

1 History and Construction of the Harpsichord

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“The harpsichord is lord of all the instruments in the world,” wrote the Neapolitan composer Giovanni Maria Trabaci in *Il secondo libro de ricercate* (Naples, 1615). As with lords and their domains, however, there was at different times and places a wide variety of harpsichords quite dissimilar in character. Knowledge of the harpsichords available to composers can inform the player or scholar about how particular works were conceived and performed.

The history of harpsichords, virginals, spinets, and similar instruments, for which “quilled keyboards” will be used here as the generic term, can be divided into five eras: late medieval, Renaissance, baroque, classical, and revival. To be sure, certain characteristics of design and construction persisted among Italian harpsichords of all periods and other characteristics persisted among Flemish harpsichords. Nevertheless, shared qualities of tone and touch are evident among early instruments of both schools, as well as those from other regions, while later instruments show qualities characteristic of their own times.

Some familiarity with the design, construction, and function of harpsichords and other quilled keyboards is necessary for understanding their history.¹ The keyboard or manual, of which harpsichords often have two, consists of a set of levers to be pressed down in front so that the far end rises. Sound is produced by plucking the string with a plectrum traditionally cut from bird quill but occasionally of leather or metal (or plastic in most modern instruments), protruding from a small wooden tongue held by an axle in an upright slip of wood called a jack, which rests on the far end of the key lever. When the key is depressed, the jack is raised and the plectrum plucks the string. When the key is released, the falling tongue swivels to pass around the string and is returned to its resting position by a spring. A small cloth flag held in a slot at the top of the jack comes to rest on the string to damp it. A jackrail over the jacks limits their upward motion.

Harpsichords have the familiar wing shape from which the form of the modern grand piano was derived (see Figures 1.1, 1.3, 1.4, 1.7, 1.9, and 1.10). They may have only one choir (set of strings) but most often two or three, occasionally more. In terminology derived from organs, an 8-foot choir is at “normal” pitch, which historically could range from about a tone

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Figure 1.1 Harpsichord, maker unknown, Naples, about 1525 (National Music Museum, Vermillion, SD, cat. no. NMM 14408; photograph by Tony Jones, courtesy National Music Museum). For clarity, the jackrail has been removed for this and most other pictures.

lower than modern $a^1 = 440$ Hz to three-quarters of a tone above (i.e., with a^1 sounding from about 385 to 475 Hz). A 4-foot choir sounds an octave higher than an 8-foot; a 16-foot sounds an octave lower (the designation “foot” will occasionally be omitted, and only the number used, in some references to registration). Each choir is plucked by one set of jacks, or occasionally two with different plucking points. Strings plucked closer to their midpoints sound rounder or flutier, while those plucked closer to one end sound brighter or more nasal.

A harpsichord's major structural components are the walls (spine, tail, bentside, and cheekpiece); the bottom closing the entire underside of the instrument; the wrestplank; the nameboard; the guides to hold the jacks; the belly rail; the soundboard and often a soundhole in which a decorative rose is placed; and reinforcing inner supporting ribs under the soundboard and internal bracing of the walls.²

A "stop" or "register" consisting of a set of jacks can be turned off by moving its guide slightly to the right or left so that the plectra miss the strings as they rise. In many instruments, when a stop is off, dampers do not touch their strings, which are free to resonate sympathetically. Guides can be moved directly by hand, by stop levers on the wrestplank or protruding through the nameboard, or, exceptionally in historical instruments, by pedals or knee levers. In two-manual or "double" harpsichords, there is usually a provision to combine the two keyboards or their stops. This can be done by a shove coupler, in which the entire upper-manual keyboard (or occasionally, the lower manual) can be shoved back or pulled forward about 7 mm. In the shoved-back position, the back ends of the upper key levers are pushed up by upright "dogs" fixed to the lower-manual key levers. Another method of coupling is the dogleg jack, the front portion of which rests on the upper-manual key while a leg extends down from the jack to rest on the lower-manual key. When a dogleg stop is engaged, it can be played from both keyboards. A choir of strings may be provided with a buff ("lute" or "harp") stop, usually consisting of pads of soft leather that can be moved to touch the strings, thus eliciting a pizzicato tone.

Many early keyboards lacked accidentals at one or both extremes of their compasses. A common sixteenth-century compass of thirty-eight notes, for example, is written as F, G, A, to g^2 , a^2 to indicate that F#, G#, and $g\sharp^2$ are not present. The common short-octave compass in which the lowest note, an apparent E, sounds C, apparent F# sounds D, and apparent G# sounds E, is indicated by C/E. Another short-octave arrangement, with apparent BB sounding GG, is indicated by GG/BB.

The overall dimensions and shape of a harpsichord are interdependent with the vibrating lengths of the strings, called the "scaling," and with the compass of the keyboard. The number of notes, with allowance for clearance at both ends of the keyboard, determines the width of the instrument, while the length of the instrument is that of the lowest string plus some expanse of soundboard beyond its far end and space for the tuning pins and keyboard(s) at the near end. Although the angle of the tail with the spine, which can be as blunt as 90 degrees or as sharp as 30 degrees, is somewhat arbitrary, the curve of the bentside is more or less parallel with

that of the bridge, which is itself dependent on the lengths of the strings as they change from note to note.

Usually, the strings in the treble double in length for each lower octave. This is called “Pythagorean scaling,” which in some instruments extends only down to about c^1 but in others much deeper into the tenor or bass. Below a certain point, however, the scaling is “foreshortened,” so that the instrument will not become unreasonably long, that is, the strings are less than double the length of those an octave higher. According to modern convention, the length of the c^2 string (the longer 8 if there are two) is regarded as the basic scale of an instrument. The scaling of a harpsichord is closely related to its intended pitch and string material. The bass strings are always brass, and some harpsichords were designed for brass throughout their entire compass, while others were designed for iron strings from the tenor to the treble. Since the tone quality of a string is purer as it is pulled tauter, harpsichord makers traditionally made their scalings, at least in the treble, as long as the strings could bear without breaking, with a safety margin of a semitone or so. Care must be taken, however, if the treble scaling is non-Pythagorean. If, for example, c^3 is significantly longer than half of c^2 , then one may regard twice the length of c^3 as the instrument’s basic scale.

The principal alternative forms of quilled keyboards are the clavictherium, which is a harpsichord turned upright; the virginal; and the spinet. In virginals the strings run from left to right within a rectangular or polygonal shape with the keyboard at the long front side (see Figures 1.2 and 1.6). Spinets resemble small harpsichords in which the long wall to the player’s left has, together with all the strings, been rotated clockwise about 65



Figure 1.2 Virginal, maker unknown, Venice, 1540 (The Metropolitan Museum of Art, New York; photograph public domain).

degrees. Most common are “bentside spinets” (see Figure 1.8), to be distinguished from the very small spinets at octave pitch, which usually have a straight wall to the player’s right.

Late-Medieval Origins

The harpsichord arose in what has jocularly been called the “Stone Age” of keyboard music.³ Much of this repertoire, including the Robertsbridge Codex (ca. 1360), the Buxheim Keyboard Manuscript, and various early sixteenth-century sources, was, with the major exception of the Italian Faenza Codex (ca. 1420), written in the old German tablature, which favors a florid treble line. The earliest-known stringed keyboard instrument was the *eschequier*, first mentioned in French documents of the 1360s. Apparently invented in England but immediately transferred to France, the *eschequier* was, in all likelihood, some sort of clavichord. The harpsichord as we know it evidently originated in Vienna with Hermann Poll, who, passing through Padua in 1397, was recorded as having invented an instrument called the *clavicembalum*. No details are known, but the name indicates that it had keys (*claves*) and “bells,” that is, the sound quality of small bells (*cymbala*), as the timbre of high-pitch undamped metal strings plucked by a hard material might well be described. Fifteenth-century depictions of harpsichords show small instruments that would often, in modern terms, have sounded at 4-foot pitch or higher.⁴

Knowledge of the instrument quickly spread throughout Europe. An illustrated description of a *clavisimbalum* in Henry Arnault de Zwolle’s manuscript (Paris, Bibliothèque Nationale, ms. lat. 7295), produced in Dijon about 1440, provides extensive technical details. It was about 940 mm long and had a 35-note compass of B (then the usual lowest note of organ keyboards) to a². The three-octave measure (the width of twenty-one natural keys, typically 495 mm in modern pianos) was rather wide, about 530 mm, and the playing surfaces of the keys were very short. Several alternative rather cumbersome plucking actions, all lacking dampers, are shown.⁵ None had a conventional jack, although the one Henry Arnault preferred had a tongue with a thin, narrow plectrum, presumably quill. Throughout the fifteenth century, harpsichords would generally have had just one choir of strings, although Henry suggested, somewhat impracticably, that a second string could be added directly above the first.

