

Harpsichord & *fortepiano*

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THE CLAVISIMBALUM OF HENRI ARNAUT DE ZWOLLE C 1440

by Chris Barlow

Arnaut's famous manuscript drawing of a clavisimbalum shows a plan view of an early form of harpsichord - or does it?

I have reconstructed this clavisimbalum using only the information supplied and adding nothing from my knowledge of the harpsichord. It should, I believe, be seen as a psaltery with an added action and keys rather than a primitive harpsichord.

Case and Layout

Stewart Pollens, in his book *The Early Pianoforte*, assumes that Arnaut's diagram is only schematic and that neither the outer casework nor the keyboard end blocks are included. This may be the situation but in all Arnaut's other diagrams details of the case are complete, down to the mitred corners. In the clavisimbalum we find that the top and lowest keys have a small significant detail. The back half of the visible part is tapered inwards, presumably to line up with the far end of the lever but also perhaps to clear the sides of the case, which lie within the outline shown.

If, instead of assuming the layout found in harpsichords, one takes the notion that this is simply a psaltery fitted with a keyboard and action, then some confusion in the text starts to disappear. I see no reason to assume the drawing is so incomplete. The only part not shown is the area that covers the action and this will be different for each of the actions specified, which is why it is omitted from the drawing but details are given in the text.

It is quite possible to build the instrument just as it is drawn and described. The end result is essentially a psaltery, a few inches deep, fitted with a keyboard and a chest constructed over the action.

The text and diagram give no indication of scale. The starting point, we are informed, is the width of the keyboard; all other measurements relate to this. To follow Arnaut's method the builder must use geometry to draw the rest of the instrument according to a series of "rules." This may seem an odd way to set about designing an instrument but such an approach was standard practice for craftsmen such as shipwrights and masons of the day. All the maker needs to set out the instrument is a straight edge and a pair of dividers. Geometry held a significant and spiritual meaning for the medieval artists and architects; it shaped and governed their world.

There are few clues to help with interpreting the scale of the drawing. Pollens bases his calculations by taking the octave span of an early Ruckers' Virginal. I think this is too wide. Arnaut is specific that the proportion of the natural key is such that the length is twice the width. Such short keys require a narrow octave span, as can be seen by measuring any keyboard with short keys. I have taken a three-octave span of 452mm (which is what Pollens gives as the span for an early spinettino attributed to Bonafinis).

Pollens uses the words "*lateral pieces*" to mean "the sides of the instrument," but the nearest translation I can find for "*asse*" is *stake or pole*. This suggests an upright piece rather than sides of a case. (*Lateralium* may translate as *lateral* or *side* but "*later*" means a "*bric*" or a "*tile*," which could also suggest a panel.) The text tells us that the thickness of these pieces is to be the length *OT* [see diagram] on the drawing, which with my scale is 18 mm. This would be quite heavy for the casework of a conventional type of harpsichord, let alone for such a small

instrument. It is suitable, though, for the ends of the chest, and their appearance is not unlike tiles.

We are also told that "Line BS, which is equal to half a unit, is the distance between the two bottoms." This would be impractically narrow if it were the space between the soundboard and the bottom, which would house most of the action and the keys. But with a chest constructed *over* the keys and action, the space between the bottom of the psaltery part and the bottom of the chest could be kept to this distance. It would be the space for the keyboard and quite workable.

There is an option given for double stringing. The second string is mounted above the first and is located in a notch filed into a stout bridge pin. This unusual arrangement only requires one unit of the action to activate both strings and rules out conventional harpsichord style dampers.

Action

Four possible actions are shown. I have used the second as it is more obviously different from the first or third and because it is so distinct from the harpsichord jack. A plectrum labelled "cornu" is shown, carefully drawn with a curving top surface and a straight, sloping under surface. Horn is an appropriate material here. There is nothing to suggest an escapement as we might know it. Actions one and three suggest a pivoted tongue holding the plectrum similar to a conventional jack. Action two does not show anything specific in this way except for the shaping of the plectrum itself. Its shape helps the string to roll off to create the "pluck." Without an escapement the horn strums the strings — four for the price of one: two up and two on the way down. The return is as loud as the original pluck.

The implication for the player is clear and demands a special technique. Without dampers the player can only determine the start of the note, not when it finishes. If a note is held down there will be a second strum when the finger is released. To avoid

this the finger must play and release without delay or sound an echo.

At the end of the main lever is drawn a shape that I believe to be a separate guide and adjustment device. When the main lever is made, there is likely to be some side-to-side movement. The flag shaped guide is fitted into a rail and can turn about a rounded stem very much like the blade of a hurdy gurdy. This fulfils two vital roles and it does them perfectly; it guides the motion of the action with precision and can be used for regulating the projection of the plectra beyond the string. Indeed it is the only method of voicing and regulating.

The proportions shown in the diagram of the second action seem accurate and work very well. The script describes a " ...rigid piece of brass." *Rigidus*, according to a Latin dictionary, translates as: "stiff, unbending, rigid, hard." " ...Latonis rigidam.." I have translated as hard brass, in other words brass hardened to make a spring, as opposed to a soft brass, which is far from springy.

