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The *cimbalo cromatico* and other Italian string keyboard instruments with divided accidentals

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It is the aim of this article to present an overview of the Italian string keyboard instruments built with additional divided accidentals for the purpose of increasing the range of consonant intervals available to the player. Speaking with the terminology of archaeology, the intention is to expose the foundations more clearly in order that a better appreciation of the subject matter may be achieved. The reasons why split sharps were provided is not discussed here in detail, this being the subject of other papers by Rudolf Rasch and Patrizio Barbieri in this volume.

The earliest use of divided accidentals in Italian keyboard instruments is recorded in Italian church organs, the oldest known being that in Cesena cathedral where in 1468 Andrea Molighi added three semitones «with perfect thirds».[1] Thus, the use of split sharps to provide better tuned thirds than would otherwise have been provided by the tunings used in this period is a practice which can be traced throughout the 16th and 17th centuries in Italian organ building. Usually it was for d♯/e♭ and g♯/a♭ that divided keys were provided and this practice also has its counterpart in string keyboard instrument making, evidence for which is presented below.

There is another line of development which is found more in string keyboard instruments than in organs: that of multiple split notes in order to provide for tunings requiring 19 notes or more in the octave. Following a definition introduced by Rasch, any instrument where the diatonic semitone in a tetrachord is divided can be referred to as an instrument incorporating the enharmonic genus.[2] Thus, keyboards incorporating an E♯ and B♯ could be referred to as «enharmonic» instruments although there is also a usage from around 1600 which calls these a «cimbalo cromatico». However, actual usage was somewhat inconsistent so that stipulative definitions will clash

1 Carlo Grigioni, «Maestri organari nella Romagna» in: *Melozzo da Forlì – Rassegna d'arte romagnola*, Forlì 1937, p. 159, quoted by Stembridge in Denzil Wraight & Christopher Stembridge, «Italian Split-Keyed Instruments with Fewer than Nineteen Divisions to the Octave», in: *Performance Practice Review* 7/2 (1994), pp. 150–181, p. 162, note 27.

2 See Rudolf Rasch, «Why were enharmonic keyboards built? From Nicola Vicentino (1555) to Michael Bulyowsky (1699)» in this volume for further discussion of this matter.

with the historical use of the term during the period when these instruments were conceived.[3]

Firstly, a list of Italian string keyboard instruments is presented, most of which could be called *enharmonic* (as defined above), of which only three instruments survive; the remainder are significant for the history of music and therefore require to be noted. This list is restricted to instruments which were *built* rather than being merely theoretical expositions. The *arciorgani* produced under Vicentino's direction have been included since they complement the description of Vicentino's œuvre and the *archicembalo*.[4] Comments on the list have mostly been restricted to describing briefly the instruments and referring the reader to the available literature. In the case of Zarlino and Vicentino the instruments have not been adequately described until now and the length of treatment is therefore longer.

Secondly, a list of surviving Italian string keyboard instruments is presented which documents the additional chromatic keys used in harpsichords and virginals. My contribution to this field has been to examine the surviving instruments, establish the original compasses, and discover by which maker they were produced. Many Italian instruments underwent modifications from around 1700 onwards which obscured the fact that split sharps were originally provided. It has been possible to identify some unsigned work, thereby increasing our understanding of the time and the place where these instruments were made.[5] Thus, a clearer focus has resulted which shows the significance of Florence and Rome as centres of this type of musical instrument making activity.

3 Documentary accounts refer to the instrument played by Luzzasco Luzzaschi in Ferrara as both a «certo strumento Inarmonico», reported in Elio Durante & Anna Martelotti, *Cronistoria del Concerto delle Dame Principalissime di Margherita Gonzaga D'Este*, Florence 1989 (= Archivum musicum, Collana di studi A), p. 193 (doc. A178), and as «Un'instrumento cromatico con due tastadure una sopra l'altra» (Este inventory of 21.10.1598, see Durante & Martelotti, *Cronistoria*, p. 205 [doc. A209]).

4 The enharmonic organs which Emilio de' Cavalieri was associated with in Florence are a significant part of the history of enharmonic instruments, but will not be discussed here. See Warren Kirkendale, *Emilio de' Cavalieri «Gentilhomo romano». His life and letters, his role as Superintendent of all the arts at the Medici Court, and his musical compositions. With addenda to ‹L'Aria di Fiorenza' and ‹The Court Musicians in Florence›*, Florenz 2001 (= Historiae Musicae Cultores 86), ch. 5, which also includes a survey of enharmonic instruments and music. I am obliged to Martin Kirnbauer for drawing my attention to this reference.

5 Denzil Wraight, *The stringing of Italian keyboard instruments c.1500-c.1650*, Ph.D. dissertation, Queen's University of Belfast 1997 (Ann Arbor: UMI, 1997, order no. 9735109). My earlier list of instruments with split sharps appeared in Wraight & Stembridge, «Italian Split-Keyed Instruments», pp. 150–160.

List of instruments, with more than 14 notes per octave

SALINAS	*Archicymbalum* c1538–1547 31/octave *instrumentum perfectum* 1538–1553 24/octave? [instrument heard in Florence 1538–1559]
ZARLINO	1548 (Dominico da Pesaro, Venice) 24/octave before 1558, 16/octave, just intonation
VICENTINO	*archicembalo* probably c1546–1549 31/octave *arciorgano* built in Rome c1549–1552 31/octave possibly another *archicembalo* by 1561 2nd *arciorgano* (Vincenzo Colombo, Venice) by 1561 3rd *arciorgano* built in Milan c1575
TRASUNTINO	1591 C-c^3 19/octave 1601 28/octave 1606 C-c^3 *Clavemusicum Omnitonum* 31/octave
STELLA	1592–1618 *tricembalo* 31/octave
COLONNA	*sambuca lincea* Naples 1618: clavichord 31/octave
FABBRI	1631 C/E-c^3 (B♯-f^2 19/octave)
ZAMPIERI	1634–35 (Orazio Albani, Rome) 31/octave?
DELLA VALLE	c1638–39 Della Valle (built by Giovanni Pollizini, Rome)
POLLIZINI	1649 *tricembalo*
NIGETTI	3 instruments: 1. c1640 with 2 keyboards 2. c1644, 5 rows of keys, only «white notes» 3. 1670 with 5 keyboards, 31/octave
SABBATINI	c1650 38/octave, just intonation

Comments on the list

SALINAS: Francisco Salinas, the blind Spanish priest and organist tells us in his *De Musica* published in 1577 that «fewer than forty years ago» there was an instrument called an «archicymbalum» by its inventor, which had 31 intervals in the octave.[6] The dating is vague, but since Salinas came to Rome in 1538 and would presumably have said «fewer than 30 years ago» if the date had been after 1547, we may tentatively infer a timeframe some 30–40 years previously, i.e., comprising the years 1538–1547.[7] It is not stated who made the instrument, but the turn of phrase used would be curiously oblique if it had been referring to Salinas' own instrument. It appears more likely to be a reference to Vicentino's *archicembalo*, especially because the division of the octave into 31 intervals matches that described by Vicentino. If this is the case it is a further clue to the date of Vicentino's instrument, which is discussed below.

Salinas' own instrument, presumably a harpsichord, is mentioned briefly as having been constructed in Rome but being in Salamanca at the time of writing his treatise.[8] Since Salinas went to Rome in 1538 and obtained an appointment to the Duke of Alba in Naples from 1553–1558 before a further position was granted to him at Siguenza in Spain in January 1559, it appears probable that his harpsichord would have been made in Rome during 1538–1553.[9] «Many keyboard instruments are arranged according to this [enharmonic] genus (such as that which I remember having heard at Florence). But the most perfect of all is that instrument which I ordered made in Rome, which I now have with me in Salamanca. On this, both the perfect

6 «*De prava constitutione cuiusdam instrumenti, quod in Italia citra quadraginta annos fabricari coeptum est, in quo reperitur omnis tonus in quinque partes divisius CAP. XXVII* Non silentio praetermittendum arbitror instrumentum quoddam, quod in Italia, citra quadraginta annos fabricari coeptum est, ab eius autore, quisquis ille fuit, Archycymbalum appellatum.» Francisco Salinas, *De Musica*, Salamanca 1577, p. 164. This is quoted with an Italian translation in Patrizio Barbieri, «I Temperamenti Ciclici da Vicentino (1555) A Buliowski (1699): Teoria e Pratica ‹Archicembalistica›», in: *L'Organo* 21 (1983), pp. 129–208, pp. 138–139.

7 Barbieri, «I Temperamenti», p. 158, suggests the dates 1538–1540.

8 Salinas, *De Musica*, book III, ch. VIII, p. 127.

9 Biographical details are taken from Robert Stevenson, «Salinas» in: *The New Grove Dictionary*, London, 1980, pp. 420–421. Patrizio Barbieri also kindly communicated the biographical details supplied by Perez (cited in «Salinas»).

instrument as well as the imperfect one which we use can be found, and a comparison of one to the other can be made.»[10]

Since these remarks about the instrument appear at the end of the chapter introducing the enharmonic genus, Palisca suggested that Salinas' keyboard had a 24-note division.[11] As Barbour states, the enharmonic genus described is just intonation with a chromatic range from G♭ to B♯.[12] Five of the keys, D, F♯, G♭, A♯, and B♭ are provided in two pitches, separated by a syntonic comma (ratio 80:81 or 21.5 cents). Salinas' obvious preference for just intonation and the didactic function of comparison with the «imperfect» instruments that he mentions, strongly suggests that his enharmonic octave division represents one keyboard of Salinas' harpsichord. By the «imperfect instrument» for the other keyboard Salinas apparently refers to a tempered tuning and with at least one divided sharp. The enharmonic keyboard would have appeared as in fig. 1 (with the exact pitch designation of the doubled notes omitted as a simplification). Both keyboards are discussed in more detail by Patrizio Barbieri.[13]

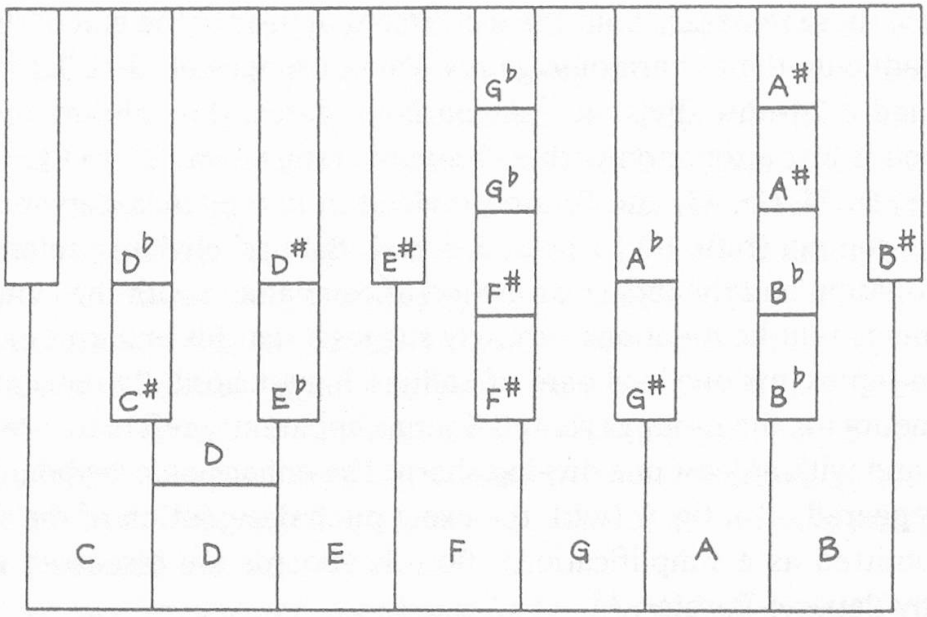
10 Translation by Arthur Daniels, «Microtonality and Mean-Tone Temperament in the Harmonic System of Francesco Salinas, Part 2», in: *Journal of Music Theory* 10 (1965), pp. 234–243, p. 243.

