

# Michele Todini's Golden Harpsichord: An Examination of the Machine of Galatea and Polyphemus

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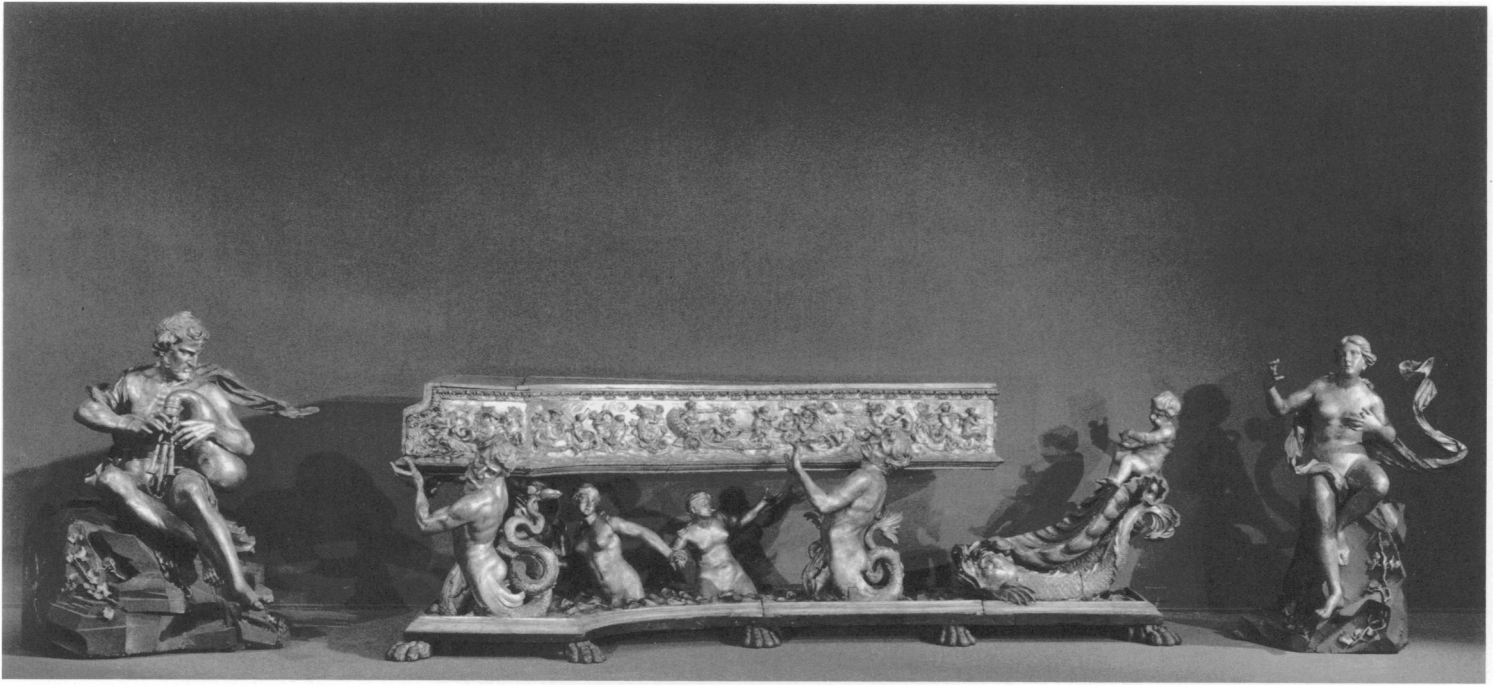
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IN 1902 The Metropolitan Museum of Art acquired a large and elaborately decorated harpsichord as part of the Crosby Brown Collection (Figure 1).<sup>1</sup> Designed and constructed in the mid-seventeenth century for Michele Todini's Galleria Armonica, the harpsichord is mentioned in numerous writings dating back to the time of its completion. The earliest account can be found in Michele Todini's *Dichiarazione della Galleria Armonica eretta in Roma da Michele Todini*, published in Rome in 1676.<sup>2</sup> Todini's own description of the instrument, found within a text that was more likely conceived as a testament to his labors and inventive genius than as a visitor's guide to his museum, reveals that this harpsichord, an organ mechanism concealed within it, and the accompanying scenery and carved figures constituted one of the major exhibits in his museum of bizarre musical and horological inventions. The most complex of these inventions was another harpsichord whose keyboard controlled a group of remote stringed instruments and an organ. This was also described in the *Dichiarazione*, as well as by other contemporaries of Todini, including Kircher in 1673<sup>3</sup> and Bonanni in 1722<sup>4</sup> (Figures 2, 3). Other early references to Todini's elaborate musical inventions include an article in Walther's *Musicalisches Lexicon* (1732)<sup>5</sup> and mention in numerous eighteenth-century travel accounts, including those of Keyssler,<sup>6</sup> La Lande,<sup>7</sup> and Burney.<sup>8</sup>

More recently, Emanuel Winternitz wrote extensively about the Metropolitan Museum's instrument, which he dubbed the "Golden Harpsichord."<sup>9</sup> Winternitz demonstrated that the outer case's carving,

depicting the triumph of Galatea, and the life-sized gilded wood figures of Polyphemus and Galatea flanking the harpsichord closely match the description found in Todini's book. Shortly after World War II, Winternitz also located a clay model of the harpsichord, presumably employed in the construction of the instrument (Figure 4). These were indeed remarkable discoveries.

None of the seventeenth- and eighteenth-century authors focused attention on the harpsichord depicting Polyphemus and Galatea, now the only surviving instrument of Todini's Galleria; rather, they concentrated on the larger keyboard instrument with its remotely controlled ancillary devices. Winternitz's chief concern in writing about the harpsichord was the mythological content of the richly carved case. The mechanical aspect of the instrument has never been examined in any of the writings besides Todini's, and this is surprising, as Todini's primary interest was the creation of auditory illusion through complex mechanical means. Because the mechanical side of the surviving instrument was never described, many have assumed that all that remains of the harpsichord is its decorative outer case. The case does in fact contain an instrument, and it is a most interesting one. It is one of the longest single-manual Italian harpsichords in existence, and its great size (see Figure 5) permits "just" or "Pythagorean" scaling (the doubling of string lengths in descending octaves) nearly down to the lowest note of its original compass. There are, however, some important discrepancies between Todini's description and the

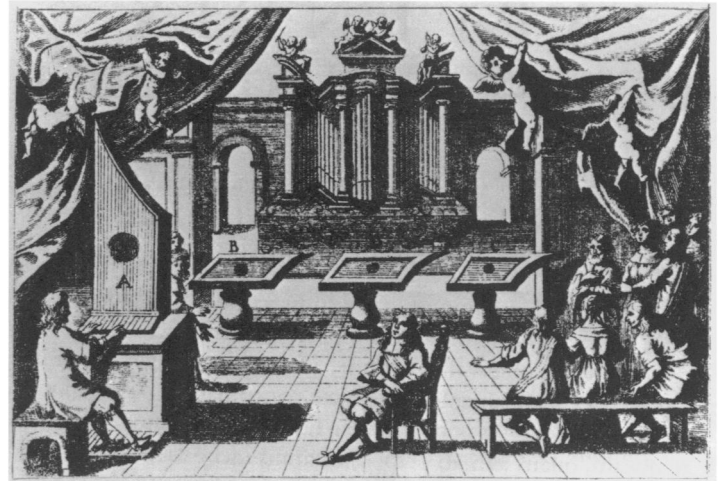


1. Michele Todini, Harpsichord. Italian, 17th century. The Metropolitan Museum of Art, The Crosby Brown Collection of Musical Instruments, 1889, 89.4.2929
2. Plate 16 from Athanasius Kircher, *Phonurgia nova* (Kempten, 1673), showing another of Todini's inventions, seven instruments controlled from one keyboard

instrument itself, and these create some doubt about the veracity of Todini's *Dichiaratione*. The purpose of this study is to examine the tangible evidence afforded by the harpsichord and to compare it with Todini's description.

