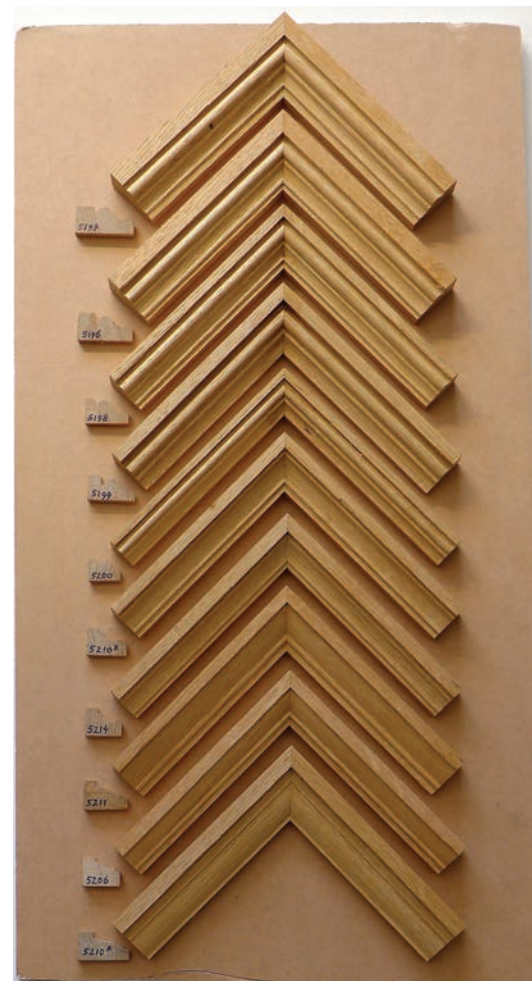


Fig. 8 The ten pieces of complex profiles mitred and combined with corresponding cross-sections. © The authors.



*Comparison to historic woodwork<sup>21</sup>*

Later in the study the template of the toe of the plane had an additional use when it served as a gauge for probing old mouldings on historic objects. It soon became clear that most matching profiles were to be found on plain oak furniture and architectural woodwork in the late renaissance and early baroque style. The search was limited to objects that could be dated to the year exactly within the period 50 years before and after 1664.<sup>22</sup> Church interiors proved to be a relatively rich source of historical woodwork that met the demands of material and a secure date. The architectural woodwork and non portable furniture there has the added advantage of known provenance. Among the earliest examples of the seventeen dedicated mouldings were interiors of buildings designed by the sculptor-architect Hendrick de Keyser from the 1620's. In the mid 17th century the seventeen mouldings were still popular with joiners as prove the interiors of the New Church of Amsterdam and Amsterdam Leper house.

The majority of the matches was found in the period between the 1620's and 1660's. As it turned out some profiles remained popular for decades (fig. 9). However, not all interior decoration followed the same trends. Mid-17th century designs by architects working in the Dutch Classicist style for instance tended to incorporate less decorative mouldings. When they did include them, the mouldings were more adapted to the size of the building; i.e. larger in size, easier to recognize at some distance and more strictly following the classical idiom.

This more or less excluded the use of Arendsz' profiles. Table 3 shows the occurrence of one or more profiles of the set of seventeen in dated Dutch furniture and interior architectural woodwork. The exact fit of the plane profiles on some datable furniture suggest that some measure of standardisation in shape and size was maintained. To communicate this, an obvious characteristic of each profile would be their effective width, measured in *Amsterdamse duimen* (the 'Amsterdam inch' measures 2,57 cm).



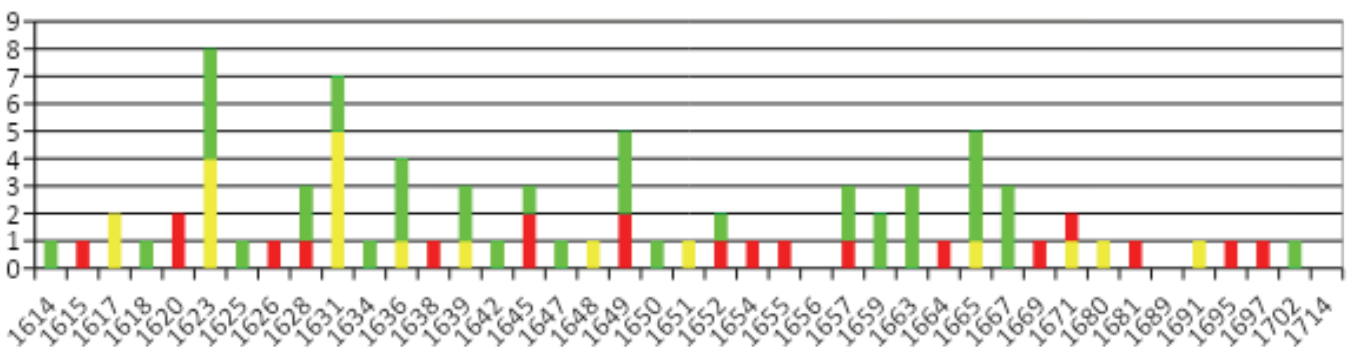
Fig. 9 Panelling of lectern, 1649 New Church, Amsterdam. © The authors.

Standardised profiles made by dedicated moulding planes probably had their largest use in the products designed by joiners. Here joiners were free to choose the most economical way to do the job and it seems logical they would resort to tools that were commercially available or already present in the workshop.

*Other contemporary moulding planes*

Because of the similarity between the more decorated Arendsz planes and Dutch moulding planes from the 18th until the 20th century, it is tempting to think there has been a continuous tradition of this type exclusively. And a possible explanation for this prevalence could be that the moulding plane with decorated stock was made according to specifications laid down by the guild of house carpenters around 1600.<sup>23</sup>

Table 3 From year 1614-1714, 0-8 number of objects. Green = matching form and size, yellow = similiar form, red = no match (0)



## List of the investigated historical woodwork

- 1614-1617 – doors, (5211), panelling council chamber, (0) City Hall, Bolsward
- 1617 – fireplace, wall panelling BK-NM-3931-A-1, BK-NM-3931-B-3, Rijksmuseum Amsterdam (5200)
- 1617 - cupboard, from wall panelling BK-NM-3931-A-3, Rijksmuseum Amsterdam, (5212)
- 1618 – burgomasters pew, Grote Kerk Monnickendam (5211)
- 1620 - government pews, column 24, (0), column 26, (0), Oude Kerk Amsterdam
- 1623- pulpit, baptismal gate, Keyser kerk, Middenbeemster (5215, 5211)
- 1623 - government pew, Grote- or St. Vituskerk, Naarden (5199, 5211, 5197)
- 1625 - government pews, column 7, Oude Kerk, Amsterdam (5215, 5210b)
- 1626 – choir screen, Grote- of St. Vituskerk, Naarden (0)
- 1628 - cabinet BK-NM-11190, Rijksmuseum Amsterdam (5206, 5208)
- 1628 – door of burial chapel, Grote Kerk, Alkmaar (0)
- 1631 - cabinet Polder administration – Poldermuseum Het Oude Gemaal, Heerhugowaard (5211, 5197)
- 1631 – pulpit (5215), south wall door (5212), north-east portal side door (5197), north wall high pew (5206), north wall pew (5199, 5211, 5197), north wall door (5212) Westerkerk, Amsterdam
- 1634 – town council pews, Grote Kerk Monnickendam (5211)
- 1636 – baptismal gate (5196), pews (5199, 5215), portal doors (5199), Dorpskerk, Bloemendaal
- 1638 - cabinet de Schermer Polder administration, Municipal Museum Alkmaar (0)
- 1639 – porch, Huydecoperhuis, BK-BFR-419, Rijksmuseum Amsterdam (5199)
- 1642-3 – pulpit, Oude Kerk, Amsterdam (5199, 5211)
- 1645 - table, BK-16626, RMA (depot) (0)
- 1645 – government pews (column 27) Oude kerk Amsterdam (0)
- 1645 – baptismal gate, Grote kerk, Beverwijk (5211)
- 1645-1649 – pulpit, (0), pews, (5216) Nieuwe Kerk, Haarlem
- 1648 – portal Grote kerk Oosthuizen 5210b
- 1647-1649 – pulpit stairs, Nieuwe Kerk, Amsterdam (5206)
- 1649 – pulpit, portals, Marekerk, Leiden (0), (0)
- 1649-1664 – lectern baptismal gate, (5199, 5210b, 5216, 5215, 5212), panelling of pews, (5210b) Nieuwe Kerk, Amsterdam
- 1650 – consistory room Furniture, Grote Kerk, Alkmaar (5206)
- 1651- pews churchwardens, Grote kerk, Alkmaar (5196)
- 1652 – pulpit (0), pew (5213), Oude Kerk, Heemstede
- 1654-'55 – pews burgomasters, Grote kerk, Alkmaar (0)
- 1657 – baptismal gate, Grote kerk, Edam (5211, 5200, 5215)
- 1657- pulpit (0), choir pew (5211), Grote kerk, de Rijp
- 1659 – pulpit, Kerk Buikslotermeer (5206)
- 1659 - Kast BK 15509, Rijksmuseum Amsterdam (5213)
- 1660 – pulpit Martinikerk, Bolsward (0)
- 1663 – governments pew, Grote- or St. Vituskerk, Naarden (5199, 5211, 5216)
- 1664 – pulpit Grote- /St. Nicolaaskerk, Oosthuizen (0)
- 1665 - pulpit, Grote kerk, Alkmaar (5199)
- 1665 – pulpit, Kerk Beets (5200)
- 1665 – wall panelling Leprozenhuis Amsterdam BK-AM-23, Rijksmuseum Amsterdam (5211, 5210b, 5216)
- 1667(?) – dignitaries pew (5206/5211), dignitaries pew with tester (5197), pew with festoons (5211) Grote kerk, Beverwijk
- 1669 – church warden benches, Grote Kerk, Alkmaar (0)
- 1671 – pulpit (0), pews (5216/5208), Oosterkerk A'dam
- 1680 – baptismal gate, Kerk Beets (5216)
- 1681 – pew (east pillar), Grote- or St. Vituskerk, Naarden (0)
- 1691 – pulpit, St. Martenstjerke, Boazum (5197)
- 1695 – pulpit, Grote kerk, Monnickendam (0)
- 1697 - table, BK-16884, J. de Rijk, Groningen, Rijksmuseum Amsterdam (0)
- 1702 – pews, Buiksloterkerk (5211, 5209)



Fig. 10 Detail of Joseph's guild panel, 1648, Pieters Church, Leiden.  
© The authors.

But how representative were the Arendsz planes for Dutch plane making practice of the day? Did Wrangel procure the most expensive type of tools available, as one would almost expect of an aristocratic military commander?<sup>24</sup> Is there evidence of a cheaper type of tools, less decorated perhaps, but functional none the less? Historic depictions and archaeological finds from the late 16th century to the late 17th century show that a more varied range of plane types did indeed exist, albeit within different woodworking trades. Pictures of carpenters and joiners tools can be found on altarpieces or commemorative panels of the Joseph's guild and sometimes these paintings show narrow planes – possibly moulding planes – that are of a relatively simple, undecorated rectangular type.<sup>25, 26</sup>

A detail of the 1648 panel in the Pieters church, Leiden illustrates that narrow planes of two types were in fact known; the ones that had a mortise for the iron cut in from the top of the body and a type that had a more elaborate plane body with a volute but the iron set in a recess simply cut into the side of the body (fig. 10).<sup>27</sup> The variation in form is also found in three early moulding planes from a Dutch ship that was wrecked in 1593.<sup>28</sup> They are of a fairly crude execution, probably user made, in part fitted with



Fig. 11 Scheurrak SO1 find SO1-14715,  
© Batavialand/Rijksdienst voor het Cultureel Erfgoed, Amersfoort.

irons in mortises, in part with irons set in open recesses cut into the side of the plane bodies. One plane from this group has an integral front tote (fig. 11).<sup>29</sup> A drawing of a 17th century frame maker's shop shows a mixed set of planes hanging on the wall, some seem to be of the top-mortise type and others of the open-throat model. Dutch picture frames of the period often had much finer mouldings than available in the Arendsz' set. As they were commonly made in materials like fruitwood or tropical hardwoods or even tortoise shell and baleen, the dense character of these materials with much variations in grain would have made planes or scrapers with blades set at an angle steeper than c. 51° indispensable (fig. 12).

Part of the variety in plane types could be caused in their being user-made. Obviously such a home-made aspect makes the uniformity of fashionable profiles less likely. The success of the more decorated Arendsz plane type that continued to be made for the Dutch market until the 1950's on the other hand, seems to be connected with the development of professional plane making in the Netherlands and the inherent standardisation through guild regulations of a quality tool that could have commanded higher prices.

Jaap Boonstra  
Furniture Conservator  
Amsterdam Historical Museum  
j.boonstra@amsterdammuseum.nl

Pol Bruijs  
Cabinetmaker and Furniture Conservator  
p.bruijs@hetnet.nl

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#### Notes

<sup>1</sup> Wider moulding planes may be fitted with an escapement on top, but they are not present in the Arendsz-collection.

<sup>2</sup> This point is made by Goodman/Rees, 1993, p. 32, who wrote: 'Conventional wisdom holds that bench planes, unlike moulding planes which were laid aside when the mould they made was no longer required, were always of use and were used until no longer fit. This is a thesis which we accept [...] this theory of survival by obsolescence.' W.L. Goodman, 3rd edition enlarged and revised by Jane and M. Rees, *British Planemakers from 1700*, Astragal Press: Needham N.J., 1993, p. 32.

<sup>3</sup> See Knutsson, Johan and Bengt Kylsberg. *Verktyg och Verkstäder på Skoklosters slott*, Utställningskatalog, 1985, Skokloster-studier nr. 19, utgivna av Skoklosters slot, p. 11-12.

<sup>4</sup> Jan Arendsz Wissing (Mr.) (Jan Arendtzen Wijssijnch) [...] Born c. 1614. Came from Burgstijnforden (Burgsteinfurt, Nordrhein Westfalen); married 1646; remarried 1657. See Gerrit van der Sterre. *Four centuries of Dutch planes and planemakers*. Primavera Pers, 2001, p. 226.

<sup>5</sup> National Archives of Sweden, 6375. *Skrivelser till*

*C.G. Wrangel*, E 8502-E8503. Unfortunately the original document was not available for study. Instead, a transcription from the van der Sterre archive, now at the Gereedschap Museum Mensert, Delft, was used here.

<sup>6</sup> *Dedicated*, or *complex* moulding planes: a type of moulding plane that has integral depth stop and fence so as to repeatedly produce exactly the same moulding. See Bickford, Matthew S. *Mouldings In Practice*, Lost Art Press: Fort Mitchell, 2012. In the catalogue of the Dutch plane maker Nooitgedagt the description '*vaste (lijst)schaven*' (lit. 'fixed' or 'stuck' moulding planes) was used. See Anon. *Album van Schaven Beitels en andere gereedschappen voor Timmerlieden, Kastenmakers enz: & Schaatsen van J. Nooitgedagt*, IJlst, ca. 1891.

<sup>7</sup> In principle all the elements used in wood mouldings were introduced in classical Greek architecture. The European Renaissance period brought about a reawakened interest in Greek art and architecture and Italian architect-authors like Vignola, Palladio and Scamozzi published their interpretations of the classical examples. But although the basic rules and elements were thus known, they still lent themselves to endless combinations and variations in size, steered by individual



Fig.12 Interior of a frame makers shop. Attributed to Salomon de Bray, 1646(?), British Museum, London, © The Trustees of the British Museum.

or local preferences and creativity.

<sup>8</sup> Here we have tried to follow the approach of Goodman/Rees, 1993, p. 45-46, who wrote on this: 'As an aid to understanding the development of the moulding plane we have found it helpful to consider three aspects. Firstly the style, by which we mean the size of the chamfers, the finish to them, the shape of the shoulder and the wedge and other like matters that do not directly affect the function. Secondly, there are constructional matters – this principally means boxing, slips, etc and thirdly, and perhaps most importantly, there is consideration of the development of function – that means tracing the development of different moulds required by changes in furniture and architectural style and the ever advancing technology of the plane.'

<sup>9</sup> van der Sterre, Gerrit. *Four centuries of Dutch planes and planemakers*, Primavera Pers, 2001, p. 67.