11 See Claude V. Palisca, «Salinas», in: *MGG* 11 (1963), cols. 1302–1306, col. 1305. Karol Berger, *Theories of Chromatic and Enharmonic Music in Late 16th Century Italy*, Ann Arbor, MI. 1980 (= Studies in Musicology 10), p. 54, has suggested that Salinas' instrument had the 15-note range described on p. 117 of *De Musica*, which discussed the chromatic genus although he also cites Salinas' description of the instrument from the section on the enharmonic genus that discusses the 24-note octave division. No reason was given to prefer the 15-note interpretation. Stevenson, «Salinas», p. 421 suggests that Salinas' harpsichord had 19 notes, without citing any evidence for this.

12 J. Murray Barbour, *Tuning and Temperament*, East Lansing, MI. 1953, p. 108.

13 See Patrizio Barbieri, «The evolution of open-chain enharmonic keyboards *c*1480–1650» (in this volume). I am indebted to Patrizio Barbieri for his analysis of Salinas' text. See also Rasch, «Why were enharmonic keyboards built?» (in this volume). Christopher Stembridge and Willard Martin have constructed an interpretation of Salinas' instrument with 21 notes per octave, omitting E♯, B♯ the second G♭s and A♯s and providing two Gs and Bs (personal communication).

Fig. 1: Salinas, 24-note enharmonic keyboard



The Florentine instrument mentioned by Salinas has been entered on the list as a record of independent activity in this field, although little more can be said about it. Whether by the implication of «enharmonic» Salinas meant an instrument with at least 19 notes per octave is a moot point.[14]

ZARLINO: Gioseffo Zarlino describes in chapter XLVII of his *L'Istitutioni Harmoniche* how the theoretical monochord, having been provided with intervals for the diatonic and chromatic genera, can be equipped with enharmonic intervals.[15] He then writes that in instruments equipped to play all three genera the strings are so ordered that each string has a corresponding major third and minor third. After criticising those instruments which have addi-

14 According to Berger, *Theories of Chromatic*, pp. 45–46, Salinas saw the less common accidental steps such as D♯ and G♭ as enharmonic.

15 Gioseffo Zarlino, *L'Istitutioni Harmoniche*, Venice 1558, ch. XVLII, pp. 139–142. There were also editions (or printings) with the following dates: 1561, 1562, and 1573, which I have not consulted, but Rasch has reported on these in «Why were enharmonic keyboards built?» (in this volume). The last revised edition appeared as vol. 1 of *De Tutte L'Opere del R. M. Gioseffo Zarlino da Chioggia*, Venice 1589. This edition is set in larger type with the result that page numbers do not correspond with the first edition. In the relevant section of text in ch. XLVII (pp. 170–172) there are a number of minor differences of wording, some of which are discussed below. I am obliged to Christopher Stembridge for a copy of the 1558 edition text at short notice and several discussions of Zarlino's instrument.

tional notes without any practical use (probably a passing reference to Vicentino's *archicembalo*) he then continues to relate that in 1548 he had an instrument constructed which would serve for demonstrating harmonies in the realm of music, just as a «touchstone» tests silver and gold.[16] This instrument, built by Domenico da Pesaro, was provided with major and minor semitones which were divided into two parts in such a way that the whole tone was divided into four parts.

Willi Apel in 1967 and Lynn Wood Martin in 1984 appear to have been the first to have correctly reported the compass as having 24 notes per octave, albeit only in passing.[17] Christopher Stembridge discussed the instrument in detail and with the assistance of Pesenti's description of the instrument established that the instrument had a 24-note compass.[18] In the literature it has mostly been recorded that the harpsichord had a compass with 19 notes in the octave.[19] Stembridge clarified the problem noting that this confusion has arisen partly because an illustration appears showing a 19-note division of the octave (fig 2).[20] Zarlino appears to refer in the 1558 edition to this *illustration* as the model of harpsichord which could be constructed by others

16 The simile with the touchstone is in the 1589 edition, but not in the 1558 edition.

17 Willi Apel, *Geschichte der Orgel- und Klaviermusik bis 1700*, Kassel etc. 1967, p. 476 (this reference was kindly provided by Riccardo Pergolis); Lynn Wood Martin, «The Colonna-Stella Sambuca lincea, an enharmonic keyboard instrument», in: *Journal of the American Musical Instrument Society* 10 (1984), pp. 5–21, p. 6, note 4, apparently drawing on Pesenti's description of the compass.

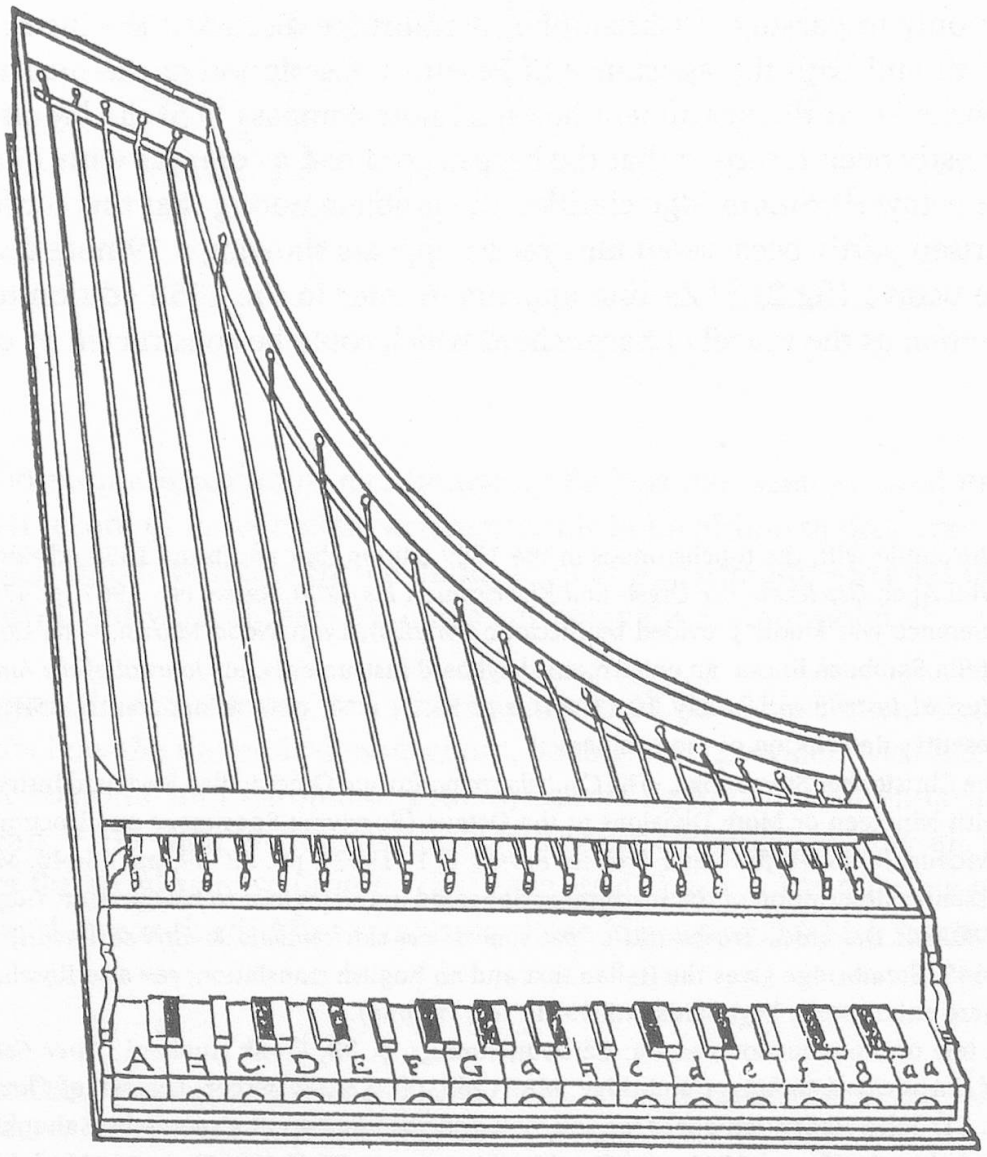
18 See Christopher Stembridge, «The *Cimbalo cromatico* and Other Italian Keyboard Instruments with Nineteen or More Divisions to the Octave (Surviving Specimens and Documentary Evidence)», in: *Performance Practice Review* 6/1 (1993), pp. 33–59, pp. 45–46. Martino Pesenti's description of the instrument appeared in the preface to his *Corrente, Gagliarde, e Balletti Diatonici, Trasportati ... per sonarsi nel clavicembalo & altri strumenti*, Venice 1645. Stembridge gives the Italian text and an English translation; see also Rasch, «Why were enharmonic keyboards built?» (in this volume).

19 A few of the main sources are: Barbour, *Tunings*, p. 33; Frank Hubbard, *Three Centuries of Harpsichord Making*, Cambridge, MA. 1965, pp. 32–33; Berger, *Theories of Chromatic*, p. 51; John Henry van der Meer, «Partiell und vollständig enharmonische Saitenklaviere zwischen 1548 und 1711», in: *Das Musikinstrument* 36/7 (1987), p. 16; Mark Lindley, «An Historical Survey of Meantone Temperaments to 1620», in: *Early Keyboard Journal* 8 (1990), p. 31; my perpetuation of the error in «Harpsichord, 2. The Renaissance, (i) Italy», in: *Early Keyboard Instruments*, London 1989 (The New Grove Musical Instrument Series), p. 23.

20 See Stembridge, «*The Cimbalo cromatico*», pp. 45–46. Stembridge inferred that Zarlino's instructions called for a 27-note keyboard, computing the notes necessary to give corresponding major and minor thirds above every string, starting with a compass containing 19 notes per octave.

(«fabricare uno istrumento alla simiglianza di quello ch'io hò mostrato»), but in the 1589 edition «mostrato» (shown) has been changed to «descritto» (described). However, the misunderstanding is not simply a confusion since Berger argues that Zarlino's tonal system *requires* 19 notes.[21]

Fig. 2: Zarlino, illustration of a 19-note keyboard (from Zarlino, *L'Istitutioni Harmoniche*, 1558, p. 141)



21 See Berger, *Theories of Chromatic*, p. 51. This matter will not be discussed here.

That Zarlino specifically states the major and minor semitones should be divided into two parts has seldom been mentioned by commentators.[22] If we were to take Zarlino's statement of the 1558 edition literally about dividing the major and *all* the minor semitones into *two* parts there could be as many as 31 divisions in the octave, with each tone divided into five parts. A 19-note octave division would suggest dividing the whole tone into three parts. However, the additional information (in later editions) that semitones should be divided in such a way so that the tone should be divided into *four* parts defines the compass as 24 notes, although it does not tell us which minor semitones should be divided.[23] Thus, part of the inaccuracy concerning the description of this instrument appears to result from scholars consulting the original, 1558 edition which is imprecise in its wording, a vagueness later corrected by Zarlino.

