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# Henri Arnaut de Zwolle's *Clavicordium* And the Origin of the Chekker

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"When *I* use a word," Humpty Dumpty said, in rather a scornful tone, "it means just what I choose it to mean—neither more nor less."<sup>1</sup>

WHEN MODERN WRITERS use such words as *harpsichord*, *virginal*, and *clavichord*, there is little question about what they mean by these terms. Unfortunately it is not possible for us to impose these modern definitions retrospectively upon earlier writers, and consequently it may sometimes be better not to translate or even define too readily the names employed by earlier writers for the various keyboard instruments. Otherwise one runs the risk of neglecting certain intrinsic features and falsely attributing others. Even when the name, like the instrument itself, is obsolete—e.g., *chekker* or *dulce melos*—one cannot always be certain to what extent these terms are specific or generic.

John Henry van der Meer has written that "the spirit of Anglo-American detective fiction has rapidly spread among organologists,"<sup>2</sup> and this spirit can be applied not only to such mysteries as the original state of a certain Flemish harpsichord, but also to those like the identification of the "chekker." The application of various scientific disciplines can sometimes assist the process of logical inference that is at the heart of detective work. For example, the methods of philology can resolve much seeming ambiguity in the inventory of the musical instruments of King Henry VIII;<sup>3</sup> the insights of a practical organ builder can shed light upon the twelfth-

This article is an edited excerpt from my forthcoming book entitled *Henri Arnaut de Zwolle on Small Keyboard Instruments*. I am grateful to Howard Schott, who read the penultimate version and contributed valuable suggestions.

1. Lewis Carrol (Charles Lutwidge Dodgson), *Through the Looking-Glass and What Alice Found There*, 1st ed. (London: Macmillan, 1871); *The Annotated Alice: Alice's Adventures in Wonderland & Through the Looking Glass*, illustrated by John Tenniel, with an introduction and notes by Martin Gardner (New York: Clarkson N. Potter, Inc., 1960), p. 269.

2. John Henry van der Meer, "More about Flemish Two-Manual Harpsichords," *Keyboard Instruments: Studies in Keyboard Organology 1500–1800*, ed. Edwin M. Ripin (Edinburgh, 1971; republished ed., New York: Dover Publications, Inc., 1977), p. 49.

3. See Wilson Barry, "The Keyboard Instruments of King Henry VIII," *The Organ Yearbook* 13 (1982): 31–45.

century instrument described by Aelred;<sup>4</sup> the application of analytic geometry can tell us much about the nature of the keyboard chordophones described and illustrated by Henri Arnaut de Zwolle;<sup>5</sup> and the use of calculus can help determine the disposition of the positive organ depicted by Jan van Eyck in the altarpiece of St. Bavo, Ghent.<sup>6</sup>

The word *clavichord* literally means a stringed instrument sounded by means of a keyboard, which is exactly what we mean today by “keyboard chordophone.” Some commentators have inferred from this application of a generic term to a particular species that the clavichord was the first and originally the only species of keyboard chordophone; it is difficult to disagree. In some places the generic use of *clavichord* continued until quite late. For example, Pablo Nassare, writing in Zaragoza in 1724, stated that the Spanish word *clavicordio* was generic and included all types of keyboard instruments, including *claviorganos* (!).<sup>7</sup>

Elsewhere, however, the word *clavichord* was reserved at an early date for the instrument we call “clavichord” today. As early as ca. 1440, Henri Arnaut de Zwolle, a scientist in the service of Philip the Good, Duke of Burgundy, produced a manuscript<sup>8</sup> in which, among other things, he described and illustrated the principles of the design of three types of keyboard chordophones: the *clavisimbalum*, the *clavicordium*, and the *dulce melos*, making it appear that even at that date, to Arnaut, *clavicordium* was not a generic term. Arnaut writes:

. . . per illum modum forpiciis etiam posset fieri clavicordium quod sonaret / sicut dulce melos; similiter etiam posset fieri clavicordium sonaret ut clavisimbalum. . . .<sup>9</sup>

4. See Wilson Barry, “A 12th-Century English Organ,” *The Diapason* 74, no. 10 (October, 1983): 10–11.

5. Wilson Barry, *Henri Arnaut de Zwolle on Small Keyboard Instruments* (forthcoming), chaps. 4 and 6.

6. *Ibid.*, chap. 11.

