

IS
LOOKING
SEEING?

Restoration Minutes
and
Attempt at Analysis
of an
Italian Harpsichord

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In the following, I would like to look at a small Italian harpsichord, unsigned and undated but presumably built about 1600 in Venice. I will preface this voyage with a translation of the catalogue page and a consideration of the restoration minutes.

Inv.N°.. G 7,817
Harpsichord, C/E-f3, 8'+8'
without signature, early 16th century
length 1823mm
width 816mm
height 196mm
length of tail 283mm
" " cheek 402mm
angle of tail 34°

Bottom of spruce, comprised of 4 boards approx. 15mm thick, between the sides and with a front crosspiece 34mm wide glued with a butt-joint. Walls of cypress 4-5mm thick, butt jointed, not mitred. Bellyrail of spruce 17mm thick with two "mouseholes" 182 x 48mm. 9 knees of lime, 4 on the bentside, 3 on the spine and in both tail corners. 4 struts of spruce. The inside height is

118mm.

Wrestplank of walnut, in the bass 164mm, in the treble 130mm wide and 39mm thick. Wretpins 4 x 45 resp. 4.5 x 90 resp. 4.8 x 52mm in two rows parallel to the nut. Hitchpins in the soundboard in front of the molding. Soundboard of spruce (pitchpockets) quartersawn, parallel to the spine and without a rose. Cutoffbar 33 x 13mm near bridge, secured at the ends with linen and in the middle with parchment. No ribs. Bridge of beech, nut of walnut, both 13 high and 9 wide in the bass and 11 high and 9 wide in the treble. The gauge nos. in ink on the wrestplank. Scaling on a separate sheet.

One manual, C/E - f3, 50 notes. Keyframe of spruce with balancerail and rack of walnut. Keys of spruce numbered +, 2-50 in ink. Ratio of naturals C/E 135:170, f3 125: 156, guided by blades of beech. Keydip governed by frontrail and jackrail. Keyboard widths 684, 488 and 163mm. Heads covered with box scored with two lines, beveled on the sides and with box arcades. sharps of pear with ebony (?) tops.

keyhead length	37mm
sharp length	73mm
" height	11mm
" lower width	12.5mm
" upper "	11mm

The "D" keys are wider than "G" and "A" The naturals have Italian solfeggio syllables written in ink.

Excepting 11 pieces, all jacks are original, of pear with beech tongues, and lead weights, quills, one damper and springs (probably not original) of steel wire. Original boxslides of pear, glued up of blocks between two veneers, the front one marked "S", the back one with "P". They are marked together with a cabinetmakers mark and "S" has a mark corresponding to one on the wrestplank. All "C"s are marked on the adjacent edges and the plucking direction is marked at C: "P"<, "S"> .

Moldings of cypress around the soundboard, wrestplank and gap as well as upper and lower edges of case, inside and out. Frontboard removable. Jackrail of cypress with moldings on upper edges, the jackrail blocks ending in a scroll at both ends. Keycheeks of blackened walnut.

The instrument had a pull-down pedal, C/E-c°. The outer case is green and yellow resp. gold chinoiserie in Louis seize style and also has the hole for the pull-downs.

I. Initial condition:

The strings of phosphor-bronze and the obviously wrong stop-levers are to be immediately removed. The registers are labeled "P" = Primo, plucking to the left and "S" = Secundo, plucking to the right. In the following, I will refer to the longer as "P" and the shorter as "S". The wretpin "P" f3 is missing, "P" e2 and "S" b2 are split. The wretpins "S"C,F,D,G&E are not old, those of "P" C,F,G&E are of type No.1, those of "P" D,A,A#,B,c°&c#° are of type No.2 and the remainder is of type No.3. All of them now have holes. The wrestplank holes of the smaller types are not, except for "P" D, filled, so that I must assume them to be the oldest: perhaps our master was using up his stocks. More probably, at least type No.3 are eighteenth century replacements. "P" register is at present in front, plucking to the left: the jacks are in no order:

"S" register: P50 new, S15, S43 new, S4, S6, S5, S7, S2, S9, S10, ?,S13, S14, S?, S16, S17, S18, S19, S2D, S21, S22, S23, P24, P47 newer, S26, S27, S29, S37, S30 newer, P32, S32, P36, S34, P35, S36, P40, S39, S38, S40, S47 newer, S48, S49 new;SI.