Chapter III of Todini's *Dichiaratione* is entitled "Descrittione della machina di Polifemo, e Galatea." The "machina" is described as follows:

In the second room is a representation of the realm of Polyphemus, with many statues of gold, among them Galatea; it shows a procession through the sea drawn by two dolphins harnessed to Cupid, who sits in a seashell surrounded by a retinue of sea nymphs and is served by Tritons as large as life that carry a cembalo, the case of



3. Plate 33 from Filippo Bonanni, *Gabinetto armonico* (Rome, 1722), showing the same instrument illustrated in Figure 2

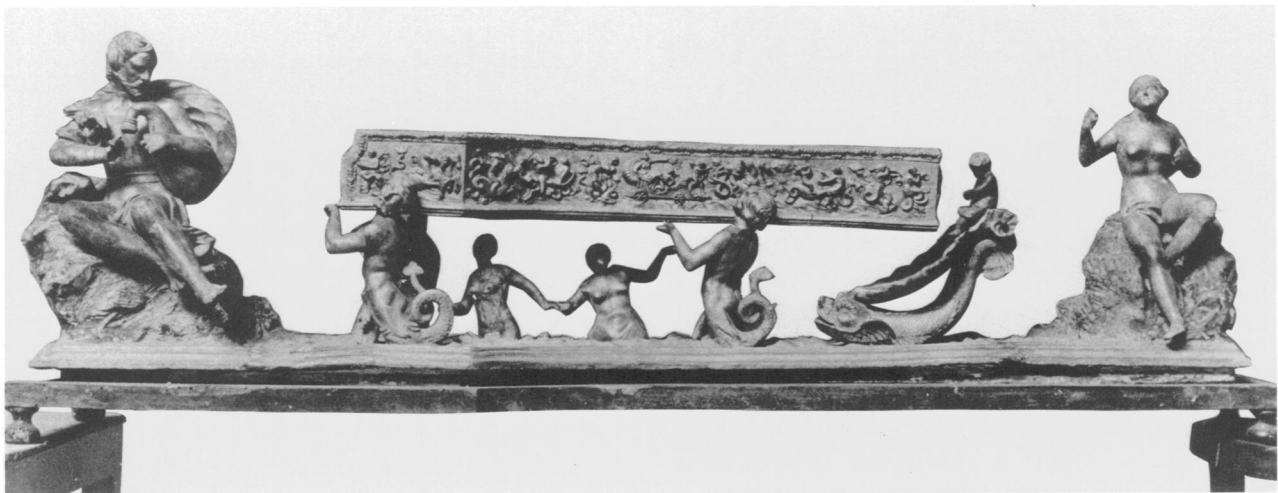


which is richly carved with representations, in bas relief dressed in gold, of the triumph of Galatea, with marine monsters presenting offerings of diverse fruits of the sea. Polyphemus sits upon a mountain, which is his habitat, according to the fable, in the act of playing a *sordellina*, or *musette*, to please Galatea; within the said mountain is a machine for producing the sound of the *sordellina*, which one plays from a keyboard situated under that of the previously mentioned cembalo. The statues have been made by worthy men in such a manner that the materials used represent the sea, mountains, air. This machine runs from floor to ceiling. The difficulty of creating this was great and is described later so as not to impede the brevity of the tale.<sup>10</sup>

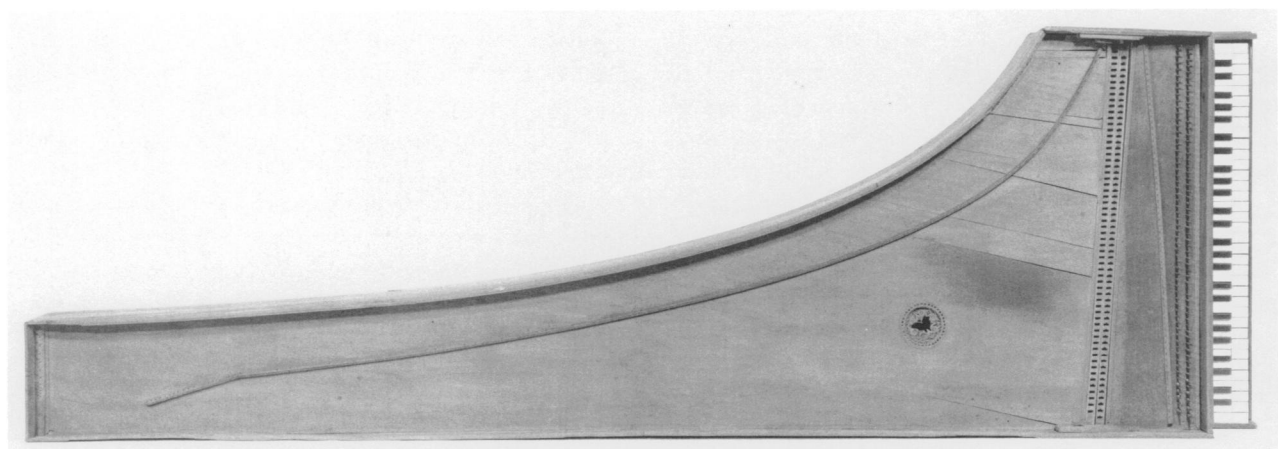
The description alluded to in the paragraph above is found in Chapter XX, entitled “Le difficoltà incon-

trate nella machina del Polifemo, provate con l'esempio di un personaggio esperto.” The chapter is concerned with the difficult and complex task of designing and commissioning the *sordellina* mechanism. To paraphrase this brief chapter, Todini reports that 14,000 *scudi* and twenty years were spent on this project. He writes that two brothers from Naples were engaged to help make the many pipes of silver and diverse woods, the bellows, keys, and other parts, and that the materials were then brought to Rome, where two foreigners (not specifically identified as the brothers from Naples) were employed to help with assembly. One of the brothers from Naples, however, was said to have given the final touches in tuning the pipes. The difficulties did not end with the building of the concealed organ; evidently, playing the instrument was also problematic. Todini explains that because the large contrabass pipes (*canne grande per li contrabassi*) required much

4. Clay model of Todini's harpsichord. Italian, 17th century. Rome, Museo degli Strumenti Musicali (photo: Museo degli Strumenti Musicali)



5. Plan view of the harpsichord in Figure 1





6. Back view of figure of Polyphemus in Figure 1

greater wind pressure than the smaller pipes, it was very difficult to control the bellows. He writes that only one person was ever able to play the instrument with perfection, and when he died, no one else could overcome the difficulties of varying the wind supply.<sup>11</sup>

There are some major problems to be reconciled if one takes a critical look at the Golden Harpsichord at the Metropolitan Museum. From a decorative standpoint, this complex and highly ornamented instrument fits Todini's description in many important respects, and there is little doubt that this instrument is in fact the very instrument described in Todini's text. Although there have been some early alterations to the harpsichord (notably a compass enlargement), the inner and outer cases, as well as the stand and platform of the instrument, appear to be essentially

unaltered except for some later structural buttressing and repair to the gesso and gilding.<sup>12</sup> (The possibility that the spine of the outer case is a replacement, and the ramifications of this possibility, are discussed below.) In perusing Todini's *Dichiarazione*, it becomes clear that either the text itself is inconsistent or that the complex instrument was being redesigned as writing progressed. More serious is the lack of any clear evidence that an organ was ever located within the hollowed rock upon which Polyphemus sits. There is very little to suggest that a second keyboard was ever present, and there is no trace of trackers or other devices for linking a keyboard with the remote organ.