The oldest existing plucked keyboard, a late fifteenth-century south German clavicytherium (housed in the Royal College of Music, London), represents the next stage of development. Its jacks, plucking a single choir, are very nearly the standard type with quill plectra, but have no slot for

dampers. The thin-walled instrument is still kept in its original outer case. The compass was originally forty notes – E, “E#,” F, G, G#, A to g^2 – with the bass likely in some short-octave arrangement. The dimensions of the keyboard are similar to Henry Arnault’s, with a three-octave measure of 529 mm and short natural heads. The scaling suggests that the instrument was tuned about a fourth or fifth above 8-foot pitch. Organs were made at alternative pitch levels roughly a fourth or fifth apart until well into the sixteenth century.⁶ It is not surprising that harpsichords, often made by organ builders and played by organists, would also have been made at either pitch, neither of which was yet privileged as normal.

Late fifteenth-century depictions show that harpsichords approaching five or six feet (180 cm) in length, about the size of a typical sixteenth-century harpsichord at 8-foot pitch, were beginning to be made. These larger sizes would have resulted both from the expansion of the compass downward and from making some instruments at lower pitches than before. The overall lowering of the tonal center towards the bass led Italians occasionally to call the instrument a *gravicembalo*.

The rectangular form of plucked keyboard, already mentioned by Henry Arnault as a possibility, acquired the name *virginale* by about 1460. Within a few decades the virginal displaced the harpsichord as the most prevalent form of quilled keyboard in northern Europe. There is no harpsichord among the systematic illustrations of musical instruments in Sebastian Virdung’s *Musica getutscht* (Basel, 1511).

The Renaissance

By 1500 an instrument originally evoking the ringing of little bells had reached a certain level of tonal and mechanical refinement. With a deeper voice and a more efficient action, the harpsichord in the age of Josquin des Prez was poised to assume its role as a medium for music making at the highest artistic level. “Renaissance,” as used here in the context of quilled keyboards, includes the sixteenth century to approximately the first decade of the seventeenth in Italy, but extends later in other regions where older techniques of composition persisted (e.g., in England, to the mid-seventeenth century, or Spain arguably into the early eighteenth). Because of the overwhelming popularity of virginals north of the Alps, the paucity of northern harpsichords before the final decades of the sixteenth century compels us first to consider Italy, from which at least forty examples made before 1600 are known.⁷

Most sixteenth-century Italian plucked keyboards were made in two major centers, Naples and Venice.⁸ Although the Venetian school is better

known because its makers signed and dated their instruments, the Neapolitan school appears to have been established earlier. Common features of Italian plucked keyboards are: thin walls, with upper and lower edges surrounded by finely cut moldings; attachment of the walls around the edges of the bottom; jacks held by “box guides;” scrolls or carved key cheeks at the front ends of the spine and cheekpiece; and a separate outer case. All the harpsichords have just a single manual. Generally intended for brass strings throughout the compass, their Pythagorean scaling deep into the bass resulted in an elegant, slender outline.

Figure 1.1 shows a typical Neapolitan harpsichord as made from about 1515 into the seventeenth century. Prominent features are the sharp tail angle (33 degrees), the maple walls and spruce soundboard (fir or occasionally maple in later Neapolitan instruments), and the jack guide perpendicular with the spine. It has a single set of strings at 8-foot pitch (two known examples also had a 4-foot stop) and a compass of C/E to c^3 . The dimensions of the keyboard, with three-octave measure of 495 mm, are similar to those of later centuries. Neapolitan harpsichords were widely distributed in Italy and imitated by Roman and Florentine makers. Neapolitan virginals, made at either 8- or 4-foot pitch, have rectangular cases, and their left-hand bridges lie on a solid wrestplank.

In Venice, harpsichords were commonly made with cypress soundboards and walls, although the latter were occasionally of ebony or other exotic woods. Tail angles are blunter than in Naples, about 45 to 60 degrees, and the guides are angled away from the player towards the bass. The keyboard is usually C/E to f^3 with the three-octave measure typically about 505 mm. The tails of the naturals, especially of the *D*-keys, are notably wide, facilitating playing between the sharps. Most Venetian harpsichords were made with a single 8+4, although a few instruments with a single 8 or with 2×8 are known, as well as the occasional octave instrument with 2×4. The scalings of many Venetian harpsichords are (or were originally) very long, with c^2 ranging from about 340 mm to 400 mm or more. Although they might have had iron strings tuned to 8-foot pitch, they were more likely designed for brass strings tuned a fourth or fifth lower. Although 8-foot pitch (albeit varying from place to place) came to be regarded as the central standard, instruments a fourth or fifth lower were useful for accompanying ensembles, which often performed at these lower transposed pitches.

Virginals were the principal Venetian form of quilled keyboard at 8-foot pitch. Scaled for iron strings in the treble, they were typically made in irregular pentagonal or hexagonal shape with the keyboard protruding from the long front side. With plucking points farther from the left-hand

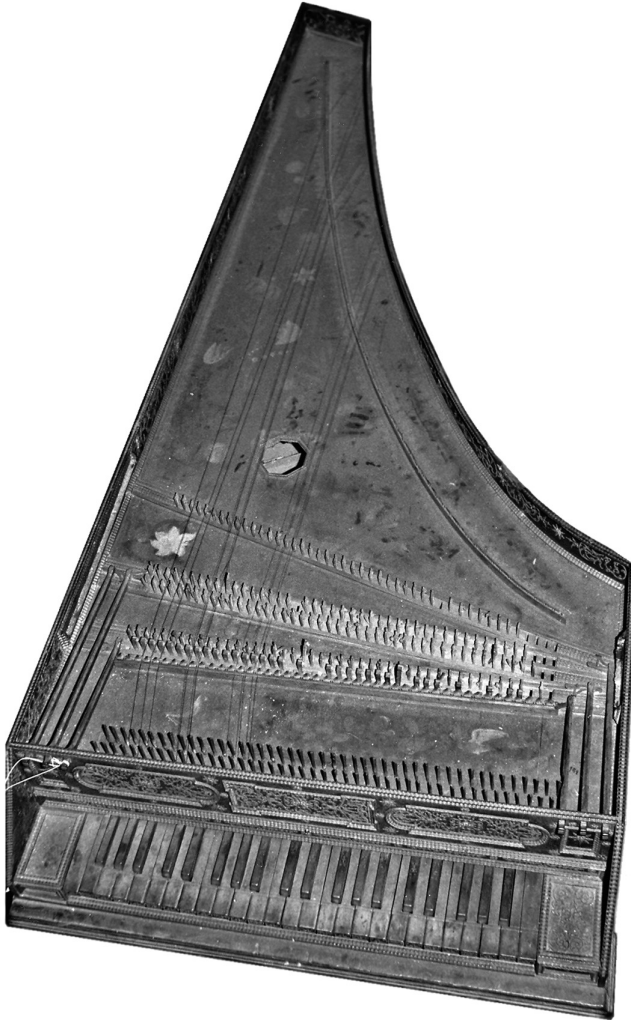


Figure 1.3 Harpsichord, maker unknown, southern Germany, about 1630 (Bayerisches Nationalmuseum, Munich, Inv. Nr. Mu 78; photograph by the author). In addition to the three 8-foot registers typical of early German harpsichords, there are here a second nasal with metal plectra and a register with distant plucking points.

bridge, which is on active soundboard, the tone is rounder than that of Neapolitan virginals.