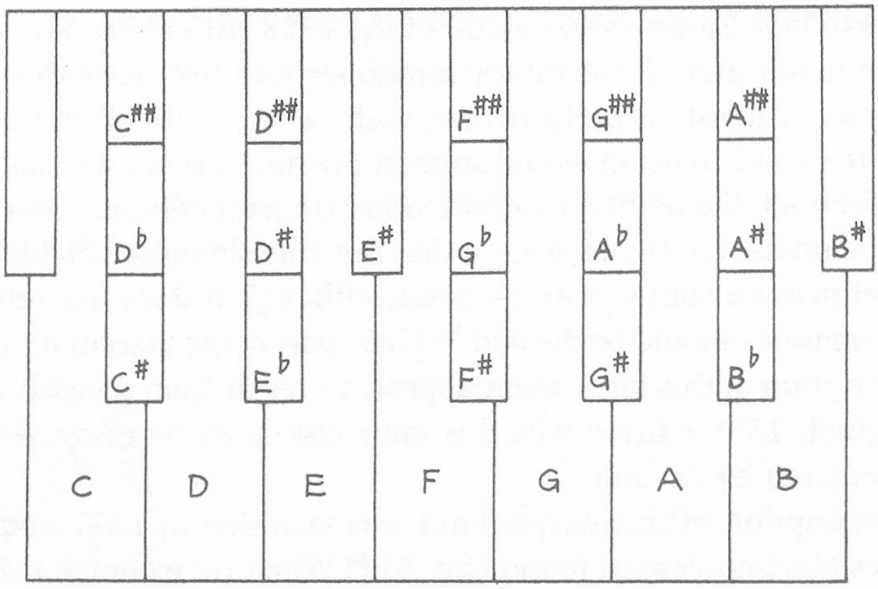
A description of this harpsichord was recorded in 1641 and shows us the notes Martino Pesenti found (fig. 3).[24] When we examine the tuning in order to discover which minor semitones should be divided it appears that Zarlino thought in terms of extending the series of fifths from B♯ through to A♯♯, i.e., dividing the small semitones on the «sharp side» of the tone.

22 In the 1558 edition the phrase: «nel quale [in the Clavicembalo] non solamente li semituoni maggiori sono divisi in due parti, ma anche tutti li minori.»; Zarlino, *L'Istitutione*, p. 140 (1558 edition), p. 171 (1589 edition). Sibyl Marcuse, A *Survey of Musical Instruments*, New York 1975, p. 287, mentions the semitones, as does Kirkendale, *Emilio de' Cavalieri*, p. 147, and Barbieri, «The evolution» (in this volume), who compares the differences between the two editions. Rasch, «Why were enharmonic keyboards built?» (in this volume), has also drawn attention to this matter.

23 Kirkendale, *Emilio de' Cavaliere*, p. 147, provides the text of the 1573 edition which is virtually identical with that of the 1589 edition, p. 171, which latter version is: «nel quale [in the Gravecembalo] non solamente li Semituoni maggiori sono divisi in due parti, ma anche i minori, di maniera ch'ogni Tuono viene ad essere diviso in quattro parti.»

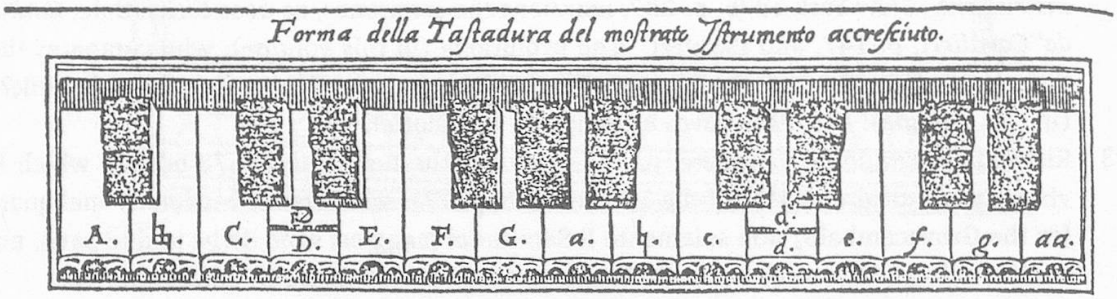
24 Stembridge, «The *Cimbalo cromatico*», pp. 44–55 with Pesenti's Italian text and a correct translation into English. Kirkendale, *Emilio de' Cavaliere*, p. 147, also mentions this but incorrectly states that Pesenti aquired the instrument, mistranslating the key phrase «quando me capitò alle mani», which Riccardo Pergolis assures me means only that he came across the instrument and was able to examine it. Rasch, «Why were enharmonic keyboards built?» (in this volume), discusses the instrument and presents a complete translation of Pesenti's text.

Fig. 3: Zarlino, 24-note keyboard (Domenico da Pesaro, 1548)



We may ask how it was that Pesenti was able to give the exact tuning of the notes. The answer appears to be supplied by Charles Burney's account of finding the instrument in Florence in 1770 in the possession of Signora Moncini: «I copied Zarlino's instructions for tuning it, from his own handwriting, on the back of the foreboard [...]».[25] The information on the nameboard may also have been the source for Pesenti's claim that this was the first harpsichord made with the diatonic, chromatic, and enharmonic. Whether this instrument still exists is unknown.

Fig. 4: Zarlino, just intonation keyboard (from Zarlino, *Sopplimenti Musicali*, 1588, p. 156)



25 Charles Burney, *The present state of music in France and Italy*, London 1773, p. 253, quoted in Hubbard, *Three Centuries*, p. 33. Barbieri, «The evolution» (in this volume), corrects the name to Mancini and supplies the information that her deceased husband, Giovanni Battista Pescetti, was second organist at the basilica of San Marco, Venice.

In his *Sopplimenti Musicali* of 1588 Zarlino related how he had ordered another harpsichord to be constructed, one which was an example of just intonation.[26] A drawing of the keyboard and a table of the intervals between the notes leaves no doubt as to what was intended: a compass with two d notes separated by a syntonic comma (ratio 80:81), having perfect fifths and thirds, with two e♭, f♯, and b♯ notes (fig. 4). This is the same version of just intonation as Salinas described, except for the doubled e♭ notes.[27] This instrument does not belong in the same category as Zarlinos's other (1548) harpsichord which extended the *tempered* tuning beyond the normal range of accidentals; this one merely supplies the normal range but with consonant thirds. This, or Salinas' harpsichord, must be the earliest Italian string keyboard instrument made for just intonation with split keys of which we presently have any record. Since Fogliano published his monochord in 1529 showing the octave division with two ds, separated by a comma, it is possible that others before Salinas and Zarlino had produced similar instruments.[28]

VICENTINO: Vicentino's enharmonic harpsichord, the *archicembalo* is well known through his publication which included measurements of certain parts and drawings showing the keyboards.[29] It is not recorded when Vicentino first had such an instrument built, but a medal shows the *archicembalo* together with an *arciorgano*.[30]

We do not know when Vicentino entered into the d'Este employment, but it may have been in the mid 1540s. Vicentino may have brought the *archicembalo* with him to Ferrara, but it is more likely that it was constructed before he left for Rome with his employer, Cardinal Ippolito d'Este, where

26 Gioseffo Zarlino, *Sopplimenti Musicali*, Venice 1588, p. 154: «poi che già molti anni sono iti, ch'io feci fabricarne uno con molto maggior numero di chorde & di Tasti, che non hanno i communi, al modo che si vede nella Tastatura posta dopo il seguente essempio». See also Barbieri, «The evolution», § 3.1 (in this volume).

27 See Salinas, *De Musica*, p. 117 and Berger, *Theories of Chromatic*, pp. 53–55, is one of the few commentators to have mentioned this instrument. See also Barbieri, «The evolution» (in this volume), who explains the use of the doubled eb notes in § 5.1.

28 Ludovico Fogliano, *Musica Theorica*, Venice 1529, p. XXXIV^{v}. See also Barbieri's discussion of Hothby's instrument in «The evolution», § 5.2 (in this volume).

29 Nicola Vicentino, *L'Antica Musica Ridotta Alla Moderna Prattica*, Rome 1555, fols. 99–102.

30 See Barbieri, «I Temperamenti», p. 161, for a reproduction of this medal. Martin Kirnbauer informs me the most detailed information concerning the medal is to be found in Davide Daolmi, *Don Nicola Vicentino Arcimusico in Milano. Il beneficio ecclesiastico quale risorsa economica prima e dopo il Concilio di Trento. Un caso emblematico*, Lucca 1999 (= Quaderni dell'Archivio per la Storia della Musica in Lombardia 1), pp. 193–216.

he was resident by the autumn of 1549.[31] Alternatively it might have been made under Vicentino's supervision in Ferrara after his return from Rome, which was evidently by late 1555, although Salinas' dating, suggested as 1538–1547 and mentioned above, speaks against this. However, when we consider the significance Vicentino attaches to consigning details of the archicembalo to posterity, and describing himself on the plaque beside the dedication in the *L'Antica Musica* as the inventor of the *archicembalo*, it seems unlikely that this instrument was merely on the drawing board at the time of his publication in 1555.[32] From my understanding of the design principles of 16th-century harpsichords I infer that these measurements were derived by Vicentino from an *actual* instrument and do not represent the blueprint.[33] Indeed, the fact that he agreed to teach five or six persons of Cardinal Ridolfi's household in October 1549 to sing chromatic and enharmonic genera, together with Galilei's later testimony about the necessity of having keyboard accompaniment in performing enharmonic music so that the singers would not lose their way, suggests that he had the *archicembalo* with him in Rome.[34] This would also have enabled Salinas, who was also in Rome (see above), to have heard the instrument. Thus, we may infer that the *archicembalo* had probably been constructed before 1549.

Some details of the constructional information and dimensions are consistent with harpsichords made in Venice, which was a noted centre of musical instrument making in the 16th century. However, these are too involved to warrant further investigation here. Vicentino had studied with Adrian Willaert in Venice and Vincenzo Colombo, who worked in Venice, later built an *arciorgano* for him. Thus, it is not improbable that the maker of the *archicembalo* should have worked in Venice.

According to Bottrigari an *arciorgano* was also built for Cardinal Ippolito d'Este in Rome and Vicentino supervised the construction of another *arcior-*

31 This date is given for Vicentino's arrival in Rome by Henry W. Kaufmann, *The Life and Works of Nicola Vicentino (1511-c.1576)*, s.l 1966 (= Musical Studies and Documents 11), pp. 15–48, from which other dates below concerning Vicentino are drawn.

32 See Vicentino, *L'Antica Musica*, fol. 100r.

33 The reasoning behind this opinion is too complicated for discussion here and includes unpublished work in progress.

34 See Kaufmann, *The Life and Works*, p. 22 and Vincenzo Galilei, *Discorso intorno all'uso dell' Enharmonio* [sic] *et di chi fusse autore del Cromatico*, in Florence, Biblioteca Nazionale Centrale, Ms. Galileiani 3, fols. 3r-34v, fols. 9r-10r. The original text with English translation is given in Berger, *Theories of Chromatic*, p. 150 and p. 73 respectively.

gano in Milan shortly before he died, *c*1576.[35] It seems likely that Vicentino supervised the construction of the *arciorgano* in Rome, in which case this may have occurred during the period 1549–1552, or at the latest by 1555, and therefore may have been the first such *arciorgano*.[36]

In addition to these two *arciorgani*, rather more details are known of an instrument made by Vincenzo Colombo of Venice by 1561 for Vicentino, which was evidently unknown to Bottrigari.[37] This had 126 pipes and two keyboards compared with the 132 notes of the *archicembalo*. The omission of six notes suggests that some of the longer, bass pipes may have been omitted for practical reasons. From the length of the longest pipe, given by Bevilacqua as seven feet, we may calculate that the lowest note would have sounded a C at a pitch of $a^1 = 411$ Hz, or at about $a^1 = 440$ Hz.[38]

In the broadsheet describing the *arciorgano*, it is mentioned that Vicentino also had a harpsichord [*clavicembalo*] which was constructed in a similar fashion to the *arciorgano* and offered his services in teaching singers with these instruments.[39] By January 1563 Vicentino was no longer in the cardinal's employment so this proposed programme of teaching implies that there was a second *archicembalo* and already in his possession, since he could hardly have expected to have loaned out the Ferrara *archicembalo* of his

35 There has been some confusion about these instruments: Kaufmann, *The Life and Works*, p. 47, quotes Bottrigari as referring to the construction of an *archicembalo* in Milan. Christopher Stembridge in «The *Cimbalo cromatico*», p. 56, gives the details correctly. Maria Rika Maniates, Ancient Music *Adapted to Modern Practice*, New Haven, CT. & London 1996 (= Music Theory Translation Series), p. li, note 90, mentions both the *arciorgani* described by Bottrigari then double counts one of the *arciorgani* as an *archicembalo* under construction in Milan.