<sup>10</sup> The standard pitch of irons in traditional Dutch planes is 50° according to van der Sterre, 2001, p. 49.

As the result looks very similar to Dutch planes (decorated) and British planes (less decorated) that were produced until the early 20th century, it is suggested by van der Sterre that already in the 17th century a different less decorated type of plane was produced for export by Dutch planemakers. See further in Van der Sterre, Gerrit. "A visit to Skoklosters Slott, Sweden", *TATHS Newsletter* 33, Spring 1991, p. 25-32.

<sup>11</sup> As this does not explain the mix of the two types of decoration in one delivery, I would like to suggest another explanation. Since producing the less decorated plane takes considerably less time (c. 8 %), the reason to do so with part of the planes may simply have been in the rushed nature of the order. It is known from archival information that between the order on 26 March 1664 and delivery in July that same year Wrangel urged Trotzig repeatedly to speed up the delivery.

<sup>12</sup> Much of the observations here are similar to what has been published on late 18th century British plane irons in Rees, Jane (ed.). *The Tool Chest of Benjamin Seaton, 1797*. 2nd edition, The Tools and Trades History Society, 2012, p. 85-86.

<sup>13</sup> The title translates as: *Album of Planes, Chisels and other tools for Carpenters, Cabinetmakers etc. & Skates of J. Nooitgedagt*. While these planes were meant for both carpenters and cabinetmakers, at least part of them will have been used for architectural purposes which implies a larger size and possibly some allowance will have been made for subsequently applied paint layers.

<sup>14</sup> The invoice holds two more items with the description *kijste macker*, while in 13 instances the tools are meant for a *huss tymmerman* or carpenters, none of them planes.

<sup>15</sup> Whelan, John .M. *The Wooden Plane, Its history, form, and function*. Astragal Press, Mendham NJ, 1993, p. 178

<sup>16</sup> Whelan, 1993, p. 273: 'Moldings at the juncture of two surfaces at different levels (as, for example a stile and a panel) and projecting beyond both are called bolection [...]. In small frame and panel work, it is usual to cut grooves in the stiles and rails into which the panel edges fit [...]. This requires that the panel be installed before the final joining of stiles and rails, which can be troublesome in large work. One option is to rabbet, rather than groove, the frame members. These can then be assembled, the panels dropped into the rabbets and held there with an applied molding. While such a molding may be attached to the edge of the rabbet, it is easier to attach it to the face of the frame, and so the *bolection* came into being. It is molded on the visible face and rabbeted on the other side to conform to the difference in level between frame and panel face. Not only was this construction method easier to manage, but it also invited decoration of the applied molding. There is more freedom to create unusual profiles when cutting a molding strip than there is in working large members, a fact that was seized upon by the early joiners. There were more elaborate profiles created for this use than for almost any other. [...] *Bolections* were also used at the top of baseboards or to cap wainscots, and as part of a built-up complex molding.'

<sup>17</sup> Former Museum's curator Arne Losman mentions in the introduction to Knutsson/Kylsberg 1985, that the luxury tools of the initiator of the building count Wrangel, were in later years used by the castle's armourers and other technicians.

<sup>18</sup> The replica planes were copied from old prototypes that were generally in good condition, but not 'as new'. Some had a more or less worn sole, some plane bodies had received altered depth stops or had deformed slightly due to shrinkage. As a control the scans of the plane blades that didn't appear to have been re-sharpened in the past were therefore traced as well, the tracing then tilted according to the bedding angle and skew of the blade in the plane body. The projected image of the plane blade was then compared to the 'nose-scans' of the plane bodies and corrections were made if necessary.

<sup>19</sup> <http://www.handplane.com/33/practical-plane-making-2/> accessed 31 July 2022.

<sup>20</sup> *stu.* is the abbreviation of *stuivers*; one guilder = 20 *stuivers*, 1 *stuiver* = 16 *penningen*.

<sup>21</sup> The authors are most grateful to all those generous people who allowed them to do photography and probe old mouldings of antique furniture and architectural furnishings

<sup>22</sup> It was hoped that occurrences in dated Dutch furniture or carpentry could reflect the popularity of the profiles. To obtain a statistically more valid result absence was noted also.

<sup>23</sup> Sterre, van der, 2001, p. 67, 112

<sup>24</sup> Some parts of Wrangels tool collection such as the optical instruments must be seen as the fruit of a genuine interest in new technology, while others like the lathes may have been a mere aristocratic pastime or purely meant to form a representative luxurious environment. Whether the Dutch moulding planes bought by Wrangel were actually used privately remains unclear. Nor have they been linked to precisely matching mouldings in the Skokloster castle to date. Workers that were actively involved in interior woodwork projects after 1664 and before Wrangels death in 1676 are D. Knutsson, Slange and Sivers. Aside from that, important interior woodwork projects had been carried out in the years just before the delivery of the Arendszen-tools (Schröder and crew), while other items were delivered by shops from Stockholm (Funck and Gillis from 1657 onwards). After Wrangels death the building activity and decoration of the interiors stopped. In later centuries the castle needed continuous upkeep and this was often done by staff that had in-house workshops, sometimes using tools from the collection (note 17). Knutsson/Kylsberg, 1985.

Andrén, Erik. *Skokloster – ett slottsbygge under stormaktstiden*, Doctoral thesis, Stockholm, 1948.

<sup>25</sup> *The predella of the Joseph altarpiece* by Michiel Claesz., c. 1565, Museum Catharinagasthuis, Gouda.

<sup>26</sup> *Joseph's guild panel*, 1648, Pieters church, Leiden.

<sup>27</sup> This 'sinking' of the mortise is a fairly laborious process compared to the other type of plane body which requires a much simpler technique of merely cutting an open throat from the side of the stock to accommodate the blade and wedge. The advantage of the first type is that the stock is less likely to warp and distort due to pressure exerted by the wedge. The second model on the other hand, is produced much quicker and without any specialised tools. (Whelan, 1993, p. 79-80).

<sup>28</sup> Inv. SO1-8539, SO1-8540, SO1-14715.

<sup>29</sup> The illustration of tools used in shipbuilding in the manual by Nicolaas Witsen from 1672 seems to indicate that plane bodies in the shipbuilding trade 80 years later were still very sober and undecorated.

Witsen, Nicolaes. *Aeloude en hedendaegsche Scheepsbouw en bestier etc.*, Amsterdam: Caspar Commelijn, Broer and Jan Appelaer, 1671.

# Mahogany Spheres – Reconstruction of an Artistically Crafted Element of a Writing Cabinet by the Berlin Ebenist Joseph Schneevogl (1795–1864)

Angelika Rauch  
Jörg Weber



Fig. 1 Writing cabinet by Joseph Schneevogl, ca 1835, Preußische Schlösser und Gärten Berlin-Brandenburg. Image by M. Heincke.

In the summer of 2017 we had been asked by Dr. Achim Stiegel, curator of the furniture collection at the Museum of Decorative Arts in Berlin, whether teachers and students of the Conservation and Restoration of Wooden Objects programme at the Potsdam University of Applied Sciences, could take a closer look at a few elements of a writing cabinet by Ebenist Joseph Schneevogl made around 1835 – to maybe even try a reconstruction and document the process (fig. 1).

Officially three project weeks were allocated to achieve an exhibition-ready result. We also had the ambition to document the production process in words, pictures and with video.

Joseph Schneevogl (1795–1881), a gardener's son from Bavaria, learned the cabinetmaker's trade, and on his journeyman's trip also came to Berlin. In 1828, he was accepted as a master cabinetmaker, married the eldest daughter of Christian Sewening, a well-known ebenist from Berlin and then took over the workshop in Wallstraße after Sewening's death.<sup>1</sup>

He created this impressive piece of furniture in Berlin around 1835 and displayed it in his workshop rooms. It is

thought that it served to demonstrate the range and quality of his work to potential clients.

The idea that the sophisticated mechanics, the quality of the veneer and the balanced form were achieved without the use of machines can surely only astonish those who have an understanding of all the individual steps of the making and who can imagine how much time and sweat went into planing and sawing each individual board, curve and profile moulding.

But why do you even take on such a task as part of a restoration course? Essential aspects of conservation sciences are the methodical and technological investigation of facts, but also the recording and passing on of knowledge that can be gained through experience-based comprehension of materials and technical contexts. A very special area of wood conservation - the study of historical production methods – provides support and information in this regard. Some of these methods have been completely lost today and are no longer practised. To pass these on is just as important as the preservation of the material cultural heritage itself.



Fig. 2 Front corner of Schneevogel's writing cabinet, Preußische Schlösser und Gärten Berlin-Brandenburg. Image by M. Heincke.



Fig. 3 Close examination of the object. Image by L. Lessinger.

One of the questions when choosing the component to be reconstructed was: What is guaranteed not to be made by hand by any cabinetmaker today? Which part of the furniture offers us as many challenges as possible for today and thus a great gain in knowledge?

The choice fell on one of the front corners with its many circular profile shapes and the spherically ending conch (fig. 2). We wanted to find out how to cover all the different components using only one sheet of veneer, how to glue brittle, unruly pyramid mahogany into a conch with glutinous adhesive that has only a short open time, how to make profiles and spheres without a router and CNC technology.

Dealing with historical techniques does not necessarily exclude modern techniques altogether. Digital media and machines were employed primarily to understand the construction and the cutting of the wood in order to save time.

#### Object examination and research

Every reconstruction begins with measuring the original (fig. 3). All accessible components of the complex corner

were measured: every band, veneer turn and visible joint. Veneer thicknesses were recorded at different locations, as it could be assumed that the mahogany had certainly been thinned in the area of the rounded mouldings.

In order to understand the substructure and also the construction principle of the circular profiles, each gap was examined. The object's restorer Marc Heincke (*Stiftung Preußische Schlösser und Gärten Berlin Brandenburg*) was able to pass on important insights into the construction details based on the restoration work he had carried out previously.

Apart from the construction, the veneering of the conch and the veneer pattern that was continuous across all components were particularly puzzling. In addition to our own observations, it was mainly historical that provided important information about veneering techniques. The relevant sections in the "Practical Handbook for Carpenters and Other Woodworkers by F. Gehrke from 1843<sup>2</sup> as well as articles on veneering from the '*Berlin Fashion Magazine for Carpenters*', which appeared weekly from 1844 to 1846<sup>3</sup>, make it obvious that the problem of veneering a conch is not only a technical challenge for us today.



All of the knowledge gained so far and the initial considerations regarding structure and workflow now had to be compiled, checked and placed in a logical order.

To find out how much wood would be required and what cutting method to use, the measurements and observations were converted digitally into an idealised drawing. A cutting list and an initial workflow plan were created. How is which element cut, glued, veneered and in what order? In fact, the working sequences turned out to be completely different from what was initially expected.

As far as we could determine the conch was glued from a block of fourteen boards. It was assumed that these were sawn out into arc segments before they were glued, in order to make later processing easier and to save material. These radii had to be laboriously determined through drawings (fig. 4).

Examination of the original also revealed the structure of the circular shape of the mouldings. It turned out that these were created from originally straight rails that were separated into small pie-shaped pieces and then glued together again in a circular shape. The angles of the individual profile segments could also be determined in the digital construction drawing. We assume that the upper cylinder and the small disc were each made from one piece.

Veneer preparation

Once the construction was planned, preparing the veneer turned out to be the first major challenge: a stack of mahogany veneer sheets was available. However, the veneer was warped in all directions and had many cracks and defects. Since further processing was initially not possible, the first task was to make the very brittle veneer sheets more flexible and to flatten them. Thinning out the individual sheets was not necessary, as their thickness corresponded to that of the original.

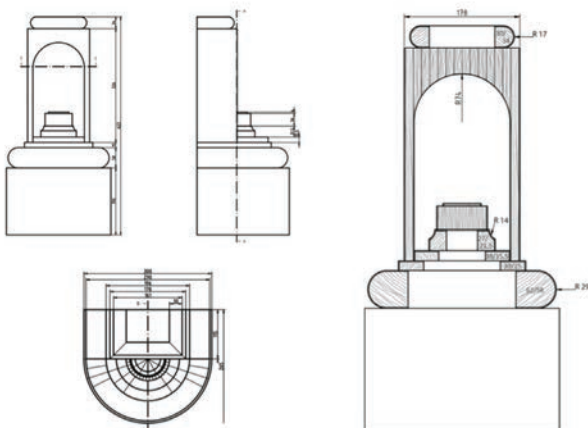


Fig. 4 Technical drawings of the reconstruction. Drawings by S. Zschommler.

First attempts with water and pressure did not produce satisfactory results: water stains formed, mould grew in some areas and the veneer remained brittle.

Using instructions from historic sources – drawing on the wealth of knowledge of the cabinetmakers around 1845 – the individual sheets of veneer were ultimately prepared successfully in the following manner:

We coated the front side of the moistened veneer with a glue size after which tissue paper was laid on top and smoothed out. In order not to trap the moisture in the veneer, we first laid wrapping paper and then an uncoated plywood sheet on top of the veneer. We then let this package dry for at least one night, weighted down lightly with sandbags. In 1846, master carpenter Zweig from Erfurt gave the additional technical advice that in order to avoid cracks when laminating veneer on substrate, it would be best not to heat the substrate too much, to use a strong glue and to press the veneer on quickly with a very evenly heated caul.<sup>4</sup>

Subsequently, the division of the now prepared veneer had to be planned. The length of all the required veneer segments was calculated and cutting templates were created. Contrary to the view often repeated in the literature that one single sheet of veneer is used to cover all vertical surfaces, we came to a different conclusion. Due to the overlaps and overhangs necessary for veneering, it is not possible to get by with just one sheet, but one must work with several consecutive sheets of the veneer stack (fig. 5). At first glance it looks as if a single sheet of veneer runs from bottom to top across all elements of the cabinet, but this is merely a clever deception. To achieve this illusion of a continuous pattern, our cabinet corner required a total of three veneer sheets that were as matching as possible.

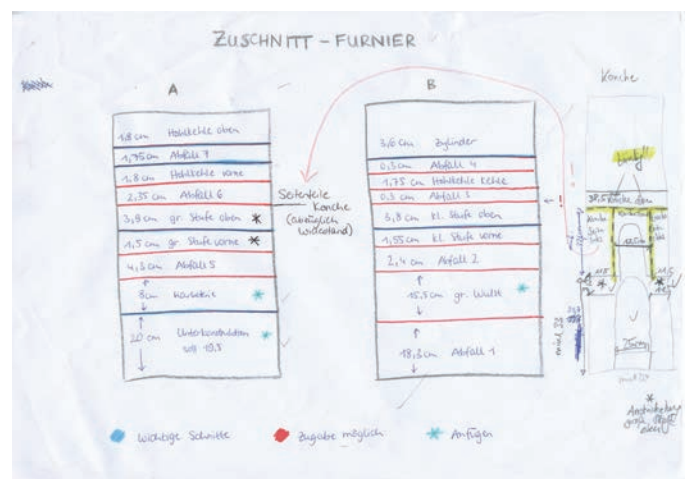


Fig. 5 Sketch of the arrangement of the veneer sheets with the aim to cover all the components in a way that pretends the use of only one sheet. Image by L. Lessinger.

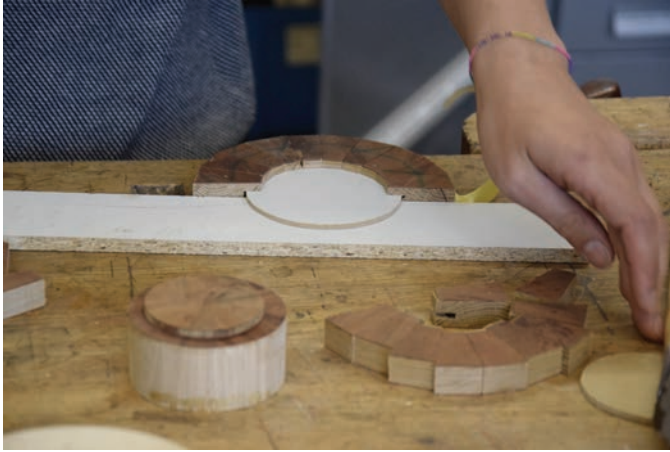


Fig. 6 Gluing up circle segments to create a circular moulding. Image by L. Lessinger.