The earliest surviving northern-European harpsichord, made by Hans Müller in Leipzig, 1537, with thin walls surrounded by moldings, superficially resembles Italian instruments, but its design and construction are quite different.⁹ As in most instruments made north of the Alps, the bottom is attached to the underside of the walls, and separate thin upper and lower guides hold the jacks. Two features, the extension of the

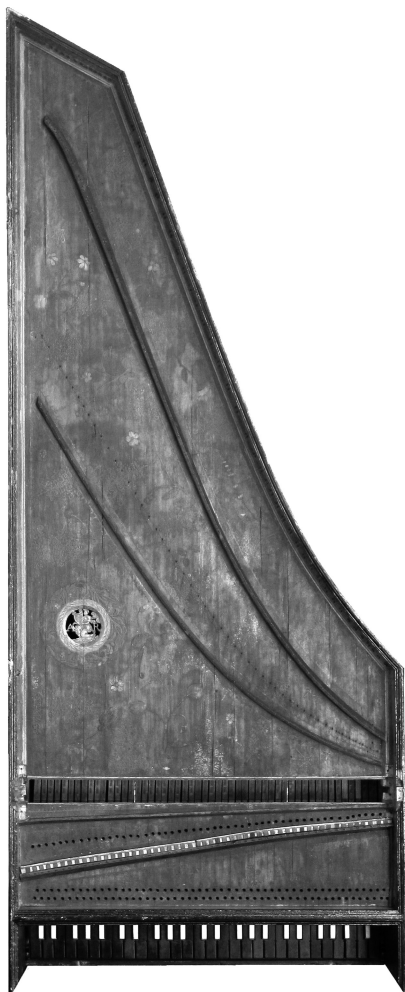


Figure 1.4 Harpsichord by Andreas Ruckers the Elder, Antwerp, 1607 (National Music Museum, Vermillion, SD, cat. no. NMM 7384; photograph by the author). A typical Ruckers single, substantially unaltered but with an eighteenth-century keyboard of larger compass than the original C/E to c^3 .

soundboard towards the nameboard, such that the nut is acoustically active, and the presence of a nasal register, are frequent in early German instruments (see Figure 1.3).

Until the late seventeenth century Germanic harpsichords commonly had a single manual with compass C/E to c^3 and two 8-foot choirs plucked by three registers, two with normal plucking points, the third nasal. Often there was a buff stop, sometimes also a 4-foot stop. The short scalings of many instruments, c^2 about 310 mm, indicate that, with iron stringing in the treble, they were tuned to *Chorton*, a common organ pitch, about $a^1 = 465$ Hz. Virginals were made at various pitches from 8-foot or a fourth or fifth above, to 4- or even 2-foot. The most usual compass was C/E to c^3 , but

C/E to g^2 , a^2 and F, G, A, to g^2 , a^2 (a common organ compass) are found in some sixteenth-century examples. In addition to native instruments, there were imported instruments from Venice in southern Germany and from Antwerp in central and northern regions.

Plucked keyboard making in the region now encompassing Belgium and the Netherlands was dominated by Antwerp even before the advent of the supremely important Ruckers dynasty.¹⁰ Throughout the sixteenth century primarily virginals were made, at first in the thin-walled manner seen in the Müller harpsichord of 1537, but the basic characteristics of the classic Flemish style of harpsichord and virginal making were fully developed by the time Hans Ruckers set up shop as a master in 1579.

Ruckers harpsichords as made until the mid-seventeenth century (most were later altered) have poplar walls about 13 mm thick with moldings cut into the top edge and were scaled for iron strings in the treble. Both single- and double-manual models had two choirs, an 8 and a 4. Each bridge was on a separate area of free soundboard, with a massive 4-foot hitch-pin rail between the 8- and 4-foot areas. Singles, with compass C/E to c^3 , had two registers, while doubles had 8+4 on each keyboard. All Ruckers doubles were originally transposing instruments (Figure 1.5). The upper manual, compass C/E to c^3 , was at 8-foot pitch, about $a^1 = 410$ Hz, but the lower, with compass C/E to f^3 , plucking the same strings, was displaced so that



Figure 1.5 Harpsichord by Joannes Ruckers, Antwerp, 1638 (Musical Instrument Museum, University of Edinburgh; photograph by the author). A typical Ruckers double in its original state with transposing keyboards.

they sounded a fourth lower. Because engagement of the registers on one manual would damp the strings shared with the other manual, simultaneous use of the two keyboards was impossible. Transposing doubles amounted essentially to two single-manual harpsichords, one at 8-foot pitch, the other a fourth lower. In 1604, Jan Pieterszoon Sweelinck (1562–1621) traveled to Antwerp to oversee the purchase of a harpsichord for the city of Amsterdam, where he was the municipal organist. From its surviving lid (Rijksmuseum, Amsterdam) the instrument can be identified as a standard Ruckers transposing double. All Ruckers harpsichords had a buff stop for the 8 strings, divided between f^1 and $f\sharp^1$ (but $c^1/c\sharp^1$ on the upper manual of doubles). Their keyboards had a 500-mm three-octave measure and relatively narrow spaces between the sharps, making it difficult to play on the tails of *D*, *G*, and *A*.

The Ruckerses and their colleagues made two types of virginals, the *spinett* and the *muselar*. In the former, the strings are plucked near the left-hand bridge, which, deadened by a heavy plank under the soundboard, elicits a bright, almost nasal tone. In *muselars* the left-hand bridge is on active soundboard, and the jacks, plucking near the midpoints of the strings, generate a hollow tone. This could be modified in the lower part



Figure 1.6 Double virginal by Hans Ruckers, Antwerp, 1581 (The Metropolitan Museum of Art, New York; photograph public domain). The mother is a *muselar*; the child is shown halfway pulled out from its storage compartment.

of the compass (up to f^1) by advancing a batten with metal hooks towards the strings to cause a jarring sound. Virginals were made at several pitches, 8-foot and a tone, fourth, or fifth higher. A virginal at 8-foot pitch was often combined with a small virginal at 4-foot pitch to form a “mother and child” or “double virginal” (see Figure 1.6). The child could be stowed inside the mother, taken out and played separately, or, after the mother’s jackrail was removed, placed on top to become an upper manual coupled to the mother’s keyboard, which thus had an 8+4 registration. To judge from surviving instruments, the Ruckerses made approximately equal numbers of harpsichords and virginals.

In England harpsichords were so infrequent during the sixteenth century that *virginall* became the generic term for plucked keyboards. “Harpsichord” did not enter the language until about 1610. It is often assumed that “the majority of instruments in use in England at the time were imported, first from Italy and later from Flanders.”¹¹ Although much of the English virginalists’ repertoire is playable on continental instruments, many pieces require chromatic bass notes lacking on their short-octave keyboards. Numerous makers were active in England, and their earliest surviving instruments, a harpsichord by Lodewijk Theewes, London, 1579, and two anonymous virginals from about 1580–1600 have C to c^3 keyboards.¹² Because low C# is extremely rare in the repertoire, this key was probably tuned to AA, which occurs more frequently.

The Theewes harpsichord (Victoria and Albert Museum, London), combined with an organ underneath, is of supreme importance, as both Thomas Tallis and William Byrd had close connections with its owner. While the walls are thick like a Ruckers’, the nuts, like Hans Müller’s, are on active soundboard. There are three choirs and registers, 2×8+4. The pitch was approximately $a^1 = 400$ Hz. For each string of the second 8 choir, the bridge holds a brass fitting, very old if not original, apparently to cause a jarring sound. Although these could all be turned on or off, it seems reasonable to suppose that they were intended to be kept on permanently. The only other surviving harpsichord from the virginalist period, by John Hasard, London, 1622 (Knole House, Sevenoaks, Kent), is similarly complex, with three choirs and registers providing a variety of color. Although the soundboard and keyboard are missing, enough remains to reconstruct its basic features. Two of the stops, one of which was a close-plucked nasal, were an octave above the third. The compass was fifty-three notes, plausibly GG, AA to c^3 , which, together with the estimated scaling, suggests that the lower-pitch choir was tuned a fourth below the prevailing English “quire pitch,” which was about $a^1 = 475$ Hz.¹³ A harpsichord by Charles Haward, London, 1683 (Hovingham Hall, Yorkshire), despite its late date, might well reflect earlier practices in addition to the archaic provision of

four roses in the soundboard. With two choirs of 8-foot strings at quire pitch, there were originally three registers, two of them nasal.¹⁴

English virginals are similar to Flemish *spinnetten*, but often with certain pre-Ruckers features including active left-hand bridges and multiple roses. Until about 1650 their compass was often C to c³. GG/BB to f³, found as early as 1644, was the most frequent of the wide compasses used after 1650. Most were scaled for quire pitch. The one known English double virginal, by Thomas White, London, 1638 (private collection), with only the child surviving, was scaled for a fourth below quire.