Evidently, there were major problems encountered with the organ mechanism, as Todini states that "it was not possible to put in all of the pipes, as the *ceppo* [meaning block, stock, or log—in this case perhaps the wind-chest] cannot accommodate them," although it is mentioned that "two auxiliary pipes were added to make up the deficiency."<sup>13</sup> Thus it would seem that Todini had to scrap many of the pipes that had been labored over for so many years. To confuse matters further, Todini alludes to certain problems with the organ that made it difficult or impossible to play several notes simultaneously, and he notes that very complex mechanical solutions were devised to attempt to deal with this problem.<sup>14</sup> Other changes include the addition of a second bellows. The pair was said to be operated in tandem by both heels of the player, which freed both hands to operate the keyboards.<sup>15</sup>

In Chapter III Todini states that the machine for replicating the sound of the *sordellina* held by the carved figure of Polyphemus was located within the mountain upon which the figure sits. Todini also informs us that initially the keyboard for controlling the organ was located below the keyboard of the cembalo. ("Polifemo siede alle falde d'un monte, nel quale ha la sua habitazione, come dice la faula, in atto di sonare una sordellina, o Musetta per compiacere a Galatea; e dentro al detto monte stanno le Machine per sar sonare la detta Sordellina, quale si suona con una tastatura posta sotto a quella del gia nominato Cimbalo."<sup>16</sup>)

Polyphemus's rock is indeed hollow (Figure 6), but it encloses a space of about half a cubic meter. Since the rock is quite irregularly shaped, much of that space would be unusable. Additionally, there are numerous beams of wood nailed in to help support the

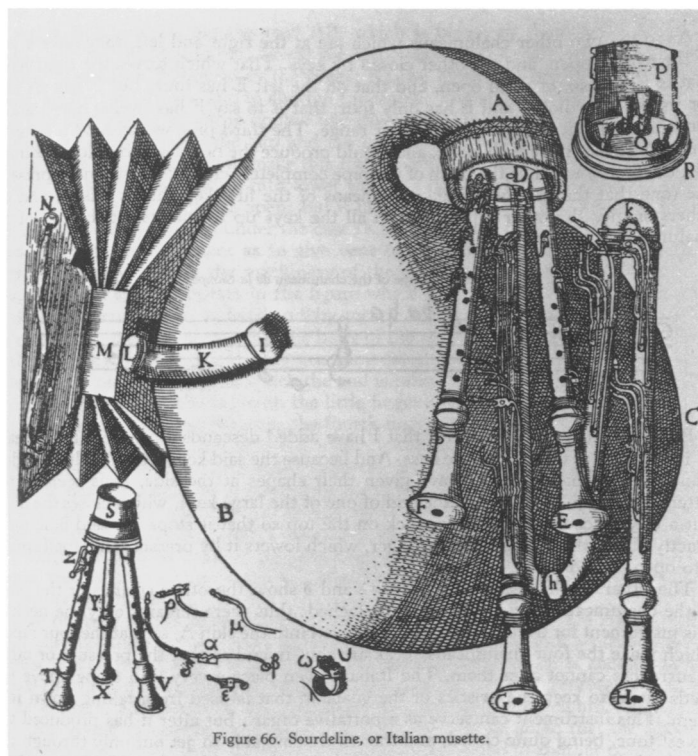


weight of the carved figure, and these would seriously hinder the installation of an organ mechanism. Several of the beams are new, though even without them usable space would be very limited. The figure of Polyphemus is carved of solid wood, but there is a back plate that covers a shallow, highly irregular cavity. This again could not have concealed any part of an organ, and there is in fact no connection between the hollow rock and the back cavity.

The organ described in Todini's *Dichiaratione* was evidently quite large and complex, especially if contrabass pipes were involved. A contemporary description of a *sordellina*, in Marin Mersenne's *Harmonie universelle* of 1635, indicates that it had a compass extending down to an octave below middle C, and this would imply open pipes of about 120 centimeters in length (Figure 7).<sup>17</sup> The double *sordellina* described by Todini suggests an extended compass reaching down an octave lower. Indeed, he writes that "in this the contrabassi are heard to the last key of the harpsichord" (. . . poiche in questa li Contrabassi si

sentono fino nell'ultima tasto del cimbalo).<sup>18</sup> Todini states that unusual amounts of wind pressure were needed for the bass pipes, and an organ requiring a large quantity of air would certainly have consumed more space than the small, hollowed rock would allow. Contrabass pipes, even if stopped and mitred, could scarcely fit in either enclosure. Even reed pipes in the contrabass region require resonators of considerable length. When one thinks of the imitative *zampogna* or *cornamusa* stops employed in Italian organs of the late seventeenth century, beating reeds with short resonators, like those of the regal, come to mind. It is conceivable that a very small organ with beating reeds could have been designed to fit into the rock beneath Polyphemus; but Todini's description of the difficulties involved in making the many pipes of metal and wood does not suggest such a compact mechanism. In addition, copious quantities of air are not required for such reeds. A possible explanation of the disparity between the available space and the quantity of pipes alluded to could be that the rock was

7. Figure 66 from Marin Mersenne, *Harmonie universelle* (The Hague, 1957), showing a *sordellina*



8. Figure of Polyphemus holding *sordellina*





9. Bottom of outer case of harpsichord

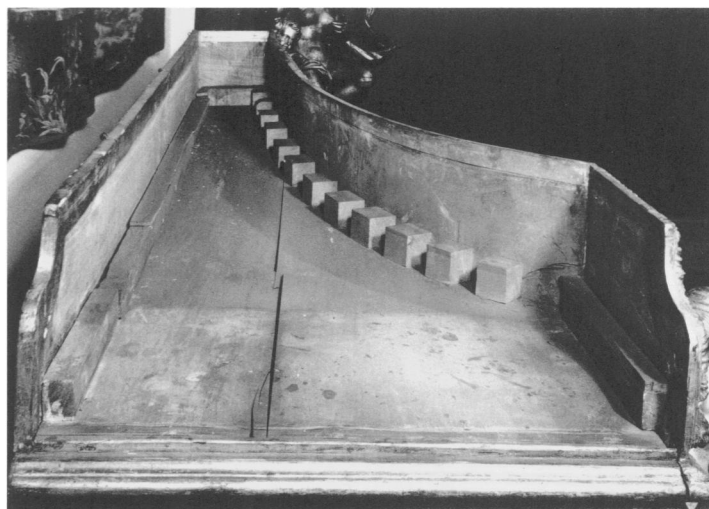
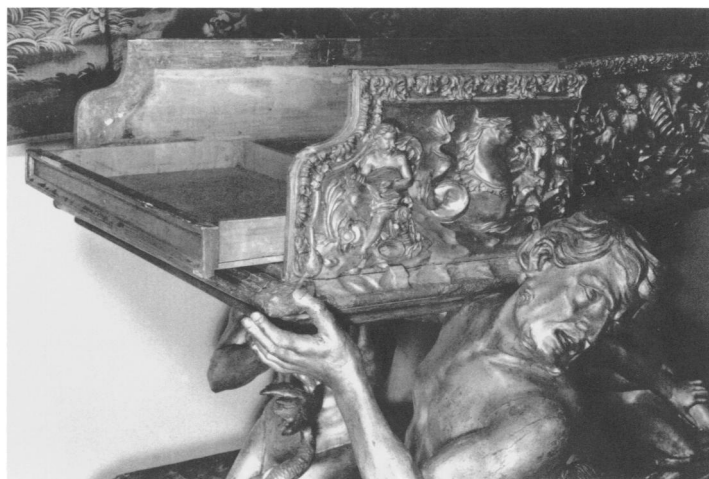
subsequently cut down in height; however, when the instrument and figures are compared with the clay model, they appear to be in correct proportion (see Figure 2).

