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Bartolomeo Cristofori's Paired Cembalos of 1726

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THE LAST SURVIVING INSTRUMENTS made by Bartolomeo Cristofori (1655–1732) are a harpsichord and a piano, both signed and dated 1726. They are preserved in the Music Instrument Museum of the University of Leipzig together with three other Cristofori keyboard instruments and works by older and younger Florentine makers, all of which make Leipzig the mecca for students of Cristofori. The 1726 cembalos,¹ products of Cristofori's seventy-first or seventy-second year, may have been his last works.

The 1726 piano has been much studied,² but the 1726 harpsichord has received little attention,³ despite being unique among all harpsichords ancient or modern in its specification (single eight-foot, fourfoot, and two-foot choirs of strings). It may be, however, that its very singularity accounts for its neglect, since it lies so far outside the norms of its time and its kind as to defy comparison.

In the elegance of their design and the mastery of their execution, the 1726 cembalos attest Cristofori's stature among the greatest figures in the history of keyboard instrument making. In addition, the 1726 cembalos take on added magnificence on account of the lavishly decorated outer cases and stands that were made for them (figs. 1 and 2). The stands were lost or destroyed during World War II,⁴ while the outer cases

1. In this essay the word "cembalo" is anglicized and used as the generic name for a grand or wing-shaped stringed keyboard instrument; "harpsichord" and "piano" are used as the specific names respectively for a cembalo with plucking action and one with hammer action.

2. The standard descriptions of the 1726 piano are by Stewart Pollens in "The Pianos of Bartolomeo Cristofori," this JOURNAL 10 (1984): 32–68; and in his monograph *The Early Pianoforte* (Cambridge: Cambridge University Press, 1995), chap. 3. A detailed study of Cristofori's six surviving cembalos (three harpsichords and three pianos) based on close first-hand observation is Kerstin Schwarz, *Bartolomeo Cristofori*, Scripta Artium, vol. 1 (Leipzig: University of Leipzig, 1999). I am grateful to Ms. Schwarz for sharing her findings prior to publication.

3. The standard description is in Hubert Henkel, Kielinstrumente: Musikinstrumenten-Museum der Karl Marx Universität Leipzig, Katalog, 2 (Leipzig: VEB Deutscher Verlag für Musik, 1979), 89–91; see also Schwarz, Cristofori, passim.

4. Personal communication from Herbert Heyde, formerly associated with the Musikinstrumenten-Museum der Karl-Marx-Universität in Leipzig, November 1993.



FIGURE 1. 1726 harpsichord by Bartolomeo Cristofori. Georg Kinsky, Musikhistorisches Museum von Wilhelm Heyer: Katalog 1 (Leipzig: Breitkopf & Härtel, 1910): 101.

have been in storage since some time after the war, because their pertinence to the 1726 cembalos was brought into question. That the outer cases do really belong to the 1726 cembalos is the initial premise of this essay. A mere glance shows that these outer cases were designed as a matched pair, suggesting that the instruments they were made to house were perceived as such. Comparative examination of the instruments themselves bears out this putative relationship. The pairing of the two instruments sheds light upon the mysterious idiosyncrasy of the harpsi-



FIGURE 2. 1726 piano by Bartolomeo Cristofori. Kinsky, Heyer Katalog 1:171.

chord and confers upon both a significance greater than that of either alone.

The Outer Cases

The earliest record of the 1726 cembalos is their appearance in a checklist of the musical instruments in the Museo Kraus, Florence, published in 1878 by Alessandro Kraus.⁵ In that year he lent the piano to the

5. Alessandro Kraus, Catalogue des instruments de musique anciens et modernes du Musée Kraus (Florence, 1878), 15–16.

Paris Exhibition, and it is probable that the checklist of his collection was published in connection with that occasion. While the piano was in Paris, the English keyboard historian A. J. Hipkins examined and played it, later describing it as "a complete and agreeable instrument with a facile touch."6 Hipkins included in his report a wood engraving of the piano (fig. 3),7 which he supplemented with the following description: "It is in an outer case, red, with Chinese figures and landscapes in gold, a decoration it has not been possible to show in the engraving. The inner side of the top cover is light blue." Wilhelm Heyer of Cologne purchased the Kraus Collection in 1908 and entrusted its cataloguing to Georg Kinsky, whose work was published in three volumes and a separate handbook in the years 1910 to 1916.8 In addition to describing both the 1726 Cristofori cembalos, Kinsky presented photographic plates of them (figs. 1 and 2). Although giving an inadequate impression of the painted decoration, these photographs offer invaluable documentation of the carved stands. The Heyer Collection was acquired by the University of Leipzig in 1926.

In 1979 Dr. Hubert Henkel, then director of the Karl Marx (i.e., Leipzig) University Music Instrument Museum, inaugurated the modern catalogue of its holdings with a volume devoted to quilled keyboard instruments—harpsichords and spinets. In his description of the 1726 harpsichord Henkel denies that the instrument and the outer case had a common origin:⁹

6. Alfred J. Hipkins, A Description and History of the Pianoforte and of the Older Keyboard Stringed Instruments (London, 1896), 100.

7. A companion view showing the 1726 piano from the front appears in Hipkins's article, "Pianoforte," in the *Encyclopedia Britannica*, 11th edition.

8. Georg Kinsky, Musikhistorisches Museum von Wilhelm Heyer: Katalog, 3 vols. (Leipzig: Breitkopf und Härtel, 1910–16).

9. Henkel, *Kielinstrumente*, 90: "Zum Instrument gehört . . . kein Kasten. Das ist auf Grund der dickwandigen Konstruktion, des original zugehörigen Deckels und der einschiebaren Klaviaturwand sowie auch auf Grund der Flankenzüge, die sich bei einer Aufbewahrung in einem Kasten nicht schalten lassen, eindeutig bestimmbar. Das Instrument wird jedoch seit Kraus in einem Kasten aufbewahrt, der folglich zu einem anderen Instrument gehörte. Dieser Kasten ist aus Pappel. . . . Das Äussere ist rot lackiert, darauf sind auf einem Grund aus metallischem Silber und Gold schwarze Pinselzeichnungen aufgebracht, die Landschaften, Architekturen, Pflanzen, Tiere und figürliche Szenen im Charakter der europäischen Ursprungs, darstellen" (my translation).



FIGURE 3. 1726 piano. Wood engraving from A. J. Hipkins, A Description and History of the Pianoforte (London, 1896), 100.

The instrument has ... no outer case. This is unequivocally determinable on the grounds of its thick-walled construction, its originally fitted lid and insertable lockboard, as well as its side-pull stops, which are rendered inaccessible by an outer case. Since the time of Kraus, however, the instrument has been housed in an outer case, which must therefore belong to some other instrument. This case is of poplar.... Its exterior is lacquered red, upon which, in a ground of metallic silver and gold, are depicted landscapes, buildings, plants, animals, and figured scenes in the manner of European *chinoiserie* of the first half of the eighteenth century, ca. 1730/40, perhaps of Saxon origin.

The observations upon which Henkel's opinion is based are correct, and one might summarize their import by stating that no utilitarian motive may be discovered to account for the existence of the harpsichord's outer case. (It is assumed in the following discussion that Henkel's opinion includes the piano's outer case as well as the harpsichord's, a point confirmed by the fact that both were exiled to storage in the Leipzig collection.) Nevertheless, some theory explaining the existence of the outer cases is required, if only because of their exceptional beauty. That their time and place of origin could be close to that of the instruments themselves is supported by expert opinion.¹⁰ Furthermore, the fit of the outer cases to the instruments is too good to be coincidental (see plates 1 and 2 on pages 19-20), and one detail of their design confirms the point beyond reasonable doubt. The plan views of the two instruments, although virtually congruent in outline (fig. 4) differ markedly in respect of the lines formed by the pluck points of the jacks in the harpsichord and the strike points of the hammers in the piano. The latter is laid out at an angle of 91 degrees to the long side of the piano, whereas the line of pluck points in the harpsichord is laid out at an angle of 100 degrees to the long side of the harpsichord. Although many Italian harpsichords have raked pluck-lines, this is the most extreme angle known to the author. The lids of the outer cases reflect the different ways in which this fundamental feature is handled in each of the two instruments: that is, the joint between lid and flap in the piano outer case is nearly perpendicular to the long side, whereas the corresponding joint in the harpsichord outer case lid lies at an angle of 100 degrees (fig. 5). This means that when the flap is opened it lies sharply skewed on the lid. It is inconceivable that such a feature would have been introduced in an outer case made for a harpsichord with a perpendicular or gently raked pluck-line.

Henkel's theory that the outer cases were made for other instruments requires one to assume 1) that two other grand keyboard instruments once existed with plan views virtually identical to those of the 1726 Cristofori cembalos, one having a nearly perpendicular, the other an extremely raked strike- or pluck-line; 2) that these outer cases were made for them; 3) that the unknown instruments disappeared while their outer cases survived; and 4) that these were found to fit the Cristofori cembalos, and were consigned to them. All of this exhausts one's

10. In response to my request for his opinion of the outer cases, Stewart Pollens of the Metropolitan Museum of Art, New York, wrote: "... I must say that the color photographs are very interesting. The chinoiserie is of good quality and looks to me to resemble some pieces of Italian furniture from the early eighteenth century that I have seen in museums and books on Italian lacquered furniture (see [Giulio] Lorenzetti's *Lacche veneziane del settecento* [1938])... I sent the photographs to Drs. Wolfram Koeppe and Daniëlle O. Kisluk-Grosheide, both experts in Italian furniture and lacquer, and they agreed that there was no reason to doubt that the outer cases were made in the early eighteenth century (ca. 1715–35). It is likely, then, that they were made around the time the instruments were constructed, possibly with a suite of furniture to match" (personal communication, November 1, 1995). Alvar Gonzàlez-Palacios, a leading authority on Italian decorative arts, writes: "... the date suggested by you for the instrument cases, ca. 1725, seems plausible—plausible at least in Italy..." (personal communication, August 8, 1995).



FIGURE 4. Plan views of the 1726 harpsichord (left) and piano (right). Adapted from Schwarz, *Cristofori*, Abbs. 14, 16.



FIGURE 5. 1726 harpsichord outer case, lid. Photo: Karin Kranich, University of Leipzig, Music Instrument Museum.

credulity. Rather, it seems reasonable to conclude that the outer cases were made for the 1726 cembalos.