No French quilled keyboards survive from this period.¹⁵ Documents indicate that virginals predominated during the sixteenth century. Many virginals in sixteenth-century inventories were only two and a half or three feet long and must have been tuned at octave pitch, but a drawing by Jacques Cellier, about 1585 (Paris, Bibliothèque Nationale, ms. fr. 9152), shows a larger instrument, compass C/E to a², generally similar to those of Antwerp and London. Double virginals were also known. Harpsichords begin to turn up in early seventeenth-century inventories. In the workshop of maker Jean Jacquet in 1632, there were two harpsichords, one with a single set of strings, the other with 100 strings. The latter presumably had a keyboard of fifty notes, likely GG/BB to c³, and two stops. An engraving of a harpsichord with these characteristics is in Marin Mersenne's *Harmonie universelle* (Paris, 1636–1637). The grouping of both sets of wrestpins, 8+4, just behind the nameboard, suggests that the wrestplank was narrow, as in the Müller and Theewes harpsichords, so that the nuts were acoustically active. One must be skeptical in considering other harpsichords mentioned by Mersenne, who, attempting to be comprehensive, described not only the commonplace and native but also the unusual and foreign, while adding his own theorizing. His passing remark about harpsichords with two or three keyboards and seven or eight *jeux*, that is, stops or combinations of stops, might refer to Ruckers transposing doubles, in which a third keyboard is occasionally present in a virginal built into the hollow of the bentside.

No Iberian quilled keyboard earlier than a harpsichord by Joseph Bueno, Valladolid, 1712, is known to survive, but documents show these instruments to have thrived in Spain and Portugal since the late fifteenth century.¹⁶ By the early sixteenth, the carpenters' guilds in Valencia and Seville included makers of *clavicímbalos*, and twelve *carpinteiros de clavicórdios* (i.e., plucked keyboards, as clavichords would be called *monacórdios*) were recorded in Lisbon. Circumstantial evidence indicates that the early Iberian makers worked in a style related to that of the northern schools, not the Italian. Flemish harpsichords and virginals were well known in Spain and her colonies, and the migration of several

Antwerp masters to Spain towards the end of the sixteenth century provided further opportunities for northern influence. The Bueno harpsichord's musical resources match those of standard Ruckers singles: compass C/E to c^3 and a two-register 8+4 disposition with a buff for the 8. Archaic features of its design and construction, however, appear to have stemmed from pre-Ruckers practices. From various documents, several concerning *claviórganos* (harpsichords combined with organs), which were rather common, one can gather that sixteenth-century harpsichords were frequently made with just an 8-foot stop, that the usual compass was C/E to a^2 (with $g\sharp^2$, unlike instruments made elsewhere with this range), and that the pitch was usually about $a^1 = 385$ Hz. Possibly, the nuts in some instruments were on active soundboard, as in the Theewes and Müller harpsichords. In addition to the Low Countries, certain Italian territories, including Milan and Naples, were under Spanish sovereignty. While there is no evidence of Neapolitan instruments in Spain, a virginal in the distinctive heptagonal form made in Milan by Annibale dei Rossi and his son Ferrante was depicted by El Greco in his Annunciation of 1597–1600 (Museo del Prado, Madrid).

In summary, the actions, dispositions, and timbral characteristics of Renaissance quilled keyboards, although varied in form and detail, were well suited to the repertoire. Keys typically had balance (fulcrum) points relatively close to the front, such that players, feeling significant resistance in plucking the strings, would naturally apply a direct and vigorous touch befitting clear and precise performance of the prevalent textures of contrapuntal lines and brilliant diminutions, as well as the punchy chords of lively dances. Girolamo Diruta, in *Il Transilvano* (Venice, 1597), distinguished between the “striking” touch of those who played dances on quilled instruments and the “pressing” touch of good organists. Clarity and rhythmic precision were also enhanced by the instruments' acoustical properties, in particular the crystalline tone of the typical harpsichord's single 8, which could be enhanced in many instruments by a 4 or sometimes by a nasal 8. In 1648, Joannes Ruckers's nephew and successor, Jan Couchet, who had made a bespoke 2×8 harpsichord, wrote to the owner that he would prefer to make an instrument with a 4-foot which “goes quicker and sharper than the unison; it is sweet and lovely in sound.”¹⁷ Thus, Couchet still favored the original Renaissance tonal ideal of clarity rather than massiveness.

Finally, one should note that, except for double virginals or the contrivance of stacking a 4-foot virginal on top of an 8-foot instrument, no Renaissance plucked keyboard provided two manuals that could be played simultaneously or in rapid alternation.

The Baroque

After the Renaissance, the history of the harpsichord concerns various adjustments and additions to the basic designs, not fundamental changes. During the baroque period, techniques of performance, composition, and notation were developed to enhance the expressive possibilities of plucked instruments. François Couperin, for one, in *L'art de toucher le clavecin* (Paris, 1716), prescribed the “suppleness” and “gentleness of touch” (*souplesse* and *Douceur du Toucher*) with which, by subtle timing and articulation, the player could give “soul” (*L'âme*) to the harpsichord. To suit this gentler touch, keyboards were made with balance points farther back than in the Renaissance. This resulted in a less resistant sensation of plucking, which gave players more control over the attack and enabled a smoother musical flow when desired.

Parallel to these developments in the solo use of plucked keyboards was their use in a new manner of accompaniment, basso continuo, for which harpsichords had to provide a solid harmonic support. To enhance the requisite gravity of tone, harpsichords were now almost invariably made with two 8-foot choirs. Needless to say, 2×8 or 2×8+4 tutti also became indispensable for the solo repertoire. It is difficult to imagine the bold gestures of a Frescobaldi toccata or a French *sarabande grave* as sounding fully effective if played with a single 8, even when supplemented by a 4. It was a fairly simple matter to alter older harpsichords to update their musical resources by adding a second set of 8-foot strings (sometimes removing the original 4) and by altering or replacing their keyboards. Most extant Renaissance Italian and Ruckers harpsichords survive in their baroque states.

Italian harpsichords (see Figure 1.7), now typically made with two 8-foot stops, were still often constructed with thin walls and provided with separate outer cases, but the so-called “false-inner outer” manner, in which the instrument was built within a thick-walled case with cypress veneer and moldings to simulate the traditional appearance, became increasingly common. Compasses, occasionally still C/E to f^3 , were most often C/E to c^3 although, towards the end of the seventeenth century, GG, AA to c^3 was not unusual. These compasses remained common during the first half of the eighteenth century, but later instruments tended to have larger compasses such as FF or GG to f^3 . Although the tone of Italian harpsichords has been described as decaying rapidly, these instruments restored or reproduced according to the best modern standards are as resonant and sustaining as any.

By the early eighteenth century, the innovative Bartolomeo Cristofori, inventor of the piano, and other makers in Florence began to make overtly thick-walled instruments. In some of his harpsichords and pianos, he contrived a double-walled construction in which the thick outer wall



Figure 1.7 Harpsichord by Giacomo Ridolfi, Rome, ca. 1660–ca.1690 (National Music Museum, Vermillion, SD, cat. no. NMM 4657; photograph by the author).

bore the tension of the strings while the soundboard was attached to an unseen separate inner bentside and tail.¹⁸ Florentine harpsichords usually had 90-degree tail angles. Otherwise, they and other Italian makers generally adhered to traditional principles of design, with scaling suitable for brass strings, Pythagorean deep into the bass.