There is considerable confusion concerning the position of the second keyboard, which operated the organ. In Chapter III Todini writes that it was positioned below the harpsichord,<sup>19</sup> but in Chapter XXI (entitled “Quanti ripieghi stano stati necessari per ridurre tale strumento trattabile sotto una sola tastatura”) he reports that this second keyboard was moved from below the harpsichord to a position above, and then he describes how this conventional keyboard was eliminated and replaced by tablike devices termed *linguette*. There is, however, no clear evidence of brackets, glue lines, screw or nail holes, or other supports that might have held a second keyboard beneath the outer case, the position referred to in Chapter III of Todini’s text. There are a number of gesso fills along the front edge of the bottom of the outer case. These appear to form two lines, one along the front edge of the bottom and one diagonally behind the front edge. At first, these were thought to be evidence of filled nail or wooden-peg holes, but after some of these gesso patches were soaked out, it be-

came clear that they filled knotholes and in fact provided no evidence of pulled nails or pegs that might have supported a keyboard (Figure 9). The front and side case moldings do form a projecting ledge, which, in fact, could have helped support a keyframe.

Another possible position for the organ keyboard is the space now occupied by a sliding drawer beneath the harpsichord (Figure 10). The space exists because the shallow case of the instrument itself is raised on blocks within the outer case (Figure 11). The blocks are approximately 6.8 centimeters in height and are numbered sequentially in ink in seventeenth- or eighteenth-century calligraphy. The harpsichord was

10. Drawer beneath the harpsichord



11. Inside view of outer case



12. The harpsichord removed from its outer case

most probably blocked up within the outer case in order to disguise its uncharacteristic proportions, for despite the great length of the encased instrument, the depth of its sides is quite conventional. When the harpsichord is removed from the outer case, one can immediately see that it is most ungainly (Figure 12). On the other hand, the proportions of the outer case do not appear disturbing because the sides are unusually deep. By raising the harpsichord up on blocks within the outer case, the top edge of the instrument was brought up to that of the outer case, as in the typical encased Italian harpsichord of conventional size and proportions. It is possible that the harpsichord may have been blocked up deliberately to provide space for a second keyboard. However, if the second keyboard had been mounted where the drawer now sits, it would have been necessary to pierce the bottom board of the outer case for mechanical linkages with the wind-chest. There is no evidence of such holes or anything to suggest that the present bottom is a replacement. (The two-piece bottom is discussed at greater length in the technical description that follows.)

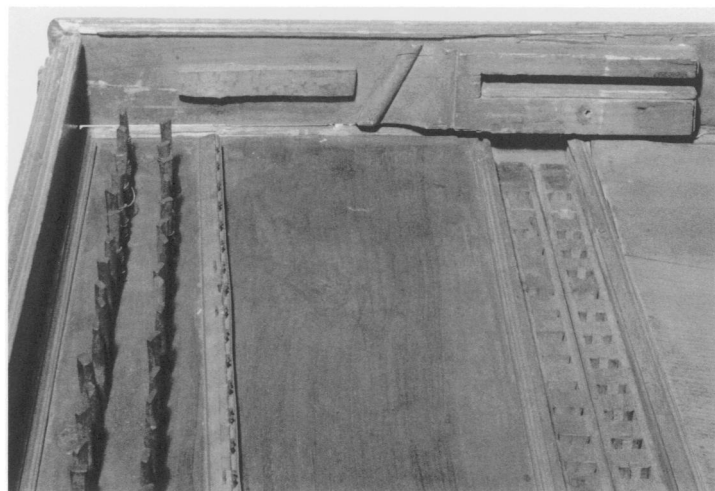
Because the drawer well is so shallow, it is unlikely that a keyboard could have been designed with enough clearance for playing. One could speculate that the lower keyboard might have been pulled forward for use; however, the problem of the mechanical linkage with the organ remains. If the keyboard was retracted so that the lid could close, what has become of the stickers or trackers? If stickers were permanently mounted along the front edge of the case

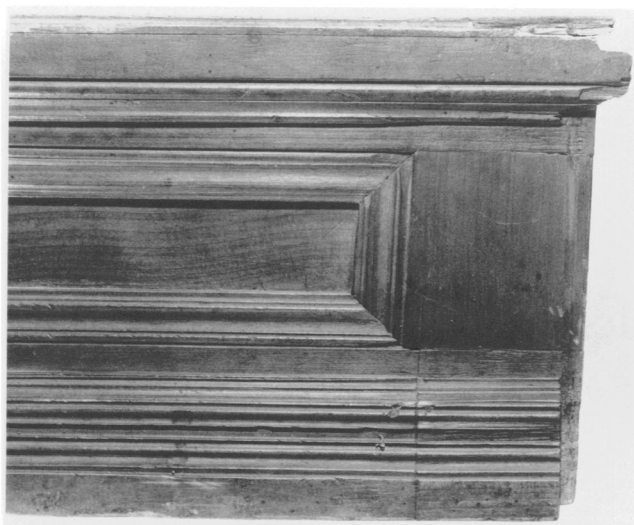
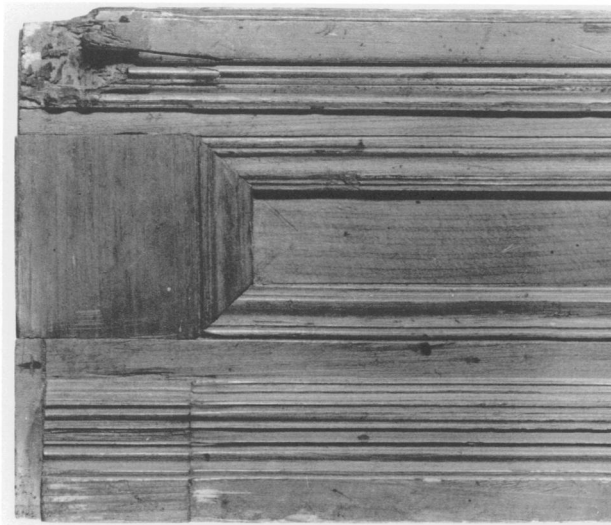
to be engaged by the sliding keyboard, why is there no evidence of a rack or other supporting structure?

There is some evidence for a second keyboard having been mounted above that of the harpsichord: wooden strips attached to the inside edges of the case above the wrestplank could have supported a keyboard above the harpsichord manual. However, there is still no evidence of trackers or stickers or any means of guiding them beyond either the inner or the outer case. These strips were more likely used to support a music rack (Figure 13).