7. Raymond Russell, *The Harpsichord and Clavichord*, 2d ed. rev., ed. Howard Schott (New York: W. W. Norton & Company, Inc., 1973), p. 116: “*Clavicordios* are of various different forms, varying both in size and in name; some are called *Claviorganos*, others *Clavicimbalos*, others *Clavicordios*, and others *Espinetas*.” See also *ibid.*, p. 66: “It must be borne in mind that the word *clavichord* was sometimes used generically in very early times, and thus covered plucked instruments as well as the real clavichord.”

8. Bibliothèque nationale, Paris, MS latin 7295; G. Le Cerf and E.-R. Labande, eds., *Les traités d'Henri-Arnaut de Zwolle et de divers anonymes* (Paris: Editions Auguste Picard, 1932); reprint ed., with postword by François Lesure (Kassel: Bärenreiter, 1972).

9. *Ibid.*, fol. 129v.

(. . . through that [fourth] style of action it is even possible to make a *clavicordium* which sounds like a *dulce melos*; similarly it is even possible to make a *clavicordium* sound like a *clavisimbalum*. . . .)

This comment is in passing and seems to be completely incidental to the surrounding text, which is concerned with a detailed description of the design and operation of the three varieties of chordophones.

The clavichord depicted by Arnaut is a double-strung, fretted instrument with ten pairs of strings and a compass of *B* to *b''*, thirty-seven notes.<sup>10</sup> The thickness of the case walls is  $\frac{1}{2}$  *uncia* (12 mm.), and the dimensions of the soundboard are a nominal  $7 \times 32\frac{2}{3}$  *unciae* ( $173 \times 806$  mm.).<sup>11</sup> The height of the case walls is  $3\frac{1}{2}$  *unciae* (86 mm.); the soundboard is set  $2\frac{1}{3}$  *unciae* (58 mm.) below the top of the case, and beneath the keys, filling the entire case.<sup>12</sup> The bridge is straight and parallel with the ends of the case. The strings run parallel with the spine, and all the hitchpins are at the left-hand end of the case. As a consequence, all the strings are the same length; to tune the instrument one need only remove the listing, tune all twenty strings in unison (plucking the strings "with quill or stick" [*cum penna aut ligno*]<sup>13</sup>), and replace the listing. Obviously the scaling of Arnaut's clavichord is rigorously Pythagorean throughout the compass.

Arnaut's clavichord seems to have been strung in brass at Arnolt Schlick's low pitch (about A–392 Hz), with a scale of *c''* equalling 300 mm.,<sup>14</sup> which may be compared with G. Grant O'Brien's proposed Ruckers scaling for brass of 305 mm. (at the same pitch).<sup>15</sup> Arnaut's clavichord was a 2' in-

10. Edwin M. Ripin has demonstrated that Arnaut erred in depicting nine pairs of strings, and that this clavichord must have had ten pairs of strings. See Ripin, "The Early Clavichord," *Musical Quarterly* 53 (1967): 524–27.

11. There are grounds for believing that Arnaut used a medieval Roman *pes* amounting to about 296 mm., which was divided into 12 *unciae* of about 24.7 mm., which were further divided into 12 *lineae* of about 2 mm., and that his clavichord drawing was to the scale 1:4. These grounds are too involved for discussion here, but are fully explained in my forthcoming book, *Henri Arnaut de Zwolle on Small Keyboard Instruments*.

12. See Ripin, "The Early Clavichord," pp. 530–31.

13. See Standley Howell, "Paulus Paulirinus of Prague on Musical Instruments," this *Journal* 5–6 (1979–80): 14. Cf. Sibyl Marcuse, *A Survey of Musical Instruments* (New York: Harper & Rowe, 1975), p. 199.

14. The string length can be obtained by scaling off the drawing. The determination of the pitch and the brass stringing depends on the detailed analysis of all of Arnaut's keyboard instruments, both chordophones and organs. These questions are beyond the scope of the present paper, but are fully discussed in my forthcoming *Henri Arnaut de Zwolle on Small Keyboard Instruments*.