36 Between November 1552 and June 1554 the Cardinal and his entourage were in Siena. Stembridge, «The *Cimbalo cromatico*», p. 56, assumes that the Colombo instrument was the first *arciorgano*.

37 Johannes Wolf, «Das Arciorgano des Nicola Vicentino (1561)», in: *Der deutsche Instrumentenbau. Zeitschrift für Instrumentenbau und Instrumentenkunde* 35 (1900), pp. 299–302, and Henry W. Kaufmann, «Vicentino's arciorgano; an annotated translation», in: *Journal of Music Theory* 5 (1961), pp. 32–53, contain Nicolo Bevilacqua's [Bevil'acqua in the original] description of the instrument, written in Venice. A facsimile of the broadsheet is given in Kaufmann, *The Life and Works*, p. 173.

38 The calculation is based on the Venetian foot of 347.7 mm., but the pitch depends on whether Bevilacqua gave the speaking length of the pipe (= 410 Hz) or the whole length including the foot (= approximately 440 Hz). As the closest point of comparison I have taken the speaking length of the F pipe of Lorenzo da Pavia's chamber organ built in 1494 that stood at $a^1 = 455$ Hz (± 4Hz), as I have determined from replica pipe experiments. See also Stembridge, «The *Cimbalo cromatico*», p. 56, who suggests a compass of F-f^3.

39 Kaufmann, «Vicentino's arciorgano», p. 39.

former employer, who at this time was in France. Galilei's record that Vicentino played his enharmonic music many times in the principal Italian cities shows that he had an instrument at his disposal around 1560. Thus, it appears probable there was at least another *archicembalo* and possible that the Ferrara instrument was the original *archicembalo*.

Luzzaschi's prowess in performing on Vicentino's *archicembalo* is well known from Bottrigari's account in 1594 of musical life at the Este court in Ferrara.[40] This information also makes clear that the vaguely-described «certo strumento Inarmonico» played by Luzzaschi in Ferrara was one of Vicentino's archicembali.[41] Whether it was the original *archicembalo* cannot be conclusively established, even though Bottrigari and Artusi speak of the Ferrara *archicembalo* as if it were the only one Vicentino had caused to be made.[42] It is to be presumed that Cardinal Ippolito had financed the construction of *this* instrument because it remained at the disposal of the court and was not taken by Vicentino when he left the Este employment *c*1560.

In any event it seems that the instrument Luzzaschi played was acquired by Antonio Goretti (a nobleman of Ferrara) between 1598 and 1602, as is briefly related by Artusi.[43] This occurred after the death of Alfonso II in 1597,

40 Hercole Bottrigari, *Il Desiderio*, Venice 1594, p. 41; translated by Carol MacClintock, s.l. 1962 (= Musicological Studies and Documents 9), pp. 1–62, pp. 50–51.

41 The reference to the «certo strumento Inarmonico» is found in Durante & Martelotti, *Cronistoria*, p. 193 (cited in note 3) and Stembridge, «The *cimbalo cromatico*», p. 56, who suggests the possible identity of this instrument, that played by Luzzaschi, and Vicentino's *archicembalo*.

42 For Bottrigari, see note 40; for Artusi see following note.

43 Georg Kinsky, «Kurze Oktaven auf besaiteten Tasteninstrumenten», in: *Zeitschrift für Musikwissenschaft* 2 (1919), pp. 71–72, (as Martin Kirnbauer has kindly reminded me) and Sibyl Marcuse, *A Survey*, p. 288, both refer to Artusi, without work or page reference as stating this. In Giovanni Maria Artusi, *L'Artusi overo delle imperfettioni della moderna musica*, Venice 1600, there is the «TAVOLA DELLE MATERIE PIU PRINCIPALI CONTENUTE NEL'LOPERA [sic]» where Artusi writes «Antonio Goretti tiene lo Instrumento di D. Nicola», with a page reference «1[illegible].b», (probably 15 b.), to which Martin Kirnbauer has re-directed my attention. On this page Artusi mentions an «Istrumento fatto secondo la divisione di Don Nicola Vicentino». This latter reference is ambiguous whether the *Istrumento* was *actually* Vicentino's or merely a harpsichord made following his idea. Given the clear statement «Goretti tiene lo strumento di D. Nicola» the probability must be that Artusi believed this to be *the* Vicentino *archicembalo*, although as argued above, it may only have been one of them. Bottrigari also records in a letter of 1602 that Goretti had acquired the instrument, indicating that he had read this information, presumably in Artusi's book, so Bottrigari cannot be regarded as an independent source of information on the change of ownership. See Berger, *Theories of Chromatic*, p. 159, note 53, who quotes this letter.

the last of the Este line in Ferrara. The timing is correct for this assumption, since an inventory in 1598 records an «instrumento cromatico con due tastadure una sopra l'altra» was at the court, although there is no mention of Vicentino or the maker of the instrument.[44] In a further inventory of the same year «Un Clavicimbalo cromatico con due testadure» is recorded, yet in an inventory of 1601 three of these instruments are not listed, suggesting that two of them and the «clavicimbalo cromatico» had been disposed of.[45]

As Kinsky noticed, at least part of Goretti's collection was purchased by the Innsbruck court of Archduke Sigmund Franz and we know that in 1653 Hofpfennigmeister Johann Heinrich Steiger was sent to Italy to buy «ein Khunstkammer mit allen Instrumenten» from Lorenzo Goretti, Antonio's heir.[46] It appears probable that Vicentino's instrument is the one recorded in an inventory of 1665 after the Archduke's demise as «a double instrument with 2 keyboards all black keys are split, of cypress. The author who made it is called *Caesar de Pollastris* from Ferrara: has a cover which is red on the inside and green outside».[47] Again we find mention of two keyboards, an essential feature of Vicentino's *archicembalo* and rare in Italian harpsichords and the information that *all* the black notes are split. These two pieces of information are sufficient to identify beyond any reasonable doubt the instrument in Innsbruck as Goretti's *archicembalo*. It is unlikely that the two claviorgani in Cricca's inventory of 1598 with split sharps could be the Pollastris harpsichord since they are not recorded as having two keyboards.[48] One of these still survives (see W366 described below), but originally had only two divided accidentals per octave.

Of the instrument maker Caesar de Pollastris nothing is known beyond this inventory reference. The implication of the Innsbruck inventory that he came from Ferrara cannot be relied upon since another instrument in the same inventory is described as «von Ferrara», indicating merely that it came from the former Este collection.

44 See an Este inventory of 21.10.1598, in Durante & Martellotti, *Cronistoria*, p. 205 (no. 2805).

45 Durante & Martellotti, *Cronistoria*, p. 209 (doc. A210) and p. 212 (doc. A217).

46 See Kinsky, «Kurze Oktaven», p. 74, note 1, and Walter Senn, *Musik und Theater am Hof zu Innsbruck. Geschichte der Hofkapelle vom 15. Jahrhundert bis zu deren Auflösung im Jahre 1748*, Innsbruck 1954, p. 334.

47 See Franz Waldner, «Zwei Inventarien aus dem XVI. und XVII. Jahrhundert über hinterlassene Musikinstrumente und Musikalien am Innsbrucker Hofe», in: *Studien zur Musikwissenschaft* 4 (1916), pp. 128–147, p. 131: «Ein doppelts Instrument mit 2 Clavirn, so alle schwarz brochne Claves haben von Cypress. Der Author, der es gemacht, haißt *Caesar de Pollastris* von Ferrara; hat ein inwendig rot und auswendig grienes Fuetrall».

48 Durante & Martellotti, *Cronistoria*, pp. 208–209 (doc. A210).

Thus, it is probable that the Ferrara *archicembalo* played by Luzzaschi was acquired by Goretti and then bought by the Innsbruck court. Nothing is known of the ultimate fate of this Vicentino *archicembalo* but in 1768 it was still in Innsbruck, having been recorded in inventories of 1741 and 1768. After this it may have been sold or stolen, together with other instruments in the collection.[49]

Fig. 5: Vicentino, *archicembalo* keyboard (from Barbieri, «I Temperamenti», p. 163)

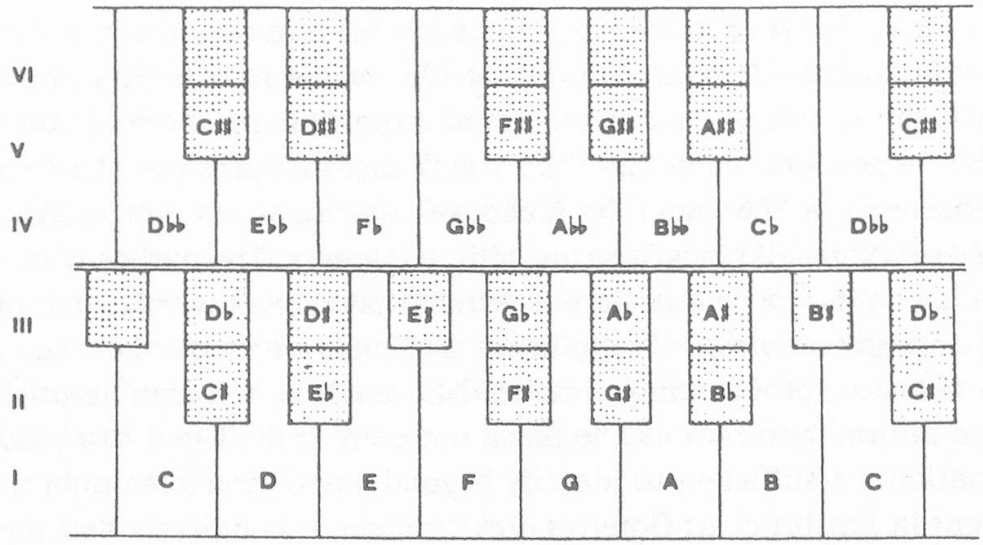


Fig. 5 shows the two keyboards of Vicentino's drawings but in Patrizio Barbieri's presentation which names all the notes as sharps or flats of their diatonic reference, rather than Vicentino's less easily understood method.[50] The sixth rank of keys is only employed in the second tuning when ranks IV-VI are to be tuned to yield perfect fifths to their counterparts on the lower keyboard.[51]

49 See Senn, *Musik und Theater*, pp. 340–341. Gerhard Stradner has kindly given me the benefit of his experience with these early Austrian inventories in tracing this history.