A cloudy description of a later modification that did away with a discrete organ keyboard is found in Chapter XXI of Todini's *Dichiarazione*. With the new system certain organ notes could be activated by six

13. Keywell of the harpsichord





14, 15. Details of nameboard showing filled areas in region of keyboard extensions

*piroletti* (possibly those that activated drones). In addition, Todini indicates that “to keep the harmony complete with the other hand, it is enough to push the little finger of the said hand a little farther [along the harpsichord key] so that it will find a small tablike projection [*linguella*], which, when the key is pressed, stays raised from the middle to the end of the same key.” (. . .volendo tener l’armonia unita con le voci dell’altra mano, basti spinger un poco avanti il dito piccolo di detta mano, che troverà una linguella, quale, essendo premuto il Tasto, stara alzata da mezzo verso il fine del medesimo Tasto.)<sup>20</sup>

Thus, the tablike projections could be activated by the fingers even as they engaged the harpsichord keys. To be in such close proximity to the playing surfaces of the harpsichord keys, the *linguella* most certainly had to pass through mortises in the nameboard; however, none are evident. Moreover, the nameboard appears to be original, as alterations suggest that it was part of the instrument prior to an eighteenth-century compass enlargement. These alterations include the filling of cutouts, which originally provided clearance for end blocks (Figures 14, 15). In addition, there is scarcely a space of two centimeters between the key levers and the wrestplank. It is difficult to imagine how a system of rollers could have been designed to fit in such tight quarters, and no glue marks, nail holes, or pinholes could be detected on the underside of the pin block.

The *linguella* would have also required holes in the bottom of both the inner and the outer cases to operate stickers or trackers. These would also have to pass through the narrow spaces between the key levers, which is rather unlikely, and again there are no holes in the bottoms of either the harpsichord or outer case. A possible place for stickers and trackers to exit would be the spines (backs) of the cases. This would be a likely method if the instrument were mounted against a wall. The spine and the left wrestplank support block do in fact show evidence of repair in the region where mechanical linkages might have passed. A large area of the spine has been replaced, as well as the abutting wrestplank support block. While this work appears to have been done in the late nineteenth or early twentieth century, it is possible that apertures in this stress-bearing region might have made it necessary to strengthen the case with new wood at a later date.

If a keyboard had been mounted above the wrestplank, it is possible that linkages could have passed over the spine of the harpsichord and through the spine of the outer case. Arguing for this is the possibility that the spine of the outer case may be a replacement, as the wood is a bit lighter in color than the tail and bentside, and the bole beneath the gesso is yellow, rather than red, the color under the gilding of the other case parts and of the carved figures. It is curious that the incised decoration on the lid is a flo-



ral motif, whereas that on the spine is purely geometric. These two patterns are not in keeping with the marine and mythological subjects portrayed on the sides of the case and the stand. The originality of the lid is thus suspect on this count, and that of the drawer as well, since its inner edges are veneered with crossbanded cypress in a fashion similar to that of the underside of the lid.

Todini writes that the *sordellina* mechanism was difficult to play because one had to increase the amount of air when the contrabass pipes were used.<sup>21</sup> This suggests that the player did his own pumping, yet there is scant evidence that a pedal or other pumping device was mounted on or supported by the front edge of the instrument's base. On the underside of the front section of the base there are two chiseled depressions and a small rectangular cutout at the right front corner (Figure 16), but it is difficult to imagine how these could have been employed to support a pedal. They might have been made to retain bolts and toggles used in anchoring the figures to the base, as similar toggles are used farther back, along the bottom of the stand. Part of the molding is missing from the front edge of the base, and there have been some gesso fills made to the gilded section above this missing wooden strip. It is possible that these fills and the damaged edging may be evidence of a lost pedal.

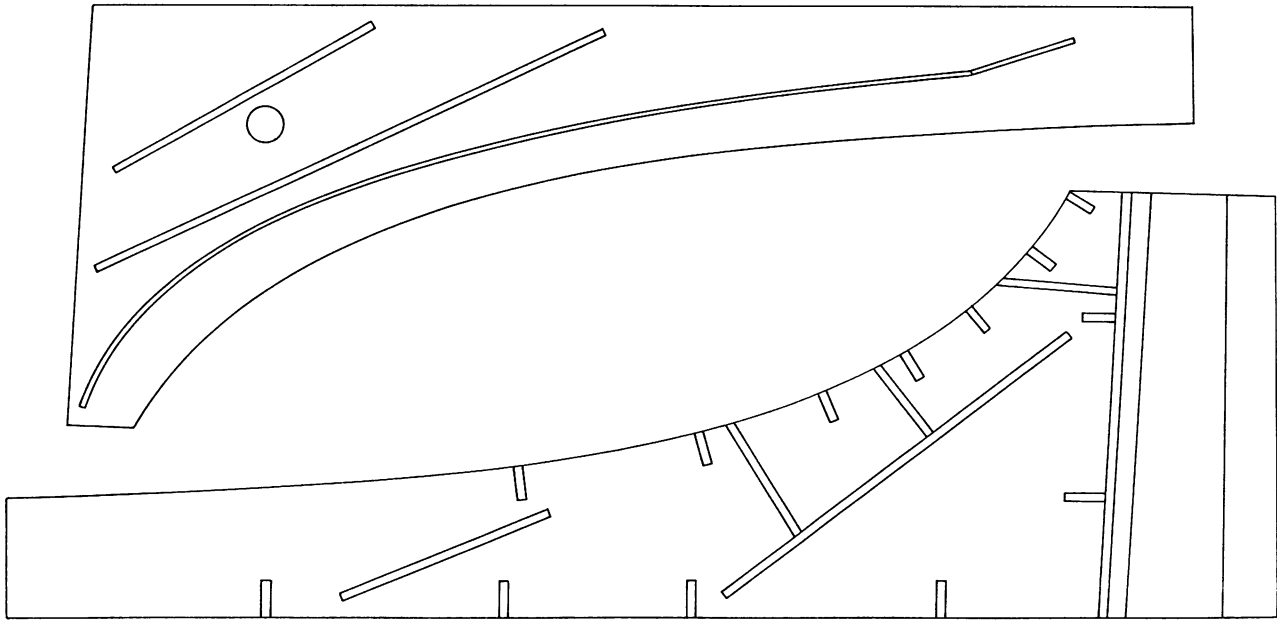
16. Front edge of base, seen from below



## TECHNICAL DESCRIPTION OF THE HARPSICHORD

The harpsichord is constructed in the common Italian inner-outer form, with a thin-walled inner case of cypress wood ornamented with delicate moldings on the upper and lower edges; on the top edge is a cap molding that conceals the joint between the upper edge of the case and its molding. Numerous cracks and openings in the case permitted the insertion of a fiberscope, and much of the case buttressing could be studied. The case sides (ca. 5 mm thick) overlap the case bottom (ca. 16 mm thick), and small softwood triangular knees (ca. 6 cm long and 12 mm thick, grain running vertically) glued to the case bottom support the thin case sides against the tension of the strings. Seven knees supporting the bentside were observed, while four appear to support the spine. Two somewhat larger knees, their grain running horizontally, brace the belly rail. The knees extend up to the poplar liner (38 mm deep, 12 mm wide, with transverse saw cuts observed in the treble). One softwood strut (square in section; ca. 25 mm thick) in the treble, between the second and third knees, runs from the bottom edge of the soundboard liner to the belly rail. Two other struts, between the fourth and fifth and the fifth and sixth knees, run from below the liner to a rail glued diagonally to the inside surface of the bottom. Another diagonal rail, roughly parallel to the one previously mentioned, is glued farther down the case bottom, but struts abutting this diagonal rail could not be seen. The harpsichord's structural design, employing a series of knees with alternating struts, is typical of Italian keyboard instruments from the sixteenth through the eighteenth century (Figure 17).