### Mouldings

Parallel to the preparation of the veneer, the substrate was cut from oak and pine. Modern woodworking machines were used for this step to save valuable time. The various profiles were hand-planed out of the oak rails. To ensure the later flush glueing of the circle segments in one plane, a groove was cut in the back, into which a connecting board could then be inserted (fig. 6). The small cylinder inside the conch could be turned. Now it was time to veneer the individual parts. Following we will focus on a few selected challenges.

To veneer the large semi-circular moulding the matching piece of veneer firstly was moistened and carefully pre-bent with the help of the slightly warmed bare wood. Then a mixture of bone and hide glue was thinly spread on the heated moulding and the veneer.

In order to apply sufficient pressure to the entire glue surface, a non-stretchy fabric was placed around the moulding, tensioned and tightened. This procedure may sound straight forward, but various difficulties appeared during the first veneer trials: if the glue was too thin, it penetrated the veneer. If the veneer was prepared by, as described in historic texts, dry or too warm pre-bending, it tended to become brittle. Undesirable side effects such as cracks caused by soggy glueing could not be detected. Occasionally, tension and pressure were not sufficient due to the elasticity of the fabric, which is why wooden cauls and clamps were used. After a drying time of at least twelve hours, the semi-circular moulding was divided into pie-shaped individual segments and these were then glued together. The difficulty here was that the final smooth outer shape could only be produced after veneering.

This in turn means that the already thin veneer of 0.6 mm thickness had to be partially removed. Only then does the ring shape finally emerge from the many corners. Adhering the segments accurately was very important as it minimises the risk of sanding through the veneer. After several unsuccessful attempts to glue the segments into



Fig. 7 Gluing up the substructure of the conch. Image by L. Lessinger.

the basic round shape with the help of a strap they were assembled individually for a precise fit. However, during the final surface treatment, sanding through could not be completely prevented and so the substrate unfortunately shines through in a few places.

### Conch

The entire reconstruction of the conch – from substrate to veneer – turned out to be a special task. That this had also been a challenge for Schneevogl's contemporaries is demonstrated by a competition that was advertised in the *'Berlin Fashion Magazine for Carpenters'* in 1844. The editor posed the question: "What is the simplest and most advantageous method of decorating a niche? The prize is a *Friedrichs d'or* and will be awarded by the editors to the person whose method is recognised as the most practical."<sup>5</sup> Only very few responses were received. One, which we will discuss later, presents various counter-forms. In 1845 Ernst Weber from Artern described a solution in which not the complete conch but the individual sections of the substrate are firstly veneered individually and only later glued up into the required shape. In his case, the preparation of the hollow body is quite complex and involves many steps.<sup>6</sup>

We however proceeded as follows: in order to create a hollow space, we accurately cut 14 small boards. We found out that the process of glueing neither allows for measurement deviance nor imprecise angles. Luckily we had planned material for three conches. After a first, unsatisfactory attempt we successfully used a glueing aid for the remaining two samples (fig. 7).

In the next step, the cavity of the conch had to be worked out from the inside. There were two options for achieving this: either the complete carving of the inner form or the turning out of the cylinder and the sphere. We tried them both and turning gave a much better result. For easier turning two of the conical blocks were glued

together at their fronts with an intermediate layer of newspaper for easier separation afterwards.<sup>7</sup>

The greatest challenge was probably veneering the inside of the conch. Eleven cuts in the veneer could be identified on the original. Our initial research suggested that the method of veneer preparation was probably modelled on the making of a globe. Contemporaries warned against using mahogany for such work and elaborately described all the necessary circle strokes for creating the spherical shape.<sup>8</sup> The adaptation revealed a subdivision of the hemisphere into twelve segments, which tapered upwards in a slightly convex shape and met at the tip. To be able to reproduce the shape of the segments, a print template for a globe was converted to the desired radius, transferred to the veneer and cut out (fig. 8). Using veneer tape, the segments were joined together before glueing and thus moulded into shape.

The most beautiful areas of pyramid mahogany consist not only of long-fibered wood, but also of end-grain sections, i.e., brittle material, which made both the cutting of the globe tips and the bending into shape considerably more difficult.

The next step was to make the counter-form for glueing the veneer. Master carpenter C. A. Holm from Hamburg suggested in 1844 using an air-filled leather bag as a caul or peat that could be shaped with a rasp. "One takes peat that is completely loose, preferably light yellow, and glues it onto a piece of wood that has the shape of the niche. When this has dried, it is shaped exactly so that it fits into the niche, but a good thickness smaller. Shaping is easily done with a rasp. This method is highly recommended. The caul is very elastic..."<sup>9</sup>

We however experimented with sand first. But, since it was not possible to create sufficient lateral pressure with warm sand bags, a counter-form was used, which consisted of modern materials, among others (fig. 9).

Unfortunately, due to the lack of time, shortcuts were taken at this point of the technical reconstruction, which

in retrospect must be evaluated as unfavourable for the result. But the sources of the time also give the impression that this very process was problematic.

To compensate for any hollow areas under the veneer, phenolic resin beads had been added to the animal glue. The bumps and dents in the veneer caused by the uneven pressure could be evened out afterwards with a heated spatula. Despite moments of crisis and the decisions made under great time pressure, quite an acceptable result could be achieved.

After finishing all the individual components of the reconstruction, the treatment of the surface could now begin. There was no analysis done on the composition or layers of the original coating of the writing cabinet. However, the gloss level, hardness and colour allowed the assumption that a coating system common in the period around 1835 could have been used, consisting of oil sanding followed by a shellac polish.<sup>10</sup> Both techniques were applied on the reconstruction. After the oil finish had dried for quite a long time, the shellac polish was applied.

The polishing process proved to be particularly difficult on the inside of the concave space of the conch, since it was difficult to maintain uniform pressure with the polishing pad without hitting the side walls and causing polishing defects there (fig. 10). Through completing the project, we gained valuable experience and knowledge but there are still some questions.

While the study of historical manufacturing methods is an important part of conservation studies, it is rare to have the opportunity to work on such a project. Learning more about how something was made raises awareness of the quality of the work you have in front of you. In addition, learning about the problems that a technical process entails can also explain the causes of damage. Last but not least, restoring objects nearly always involves using the techniques that were relevant in their manufacture in terms of construction, veneering and surface treatment.



Fig. 8 Preparing the veneer for the spherical upper part of the conch. Image by L. Lessinger.



Fig. 9 Veneering using a negative form. Image by L. Lessinger.

One insight that we gained is that even after careful planning you will underestimate the experimental phases. You have to allow for a much longer experimental stage to really develop or perfect a technique. In this case, this is especially true for the veneering of the conch. There must have been sophisticated aids in Schneevogl's workshop – such as moulding counter-shapes or glueing aids, which we would still have had to develop.

The question of how the veneer sheets were used to laminate the individual parts, the basic production of the circular mouldings from pie-shaped segments and the moulding of the veneer inside the sphere have largely been answered. But here, too, it became apparent that the slightest deviations have a great effect on the quality of the result.

Schneevogl, although he did not have a circular saw with a pre-set angle at his disposal, worked more accurately than we did in our experiment. In other places we were certainly hasty and cut parts to final size where more play would have been needed later. Nevertheless, the result is quite respectable.

We hope that with this project, the result of which is available as a video, we were able to make a small contribution to a better understanding of historical techniques.

After all, they appear on Schneevogl's furniture in all kinds of variations. They invite us to check our results and to perfect the solutions, which we will certainly do with another group of students in the future.

Prof. Dr. Angelika Rauch

University of Applied Sciences, Potsdam, Germany  
angelika.rauch@fh-potsdam.de

Dipl.-Rest. Jörg Weber

Head of Workshop, University of Applied Sciences,  
Potsdam, Germany  
joerg.weber@fh-potsdam.de

## Notes

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Fig. 10 Polished end result. Image by A. Rauch.

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<sup>9</sup> *Man nimmt von ganz losem Torfe, am besten von hellgelbem und leimt ihn auf ein Holz, das einigermassen die Form der Nische hat. Wenn dies getrocknet ist, dann formt man es genau so, daß es in die Nische paßt, aber eine gute Fournirdicke kleiner. Das Formen geschieht leicht mittelst einer Raspel. Diese Methode ist sehr zu empfehlen. Die Zulage ist sehr elastisch.*

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# Construction Features that are Typical for Marquetry Cabinets by Jan van Mekerem

Paul van Duin  
Iskander Breebaart



Fig. 1 Jan van Mekerem, Cabinet on stand, Amsterdam c. 1695–1710. Oak veneered with ebony, kingwood, olivewood, holly and other wood species. 205,5 cm high, 174 cm wide, 61 cm deep. Rijksmuseum, BK-1964-12. © Rijksmuseum.

The Rijksmuseum furniture conservators have studied furniture attributed to Jan van Mekerem (Tiel 1658 – Amsterdam 1733) for several decades after the conservation treatment of his marquetry cabinet and table in the Rijksmuseum.<sup>1</sup> Van Mekerem is exceptional, not only because his floral marquetry is of outstanding quality, but also because he is the only Dutch cabinetmaker from the late 17th century to which furniture can be attributed with certainty.<sup>2</sup> His large cabinets on stand are characterized by intricate large flower bouquets (fig. 1). The flowers, birds and insects in the marquetry on these cabinets are cut after the same designs, but are arranged in different order for each cabinet.<sup>3</sup>

Around 1700, large cabinets on stands like Van Mekerem's cabinets were very popular. The decorations on the large flat surfaces of these cabinets vary from different types of floral marquetry, seaweed marquetry to geometrical marquetry with stars, ovals and semi-circles.<sup>4</sup> Our main research question was to identify technical features specific for Jan van Mekerem. If these existed, they

would be an important tool to decide if he also produced cabinets with other decorations than the large flower bouquets. At the time we did not yet know neither what to look for, nor whether this approach would work.

From year 2000 onwards we have compared the construction of some fifty different cabinets on stand. They all share a very simple shape: a rectangular two-door cabinet with large flat surfaces and modest mouldings, resting on a stand with four, five or six legs which are connected by a stretcher below. We made detailed descriptions, photographs and drawings of their construction features, dimensions and materials (fig. 2).<sup>5</sup> We were surprised to find many differences in construction details, which greatly encouraged our research.

The results of this comparison, including the investigation of 10 marquetry cabinets in England in 2018, exceeded our expectations.<sup>6</sup> These late 17th century cabinets on stands show a great variety in construction. The construction of the doors, sides, drawers and stands differs considerably in detail. To give just some examples

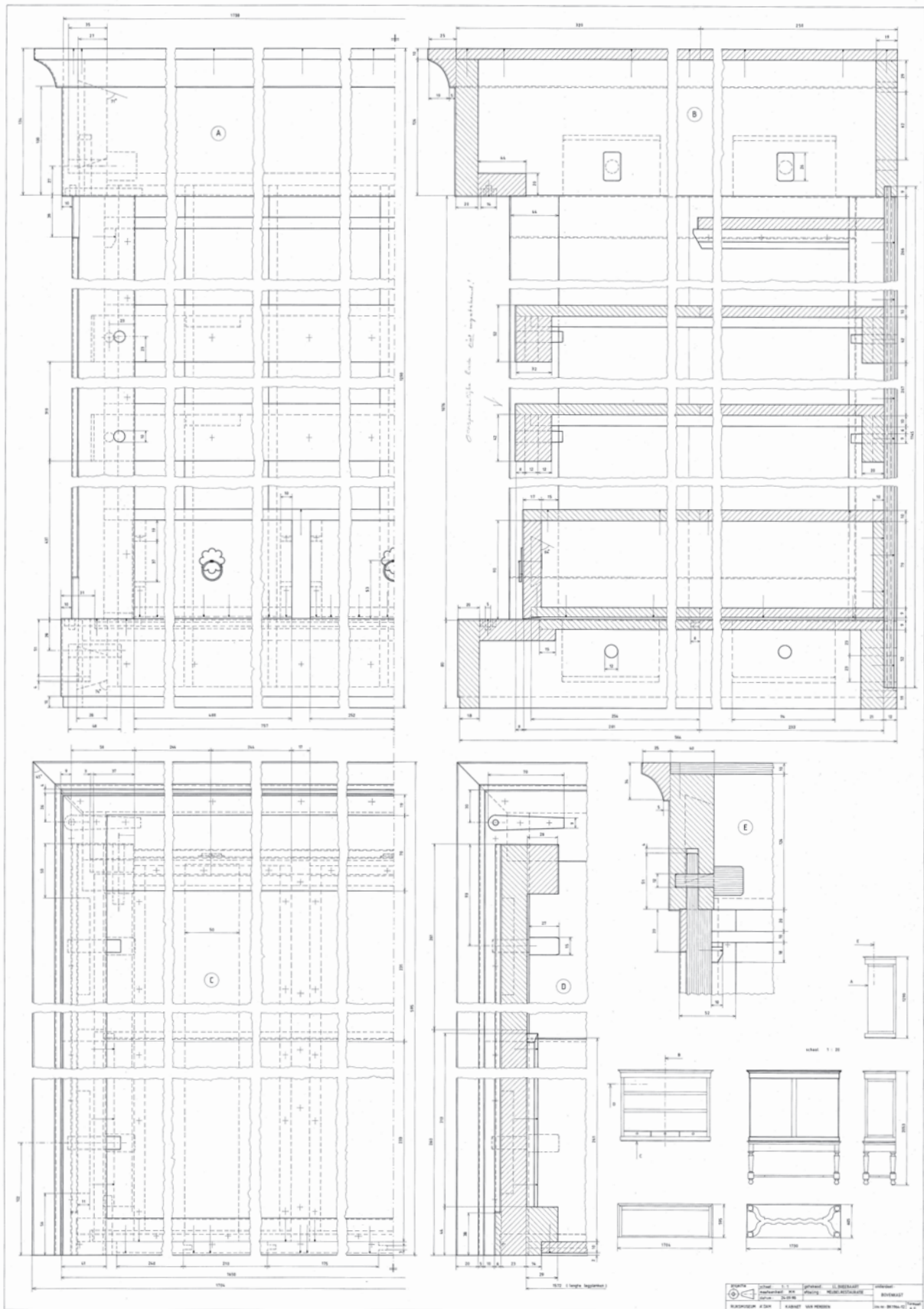


Fig. 2 Drawing by Iskander Breebaart of the construction of the cabinet of Figure 1. © Rijksmuseum.

of endless variations: doors can be hollow or of solid wood, with or without cleated ends, or consist of frames with thin panels, and the boards can be butt-joined or joined with tongue and groove.<sup>7</sup> Sides can consist of a thin panel on a frame, or just vertical boards, and can be with or without stiles. Drawer frames and legs of stands can be connected with dovetails, butt-joints, nails, or mortise and tenon. Dimensions of the various components can also vary.

The research has significantly contributed to our knowledge of the different construction types that were applied around 1700 in The Netherlands and has allowed us to form groups that share the same construction features.<sup>8</sup> We now feel confident that we have achieved the aim formulated in 2000 to identify the typical features for Van Mekerens's furniture.

In this article we will describe those construction features in detail, preceded by an overview of cabinets that share them.

#### Overview of furniture made by Jan van Mekerens

The cabinet and table by Van Mekerens in the Rijksmuseum are very similar in appearance to two cabinets and two tables in Castle Amerongen, and a smaller cabinet in the Metropolitan Museum of Art in New York.<sup>9</sup> They all have large floral bouquets, of which the individual flowers are after identical designs but arranged in different order on each cabinet. This also applies to the birds and insects sitting on or flying around the flowers. It was therefore not surprising that we established that the above mentioned cabinets are all identically constructed, like the other cabinets with large bouquets of flowers in the Victoria and Albert Museum,<sup>10</sup> Charlecote Park, Warwickshire, UK,<sup>11</sup> and at Zebregs&Roëll in Amsterdam.<sup>12</sup> The marquetry of the cabinets in the V&A and Zebregs&Roëll has a background of walnut veneer, instead of ebony veneer.

A group of marquetry furniture with smaller bouquets, surrounded by large scrolls was identified to have a construction as well as many flowers, birds and insects identical to the cabinets mentioned above. Examples are a cabinet without a stand in Belton House, Lincolnshire, UK,<sup>13</sup> a cabinet and a table sold at Christie's in 2000 (fig. 3),<sup>14</sup> and a cabinet in a private collection.

