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luthiers developed the hurdy-gurdy that is the model for today's folk instrument. Chassaing's two essays on the hurdy-gurdy in the nineteenth century conclude the study section of the catalog. The first, "Spécificités de la vielle bressane," discusses the prominent hurdy-gurdy builders of Bourg-en-Bresse, the location of the exhibit. Several prospered in this area in the middle of the nineteenth century, taking as their models the instruments of the eighteenth-century Parisian family the Louvets. The work of those luthiers was a direct link between the nineteenth-century folk instrument and the "classical" hurdy-gurdy of the eighteenth century. Chassaing discusses the social conditions that allowed these makers to prosper. He points to the traveling musicians who played for weddings and balls in neighboring villages, who, far from being beggars, were true professionals. At the same time, bourgeois amateurs used the instruments in more intimate surroundings.

Chassaing's second essay traces the symbolism of the hurdy-gurdy from medieval times to the twentieth century. His central point is the continuity and interrelationship between themes associated with this symbolism. The first manifestation of the hurdy-gurdy was the eleventh-century organistrum, associated with the church. The blind beggars in subsequent centuries were in some sense supported and encouraged by the church. In the late eighteenth and early nineteenth century, as the wandering Savoyards succeeded the blind beggars, the hurdy-gurdy became a geographical signifier. While this article in some ways functions as a helpful summation, many of these connections seem to be a stretch.

Though the catalog of objects displayed gives a rather cursory description of the instruments, it provides a fairly extensive analysis of the art objects, in keeping with the emphasis of the exhibition. It would have been appropriate to devote more space to the instruments, since a number were originally collected by residents of Bourg-en-Bresse and are not on display in major collections. Nevertheless, this catalog, with its studies, illustrations, and analyses, is an essential acquisition for anyone interested in the hurdy-gurdy and its history.

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Patrizio Barbieri. *Enharmonic Instruments and Music, 1470–1900: Revised and Translated Studies*. Latina: Il Levante Libreria Editrice, 2008. xii, 616 pp.: 21 color illus., 126 black-and-white illus., 82 tables, 58 musical exx., CD. ISBN: 978-88-95203-14-0. €60,00 (hardcover).

Trained as an electronics engineer, polymath Patrizio Barbieri is also a musicologist, with interests in acoustics, organ building, gut strings, and temperaments. His bibliography runs to more than eighty articles and includes a book on temperament. He was awarded the American Musical Instrument Society's Frances Densmore prize in 2008, for his article "Roman and Neapolitan Gut Strings 1550–1950" (*Galpin Society Journal* 59 [2006]: 147–81). Now Barbieri, with his customary thoroughness and attention to the minutest detail, has compiled a book dealing with octave divisions of more than twelve notes ("compiled," because—as the subtitle indicates—much of the book is an updating of earlier articles and studies by the author). This is a complex subject, and those who fell into the rabbit hole of enharmonicism probably had more than just a little of the fanatic about them. To his credit, Barbieri treats the material in an entirely non-judgmental manner—something I would not have had the restraint to do—laying out the evidence and leaving it to his readers to rate it on their personal fanat-o-meters. The eleven chapters are lettered rather than numbered, and divided into three sections: open-chain systems, closed-chain systems, and a third section of four pages whose humorous contents I will not divulge.

Most of us understand the word "enharmonic" to refer to the equivalency of, say, G-sharp and A-flat on an equal-tempered keyboard or in tempered intonation; but in the world of enharmonicism it has a wider meaning. Let us begin at the beginning. We understand that in meantone temperament, where a keyboard's accidentals are usually tuned C-sharp, E-flat, F-sharp, G-sharp, and B-flat, these five notes are not enharmonic—that is, the C-sharp is not also a D-flat, the E-flat is not also a D-sharp, and so on. The practical result of this is that four major chords in meantone temperament (on B, C-sharp, F-sharp, and G-sharp) are dissonant enough to be unusable. This is an open-chain system, and composers seemed to accept this limitation without complaint. To most musicians of the sixteenth and seventeenth centuries, twelve notes per octave were quite sufficient. Nevertheless, there are circumstances where the restrictions of this scheme become a problem, such as the very real need of church organists to transpose. An upward transposition of a fifth, for example, requires a keyboard with an A-flat (in order to transpose to an E-flat); so keyboards with thirteen notes to the octave, including both G-sharp and A-flat, were not uncommon.

If one split accidental is good, two split accidentals, with G-sharp/A-flat and E-flat/D-sharp, are better, and there are many sixteenth- and seventeenth-century examples, lending ease to transposition. Splitting

all the accidentals is better yet, and if two more are added, between E and F, and B and C, a keyboard (usually a harpsichord, since organs with that many pipes start to become prohibitively expensive) with nineteen notes to the octave emerges. Now, however, we are no longer talking about transposition; this is an entirely different phenomenon, having to do with overcoming the limitations of meantone temperament by producing usable chords on every scale degree. Now we are headed into the rabbit hole. Harpsichords so disposed were common enough to have a name, the *cembalo cromatico*. Although the first known example of such an instrument dates from 1609, such keyboards were already discussed as early as 1555. These instruments were certainly not unusual, particularly in Italy, where such matters seem to have been taken far more seriously than elsewhere. But even nineteen notes per octave were not enough to achieve the holy grail of keyboard music: the ability to play all thirds and fifths in pure, beatless (simple ratio) just intonation. For this, it takes an *archicembalo* or *arciorgano* of thirty-one notes per octave (not really, since even thirty-one notes are not enough; but they come close), and the earliest known examples of both were built for the theorist and composer Nicola Vicentino around 1561. A fair amount of music was written for such instruments by composers such as Trabaci, Pesenti, and Maione.