The outer decorative case is primarily of poplar, with carved, gessoed, and gilded decoration. The boards that form the bottom of the outer case do not run the full length of the instrument. There is a slightly tapering diagonal lap joint terminating in the vicinity of the miter between the bentside and cheek piece; however, this appears to be an original design feature (see Figure 9). Considering the extreme length of this instrument, it is quite likely that a harpsichord builder would have constructed the bottom of an outer (non-stress-bearing) case with a two-piece bottom. The bentside is made up of three joined lengths of poplar. Shrinkage cracks of similar



17. Schematic representation of harpsichord buttressing and soundboard ribbing, showing knees and diagonal supports

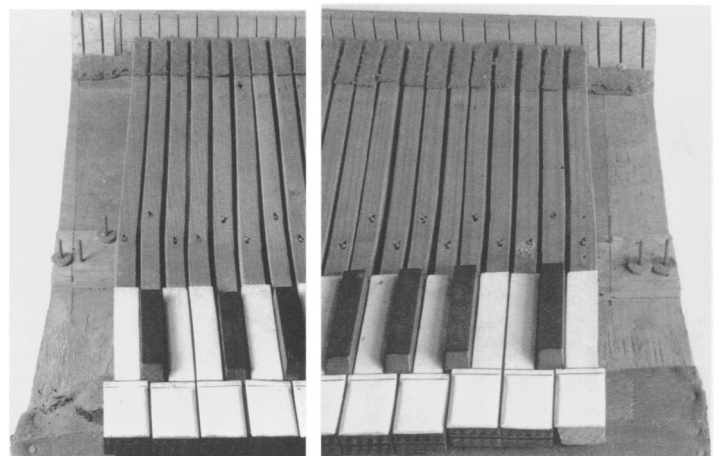
width run through both bottom sections, suggesting that they shrank at the same rate and were subjected to similar restraining forces while shrinking; hence, they are most likely of the same vintage. This is important, as the replacement of the front section of the bottom would have destroyed evidence of trackers or other contrivances that might have linked a lower keyboard with an organ mechanism.

The keywell of the inner case now appears quite plain. Presumably, carvings or simple ornamental brackets were once glued on either side of the keyboard, but they may have been removed along with the end blocks when the keyboard was enlarged.

The instrument's present compass is sixty keys, FF–f<sub>3</sub>, with the FF# omitted. However, it is clear that the keyframe and pin rack were extended in both the bass and the treble. Two pin slots were added to the bass end of the pin rack and three were added to the treble end. The saw kerfs in the original back rail are narrow, but those in the bass and treble extensions are much wider; thus it would appear that no additional saw kerfs were made in the old rail (Figures 18, 19). It is therefore likely that only five keys were added, and it would appear that the com-

pass was originally GG–d<sub>3</sub> with the GG# omitted. One balance pin, that of GG, has been moved to the left by about 7 millimeters in order to make room for the added accidental. All of the quartered-spruce key levers are replacements, as are the double-scored ivory natural platings, the undulating ebony key fronts (cut by a waving engine), and the balance pins. The tails of D keys are wider than others in the oc-

18, 19. Left and right views of keyframe with top and bottom keys removed to show extensions to pin rack



tave, a feature typical of Italian keyboards. It is most likely that the compass change was made about the middle of the eighteenth century. It should be noted that there appears to be a two-key discrepancy between the space occupied by fifty-five key tails (74.5 cm) and the distance between added nameboard moldings (77.5 cm), which were presumably glued in when the end blocks were removed (see Figures 14, 15).

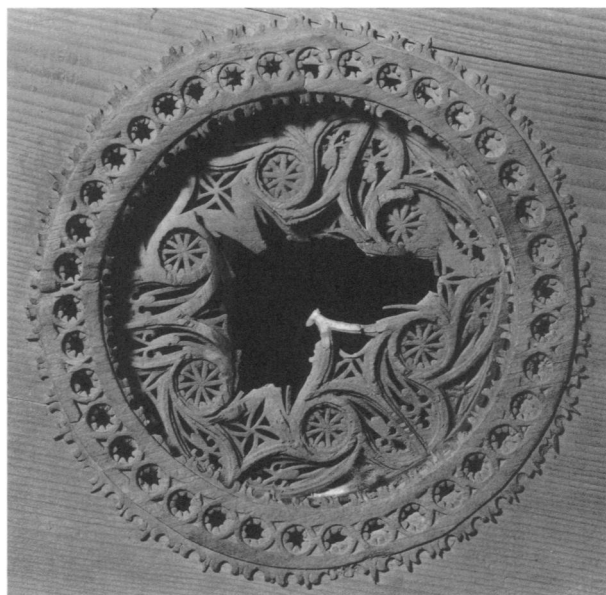
The two box slides appear to be original. Each consists of a sandwich of walnut blocks, spaced to create mortises for the jacks, glued between thin walls of cypress and beech (each box slide has outer sections composed of the two different woods). When the compass was extended, a wall on one side was sawed through transversely at both bass and treble ends, and the walnut end blocks were removed and resawed to provide mortises for the extra jacks. These new saw cuts are distinguishable from the more cleanly planed edges of the original spacers.

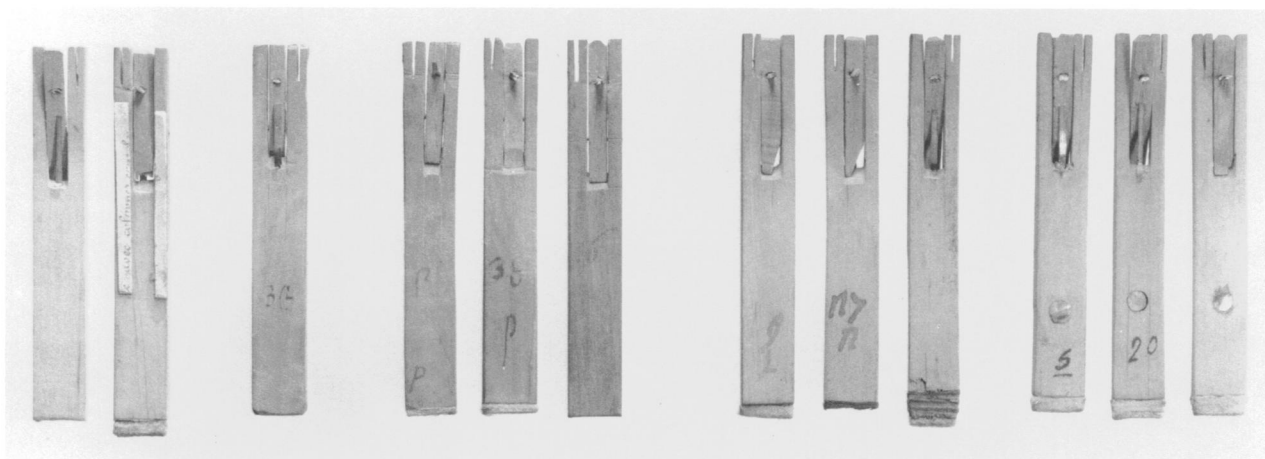
The nonveneered walnut wrestplank has not been plugged; however, the unpierced, oblong-headed pins appear somewhat stout for a seventeenth-century keyboard instrument, a clue that this is a repinned wrestplank. Since all the pins are similar, it is probable that the original holes were simply enlarged slightly when the extra holes were made. At the bass end, the last two pins are a bit more widely spaced than the others, further evidence that this is the original pin block. From glue lines on the bottom of the wrestplank it would appear that the original support blocks were about 4 centimeters wide; however, the right block has been crudely chopped out to permit the new treble keys to pass through. The left block is of pine, a modern replacement dating from the late nineteenth or early twentieth century. It adjoins a new strip of wood, of the same variety, pieced into the bottom. Part of the spine in the vicinity of the wrestplank has also been replaced. The cheek piece is completely shattered at its juncture with the pin block.