To our surprise, a cabinet in Kingston Lacy, Dorset, UK, decorated with seaweed marquetry and resting on a stand with six S-formed legs shared exactly the same construction features.<sup>15</sup> In addition, the stand has an extra rail underneath the drawer to which the two middle front legs are connected. Recently a similar cabinet of identical construction was offered for sale by Zebregs&Roëll,<sup>16</sup> and another one, although not inspected, is at the Fabergé Museum in St. Petersburg.<sup>17</sup> Although the marquetry design is different, the construction is undoubtedly by Van Mekerens.

Dendrochronological research on some of the pieces described above indicates that oak of the cabinet with floral marquetry and scrolls sold at Christie's was felled between 1672 and 1693, preceding the furniture with large flower bouquets in the Rijksmuseum and Castle Amerongen, of which the oak has felling dates between 1695 and 1713.<sup>18</sup> We hope that in the future we will be able to perform dendrochronology on other cabinets by Van Mekerens, to obtain more insight in the chronology of his production.

#### Construction features typical for Van Mekerens cabinets

##### *Construction of the stand*

Above the bun feet are square housings connecting feet, legs and the bottom stretcher. The housings are cubes with edges of 10 cm. The typical wavy stretcher ends with a square shape in the middle of the housing, which further consists of a block above and below the stretcher. Together these form the cube. This layered construction is visible at the rear of the back legs because these are not veneered (fig. 4 and 6). The long middle part of the stretcher is connected with a nailed lapjoint to the two (or three, in case there are four front legs) diagonally placed parts of the stretcher which end in the housings (fig. 5 and 6). The veneers which are glued to the front of the stretcher are on either end secured in a saw cut.

Above and below the square tapering legs are relatively simple mouldings, with alternating hollow and round shapes, mitred together. The top parts of the rear legs are glued into the corners of the inside of the drawer frame which forms the top of the stand (fig. 5). The cabinet and table sold at Christie's in 2000 have spirally-turned legs (fig. 3), the cabinets with seaweed marquetry have S-shaped legs. The sides and back rail of the drawer frame are connected with dovetailed joints (fig. 4 and 6). The front rail, situated above the drawer front, is glued into a rebate of the two front legs. The drawer runners are fitted into grooves of the legs.

A semi-triangular moulding is glued to the side and front rails of the drawer frame, and has on the outside a small quarter round cross-grain moulding with a small triangular oak core (fig. 6). The moulding is slightly higher (5 mm) than the rails of the drawer frame, thus forming a recess into which the bottom of the cabinet fits. A small vertical piece of wood is nailed onto the back rail, to prevent the cabinet from sliding backwards. Initially it was assumed that this was a later addition, but similar pieces of wood or remnants in the form of nail holes are present on other Van Mekerens's cabinets.

##### *Drawer of the stand*

The large drawer of the stand fits underneath the front rail of the stand and between the housings of the legs and is supported by two drawer runners in the form of a



Fig. 3 Jan van Mekerem, Cabinet on stand, Amsterdam c. 1690–1700. Oak veneered with ebony, kingwood, olivewood, holly, and other wood species. 195 cm high, 174 cm wide, 61 cm deep. Christie's London, 11 May 2000, sale 6326, lot 250. © Christie's.



Fig. 4 Jan van Mekerem, Cabinet on stand, Amsterdam c. 1695–1710. Oak veneered with ebony, kingwood, olivewood, holly and other wood species. 205,5 cm high, 174 cm wide, 61 cm deep. Castle Amerongen, 237/1. Many of the construction features of van Mekerem's cabinets are visible at the unveneered back. © Rijksmuseum.



Fig. 5 Jan van Mekerem, Cabinet on stand, Amsterdam c. 1695–1710. Oak veneered with ebony, kingwood, olivewood, holly and other wood species. 205,5 cm high, 174 cm wide, 61 cm deep. Castle Amerongen 238/1. Left: Stand lying on its back. The legs are glued into the corners of the drawer frame. The wavy stretcher is a distinct feature of Van Mekerem's furniture. Right: The parts connecting the stretcher with the legs are lap-joined and nailed to the central part. © Rijksmuseum.





horizontal planks that, as mentioned above, are fitted into grooves in the legs (fig. 5). The sides of the drawer have a groove with which it slides on these runners (fig. 8). The sides are joined with two dovetails to the drawer front, or in some cabinets are nailed into rebates of the front. The back of the drawer is not dovetailed but just nailed onto the rear end of the sides. The bottom consists of two boards parallel to the front, joined together with tongue and groove. The bottom fits into rebates of the drawer front and the sides and is nailed underneath the back of the drawer.

### *Cabinet*

The upper part of the cabinet can be dismantled, to facilitate transportation. It consists of two sides which are fitted with two tenons into mortises in the plinth and two into the top (fig. 7). These joints are secured with removable wooden pegs. Two shelves which have the full depth of the cabinet are fixed with tenons into mortises in the front and back stiles of the sides. These joints also have wooden pegs to secure them. A narrow shelf, situated between the upper large shelf and the top, rests on two strips of wood which are nailed to the interior of the sides. The back consists of vertical boards, with tongue and groove joints. Two drawers are suspended below the

middle shelf. Three drawers are situated on the bottom of the cabinet, underneath a thin shelf which is secured into grooves of the stiles of the sides. The two large doors are pivot-hinged between the bottom and the top. To take the doors out, the top has to be slightly lifted. In order to do that, the wooden pegs of the mortise and tenon joints between sides and top need to be temporarily removed.

### *The bottom of the cabinet*

The plinth of the cabinet is constructed as a frame. The back rail fits with a dovetail into the side rails (fig. 4 and 7). It is slightly set forwards to provide room for the back boards. The front consists of a horizontal and a vertical element. The vertical element is mitered to the side rails, the horizontal element is situated behind it and sits in a rebate. Two thin tongue and groove joined boards are set into a rebate along the top of the frame.

### *The sides of the cabinet*

The sides of the cabinet consist of two 18 mm thick butt-joined boards, with stiles on the inside, glued onto the front and back (fig. 8-10). These stiles have mortises for the tenons of the shelves, as well as grooves for the thin shelf above the lower three drawers. A horizontal clamp of equal thickness as the stiles is glued between the stiles



Fig. 6 Joints in stand and bottom of the cabinet 238/1 in Castle Amerongen. The back rail and side rail of the drawer frame are joined with two dovetails. The top dovetail is partly hidden by a vertical piece of wood, which prevents the cabinet to slide backwards on the stand. Above it is the large dovetailed joint between back and side rail of the bottom of the cabinet. The boards of the back of the cabinet are nailed onto this back rail. © Rijksmuseum.



Fig. 7 The right side of the cabinet in the Rijksmuseum (fig 1). After dismantling the cabinet. The tenons fit into the top and bottom of the cabinet and can be secured with pegs. At the bottom is a horizontal clamp, which acts as a drawer runner for the lower drawers inside the cabinet. The shelf above the drawers fits into grooves just above the clamp. Mortises house the tenons of the two large middle shelves. A strip of wood at the top left supports the thin upper shelf. © Rijksmuseum.

against the bottom, acting as a drawer runner. Also on the inside, a strip of wood is nailed to the rear board, to carry the shallow shelf at the top. Along the top, bottom and rear of the exterior, a thin flat moulding is applied, framing the veneer and marquetry on each side. The outer ends of the doors form the front of this frame.

#### *The top of the cabinet*

The top of the cabinet is also constructed as a frame. The back rail is dovetailed to the side rails. Most cabinets have a back rail with one large dovetail on either side. Two cabinets with walnut as background veneer for the marquetry differ and have two small dovetails instead of one connecting it to the side rails (fig. 9). The front consists of a horizontal and a vertical element. The vertical part is mitered to the side rails, the horizontal section is situated behind it and sits in a rebate underneath the side rails. The thin deck consists of two boards which are nailed on top of the frame and is hidden behind a quarter hollow moulding which is glued around the front and sides of the top (fig. 9).



Fig. 8 Interior with half-open drawers of the cabinet 237/1 in Castle Amerongen. © Rijksmuseum.

#### *The back of the cabinet*

The back of the cabinet consists of thin tongue and groove boards and into grooves of the top back rail and the rear stiles of the sides. The back boards are nailed to the back rail of the bottom of the cabinet, and also to the back rails of the shelves (fig. 4, 6 and 9).

#### *Shelves*

The shelf above the three drawers in the bottom of the cabinet consists of two tongue and groove jointed boards which fit into a groove in the front and back stiles of the sides (fig. 8). Two partition boards between the drawers are nailed underneath the shelf to further support it. The large middle and upper shelves of the interior consist of a front and a back rail. The top of the shelves is formed by two thin tongue and groove jointed boards which fit into a rebate in the front rail and are nailed on top of the back rail. Two strips of wood connecting the front and back rail support these boards. Underneath the lower large shelf are two drawers. To support them, there is a drawer runner between the drawers nailed underneath the front and back of the shelf and two drawer runners on either side fitted into grooves in the sides. The narrow top shelf consists of only one board, and rests on two strips of wood (fig. 7 and 10).

#### *Doors*

The doors are hollow. Front and back each consist of three to four 8-10 mm thick vertical boards, butt-joined together. The interior consists of a mitered frame, with five horizontal stretchers.<sup>19</sup> Between these stretchers glue blocks are placed. The glue blocks that cover the butt-joins of the boards have the same grain direction as the boards. The glue blocks that are situated in the middle of the boards have a grain direction perpendicular to the boards. The back panel is glued and nailed to the frame and stretchers, the front is only glued.

#### *Drawers inside the cabinet*

The three drawers below the bottom shelf slide across the bottom of the cabinet. The sides of the drawers are connected with one big dovetail to the front (fig. 10). The back is nailed against the end of the sides. The bottom consist of two tongue and groove jointed boards, parallel to the front. It fits into a rebate of the front and is nailed underneath the sides and back. In some cabinets, the drawer sides have a rebate to accommodate the bottom.

Two drawers are fitted underneath the middle shelf (fig. 8). They are supported by two drawer runners that are fitted into grooves in the stiles of the sides of the cabinet, and on a drawer runner nailed underneath the middle of the shelf. The sides of the drawers have a groove with which they slide on these runners. The drawer fronts are extended on one side to hide the drawer runner underneath the middle of the shelf. The sides of each drawer are nailed into a rebate of the front. The back is nailed against the rear end of the sides. The bottom consist of two tongue and groove boards parallel to the front. It is nailed into a rebate of the front and underneath the sides and back. In some cabinets, the drawer sides have a rebate to accommodate the bottom.



Fig. 9 Top of the cabinets in Charlecote Park (left) and the Victoria & Albert Museum (right). The top of the V&A cabinet has two small dovetails instead of a large one. Notice the slight difference in the top moulding: The V&A cabinet has a small extension below. © Rijksmuseum, photographs Elise Andersson.

### Conclusion

Not all the features described above can be distinguished without dismantling the cabinet. Nevertheless, opening the cabinets reveals enough to make a judgement: the construction of sides, shelves, drawers and top (fig. 8 and 10). The joinery at the rear of the cabinet and underneath the stretcher and stand can hopefully be inspected with a mirror or camera on a cell phone. A light knocking can reveal if the doors are hollow. Underneath the hollow doors the end grain of front and back on either side of the frame should be visible. The joints between the boards continue over the full height of the doors.

And perhaps we did find one single feature that can be regarded as a signature of Jan van Mekerem: the saw cuts that extend from each hidden dovetail (fig. 4, 6, 8 and 9). We have not yet found these on differently constructed cabinets.



Fig. 10 The upper left corner of the interior of the cabinet of fig. 1 in the Rijksmuseum, revealing many of Van Mekerem's typical construction features. © Rijksmuseum.

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Paul van Duin

Head of Furniture Conservation  
Rijksmuseum, The Netherlands  
p.van.duin@rijksmuseum.nl

Iskander Breebaart

Senior Furniture Conservator  
Rijksmuseum, The Netherlands  
i.breebaart@kpnmail.nl

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# Australian Timbers and Contemporary Woodworking

Evan Dunstone



Fig. 1 Evan Dunstone, Heatwave Sideboard, 2009. Made from a single flitch of WA jarrah. 220 x 40 x 95 cm. Private Collection, Murrumbateman © Dunstone Design. Image by Bronwen Healy.

The dominant genus of trees in Australia is Eucalyptus, with more than 700 species comprising about 77% of the original native forest area.<sup>1</sup> Australia's second most common tree genus is Acacia, with Acacia forests making up 8.2% of Australia's original native forest area.<sup>2</sup> Despite the dominance of the Eucalypts and Acacias, temperate rainforest species constitute the bulk of the most prized Australian cabinet timbers. Queensland maple (*Flindersia brayleyana*), Tasmanian myrtle (*Nothofagus cunninghamii*), Australian red cedar (*Toona ciliata*) and Huon pine (*Lagarostrobos franklinii*) are examples of Australian rainforest species that have significantly exploited for fine cabinetry. All these species are now in very limited supply.

Of the eucalypts, only Western Australian jarrah, (*E. marginata*) is traditionally considered a fine cabinet species (fig. 1). The Western Australian government plans to ban the logging of State Forests from 2024, which will impact the availability of jarrah. A variety of eucalyptus species fall under the colloquial nomenclature "ash-group of eucalypts".<sup>3</sup> There are 35 key commercial species, of which mountain ash (*E. regnans*), alpine ash (*E. delegatensis*), messmate stringybark (*E. obliqua*) and silvertop ash (*E. sieberi*) are among the most significant.

The ash group of eucalyptus have some furniture and high craft applications, but their primary commercial applications are in construction and interior woodwork.

Of the Acacias, blackwood (*A. melanoxylon*) has always been highly valued as a fine cabinet timber.<sup>4</sup> When grown in the right conditions, blackwood is a tall, straight, relatively fast-growing tree that produces a beautiful golden-brown timber (fig. 2). Blackwood readily re-colonises cleared areas and many consider it to be the most sustainable of the Australian cabinet timbers. Blackwoods grown in isolation tend to branch out, while blackwoods grown in a forest situation are the straightest and most commercially attractive trees.

Some of the Acacias, such as blackwood, have a long fibre which can make machining complex shapes problematic. Most Acacia species are relatively small, slow growing trees that occur in either semi-arid or desert areas. These Acacias are typically considered "difficult to work" due to their density and high silica content.

Eucalypts are typically difficult to season – the boards are prone to checking, splitting, warping and cupping during the drying process. Many eucalypts are susceptible to a variety of insect attacks, including borers that traverse



Fig. 2 An example of highly figured Victorian blackwood, sanded to P400 and finished with an oil finish. 2022 © Dunstone Design. Image by Cam Mills.



Fig. 3 Mature old growth river red gum trees (*E. camaldulensis*). © State of New South Wales and Department of Planning and Environment. Image by Stuart Cohen.

the living trunks. Most eucalypts hold natural gum pockets which mar the seasoned boards (although there is a taste for “natural feature” in some furniture). Eucalypts typically embody high tangential and radial movement, resulting in seasoned timber that moves significantly in response to changes in humidity and temperature. Many of the eucalypts, such as red ironbark (*E. sideroxylon*), are notoriously difficult to glue, especially with water-based glues, due to their high level of oils and the density of the timber.

Australian woodworkers have traditionally focused on the rain forest “cabinet timbers” and considered the “difficult” species as unsuitable for fine work. Contemporary craft practitioners are now looking at these minor species and re-evaluating their potential. These hard, dense timbers often have extraordinary colour and grain, if only the craftsman can access them.