50 Barbieri, «I Temperamenti», pp. 160–168. The main sources dealing with the tuning are: Kaufmann, *The Life and Works*, pp. 163–174, and Henry W. Kaufmann, «More on the Tuning of the *Archicembalo*», in: *Journal of the American Musicological Society* 23 (1970), pp. 84–94; Marco Tiella, «The archicembalo of Nicola Vicentino», in: *English Harpsichord Magazine* 1 (1975), pp. 134–144; Mark Lindley, «Chromatic systems (or non-systems) from Vicentino to Monteverdi» (review of Berger, *Theories of Chromatic*), in: *Early Music History* 2 (1982), pp. 385–391. Maniates' translation, *Ancient Music*, is a useful aid in this context.

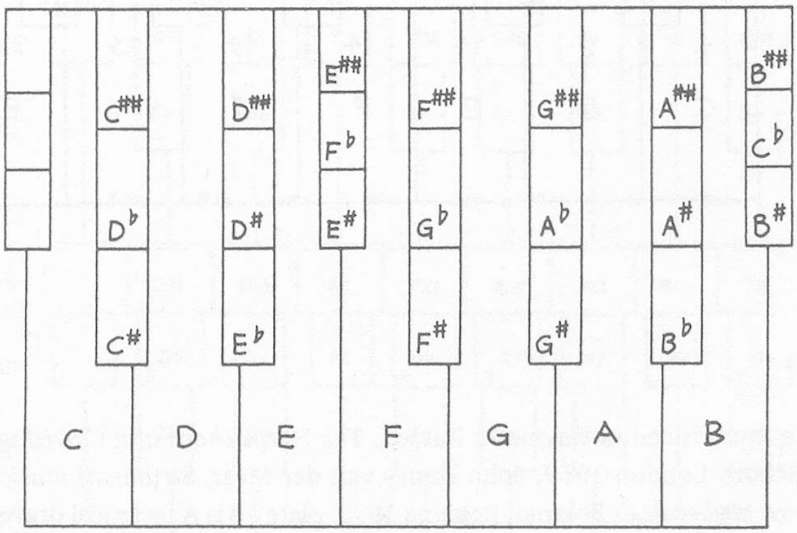
51 See Vicentino, L'*Antica Musica*, book V, ch. VI and especially Lindley, «Chromatic systems», who discusses intricate questions of the tuning.

TRASUNTINO: Three enharmonic instruments are known to have been made by «Vito de Trasuntinis» (as he usually signed his name on instruments), whose family name was Frassonio. Born 1526 in Treviso, he died some time after 1606 and was one of the most renowned Venetian string keyboard instrument makers of the 16th century, who was also called upon to judge the work of organ makers.[52]

A Trasuntino harpsichord dated 1591 has only recently come to light again.[53] Although the original keyboard no longer survives it was established during its restoration by Christopher Nobbs that the original compass would have been C-c^3 with 19 notes in each octave, i.e. with sharps and flats for each accidental key and E♯ and B♯. This would have been identical with Vicentino's lower keyboard (fig. 5) and has not been illustrated separately.

In 1601 Trasuntino made another harpsichord whose existence is now only known through Martino Pesenti's description recorded in 1645, to which Christopher Stembridge has drawn attention.[54] Fig. 6 shows the keyboard described by Pesenti with its 28 notes per octave. The difference between Zarlino's instrument and this one is the provision of E♯♯ and F♭ as well as B♯♯ and C♭. Strictly speaking we do not know the exact position of the notes, but the placement of F♭ behind E♯ agrees with the order indicated on the *Clavemusicum Omnitonum*.

Fig. 6: 1601 Vito Trasuntino, 28-note keyboard



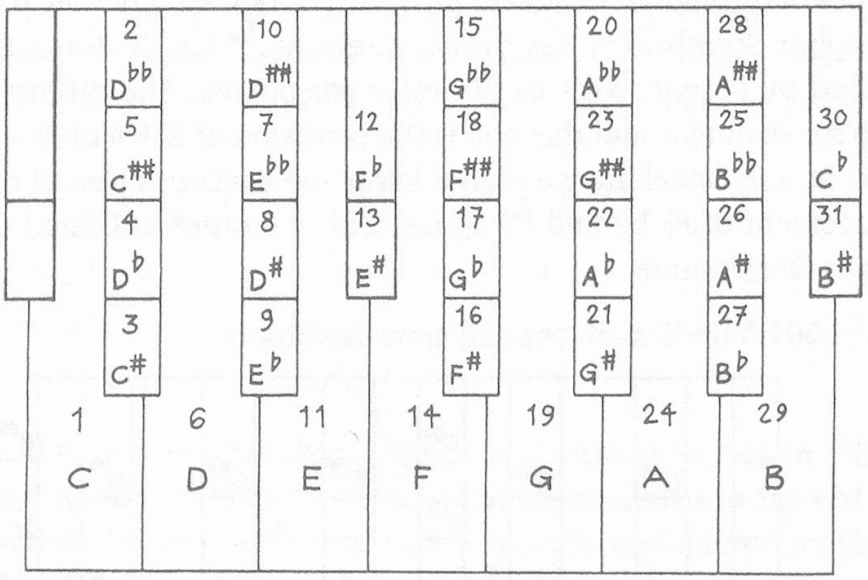
52 See Renato Lunelli, *Der Orgelbau in Italien*, Mainz 1956, p. 191 on Trasuntino's organ activity citing Caffi; Wraight, *The stringing*, part 2, pp. 291–292; Donald H. Boalch, *Makers of the Harpsichord and Clavichord 1440–1840*, 3rd ed. by C. Mould, Oxford 1995, p. 195 for further biographical details.

53 Ian Pleeth Collection, England.

54 Martino Pesenti, *Corrente*, introduction; Stembridge, «The *Cimbalo cromatico*», pp. 46–54. Kirkendale, *Emilio de' Cavaliere*, p. 149, conflates this instrument with the 1606 *Clavemusicum Omnitonum*.

One of the best known enharmonic instruments is the *Clavemusicum Omnitonum* made in 1606 for Camillo Gonzaga.[55] This tuning with 31 divisions for the octave yields a whole tone with five parts, as discussed by Michael Thomas.[56] The museum drawing of this instrument is an important record, but I know of only one description in print of the order of the keys, given by Claudio di Véroli.[57] Since a monochord was made by Trasuntino to indicate the tuning, the intended pitch of each note is known and is shown in fig. 7 On this drawing Trasuntino's numbering has been included in order that the reader may be sure of understanding the actual pitch of these rare notes, e.g. that D𝄫 is lower in pitch than C♯.

Fig. 7: 1606 Vito Trasuntino, 31-note octave division *Clavemusicum Omnitonum*



55 Photos are reproduced in Raymond Russell, *The Harpsichord and Clavichord*, 2nd ed. by Howard Schott, London 1959; John Henry van der Meer, *Strumenti musicali europei del Museo Civico Medievale di Bologna*, Bologna 1993, plate 141. A technical drawing is available from the Germanisches Nationalmuseum, Nuremberg, where the instrument was conserved. A conference was devoted to the study of this instrument and the music of the period in the Germanisches Nationalmuseum, Nuremberg in July 1985, but no conference proceedings were published. Lewis Jones has also given papers on this instrument at the Warburg Institute, London (private communication).

56 Michael Thomas, «The Development of the Tuning and Tone Colour of an Instrument made in Venice about 1500», in: *English Harpsichord Magazine* 1 (1975), pp. 145–153.

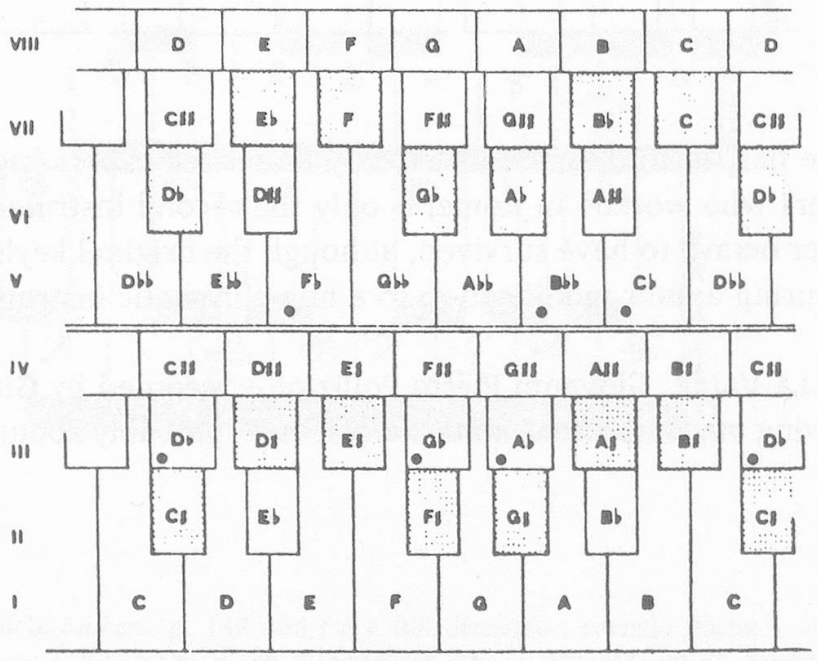
57 Claudio di Véroli, *Unequal Temperaments and their Role in the Performance of Early Music*, Buenos Aires 1978, pp. 238–239. The instrument is conflated in the text with Vicentino's *archicembalo*. B♯ and C♭ are not given in their correct positions.

From this drawing it is clear that the notes of Vicentino's *archicembalo* and the *Clavemusicum Omnitonum* are nominally the same but merely arranged in a different way: Vicentino uses two keyboards where Trasuntino provides extra split accidentals.

A general principle to be observed in Italian keyboards with split sharps is that the accidental *usually* employed is at the front of a divided key, the one less commonly used is placed further back. In the *Clavemusicum Omnitonum* the double sharps and double flats are also ordered analogously to this scheme. In Vicentino's *archicembalo*, however, the double sharps are all to be found in one row, as is also the case for Zarlino's harpsichord and the 1601 Trasuntino instrument.

STELLA: A visit in 1594 to Ferrara with Gesualdo apparently inspired Scipione Stella to construct an enharmonic instrument, which was described by Fabio Colonna in 1618. Fig. 8 shows Stella's keyboard which has 52 notes distributed over eight rows of keys.[58] This instrument is technically a fretted clavichord, which reduces the number of strings required.

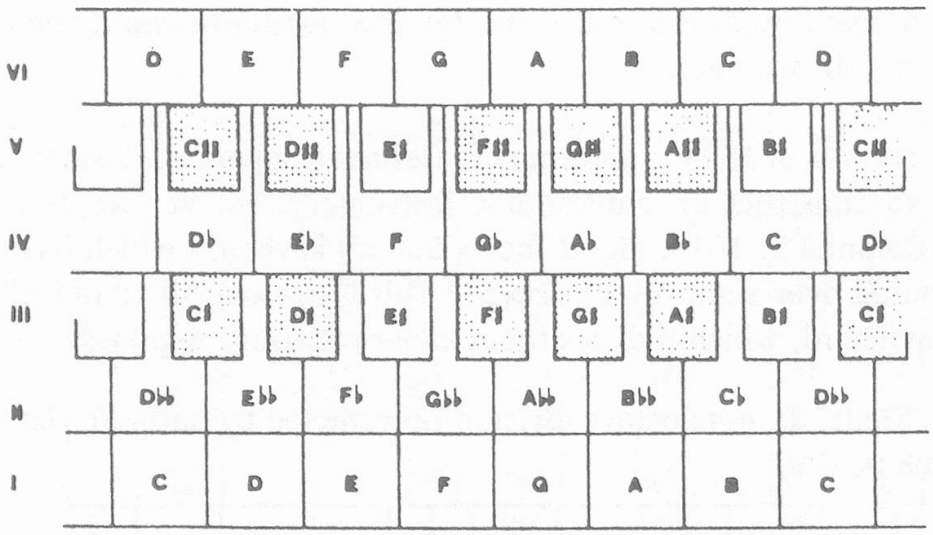
Fig. 8: Stella, 31-note octave division (interpreted by Barbieri, «*La Sambuca Lincea*», p. 179)



58 See Patrizio Barbieri, «La *Sambuca Lincea* di Fabio Colonna e il *Tricembalo* di Scipione Stella, Con notizie sugli strumenti enarmonici del Domenichino», in: *La Musica a Napoli Durante il* Seicento, Atti del Convegno Internationale di Studi, Napoli, 11–14 aprile 1985, ed. by Domenico Antonio D'Alessandro & Agostino Ziino, Rome 1987, pp. 176–187. I would like to thank Patrzio Barbieri for supplying a copy of this and some other articles cited here.