New virginals were seldom made after about 1620 except in Naples where the leading maker, Onofrio Guarracino, continued to make them into the 1690s. Otherwise, to the extent that new small instruments at 8-

foot pitch were needed, makers turned to bentside spinets, the earliest-known example of which was made by Girolamo Zenti, Rome(?), 1637.

With few exceptions, French harpsichords – from the earliest known, by Jean Denis II, Paris, 1648 (Musée de l'Hospice Saint-Roch, Issoudun), to those made just before the storming of the Bastille in 1789 – have two manuals, with 8+4 on the lower, 8 on the upper, and a shove coupler.¹⁹ The earliest unquestionable evidence of such doubles is in the first edition of the aforementioned Jean Denis's *Traité de l'accord de l'espINETTE* (Paris, 1643), which mentions "harpsichords with two keyboards for passing all the unisons, which the lute cannot do."²⁰ That is, with one hand on each keyboard with its separate 8-foot stop, the player can cross hands and sound simultaneous unisons. Except, however, for a handful of *pièces croisées*, the entire French harpsichord literature contains very few pieces in which this or any other two-manual registration is necessary. The great *claveciniste* Jean-Henry D'Anglebert, upon his death in 1691, owned four single-manual harpsichords but no double.²¹ The two-manual harpsichord might primarily have thrived because it was useful for accompaniment. Saint-Lambert, in his *Nouveau traité de l'accompagnement du clavecin* (Paris, 1707), stated that a singer performing with a very weak "half voice" should be accompanied on the *petit jeu*, i.e., the upper manual, while all the stops should be used for a singer with a strong chest voice. To accommodate performers who issued varied degrees of loud and soft within a movement, the harpsichordist presumably would change manuals.

Seventeenth-century French harpsichords vary greatly in details of construction. Nevertheless, from the Denis of 1648 to about 1690, French harpsichords were quite standardized in their two-manual dispositions and in the details of their keyboards and actions. The compass was GG/BB to c³, occasionally with one or both of the lowest sharps divided to provide C# and E^b in addition to the AA and BB of the short octave. Three-octave measures were very narrow, about 465 to 470 mm, such that an average hand could span the tenths occasionally required in the literature. Key levers and jacks were light and delicate, as presumably also was the voicing, in accordance with the refined grandeur of these instruments.

Towards the end of the seventeenth century Ruckers harpsichords were becoming so prized in France for their tone that they began to undergo *petit ravalement*, that is, updating with additional 8-foot choirs, and keyboards being modified or replaced. By the early eighteenth century, French makers had absorbed the major Flemish stylistic elements of construction, scaling, and soundboard layout, albeit expanded to suit extended compasses, typically GG to e³ in the early decades, FF to e³ into the 1750s, then FF to f³. Eighteenth-century key levers and jacks were somewhat heavier

and less delicate than those of the seventeenth century, and three-octave measures were slightly larger, about 475 mm. Buff stops were not usually included until the 1760s. In general, the tone of the eighteenth-century harpsichords could be characterized as more voluptuous than in those of the seventeenth-century. All along, Ruckers harpsichords underwent radical rebuilding – *grand ravalement* – with enlarged soundboards and cases to accommodate the wider compasses. Fake Ruckers instruments were also made. The very few known French single-manual harpsichords are disposed 2×8. More popular were bentside spinets, a fair number of which have survived from both the seventeenth and eighteenth centuries.

In Antwerp, the last known transposing doubles were made in 1646, after which only singles were produced until the eighteenth century. Although the Ruckers family began to make a few harpsichords with two 8 choirs as early as the mid-1630s, the last master of the Ruckers dynasty, Joseph Joannes Couchet, continued to make harpsichords with the traditional 8+4 until the end of his career, about 1680, albeit with compasses sometimes extended to nearly five octaves. A single by Joris Britsen III, Antwerp, 1681 (Museum Vleeshuis, Antwerp), had the compass GG/BB to c^3 with three choirs and registers, of which the second 8 was nasal. The most prominent eighteenth-century maker was Johann Daniel Dulcken, whose impressive surviving instruments date from 1745 to 1755. His doubles, all with compass FF to f^3 , were usually disposed with 8+4 on the lower manual, 8-foot dogleg, and nasal 8-foot on the upper. Although registrations with an independent solo 8 on each manual were not possible, there were other interesting options.

Harpsichord making in the German-speaking areas was scattered among regional centers, not concentrated in national capitals like Paris and London. Styles varied from region to region, and musicians, such as J. S. Bach, who traveled among them would have encountered many different kinds of harpsichords.²² Because many German harpsichords were made as a sideline by organ builders and virtually all professional harpsichordists were primarily organists, ideas from organ building had significant influence. In 1662 the prominent Westphalian organ builder Hans Henrich Bader made a large harpsichord with four registers, 2×8+4 and an *archispinnetto*, presumably an 8-foot nasal stop, at the time a fairly normal disposition for German single-manual instruments. The contemporary account added, however, that “these stops can be interchanged in a special way or be used and played simultaneously on two keyboards.”²³ This is the earliest evidence of a two-manual harpsichord in Germany. Bader, if he did not independently adopt the idea of multiple keyboards from the organ, must have been influenced at least indirectly by recent developments in France.

Ruckers harpsichords were well known in northern Germany, some, no doubt, brought there at the behest of J. P. Sweelinck's many German pupils. A group portrait by Johannes Voorhout, 1674 (Museum für Hamburgische Geschichte), includes Dietrich Buxtehude and Sweelinck's grand-pupil Johann Adam Reinken, with the latter seated at a Flemish double. Several Ruckers instruments that underwent *ravalement* in northern Germany are known, for example, a Joannes Ruckers double of 1618 (Kulturhistoriska Museet, Lund) rebuilt in Hamburg in 1724 by Johann Christoph Fleischer with aligned GG/BB to c^3 keyboards. Although the harpsichords made in Hamburg by members of the Fleischer and Hass families have S-shaped bentsides, they show the strong influence of Ruckers principles of scaling, design, and construction. Hamburg singles were usually $2 \times 8 + 4$, but as late as the 1720s, these builders did make some single-manual harpsichords with the same $8 + 4$ disposition favored by the Ruckerses. Each of the surviving doubles by Hieronymus Albrecht Hass (1689–1752), with compasses from FF (or GG in one) to c^3 , d^3 , or f^3 , has a different elaborate disposition: $2 \times 8 + 4$ on the lower manual and 8 on the upper, each 8 with its own strings; $16 + 8 + 4$ on the lower, $8 + 4$ on the upper; $16 + 8 + 4$ on the lower, the upper with 8 and nasal 8 sharing the same strings; and one by his son, Johann Adolph Hass, with $16 + 8 + 4 + 2$ on the lower, the upper with 8 and a 2 up to c^2 .²⁴ The elder Hass's magnum opus was a three-manual instrument of 1740 (private collection), compass FF, GG to f^3 , with $16 + 2$ on the lower manual, $8 + 4$ on the middle, and a dogleg 8 on the middle and upper, which also has a nasal 8. These instruments, which were also supplied with various couplers and buff stops, clearly show the influence of the organ aesthetic in the provision both of choruses consisting of stops at different octaves ($16 + 8 + 4 + 2$) and of colorful stops such as nasal registers. With one exception, the 16-foot strings of Hass harpsichords were provided with their own bridge, thus were longer and closer to their ideal lengths than if they shared the 8-foot bridge. Many North German harpsichords were exported to Scandinavia, where native makers worked in a similar style.

In Berlin, the leading maker, Michael Mietke (ca. 1656/1671–1719), reportedly sold some of his harpsichords as French imports. Presumably these had the standard French disposition, as does his one surviving double (Schloss Charlottenburg, Berlin), made about 1703–1713, originally with compass FF, GG, AA to c^3 . His two known singles are disposed 2×8 . The large two-manual Mietke harpsichord that Bach purchased for the Köthen court in 1719 might, like two other harpsichords Mietke is known to have made, have had a 16-foot stop.

From registrations indicated in C. P. E. Bach's Sonata in D minor (Wq69), composed in 1747 while he was court harpsichordist in Berlin,

one can reconstruct the instrument's four-register disposition: lower manual with 8+4, upper with 8 and nasal 8 (probably with its own strings), coupler, and buff for the upper 8. The registrations in the final movement, a set of nine variations, are particularly imaginative, including the buffed upper 8 coupled to the 4; solo 4 accompanied by the buffed upper 8; and 2×8 on the upper manual accompanying 8+4 on the lower.