Of the eucalypts, river red gum (*E. camaldulensis*) has seen the biggest revision by woodworkers (fig. 3). Red gum grows throughout the Murray-Darling Basin, with its highest densities in the southern areas. The seeds of the river red gum germinate readily after floods and the trees require regular spring floods throughout their life cycle to

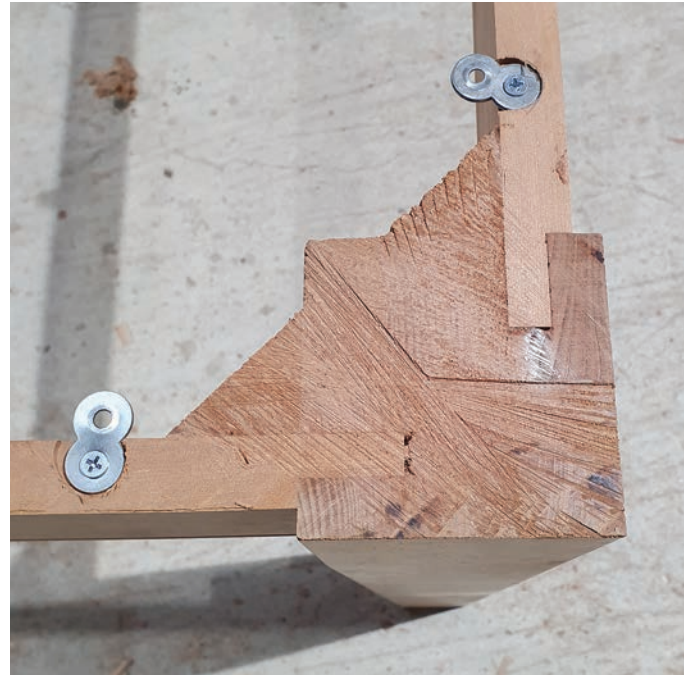


Fig. 4 Details of a Tasmanian myrtle (*Nothofagus cunninghamii*) dining table made by Village Green Furniture circa 1998. Although not red gum, this table shows the poor level of workmanship and the lack of technical understanding of wood movement typical of the self-taught woodworkers active in Australia at that time. Note the incorrectly fitted figure-of-eight fixtures, the rough workmanship, and the exposed joinery. © Dunstone Design. Image by Evan Dunstone.

survive. In the Murray-Darling Basin, such floods are now rare due to river-regulation for irrigation. As a result, 75% of river red gums in the lower Murray are stressed, dead or dying.<sup>5</sup>

The Barmah-Millewa Forest lines the lower Murray River and constitutes the largest density of red gums in Australia. The NSW and Victorian governments banned the commercial logging of red gum forests in 2010 and created extensive National Parks to protect what remained. Traditionally, red gum was utilized locally for ad hoc construction of rural structures and for fence posts and the like. Commercially, red gum was used for railway sleepers and other heavy-section applications. There is now reduced commercial hunger for red gum in construction, except as floorboards.

From the 1980’s, bark-to-bark redgum slab furniture became fashionable in Australia. Companies such as Nicholas Dattner & Co pioneered the use of red gum and sold it as a premium product. Through extensive marketing, they celebrated the colour and natural variation of red gum.

Almost all the principals of these red gum furniture companies came with a passion for Australian timbers but

without formal training in furniture making, craftsmanship or wood technology. As a result, classically trained woodworkers felt very conflicted by the sudden popularity of red gum. Much of the furniture was technically poor, with little or no consideration to wood movement or joinery (fig. 4). The furniture was marketed as “rustic” and when it started to tear itself apart in airconditioned houses, it was dismissed as all part of the charm. Section sizes, especially of tables, were thick, with table tops often 50 mm thick or more.

The popularity of this chunky, often questionably constructed furniture waned from the mid 2000’s, with many of the big players shutting down (Nicholas Dattner & Co closed in 2008). This left room for more technically minded makers to re visit red gum and explore more sophisticated applications of the timber. The average density of dried red gum is 900 kg/m<sup>3</sup>. Despite its weight and hardness (Janke hardness rating of 9,600 N) red gum is not a particularly strong timber. Fine sections of red gum, such as chair components, are notoriously vulnerable to breakage (fig. 5). Most sawn boards now come from portable mills accessing red gums that have died or been removed for a variety of reasons, such as road construction or agricultural development. Due to their prodigious size and weight, most logs are processed on-site and only the sawn boards are removed.

Red gum is a notoriously difficult timber to dry, with high loss rates and significant wastage. The best drying

results come from initially air drying the boards for 12 months, then transferring them to a low temperature dehumidifying kiln. It is exceedingly difficult to satisfactorily air-dry red gum in section sizes above 25 mm. With tangential movement of 8.9% and radial movement of 4.4%, even perfectly dried boards will move significantly. Red gum is not a timber that responds well to traditional woodworking hand tools. The hard, interlocking grain makes hand planing red gum challenging. Most Australian woodworkers set a 35 degree sharpening angle on their plane blades to cope with red gum. The interlocking grain makes chisel work similarly challenging. Red gum will crumble, tear out and pit easily. It saws well with a properly set western-style hand saw. Red gum will quickly destroy the teeth on a Japanese-style pull saw.

Red gum can be difficult to surface plane and thickness. Light weight hobby-grade machines will struggle to create acceptable cuts, and the machines will quickly burn-out from overloads. Mid-range machines fitted with spiral head cutters do much better and good cuts can be achieved. Heavy machines with TERSA style cutters, such as the Martin T54 surface planer and Martin T45 thicknesser are ideal for working red gum. Because many logs come off private land, red gum boards should always be carefully inspected for intrusions such as bullets, wire, and other metal. The physical weight of red gum boards can be fatiguing on the craftsperson and result in pinch injuries and lifting injuries.



Fig. 5 Broken red gum chair leg on a Seren Chair by Dunstone Design. The short, interlocking grain of the red gum has failed around the tenon.1998. Private collection, Sydney. © Dunstone Design. Image by Evan Dunstone.



Fig. 6 Evan Dunstone, Walliga Beside Table, 2010. A demonstration of the gum veins, borer holes and other faults typical of red gum. Red gum (solid and resawn veneer), wenge and rock maple. 45 x 45 x 51 cm. Private collection, Canberra. © Dunstone Design. Image by Bronwen Healy.



Fig. 7 HNT Gordon, Smoothing Plane, 2022. Gidgee, brass and HSS. ©HNT Gordon. Image by Tim Tombs.

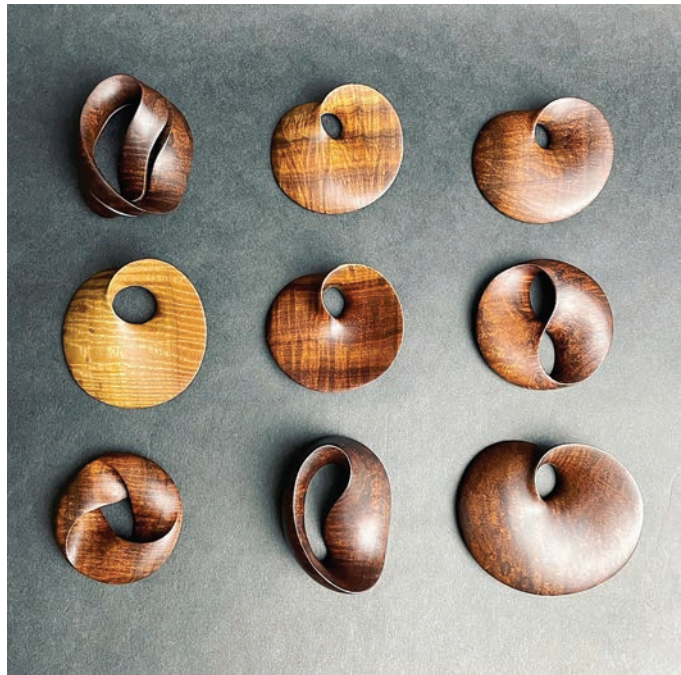


Fig. 8 Hape Kiddle, Mobius Forms, 2022. Gidgee. These small carvings (average diameter 7 cm) show the range of colour and figure in gidgee (*A. cambagei*). Private collections (sold separately). © Hape Kiddle. Image by Sarah Brown.

Red gum can be excellent to shape with machines such as the spindle moulder or router table. A skilled and experienced operator will feel for vibration, listen to the cut, watch the quality of the swath as it goes up the extractor and adjust their feed rate, weight of cut and RPM to suit. When shaped correctly, red gum can come off the spindle moulder so cleanly that sanding can commence at P240. Using CNC machines can be more problematic, as there is no operator feed-back to allow the craftsperson to interpret each unique piece of timber.

Red gum will not steam bend, but it can be formed into curved laminations when supported correctly during the bending and gluing-up process. Red gum can be readily shaped by abrasives such as a Brumby disk in an angle grinder. Sanding red gum is more analogous to abrading stone than working wood. Sanding long grain through to P600 and end grain through to P1200 will reward the craftsperson with an excellent polish (fig. 6). Red gum is notorious for borer holes, gum veins and other imperfections. These can be filled with either coloured epoxy or cyanoacrylate mixed with dust. Red gum should only ever be finished with an oil. Due to the high level of movement

and the many voids in the timber, using a sprayed lacquer will inevitably fail within a decade.

The Dunstone Design workshop specifies allowing plus or minus 1 mm of movement for every 100 mm of width. Thus, a 1000 mm wide tabletop must be free to move down to 995 mm and out to 1005 mm annually. Although commercially sliced red gum veneers are available, the back of the veneer is always torn, the colour leached and the veneer is exceptionally brittle and crumbly. To create quality red gum veneers, they must be cut on a band resaw. Resawn veneers must be thickened through a wide belt sander down to 1.8 mm, then laid up on a substrate with liquid epoxy resin, such as West System. The panel must then be further sanded to a finished thickness of 1.5 mm. Veneer thicker than 1.5 mm will retain enough strength to start moving.

Red gum will not compress. If a tenon is not a sweet fit, then forcing the joint will split the component rather than compress the tenon. Red gum responds very poorly to doweling, especially if the dowels are glued with a water-based glue such as PVA. The best joinery is achieved using floating tenons in double mortises. The best prac-



tice is to use a perfectly fitted straight-grain jarrah floating tenon in red gum mortises. Red gum responds best to non-water-based glues. Liquid epoxy is ideal for laying resawn veneers, paste epoxy for joinery and polyurethane for long-grain to long-grain gluing applications, such as tabletops. For small work, a cross-linking PVA will work, but the glue lines might well creep over time.

The so-called Desert Acacias are represented by such species as mulga (*A. aneura*), gidgee (*A. cambagei*), dead finish (*A. tetragonophylla*) and lancewood (*A. shirleyi*).

The prince of the desert timbers is gidgee (*A. cambagei*). Coming in at 1,150 kg/m<sup>3</sup> and with a Janke hardness of 18,990 N, it's one of the most durable timbers in the world. Very figured examples of gidgee are known as ringed gidgee, which is highly prized by knife makers, musical instrument makers and carvers. First Nations people in Australia made significant use of Acacias, particularly mulga and gidgee. Woomeeras, boomerangs, spears, nulla nullas, shields and digging sticks were commonly made from Acacias.<sup>6</sup>

Australian toolmaker Terry Gordon uses gidgee for the bodies of his exceptional hand planes (fig. 7). Terry travels to far Western Queensland in winter to source the gidgee from remote properties. Each tree must be assessed carefully before harvest. Trees with a trunk diameter over 300 mm are commonly piped in the centre. With a practised eye, Terry can usually assess the level of figure in the trunk by the patterns in the bark. Once a tree is selected, the harvester must move fast. Gidgee cuts well with a chainsaw, however the blades will dull quickly. Once a tree is down,



Fig. 10 Pete Curly, Sloyd Knife, 2022. Hand forged steel, eucalyptus handle. 13cm. Private collection. © Pete Curly. Image by Pete Curly.

Terry blocks out the log into manageable sections that display sound wood. It is common to discover considerable rot and piping within the bole of the tree.

Once cut, the end grain must be waxed immediately, and the block completely wrapped in layers of plastic to retain the moisture. A delay of even 10 minutes on a dry day can result in catastrophic checking. Once wrapped, a block can be stored for many years in that condition without deteriorating.

Back at his costal workshop, Terry will wait for a day of high humidity before blocking out the gidgee and charging his dehumidifying kiln. The gidgee will be brought down to around 8% moisture in the kilns over approximately 7 weeks. Once finished, the gidgee must rest for at least 6 months in the workshop to stabilise. If these steps are correctly performed, the resulting timber will be remarkably stable. Even ringed gidgee will stay true. It is Terry's opinion that it is not possible to satisfactorily air dry gidgee.

The high silica content in the desert Acacias (and blackwood) make them extremely abrasive of hand tools and machine blades. The timber burns easily with dull router cutters, saw blades and even powered abrasives. Some of the desert species, such as gidgee, also have a waxiness that can clog fine abrasives.

Master sculptor Hape Kiddle has developed a range of techniques for shaping gidgee and other desert Acacias. Hape roughs out with a band saw, then uses a combination of rasps, files, knives, gouges, scrapers and abrasives (fig. 8).



Fig. 9 Peter Trott, Draw Knives, 2022. Hand forged steel, blackwood handles. Sold separately. © Peter Trott. Image by Peter Trott.

Australian toolmakers such as Peter Trott (fig. 9) and Pete Curly (fig. 10) have been experimenting with blade angles, steel compositions and blade geometry to create cutting tools that can manage tough Australian timbers. Hape Kiddle has consulted with both these toolmakers to help develop exceptional tools. Both Peter Trott and Pete Curly are experienced woodworkers, and this knowledge has helped inform them on the development of their tools. With constant “real time” feedback through social media, and with direct connection with master craftspeople, a circle of knowledge has informed these contemporary tool makers.

Both professional makers and woodworking enthusiasts throughout Australia are starting to reassess the “difficult” Australian timbers. New tools, a better technical understanding of the material, superior harvesting and drying techniques and a refined design sense are transforming the way these “difficult” timbers are approached.

### Acknowledgments

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Evan Dunstone

Furniture Designer and Woodworker

Dunstone Design, Australia

evan@dunstonedesign.com.au

### Notes

<sup>1</sup> ABARES. *Australian Forest Profiles: Eucalypt*. Canberra : Australian Bureau of Agricultural and Resource Economics and Sciences, 2019. Report.

<sup>2</sup> Forests Australia. *Australian Forest Profiles- Acacia*. Canberra : Department of Agriculture and Water Resources – ABARES, 2016.

<sup>3</sup> Attiwill, Dr. Peter. *The Ash Forests of South Eastern Australia. National Forestry Inventory*. Canberra : Australian Forest Profiles, 2002. p. 12. ISBN 0 642 47586 5.

<sup>4</sup> Baker, R.T. *Cabinet Timbers of Australia*. Sydney : Government of the State of N.S.W, 1913.

<sup>5</sup> Cutten, Felicity. "A river is dying: [Climate change and excessive water extraction are threatening the Murray River and its iconic species, the magnificent cod and river redgums.]" *Australasian Science*, 2009, Vol. 30, 8.

<sup>6</sup> Morrison, Norman. *Aboriginal use of Wattles*. Canberra : Australian National Botanic Gardens Education Services, 2000.

# Woodworking as Means for Understanding and Developing the Human-Technology Relationship – Discussed Through the Work of Cabinetmaker Thomas Tempte

Andreas Nobel



Fig. 1 Thomas Tempte, The lathe of Roubo 1982, birch, ash etc.

Thomas Tempte (1942–2016) was a versatile woodworker. Prominent, and sometimes a little controversial, within such different fields as cabinetmaking, intarsia, building conservation, furniture design and the research of historical technologies for woodworking. Last but not least he developed the understanding of the significance of craft-based knowledge and labor. A significance he traced back historically, as well as into contemporary society. He did this in writing, but mostly in practise. It seems like, for Tempte, history was never a thing of the past but very much alive, always present- omnipresent.

This article is written in the middle of the research process concerning the work of Thomas Tempte. There are gaps in the research and one important reason for publishing it here is for us to get feedback and collect new information that might be valuable for the ongoing research work.

Tempte also conducted pioneer work in the field of practical/ tacit knowledge – 1982 he published a book on the subject, in which he introduces the term “the practical intellect”.<sup>1</sup> This was one year prior to Donald Schön’s famous *The Reflective Practitioner*. This is mentioned not

to enhance Temptes brilliance but rather to suggest that the beginning of the 1980s was a time when these subjects seem to have engaged a lot of people around the world. There seem to have been something in the *zeitgeist*.