"P" register: S3 new, P5, P6, P7, P1, P8, P2, P4, P12, P11, P13, P15, S10, P17, P16, P19, P18, P21D, P21, P22, P23, P26, S24, P25, P D , P28, P29, P31, P3D, S31, P34, P33, S33, S35, P38, S28?, P42 newer, P39, P9, P41, P43, P44, P37, P46, P14, S49, P48, P49 new, S50 new.

The jacks of pear with beech tongues (photo 5) are even now quilled. The springs are of piano wire but, judging by their receptacle, they were probably brass leaf, whalebone or quill. The flag dampers are now of red cashmere, unfortunately glued. The box keyplates are lacquered, the keyframe is held down with 4 woodscrews from underneath, the bumper cloths have been replaced by modern felt. The jackpads and that of the jackrail are of reddish baize. Thee liner is broken away from the bentside between c2 and c3 (photo 6). Apart from that, the soundboard itself is loose at a2 and on the bellyrail to the left of the crack (photo 7). Because of this, the soundboard has moved forward, jamming the slides. Photo 3 shows how the soundboard has moved from under the molding and also the same can be seen at the end of the bridge. This constitutes the actual reason for the renewed "restoration" after about only ten years. The lavish use of PVAc glue is not my doing.

II. What was done:

In order to glue, I widened the openings with wedges as far as possible, cleaning them first dry and then with warm water. It was necessary to remove part of the molding and the hitchpins in this area (photo 6). First, the liner was glued to the bentside, then the soundboard to the liner and the bellyrail. The bridge was reglued and the crack shimmed. Because the wrestplank was also loose, I removed the moldings here and cleaned the surfaces. The pinblock was reglued to the cheek, the moldings reinstated and the hitchpins put back.

In the process of cleaning, I ascertained that, at least the soundboard had been sized. The filler on the soundboard and case is apparently original: at one place, I carefully removed part of it; the wood beneath was like new, not darkened. This filler is a gesso or plaster, retouched with a watery tempera or gouache. With this, all visible nailholes, inside and out, those, now without nails (X-ray), that positioned the cutoff and all the places that tore out while planing are filled.

After everything was cleaned, it was obvious that the slides had been in the wrong order: "P" should have been at the back and "S" in front. The slides are marked with a cabinetmakers mark and with an index on the edge of "S" matching a mark on the wrestplank molding. The "C"s are all marked on the adjacent edges of both slides and the plucking directions are marked at C (photo 8). The jacks were put in the right order and, as far as necessary, repaired: some had to have worm damage replaced. N^os. "P" 2,5,9&45, "S"2,15&37 received new tongues. For "S"25 I made a new jack.

Those jacks whose springs were missing (e.g. "S"28) as well as my new "S"25 received new ones of quill which works very well. I removed the cashmere dampers. Because they were glued, I had to repair many forks. I shimmed the jacks with paper and/or cardboard to fit their slots so as to make reasonable voicing possible.

Before restringing, I had first to remove the split wrestpins. I heated them with a propane torch to break them loose. The necessary replacements were then made. The gauge N^os. are written in ink on the wrestplank (photos 9-11) so that it was "only" necessary to define them. Based on several lists (Thomas & Rhodes, Organ Yearbook 1979, p.126 and private lists of Denzil Wraight, M. Rose and myself), I restrung as on the table. The scale allows a tuning at 440 cps. with no problems. It is interesting to note that, for the first 10 notes, every note is marked. This makes it obvious that the short-octave notes C, D,& E were not thicker although we "moderns" automatically do this.

After taking the keys from the frame, I discovered that the felts were "glued" with "UHU", a butyl acetate adhesive. This is certainly not the finest method. And difficult to remove. The front- and balancerails, being warped, were sawn and wedged to straighten them. The lacquer was easily removed with acetone without damaging the calligraphy. Several keys had traces of

other calligraphies: these were tone letters instead of the solfeggio syllables now present. Layers of black wool cloth (there were black fibers in the glue rests under the "UHU") were sewn together and glued to the frame to establish a keydip of approx. 7mm. After removing the baize jackpads, I could see that white leather of the kind used by organbuilders had once been glued: this is what I then used. Also, an inked line for the pluckingpoint of "P" came to light. Judging by the traces in the keywell, the keyframe once rested On four wooden blocks in the corners. Using the most "virgin" jacks, I made these to establish the correct height. Since the instrument has no subframe or rails, the keyframe is suspended above the bottom in this manner. The screws were redundant. After removing the baize from the jackrail, it was obvious that the original cloth had been nailed. A new pad was sewn from the same black cloth and nailed on. The keydip of approx. 7mm is correct: the jackrailblocks are scribed with both the under edge of the jackrail and the lower edge of the cloth (photo 4). Since most of the sharps drop behind the frontrail, it is clear that the jackrail governs keydip. The mutilated jackrailblock in the bass was repaired. The eyes for the pedal pull-dawns were made of 1.2mm iron wire and replaced in the foremost of the 3 rows of holes since it made the most sense: the keys do fall very little just in front of the balance rail.