The Thuringian organist Jacob Adlung wrote in his *Anleitung zu der musikalischen Gelahrtheit* (Erfurt, 1758) that harpsichords, while they sometimes had one or four sets of strings, usually had two, most often 2×8 but occasionally 8+16, or three, presumably most frequently 2×8+4. Four-choired instruments were either 2×8+2×4 or 16+2×8+4, presumably spread over two manuals. He went on to describe doubles with two stops on the lower manual, one on the upper, and a coupler, and the possibility of adding extra registers to both manuals. An anonymous early eighteenth-century Thuringian 2×8 single (Bachhaus, Eisenach), has the archaic feature of the nut on active soundboard. An early eighteenth-century double by a member of the Harrass family in Großbreitenbach (Schlossmuseum, Sondershausen) has the standard French disposition while another (Musikinstrumenten-Museum, Berlin), once thought to have belonged to J. S. Bach, was originally made with 16+4 on the lower manual, 8 on the upper, with shove coupler, and later rebuilt with 16+8 on the lower manual, 8+4 on the upper.²⁵ As discussed in the chapter on Bach, its acceptance in the twentieth century as the "Bach" disposition has fallen out of favor. Nevertheless, a similarly disposed instrument advertised in a Leipzig newspaper in 1775 had been made by Zacharias Hildebrandt (1688–1757), who was closely associated with Bach during his Leipzig years.

Two-manual harpsichords made in Saxony by members of the Gräbner family in Dresden from the 1720s to 1780s and Gottfried Silbermann (1683–1753) in Freiberg, as well as by the latter's relatives in Strasbourg, mostly with compass FF to f³, have the standard two-manual French disposition, although sometimes with a dogleg rather than shove coupler.²⁶ Among the Strasbourg Silbermanns, Gottfried's nephew Johann Heinrich (1727–1799), who made particularly beautiful spinets, also reportedly made a harpsichord with a 16-foot stop. Unlike North German harpsichords, those by Saxon and Thuringian makers show little if any Flemish influence.

As for southern Germany, Switzerland, and Austria, it seems that the typical harpsichord in these regions had a single manual with a 2×8 disposition, although there is a double with the standard French disposition by Peter Hellen, Bern, 1759 (Württembergisches Landesmuseum, Stuttgart).²⁷ From the late seventeenth century to about 1780, a distinctive style of harpsichord was made in Vienna.²⁸ Although certain features

varied – some instruments had separate angled tails, others S-shaped bentsides – others were constant: the single-manual 2×8 disposition, scaling for brass strings throughout the compass, Italian-style box guides, and downward-sloping upper edges of spine and cheekpiece around the keyboard as in later Viennese pianos. Except in the two latest known examples, both made in 1778, with compass FF to f^3 , they had a “Viennese bass octave” beginning on FF; then a natural key divided into three front to back for GG, AA, and BB \flat ; a natural divided into two for C and BB \sharp ; F; a divided sharp for D and F \sharp ; G; a divided sharp for E and G \sharp ; then in normal chromatic order. Any hand could play such widely spaced left-hand chords as the GG-G-b at the end of Joseph Haydn’s Capriccio “Acht Sauschneider müssen sein” (HobXVII:1). The compasses end variously with c^3 , d^3 , e^3 , f^3 , and g^3 . Two spinets (technically, polygonal virginals with bentsides at the right) made by tuners to the imperial court theater in Vienna are known, dated 1799 and 1804.

More elaborate harpsichords were known in Vienna. Shortly after settling there in 1781, Mozart wrote to his father that “We have two *Flügel* in my residence, one for playing *Galanterie* and the other a machine with a lower octave throughout [i.e., 16-foot stop], like the one we had in London[!], therefore like an organ. On this, then, I’ve improvised and played fugues.”²⁹ Although the term *Flügel*, referring to the form of the instruments, admits the possibility that the first of these had a hammer action, the second was doubtless a two-manual harpsichord. Imported English two-manual harpsichords were also known in Vienna.

In England, virginals fell out of fashion towards the end of the seventeenth century, their place taken by bent-side spinets (Figure 1.8), at first modeled after French instruments. With burgeoning prosperity, the market for spinets, harpsichords, and eventually pianos was ever increasing. About 1690 a new style of single-manual harpsichord came into fashion.³⁰ Instead



Figure 1.8 Spinet by Charles Haward, London, 1689 (National Music Museum, Vermillion, SD, cat. no. NMM 10773; photograph by Bill Willroth, Sr., courtesy National Music Museum).

of the colorful three-register dispositions of earlier English harpsichords, these, scaled for brass throughout the compass, have just two 8 stops. Some have S-shaped bentsides, others angled tails, a variability also found in spinets of the period. The earliest surviving example, by Thomas Barton, London, 1709 (Edinburgh University Collection) has a GG/BB to d^3 compass with the two lowest sharps divided, while the latest examples, made about 1725, have the GG to g^3 compass which by then and into the second half of the century was the usual compass of spinets. A portrait of George Frideric Handel painted by Philippe Mercier in the late 1720s (Handel House Museum, London) shows him seated by a harpsichord of this type. The earliest-known English two-manual harpsichord, by Joseph Tisseran, London, 1700 (Bate Collection, Oxford), with compass GG/BB to d^3 , has 8 +4 on the lower manual and an 8-foot dogleg shared with the upper. A letter sent to the purchaser of this harpsichord in 1712 advised: the “three Setts of Strings . . . all together are only a thoroughbass to a Consort: for Lessons [i.e., solo pieces] any two sets of the three are more proper.”³¹ A harpsichord with this disposition but compass GG, AA to d^3 , e^3 was made by Francis Coston, London about 1725 (Edinburgh University Collection).

The standard model of English double as made in large numbers from the 1720s to the end of the century has a substantial case with walls of oak handsomely veneered (see Figure 1.9). Unlike earlier English instruments, they show Ruckers influence in the overall manner of construction, sound-board structure, and scaling principles. The keyboards, with a three-octave measure of 485 mm, have the compass FF to f^3 , without FF# until the 1770s. The disposition is 8+4 on the lower manual and an 8-foot dogleg shared with the upper, which has, in addition, a nasal 8 plucking the same strings; there is a buff stop for one of the 8 choirs. The two rival firms founded by Burkat Shudi (1702–1773) and Jacob Kirckman (1710–1792) dominated English harpsichord making until its demise. Shudi occasionally made doubles with keyboards extending down to CC. His and Kirckman’s single-manual harpsichords, all FF to f^3 in compass, are usually disposed 2×8+4, sometimes just 2×8, rarely also with a nasal 8. The tone of these instruments, single or double, is more brilliant than that of the French instruments, direct and imposing rather than sensuous and subtle. One might similarly compare the harpsichord suites of Handel with those of François Couperin.

In some regions of Spain, very old-fashioned harpsichords continued to be made, for example, a single by Zeferino Fernández, Valladolid, 1750 (Fundación Joaquín Díaz, Uruña), compass GG/BB to c^3 (8+4).³² Elsewhere, however, more progressive instruments are known, although none with two manuals. Examples include a harpsichord attributed to Francisco Pérez Mirabal, Seville, 1734 (private collection, England), GG/

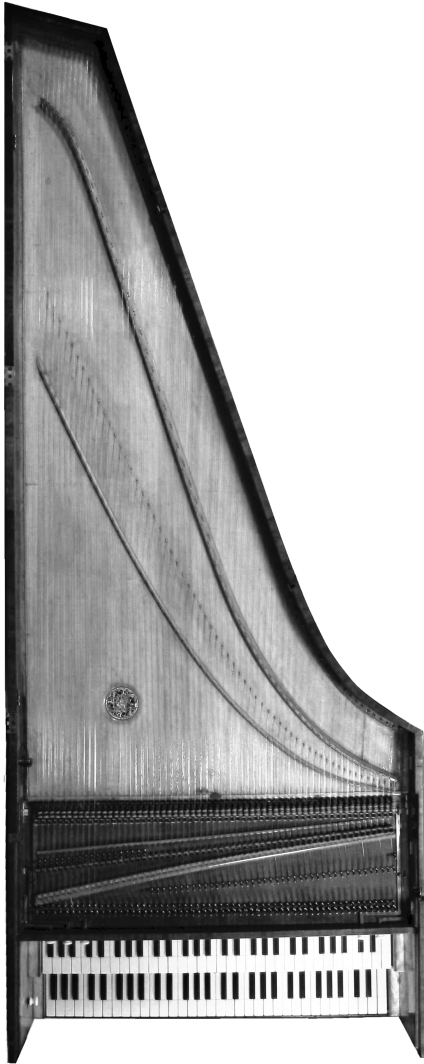


Figure 1.9 Harpsichord by Joseph Kirckman, London, 1798 (National Music Museum, Vermillion, SD, cat. no. NMM 3328; photograph by the author).