Possibly it was the first wave of computerization of society, labour and industry that triggered this interest for a less abstract and more concrete form of work. *Is the computer a tool?* was the title of an investigation funded by Arbetslivscentrum which he and the artist Anna Sjö Dahl performed together. The two was a couple. The investigation resulted in the book mentioned above and an exhibition, *Konst och vetenskap och arbetets ära* (Art and Science and the Honour of Work) which was shown at Tekniska Museet in Stockholm 1982. Temptes book was no best-seller but it did have considerable influence within fields such as pedagogics, art education and within some craft communities. Today, however, it is not so read. For this investigation Tempte built a reconstruction of the lathe presented in Roubo’s *L’art du Menuisier*.<sup>2</sup>

For unknown reasons Tempte always refers to it as “the lathe of Diderot” although it is obvious that it comes from Roubo and that Tempte also knew this. He also had

the chisels made according to Roubos description. When we first installed this lathe and unwrapped the chisels we thought that they were deliberately made over-size. Tempte did have a faiblesse for heavy, dense and big machines and tools. We asked ourselves if the tools were made to be seen in an exhibition rather than being used? However, going back to the source (Roubo) it seemed like the measurements were accurate and when starting to work in the lathe, the size and the weight of the tools are explained in practise. Their sturdiness guarantees steadiness, balance and control to the cutting process and their weight is not a problem as they lean on the tool rest.

In the 1970s there was an Egyptian exhibition at Nationalmuseum in Stockholm. Tempte went and became interested in a small wooden, white painted chair on display behind a glass case. The chair was from the grave of Tutankhamun. He spent many hours with his nose to the glass case before starting to reconstruct it himself. But after a couple of weeks he realized that it was impossible to reconstruct a 3000 year old chair with the tools of the 20th century. He stopped working and instead started to do research on the tools and technologies for wood working in ancient Egypt. This research resulted in him having made a complete set of tools for an Egyptian cabinetmaker. Among these were chisels and saws in bronze, as well as a bow lathe as seen on the oldest known image of a lathe, an Egyptian stone relief. When this research, both abstract (reading) and concrete (building) was done Tempte went on to make the chair of Tutankhamun.



Fig. 2 Tempte's poster for *Institute Suedoise*, Paris, 1991.

The result can be seen at Östergötlands Läns Museum in Linköping and it is likely that this project was a ground breaking point for Temptes development as furniture designer. A field where he showed an independence and a mastery that could maybe be described as a unique ability to bring historical form references into relevant contemporary design without being neither ironic (as some postmodernist designers) or puritanistic and pedantic (as some romantics and conservative craftsmen, designers and architects). This synthesis (in his design) between history and the present seems to (in his later years) have become absolutely effortless for him.

Such a high level of sensitivity for design is related to what we see in some old artifacts such as for example the stave churches of Norway. An engagement and absolute presence, in the detail at the same time as in the overall structure, the *gestalt*. It is questionable whether this level of concentration and engagement is reachable for a designer or craftsman using the abstraction of the representation, the drawing as means/medium for design.

Jörg Renner was the Lechmesister of the city of Augsburg in the beginning of the 16th century. Lech is the river running through Augsburg. There is/was an advanced system of channels and locks connected to the river. Lech could be described as the nervous system of the body of Augsburg. It was also the muscles as well as its intestines so to speak. The river was used for transport, for hygiene (waist was dumped and channelled out of the city through the channels) and for power. A number of mills and other machines got its power from the Lech. The title Lechmeister was an important position as the Lechmeister was the person responsible for all of this. Around 1530 Lechmeister Renner constructed a *fanermühle*, a veneer mill or a veneer sawing machine that, according to Thomas Tempte, was unique in the world at the time.

Renner's machine could cut better and more veneer than any other in the world. This technological invention made way for an advanced industry of cabinet makers and intarsia makers in Augsburg, and also for a considerable amount of veneer export.



Fig. 4 Thomas Tempte, A stool and some parts for additional copies, date unknown.

Fig. 3 Thomas Tempte, The Augsburg veneer sawing machine, 2011.

Thomas Temples first encounter with intarsia was as a small child. His mother worked at the castle of Kalmar. Tempte would follow his mother to work and was intrigued by the intarsia works covering the walls in *Kungagemaket*, a small room at the castle where walls are covered with intarsia. The artwork made a big impression on him. As any child would, Tempte looked at these artworks as images, he didn't pay attention to technique, material etc. It was only later when Tempte returned as a twelve-year-old child that he realized that these images was made out of wood, was intarsia. This was the point when he decided he would learn the trade of wood working. So intarsia was the starting point for the work of Thomas Tempte and intarsia followed him throughout his life. He used intarsia, not only as an expression of art, but also as it seems, as a method for thinking, for sketching for seeing. He would for example make quite a sketchy plan view (in intarsia) of *Kungagemaket*, almost as if to only make it with pen and paper would not help him understand and experience the space in any deeper sense, only intarsia could.

Fairly late in his career, Tempte started working on a big project in which Lechmeister Renner and his *fanermühle* was the center. It was first presented in 2011 at Waldemarsudde in Stockholm and consisted of a large

number of intarsia images and a veneer sawing machine which was Temples speculation on how the legendary Augsburg *fanermühle* might have worked. According to Tempte, prior to the invention of Renners machine veneer sawing was done by the coopers using a frame saw. This was the starting point for Temples investigation.

Speculation is completely central for Temples research throughout his career. Live speculation is his research method. He is the Thor Heyerdahl of woodworking. Much like the legendary norwegian archaeologist Tempte would gather information and experiences from all aspects of human culture. He would look at technology, art, history and the present so as to make for himself a "big picture", a complex, multi-layered, multi-sensory overview of a given field, practise or artifact. A sensitive eye and a deep interest for art is crucial for this type of research. Just like Heyerdahl would build his theories of ancient seafaring on comparative studies of ceramics, architecture and such in different parts of the world, Tempte seem to have used his sensitive eyes, and body, for art as an instrument for being able to make connections and explain complex historical events.

Craft knowledge, craft culture, for Tempte was never just of historical interest or for some sort of personal,



Fig. 5 Thomas Tempte, A roman (left) and medieval truss (right), date unknown.

therapeutical, feel-good purposes. It was always political.

Tempte built two scaled down principles of roof constructions. The first represented the Roman way of constructing a truss and the second one was from the medieval Garda church on Gotland. Tempte claimed that the first truss, the roman one, was unmistakably made by a slave while the medieval one was, just as obviously, made by a free craftsman.<sup>3</sup> The german philosopher Hanna Arendt made a distinction between animal laborans and *homo faber*.<sup>4</sup> The former performs his/her work mechanically while the latter creates while working. *Animal laborans* asks how a thing should be made, while *homo faber* asks why it should be made.

The following part is a speculation from my part. It is influenced by, among other things, the work of Tempte and my reading of his work. The story of the development of technology through history is also the history of the way in which human technology gradually transforms from tool to aid.<sup>5</sup> A tool would be a hammer used in the hands of a blacksmith. The hammer and the blacksmith interact, they are interdependent and they, so to speak, give each other meaning. They both become better versions of themselves in this union. When separated, the hammer is a lifeless lump of iron with a wooden stick sticking out of it while the blacksmith is a frustrated *homo faber*, frustrated because the smith lacks the strength and hardness to be

able to realize his/her visions in iron. The hammer added strength and hardness to the blacksmiths body. This happy union between tool and human generated joy in work, creativity- artistic and technological development. A tool makes its user more capable, more active, more creative.

An aid has precisely the opposite effect on its user. It has a pacifying effect. There is always a certain amount of helplessness in the users relationship to technological aids.

The aid doesn't challenge its user in the same way that the tool does. The aid separates its user from the physical world while the tool enhances and deepens this same relationship. The dish brush is replaced by a dish washer machine, the razor is replaced by an electric shaver, the car is replaced by a self-driving car. In what sense is this to be considered technological development? Is not the actual driving, the sensuous relationship between the driver and a perfectly trimmed technology, the main quality of automobile culture as such? Take away that and what is left?

Now, how to tackle this situation where technology is all around us and this technology is at such an advanced, complex and abstract level that we, as citizens, have a slim chance to influence this technology but are directed to consume, rather than interact, with technology?

I believe that one possible way out of this tech-trap lies within the craft and the arts. Within the communities of



Fig. 6 Thomas Tempte, Wallpaper printing press, date unknown.

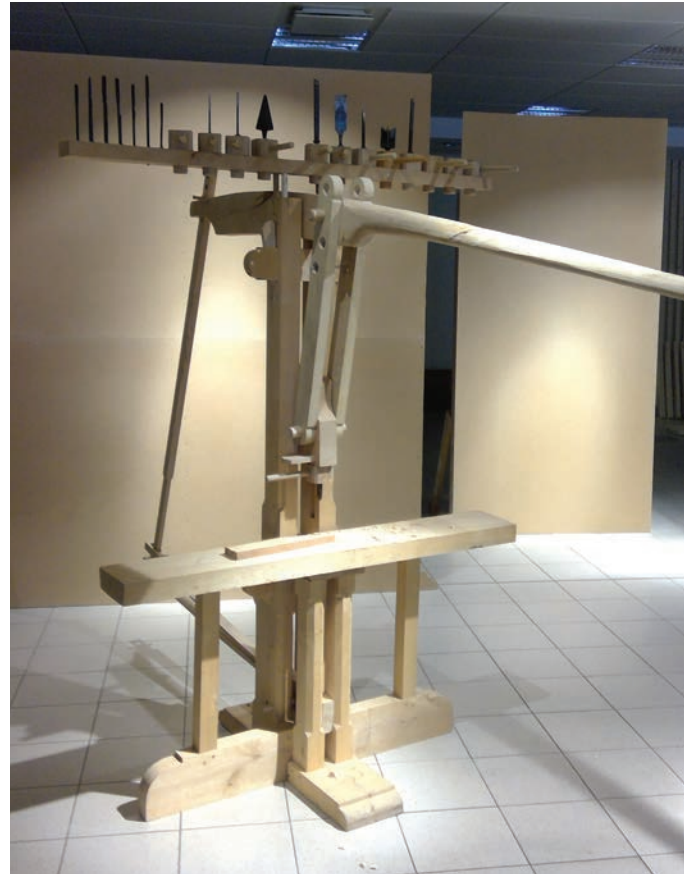


Fig. 7 Thomas Tempte, The mortiser machine, date unknown.

art, craft and of craft-based artists you can find a certain degree of disrespect for new technology which you do not easily find elsewhere. This disrespect is important for the sense of belonging and control in a highly technologized society. For these people all technology can and should be used not only as they were intended to by the engineers and companies that developed it, but also it can, and should, be tampered with and played around with. In this act the craftsman/artist takes control over technology and transforms the aid into a tool. In this act he passive consumer of technology reclaims technology and becomes an active maker in control of his/hers technology. This is an empowering act.

An example of this from the field of music would be the way in which disc-jockeys during the 1970s, starting to use scratching for making music. It is a highly disrespectful act to use the technology for reproducing other music as an instrument (drum) for making your own music. To use the turntable, a highly advanced technology as a rhythm instrument, the world's oldest and most basic instrument is an act of defiance. The DJ don't accept the role as an obedient tech-consumer. He/she needs to create and does this by misusing, in a highly disrespectful manner, the turntable. Low-tech, high concept. This is an example of real and deep interest in technology not only as an aid accepted and used but of something that

we humans interact with daily whether we like it or not. Craftsmen and craft-based artists are not the enemies of new technology but on the contrary they are maybe technology's last and only true friends- their interest in technology is genuine and deep. They challenge technology and they refuse to accept an unequal relationship between man and machine. Technological development is too important to be left for the technological engineers to develop on their own and the artistically informed craftsman could have an important role to play here in this next step of the technological revolution.

All images in this article are taken from *Project Room Augsburg*, an exhibition and workshop space at Vasagatan 25 in Stockholm open during the fall of 2022. The space exhibited a selection of Thomas Temptes works as well as contemporary works by designers, artists and craftsmen. The exhibition also had the function of the editorial office for the making of the book on Temptes work.

This project involved a lot of people of which maybe the most notable ones would be: Johan Adelswård, William J Andersson, John Funkquist, Sissela Jensen, Oskar Laurin, Andreas Nobel, Lauri Vaher and Joakim Zickert.

The project about the work of Thomas Tempte, this article, the coming book, the exhibitions, are all the result of collective work with much more people (than mentioned

above) involved. We have put Temptes woodworking machines together and we run the machines inviting anyone to use them for their own art works.

Among the work Tempte left behind him is also a considerable amount of not yet mounted furniture parts which we now invite students to put together. Furthermore artists and craftsmen have been invited to participate and are given more or less full freedom. This will add to the Marshall-McLuhanesque “shaking of the kaleidoscope” that is crucial for any deeper going research. It forces us as researchers to look at Temptes work from new angles, other perspectives, in another light, in another enlightenment. Everytime a new exhibitor adds their work to the exhibition space, putting it besides, or in front of, Temptes work, the context in which Temptes work is experienced will change. In fact Temptes own work will change. This forces the researcher to reconsider and it adds to a deeper and more multi-dimensional view.

Andreas Nobel  
 Professor in Furniture Design  
 Malmstens LiU, Sweden  
 andreas.nobel@liu.se

Notes

<sup>1</sup> Tempte, Thomas. *Arbetets ära: om hantverk, arbete, några rekonstruerade verktyg och maskiner*. Arbetslivscentrum, 1982.

<sup>2</sup> Roubo, M. *L'art du Menuisier*. Paris: Académie Royale des Sciences, 1769.

<sup>3</sup> Source: An article sent by e-mail from Johan Elwing in 2022.

<sup>4</sup> Arendt, Hannah. *Människans villkor*. Göteborg: Daidalos, 1958.

<sup>5</sup> Nobel, Andreas. *Shady Enlightenment- textualized thinking and its consequences for design*. Stockholm: Konstfack, 2016.

# Projekttrum:



Varusnamn	Storlek	Mått	Antal	Pris
SKAPTÄR	57 x 65 x 330	1	1	8000
BENK	57 x 65 x 330	1	2	2000
SITTTRÄSK	57 x 65 x 330	1	2	2000
FRONT	57 x 65 x 330	1	2	2000
BACK	57 x 65 x 330	1	1	2000
BENK	57 x 65 x 330	1	1	2000
FRONT	57 x 65 x 330	1	1	2000
BACK	57 x 65 x 330	1	1	2000
BENK	57 x 65 x 330	1	1	2000
FRONT	57 x 65 x 330	1	1	2000
BACK	57 x 65 x 330	1	1	2000
BENK	57 x 65 x 330	1	1	2000
FRONT	57 x 65 x 330	1	1	2000
BACK	57 x 65 x 330	1	1	2000

**Augsborg**  
 Vasagatan 25      Öppet: fredagar-lördagar 12-16

Fig. 8 William J Andersson, Sissela Jensen, Oskar Laurin, The program for Projekttrum Augsborg, p. 1, 2022.



# The Future of Furniture Craft Education— a Churchill Fellowship

Joseph Bray

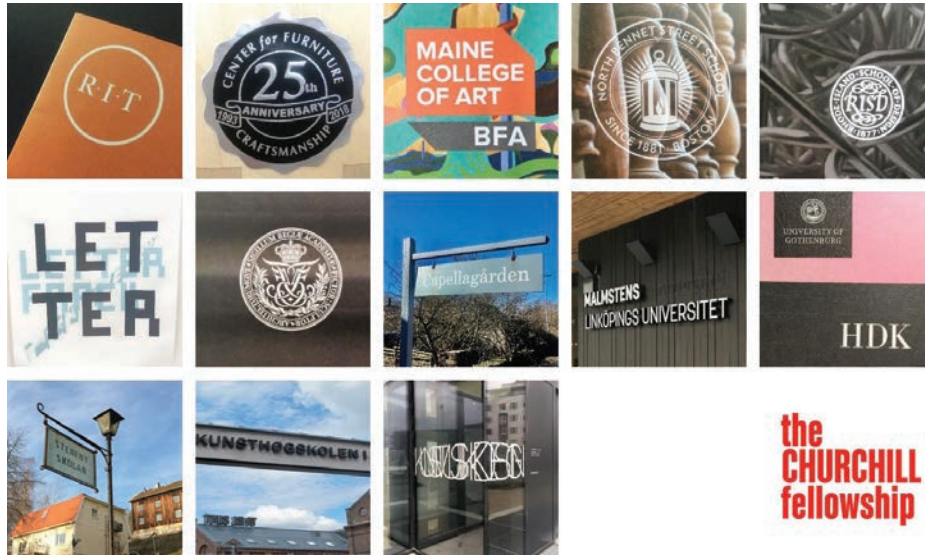


Fig. 1 A collection of images illustrating the institutions visited during the Churchill Fellowship research trips, 2022, © The author.