15. See G. Grant O'Brien, "The Stringing and Pitches of Ruckers Instruments," *Colloquium. Ruckers klavecimbels en copieën: Universele instrumenten voor de interpretatie van de muziek uit Rubens tijd* (Antwerp, Museum Vleeshuis, September 30–October 2, 1977), ed. J.

strument, apparently an octave higher in pitch than Arnaut's larger organ, but actually only a fifth higher because the organ was at Schlick's *high* pitch (about A–523 Hz). (The "4'" low C of the organ was only a nominal 3' in length.) Arnaut's tuning (*not* temperament) was very similar to that described by Martin Agricola: the eight natural notes, including both B (B♭) and H (B♯), were tuned as perfect fifths, and the four sharps were tuned as schismic, or nearly pure, thirds.<sup>16</sup>

Arnaut's *clavicordium* may be viewed as a set of monochords applied to the (finger-scale) keyboard of the positive organ. Two innovations to the keyboard were required to effect this application: (1) the keys could no longer be pivoted at their tails, but needed a central balance rail, so that the tail rose as the head went down; and (2) the keytails, with their tangents, had to be located precisely at the position dictated by the vibrating string length, i.e., spread out in the tenor and crowded together in the treble. The keys were made sufficiently long to reach the spine, where a rack, or *diapason*, with accurately located saw kerfs, positioned and guided the keytails. The reconciliation between the spacing of the keyheads and the spacing of the keytails was accomplished by splaying the keys between the balance rail and the tangents.

One might well ask: beginning with the design of Arnaut's *clavicordium*, what changes would need to be made to produce an instrument that sounded like a dulce melos or a clavisimbalum? The following changes seem necessary:

1. The instrument can no longer be fretted, so the case must be widened and the number of strings increased from twenty to thirty-seven (or perhaps even seventy-four, if the "hammered clavichord" is double-strung).
2. The keytails are lengthened, so that they still reach the rack, and the tangents are replaced by actions of the first or fourth styles. Arnaut's "first style of jacks, and the better" were guided (at the bottom) by mortises in the keytails and (at the top) by pivots in the back of the wrestplank. However, in the *clavicordium* they would have required a separate pivot rail above the keys but below the strings.

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Lambrechts-Douillez (Antwerp: Ruckers Genootschap, 1977; The Brussels Museum of Musical Instruments, *Bulletin*, vol. VII-12-1977 [reprint, 1978]), p. 67. 289 mm. ×  $135/128 = 305$  mm.

16. Martin Agricola, *Rudimenta musices* (Wittenberg, 1539; facsimile ed., Hildesheim: Georg Olms Verlag, 1969), cited by Owen Jorgensen, *The Equal-beating Temperaments* (Raleigh: The Sunbury Press, 1981), p. 13. Arnaut describes and illustrates the lengths of both the organ pipes and the clavichord strings. Since these dimensions are given as Pythagorean proportions, they are independent of the determination of the scales to which Arnaut's drawings were made.

3. A single left-hand bridge is installed for each individual string and held in place by downbearing; and it is these bridges that determine the vibrating string length. The jacks and the keys are located at a suitable distance to the right of these bridges to achieve the desired plucking point.

4. Perhaps the listing is retained, as in the clavichord, to suppress the sympathetic vibration of the unplucked portion of the strings.

The resulting clavicordium that sounded like a clavisimbalum was tuned by removing the listing and all the individual bridges, and then tuning all the strings in unison. The soundboard was marked to show the proper location of each individual bridge. Now those early clavichords whose keys were above the soundboard were furnished with high right-hand bridges—like those of viols—and with high hitchpin rails, so that the strings could be carried sufficiently above the soundboard to allow clearance for the keyboard. Such a bridge may be seen on the clavichord of the Urbino intarsia.<sup>17</sup>

The individual left-hand bridges were equally high and were probably made by turning in a lathe. One can imagine them standing among the spreading keytails, marching across the soundboard in an oblique line, looking for all the world like the royal pieces in a chess game. A good nickname for such an instrument would have been *chekker*, i.e., chessboard.

A somewhat different, and possibly later, configuration of a clavicordium sounding like a clavisimbalum differed from Arnaut's model in the following ways:

1. The keys were below the soundboard.

2. The jacks were simple slips of wood, guided by mortises in the soundboard and in a lower counter-soundboard.<sup>18</sup> Their upward motion was checked by a jack rail.

3. The right-hand bridge was low—like that of a lute—and the individual left-hand bridges were the size of chess pawns.<sup>19</sup>

4. The soundboard (like that of a monochord) was scribed from front to back with lines showing the vibrating string length and perhaps also from side to side with lines showing the spacing of the strings. Thus each little bridge could be put back properly after tuning at the intersection of the two appropriate lines.

17. See Edmund A. Bowles, "A Checklist of Fifteenth-Century Representations of Stringed Keyboard Instruments," *Keyboard Instruments: Studies in Keyboard Organology 1500–1800*, ed. Edwin M. Ripin, plate 14.