BB to c^3 , 2×8 scaled for iron in the treble, with an S-shaped bentside; another, possibly made in Salamanca province (private collection, USA), with the same characteristics but scaled for brass throughout; an anonymous instrument (Museo Arqueológico Nacional, Madrid), compass C to c^3 , $2 \times 8 + 4$, buff to one 8, also with an S-shaped bentside. A harpsichord by Salvator Bofill, Barcelona, 1743 (Museo de Arte Sacro, Bilbao), C/E to c^3 , 2×8 , closely resembles Italian instruments.

The growing influx of Italian musicians to Spain and Portugal, epitomized by Domenico Scarlatti's arrival in Lisbon in 1719, had a profound effect on



Figure 1.10 Harpsichord by José Calisto, Portugal, 1780 (National Music Museum, Vermillion, SD, cat. no. NMM 6204; photograph by Bill Willroth, Sr., courtesy National Music Museum).

Iberian harpsichord making.³³ Florentine instruments by Bartolomeo Cristofori and his followers came to the Portuguese court, then to Spain upon Scarlatti's transferal there along with his pupil, Princess Maria Barbara. She owned nine harpsichords at the time of her death in 1758, of which only one, a Flemish instrument with three sets of strings, doubtless $2 \times 8 + 4$, might have had two manuals. Most of the others were made by the Madrid-based Diego Fernández (1703–1775), who worked for the Spanish royal family from 1722 until his death. As Ralph Kirkpatrick noted, "The only instruments in the Queen's possession on which the full five-octave sonatas of Scarlatti could have

been played were the three Spanish harpsichords with sixty-one notes and two registers!”³⁴ The one surviving harpsichord attributable to Fernández (Smithsonian Institution, Washington) closely resembles Florentine models in scaling and layout, but the materials and details of construction demonstrate its Spanish origin.³⁵ With GG to g³ compass, the instrument is disposed 2×8, with no provision to turn either register off, entirely consistent with Kirkpatrick’s observation that “Scarlatti sonatas do not seem to call for a harpsichord with a wide variety of registers; his writing itself is too colorful.”³⁶

Similar Florence-inspired harpsichords were made in Portugal, for example, one by José Calisto, 1780 (Figure 1.10). In this instrument, the back 8-foot register can be turned off, leaving on the permanently engaged front 8, for which there is a buff stop.

The Classical Era

The harpsichord was as familiar as the piano to musicians of Haydn and Mozart’s generation, and many fine harpsichords insignificantly different from earlier instruments were made throughout Europe during the 1780s and 1790s. Inevitably, however, there were efforts to render the harpsichord more capable of that manner of expressivity which relies on actual, rather than feigned, shadings of loud and soft. Further, there was a gradual change of taste towards roundness of tone. Charles Burney (1726–1814), writing near the end of his life, noted that the tone of grand pianos had so improved towards the end of the eighteenth century that “the harsh scratching of the quills of a harpsichord can now no longer be borne.”³⁷

Leaving aside efforts that fundamentally altered the nature of the instrument – most notably Cristofori’s invention of the piano by substituting hammers for jacks – we may also dismiss the many one-time creations of no lasting import, such as a harpsichord with four choirs, five registers, and ten pedals made by Diego Fernández in response to a whim of Queen Maria Barbara. A consequential innovation, developed by the prominent French maker Pascal Taskin in 1768, was a register with plectra of *peau de buffle*, a thick soft leather. According to a contemporary account:

From the effect of this leather on the string of the instrument there resulted delicious and velvety sounds. One increased the sound at will by pressing more or less hard on the keyboard. By this means one obtained rich, pithy, and suave tones, voluptuous to the most epicurean ear . . . The *buffle* obeys the pressure of the finger; it does not pluck any more but caresses the string.³⁸

Taskin and other Parisian makers usually installed the *peau de buffle* as an addition to the three quilled stops of standard doubles and included a

mechanism to control the registers by knee to vary the timbre and volume as one played.

Most late eighteenth-century English harpsichords had a pedal, the “machine stop,” which, pushed down, effected a decrescendo on the lower manual and exchanged the dogleg for the nasal 8 on the upper. In 1769 Burkat Shudi introduced the Venetian swell, a set of louvers over the strings that could be opened by a pedal to create a crescendo effect. After the mid-1770s Shudi’s successor John Broadwood often made plectra of soft leather faced with a thin layer of glove leather for the lower-manual 8-foot register (or the back 8 in singles).³⁹ Similar plectra are described in a pamphlet published in Rome in 1775. The anonymous author, calling his invention the *cembalo angelico*, recommended that each jack be provided with two tongues facing in opposite directions, one with leather plectra, the other with quill. A register moved in one direction or the other by a pedal would sound alternatively with hard or soft plectra. Two harpsichords by Vincenzo Sodi, Florence, 1782 and 1798, have such double-tongued jacks; late Italian makers sometimes used hard sole leather instead of quill.

Revival

Except for a few virginals outwardly resembling square pianos made in northern Italy as late as 1839, production of plucked keyboards ceased by 1810. Increased interest in early music towards the end of the nineteenth century led to a revival of the harpsichord, but because the traditions of harpsichord making had been lost during the intervening decades, it fell to piano makers to produce new ones. In doing so, they applied their own techniques of design and construction, such that most harpsichords made from the late nineteenth century to the 1950s were saddled with ponderous keyboards, massive cases, and thick, heavily ribbed soundboards like those of modern pianos. As if to compensate for the deficient tone issued by the unresonant soundboards, hard steel strings, and leather plectra of these “plucked pianos,” the larger models were provided with 16-foot stops and pedals to change registrations while playing. Although such devices were known during the eighteenth century, the early revivalists applied them out of all proportion to historical precedent, and performers generally employed them without regard to chronology or style. Instruments such as the Pleyel harpsichords promoted by Wanda Landowska, however, retain a certain interest as the media for which composers including Francis Poulenc, Manuel de Falla, and Frank Martin conceived significant works. Enhanced by amplification and manipulative recording techniques, harpsichords of the

early modern type have found much use in pop and rock music and for special effects in film and television scores.

After the Second World War, harpsichord makers began to produce instruments designed and constructed like those of the historical masters, and by the 1960s these were favored by leading performers of the era. For the past half-century, most new harpsichords have been copied, at least nominally, after historical models.