To be awarded the opportunity to ‘travel to learn’ is such an incredible one! Accomplishing a Churchill Fellowship has been a long-term personal goal, and it allowed me to visit some of the most impressive institutions that offer furniture education in Europe and the USA (fig. 1). Often being camped with them for two to three days, I was able to explore much further than the short introduction and tour you might expect during an open day, giving me a much deeper understanding of how these institutions operate. I was able to reflect on my observations to enquire further and subsequently learn much that will benefit myself personally, my role as a teacher, and wider to furniture education in the UK and beyond. I met incredibly supportive and passionate students and teachers everywhere that I visited, and felt so comfortable in some that I could easily have stayed.

Having spent fourteen years teaching at Rycotewood in Oxford, I became passionate about educating the next generation of craftspeople/makers. I have observed both the demise of undergraduate level craft programmes in the UK and the significant reduction in children learning craft in schools. Overall, there has been a significant reduction in the opportunities to learn furniture making at all levels. At the same time the UK furniture industry reports a skills gap and aging population, while craft skills are in very high demand.<sup>1</sup> I set out to explore how

furniture education outside the UK supports students in becoming highly-employable craftspeople, or prepares them to enter self-employment on graduation. What can we learn to help plug the gaps?

My proposal was to visit world-renowned undergraduate furniture programmes, investigating demand for furniture craft skills from students and industry, the emphasis placed on craft skill development, and the balance between creative exploration, craft development and business skills. I aimed to establish how industry links are embedded into furniture programmes within higher education, and whether industry work placements are available and successful. Also, to look beyond study towards understanding how graduates are supported to become self-employed.

It became clear that similar challenges and frustrations are commonplace and that sharing of knowledge and experiences is beneficial to us all. My conclusions have led to three key recommendations:

1. Establish inspirational opportunities for young people to experience making
2. Integrate rigorous professional practice into craft education
3. Stimulate collaboration locally, nationally and internationally

### The Catalyst for my Fellowship

I am passionate about furniture and I feel incredibly fortunate for the opportunities within my education that have firstly engaged my interest and subsequently fostered it to become my career. I was lucky enough to study woodwork at school in the mid 1990s, this was not the norm at this time as the curriculum had already lost the craft from CDT (craft, design and technology) to become Design and Technology. However, my school still had teachers who believed in making and luckily the workshop with benches and tools had not been removed – therefore in both my GCSE and A-level courses I was encouraged to make furniture in wood. The hours spent in after-school clubs and lunch times to make my ideas a reality really took hold and I went on to study furniture design and craft at university in High Wycombe. This was within a fully functioning furniture department with excellent staff and resources – we all had our own benches and tools and were expected to develop as craftspeople by learning through making.

Unfortunately, the education system for creative subjects in the UK has changed over that time – you could argue that it has been under attack! Will children and students ever again have access to the same experiences and opportunities the formal education system afforded me?

Schools are under pressure and many have placed more emphasis on academic subjects, the practical assessment has been so significantly reduced that teachers are often unable to provide a focussed experience in a single material. Frequently chisels and hand planes have been replaced with laser cutters and 3D printers – cleaner and safer for large classes to all have a go. I am not advocating that we go into reverse, more that we value experiences of both digital and hand tools. This is compounded by the significant reduction in schools offering design and technology as a subject at both GCSE and A-level.<sup>2</sup>

Higher education has certainly not been immune to change, and the same challenges have meant a significant reduction in opportunities. This has been felt right across the craft sector with Ceramics as a single subject almost wiped out completely and most institutions merging all crafts into a single programme - this can only lead to less specialisation and opportunity to develop technical skills.<sup>3</sup> Whilst there are twenty-seven providers offering undergraduate courses with furniture in the title, it is mostly grouped with product design (sometimes in 3D crafts). Many of these are excellent programmes, but the emphasis is on design and prototyping rather than developing craft skills. As far as I am aware, there is only one programme left where every student has their own workbench, tools and training to fully access to wood machines.<sup>4</sup>

I am very aware of the reduction in skills and knowledge on entry to higher education, and believe that this can be traced back even further than secondary education.

Do primary school teachers have the confidence, knowledge and resources to allow children to access woodwork? Whilst there has been a significant increase in the amount of schools offering a forest school experience, I question whether this is being built on within the classroom? My daughter is fourteen and studying at our local secondary school. I am not confident she will actually pick up a piece of wood during her time there, let alone be given the opportunity to experience how sharp tools are able to cut through it.

Further education is possibly the sector under most pressure, and as a result both the number of colleges which offer furniture craft and student numbers have diminished. This is true of apprenticeships as well. Evening classes under the ‘learning for leisure’ banner are often bursting at the seams, but the longer full-time courses are certainly not overwhelmed with applications. With employers desperate for skilled furniture makers we must, as a minimum, maintain and develop those that remain. Part of the challenge in closely linking education and the job market is that craft businesses are spread widely over the UK and not centred in any particular region, compelling local colleges to look nationally.

A frequent criticism of higher education is that graduates are not fully prepared for the world of work and that typically they are left to fend for themselves when they leave. I believe that setting up a workshop on graduation requires a unique set of circumstances – in my experience, access to funding, a workshop space and previous work experiences – often all come together. It is inexpensive to give someone an equipped office space to work from, but a fully functioning workshop is something very different. There are examples of business incubation and crafts-person/artist in residence schemes in operation, but they are not widespread.

### Where did I Travel?

My Fellowship began as a desk-based investigation exploring institutions across Europe and North America to find those that offer furniture programmes of high quality. I chose to focus on countries that I believe have a positive cultural association and support of craft as well as appropriate furniture heritage/industry. The institutions I visited are detailed in figure 2.

The rich legacy of the ‘Studio Furniture’ movement in the USA, with an emphasis on one-of-a-kind furniture, is very apparent on the east coast. Exhibiting furniture designer-makers from organisations such as the Furniture Society and the New Hampshire Furniture Masters are evidence of a continued tradition in the region that has grown out of successful programmes at the School of American Crafts – Rochester Institute of Technology and Rhode Island School of Design.<sup>5</sup> Both of these institutions continue to deliver both under- and post-graduate furni-



Fig. 5 A student working in a workshop equipped with industry standard machinery at Letterfrack in Galway, Ireland, 2019, © The author.



Fig. 4 One of the impressive and professional wood machinery workshops at Malmstens in Stockholm, Sweden, 2019, © The author.

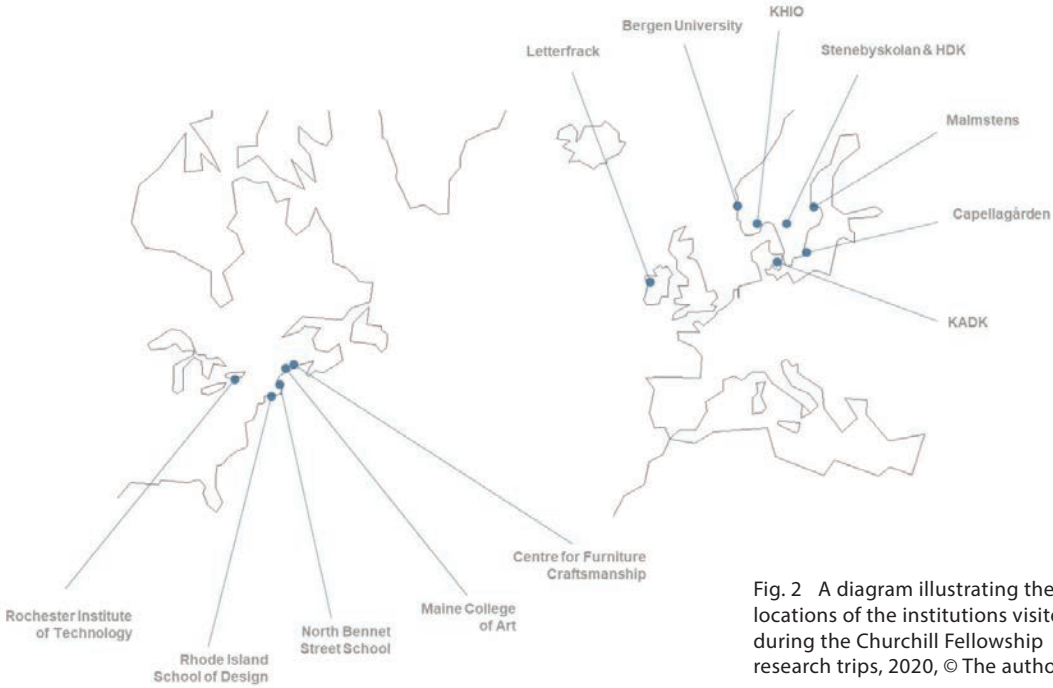


Fig. 2 A diagram illustrating the locations of the institutions visited during the Churchill Fellowship research trips, 2020, © The author.



Fig. 3 The very well organised furniture making workshop at the Centre for Furniture Craftmanship in Maine, USA, 2018, © The author.

ture studies and formed the core of my visit. The Centre for Furniture Craftsmanship in Maine (fig. 3) has developed a reputation for excellence under the direction of Peter Korn<sup>6</sup> (himself a 'Studio Furniture' maker) offering an intensive hands-on experience in a not-for-profit environment. This along with a two-year intensive programme at North Bennet Street School in Boston provided a valuable comparison to the university sector.

The heritage of furniture design and craftsmanship in Scandinavian countries is well-known through the mid-century work of Danish designers such as Arne Jacobsen, Finn Juhl, and Hans Wegner. The less well-known yet equally important Swedish furniture designer, Carl Malmsten, established a number of schools across Sweden to provide skilled craftspeople to make his furniture. I visited two contrasting schools that emphasise making, Malmstens based in Stockholm, with incredible links to industry and impressive workshops (fig. 4) and Capellagården located more rurally, described as a 'creative monastery'. Carl Malmsten also influenced the renowned Stenebyskolan, that offers a broad range of furniture craft programmes at different levels from preparatory studies to Masters level. The furniture programmes (under- and post-graduate) in Copenhagen and the Norwegian art schools in Oslo and Bergen perhaps lean more towards design than craft, but still have excellent workshops and reputations for quality, as well as support opportunities for students on graduation.

I was also aware of the impressive work at Letterfrack in Ireland (fig. 5) through its connections with Rycotewood, whose staff were instrumental in supporting the school in Connemara over twenty-five years ago. The opportunity to visit an institution in a country with a very similar culture to the UK was a useful contrast.

I arranged my itinerary so that I was able to spend two to three days in each location, allowing me to spend time with staff, students and when possible graduates. This was complemented with visits to meet employers and alumni in their workshops as well as shared incubator spaces.

### Conclusions and Recommendations

My conclusions reflect on three stages of progression through our formal education system: (1) the pipeline into advanced level furniture craft programmes (schools); (2) how to develop and maintain advanced level craft programmes to the highest possible standard, and; (3) how to support graduates stepping out into the world.

### Pipelines into Furniture Craft Education

I was hopeful that I would return with stories of excellent school woodwork opportunities where children were inspired to study furniture craft at a higher level, however I was sadly disappointed. Of the countries that I visited, only Ireland has managed to maintain a high level of

provision for making (woodwork) at secondary school, whereas other countries have, like the UK, moved towards more academic study between the ages of fourteen and nineteen.

I learnt that in Sweden *sloyd*, roughly translated as handicrafts, is still compulsorily taught in primary schools and is gender neutral. The cultural relationship in Scandinavian countries with wood as a construction material is evident. Perhaps these form the catalyst for young people studying craft and design. Thinking through making, by handling materials and working them with tools, has many broad educational benefits and engendering this in all of our children of primary school age is highly valuable.

I believe we should:

- Reinvigorate craft education in schools, perhaps by building on the growing forest school movement in primary schools to give young people opportunities to handle tools and materials, aiming to sow the seeds for future involvement in craft and a connection with nature (fig.6).
- Put craft back into design and technology, secondary school children should be provided with the opportunity to demonstrate practical skills in GCSE and A-level studies. This should be evidenced through substantial practical coursework rather than examination focussed assessment. Craft should be promoted to ensure that skills are not devalued compared to academic subjects, to provide the inspiration for careers as makers, technicians, craftspeople, and artists.

### The Highest Standards of Furniture Craft Education

Selecting world-renowned institutions and furniture programmes to visit assured me that I would learn much about high standards of teaching and learning. I expected to see students learning in well-resourced professional workshops, in their own personal spaces with bench, hand-tools and regular access to industrial machinery. I was not expecting to see the levels of independence and responsibility afforded to students (fig. 7) or the standards of excellence achieved in the Swedish Gesäll projects. International opportunities to enhance the learning experience through student and staff exchange as well as closer collaboration could help maintain standards.

Observing the decline in programmes that emphasise furniture craft skills in both further and higher education, perhaps maintaining what we have still in place, would be the first stage of a process of re-establishing our furniture craft education. Recognising the incredible input by a small number of specialist teachers and identifying how we can create a pipeline to educate and encourage future woodwork (schools) and furniture craft (higher level) teachers is essential.



Fig. 6 The author teaching woodworking techniques to young people at the Sylva Wood School, Oxfordshire, England, 2019, © The author.

I believe we should:

- Revive furniture studies at vocational and higher-level study with an emphasis on making. Building on the remaining centres of excellence we should re-establish opportunities to learn advanced craft skills that can lead to employment.
- Train inspirational and technically knowledgeable woodwork teachers to inspire the next generation. To value the combination of skills required to be an excellent craft teacher with the ability to share information and support the learning of practical skills and knowledge. To foster the next generation of woodwork and furniture educators through assistantships and mentoring. To ensure that we do not find ourselves in a position where we cannot find teachers with the necessary skills.
- Establish a national standard of excellence for furniture craftsmanship that is managed outside the education system. Much like the Gesäll observed in Sweden.
- Develop international networks with like-minded institutions for the benefit of staff, students and the UK furniture industry.
- Develop programmes that meet the following requirements for excellence:
  - Every student to have their own workbench, hand tools and the time to practice using them.
  - Craft skills development through projects of increasing complexity free from the additional challenge of design.
  - Risk assessment by institutions and individuals to enable students to have increased time and space in wood machining workshops (without the need for constant supervision).
- Enhance individual responsibility and employability by making professional workshop practice compulsory and rigorous, including subjects such as machine maintenance, lean manufacturing and cleanliness.
- Maintain libraries as valuable resources for students and graduates.
- Make collaborative learning a key component in programme design.
- To develop successful, mutually beneficial partnerships with industry to include live projects, work placements and sponsorship.
- To create an international network of furniture craft exchange opportunities for students and teachers.
- To foster learning across disciplines and materials by establishing assignment briefs that bring students together to learn together and from each other.

#### Supporting Graduates to Set-up in Business

A frequent criticism of arts education is that graduates leave without the skills and support necessary to set up their own business. Not only should students be up-skilled while on a programme, but mechanisms for support following graduation and access to resources are essential. I met many students who aspired to being self-employed designing and making furniture, but in every country I visited there were similar challenges to those which graduates experience in the UK. I hoped to find examples of highly-sophisticated incubator workshops and packages of support/funding linked to furniture programmes, however those that I did find were mostly operating outside the educational system.



Fig. 7 A student demonstrating advanced professional practice by maintaining woodworking machinery at Rochester Institute of Technology in Rochester, USA, 2018, © The author.



Fig. 8 The Rycotewood sponsored incubation workshop located at the Sylva Foundation Wood Centre in Oxfordshire, England, 2019, © The author.

Cooperatives, fellowships, bench-renting, and maker-spaces all provide opportunities for graduates, but a more comprehensive support package with mentoring and networking may be necessary in a field that is extremely expensive to set up a workshop.

I believe we should establish sustainable opportunities, both in and outside of the university sector, for graduates, and others wanting to set up in business. Using existing models of cooperative workshops with shared resources and bench-renting, Fellowships/craftsperson in residence schemes, and incubator opportunities (fig. 8).

Joseph Bray  
Head of Wood School  
Sylvia Foundation, United Kingdom  
joseph@sylva.org.uk

#### Notes

<sup>1</sup> Furniture Industry Research Association. *Mind the gap: Skills and training in the furniture industry*. Stevenage. Furniture Industry Research Association, 2015.