It remains to ask by whom these cases were made. Although the making of double-cased harpsichords in Spain toward the middle of the eighteenth century has been documented,¹¹ we may probably narrow the field to an Italian maker, since the convention of double-case construction was followed more persistently in Italy than anywhere else. Here a digression on methods of case construction is necessary. Present evidence suggests that from the earliest times of making string keyboard instruments two different approaches were taken. The case walls might be made of thick lumber and braced to withstand the tension of the strings, with the bottom board applied to the rim mostly to close the box rather than as a fundamental structural element. Such built-in-the-rim instruments are known from early documentary sources, and by the seventeenth century this method dominated in most areas of northern Europe, especially in the Low Countries. The other approach begins with a panel cut to the outline of the instrument, upon which a frame is erected to withstand the tension of the strings. Here the case walls, which are applied to the outside of the frame and the edge of the bottom board, add little to the structural integrity of the case, and can be made of wood (usually cypress) nearly as thin as that employed by makers of lutes and bowed stringed instruments. Built-on-the-bottom keyboard instruments show an affinity with the craft of the luthier, especially in their employment of unfinished or naturally-finished wood, their elegantly mitred case joints, and their decorative detailing worked directly in the wooden fabric of the instrument. The bottom-built style predominated throughout the Italian peninsula.

While the upper edges of these cypress cases are reinforced with molded battens, they are insufficiently robust to support a hinged lid. For this reason, and also to protect the delicate woodwork, the instrument was usually fitted into a painted protective case, often rather

11. Recounting his visit to the great singer Farinelli (Carlo Broschi) in Bologna in 1770, Charles Burney described his collection of keyboard instruments, including "two Spanish harpsichords... of the Italian model, all the wood is cedar, except the bellies, and they are put into a second case" (*The Present State of Music in France and Italy* [London, 1771], 204). According to Beryl Kenyon de Pascual, these instruments were probably made by Diego Fernández for Queen Maria Barbara of Spain: see "Diego Fernández—harpsichord-maker to the Spanish royal family from 1722 to 1775—and his nephew Julián Fernández," *The Galpin Society Journal* 38 (1985): 35–47.

coarsely worked. Posed on a stand and fitted with a hinged lid, such a case becomes virtually a part of the instrument, and this is what is meant by double-case construction. The prestige of this manner of construction is attested by the phenomenon of the so-called "false inner-outer" construction,¹² first seen in spinets dating as early as the last quarter of the sixteenth century,13 in which an instrument built with thick walls and a hinged lid is decorated on the interior above the soundboard with cypress veneer and applied moldings to mimic the appearance of a separate cypress instrument nestled in a typical protective outer case. False inner-outer construction was restricted to rectangular spinets until late in the seventeenth century, when the style was adapted to harpsichords.14 Single-case construction, usually with trompe-l'oeil interior decoration, was employed more and more often in the eighteenth century, but did not immediately supplant the earlier style. The latest doublecased harpsichord (other than the 1726 Cristofori) known to this author was built by Giovanni Maria Goccini in Bologna in 1721.15

Cristofori's early instruments were of the double-case type, as Henkel has pointed out,¹⁶ but as early as the 1690s he began to make single-cased instruments. Two of his surviving spinets conserved in Leipzig illustrate the transition. The so-called oval spinet dated 1693, a double-strung instrument laid out with symmetrical eight-foot bridges, has thin cypress case sides elaborately decorated with ebony marquetry; its outer case, described in an early inventory, is lost. The theater spinet (undated but probably made before 1700) is single-cased. Rather roughly finished on

12. This apt term was coined by Frank Hubbard, *Three Centuries of Harpsichord Making* (Cambridge, Mass.: Harvard University Press, 1965), 20.

13. For instance, a single-cased rectangular spinet made by Joannis Celestini in Venice, 1587, in the collection of Andreas Beurmann (*Schöne antike Tasten-Instrumente* ... aus der Sammlung Andreas E. Beurmann, Schloss Hasselburg, Ein Kunstkalender aus dem Dr. Schwarze-Verlag [Wuppertal, 1994], no. 9). This exceptionally beautiful instrument is covered inside and out with extraordinary marquetry decoration, but the interior of the case above the soundboard is veneered in cypress with applied moldings, a *trompe-l'oeil*.

14. The earliest surviving false inner-outer harpsichord, according to a personal communication from Denzil Wraight, is the one made in 1681 by G. B. Giusti in Lucca, now in the Germanisches Nationalmuseum, Nuremberg.

15. This instrument is conserved in the collection of Luigi Ferdinando Tagliavini. For a description and pictures see L. F. Tagliavini and John Henry van der Meer, *Clavicembali e spinette dal XVI al XIX Secolo: Collezione Luigi Ferdinando Tagliavini*, 2d ed. (Bologna: Grafis, 1987), 86–93.

16. "Bartolomeo Cristofori as Harpsichord Maker," *The Historical Harpsichord* 3 (Stuyvesant, N.Y.: Pendragon Press, 1992), 5.

the exterior, this large double-strung spinet (8' + 4') has an elegant interior. The cypress soundboard carries a handsome rose and the rim of the case is veneered in cypress, but with no attempt to mimic double-case construction. Indeed none of Cristofori's surviving instruments show any trace of trompe-l'oeil in their interiors. However, the five cembalos from the decade of the 1720s (that is, the 1720 piano in the Metropolitan Museum of Art, New York; the 1722 piano in the Museo nazionale degli strumenti musicali, Rome; and the 1722 harpsichord, 1726 harpsichord, and 1726 piano in the Music Instrument Museum, Leipzig) display an exterior design drawn from a common type of outer case construction in double-cased instruments. Substantial cross-grain battens set at intervals around the perimeter reinforce the sides of the case (fig. 6). At the very front of the instrument these battens are joined to a reinforcing board spanning the front edge of the bottom; flat moldings applied to the edges of this yoke form a groove that accepts a lockboard. Except for the 1722 piano, all these instruments are painted on the outside, the 1726 cembalos rather roughly. (The 1722 piano in Rome remains "in the white," without any finish whatsoever, although a painted finish was certainly intended, since nail holes and other imperfections were filled with putty.) Although these late instruments are beautifully finished on the inside, their exteriors give the impression of shipping crates. One might suspect Cristofori of having turned the play on double-case construction inside out, feigning not by means of trompe l'oeil in the interior but by conforming the exterior to the heaviest and coarsest style of separate outer case construction.

An added complication arises from the fact that each of the five late grand instruments contains what might be described as a vestigial "inner instrument." Cristofori developed a unique method of case construction designed to isolate the soundboard from the tension of the strings. This he did by posing the soundboard on a thin bentside lying inside and parallel to the structural bentside. The strings are hitched on a hardwood plate anchored in the outer bentside and cantilevered over the soundboard, hiding the existence of the inner bentside. Struts and braces to support the structural bentside are conducted through holes in the inner bentside. This inner bentside has approximately the dimensions of an old-fashioned thin-cased cypress instrument, and given that Cristofori employed cypress for his soundboards, one might think of these late grand instruments as each having a thin cypress instrument immured within a very heavily built outer case. Again one would suspect Cristofori





of playing with the convention of inner-outer construction, except that this particular joke could be known only in the maker's shop and to the Almighty, since the inner bentside leaves scarcely any visible sign on the outside to betray its existence.

To return now to the stated problem, Cristofori is by far the most likely candidate to have made the outer cases for the 1726 cembalos.¹⁷

17. To be more precise, he may only have designed, or authorized the making of, the outer cases. It is at least likely that their decoration was carried out in a specialized shop, and in the absence of evidence pro or con it is impossible to judge whether Cristofori himself fabricated these objects.

He himself had ample experience with the style of double-case construction, and he seems to have employed, or played with, the convention variously in designing the grand instruments from the 1720s. Whatever difficulty we may have in imagining him undertaking this project would be immensely magnified by trying to imagine anyone else doing it. Furthermore, the registration machinery devised for the harpsichord to serve in place of its external push-pull stops, which were rendered inaccessible by the encasing of the instrument, shows typical signs of Cristofori's genius, as will be discussed below. The 1726 cembalos as originally completed were merely functional musical instruments (although extraordinary ones). The addition of outer cases transformed them into objects of luxury. What brought the outer cases into existence, in other words, was not a utilitarian need for protection but an imperative of style, probably reflecting the particular wishes of a patron.¹⁸

The generously dimensioned outer cases are substantially deeper than the height of the instrument case walls and provide plenty of clearance all around. They are made of what appears to be linden or lime (Italian tiglio)-in any event, certainly a deciduous hardwood. A striking feature is the prominent modeling of their exterior side surfaces (plates 3 and 4). Seen in section, the carved surface describes a concave line descending from the wide square of the upper edge through about threefifths of the height of the case wall, then swelling dramatically into a convex curve in the lower two-fifths and ending with a complex molding at the bottom. This molding balances the molded edge of the lid when the lid lies closed upon the case sides, and both moldings are gilded. The modeling is carried all the way around the case, and it appears to be carved directly in the wooden fabric, rather than in applied plaster or other filler. The frontboards are tenoned along their edges and slide into grooves in the corners of the cases (plate 4). Each is fitted with a half-mortise lock and with iron straps at its upper corners; the straps

18. The 1721 Goccini harpsichord mentioned above as the last known doublecased harpsichord exemplifies a similar stylistic imperative. The commission for the instrument may have arisen from the residence of James Stuart, pretender to the English throne, and his court in Bologna in those years. The instrument was made for Lady Elizabeth Parker, who was married in 1720 to Sir William Heathcote of Hursley, and it remained in the Heathcote family until 1975. The instrument itself is a conventional representative of the Italian thin-walled cypress type, but the outer case is executed in mahogany with elaborate brass fittings and a trestle stand designed along familiar English lines, although possessing an entirely foreign delicacy and grace. Clearly the outer case was intended to conform to English taste. See Tagliavini and van der Meer, *Clavicembali e spinette*, 86–93. hold pins that register in holes in the upper edges of the front corners of the case to pull these joints together when the case is closed. The large and small lids (lid and flap) are united by handsome butterfly hinges inlaid nearly flush with the top surfaces. A clasp in the middle of the bentside holds the lid down snugly.

"Magnificent" is not too strong a word to describe these outer cases. Their svelte modeling marks them as products of rococo taste, yet the simplicity and clarity of their shape lends them dignity and a degree of monumentality, and they are saved from any danger of blandness by the aggressively angled columns and barbaric writhing feet of the stands. The painted decorations are laid out as a series of unrelated scenes interspersed with stock themes-grass, birds, rocks, and water. Generously separated from each other, these scenes draw emptiness itself (or the beautiful red lacquer ground) into the composition as a positive element. Although partially obscured by later overpainting and restoration, the hand of the artist discloses an acquaintance with principles of Chinese art. In depicting grass, for instance, the painter understands the rhythmic laying down of curved lines changing continuously in their arc and diminishing smoothly in thickness to imperceptibility (plate 3). The lively quintet of acrobat-musicians presents a fine study in asymmetrical balance, and the nested lines by which they are depicted again shows acquaintance with Chinese drafting technique (plate 5).¹⁹

Cristofori's two splendidly encased cembalos stood at the pinnacle of fashion early in the second quarter of the eighteenth century, when the vogue of oriental lacquer work had triumphed throughout Europe. The taste for *chinoiserie* reflects a strain of Enlightenment thought which proposed for the first time to pay serious attention to the art and culture of non-Christian peoples.²⁰ Some of the scenes bear out this philosophical underpinning. On the harpsichord bentside we see an Indian elephant

19. I am indebted to Christine Arveil for guidance in matters of style pertaining to Chinese art, and in the history of European *chinoiserie*.