18. See Frank Hubbard, *Three Centuries of Harpsichord Making* (Cambridge: Harvard University Press, 1965; reprint ed., 1967), p. 48.

19. It is interesting to observe that, beginning ca. 1600, there is evidence of some dulcimers with "chessmen" bridges. See David Kettlewell, "Dulcimer," *The New Grove Dictionary of Music and Musicians* (1980), vol. 5, pp. 695–704 (especially pp. 697–98 and fig. 4b).

This version of the instrument, with its keytails out of sight beneath the soundboard, with the soundboard ruled off in rectangles, and with “pawns” scattered over its surface, would all the more appropriately have been called “chekker.”

The earliest known reference to the chekker is dated July, 1360, when Edward III of England presented an *eschequier* to John II of France, then his prisoner, and the latest known reference is in a book by Antoine d’Arena first published in 1519.<sup>20</sup> If one can accept the foregoing chain of hypotheses, the chekker seems to have been the earliest form of the virginal, clearly exhibiting its ancestry by retaining the angled keys of the clavichord and the ruled soundboard of the monochord. The great advantage of this configuration is that, as with Arnaut’s clavicordium, the player need only tune all the strings in unison. On the other hand, the little “pawn-bridges” would have been a nuisance. A player who knew how to “lay the bearings” might well have glued them down permanently.

The next stage in the supposed transition would be new instruments furnished with glued-down “pawns.” The scribed lines of the soundboard would have been functionally superfluous in this version, although they might still have persisted as a vestige of the earlier tradition, or as a decorative detail. Such an instrument would still appropriately have been called “chekker” and would still have retained the splayed key levers of the clavichord.

Since maintaining the precise vibrating string length was no longer essential, however, one could as well have replaced the “chess pawns” with a single left-hand bridge. One can imagine two instruments, side by side, identical in every respect except that one, called “chekker,” has a row of “pawns” behind the jack rail, and the other, perhaps called “virginal,” has a left-hand bridge, or wand (Latin *virga*), behind the jack rail.<sup>21</sup> From a functional and tonal point of view, the two instruments could have been identical, but there was an obvious distinction in their appearance. The “pawns” that made the name *chekker* suitable for the first type also made this name inappropriate for the second. The application of the new term *virginal* to the second type could thus have been almost inevitable.

20. The thirty-one known references to the chekker are quoted in their entirety in chronological order in the appendix to Edwin M. Ripin’s “Towards an Identification of the Chekker,” *Galpin Society Journal* 28 (1975): 11–25.

21. The derivation of “virginal” from *virga* (“wand” or “rod”) was first proposed by Curt Sachs, *Real-Lexikon der Musikinstrumente* (Berlin, 1913; reprint ed., New York: Dover Publications, Inc., 1964), p. 416, but Sachs supposed that the “rods” were the jacks.

Edwin M. Ripin seems almost to have predicted the possibility of such an identification of the chekker:

Was the chekker an instrument unlike any known to us from surviving examples or was the name applied to an instrument that we now know by another name? Or, to ask the same question in another way, does the gradual disappearance of the term "chekker" in the 16th century indicate the gradual falling into obsolescence of a unique instrument or does the disappearance of the term merely mean that another name for the same instrument replaced "chekker" and its cognates during the 16th century?<sup>22</sup>

Arnaut uses the expression "it is even possible to make" (*etiam posset fieri*) several times throughout his manuscript. Since Arnaut was a professional scientist—simultaneously a physician, astronomer, astrologer, physicist, and mechanic to the Court<sup>23</sup>—rather than a musician or a builder of instruments, it may be, in some instances, that when Arnaut tells us that a certain variant configuration beyond the ordinary is possible, he is describing an invention of his own, or even an idea for an invention, seldom or never actually realized in concrete form. Among the things that are "even possible to make" are a clavisimbalum double-strung vertically, a clavisimbalum with hammer action (a fortepiano in modern terms), an alternative wind apparatus for the *portivus* consisting of a single feeder surmounted by a reservoir (a surprisingly modern idea), and, of course, a hammered clavicordium.