<sup>2</sup> England, Lauren. *A pipeline problem: exploring policy disconnect in craft higher education*. 2018. King's College London in partnership with Crafts Council UK. [www.craftscouncil.org.uk/about/research-and-policy/crafting-professional-practice-through-higher-education](http://www.craftscouncil.org.uk/about/research-and-policy/crafting-professional-practice-through-higher-education). Accessed 9 August 2022.

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<sup>4</sup> "Undergraduate course search: Furniture" in The Universities and Colleges Admissions Service in the UK. [digital.ucas.com/coursedisplay/results/courses?searchTerm=furniture%20&studyYear=2023&destination=Undergraduate&postcodeDistanceSystem=imperial&pageNumber=1&sort=MostRelevant&clearingPreference=NextYear](https://digital.ucas.com/coursedisplay/results/courses?searchTerm=furniture%20&studyYear=2023&destination=Undergraduate&postcodeDistanceSystem=imperial&pageNumber=1&sort=MostRelevant&clearingPreference=NextYear). Accessed 9 August 2022.

<sup>5</sup> Ward, Gerald. "Studio furniture in Massachusetts; Continuity and change in the commonwealth" found in Brown, Jeffrey, and Pat Warner. *Made in Massachusetts; Studio furniture of the bay state*. Brockton, Fuller Craft Museum, 2014, p. 17-23.

<sup>6</sup> Korn, Peter. *Why we make things and why it matters; The education of a craftsman*. London. Square peg, 2015.

# Applied Information Management (IT) and Mathematics in Woodturning

Ulf Jansson



Fig. 1 After drying the complete tree for some months the trunk is cut into 2 m pieces and moved inside a barn. Pieces of the bark are removed around the trunk, using a draw knife. The subsequent drying will be slow with the trunks standing.

Travelling on rail does not take us to new places! Through insights in different disciplines, new ways to explore and understand are made possible. By combining the analogue woodturning world with the digital computer world, a way to break down an intricate system into bits and pieces that could be explored and understood separately. Using this method became the means for reaching a goal to turn bowls with wall thickness less than 1 mm. The goal in its turn became a way to explore and develop mathematical designs in woodturning. Woodturning is fun and mathematics is a key to understanding and a fantastic base for design in the woodturners world.

Combining the parallel worlds of the electronics engineer and woodturner

Travelling on rail does not get us to new places! With a background as MSc EE, I have mapped the woodturning to the electronic worlds. Working with microcomputers and electronic design during the evolving IT era and simultaneously “charge my batteries” through woodturning for a 45-year period has formed the base for my thoughts and insights. This way of thinking has given me a new track to explore, understand and develop the woodturning process.

Understanding the continuous flow of information in the form of sounds, the form of the shavings, smells and vibrations emanating from cutting angles, sharpness of the tool, tool angles, pressure, rotation speed and more is a major key to success for the wood turner. Describing all parameters with intricate formulas and feeding information into a regulation system could be a way forward. The better way is to use the human sensor system and let the brain, the human CPU (Central Processing Unit), process the data. Understanding the variables involved and their relations let us make use of a portion of the human processing capacity. This could be called “man learning” as opposed to “machine learning”.

Nowadays the bowls are “talking to me”. This is hard to grasp for some – but many are fascinated and impressed by the results “from the bowl talking with the turner!” This is an example of applied IT (Information Technology) in the field of crafts and arts.

Working towards a goal opens eyes and give new insights

Travelling on rail does not take us to new places! Through insights in different disciplines, new ways to explore and understand are made possible. By combining the analogue



Fig. 2 The result from the summer-felling of a birch is a tough material, excellent for turning.

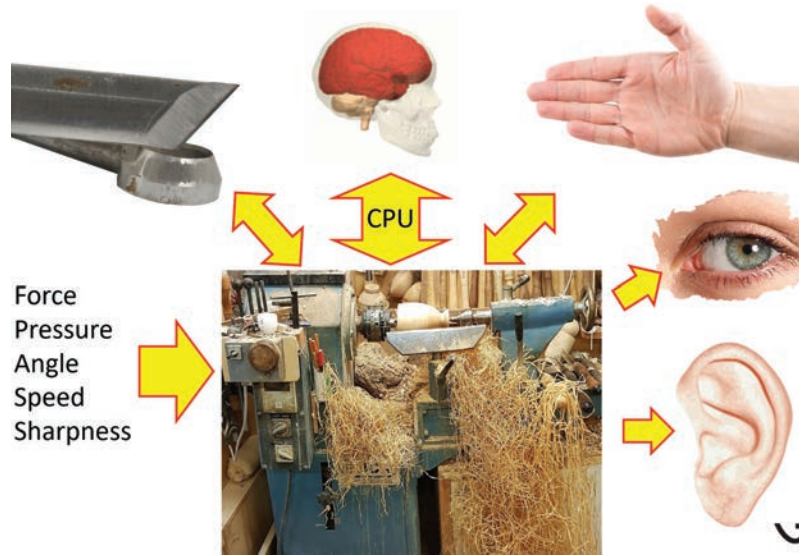


Fig. 3 The woodturning process has the properties of an information system where the brain is the CPU (Central Processing Unit) and the sensors and transducers are found in the human body. One way of programming a computer is through machine learning. The human brain is programmed through man-learning!

woodturning world with the digital computer world, a way to break down an intricate system into bits and pieces that could be explored and understood separately. Using this method became the means for reaching a goal to turn bowls with wall thickness less than 1 mm. The goal in its turn became a way to explore and develop mathematical designs in woodturning. Woodturning is fun and mathematics is a key to understanding and a fantastic base for design in the woodturners world.

#### Summer-felling produce excellent woodturning materials

This section contains a brief description about how to harvest and dry trees to become excellent wood for turning. Living in Sweden, having many farming friends with unlimited access to wood, I decided to use local wood harvested within a 20 km radius from where I live. This decision remains. I talked with handcrafters about drying wood and learned how to acquire what in Swedish is called “*syrfallning*”, which translates to “summer-felling” in English. The word suggests cutting the tree (normally birch where I live) and leaving it as is on the ground for 9 weeks. During this period the leaves “suck” the sap from the trunk as long as there is a sufficient amount of water left to keep the leaves fresh. After a couple of months, the old encyclopedias define a 9-week period, the leaves have dried, and the trunk must be presented to other processes to get from a 25-30% humidity to a “dry enough level” for “dry wood turning”.

This process starts with cutting the trunk into approximately 2-meter pieces (in practice, pieces that can be eas-

ily handled and stored). The pieces are given cuts with a draw knife to produce holes for the remaining water to leave slowly. The trunks are moved into a barn and the trunks are dried standing up. This way the trunk does not have a “cold side” due to resting on the ground. It’s important to have a uniform climate around the trunk during the final drying period. In the barn the trunks dry without interference from the direct sun rays, and the barn climate will change slowly, following the normal day variations. The trunks are left to dry for 3-5 years. The resulting wood is dry, tough, and well suited for handcrafted and turned artifacts. I have used this method to dry trunks up to 35 cm diameter.

#### Mapping the woodturning process to the Information Technology (IT)

While working towards the thin-turning-goal my wage came from a high-tech company where I worked as a design engineer in the electronics department. I was programming microcomputers and making electronic construction with control systems as the end product during the daytime and during evenings and nights I transformed myself into a woodturner.

Information Technology, IT, nowadays is widely and frequently used in the computer and computer related areas. I still remember the confusion it caused when there was a demand from the management that this expression should be used to describe our business which was a military maintenance company – the problem was that we had no idea about the real meaning or value of the word! The term Information Technology (IT) started to



get frequently used among computer nerds in the late 1900s. I soon realized that this term had its equivalent in my woodturning-nerd-world. The information fragments were found in tools and tool related parameters that were producing “signals” that could be picked up by the human transducers and processed by the human CPU – the brain. As I was mapping the different procedures and processes from the woodturning to the electronics world the discrete actions were transferred into a complex human CPU centered system. The bowls started to “talk to me” and gave me vital information about how to proceed to reach the goal for my turnings. Exciting information about what was going on was flowing between my body and the piece of wood rotating on the lathe! The computer can only handle one thing at a time and the complex course of events was broken down into bits and pieces. This helped me to understand what was going on and gave me a way to slowly acquire the necessary means to control the course of events.

To define the properties of a beautiful shaving, could at a first glance be a difficult task. At a second thought I realized that some things are self-evident to every turner when the moment occurs. It reminds me of a walk in the desert in Arizona. My friends told me to be careful as the trail was going through an area known for having lots of rattlesnakes. I asked, “how will I know what a rattlesnake sounds like”. My question was answered with a laugh, and the man told me “Don’t worry – you will know once you hear it”! A few seconds later I understood what he meant – there was no doubt, whatsoever, the sound of a rattlesnake most likely is programmed into our brain!

The shaving is observed by the eye, a most important sensor for the woodturner. For the beginner it often is believed to be the only one. Now I know that the ear often



Fig. 4 The shaving “dancing” away from a wide, sharp, chisel resting on a slowly rotating chunk of wood produces a high-quality surface. This is one of 38 unique pieces being turned to show the soul of different trees. No sanding was done as that would have torn the soul!

is just as important and sometimes it beats the eye. Hollowing a bowl, especially if the bowl has an embracing form, the ear becomes the primary sensor as the cutting point cannot be seen. The turner must learn the “bowl language”! A bowl will “talk” to the turner all the way through the cutting process. The bowl “will say” things like “you must sharpen”, “change the tool pressure”, “change the turning speed”, “change the tool angle” or simply “quit immediately”. I had a very interesting discussion concerning this matter with a blind man. He got interested in my hobby and asked me if it was possible for him to come to visit my workshop. The visit took place shortly afterwards and as the turning started, he almost immediately said “I perfectly understand what you mean”. We then turned for hours and discussed information fragments coming to us from the bowl being turned.

The control system encompassed in the human body is probably one of the most intricate ones found on earth and the turner has the noble pleasure to make use of it for the turning task. To achieve a beautiful shaving slowly dancing away from the piece of wood being turned many human sensors must work simultaneously in an intricate system to control several muscles in the hands, arms, legs not to mention the breathing and more (fig. 5). I leave it to the reader to determine if it’s an analogue system or a fast digital computer system with high resolution A/D (Analog to Digital) and D/A (Digital to Analog) converters used for sensing and command and control.



Fig. 5 The skew is cutting a beautiful shaving and producing a surface that made both the woodturner and customer happy. The low turning speed assures safe turning as only a low force is needed – provided that the tool is sharpened in a correct way.



Fig. 6 A sharp tool will focus the force and allow the tool to cut the wood fibers easily and distinctly, leaving a shiny surface.



Fig. 7 This is a late example of my definition, a thin and delicate bowl – but not too thin!

Sharpening is to focus the force of the woodturning tool. In the above discussion the shaving has been mentioned in several places. It has been assumed that the reader has a deep understanding of the importance and necessity of extremely sharp tools (fig. 6). Basically, woodturning is just about the force! Sharpening the tool is equivalent to focusing the force.

The importance of sharp tools that produce a shining surface is fundamental. Unfortunately, many turners believe that force and high speed is a way forward while my experience is the opposite. To reach my goal to turn thin bowls, low speed, small edge angles and frequent honing were essential parts of the winning concept.

#### Reaching the goal

Having found a way to acquire wood suitable for turning and having gained the understanding of the importance of sharp tools and of how to sharpen, the subsequent technique steps were refined gradually. Then my definition of a super thin bowl became clear to me. Turning end grain birch bowls with a diameter of 15-20 cm allowed me to come to a thickness of less than 1 mm ( $\approx 0,7$  mm). I

used three different tools, a 19 mm wide shallow gouge, a 19 mm wide skew and the ring tool with an outer diameter of 17 mm. The journey to travel the road to reach the goal took a few years and forced me to solve quite a few problems along the way, but the time spent was worth every second.

The short summary of my findings discussed in this paper is that woodturning is just the tip of the iceberg! Besides reaching the goal of being able to make delicate turnings I acquired a most unexpected and surprising insight. It came clear to me that the bowl had passed a limit, that earlier did not exist in my mind – the bowl was too thin and not beautiful! Seen through my eyes it looked paltry! The way forward was to make thicker bowls and in my woodturning world I find that bowls with a thickness of 1,5 - 2,5 mm appeal to me and people coming to see (and buying) my artifacts (fig. 7).

#### Mathematics is beautiful

The rotation is the woodturning fundamental and at the same time its curse! To describe the (lathe) rotation the trigonometric function  $f(t) = A \sin(\omega t + \varphi)$  where  $\omega = 2\pi f$ ,

often is used. This and many other mathematical functions can also be used in the design process. The fact that  $f(t) = A\sin(\omega t)$ , the shape of a rectified sine wave (fig. 8) will interact in a harmonic way with a turned bowl when used as a design parameter is no surprise! The same is true for many complex mathematical functions.

The circle and sine wave exist in harmony with each other. They constitute a wonderful couple and can be used as design elements in different ways. The bowl in figure 9 is such an example. The bottom half of the bowl is a hollow half sphere while the upper half of the bowl is a hollow cylinder with a period of a rectified sine wave cut. When looking at the bowl from different aspects the view changes in an exciting way. The illusion of a sphere turns into a heart or a V-cut and of course a vast number of other shapes.

The thin bowls lend themselves to many interesting design possibilities with mathematical connections. In figure 10 the graph displays the variation of the exchange between the Swedish crown and the US dollar over a 65-year period. The exchange rate is displayed as a combination of cutting the rim and sewing. The real background for this bowl is the life of a woman working with economics in a computer company. Her life before starting in the company is sewn and the period she worked in the company till her retirement is cut.

Finally, I would like to point out that mathematics also is used in the binary (computer) world. The bowl in the right part of figure 11 is an example of a binary display

of the temperature as it rises to the set point. As the set point is reached the temperature is kept steady with small adjustments!

Woodturning is fun and mathematics is a key to understanding and a fantastic base for design in the woodturners world.

Ulf Jansson

MSc EE and Woodturner

Private practice in Alvesta, Sweden

ulja66@gmail.com

#### Notes

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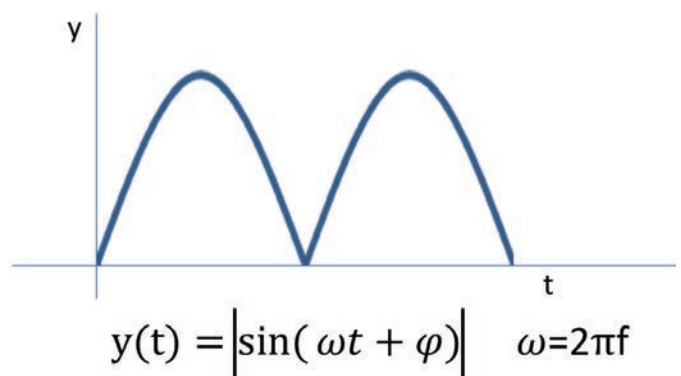
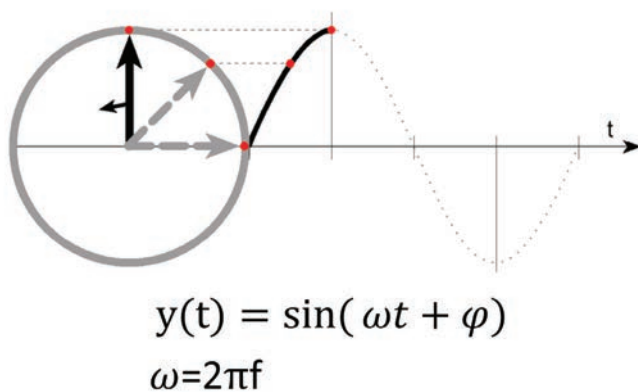


Fig. 8 The sine wave emanates from rotations as indicated in the part of the figure. Forcing a generator to rotate will produce the sine wave as the output signal just as the generator will become a motor when fed with a sine wave signal. In the left part of the figure the sinewave has been rectified (using electronic equipment) and thus the negative half periods are converted to positive half periods.



Fig. 9 Three different aspects of the same bowl. The sine wave is used as a design element which cause interesting interactions to occur.



Fig. 10 The above bowl sewn and cut to display the exchange rate between the Swedish Crown and the US dollar over a 65-year period. The bowl below is displaying temperature in the binary domain.



Fig. 11 The bowl above is displaying temperature in the binary domain.



Skoklosters slott