20. Adolf Reichwein sets forth the philosophical and aesthetic foundations of rococo and chinoiserie in China and Europe: Intellectual and Artistic Contacts in the 18th Century (London: Keagan Paul, 1925). He identifies Johann Bernhardt Fischer von Erlach's Entwurff einer historischen Architecture in Abbildung (Vienna, 1721) as the earliest serious presentation of non-European architectural monuments. Among Fischer's beautiful drawings are views of the Egyptian pyramids, and buildings from Turkey, Siam, Japan, and China. There is also a remarkable engraving of Stonehenge. I am grateful to Max J. Okenfuss for drawing this matter to my attention, and for giving me these citations.





PLATE 2. 1726 piano in its outer case. Photo: Karin Kranich, University of Leipzig, Music Instrument Museum.

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PLATE 3. 1726 harpsichord outer case, detail of tail. Photo: Karin Kranich, University of Leipzig, Music Instrument Museum.



PLATE 4. 1726 harpsichord outer case, case front. Photo: Karin Kranich, University of Leipzig, Music Instrument Museum.



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PLATE 5. 1726 harpsichord outer case, detail of the bentside showing quintet of musician acrobats. Photo: Kerstin Schwarz.



PLATE 6. 1726 harpsichord outer case, detail of the bentside showing elephant. Photo: Kerstin Schwarz.

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PLATE 7. 1726 piano outer case, detail of the cheek. Photo: Kerstin Schwarz.



PLATE 8. Overlaid plan views of the 1726 harpsichord (red) and the 1726 piano (black). Adapted from Schwarz, *Cristofori*, Abbs. 14, 16.

with its howdah carrying a turbaned rider and driver (plate 6). The appearance of an ostrich on the frontboard of the same case can be seen as a reference to Africa (plate 4). Another figure points closer to home—this is the philosopher, prominently placed on the cheek of the piano case (plate 7). With a manuscript in one hand he walks out of his house, supporting on his left arm a telescope through which he examines a celestial phenomenon, doubtless a comet. Are we not meant to remember the great Galileo Galilei (1564–1642), whose lifetime appointment in 1610 as astronomer to the court of Tuscany supported him through the most triumphant and the most turbulent years of his career? And are we not also reminded of the superb tradition of Medici patronage which had so greatly enriched human civilization, and which in the 1690s supported Cristofori in his invention and development of the piano?

Patronage

A project carried out on the scale of the 1726 cembalos could scarcely have been destined for the ordinary commercial market. Such things reflect sovereign taste and wealth. Can the patron of the 1726 cembalos and their splendid cases be identified?

One possibility arises from the nineteenth-century provenance of the instruments, which were acquired by Alessandro Kraus from a patrician family in Modena. This does not necessarily mean that an ancestor of the nineteenth-century owner commissioned the instruments, although such an origin is possible. Unfortunately, further inquiry as to the identity of this family has proven fruitless.²¹

21. In response to my inquiry whether it might have been the Este family (who had removed from Ferrara to Modena early in the seventeenth century), Hubert Henkel wrote as follows (personal communication, July 9, 1996): "... Ich habe den Urenkel von Alessandro Kraus, Baron Gatti-Kraus, 1980 in Vancouver besuchen können. Er besitzt in zahlreichen Aktenordnern noch den gesamten Briefwechsel seines Urgrossvaters zum Erwerb der einzelnen Instrumente, darunter auch Briefwechsel zu diesen Flügel, doch habe ich keine Erlaubnis bekommen, diesen Briefwechsel einzusehen. Gatti-Kraus hat mir lediglich vorgelesen, das sein Urgrossvater 480 Lire (!) für diesen Flügel bezahlt hat. Er hat mir auch flüchtig den Namen des Verkäufers genannt. Das war kein d'Este, doch hat Gatti-Kraus so undeutlich und schnell gesprochen, das ich den Namen nicht behalten und aufschreiben konnte. Baron Gatti-Kraus ist vor einigen Jahren 'verschwunden.' Niemand weiss, wo er jetzt wohnt." (I had the opportunity to visit the great-grandson of Alessandro Kraus, Baron Gatti-Kraus, in Vancouver in 1980. He possessed in numerous files the complete correspondence of his great-grandfather relating to the acquisition of various instruments, among them the correspondence

A second possibility is that the patron was King João V of Portugal, who purchased pianos from Cristofori. A notation by Cristofori's colleague in Florence, Niccolò Susier, specifies the price paid by the king as 200 *Luigi d'oro*, a "... staggering sum ... four or five times what might have been paid for an antique Ruckers harpsichord that had undergone a *grand ravalement* in Paris."²² One can well imagine that the 1726 cembalos might have brought such a price from the king of Portugal. If they were indeed made for the Portuguese court, however, it is remarkable that they escaped the ruin of the Lisbon earthquake in 1755 and made their way back to Italy.

A third possibility, which must be mentioned although it contradicts findings of the present study, is that Cristofori sent the 1726 cembalos to Dresden, where they were encased. This would be consistent with Henkel's opinion that the *chinoiserie* decoration of the harpsichord outer case could be of Saxon origin.²³ Undoubtedly there was a Cristofori piano located in or around Dresden in the second quarter of the eighteenth century, as we can infer from Gottfried Silbermann's three surviving pianos, built in 1746, ca. 1747, and 1749. Silbermann adopted Cristofori's action design, and his modeling of it is too close (not to say slavish) to have been made from a drawing. Perhaps the 1726 piano is the very one whose action was posed on Silbermann's bench.

The most likely possibility is that the patron was Grand Duke Gian Gastone de' Medici, who succeeded as ruler of Florence upon the death of his father Cosimo III in 1723. Here it is necessary to review Cristofori's relationship with the ruling family of Florence. Financial records of the Florentine court show that Grand Prince Ferdinand, Gian Gastone's elder brother, brought Cristofori to Florence in the spring of 1688 as his new instrument maker.²⁴ Cristofori was granted a salary, his rent was

pertaining to these grand instruments [the 1726 piano and harpsichord]. But I was not given permission to examine these letters. Gatti-Kraus merely read aloud to me that his great-grandfather paid 480 Lire (!) for these grands. He also fleetingly mentioned the seller's name. It was certainly not d'Este, but Gatti-Kraus spoke so quickly and unclearly that I could not catch the name and write it down. Baron Gatti-Kraus 'disappeared' several years ago. No one knows where he is at present [my translation].)

^{22.} Pollens, The Early Pianoforte, 118.

^{23.} Kielinstrumente, 90.

^{24.} The fullest survey of source materials for Cristofori's biography is in Michael O'Brien, "Bartolomeo Cristofori at Court in Late Medici Florence" (Ph.D. diss., The Catholic University of America, 1994; UMI order no. 9424289), 67–89 and Appendix V, 135–180; see also Pollens, *The Early Pianoforte*, chapter 3, "The *Gravecembalo col piano e forte* of Bartolomeo Cristofori," *passim*, and especially 47–55.

paid, and his house furnished from the resources of the guardarobe. Throughout the decade 1688-98 he submitted invoices to the grand prince's treasury for the restoration of old instruments and the making of new ones, and for tuning, regulating, and moving instruments. These invoices correspond closely with another critically important document, an inventory of the musical instruments pertaining to the Medici family drawn up in 1700, and also with Cristofori's surviving instruments from the 1690s. An approximate tally of Cristofori's work for Grand Prince Ferdinand emerges. One reckoning places the number of restorations of old instruments undertaken by Cristofori at sixteen and the number of new instruments built by him at nine, in addition to the occasional tuning, regulating and moving of instruments.25 If this were, indeed, a complete and accurate summation of the work of an entire decade it would be a shockingly low output, but since these projects were invoiced on a piece-work basis, we must conclude that they lay beyond the scope of Cristofori's regular salaried position.

What, then, did Cristofori do to earn his salary? It may be, as O'Brien states,26 that he was hired to replace the recently deceased Antonio Bolgioni, who had tuned and regulated court instruments for fifteen years previously. As Pollens points out, the size of the Medici collection of instruments and the extent of musical life in Grand Prince Ferdinand's court would have far exceeded the resources of a single caretaker. There is no evidence, however, that Grand Prince Ferdinand intended to keep all his musical instruments in working order or that the burden of such maintenance fell on Cristofori. Indeed the simplest construction of his separate invoices for tuning, regulating, and transporting keyboard instruments is that all such labor lay outside the conditions of his salary. It is probably reasonable to surmise that while Grand Prince Ferdinand expected Cristofori to shoulder a share of such work, he hired him primarily as a genius who could be expected to produce works of genius. If so, the Arpicembalo . . . di nuove inventione, che fa' il piano, e il forte (newly invented harpsichord which plays soft and loud)²⁷ is what the accumulated salary payments purchased.

25. Giuliana Montanari, "Bartolomeo Cristofori: A list and historical survey of his instruments," *Early Music* 19 (1991): 383–96, at 385.

26. O'Brien, "Cristofori at Court," 75. O'Brien's attempt (p. 111) to calculate the number of tunings Cristofori might have performed to account for his yearly income seems to me to misunderstand completely the import of Cristofori's salaried position.

27. Thus begins the description of Bartolomeo Cristofori's first documented piano in an inventory dated 1700 of musical instruments owned by Grand Prince Ferdinand de' Medici (quoted in Pollens, *The Early Pianoforte*, 43). Around 1698 Cristofori's financial status apparently changed. From that time onward no record of a monthly stipend exists. O'Brien attributes this to the deterioration of Grand Prince Ferdinand's financial resources, but it seems at least plausible that Ferdinand's patronage ended once Cristofori's project of realizing the *gravecembalo col piano e forte* had been achieved.²⁸ It may well be that Cristofori preferred to make his own way in the open market, if only because the Medici purse had proven not entirely reliable.²⁹

After Ferdinand's death in 1713, Grand Duke Cosimo III appointed Cristofori as *custode* of the court musical instrument collection. Apart from inventorying the musical instrument collection in 1716, court financial records show that Cristofori neither undertook any work nor received any pay related to this appointment. The title of *custode* was merely honorific, and it may be that its advantage lay not with Cristofori but rather with Grand Duke Cosimo III, who thus retained an official relation with the celebrated instrument maker. On balance, Cristofori's dependence on Medici patronage seems to have been restricted to the years 1688–98, but this crucial decade of support enabled him to realize his conception of a touch-sensitive keyboard action, an invention which certainly ranks as one of the most influential in the history of western music.³⁰ The piano may thus be reckoned as the last great legacy of Medici patronage.