The measured action weights are as follows:

- key c' alone 5gr.
- with "P" jack 10gr.
- with both jacks 15gr.

The instrument was requilled and dampers of the same black wool cloth inserted.

III. Two remaining points:

At the bass end of the nut there are many cut marks (photo 12), a medium sized screw hole with concentric scratches and a nail hole in front of the nut. The front surface of the nut has also been chiseled vertically to the wrestplank. What could have been here? The only attachment to be found only in the bass is the arpichordum. Although very speculative, I have reconstructed one. An historical screw fitting the hole quite nicely holds a cam to adjust the movement and a staple in the nail hole holds the batten in place. The hooks are made from historic 1.8mm iron wire. They buzz "P" from C-c°.

The other point concerns the carved consoles (photo 16). The case walls run full-length under the moldings, they were cut away on the finished case for the consoles. I would venture that they were added, perhaps in the late 17th. or early 18th cent. to augment the instrument. Its outercase in Louis seize style is a case in point.

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Now, I would like to proceed considering the instrument and how it was made - or at least how I think it was made. I find this instrument particularly interesting because it is almost entirely original, because of its makers working style and because it is a straight-forward simple tool - it is not ornate or unusual. And it is a fine musical instrument.

First, then, a look at working methods. On the bottom there are scribed lines for the plucking point of "P", the bellyrail and a line roughly between the balance pins but parallel to the front edge. The bridge is marked out with lead on the bottom. The nut and both rows of wrestpins are scored on the wrestplank surface. These lines are parallel: they must have been made with a dividers or fixed gauge because the mistake in the treble affects all of them. The "C's are marked on the surface and on the gap edge of the wrestplank with lead (photos 11,12& 18): these are the key centers. These lines run under the nut and the line for c' determines the "P" c' wrestpin.

Because the drill depthgauge left its marks not only on the surface of the wrestplank but also on the molding for the first holes (photo 13), it is obvious that the holes were drilled after the case was finished.

To further understand, we must attempt to find our builders' measure. Assuming, for the moment, that an octave equals 6", then one division would equal 1/2". The measure (nach Ernst) of the keyboard is 488mm and of the wrestplank is 487mm, practically identical. Dividing this by 36, we get a spacing of 13.53mm.

That would give an inch of 27,06mm: I round this off to 27mm. How does this fit? The instrument is 30" wide: $816:30 = 27.2$ mm. The distance from the bottom to the soundboard surface is 4.5" - $121:27 = 4.48$. The distance from the front edge to the end of the bridge is 60", from the front edge to the soundboard on the spine is 12", the cutoffbar is exactly 30" long. The longer c2 string is 269mm, almost 270 or 10" long. In that case, c' should be 540 or 20" long but it is only 517. However, there are other bridgepin holes in this area, grouped to give "P" a#, b°, c' & c#' and "S" b° & c': these holes have not been plugged. Their sequence shows that first the longer strings were marked out and then the shorter, marking the close pairs of pins with a dividers. The most important thing about these "wrong" holes is that c' would have been 539mm long, our theoretical measure. Otherwise, there are no "wrong" holes anywhere in the bridge. For me, it is apparent that our master worked to this measure, otherwise he would not have marked out the bridge to this length. To begin, he drew the plan on the bottom, quite normal, and then made the box complete with soundboard, both bridges unpinned and all the moldings. He then drilled the wrestpins, probably marking them out with a dividers from c' but somewhat inaccurately. In the bass there is virtually no sidedraft (which is OK) and in the treble the draft is so that some of the strings bear against neighboring wrestpins: the addition of a minimal inaccuracy would move the hitchpins farther to the left and the treble pins to the right.