Matters get more complicated—much more complicated. Barbieri explores the strange sound world of the Florentine humanist Giovanni Battista Doni, who in ca. 1635 proposed the revival of the diatonic, chromatic, and enharmonic genera as well as the *tonoi* of ancient Greek theory. Doni's ideas generated several instruments, including a ca. 1638–39 *triharmonic harpsichord* with three manuals, built by Giovanni Pietro Polizzino (the forty-five keys per octave are pictured on p. 241). Doni's most famous instrument is the *amphichordos* (pictured on p. 232), a “lyre” strung both front and back, intended for the playing of ancient Greek music. Doni rates two chapters (D and E), and both are pretty tough going. Barbieri navigates this material and its complex numerology with ease, but it does not make for undemanding reading.

The second part of the book is devoted to “Closed-Chain Systems.” Barbieri explains the desire for such systems. Start with a low C. Tune successive pure fifths on top of it. Thirteen fifths and seven octaves later you arrive at a B-sharp. Tune the first C up seven octaves and compare the two notes.

The B-sharp is sharper than the C by about a quarter of a tone—the Pythagorean comma. One way to close the system is to narrow each fifth by $\frac{1}{12}$ of the comma. Now, seven octaves of tempered fifths on top of

that C will result in an exactly equivalent B-sharp, thus closing the system through one cycle of fifths. This is, of course, our ubiquitous equal temperament, which, in temperament jargon, is ETS 12. Equal temperament proves the dictum implied (although never stated) throughout the book: in matters of temperament there is no free lunch, since the fifths will not be acoustically perfect (although they will be close; that is, they will be *nearly* whole-number ratios, sounding *nearly* beatless), and the thirds will be quite sharp. Barbieri devotes 226 pages to equal-tempered systems, describing ETS's of up to 136 divisions of the comma. Such a scheme, if realized in an instrument, would result in a keyboard of 136 keys per octave. Fortunately, there are physical limits.

One of the most interesting sections is the one describing the *tricembalo* of Scipione Stella, a musician who worked for the chromaticist Carlo Gesualdo. In 1594, inspired by hearing Luzzasco Luzzaschi (another chromaticist) play one of the *archicembali* constructed by Nicola Vicentino, Stella built one of his own, tuned in ETS 31. But Stella didn't stop at a mere thirty-one keys per octave; some notes were doubled to ease fingering difficulties, and the eight rows of keys numbered fifty-two per octave. Deeming this harpsichord too complicated in its tuning, the botanist Fabio Colonna made a similar instrument, the *Sambuca Lincea*, which he disposed as a clavichord—presumably at least partially fretted, thus reducing the number of rows of keys from eight to a mere six. Colonna's drawing of his keyboard and Barbieri's comparison of it and Stella's are shown on pages 406–7. The complexity is mind-boggling, but clearly an enharmonicist's passion knows no bounds.

The CD accompanying the book is a three-inch mini-disc, rather than the usual five-inch size, and I wonder why. Full-size discs are certainly cheap enough, and of the four CD players in my home, only one was capable of accommodating the smaller size. Other readers may not be as fortunate. The well-chosen examples were all electronically generated—unfortunate, but understandable given the expense, and in many cases the impossibility, of recording real-life instruments. In any case, close listening is advised.

There are some linguistic infelicities, such as printing Doni's given name(s) as Giambattista on page 180 and Giovanni Batista everywhere else—no doubt the result of the fragmentary nature of the book. Typographical errors, such as the one on page 325, section F.8.2, where the “n” is omitted from the word “and,” are few and inconsequential. The exhaustive bibliography, which lists forty-one of the author's own works, runs to thirty-nine pages.

A remarkable summing-up of nearly thirty years of research by Barbieri, *Enharmonic Instruments* is crammed full of minutely detailed information on enharmonicism, with the matters dealt with in this review representing only a portion of the total. Formulae, tables, charts, and mathematical explanations abound; but the material is accessible, and although not an easy read, it represents an exhaustive discussion of this arcane corner of our tonal system.

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Luisa Morales, editor. *Cinco siglos de música de tecla española / Five Centuries of Spanish Keyboard Music: Proceedings of FIMTE Symposia 2002–2004*. Garrucha, Almería: Asociación Cultural LEAL, 2007. 460 pp.: 9 color plates, 13 black-and-white plates, 62 illus., 52 musical exx. ISBN: 978-84-611-8235. €75,00 (paper).

This volume, the second in a series of publications from the Festival Internacional de Música de Tecla Española (FIMTE), contains selected papers in Spanish and English from the FIMTE symposia of 2002, 2003, and 2004. Several items are of interest to organologists and this review will focus on them.

During the 2002 FIMTE Symposium an exhibition entitled “The Origins of Spanish Keyboard Music” was on display at the Parador of Mojácar. A catalog corresponding to that exhibition is included in this volume. Twenty-two photographic plates depict keyboard instruments in Spain from the last decades of the thirteenth century to the end of the sixteenth century. Sixteen of these are iconographic representations of clavichords, harpsichords (one of which may be a keyed psaltery), and a virginal, all from Spanish sources. The other six photos are of Flemish stringed keyboard instruments related historically to Spain. These include the only extant instrument by Hans Bos, a virginal (1578) at the female monastery of Santa Clara in Tordesillas; a double virginal (1581) by Hans Ruckers the Elder found near Cusco, Peru, and now at the Metropolitan Museum of Art, New York; and a harpsichord (1601) by Andreas Ruckers in the Cathedral of Segovia. This pictorial catalog complements that of known historical Spanish keyboard instruments in Morales’s first publication, *Claves y pianos españoles: Interpretación y repertorio hasta 1830* (Almería: Instituto de Estudios Amerienses, 2003).