Prince Gian Gastone shared his family's musical inclination. It was he who recruited George Frideric Handel to visit Florence in the first decade of the century.³¹ In 1714, the year following Grand Prince

28. O'Brien, "Cristofori at Court," 86–89. A document of dubious authenticity reports that Cristofori began work on the piano in 1698; this would be credible if understood as referring to the particular instrument described in the 1700 inventory, but it is difficult to imagine that the research and experimentation underlying the development of the piano action could have been compressed into two years' time. See O'Brien, "Cristofori at Court," Apps. I and II, and especially 125–27. Indeed, the basic facts suggest that he had already conceived of the piano action when Ferdinand hired him in 1688, a possibility acknowledged by O'Brien (ibid., 112–13).

29. "As late as 1720 Cristofori's unpaid balance of 300.4.7.4 *scudi* on his invoices to the Grand Prince was recorded in the volume of Ferdinando's debtors and creditors as still outstanding" (O'Brien, "Bartolomeo Cristofori at Court," 85).

30. See John Koster, "Three Grand Pianos in the Florentine Tradition," *Musique, Images, Instruments* 4 (1998): 101: "Arguably, no new invention in the history of music has had a greater or more lasting influence [than Cristofori's invention of the piano]."

31. Donald Burrows, *Handel* (Oxford, 1994), 20–21 and note 34. Handel's conversations with Gian Gastone in Hamburg in 1705, as reported by the composer to his first biographer, John Mainwaring, present a vivid picture of the Medici prince.

Ferdinand's premature death, Gian Gastone secured Cristofori's first piano, the *Arpicembalo*... *che fa' il piano, e il forte,* on permanent loan from the grand ducal household.³² While the deceased grand prince had been an expert keyboard player, Gian Gastone made no claim to competence as a performer, and thus had no practical use for the instrument. There is a hint in this transaction that Gian Gastone understood the value of Cristofori's work and wished to preserve the historically important first piano.

The style of the 1726 cembalos was apt for the grand ducal court both in the time of Cosimo III and of Gian Gastone. Cosimo III had taken a serious interest in the new fashion of oriental lacquer even before the turn of the century, perhaps inspired by its vast commercial potential. In 1690 he obtained samples of resin and oil from China and set about getting them analyzed. At first this research bore no fruit, but a second attempt, carried out by Father Filippo Bonanni employing these same samples, was successful. Bonanni was the first to publish a correct analysis of Chinese lacquer and to offer suggestions for the adaptation of lacquer techniques in Europe.³³ This incident lends credibility to the following brief description of taste at the grand ducal court (in this passage, "French mode" and "French fashion" mean what we would call rococo):³⁴

French modes and manners had been introduced as early as the reign of Cosimo III, by his Duchess, Margaret Louise of Orleans, a cousin of Louis XIV, and a favorite at his court. . . . However, in the succeeding rule of Gian Gastone, with his inordinate love of entertainment and the society of gay young people, and by the aid of the Princess Violante, who acted the part of the Grand Duchess with such popular success, the court became brighter with French fashions and social freedom.

In summary, it seems reasonable to propose that the patron of the 1726 Cristofori cembalos was Grand Duke Gian Gastone de' Medici. Lacking documentation of the transaction, we can only guess at the details. It seems likely that the making of two contrasting instruments on a single plan arose from Cristofori's conception, rather than from a

^{32.} Pollens, *The Early Pianoforte*, 52–53. O'Brien agrees with this interpretation of the record ("Cristofori at Court," 103–04).

^{33.} Hans Huth, Lacquer of the West: The History of a Craft and Industry, 1550-1950 (Chicago: University of Chicago Press, 1971), 22.

^{34.} William Odom, A History of Italian Furniture, vol. 2 (New York: Archival Press, 1967), 117. Odom offers no documentation.

suggestion of the grand duke. It is easier to imagine that when he was shown the instruments in their original plain form he agreed to purchase them on condition that they receive a decoration suitable for his rooms in the Pitti Palace. If so, we might credit the grand duke with initiating the making of the outer cases.³⁵

The 1726 Cembalos as a Pair

Overall design. Although the outer cases of the 1726 piano and harpsichord present the two instruments as a pair, as afterthoughts they tell us nothing about the origin of the idea of this pairing. What the cases do tell us is that their designer perceived the two cembalos as constituting a pair, an idea that is not obvious at first sight. An attentive observer of the two instruments as originally built could have been expected to see that

35. A portrait of Cristofori seems to present further evidence of renewed Medici patronage. This painting, formerly owned by the Staatliche Sammlung alter Musikinstrumente in Berlin, was lost or destroyed during World War II (see Georg Schünemann, "Ein Bildniss Bartolomeo Cristoforis," Zeitschrift für Musikwissenschaft 16/11-12 [November-December, 1934]: 534-36; and Pollens, The Early Pianoforte, vii, 44, note 44, and 56; the photographic reproduction in Schünemann's article is superior to those in Pollens's book). The unknown painter included his monogram, "ATE," and the date 1726. Cristofori is portrayed in three-quarter length, formally dressed, standing beside a keyboard instrument, undoubtedly supposed to be one of his pianos. The setting is a richly appointed, high-ceilinged chamber with an enormous round-headed window overlooking the city of Florence. This is assuredly not a room in Cristofori's own lodging on the Via Canto agli Alberti in the vicinity of the Uffizi (now called Via de' Neri, as Giuliana Montanari tells us ["Bartolomeo Cristofori," 385]). Rather, the painting recalls the gigantic round-headed windows of the facade of the Palazzo Pitti, residence of the grand dukes of Florence. Although the cityscape revealed by the window seems far too distant, its alignment is correct in relation to the Pitti Palace. The viewer may well suppose that Cristofori is portrayed in the Grand Duke's residence, and hence in his favor. Unfortunately, anomalous details in the painting betray it as a nineteenth-century production, and therefore without evidentiary value in the present argument. The keyboard is shown with long ivory-covered natural keys and key-fronts. All of Cristofori's keyboards were finished with decorative arcades on the fronts of the natural keys, as was indeed the norm in Italian keyboard building right down to the end of the eighteenth century. The flat ivory key-fronts seen in the painting did not make their appearance until well into the nineteenth century, and the length of the natural key heads points to a similar dating. Schünemann's rendering of the action drawing shown in the painting discloses another damning detail, endowing Cristofori's action with what is clearly a mid-nineteenth-century hammer. This second and parallel solecism overstrains credulity and strongly suggests that the portrait dates from the revival of interest in Cristofori in the 1870s.

they looked the same on the outside except for being painted different colors, and that they shared a common range of four octaves. It seems likely, however, that this same observer would have been at least as forcibly struck by the differences between them. The harpsichord's three choirs of strings, its multiple bridges and nuts, and its strangely archaic outside drawstops, give it an air of gothic complexity, in contrast to the piano's streamlined and almost mysterious simplicity—"mysterious" in that the piano's inverted wrestplank hides its action entirely from view.

What such an observer could not easily have discovered is that the plan views of the two instruments are very nearly identical, for this only becomes apparent when drawings of them are compared (fig. 4). The salient points are 1) the outline of the cases; 2) the layout of the eightfoot bridges; 3) the position of the eight-foot nuts; and 4) the placement of the gaps, or to be more precise, the lines of plucking or striking points. (All other elements in the harpsichord plan relate to the fourfoot and two-foot choirs, which have no counterpart in the piano.) When the drawings are overlaid, it will be seen that the bentsides and eight-foot bridges are nearly congruent (plate 8). The nuts and the gaps, however, do not agree. To sound well, the striking points of a piano must be much closer to the nut in the treble than the typical plucking points of a harpsichord. Hence a small but crucial difference in the layout of the nuts must arise, but this in no way accounts for the gross displacement of the bass end of the eight-foot nut (and by extension the fourand-two-foot nut) in the harpsichord to lie nearly parallel with the frontboard. No mechanical necessity can be cited for this decision, which may therefore be described as willful.

Here, with due caution, we may attempt to follow the designer's thinking in detail. The near congruence of the curves of the bentsides and eight-foot bridges, as well as the treble ends of the eight-foot nuts, suggests an intention to employ the same scaling in both instruments. Comparison of the C-strings (plus the D-strings in the bottom octave) shows how nearly this intention was realized (see table 1). At first glance, these similarities seem impossible, since the displacement of the bass end of the harpsichord nut away from the front of the instrument ought to have progressively shortened its scale. However, Cristofori compensated by widening the spacing of the string band along the bridge so that the strings lie farther along it. This means that the string band runs off the bridge at D in the bass octave; thus the last two strings are carried on

	1726 harpsichord (8' choir)	1726 piano (longer string)	difference as % of shorter length
С	1857	1960	5.5
D	1859	1830	1.5
с	1130	1125	0.4
c'	571	568	0.5
c″	287	281	2.0
c‴	144	145	0.7

TABLE 1. Sounding lengths of C-strings in mm. (Data derived from Schwarz, Cristofori, Tab. 2)

a separate short segment of bridge lying parallel to the main bridge.³⁶ These two notes (C-sharp and C) are disproportionately short, but the tonal effect of this foreshortening is practically nil in strings of this length.

Cristofori could have accomodated the harpsichord's string band to exactly the same plan view outline as that of the piano, but he did not. The harpsichord's eight-foot bridge (that is, its main part) is slightly longer (by 2 or 3 cm) than the piano's bridge, and its two lowest strings lie to the left of the main bridge's termination (on their small section of bridge). Consequently, he lengthened the case by about 5.6 cm and widened it slightly, to ensure the same amount of soundboard room around the lowest strings as he had provided for the piano. The slight enlargement of the harpsichord's tail, in other words, is neither arbitrary nor accidental, but arises from the displacement of its eight-foot nut. That the plans of the two 1726 cembalos are nearly congruent in spite of this major difference in the position of one of the key elements (the harpsichord's eight-foot nut) is a result that could hardly have arisen by chance. Rather, it strongly suggests a deliberate choice on the part of the designer.

Disposition and scaling. The range of both instruments is four octaves, C to c''' (49 notes). The piano is double-strung throughout, while the harp-

36. Cristofori employed separate short segments of bridge at the top or bottom of the range in several instruments. The 1722 piano has a separate bridge segment in the bass, while the theater spinet shows this feature in the treble of the four-foot choir. The present harpsichord is the only instrument to possess separate bridge segments in both the extreme bass (of the eight-foot choir) and the treble (of the two-foot choir). Cristofori's followers Giovanni Ferrini and Giuseppe Solfanelli also employed this feature.



FIGURE 7. 1726 harpsichord, details showing wrestpins, nuts, gap, and right-hand register lever. Photos: David Sutherland.

sichord has the unique disposition, noted above, of single choirs at eightfoot, four-foot, and two-foot pitch, with a row of jacks pertaining to each choir. The front row, playing the four-foot choir, plucks to the right; the middle and back rows, playing respectively the eight-foot and two-foot choirs, pluck to the left (fig. 7). The eight-foot register is divided between c and c-sharp in the tenor octave, so that its two parts can be engaged independently.³⁷

As noted in table 1, both instruments have nearly the same scaling, which is almost just (i.e., such that the sounding length of the strings doubles for each octave of descent) down to tenor c. The bass octave of the piano is foreshortened so that F is a semitone shorter than its just length, and C is somewhat less than a major third shorter than its just length.³⁸ This scaling is appropriate for brass music wire at a pitch of about a' = 415 Hz. It is interesting that the harpsichord is more accurately scaled than the piano; the latter exhibits a slight anomaly around c". The scaling of the harpsichord's four-foot choir is nearly just throughout, the foreshortening in the bass octave amounting to less than a semitone at bass C.