The possibility of a clavichord with hammer action has caused some commentators to remark that Arnaut was describing a square piano three centuries before its supposed invention.<sup>24</sup> Arnaut's clavichord with hammer action would have differed from his clavichord with jack action only in the action itself; the individual left-hand bridges would have been the same. Thus, if the distinguishing feature of the chekker was individual turned left-hand bridges, theoretically there would seem to have been four possible varieties of chekkers:

22. Ripin, "Towards an Identification of the Chekker," p. 11.

23. Karl Bormann, *Die gotische Orgel zu Halberstadt* (Berlin: Verlag Merseburger, 1966), p. 147.

24. The invention of the square piano has been attributed to the Swabian Johann Socher, shortly before 1742. See Sibyl Marcuse, *Musical Instruments: A Comprehensive Dictionary*, 2d ed. (New York: W. W. Norton & Company, Inc., 1975), p. 491. See also Marcuse, *A Survey of Musical Instruments*, p. 327; and Donald H. Boalch, *Makers of the Harpsichord and Clavichord 1440–1840*, 2d ed. (Oxford: Oxford University Press, 1974), p. 168. The mere fact that the earliest known dated square piano is signed by Socher does not prove that he invented the instrument.



- Type 1. Keys above soundboard; plucking action
- Type 2. Keys above soundboard; hammer action
- Type 3. Keys below soundboard; plucking action
- Type 4. Keys below soundboard; hammer action

Types 1 and 3, with the form of the clavichord, the action of the harpsichord, and the individual turned left-hand bridges of the chekker, would seem to have been the prototypical virginal. Types 2 and 4, with the form of the clavichord, the action of the dulce melos, and the individual turned left-hand bridges of the chekker, would seem to have been the prototypical square piano.

Previous efforts to identify the chekker have been plagued by the ambiguity of the references in early literature. Francis W. Galpin<sup>25</sup> proposed that the chekker was a variety of Arnaut's dulce melos provided with a separate string for each note. Curt Sachs<sup>26</sup> and Edmund A. Bowles<sup>27</sup> have suggested that the chekker was a clavicytherium. Ripin<sup>28</sup> examined all of the early references, the hypotheses of Galpin and Sachs, and possible explanations for the name *chekker*, and concluded "that the chekker was in fact only a clavichord." Sybil Marcuse<sup>29</sup> wondered whether the chekker could have been an upright clavichord. Christopher Page<sup>30</sup> re-examined all of the evidence and argued effectively that none of the previous "theories are tenable in the form in which they have been proposed; not only are they based upon slender evidence—they are fundamentally misconceived."<sup>31</sup> Page concluded that there was insufficient evidence:

We must continue the fine work begun by Edmund Bowles and search for new pictorial sources; at present we have too few to proceed. And we must seek new literary references, asking ourselves "what was this chekker as known to this author at this time?"<sup>32</sup>

This ambiguity now seems very understandable, and it appears that if Galpin, Marcuse, and Ripin were not entirely correct in identifying the chekker, neither were they entirely mistaken.

25. Francis W. Galpin, "Chekker," *Grove's Dictionary of Music and Musicians*, 4th ed. (London: Macmillan, 1940), supp., pp. 118–19.

26. Curt Sachs, *The History of Musical Instruments* (New York: W. W. Norton & Company, 1940), pp. 336–37.

27. Edmund A. Bowles, "On the Origin of the Keyboard Mechanism in the Late Middle Ages," *Technology and Culture* 7 (1966): 153.

28. Ripin, "Towards an Identification of the Chekker," pp. 11–25.

29. Marcuse, *A Survey of Musical Instruments*, pp. 242–44.

30. Christopher Page, "The Myth of the Chekker," *Early Music* 7, no. 4 (1979): 482–89.

31. *Ibid.*, p. 482.

32. *Ibid.*, p. 487.

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The following definitions are therefore proposed:

The chekker was a keyboard chordophone in the rectangular shape of a clavichord and provided with individual turned left-hand bridges. One variety, furnished with the plucking action of the harpsichord, evolved into the virginal. Another, furnished with the hammer action of the dulce melos, was the earliest form of square piano.

The original virginal was exactly the same as the variety of chekker that was provided with plucking action and whose keys were below the soundboard, the sole distinction being that the individual turned left-hand bridges (Latin, *latrunculi* [pawns]) standing on a ruled soundboard (Latin, *scaccarium* [chessboard]) were replaced by a single left-hand bridge (Latin, *virga* [wand]) standing on an unruled soundboard.

A further point may be made: it seems that *clavicordium* was a generic term to Arnaut after all, to the extent that it included the instruments we now call “clavichord,” “chekker,” “virginal,” and “square piano.”

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