COLONNA: Colonna's own keyboard is shown in fig. 9, reported in the same volume as his description of Stellas keyboard. The *sambuca lincea* was built for Colonna by Francesco Beghini.[59] Both Stella's and Colonna's keyboards utilise a 31-note division of the octave and have been extensively described and analysed by Martin and Barbieri.[60]

Fig. 9: Colonna, 31-note octave division *Sambuca Lincea* (interpreted by Barbieri, «La Sambuca Lincea», p. 179



FABBRI: The harpsichord, made in 1631 by Francesco Fabbri (signed Franciscus Faber) who worked in Rome, is only the second instrument having 19 notes per octave to have survived, although the original keylevers were removed during a later modification to a non-chromatic instrument.[61]

DONI / DELLA VALLE: Giovanni Pietro Pollizini is recorded by Giambattista Doni as having made an enharmonic harpsichord, probably about 1638–39,

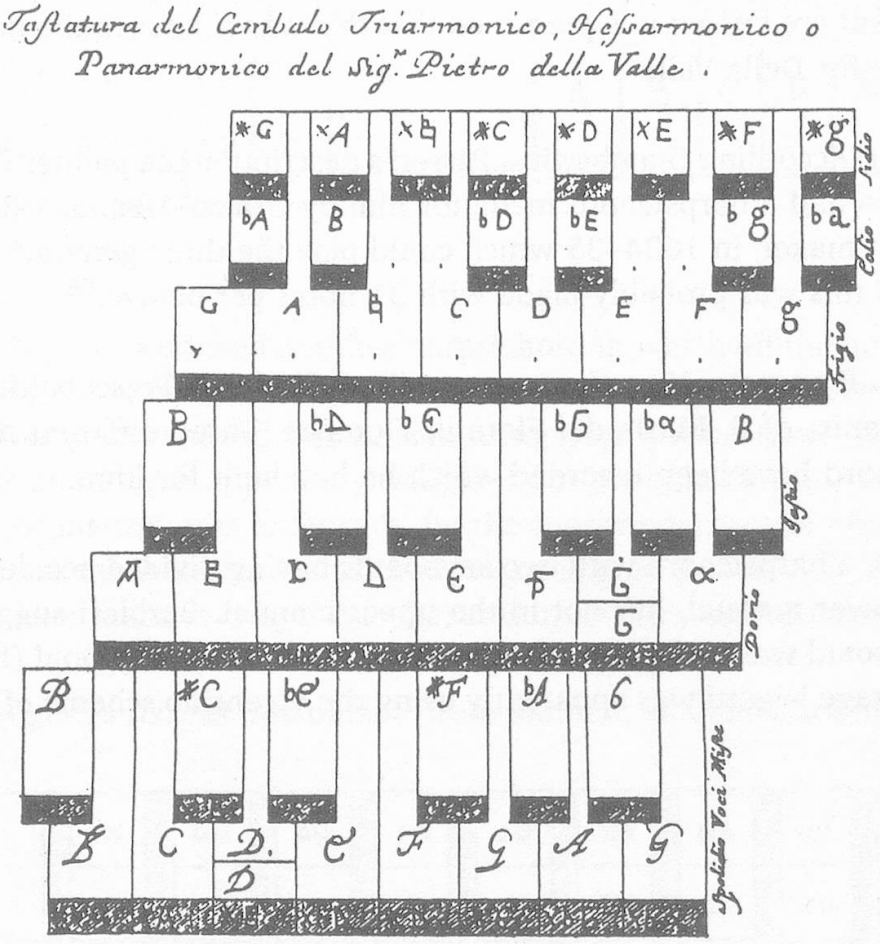
59 Fabio Colonna, *La Sambuca Lincea*, Naples 1618, p. 76. Beghini was paid 60 ducats for this instrument in 1621; see Barbieri, «La *Sambuca Lincea*», p. 199, who kindly drew this to my attention.

60 Martin, «The Colonna-Stella», and Barbieri, «La *Sambuca Lincea*», pp. 168–176.

61 Only a modified keyboard of a third instrument survives, as discussed under Giovanni Boni?, no. 2826 Collezione degli Strumenti Musicali, Rome, below. For evidence of Fabbri's activity in Rome see Patrizio Barbieri, «Cembalaro, organaro, chitarraro e fabbricatore di corde armoniche nella ‹Polyanthea technica› di Pinaroli», in: *Recercare* 1 (1989), pp. 123–210, pp. 150–151.

from a design by Pietro Della Valle (1586–1652).[62] He was following Doni's *cembalo triarmonico* described in 1635 which incorporated Doni's ideas of the ancient Greek modi and genera.[63] Doni published a drawing of the Della Valle keyboard (fig. 10), but Barbieri relates that contrary to the indications of the drawing, a tempered tuning was used rather than the doubled d keys, which imply just intonation.[64]

Fig. 10: Della Valle, *triarmonico* (from Barbieri, «Gli Strumenti», p. 109)



62 See Boalch, *Makers*, p. 149 and for a full discussion Patrizio Barbieri, «Gli Strumenti Poliarmonici di G.B. Doni e il Ripristino dell'Antica Musica Greca (c.1630–1650)», in: *Analecta Musicologica* 30 (1998), pp. 89–91; p. 89, note 23 includes biographical details of Pollizini and instrument inventories.

63 Giovanni Battista Doni, *Compendio del Trattato de' generi e de' modi della musica*, Rome 1635, p. 43. See also Martin Kirnbauer, «›Si possono suonare i Madrigali del Principe‹ – Die Gamben G. B. Donis und chromatisch-enharmonische Musik in Rom im 17. Jahrhundert» (in this volume).

64 Patrizio Barbieri, «Gli Strumenti Poliarmonici», p. 90, drawing on Doni gives this and other details of the instrument.

At this point we can note that Doni mentions harpsichords which he describes as *panarmonici*, built in Ferrara, Naples and Messina, with four, six, or even eight keyboards.[65] The reference to Ferrara may refer to a Nigetti harpsichord in Goretti's collection, and Naples may refer to Stella and Colonna's instruments. However, such instruments which are clearly Sicilian have not been identified.

POLLIZINI: A second instrument with three keyboards was made in 1649 by Pollizini and sent to Giovanni IV of Portugal.[66] Although no details of the instrument are known it is presumed that this was similar to the instrument he made for Della Valle.

ZAMPIERI: According Giambattista Passeri's description the painter Domenico Zampiero had a harpsichord made for him by Orazio Albana, a Roman instrument maker, in 1634–35 which could play the three genera.[67] Barbieri suggests this was probably made with 31 notes per octave.[68]

NIGETTI: Francesco Nigetti was a pupil of Girolamo Frescobaldi and the first organist of S. Maria del Fiore in Florence. Three different models of harpsichord have been recorded which he had built for him.

1. *c*1640, a harpsichord with two keyboards having divided accidental keys in the lower manual, but not in the upper manual. Barbieri suggests that this keyboard was probably similar to one of those shown by Doni (fig. 11).[69] At this stage Nigetti was apparently using the Vicentino scheme of two keyboards.

65 Giovanni Battista Doni, *Annotazione sopra il Compendio de' Generi e de' Modi della Musica*, Rome 1640, p. 68, quoted and discussed in Patrizio Barbieri, «La *Sambuca Lincea*», pp. 213–214.

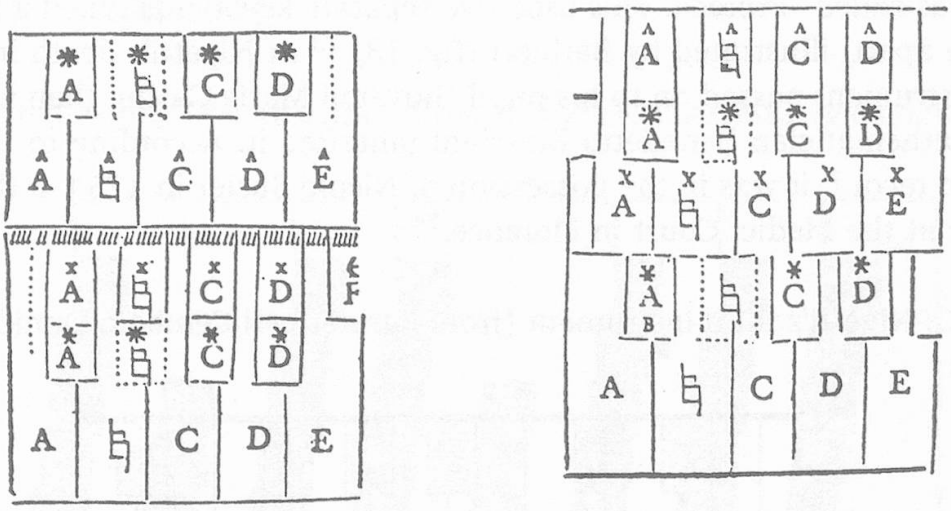
66 See Barbieri, «Gli Strumenti», p. 91.

67 Giambattista Passeri, *Vite de' pittori scultori ed architetti che hanno lavorato in Roma – Morti dal 1641 fino al 1673*, Rome 1772, p. 44. This can be found in a modern edition by Jacob Hess, *Die Künstlerbiographien von Giovanni Battista Passeri*, Leipzig & Vienna 1934, p. 67. Two virginals and four harpsichords can be attributed to Albana, but none has split keys. For details see Wraight, *The stringing*, part 2, pp. 16–20.

68 See Barbieri, «La *Sambuca Lincea*», pp. 209–214.

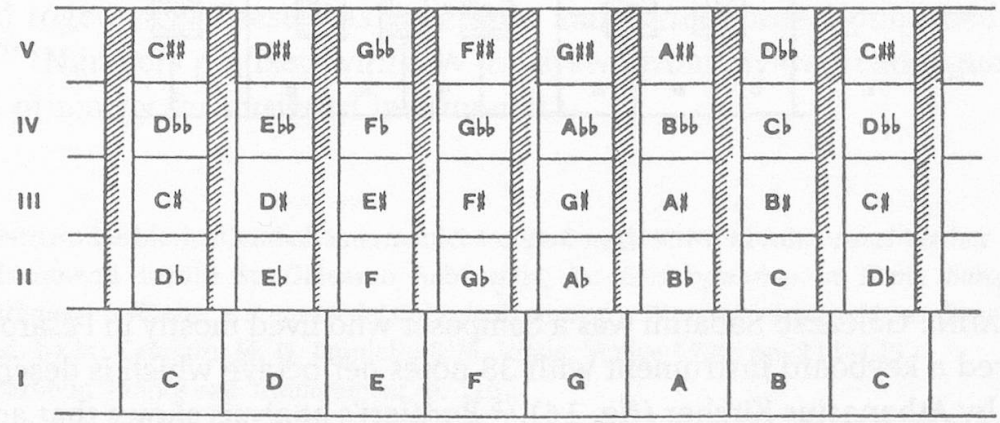
69 See Patrizio Barbieri, «Il Cembalo Onnicordo di Francesco Nigetti in due Memorie Inedite di G.B. Doni (1647) e B. Bresciani (1719)», in: *Rivista Italiana di Musicologia* 22 (1987), pp. 57–60. Nigetti's instruments are also discussed in a shorter version by Barbieri, «I Temperamenti», pp. 177–179.