One reason for the rarity of the two-foot stop in harpsichords is that the sounding lengths of the treble strings become so short that mounting them is virtually impossible. The theoretical sounding length of the

38. String lengths and equivalent lengths are from Schwarz, Cristofori, Tab. 7.

^{37.} The purpose of this division is mysterious, to judge by the results of an informal canvassing of several colleagues, none of whom felt entirely confident in offering an explanation.

highest two-foot C-string in the 1726 harpsichord would be 35 mm, but the width of the three jackslides or registers which it must span is ca. 50 mm. Thus, the two-foot bridge and nut would have to be located in the space allotted to the jackslides in order to mount that string.

Cristofori's solution to this problem makes the two-foot choir appear to be a sort of patchwork extension of the four-foot (fig. 7). From C to Fsharp in the bass octave (sounding c' to f^{\sharp}) the two-foot strings are carried on the four-foot nut; thereafter a two-foot nut diverges from it in the manner of a railroad switch. From $f\sharp'$ to f'' (sounding $f\sharp'''$ to f'''', i.e., the middle of the second highest octave to the middle of the highest octave) the two-foot strings are carried on separate nut and bridge segments set farther apart than the main bridge and nut would have been if continued. This longer scaling requires iron stringing. Its purpose is to postpone the incursion of the two-foot nut into the space of the front jackguide. Nevertheless, just such an incursion ensues at the beginning of the highest octave. The nut grows in width, so that its undivided back edge remains perched on the soundboard adjacent to the front register, while extensions carrying the strings push ever farther into the spaces between the four-foot jacks. Even this measure, however, does not enable the two-foot register to be completed. Its highest seven notes "break back" to four-foot range, sounding f#" to c""; reverting to brass, these strings are in unison with the corresponding notes of the four-foot choir and are paired with them on the four-foot nut and bridge.³⁹ This arrangement mandates that the jacks pertaining to the two-foot and four-foot choirs face in opposite directions. In spite of its discontinuity, the scaling of the two-foot choir is almost exactly just if one takes the changing unit of measurement into consideration.

Registration. Harpsichord registration had become largely a thing of the past in Cristofori's Italy.⁴⁰ While the typical Italian Renaissance harpsi-

39. The break-back to four-foot pitch in the middle of the top octave alleviates a practical difficulty that would otherwise have been nearly insurmountable, that of tuning. The highest note in the two-foot choir of the 1726 harpsichord (f", sounding f"") is identical with the highest note in the four-foot choir of a large triple-strung harpsichord of five octaves, the familiar French double disposition. The tuning of the last half-octave of such a four-foot stop becomes increasingly problematic; tuning very much beyond sounding f"" becomes excruciatingly difficult, and tuning all the way up to c"" is probably not feasible.

40. An exception to this generalization lies close at hand, in Cristofori's own spinets. The two that survive are double-strung. Their movable keyboards may be stopped in three different positions so as to play one choir or the other alone, or both together.

chord, with its choirs disposed "vertically" an octave apart (8' + 4'), had customarily been fitted with drawstops in the cheek to permit each set of strings to be engaged and disengaged separately, the 2 × 8' harpsichord of the late seventeenth and eighteenth centuries was considered to be a unison instrument, with both choirs sounding together except for special effects or for tuning. On these occasions the front register could be moved off by pushing sideways on its jacks or on blocks mounted at either end of the front jackslide. Unison instruments with immovable jackslides are known;⁴¹ their tuning requires muting one of the choirs by weaving a strip of cloth between the courses of strings.

Cristofori's 1726 harpsichord, with its extended vertical disposition $(1 \times 8', 1 \times 4', 1 \times 2')$, required a convenient system of registration, not only to take advantage of its several tone colors, but also to facilitate tuning. Its jackslides were therefore elongated at either end to project through both sides of the case, and the projecting ends (called drawstops in the following discussion) were shaped and finished to make them convenient to handle.⁴² The jackslides are suspended just under the soundboard, which is mortised to permit passage of the jacks. Wooden plates with precisely drilled holes are glued to the surface of the soundboard just beyond the highest and lowest jacks (fig. 7). Pins of smaller diameter than these holes must have been fixed in the ends of the jackslides, although no such endpins are in existence today. By bearing first on one side of the plate hole and then on the other, such a pin would limit the lateral motion of its slide. Thus the endpins, fixed vertically in the jackslides and working in the plate holes, delimited the motion of the jackslides, while that motion was imparted to them by the player manipulating their drawstops on the outside of the cheek or the spine. This original system of registration contains an element of redundancy, for while the divided eight-foot jackslide must extend through both the spine and the cheek for its two parts to be controlled independently, the undivided four- and two-foot jackslides need only

41. For instance, a unison harpsichord made by Stephano Bolcioni in Florence in 1631 (Yale University Collection of Musical Instruments, no. 4889.72). Bolcioni fitted drawstops in the check, but when the instrument was enlarged, probably in the eighteenth century, the registers were immobilized and the check opening closed over.

42. To facilitate manipulating them by feel alone the eight-foot drawstop at the treble side is enlarged so that it stands out from the flanking two-foot and four-foot drawstops. Since the front slide (four-foot) is not parallel with the other two, there is a space at the bass side between its drawstop and those of the other two slides. The drawstops may thus be easily distinguished by feel at the spine side as well. See Henkel, *Kielinstrumente*, plates 8 and 9. have extended through one side or the other. That Cristofori provided drawstops at both ends of the four and two-foot jackslides suggests that from the beginning he intended to make registration as convenient as possible.

Encasing the instrument made the drawstops inaccessible. The endpins could have served as handles for moving the jackslides, and perhaps it was the existence of this possibility which explains why the outer case was not fitted with hatches allowing access to the drawstops. However, access to the endpins is seriously hindered by the jackrail, a padded rail suspended over the jacks to prevent them from flying out when the instrument is played. Registering any except the front-most (i.e., four-foot) stop by means of the endpins would require sliding the jackrail back out of the way in its mounting blocks and returning it afterwards to its proper playing position. For this reason, registration by means of the endpins could hardly have been much more than a stop-gap measure. Thereafter an ambitious registration system was newly designed, employing levers extending through the front board into the keywell (fig. 7). The levers themselves are in existence, but the attachment pins (that is, the endpins in the jackslides) are missing, as is the pivot-pin of the lefthand lever. Because of the missing elements, the intended working of the register levers must be conjectured.

The restoration here proposed, which has been tested by means of a model described in the appendix, is based on the assumption that the keywell levers were designed to control the upper works (four-foot and two-foot stops) only, the eight-foot principal being regulated by other means which will be discussed below. Keeping in mind that the four-foot and two-foot jackslides are located at the front and back of the gap, respectively, and that their jacks face in opposite directions (fig. 8), it is evident that if the left-hand lever is attached to these two slides it will move them both in the same direction, engaging one of the opposite-facing rows of jacks and disengaging the other. (Pushed to the left this lever cancels the two-foot register and engages the four-foot, and vice versa.) The function of the right-hand lever (actually, a lever system) is complementary. If the secondary, or slave, lever is attached to the treble ends of the two-foot and four-foot jackslides, moving the main lever imparts contrary motion to the two jackslides, so that both registers engage when the main lever is pushed to the right, and disengage when it is pushed to the left. Thus all possible combinations of the upper-work stops are produced by the keywell levers.



FIGURE 8. Schematic representation of the registration machinery in the 1726 harpsichord. Drawing: David Sutherland.

Several dubious points about the registration machinery as it actually exists must be addressed. In the first place, only two holes have been drilled in the slave lever of the right-hand system, one aligned with the four-foot slide and the other with the eight-foot slide (fig. 7). There is no hole which could serve as an attachment point for the rear-most, twofoot jackslide. In his catalogue description of the instrument, Hubert Henkel assumed that the hole over the front jackslide (4') must serve as a fulcrum and the hole over the middle jackslide (8') as an attachment point, and that the purpose of this lever system was to engage and disengage the eight-foot slide—or rather, its larger segment.⁴³ But if only a single motion had been wanted it could have been obtained directly from

^{43.} Henkel, *Kielinstrumente*, 89. In "Cristofori as Harpsichord Maker," 22–23, Henkel discusses the matter in greater detail.

the main lever, and there would have been no reason to go to the trouble of adding the slave lever. Asserting that the right-hand lever system is intended to control the eight-foot jackslide is the same as asserting that it is nonsensical. In this case there would be no point in discussing the registration machinery, since no rational explanation of it would be possible.

The missing hole in the slave lever in the right-hand lever system is one of several apparently anomalous features which have led some observers to suppose that the registration machinery in the 1726 harpsichord is a meaningless farrago added to the instrument long after Cristofori's death.⁴⁴ But a different explanation presents itself if we consider the human context. Cristofori completed the 1726 harpsichord in its original form in his seventy-first or seventy-second year, and the project of fabricating registration machinery in the keywell must have been undertaken sometime later, following the instrument's being placed in an outer case. It is therefore not unreasonable to think that this project was interrupted by the illness or death of its author.

It is evident, therefore, that if we are to accept the registration machinery in the 1726 harpsichord as rational, and not a piece of nonsense, an attachment to the two-foot jackslide must have been intended, although it was never actually carried out. Other features also suggest a work left incomplete—in particular, the holes aligned with the eight-foot jackslide in both the left-hand lever (fig. 9) and the right-hand slave lever (fig. 7), and the placing of the left-hand lever under the soundboard. The significance of these features will be clarified by returning to the question of how the two parts of the eight-foot principal were to have

44. The eminent keyboard-instrument makers Thomas and Barbara Wolf formed essentially this opinion in examining the 1726 harpsichord (personal communication, December 30, 1996). They point out that the registration levers, being made from iron flat-stock with their handle-ends plated in hardwood, are unprecedented in Italian keyboard string instruments except for several other strikingly similar instances found in cembalos in the Leipzig instrument museum, a circumstance they see as pointing to interventions by someone in modern times. However, it is just as easy to explain the suspicious similarity by supposing that the existing levers in the 1726 Cristofori harpsichord were later copied. While the fabrication of the 1726 machinery is admittedly unusual, it clearly arises from the mechanical design: the neat and compact fashioning of the components of the right-hand lever system (main lever, link, and slave lever) virtually mandated the use of iron instead of wood, while the great length of the left-hand lever also benefitted from the strength and stiffness of iron. It is quite understandable that leaving the bare iron straps to serve as handles would have seemed uncouth, a fault easily remedied by riveting hardwood plates to them.