The nut is of one piece and accommodates all the pins of the present compass, so one must assume that it is a replacement. Its molding profile does not match that of the main bridge, but it does match the molding of an extension to the mitered bass section. String gauges are penciled on the nut and run from 1 in the bass (the lower two gauges are visible with an infrared viewer) to 10 in the treble (see appendix for

listing of transition points). The present scale of c2–27.6 centimeters is not inconsistent with the scales of Italian harpsichords of either the seventeenth or eighteenth century, and, as stated earlier, the unusually long case permits string lengths to nearly double on the octave down to the lowest C. The present bridge and nut positions are not original, however. Under ultraviolet light, the presence of a glue line reveals that the new nut has been positioned away from the bridge by about 1.5 centimeters. Plugged holes in the soundboard made for bridge-positioning pins indicate that the bridge has been moved toward the nut. The strings are now significantly shorter than they were originally. C above middle c (c2) appears to have been 31 centimeters, as derived from the bridge-positioning pins (see table of string lengths below). The walnut bridge has not been repinned, but it has been extended in the bass, and the mitered bass section has been lengthened to accommodate the added strings. (The molding of the bass extension matches that of the nut, indicating that they were added at the same time.) The keyboard appears to have been shifted toward the bass by one note, but the original part of the bridge was also shifted, although to the right, and presumably rebent slightly to accommodate the additional treble

20. Rosette on soundboard of harpsichord





21. Several jacks found in harpsichord

notes. Hitch pins have been repositioned and the original holes neatly plugged.

The soundboard is of quarter-sawn spruce (ca. 3 mm thick in treble, 4.2 mm in bass, measured near belly rail), with the grain running approximately fifteen degrees to the spine. A nicely cut rosette of laminated cypress wood and parchment is glued up against the soundhole (Figure 20). The pins that fix the present bridge to the soundboard are bent over below the soundboard, which was undoubtedly removed when the bridge was repositioned. Soundboard ribbing consists of a heavy cutoff bar (ca. 12 mm wide at the extreme end, with a maximum depth of ca. 5 cm at the center; the year rings run horizontally) located between the bridge and the rosette. A second rib, roughly parallel to the cutoff bar, is located beyond the rosette. Ribbing at the far end of the soundboard could not be observed. The tail section of the case is a replacement, and there have been some crude repairs made to the bass hitch-pin rail as well as to the hitch-pin rail in the treble.

All of the jacks appear to be from the seventeenth or eighteenth century, but they are of at least two generations, and there are four handwritings evident in the numbering. About one-third of the jacks are numbered in the same hand that numbered the present key levers. Most of the jacks are of service wood with brass leaf springs, and remnants of quill are present in most of them (Figure 21).

At present, the condition of the harpsichord concealed within the outer case is extremely poor. In

addition to the badly damaged cheek piece, long sections of the bentside and spine are split above and below the soundboard line; the soundboard is unglued along the belly rail, and the wrestplank is completely unglued. All of the observations about the internal structure of the harpsichord were made directly through openings in the case. The inside of the tail end of the instrument could not be observed, in part because the rails mounted on the case bottom and the very deep cutoff bar restrict visibility, and the fiber-optic probe could not illuminate or reach down into the far end of the case. Unfortunately, the instrument is too large to be accommodated by the Metropolitan Museum's X-ray room. It is conceivable that another knee or strut is present, and perhaps another diagonal soundboard brace is in the far end of the case.

## CONCLUSION

Although the instrument is presumably the same one described in Todini's *Dichiarazione*, published in 1676, there is no conclusive evidence that the organ mechanism that imitated the sound of the *sordellina* was ever installed precisely as described in the text. There is even considerable doubt that the organ ever existed. Admittedly, Todini does declare that the "machina" ran from floor to ceiling, and we can surmise that a large organ mechanism may have been concealed, not "within" the rock upon which Polyphemus sits, as described in the text, but perhaps

behind some artificial scenery contiguous with the sculpted rocks. The figures of Polyphemus and Galatea and the carved "rocks" that support them suggest that they may have been positioned against a flat surface, perhaps the scenery alluded to in the *Dichiaratione*.

Ideally, a keyboard situated below or above that of the harpsichord would have been in close proximity to the upper manual, but in this instance it might indeed have extended from the scenery against which the harpsichord was displayed. If the organ was concealed within the scenery, matters would have been simplified from a mechanical standpoint. There is no evidence that a second keyboard was mounted in the well below the harpsichord (now occupied by a drawer), nor is there any evidence of hardware used to suspend the second keyboard below the bottom of the outer case. The alteration mentioned in Todini's text that resulted in the repositioning of the keyboard above the harpsichord may be indicated by the support blocks glued to the sides over the wrestplank. There is scant evidence for the third key mechanism discussed in the text; the *linguette* mentioned in the text are not present, nor are corresponding notches or mortises evident in the old nameboard.

Although the *Dichiaratione* recounts the great difficulty in regulating the air when imitating the *sordellina*, no information is given concerning the position of the pumping mechanism. Evidently the player did his own pumping (especially since it was necessary to regulate air pressure while playing), although there is no clear evidence for feeders on or beneath the harpsichord's stand.

A minor though interesting omission from Todini's text concerns the instrument apparently held by the figure of Galatea. To judge from the hand position, this was undoubtedly a necked string instrument, perhaps a lute, *chitarrone*, *cetera*, *ceterone*, or *colascione*. A lute-backed instrument would have had to be carved in flattened form to fit between Galatea's chest and wrist, whereas the flat-backed *cetera* or *ceterone* might have fit perfectly. It is curious that whereas Polyphemus's *sordellina* is very accurately carved, Galatea is left empty-handed in both the full-sized figure and the model. Because of the tenuous connection between the figure and the plucked instrument, it is likely that it would have been carved as a separate piece and placed in her hands as a real in-

strument might have been. Such an instrument could easily have been separated from the figure and lost over the years.

The mystery of where the organ and its keyboard were situated and how it was supplied with air thus remains unsolved. Perhaps Todini erred when describing the specific placement of the organ and the keyboard. The possibility exists, however, that the organ mechanism was never actually completed and that Todini's *Dichiaratione* was an optimistic account of an unfinished project. The fact that only one person is alleged to have mastered the instrument, and he was dead at the time of publication, may have been merely an excuse to the gallerygoer who came to hear but was allowed only to see. It is again curious that the only one of Todini's complex inventions ever described by Kircher and Bonanni was not the *Machina di Polifemo, e Galatea*, but that in which a single keyboard played seven remote instruments. In 1770 Dr. Burney visited Todini's gallery in the Vespri Palace and wrote in *The Present State of Music* that

all the accounts of Rome are full of the praises of this music gallery; or, as it is called, gallery of instruments; but nothing shows the necessity of seeing for one's self, more than these accounts. The instruments in question cannot have been fit for use these many years; but, when a thing has once got into a book as curious, it is copied into others without examination, and without end. There is a very fine harpsichord, to look at, but not a key that will speak: it formerly had a connection with an organ in the same room, and with two spinets and a virginal; under the frame is a violin, tenor, and basse, which, by a movement of the foot, used to be played upon by the harpsichord keys. The organ appears in the front of the room, but not on the side, where there seems [*sic*] to be pipes and machines enclosed; but there was no one to open or explain it, the old Cicerone being just dead.<sup>22</sup>

Burney is here describing Todini's *Machina maggiore con sette strumenti sotto una Tastatura*, mentioned in the *Dichiaratione* and pictured in Kircher and Bonanni; but this highly reliable historian gives a very clear impression of the instrument's disrepair a little over a century after its construction.