Fig. 11: Nigetti's first instrument (from Barbieri, «Il Cembalo Onnicordo», p. 60)



2. *c*1644 Nigetti produced another harpsichord in which all the notes were white, i.e., the accidentals were not distinguished by a different colour. Barbieri has reconstructed this version using Doni's indications (fig. 12).[70] This instrument was apparently bought from Antonio Goretti, the noted collector of instruments in Ferrara, by the Innsbruck court in 1653 at the same time as the Pollastris harpsichord was acquired (see above).[71] This instrument later found its way to Vienna, as Gerhard Stradner has described.[72]

Fig. 12: Nigetti's second instrument (from Barbieri, «Il Cembalo Onnicordo», p. 61)



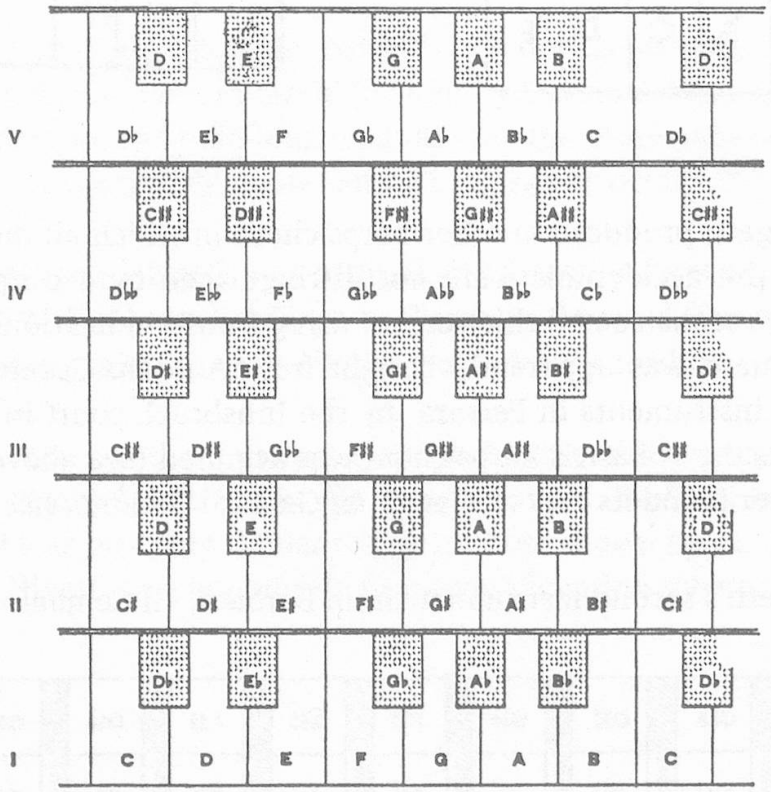
70 See Patrizio Barbieri, «Il Cembalo Onnicordo», pp. 59–68.

71 See Senn, *Musik und Theater,* p. 340: «ein anderes Instrument mit vielen Clavieren [«5 Tastaturen» = gestrichen] von weißem Elfenbein, worauf die Florentinische Wappen und in der Mitte des Auctoris Francisci Nigetti Namen».

72 Gerhard Stradner, «Saitenklaviere in österreichischen Inventaren», in: *600 Jahre Cembalobau in Österreich,* ed. by Alfons Huber, Tutzing 2002, pp. 329–342.

3. 1670 is the date of the last version, which according to the Latin inscription on the nameboard was made using Vicentino's division of the octave and was called «Proteo». This used five separate keyboards tuned a fifth of a tone apart, illustrated by Barbieri (fig. 13).[73] At Nigetti's death in 1681 the instrument passed on to his pupil Giovanni Maria Casini, then in 1719 the mathematician Benedetto Bresciani inherited it. According to the last known record, it was in the possession of Nicolò Susier in 1754, a theorbo player at the Medici Court in Florence.[74]

Fig. 13: Nigetti's third instrument (from Barbieri, «Il Cembalo Onnicordo», p. 54)



SABBATINI: Galeazzo Sabatini was a composer who lived mostly in Pesaro and devised a keyboard instrument with 38 notes per octave which is described only by Athanasius Kircher (fig. 14).[75] Barbieri's analysis shows that according to Kircher's information this instrument had a tone divided into five

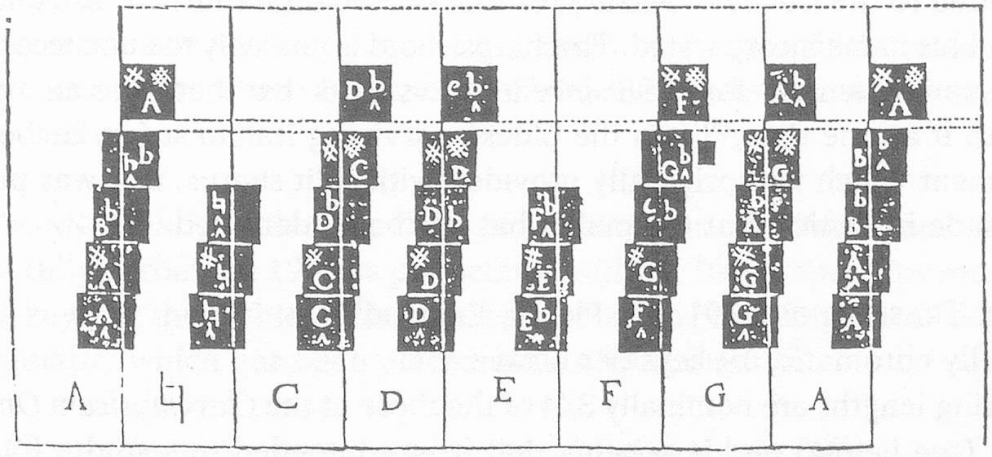
73 See Barbieri, «Il Cembalo Onnicordo», pp. 53–57.

74 See Barbieri, «Il Cembalo Onnicordo», pp. 68–76.

75 Athansius Kircher, *Musurgia universalis*, Rome 1650, pp. 460–461.

parts, but unlike Vicentino's *archicembalo* did not have a tempered tuning.[76] Thus, this instrument represents another example of just intonation, as also discussed by Barbour.[77]

Fig. 14: Sabbatini, 38-note octave division (from Kircher, *Musurgia universalis*, p. 461)



Complete list of surviving Italian string keyboard instruments originally provided with more than 12 notes per octave

Harpsichords

This survey includes three instruments already mentioned above, but they have been entered again here in order that all surviving harpsichords are listed together.[78] These lists supersede and correct ones I published earlier.[79] (Numbers prefixed with a W are drawn from my own catalogue and used primarily for unsigned instruments).

76 Patrizio Barbieri, «Cembali enarmonici e organi negli scritti di Athanasius Kircher – Con documenti inediti su Galeazzo Sabbatini», in: *Enciclopedismo in Roma barocca – Athanasius Kircher e il museo del Collegio Romano fra Wunderkammer e Museo Scientifico*, ed. by M. Casciato, M. G. Ianniello & M. Vitale, Venice 1986, pp. 111–128.

77 Barbour, *Tuning and Temperament*, p. 110.

78 In order to save space I have not given a reference for each instrument to my thesis, Wraight, *The stringing*, part 2 of which contains further details of all the instruments. An instrument signed 1670 Tollenari, in the Landesmuseum, Stuttgart, now has the following compass:
C-c^3 + D♭, D♯, d♭, d♯
The keyboard is new and the compass implausible; it has only been included here for the sake of completeness. There is no evidence this was originally built with split sharps.

79 Wraight & Stembridge, «Italian Split-Keyed Instruments», pp. 152–157.

W366 FERRARA *c*1559–97, Schloß Köpenick, Berlin
C/E-c^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}, d♯^{2}
From an analysis of the measurements and building methods in this and Venetian instruments it is now possible to confirm this compass. The nameboard has been skillfully altered to include the initials of Alfonso II which leads to hypotheses that the instrument may have been ordered before he succeeded to the Duchy of Ferrara, or that he bought a finished instrument and had his name incorporated. This harpsichord is probably the one recorded in a Ferrara inventory for 1598 since it shows signs that there was an organ beneath it at one time.[80] It is the oldest, surviving Italian string keyboard instrument which was originally provided with split sharps, and was probably made in Venice, but the maker has not been identified.

VITI DE TRASUNTINIS 1591, Ian Pleeth, England[81]
C-c^3 fully chromatic, 19 keys per octave
The string lengths are nominally 3/4 of the those of the *Clavemusicum Omnitonum* (see below) and it appears that it was intended to sound a fourth higher than the 1606 instrument.

VITO DE TRASUNTINIS 1606, Museo Civico, Bologna, no. 1766
C-c^3 31 keys per octave *Clavemusicum Omnitonum*
At least two reproductions of the instrument have been made: in the Germanisches Nationalmuseum, Nuremberg and by Lewis Jones, London.

GIOVANNI BONI 1619, Musée Instrumental, Conservatoire Royale, Brussels, no. 1603
C/E-c^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}, d♯^{2}

80 See Durante & Martellotti, *Cronistoria*, p. 208 (doc. A210), where two instruments are described that fit the Schloß Köpenick harpsichord: «Un'instromento con li semitoni tagliati tutto lavorato di groppi con il suo organo sotto, n.1
Un'instromento da li semitoni tagliati, tutto di groppi, con il suo organo sotto, n.1»
On p. 207 (doc. A209bis), the third instrument is given as «Un istromento a doi registri e l'organo sotto» which would correspond to the Schloß Köpenick instrument since it surely did not have the three registers which are mentioned for the second instrument in this inventory.

81 This information was kindly supplied by Christopher Nobbs. «Viti» is the spelling he gives for the inscription.

GIOVANNI BONI 1619 [A][82] Vizcaya, Florida
C/E-c^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}, d♯^{2}
This instrument has an original Orazio Albana 1645 signature on the nameboard which has been taken from another instrument.

GIOVANNI BONI *c*1619 [A], Alexander McKenzie of Ord, England
GG(AA?)-c^3 + F♯, G♯, d♯, a♭, a♯, d♯^{1}, a♭^{1}, a♯^{1}
This instrument is remarkable for the multiple division of the natural keys in the bass. The exact designation of the bass notes has not been clearly determined.

GIOVANNI BONI?, Collezione degli Strumenti Musicali, Rome, no. 2826
C-c^3 fully chromatic 19 keys per octave, without D♭ and perhaps some divided keys in the treble. This may just be a modified keyboard, originally chromatic, which has been placed in this instrument.[83]

W325 *c*1620 Anon., Russell Collection, Edinburgh, no. 2[84]
C/E-f^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}, d♯^{2}
Although the maker of this harpsichord has not been identified a Roman or Florentine origin in possible, with Florence being more likely.

PASQUINO QUERCI *c*1625 [A], Musikinstrumenten-Museum, Leipzig, no. 75
C/E-c^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}
This was previously known as a Zenti harpsichord dated 1653 (or 83) but a comparison of moulding profiles has revealed that it was produced in Querci's workshop.

82 The [A] abbreviation indicates that I have attributed an instrument to the maker indicated. For further details see Wraight, *The stringing*, Part 2.