FIGURE 9. 1726 harpsichord, detail of the left-hand register lever. Photo: Kerstin Schwarz.

been controlled. The obvious solution (although marred by the inconvenience of having to move the jackrail) would have been to rely on the endpins fixed at the bass and treble ends. This would explain the holes found in both the left-hand lever and the slave lever of the right-hand system as clearance holes for these pins. Yet the left-hand lever is located below the soundboard, immediately beneath the registers, so that its eight-foot clearance hole is superfluous. What this suggests is that the left-hand lever was originally placed above the soundboard, with the endpin of the bass segment of the eight-foot register rising through its access hole, and that it was later moved to its present position. Burying this lever involved the not inconsiderable labor of cutting a mortise through the wrestplank, and yet no motive can be discovered in its working to account for this effort. Removing the left-hand lever from the surface of the soundboard, however, did clear the way for a new lever to be mounted in its place to control the eight-foot principal. No trace of such a lever exists, yet we may conclude that it must have been intendedotherwise, the present position of the left-hand lever is meaningless. Thus it seems that control of the eight-foot principal was at first left to the manipulation of endpins extending through clearance holes in the left- and right-hand levers, but that subsequently a decision was made to provide a lever for this purpose.

The working of this hypothetical eight-foot lever is easily reconstructed and suggests yet another intended change. Supposing both parts of the register to be in the on position, pushing the lever to the left would disengage the entire register, since the short bass segment directly linked to the lever would bear on the longer treble segment, pushing it off. Subsequently reversing the lever would engage the bass segment, leaving the treble segment in the off position. The only way to engage the treble segment would be by means of its endpin, accessible only by sliding the jackrail out of the way. There is a strong hint in this that Cristofori intended to reattach the two segments of the eight-foot jackslide so as to obviate moving the jackrail to register the instrument.

On balance one may reasonably propose that the registration machinery in the 1726 harpsichord was Cristofori's last project and that he left it incomplete.⁴⁵ It seems to have included the first combination stop in Italy (that is, the right-hand lever); this combination stop is among the earliest anywhere.⁴⁶ The design bears the marks of Cristofori's genius: originality, elegance, ingenuity, simplicity of operation.

The 1726 piano also has a registration device. The keywell is slightly wider than the keyboard and action. The keyboard and action, normally positioned flush to the right side of the keywell, can be slid to the left by means of knobs mounted on the end-blocks, so that the hammers strike

45. If the specific details of the registration machinery were worked out in situ, as here proposed, the nameboard must have been removed for the duration and adapted prior to reinstallation. And indeed, the furnishings of the keywell of the 1726 harpsichord do differ significantly from those of Cristofori's other grands: instead of the usual vertically-removable nameboard fitted in grooves formed behind characteristic decorative brackets flanking the keyboard, we find two boards used to divide the keywell from the wrestplank. The upper of these is permanently glued in place against the front surface of the wrestplank and is mortised to accomodate the registration levers, while a removable lower board-the nameboard proper, since it bears the maker's name, date, and place of manufacture-is held in place by two knob-headed screws anchoring it against the lower portion of the wrestplank. As originally designed, the 1726 harpsichord could certainly have followed the usual convention of a verticallyremovable nameboard, since its drawstops extended through the cheek and spine instead of through the nameboard as the handstop levers do now. It is therefore clear that the present arrangement arose from a major redesign of the keywell, something it is difficult to imagine anyone doing other than the maker himself or his assistant and successor, Giovanni Ferrini.

46. Grant O'Brien deduces the existence of a machine stop on a Couchet harpsichord made in 1652 (*Ruckers: A Harpsichord and Virginal Building Tradition* [Cambridge: Cambridge University Press, 1990], 273–74). In *Musick's Monument* (London, 1676) Thomas Mace describes a pedal mechanism devised by John Hayward (cited in Hubbard, *Three Centuries of Harpsichord Making*, 146–47). only the left-most string of each unison pair—essentially the same *una* corda shift that has been a feature of most grand pianos ever since Cristofori's day. The *una corda* greatly facilitates tuning, and also discloses a quiet voice of exquisite sweetness. It was undoubtedly designed by analogy with the movable front register of the unison harpsichord.

Precedents for the Design of the Harpsichord

The disposition of the 1726 harpsichord, although unique among harpsichords, is common in chamber organs, a point that may show us the direction of Cristofori's thinking. Organ practice seems to be reflected in the split eight-foot register. Possibly Cristofori's original intention was to provide a pull-down pedalboard, that is, a pedalboard connected to the lowest notes of the keyboard by means of ribbons or cords; but if so he changed his mind, since neither the bottom board of the instrument nor that of the outer case were drilled to accommodate the pull-downs. With or without a pedalboard, the bottom octave of the eight-foot in combination with the four-foot and two-foot would have the effect of extending the tessitura of the instrument upwards by an octave while providing powerful bass notes. The design of the two-foot stop is analogous with the upperwork of an Italian organ, in which "the high-pitched ranks typically break back an octave so that no pipe has a speaking length shorter than $1\frac{1}{6}$ inches."⁴⁷

John Koster has proposed that one of the prototypes in the early development of stringed keyboard instruments may have been the table organ.⁴⁸ Did a concept of the cembalo as being derived from the organ persist even down to Cristofori's time? An upright harpsichord in the Museo nazionale degli strumenti musicali in Rome, undated and unsigned but tentatively identified as an early work of Cristofori,⁴⁹ displays

47. John Koster, personal communication, September 1, 1999.

48. "The upright harpsichord in London"—Royal College of Music, Museum of Musical Instruments, dating from the late fifteenth century, the oldest surviving stringed keyboard instrument—"could be considered as ... a pseudomorph of the familiar type of table positive with one rank of pipes following the order of the keyboard, the lowest pipe being about three feet long." "Toward a History of the Earliest Harpsichords," in 600 Years of Harpsichord-Making in Austria, proceedings of a conference at the Kunsthistorisches Museum, Vienna, October 1997, publication forthcoming.

49. David Sutherland, "The Florentine School of Cembalo-Making Centered in the Works of Bartolomeo Cristofori," *Early Keyboard Journal* 16–17 (1998–99): 7–75, at 69–75.

a formal similarity with organ design. Its strings are laid out symmetrically with the longest course in the middle and successive shorter courses set first to one side and then to the other until the two highest are reached at the edges of the string band. Such axially symmetrical schemes are commonly employed in arranging the facade pipes (i.e., those visible at the front of the case) in practically every school of organ building. Since keyboards are arranged in linear order from the lowest to highest, except for the various short-octave schemes commonly employed for the lowest octave, symmetrical layout of pipes or strings requires a means of conveying the action of each key to its proper pipe or string. A roller board, as such a device is called in the organ trade, is necessary in any large or complex organ, since the pipes occupy too much space to be aligned with the keys, but superfluous in a harpsichord where strings and keys share a common span. Hence it may be said that the symmetrical design of the Rome instrument is purchased at a high price. Collateral advantages are hardly evident, since there is no apparent tonal gain, and the possibility of greater structural integrity from a balanced stressing of the frame seems of dubious utility.50 All the more surprising, then, that the Rome upright harpsichord is not unique. A similar instrument is found in the Vienna Kunsthistorisches Museum,⁵¹ which bears the inscription "Martinus Kaiser / Ser: Electoris: / Palatini / Instrumentorum Opifex / et huiusmodi Inventor." Details such as the bow-shaped curve of the nut and the layout of the tuning pins are so alike as to suggest that one was modeled on the other, the prima facie evidence of the inscription favoring Kaiser as author of the design. The pseudomorphology of these two late seventeenth-century upright harpsichords with organ prototypes is the same in principle as that of the fifteenth-century upright harpsichord in London, Royal College of Music, with the then-commonplace table organ.⁵² This suggests that a tradition linking the craft of harpsichord making with that of the organ persisted throughout this entire period, so that the organ-like features of Cristofori's 1726 harpsichord would have seemed less singular to the contemporary observer than they do to us.

50. While it is true that the normal asymmetric harpsichord design concentrates stress at the weakest point in the case, the meeting of the bentside and cheek at the treble side, reliable methods of overcoming this Achilles heel were well-known in every school of building. Symmetrical layout thus solves a merely theoretical problem.

51. Victor Luithlen and Kurt Wegerer, *Katalog der Sammlung alter Musikinstrumente*, *I. Teil: Saitenklaviere* (Vienna: Kunsthistorisches Museum, 1966), 17–18 and Tafel 7.

52. See note 48 above.

The 1726 harpsichord also evokes earlier schools of harpsichord making. A disposition of single eight- and four-foot choirs with drawstops on the treble side of the case had once been commonplace on both sides of the Alps. The Ruckers-Couchet family carried this disposition up to the middle of the seventeenth century, whereas in Italy the iron-scaled 8' + 4' disposition with a keyboard range of C/E–f''' became rare after 1600.⁵³ Cristofori elaborated this principle in the 1726 harpsichord by adding a two-foot choir and drawstops on the bass side of the case, and modified it by scaling for brass wire.⁵⁴ This instrument with its external drawstops must have seemed notably archaic, especially prior to its encasement. Nothing like it had been built in Italy for a century or longer.

The layout of its tuning pins, nuts, and jacks revives a long-abandoned design (fig. 7). The soundboard runs all the way from the tail of the instrument to the nameboard, its continuity interrupted only by the mortises cut for the jacks. The tuning pins are gathered in three parallel rows close to the nameboard and set in a narrow wrestplank of hardwood. The nuts thus rest on freestanding soundboard wood, a feature which may be called "live-nut" construction. Since the eight-foot nut is placed between the tuning pins and the nuts for the two higher choirs, the four-foot and two-foot strings must be conducted through holes in the eight-foot nut, and the four-foot nut must in turn be notched to accommodate the two foot strings except where these are mounted on the four-foot nut.

The mounting of both the bridges defining the sounding length of the strings on active soundboard, a common feature of virginals and spinets, is rare in harpsichords. In Italian renaissance-era harpsichords with 8' + 4' disposition the tuning pins are typically gathered in two close-spaced rows and fixed in a narrow wrestplank in front of the nameboard. The four-foot strings must therefore be let through the eight-foot

53. Ralph Denzil Wraight, "The Stringing of Italian Keyboard Instruments c. 1500–c. 1650. Part Two: Catalogue of Instruments" (Ph.D. diss., The Queen's University of Belfast, 1997; UMI order no. 9735109), 156, 302; further, "only five [Italian] harpsichords after 1600 had the 8' + 4' disposition" (p. 159). Elsewhere he states that "it is generally true that $1 \times 8'$, $1 \times 4'$ instruments were provided with stop knobs through the case, but means of changing registers on other instruments were much less common" (personal communication, March 28, 1999). It should be noted that Wraight's argument that the C/E–f^m disposition in Italy was intended to be strung in iron is controversial.