Notes

1. General surveys include Raymond Russell, *The Harpsichord and Clavichord: An Introductory Study*; Frank Hubbard, *Three Centuries of Harpsichord Making*; Donald H. Boalch, *Makers of the Harpsichord and Clavichord, 1440–1840*; and John Koster, “Reflections on Historical Harpsichord Registration” (see further reading).
2. Further details about these structural elements can be found in Hubbard, *Three Centuries of Harpsichord Making*; and “Harpsichord” in *The New Grove Dictionary of Music and Musicians*, second edition, Stanley Sadie and John Tyrrell, eds. (London: Macmillan Publishers, 2001).
3. Matters in this section are discussed further in Koster, “Toward a History of the Earliest Harpsichords,” in *Das österreichische Cembalo: 600 Jahre Cembalobau in Österreich*, Alfons Huber, ed. (Tutzing: Hans Schneider, 2001), pp. 17–33, and “The Harpsichord Actions of Henry Arnault de Zwolle in Their Developmental Context,” in *Unisonus: Musikinstrumente erforschen, bewahren, sammeln*, Beatrix Darmstädter and Ina Hoheisel, eds. (Vienna: Praesens, 2014), pp. 167–196.
4. See Edmund A. Bowles, “A Checklist of Fifteenth-Century Representations of Stringed Keyboard Instruments,” in *Keyboard Instruments: Studies in Keyboard Organology, 1500–1800*, Edwin M. Ripin, ed. (Edinburgh: Edinburgh University Press, 1971), pp. 11–17.
5. Henry also described a striking action, but this was seldom if ever made.
6. The matters in this section are discussed further in John Koster, “Pitch and Transposition Before the Ruckers,” in *Kielinstrumente aus der Werkstatt Ruckers* (Bericht über die Internationale Konferenz, September 1996; Schriften des Händel-Hauses in Halle, 14), Christiane Rieche, ed. (Halle an der Saale: Händel-Haus, 1998), pp. 73–94; “Transposition and Tuning from Schlick to Sweelinck,” *The Organ Yearbook* 41 (2012), 59–90; and “Questions of Keyboard Temperament in the Sixteenth Century,” in *Interpreting Historical Keyboard Music: Sources, Contexts and Performance*, Andrew Woolley and John Kitchen, eds. (London: Ashgate, 2013), pp. 115–130.
7. Denzil Wraight, *The Stringing of Italian Keyboard Instruments c.1500 – c.1650* (PhD diss., The Queen’s University of Belfast, 1996/1997), provides a thorough survey of Italian harpsichord making.
8. See Koster, “The Early Neapolitan School of Harpsichord Making,” in *Domenico Scarlatti en España / Domenico Scarlatti in Spain*, Luisa Morales, ed. (Garrucha, Almería, Spain: Asociación Cultural LEAL, 2009), pp. 47–80.

9. Early German harpsichords are surveyed in John Henry van der Meer, "Beiträge zur Cembalobau im deutschen Sprachgebiet bis 1700," *Anzeiger des Germanischen Nationalmuseums* (Nuremberg) 1966, pp. 103–133.
10. See Grant O'Brien, *Ruckers: a Harpsichord and Virginal Building Tradition* (Cambridge: Cambridge University Press, 1990); Jeannine Lambrechts-Douillez and Koster, "Master Joos Karest and the Rise of Clavecimbel Making in Antwerp," *Musique-Images-Instruments* 6 (2004), pp. 116–131; and Koster, "The Musical Uses of Ruckers Harpsichords in Their Own Time," in *The Golden Age of Flemish Harpsichord Making: A Study of the MIM's Ruckers Instruments*, Pascale Vandervellen, ed. (Brussels: Musical Instruments Museum, 2017), pp. 50–69 and 399–404.
11. Hubbard, *Three Centuries*, p. 133.
12. Recent publications about the early English school are Malcolm Rose, "Further on the Lodewijk Theewes Harpsichord," *Galpin Society Journal* 55 (2002), pp. 279–309, Darryl Martin, *The English Virginal* (PhD diss., University of Edinburgh, 2003), and Rose, "The History and Significance of the Lodewijk Theewes Claviorgan," *Early Music* 32, no. 4 (November 2004), pp. 577–593.
13. See Bruce Haynes, *A History of Performing Pitch: The Story of "A"* (Lanham, Maryland: Scarecrow Press, 2002), pp. 88ff.
14. See Darryl Martin, "The Native Tradition in Transition: English Harpsichords circa 1680–1725," in *The Historical Harpsichord, volume five: Aspects of Harpsichord Making in the British Isles*, John Koster, ed. (Hillsdale, NY: Pendragon Press, 2010), pp. 1–115, specifically 36ff.
15. Matters in this and the following paragraphs are discussed further in Koster, "The Harpsichord in Seventeenth-Century France," in *Cembalo, Clavecin, Harpsichord: Regionale Traditionen des Cembalobaus*, Christian Ahrens and Gregor Klinke, eds. (Munich and Salzburg: Musikverlag Katzbichler, 2011), pp. 10–42.
16. Matters in this paragraph are discussed further in Koster, "Traditional Iberian Harpsichord Making in Its European Context," *Galpin Society Journal* 61 (2008), pp. 3–78.
17. O'Brien, *Ruckers*, p. 306.
18. See Kerstin Schwarz, *Bartolomeo Cristofori: Hammerflügel und Cembali im Vergleich (Scripta Artium 2)*, Universität Leipzig, 2001; Halle an der Saale: Verlag Janos Stekovics, 2002).
19. Matters in this and the following paragraphs are discussed further in Koster, "The Harpsichord in Seventeenth-Century France." Two provincial instruments have only a doglegged 4 on the upper manual.
20. Translation adapted from Hubbard, *Three Centuries*, p. 123; original text on p. 17 of the 1643 edition and p. 13 of the 1650 edition.
21. See Hubbard, *Three Centuries*, p. 315.
22. See Koster, "The Harpsichord Culture in Bach's Environs," in *Bach Perspectives 4, The Music of J.S. Bach: Analysis and Interpretation*, David Schulenberg, ed. (Lincoln, NE: University of Nebraska Press, 1999), pp. 57–77.
23. Hugo Wohnfurter, *Die Orgelbauerfamilie Bader 1600–1742* (Kassel: Bärenreiter, 1981), p. 193.

24. Hass harpsichords are described in Lancelot Whitehead, *The Clavichords of Hieronymous and Johann Hass* (PhD diss., University of Edinburgh, 1994), pp. 321–333.
25. Dieter Krickeberg and Horst Rase, “Beiträge zur Kenntnis des mittel- und norddeutschen Cembalobaus um 1700,” in *Studia Organologica: Festschrift für John Henry van der Meer zu seinem fünfundsechzigsten Geburtstag*, Freidemann Hellwig, ed. (Tutzing: Hans Schneider, 1987), pp. 294–302.
26. See John Phillips, “The 1739 Johann Heinrich Gräbner Harpsichord – an Oddity or a *Bach-Flügel?*,” in *Das deutsche Cembalo*, Christian Ahrens and Gregor Klinke, eds. (Munich and Salzburg: Musikverlag Katzbichler, 2000), pp. 123–139, and Philippe Fritsch, *Les ateliers alsatien et saxon de la dynastie Silbermann: étude des “Claviers” et du répertoire musical, leur influence réciproque* (PhD diss., Université François-Rabelais, Tours, 1995).
27. See Michael Latcham, “The Musical Instruments *en forme de clavecin* by, and Attributed to, the Workshop of Johann Ludwig Hellen,” *Musique-Images-Instruments* 6 (2004), pp. 68–94.
28. See Huber, *Das österreichische Cembalo* and Richard Maunder, *Keyboard Instruments in Eighteenth-Century Vienna* (Oxford: Clarendon Press, 1998).
29. *Mozarts Briefe*, Ludwig Kohl, ed. (Salzburg, 1865), p. 302.
30. See Martin, “The Native Tradition.”
31. Hubbard, *Three Centuries*, p. 153.
32. Matters in this paragraph are discussed further in Koster, “Traditional Iberian Harpsichord Making.”
33. See Koster, “Towards an Optimal Instrument: Domenico Scarlatti and the New Wave of Iberian Harpsichord Making,” *Early Music* 35, no. 4 (November 2007), pp. 575–604.
34. Ralph Kirkpatrick, *Domenico Scarlatti* (Princeton: Princeton University Press, 1953), p. 179.
35. See Koster, “A Spanish Harpsichord from Domenico Scarlatti’s Environs,” *Early Music* 39, no. 2 (May 2011), pp. 245–251, and “A Harpsichord by Diego Fernández?,” *Galpin Society Journal* 64 (2011), pp. 5–48.
36. *Scarlatti*, p. 177.
37. Abraham Rees, ed., *The Cyclopædia*, Vol. 17 (London, 1819), s.v. “Harpsichord.”
38. Hubbard, *Three Centuries*, p. 252.
39. John Barnes, “Boxwood Tongues and Original Leather Plectra in Eighteenth-Century English Harpsichords,” *Galpin Society Journal* 54 (April 2001), pp. 10–15.

Further Reading

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