Arnaut shows this spring in plan view instead of the side elevation used for the rest of the drawing. It was not uncommon to combine views to give the maximum information. To make the springs I used a brass strip 1.6 x 3.2 mm and beat it till it was about half its original thickness. This 'work-hardening' produces strips that have an uneven outline. Arnaut has used a ruler for the drawing of the lever and supporting bracket but the strip is drawn with an uneven outline and slightly flared ends. This is just the appearance of the beaten brass. When installed as a complete action it is possible to disconnect the chain from the spring, which can then be swung to one side to allow removal of an individual lever unit. This is an important point (if we are to consider that this was a 'real' instrument), as the only alternative, to enable repairs, would have been to dismantle everything and remove the whole set of springs before gaining access to the levers. (Probably a days work - not very practical!)

The text for the second action has the instruction:

“Öthe keys are long and extend almost to *A* and in this case it is also necessary that the keys be thoroughly bitumened, as in portatives, on account of their length.”

Various explanations are possible. The word *bitumen*, apparently, was used quite commonly in Latin to mean any natural hydrocarbon. It could be used in connection with mortar (referred to as “slime” in some translations of the Bible.) In the eighteenth and nineteenth centuries bitumen was used as a pigment to make a rich brown paint, which unfortunately never dries completely and has caused problems to many paintings. (I have not been able to discover whether it was used in this way in the fifteenth century, however). Lamp-black is also a hydrocarbon and might even be referred to as bitumen, though the Latin word for lamp black is *fuligo*. For action number two, the back ends of the keys do extend beyond the chest and are visible beneath the instrument. I have taken this to mean that because of their length they therefore need sealing and painting.

The only alteration to the mechanism I made was to move the position of the pivot. As drawn the lever reduces the motion of the plectrum end from the dip of the key. Experiments suggested that for a double strung version the key dip would have to be at least 12mm, which seemed too much for such tiny keys. On the other hand, the position shown would be quite appropriate for a single strung version.

Chains, springs, rivets and links would, you might think, give a very noisy action. However the result is surprising and there is virtually no action noise at all. It is actually quieter than jacks running in a slot, as the use of the guide takes away any side shake in the main lever and the spring keeps the whole mechanism in tension. There is nothing loose to rattle.

Stings and Pitch

Determining the size of the keyboard influences the string lengths and therefore has implications for pitch. The bass strings are short in relation to the treble. In practice they do work. I have tuned to $a=466$ and find that the treble is clear and bright but with less of the ‘pop’ you get from a harpsichord. The bass is light in weight, dark in colour and the sound swells as the harmonics are picked up by the other, undamped strings. The bass can be very effective as a drone.

This is not the highest possible pitch, but if the tension is increased either by raising the pitch or using a heavier gauge wire, several things happen as I have found out by experimentation:

- Low tension allows the pluck to happen without a twang to the sound.
- Increasing the tension requires a stronger return spring thus creating a heavy action.
- It sounds better with light tension. On a psaltery the strings cannot be critically stressed; being plucked by hand, they would break too frequently. It would seem that this notion came later on in the development of stringed instruments and suits the controlled pluck of the harpsichord.

Brass and iron are probably the most likely stringing materials but the text refers to a brass or iron wire to be laid along the length of the bridge next to the bridge pins and not as stringing materials. This wire resists the action of the strings cutting into the wooden bridge. We are told that this is not required if the option for double stringing is used as both strings run in grooves cut into a thicker bridge pin, and do not touch the wooden part of the bridge. However the suggestion that the strings could dent the bridge in this way does seem to imply the use of wire rather than gut.

What's in a name?

Arnaut calls this instrument a *Clavisimbalum*. One feature of psalteries and dulcimers (simbala?) is that they are undamped. The ring or echo from the undamped strings on the clavisimbalum is very reminiscent of dulcimers. Its name seems a good choice and may deliberately distinguish it from other similar instruments for this reason.

There are several contemporary images of large psalteries being played. These compare in shape and size with Arnaut's clavisimbalum. Adding a keyboard and mechanism makes the connection clear. It may even suggest that the clavisimbalum can be played with the right hand whilst being held against the player's chest - accordion fashion! This may be taking too much of a leap of imagination, but could it explain the apparent error in the layout of the keyboard? The sharps are properly aligned in the bass but become progressively misaligned towards the treble to the point that the top F natural has to have quite a kink in it that overlaps the E

next to it. It could be a drawing problem but perhaps it is quite deliberate and is meant to compensate for the visual foreshortening of the keyboard when held against the chest and viewed from just above the bass end. Could this also be a characteristic which distinguishes the clavisimbalum from that elusive instrument the chekker? The latter must be placed on a table, like the 'counters' in the early exchequer, to be played, while clavisimbala could be held. Who knows?

The resulting instrument owes much more to the late medieval period than to the Renaissance. It is a practical musical instrument and not a product of Arnaut's imagination. The sound seems appropriate for the period with its strummed, undamped strings that allow the sound to develop a special acoustic. The sound is distinctly different from a harpsichord.

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An extended version may be viewed at www.barlowharps.demon.co.uk

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