54. Except for the iron scaling in the upper range of the two-foot choir, as noted above.

bridge to reach their own nut. However, the wood on which the nuts rest is considerably thicker in virtually all surviving examples than that of the soundboard.⁵⁵ Furthermore, the eight-foot nut is typically located close to the tuning pins at the bass end, and may actually be supported by the edge of the wrestplank. It is therefore doubtful whether the Italian 8' + 4' harpsichord can be said to feature live-nut construction.

Surviving harpsichords with true live-nut construction all originated north of the Alps. These include the single-manual harpsichord built in London in 1579 by Lodewijk Theewes; the Hans Müller harpsichord, Leipzig, 1537; some of the few surviving seventeenth-century German harpsichords; and an anonymous eighteenth-century Thuringian harpsichord found in the Bachhaus Museum in Eisenach. Another point of resemblance between the 1726 harpsichord and surviving German instruments is the position of the nut. As noted above, Cristofori moved the bass end of the nut far away from its normal position close to the tuning pins, resulting in an extremely raked gap. The same nut position is found in the Hans Müller harpsichord (fig. 10), an anonymous instrument of ca. 1630 in Munich (Bayerisches Nationalmuseum MU 78), and an anonymous and undated, but certainly seventeenth-century German harpsichord in the Beurmann Collection.⁵⁶ In each of these the nut lies far from and roughly parallel with the nameboard, and the plucking line of the principal eight-foot jacks is sharply raked. It is an altogether remarkable fact that both the 1726 Cristofori and the 1537 Müller harpsichords share an identical angle of the line of plucking points (principal register) and a practically identical positioning of the nut, with the bass end farther from the nameboard than the treble end (figs. 4 and 10).

One further point of resemblance between German seventeenthcentury instruments and the 1726 Cristofori harpsichord may be noticed. The bentside of the Beurmann anonymous is cut across the grain (or kerfed) to achieve its curve.⁵⁷ These cuts are on the outside of the bentside (that is, the inside of the curve), and have been carefully filled so that the painted finish makes them hard to see except in a raking

57. I have not yet been able to ascertain whether the other surviving early German harpsichords have kerfed bentsides.

^{55.} Denzil Wraight, personal communication, March 28, 1999.

^{56.} This instrument, although lacking its keyboard and most of its soundboard, shows so many similarities to the Munich anonymous that its owner, Dr. Andreas Beurmann, has no doubt that both instruments came from a single hand. Personal communication, June 6, 1998.



FIGURE 10. 1537 harpsichord by Hans Müller, plan view. Drawing: John Koster.

light. A related solution to the problem of forming bent shapes in wood is seen in the German upright harpsichord in the Germanisches Nationalmuseum, Nuremberg, an instrument with a doubly curved bentside. The curve from the cheek appears to have been dry-bent, or bent with the aid of heat, but in any event without kerfing. The second and steeper curve at the upper end of the bentside, however, consists of many short segments joined to approximate the desired curve. The kerfing of curved elements in the case is a distinctive feature of Cristofori's instruments, one that was taken up by his students and successors in Florence.⁵⁸ While it would seem natural to guess that Cristofori derived this idea from the nearly universal Italian custom of kerfing the bentside liner to conform it to its curve, the fact remains that precedents exist in the tiny surviving corpus of early German harpsichords.

It would be unwise, however, to overstress the possibility of German and northern European models for the unusual features of Cristofori's 1726 harpsichord. Similar features might well have existed in archaic Italian instruments that have since disappeared. The essential point is that Cristofori based the design of the 1726 harpsichord on the earliest principles and conventions of the cembalo-making craft, achieving what is probably their most elaborate and ideal realization. This instrument evokes the antecedents of the cembalo in the tradition of organ-making, and memorializes the central "international style . . . which unfolded directly from an original 'Gothic' tradition of making stringed keyboard instruments centered in Germany and the adjacent Burgundian Netherlands . . . [of which] Italian harpsichord making is . . . a separate offshoot."⁵⁹ The initiative for this undertaking must have lain with the maker; it is difficult to imagine a patron or a wealthy customer requesting such a thing.

Tonal and Musical Properties

Since neither of the 1726 cembalos is currently in playing condition, an assessment of their tonal properties must rest on indirect evidence. Several more or less exact copies of the piano have recently been under-

^{58.} Sutherland, "The Florentine School of Cembalo-Making," 23.

^{59.} John Koster, "Harpsichord Culture in Bach's Environs," *Bach Perspectives* 4 (1999): 60; see also "The Importance of the Early English Harpsichord," *The Galpin Society Journal* 33 (1980): 66.

taken,⁶⁰ which permit us to form some impression of the sound of the original. As for the harpsichord, basic aspects of its tonal character can be deduced from its construction and from comparison with other Cristofori instruments.

Based on the performance of recent copies it is fair to rate the voice and action of the Cristofori piano very highly. While its maximum volume is certainly less than that of a Steinway, and maybe less than that of a Stein, it nevertheless possesses a real forte, and can speak in a commanding voice. What is perhaps unexpected is that it can be controlled down to extremely low dynamic levels such as one associates with the clavichord. This is especially the case when the action is displaced to sound only a single choir of strings—here the instrument reveals a voice of almost unearthly sweetness and legato. The action, exceedingly fast and responsive, is supremely fit for rendering ornamentation and passagework. No doubt its greatest virtue is note-by-note dynamic and tonal variability. In short, the Cristofori piano possesses a quintessentially soloistic voice.

In the harpsichord, the posing of its nuts as well as its bridges on active soundboard should produce a characteristic response in which a large proportion of the sounding energy is expended quickly after the attack. The fineness of its bridges, and the lightening of the eight-foot nut by means of the large oval holes to permit passage of the higher choirs of strings, may also be expected to reinforce this "front-loaded" tonal response.

It is also possible to surmise the effect of the reinforcement of the eight-foot principal at the octave and super-octave levels with some confidence. Although the 8' + 4' disposition is scarcely known today in the Italian context, it is well known in that of the Flemish tradition, both through surviving antiques with this disposition and through modern copies. From these instruments we know that the 8' + 4' disposition produces a loud, clear, bright, and incisive tone. The four-foot stop makes its contribution best when voiced lightly (especially in the upper octaves),

60. Copies of the 1726 piano, or instruments based on it, are: 1) an instrument made ca. 1993–94 under the sponsorship of the Kawai piano company; 2) an instrument made by Reiner Thiemann in Lauf, Germany, in 1995, enlarged by a few notes and triple-strung in the treble; 3) an instrument made by the present author for the Schubert Club, Saint Paul, Minnesota, delivered in 1997, modeled as closely as possible on the original; 4) an instrument made by Kerstin Schwarz in Halle, Leipzig, and Florence, completed in 1997, also a replica; and 5) another replica completed in 1999 by Nobuo Yamamoto and Midori Hadano in Osaka, Japan.

with the result that the *plenum* in this disposition can be light to the touch. Because of the redoubled emphasis on the octaves of the fundamental pitch one would expect the 1726 harpsichord to command an unusually brilliant but exceptionally clear *plenum* or *ripieno*.

Cristofori employed 8' + 4' disposition in one of his surviving instruments, the transverse cembalo, or spinettone (undated and unsigned but of secure attribution) currently preserved in the Music Instrument Museum, Leipzig.⁶¹ This instrument appears to have been designed for the opera orchestra of the Pratolino Theatre, where Grand Prince Ferdinand de' Medici mounted new opera productions annually during the 1690s and into the early years of the next century. The spinettone must be rated as one of Cristofori's great successes. Two copies survive, one by Giovanni Ferrini dated 1731, and the other by Giuseppe Solfanelli, undated.⁶² Cristofori's spinettone was rebuilt and enlarged in 1795, and it is likely that it remained in use for some time thereafter, perhaps even into the nineteenth century. The extraordinary wearing of its keyboard bears witness to countless hours of use in its century or more of active service. We may very properly assume that, in addition to the compact format of the instrument, which placed the player directly facing the stage, its success arose from an incisive tone that projected well in a large space.

It seems that Cristofori intended to endow the 1726 harpsichord with a voice of maximum strength and trenchancy, as well as with an unusual variety of tone colors and dynamics. How well he succeeded is a matter for speculation, but considering that the 1726 piano shows its maker as still at the height of his powers it would seem unwise to dismiss the potential of this harpsichord too casually. It is worth noting that the presumed tonal properties of this instrument were quite at odds with contemporary taste. The trend was, and remained, to favor an ever smoother and more cantabile legato style—indeed, this trend has governed musical taste right down to the present moment. The 1726 harpsichord must have sounded no less archaic than it looked.

61. Henkel, *Kielinstrumente*, 91. Henkel dates the instrument in the 1720s, but it closely resembles a *spinettone* "for the orchestra," or "for the theatre," as it is variously described in Medici instrument collection inventories from 1700 to 1744 (Montanari, "Bartolomeo Cristofori," 390–91). If the Leipzig *spinettone* is identical with that named in the inventories, it cannot have been made later than 1700.

62. Sutherland, "The Florentine School of Cembalo-Making," 12-13.

It would be difficult to imagine a greater contrast than that between the musical characters of these two instruments, and yet both are realized from a single plan. They may perhaps best be imagined as an entity composed of two complementary parts: *ripieno* (harpsichord) and solo (piano). The same description fits the combined harpsichord and piano made twenty years later in 1746 by Giovanni Ferrini, successor to Cristofori's shop. This remarkable instrument provides two actions harpsichord on the lower manual and piano on the upper—acting upon a single string band. In order to work feasibly for the piano these strings must be somewhat heavier than is normal for a harpsichord. The harpsichord jacks are also rather close-plucking, in spite of being placed at the back of the gap.⁶³ The resulting harpsichord tone is somewhat harsh and plangent, perhaps not ideal for solo literature but superb as a *ripieno*, and the perfect foil to the piano's suave solo on the upper manual.

The question of what uses the 1726 cembalos could have served in actual music-making lies beyond the scope of this article. Indeed, given the pervasive ignorance, at least in English-language scholarship, of the history of eighteenth-century Italian keyboard music, pronoucements along these lines could hardly inspire much confidence. One of the few recent studies in this area, however, is very much to the point. Daniel E. Freeman has called attention to keyboard concertos composed ca. 1730-50 by Domenico Auletta (1723-53), Giuseppe Sammartini (1695-1750), Francesco Durante (1684-1755), Giovanni Battista Martini (1706-84), Giovanni Battista Pergolesi (1710-36), and Giovanni Benedetto Platti (ca. 1690-1763), pointing out that their works differ significantly in form, melodic structure, and texture from keyboard concertos of the Bach family and other German composers.⁶⁴ It is at least a provocative circumstance that, among the hundreds of Italian concertos for almost every variety of solo instrument, none were written for keyboard until just the time when a working knowledge of the hammer cembalo could be supposed to have taken hold. It would be premature to postulate a connection between the new musical instrument, the piano, and the new

63. See Luigi Ferdinando Tagliavini, "Giovanni Ferrini and his Harpsichord 'a Penne e a Martelletti'," *Early Music* 19 (1991): 398–408. I am grateful to L. F. Tagliavini, the owner of this extraordinary instrument, for permitting me to examine it and for demonstrating it for me.