He then marked off the correct length for c' and began again, in both directions, to mark off. The c' line is his "middle" of the instrument. Whether a cabinetmaker a piece of furniture, an organbuilder an organcase or a luthier a violin, all of them "live" from a "middle" or symmetry axis: this reduces exactly these additive errors. In any case, he saw immediately that, although the strings need not necessarily be parallel to the case, they would be too far to the left or too unevenly spaced to fit at the gap. Therefore, he moved c' far enough to the right, it still runs to the left, to make a reasonable spacing in the gap. This, of course, corrupted the scaling, but our master apparently knew or felt that geometry and layout were more important than religious adherence to the scaling. In as much as the strings are in no way parallel but with vacillating spacing, narrower and wider, it seems reasonable to assume that he marked off the long bridge with a dividers, judging the spacing and adjusting accordingly. He must have marked off the nut with a masterjack because the spacing in the gap is surprisingly even. That doesn't answer the question why the bridge is not where it should be mathematically. Because the instrument was not opened, I could not determine whether the bridge corresponds to the marking on the bottom which also doesn't show on the X-rays.

How to arrive at a plan. One possibility is to mark off the centerlines of, say, the "C" and "F" keys along the length of the bottom, adding to this the keywell borders which are defined by the keyboard, as well as the pluckingpoint and a line for the nut (these are actually present on our instrument). From this the string lengths can be measured for the scribed notes giving points along a curve defining the bridge and from this the bentside curve, at an appropriate distance from the bridge is drawn. This is nothing but a simple graph or coordinate system- it is the method I use. We can consider this to be working from the inside out. But the key centers are missing on the bottom of our instrument although they are present on the wrestplank.

There is also the possibility of working the other way around. It is well known that, for instance, luthiers made their instruments according to so-called divine proportions: Fibonacci numbers, Golden Section, primes. I will try to apply the Fibonacci row 1,2,3,5,8, 13,21,34,55...to our instrument. It is 2 1/2' wide which equals 5 octaves: let this be our Fibonacci No. 5, then 1 would be 6" or one unit (unit measure). The length would have to be one of the next numbers, perhaps the sum of the next two: $5+8 = 13$. $13 \times 6'' = 78''$ but the length is only $67 \frac{1}{2}''$. Try again. $67 \frac{1}{2}'' : 6''$ approx. 11, a prime and incidentally the sum of the first four numbers of the row: $1+$

$2+3+5=11$. At the point on the line of the spine 78" from the front is the intersection of the straight continuation of the long bridge, so that number does have some relevance. It is very common in the 15th. and early 16th. centuries for the cheek to be $1/2$ of the width and here, also: $15"-30:2$. The width of the tail is about 6" Or 1 unit. What about the curve? It is equally common for the width $1/2$ at $1/2$ of the length, but in this case it is not. However, at unit 5 of the length it is about $1/2$ of the width and at unit 8 it is 8" wide. We have used the numbers from 1 to 13, if we divide 13 by 21 we get .619, very close to the Golden Section .618 (the same is true if we divide 21 by 34, 34 by 55, 55 by 83...). At the minor of the length, the instrument is $1/4$ of the length wide and here is the first knee on the spine. The center knee on the bentside is at $1/2$ of the length, all knees are roughly equally spaced at about 13". The front edge of the soundboard is 12" or 2 units from the front, the end of the nut about 6" or 1 unit from the front. The treble end of the nut is about 9" or $1\ 1/2$ units and the end of the bridge is quite close to 12" from the front. The ends of the bridge are about 3" from the bentside and if our master had kept this distance constant along the length, the scale of c' would have been correct. For my taste, there are just too many parallels here for it all to be coincidence and I am quite ready to accept his working from the outside in and, as can be seen, following his "divine" numbers, he could have arrived at a just scale without even considering the string lengths. For some reason we will never know, he deviated from this plan in actually gluing the bridge on: had he planed away too much with the compass plane (the instrument is somewhat narrower than its' theoretical width) or was, perhaps, the soundboard wood just too stiff?

What I am trying to get at is the fundamental difference between his method and ours: inside-out vs. outside-in or, more basic, reductionistic vs. "holistic". At the risk of sounding trite, this is the problem of our time. We have been, as have been all generations since Newton and Descartes, taught to see parts, smallest units, to assemble reality out of them, to believe that the whole is only the sum of its parts. We are unable to see the whole, to comprehend it otherwise than as the interaction of its parts. Today, modern physics is making it clear that whole cannot be described by the properties of its parts. We cannot revert, go back in time, become naive in the way our master was, but he had one intellectual advantage over us. He envisaged his musical instrument as an entity, adhering to a larger system, following a pattern larger than the instrument itself, defining its own structure and not being defined by its parts - a metasystem which also defined him and his world. Outside-in. As long as we are unable to see the wholeness - reality -, we will never understand how they did what they did and, much more important, we will never be able to make new instruments which will equal theirs', musically. It is not a question of age or aged woods or of trade secrets lost to the world or of alchemy, it is a question of direction, conception, will.

June, 1983,

December, 1989

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