83 See van der Meer, «Partiell und vollständig», p. 16. The harpsichord was originally made with 19-notes/octave, but according to Stembridge, «The *Cimbalo cromatico*», p. 37 note 6, citing Grant O'Brien, «there are no signs that the harpsichord ever had 19 divisions to the octave; the key-frame has clearly been cut at the bass end to make it fit into the harpsichord.» Stembridge describes how the present keyboard (not the harpsichord) appears to have been made from one which was originally intended to have been fully chromatic C-c^3 «but without D♭ and possibly without some of the chromatic keys in the top octave.» The present order of the naturals (as altered by GBC [=Giovanni Battista Boni, Cortona?]) with three divided keys in the bass octave, according to Barbieri, «Cembalaro», p. 137, example g is thus:
BB♭
AA BB D
GG C E F (hereafter normally)

84 W325 is a reference number in my catalogue; see Wraight T*he stringing*, part 2, p. 327.

STEFANUS BOLCIONIUS 1627, Russell Collection, Edinburgh, no. HT1-SB1627.4
C/E-c^3 + d♯, a♯, d♯^{1}, a♭^{1}
This compass description was produced by Grant O'Brien following a detailed analysis of the construction of the instrument.[85]

W139 1630 G.A., Collezione degli Strumenti Musicali, Rome, no. 1187
C/E-c^3 + d♯, a♯, d♯^{1}, a♭^{1}, a♯^{1}, d♯^{2}
This compass is given by John Henry van der Meer who found the missing keys for g♯/a♭ unusual.[86]

FABBRI (FABER) 1631, Germanisches Nationalmuseum, Nuremberg, MIR 1072
C/E-c^3 fully chromatic B♯-f^2
This harpsichord is signed Franciscus Faber. The original compass of C/E-c^3 was established by examination of the original balance pin holes, which show that the fully chromatic range was only from B♯-f^2.[87]

FABBRI (FABER) Barbetta Restaurant, New York
C/E-c^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}, d♯^{2}, + a♯?
The compass is given as C/E-c^3 with eight divided keys by Laurence Libin and Kathryn Shanks.[88]

FRANCISCUS MARCHIONUS 1666, Yale, New Haven, no. 4882.61
C/E-c^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}
According to Boalch all the sharps were divided, but Hubbard gives them thus.[89] Marchioni was from Florence but built this instrument in Rome. If this date is correct it is the last known Italian string keyboard instrument of this type.[90]

85 Grant O'Brien, «Towards establishing the original state of the three-manual harpsichord by Stefano Bolcioni, Florence, 1627, in the Russell Collection of Early Keyboard Instruments, Edinburgh», in: *Galpin Society Journal* 53 (2000), pp. 168–200.
86 Van der Meer, «Partiell und vollständig», instrument no. 131.
87 Van der Meer, «Partiell und vollständig», instrument no. 21. The total number of notes is 65, and not 68 as reported by van der Meer, as corroborated by an independent, later examination; see Stembridge, «The *Cimbalo cromatico*», p. 36.
88 Laurence Libin & Kathryn L. Shanks, «A harpsichord from Sorrento», in: *Early Music* 18/2 (1989), pp. 216–218, p. 216.
89 See Boalch, *Makers*, p. 110; Hubbard, *Three Centuries*, p. 36.
90 See also Barbieri, «The evolution» in this volume, note 87 for details of Sarti's instrument in 1779–84.

W730 Collezione degli Strumenti Musicali, Rome (?no. 1868)
C/E-c^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}, d♯^{2}
The compass given by van der Meer.[91]

Documentary evidence

The following two harpsichords are only known from a Florentine inventory of 1700.[92]
DOMENICO DA PESARO 1566
The entry lists a compass of C/E-a^2 with 50 keys and F♯, G♯. This would probably have been the following:
C/E-g^2,a^2 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}, d♯^{2} + a♯, a♯^{1}
It was probably still an unmodified instrument in 1700. The measurements show it has a length similar to another Dominicus harpsichord but that the width is larger by the amount of the extra keys involved.[93] This is a rare indication of the manufacture of instruments in Venice with split sharps.

GIROLAMO ZENTI 1653
GG-c^3 + d♯, a♭, d♯^{1}, a♭^{1}, d♯^{2} (probable)
It is unusual that a harpsichord whose compass extends to GG has split sharps.

Two Neapolitan harpsichords with split sharps are recorded in Cardinal Aldobrando's household in 1603.[94]

Another claviorganum with split sharps is recorded in the same Ferrara inventories as W366 mentioned above.[95]

A harpsichord is mentioned in a Ferrara inventory of 1598 as having split sharps.[96]

91 Van der Meer, «Partiell und vollständig», instrument no. 125.
92 See Vinicio Gai, *Gli strumenti musicali della corte medicea e il museo del conservatorio ‹Luigi Cherubini' di Firenze*, Florence 1969, p. 8. (Dominicus), p. 7 (Zenti).
93 See Wraight, *The stringing*, Part 2, p. 151, the instrument numbered W437.
94 See Frederick Hammond, *Girolamo Frescobaldi*, Cambridge, MA. 1983, p. 364, note 28.
95 See note 80. This instrument is one of the two cited by Stembridge in Wraight & Stembridge, «Italian Split-Keyed Instruments», p. 161.
96 Cited by Stembridge, «Italian Split-Keyed Instruments», p. 160. This is no. 2804 in Durante & Martellotti, *Cronistoria*, 205 (doc. A209), dated 21 October 1598, «Un instrumento adorato con la tastadura tagliata da due registri, n.1» but this might be one of the instruments mentioned above (see note 80), without reference to the organ. Slight differences in the descriptions of each inventory make it difficult to track the instruments.

A list of surviving virginals with more than 12 notes per octave

STEFANUS BOLCIONIUS 1629 [A], Deutsches Museum, Munich, no. 9231
C/E-f^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}
This was previously known as «Petrus Centamin 1711» but is signed on the reverse of the nameboard «Stefanus Bolcionius Pratensis 1629» and a moulding comparison confirms that Bolcioni was the maker.

STEFANUS BOLCIONIUS 1627 [A], Musée de la Musique, Paris, no. E.980.2.638
C/E-f^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}, d♯^{2}
Formerly known as «Viti de Trasuntinis 1601» from a faked signature, but there is also a faded one by Bolcioni. Moulding comparisons also confirm he was the maker.

STEFANUS BOLCIONIUS 1641 [A], Musikinstrumenten-Museum, Leipzig, no. 09.279
C/E-f^3 + F♯, G♯, a♭, a♭^{1}
Signed «Stefanus bolcionius Pratensis 1641».

STEFANUS BOLCIONIUS 16?? [A], Washington, DC, no 60.1392
C/E-f^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}
«Ionnes Batt Boni da Cortona fecit Anno 1617» is on the nameboard but a moulding comparison shows that Bolcioni was probably the maker.

W451 POGGI [A], Musée Instrumental, Conservatoire Royale, Brussels, no. 1596
C/E-f^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}

W440 POGGI [A], Musikmuseet, Stockholm
C/E-f^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}

W327 POGGI [A], Russell Collection, Edinburgh, no. 45
C/E-f^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}

W21 POGGI [A], Liverpool Museum (accession no. 1967.161.13)
C/E-f^3 + F♯, G♯, d♯, a♭, d♯^{1}, a♭^{1}
This has a faked signature «Baffo 1581».

Documentary evidence

A Florentine inventory at the Medici Court of October 1640 records two spinette with five split sharps which were probably made by Bolcioni and might therefore have had the following compass:[97]
C/E-f^3 + F♯, G♯, d♯, a♭, d♯^{1}

From these surviving instruments it is clear that the additional accidentals were usually d♯ and a♭. When a further accidental was provided it was usually a♯, indicating that the circle of fifths was extended in the direction of the sharps rather than complementing all the diatonic notes with major and minor thirds, which would have required a d♭. It is usual that when additional d♯ and a♭ notes were provided the short octave bass was complemented with F♯ and G♯. Only occasionally do we find Italian instruments which have F♯ and G♯ in the bass octave without additional split keys.[98]

When we consult the list of virginals it is apparent that all of the instruments were built in Florence by only two makers, Bolcioni and Poggi around 1620–1641. This corrects an earlier view of the œuvre according to which the work was also Venetian, formed before the new attributions were available. It can be estimated how popular such virginals with split sharps were in Florence, since these eight instruments represent a quarter of the virginals we can be sure were made in Florence in the same period. The four instruments which Bolcioni and Poggi each provided with divided sharps represent half of Bolcioni's known virginal output and a quarter of Poggi's recorded production.

In a similar fashion we can see the strong representation of the eight Roman harpsichords among the 17 instruments listed here. When we compare the number Roman harpsichords having split sharps with the *total* Roman harpsichord production for the same period, then 8 of the instruments (out of a total of 14) shows an even stronger preference for divided

97 Frederick Hammond, «Musical Instruments at the Medici Court in the Mid-Seventeenth Century», in: *Analecta Musicologica* 15 (1975), pp. 202–19, p. 204, also cited in Wraight & Stembridge, «Italian Split-Keyed Instruments», p. 161: «Stefano Strumentaio Dua Spinette stauatr:e della Cassa con cinque semituoni spezzati». Riccardo Pergolis suggests reading this as «due spinette staccate della cassa», i.e. not attached, or inner-outer instruments in our modern parlance. Patrizio Barbieri, «Gli Strumenti Poliarmonici», p. 89 note 23, has established that the terminology «attacato alla cassa» indicated in Rome an instrument which is not separable from its apparent outer case, or false-inner-outer as we now call it.

98 One example is the oval-shaped *spinetta* recorded in an inventory (see Gai, *Gli Strumenti*, p. 10) by Bartolomeo Cristofori of 1690 with the compass C/E-c^3 and F♯, G♯.

keys. Florentine harpsichords are less well represented with only two or three instruments.

The weighting which these statistics give to the popularity of instruments with split sharps could easily be substantially altered if it were possible to assign more of the several unsigned virginals and harpsichords to Roman or Florentine production. Nevertheless, the data avilable suggests that the manufacture of virginals and harpsichords with split sharps formed a significant part of the instrument makers' output in the first half of the 17th century.

Abstract

The article is a succinct survey of the whole field of the construction of Italian string keyboard instruments with divided accidentals. Twenty three multi-keyed instruments made between *c*1548 and *c*1650 are listed and briefly described together with illustrations of the keyboards used. These document the experiments with enharmonic instruments made by Vicentino and others. A complete checklist of surviving Italian instruments (15 harpsichords and 8 virginals) is presented. The recent identification of unsigned instruments now shows the extent that instrument making in Florence and Rome contributed to this œuvre between *c*1620 and *c*1650.

Zusammenfassung

Der Beitrag gibt einen knappen Überblick über italienische besaitete Tasteninstrumente mit geteilten Obertasten. Dreiundzwanzig «vieltönige» Instrumente, die zwischen etwa 1548 und 1650 gebaut wurden, werden kurz beschrieben, zusammen mit Abbildungen der verschiedenen Tastaturen. Sie dokumentieren die Experimente mit enharmonischen Tasteninstrumenten, wie sie von Vicentino und anderen in dieser Zeit angestellt wurden. Darüber hinaus wird eine vollständige Liste aller erhaltenen italienischen Instrumente dieser Art (fünfzehn Cembali und acht Virginale) gegeben. Die unlängst erfolgte Zuschreibung von unsignierten Instrumenten zeigt, dass sich vor allem Instrumentenbauer in Rom und Florenz zwischen etwa 1620 und 1650 daran beteiligten.