64. "The Earliest Italian Keyboard Concertos," Journal of Musicology 4 (1985-86): 121-45.

musical species, the keyboard concerto, but it likewise seems premature to rule it out. 65

The Meaning of the 1726 Cembalos

Cristofori's 1726 cembalos excite wonder today, as they must have done when new, but our twentieth-century perceptions are necessarily different from those of Cristofori's time. In 1726 a new piano from Cristofori's hand was a rare and expensive marvel, very likely containing refinements unknown even to those who were familiar with his work.66 Today we take his great invention for granted and perhaps fail to appreciate how revolutionary such instruments must have seemed at the time. Meanwhile the harpsichord might not have baffled the eighteenthcentury observer as it does us, since the archaic instruments to which it makes reference were more common then than now. As matters stand today, the singularity of the 1726 harpsichord, both in detail and in general character, raises a question about its reasonableness. A skeptic might find ample grounds for dismissing this instrument as an incoherent freak, above all because of its irrelevance to eighteenth-century musical conventions. Yet it is precisely the archaic features of the 1726 harpsichord that finally make it intelligible. The 1726 harpsichord can be understood as a new design realizing the earliest principles of Italian cembalo making. It is astounding to contemplate that Cristofori intended an historical allusion, but if we are to make sense of this instrument is any other interpretation possible?

In Florentine tradition the fine or major arts (painting, sculpture, and architecture) were distinguished from the work of craftsmen and mechanics by containing an intellectual and imaginative component. It is to the mind of the artist that Giorgio Vasari assigns the guidance of his

65. As Freeman does: "... the early date of [Platti's keyboard concertos] leaves no doubt that harpsichord is the preferred instrument of performance. Idiomatic writing for hammered keyboard instruments is generally not found in solo concertos until the 1760s." Freeman omits to describe what might constitute such idiomatic writing. See *Giovanni Benedetto Platti: Two Keyboard Concertos*, ed. Daniel E. Freeman in *Recent Researches in the Music of the Classical Era* 37 (Madison, WI: A-R Editions, 1991), vii.

66. The three surviving Cristofori pianos differ from one another, and none of these three actions conforms to that described by Scipione Maffei in 1711. See Scipione Maffei, "Nuovo invenzione d'un gravecembalo col piano, e forte," *Giornale de' letterati d'Italia* 5 (Venice, 1711); transcribed and translated in Pollens, *The Early Pianoforte*, 238–43 and 57–62.

hand and eye, in his famous definition of disegno in the Lives of the Painters.⁶⁷ He further asserts that the artist's imagination, nourished by repeated observation of beautiful models in nature, produces an image of idealized beauty more perfect than any particular natural beauty, by means of which the deficiencies of a natural form may be correctedthis is the basis of the bella maniera. The idealizing imagination could take nourishment from history and culture as well as from nature. Throughout the Renaissance and Baroque eras a didactic and classicizing spirit flourished. Just as J. S. Bach's The Art of Fugue, with its archaic open-score format, is an idealizing summary of contrapuntal technique—"idealizing" in the sense of pressing farther along every possible path of development than any earlier work had ventured-so Cristofori's last harpsichord idealizes the historical roots of cembalo making in Italy. Cristofori here enters territory unexplored by musical instrument makers, appearing not as an artisan, like the Cremona violin makers Amati and Stradivari, but as an artist-philosopher like Leonardo da Vinci.68 Grand Prince Ferdinand de' Medici apparently recognized him as such, and the reference to Galileo in the decoration of the piano's outer case seems particularly apropos.

The 1726 cembalos, probably Bartolomeo Cristofori's swan song, are first and foremost musical instruments of unsurpassed beauty. However, the maker has employed them in a conceit. We are presented with antipodal realizations of an Idea—The Cembalo. The quilled version gestures rhetorically towards its origins in the Gothic period and in organ

67. Lives of the Painters, Sculptors and Architects, transl. by Gaston du C. de Vere, intro. by David Ekserdjian, 2 vols. (New York: Knopf, 1996). Vasari's sketchy definitions of these and related terms are found in the Preface to the Third Part of the Lives. Vasari attributes to Leonardo da Vinci the statement that "men of lofty genius sometimes accomplish the most when they work the least, seeking out inventions with the mind, and forming those perfect ideas which the hands afterwards express and reproduce from the images already conceived in the brain" (Lives 1:632). Helpful discussions of the epistemology of the fine arts may be found in the following articles in *The* Encyclopedia of World Art (New York: McGraw-Hill, 1959–): "Art," by Nikolaus Pevsner (1:769); "Education and Art Teaching: Renaissance" by Rosario Assunto and Giuseppe Scavizzi (4:563–64); and "Mannerism," by Luisa Becherucci (9:444). For an exposition of the place of imagination and innovation in musical composition, especially during the Renaissance, see Edward E. Lowinsky, "Musical Genius: Evolution and Origins," Musical Quarterly 50 (1964): 321–40 and 476–95.

68. Compare Stewart Pollens's characterization of Cristofori as "primarily a brilliant mechanical engineer" in "Three Keyboard Instruments Signed by Cristofori's Assistant, Giovanni Ferrini," *The Galpin Society Journal* 44 (1991): 78–79. making, establishing time itself, or history, as the viewing axis. The hammered version faces in the opposite direction. Cristofori presents us with a summa of the cembalo and stakes his claim as inventor of its future.⁶⁹

APPENDIX

Notes on a Model of the Registration Machinery in the 1726 Cristofori Harpsichord

In order to test the feasibility of the reconstruction of the 1726 harpsichord's registration machinery proposed in this essay, the author made a model incorporating every feature of the existing machinery, but with a third hole drilled in the slave lever of the right-hand system aligned with the two-foot jackslide (fig. 11). The use of screws as endpins in the mock jackslides made it possible to reproduce the friction loading that might be expected to exist in the instrument itself. The screws used in this model have a shaft diameter of 4.0 mm working in holes of diameter 5.7 mm, allowing a maximum travel of 1.7 mm, which provides sufficient clearance between the on and the off positions.

It will be evident to anyone thinking through the proposed working of the two levers that they are mechanically contradictory. If the four-foot and two-foot jackslides are firmly attached to the left-hand lever, the right-hand lever system, which is designed to impart contrary motion to them, cannot move. Only if all attachment holes are drilled oversize relative to the pins they work upon is it possible for both to operate. The realization that the contradictory mechanical motions could be accommodated by loosely-fitted connections is perhaps the most ingenious aspect of the design of this machinery. Since the attachment holes in the levers are roughly the same size as the holes in the stop-motion plates, the attachment pins, which double as stop-motion pins, must have fit as loosely in the one set of holes as in the other. The loose fit of the attachment

69. I wish to thank Edward L. Kottick, Denzil Wraight, and John Koster for critical readings of this essay. The latter, along with Thomas and Barbara Wolf, challenged my thinking on several points so as to strengthen my argument. Art historian Robert R. Coleman offered invaluable guidance in my foray into his field. None of these should be held accountable for errors in fact or judgement which may remain. Winnfried Schrammek, then director of the Leipzig Music Instrument Museum, and his staff extended every courtesy to me when I visited in 1994. I am particularly grateful for the opportunity they afforded me to examine the outer cases of the 1726 cembalos in the storage area of the museum. The present director, Eszter Fontana, has continued to be helpful as this work progressed. Kerstin Schwarz generously provided me with prints of her superb photographs of the outer cases, as well as copies of other important photographs, in addition to pre-publication access to her research on the surviving Cristofori grand instruments. Finally, at a critical moment my wife, Enid Sutherland, communicated a brilliant idea to me, without which this article would have been much the poorer.



FIGURE 11. Model of the registration machinery of the 1726 harpsichord. Photo: David Sutherland.

pins constitutes strong supporting evidence for the reconstruction here proposed.

The proper working of the two levers requires a nice adjustment of size and position of the attachment holes. At present, for instance, the model is set up such that the left-hand lever does not push the four-foot jackslide quite all the way off when pushed to the right, a fault which could be remedied by adjustments elsewhere. It seems possible that Cristofori had worked out the principles of the mechanism in a model or mock-up of his own, and then was proceeding one step at a time to drill the attachment holes in the machinery actually fabricated for the instrument, beginning with those in the left-hand lever.

The model demonstrates unequivocally that the slave lever does not require a fixed fulcrum at its mid-point. Observed in detail, its working is as follows.

- Pushed from either position towards the opposite position, the slave lever moves through a neutral zone until its front and rear holes come into contact with the other sides of the corresponding endpins, bearing against them so as to move them. Since the slave lever enjoys far more favorable leverage in acting upon the rear (2') endpin than the front one (4'), it works first upon the former, while the latter serves as a (temporary) fulcrum.
- When the rearmost (2') jackslide has come to rest at the limit of its travel, its endpin in turn serves as the fulcrum against which further pressure on the slave lever moves the front (4') jackslide. During this second part of the motion the slave lever exerts unfavorable leverage upon the front (4') pin, the difference in effort needed to effect the two parts of the entire motion being quite noticeable.
- Moving hardly at all at its mid-point, the slave lever exerts little force upon the eight-foot pin, no matter where this is within its travel, and so long as the friction-loading of the eight-foot jackslide is slightly greater than that of the other two jackslides it will remain unaffected by the slave lever.

Given properly sized and spaced clearance holes and sufficient friction, the two levers work very well together. In particular, the action of the right-hand lever in engaging or disengaging both the upperwork stops simultaneously is very efficient.

Such a model makes it possible to explore alternative reconstructions of the registration machinery. Those in which the right-hand lever system works only upon a single jackslide (either the four-foot or the eight-foot) have been rejected on the grounds of logic as explained in the main text above. There remains the possibility of engaging the slave lever to work upon the jackslides for which holes actually exist in the machinery of the 1726 harpsichord, that is, eight-foot and four-foot. This is accomplished in the model by simply removing the rearmost (2') endpin. The right-hand lever system can in fact function in this mode, albeit with somewhat excessive travel at the handle. It now moves the eight-foot and four-foot jackslides in opposite directions. Since their jacks face in opposite directions, both are engaged when the main lever is moved to the right in the keywell, and vice versa. To engage the eight-foot principal alone, the right hand lever is moved to the left (canceling both registers), and then the eightfoot register can be engaged by means of its endpin. If the left-hand lever is attached to both the front and rear jackslides, however, it is impossible to engage the two-foot register without disengaging the four-foot, so that the registration 8' + 4' + 2' is not available; one must be content with either 8' + 4' or 8' + 2'. While mechanically feasible, this arrangement of the registration machinery is musically useless, since the two levers do not work together coherently. It therefore cannot be accepted as the intended design.