Although the Golden Harpsichord and the two figures of Polyphemus and Galatea may be all that remain of Todini's Galleria, it is possible that the supplementary floor-to-ceiling scenery concealed an



organ mechanism; however, if the text of Todini's *Dichiarazione* is taken literally, there is a clear discrepancy between the description of the mechanism and the object as it is today. It is clear that the instrument has been through the hands of many restorers, and removing the instrument from Todini's Galleria undoubtedly made some modifications necessary. Perhaps the spine of the outer case was initially undecorated and required some superficial decoration and gilding. If it was originally built against a wall containing the scenery, it is conceivable that the outer case did not originally have a spine. Trackers or stick-

ers linking the organ keys could have then been directed either over or under the encased harpsichord, and then perhaps through the wall. Presumably after the harpsichord was dissociated from the organ, it underwent a compass enlargement and rescaling to make it more serviceable. It is entirely plausible that all traces of the *sordellina* mechanism, if it ever existed, were destroyed at that time. While there is no hard evidence for the second keyboard, a pumping mechanism, or even the organ itself, their existence in the seventeenth century cannot be entirely ruled out.

Translations by the author

## NOTES

1. Although this instrument bears the acquisition number 89.4.2929, it was acquired between 1901 and 1902, shortly after being exhibited in the Paris international exposition of 1900. Instruments collected by Mrs. Brown after the initial gift of her collection in 1889 were later renumbered with the 89.4 prefix.

2. Michele Todini, *Dichiarazione della Galleria Armonica eretta in Roma da Michele Todini Piemontese di Saluzzo, nella sua habitatione, posta all'arco della ciambella* (reprint, Rome, 1676).

3. Athanasius Kircher, *Phonurgia nova* (Kempten, 1673) p. 168.

4. Filippo Bonanni, *Gabinetto armonico* (Rome, 1722) p. 80.

5. Johann Gottfried Walther, *Musikalisches Lexicon* (Leipzig, 1732).

6. Johann Georg Keyssler, *Neueste Reisen I* (Hanover, 1751) p. 668.

7. Jérôme de La Lande, *Voyage d'un françois en Italie, fait dans les années 1765 et 1766 III* (Venice/Paris, 1769) p. 616.

8. Charles Burney, *The Present State of Music in France and Italy* (London, 1773) pp. 392–393.

9. Emanuel Winternitz, *Musical Instruments and Their Symbolism in Western Art*, 2d ed. (New Haven, 1979) pp. 110–115; idem, "The Golden Harpsichord and Todini's galleria armonica," *MMAB* 14, 1 (1956) pp. 149–156.

10. Todini, *Dichiarazione*, pp. 5–7.

11. Ibid., pp. 70–73.

12. Two letters preserved in the files of the Department of Musical Instruments deal with restoration work undertaken in Paris shortly after the purchase of the harpsichord. The letters were written by Mr. F. Edwin Elwell of the Department of Ancient and Modern Statuary to Mr. John Crosby Brown. The letter dated January 13, 1903, reads as follows:

Dear Sir: I have the honor to report to you as follows. I have just come from the studio of Mr. Louis Saint Lanne and have examined the work in progress on the ancient "harpsichord." The following is a free translation of some of the things said to me in the studio. "This instrument has been restored several times, and the restorations were badly done because it was necessary for me to take many joints apart that did not appear at first sight causing me a good deal of extra labor. Certain pieces were nailed (with a number of useless nails) and I was obliged to rearrange the parts. There were other parts where it was absolutely necessary to replace the plaster and paper filling by wood. In places I was obliged to remove thick clumsy joints and put the parts in their proper places."

Another letter, dated January 23, 1904, reads:

Dear Mr. Brown: The following is some more of the conversation between Mr. Saint Lanne and myself in regard to the harpsichord. "The last restoration was made in Paris in 1888, as proved by the date found on a Paris newspaper used with plaster to make a rough joint. The original work is in the style of Michelangelo or near that period of Italian sculpture and is undoubtedly of Italian workmanship. When this work was first made it was enameled a flesh color and the water was an Italian blue. The gilding is a restoration about the time of Louis XIV. There is a probability that the original color was so difficult to imitate that the easiest way out of it was to gild the entire group of figures. The gilding is well done and is known as 'water gilding.' The nails of the first restoration would indicate a date about the time of Louis XIV and are wrought iron, hand made. It is doubtful if the present cast iron feet are even from the originals in wood and seem to be of an inferior workmanship. It was necessary to fasten transverse blocks of wood across the bottom of the base to secure strength as the feet would not be strong enough to support the figures and the body of the harpsichord. The two wooden figures, outside the general composition under the body of the harpsichord, were evidently not made at the time the harpsichord was carved. The large one playing on the pipes

may have been a figure ornament on an organ or in a theatre devoted to music. It has the appearance of having been fastened to a wall and the theatrical property in the form of rocks underneath is not solid and is apparently not the original base on which this figure rested. Both the male and the female figures represented as outside the original base of the harpsichord are evidently no part of the original composition and seem to have no proper place in connection with this instrument. I would therefore respectfully recommend that two separate pedestals be made for the two parts and to rest the instrument proper on a base as per drawing enclosed."

13. Todini, *Dichiaratione*, pp. 76–77.

14. Ibid., pp. 74–78.

15. Ibid., p. 74.

16. Ibid., p. 6.

17. Marin Mersenne, *Harmonie universelle*, Roger Chapman, trans. (The Hague, 1957) pp. 366–368.

18. Todini, *Dichiaratione*, p. 74.

19. Ibid., p. 6.

20. Ibid., pp. 77–78.

21. Ibid., p. 73.

22. Burney, *The Present State of Music*, pp. 392–393.

## Appendix

### Measurements of the Instrument

Length of inner case spine (without front molding): 269.4 cm

Width of inner case (without moldings): 87.3 cm

Height of inner case (without cap molding): 18.3 cm

Thickness of wrestplank: 4.7 cm

Slider gap: 4.7–4.9 cm

Thickness of belly rail: 2.0 cm; upper section 1.4 cm

Thickness of cheek piece: 5 mm

Thickness of bentside: ca. 5 mm

Thickness of bentside at cheek miter: 3.9 mm

Thickness of spine: ca. 5 mm

Thickness of bottom: 1.6 cm

Thickness of soundboard: 3 mm at treble edge of belly rail; 4.2 mm at bass edge of belly rail

Width of cutoff bar at gluing surface: 1.2 cm

Three-octave span: 48.9 cm

c1 54.6 cm / 11.8 cm

f1 41.2 cm / 11.1 cm

c2 27.6 cm / 9.6 cm

f2 21.2 cm / 8.5 cm

c3 14.4 cm / 7.4 cm

f3 9.6 cm / 6.4 cm

### String Gauge Markings on Nut

A# 3

B 4

d# 5

g 6

c<sup>1</sup> 7

f#<sup>1</sup> 8

c#<sup>2</sup> 9

a<sup>2</sup> 10

### Present String Lengths and Plucking Points

(longer string of each pair)

FF 221.9 cm / 17.1 cm

C 206.1 cm / 16.0 cm

F 157.8 cm / 15.1 cm

c 106.0 cm / 13.9 cm

f 80.3 cm / 13.2 cm

The nut is not original though probably eighteenth century. There were, presumably, additional gauges below A#; however, the markings are no longer legible.

### Original Scaling/Plucking Point

C" 31 cm / 8.5 cm (estimated from score line indicating old position of nut and from plugged bridge-positioning pin in soundboard)