book reviews

paring metal away at strategic points; depending on whether metal is removed predominantly from antinodal or nodal areas (vibrating or non-vibrating areas), modes can be tuned up or down in frequency. Recently, science has helped to develop new types of bells. Traditionally, bells have a strong minor-third overtone, which is what produces their characteristic doleful sound. Rossing describes how the combination of traditional know-how with modern finiteelement methods has created a major-tuned carillon bell, now available commercially.

Rossing's account of the complex metallurgy and manipulations involved in steeldrum construction makes for similarly fascinating reading, especially when you consider that many pans are still constructed from used oil drums over an open fire in back-street workshops! The universal appeal of these steel drums is now creating such a demand that manufacturers are having to seek new materials and methods of construction. The sort of research and level of detail covered by this book should surely help in this goal.

In short, this is a very welcome book. It is fair to say that the science of percussion instruments would not have advanced anywhere near so far without the tireless enthusiasm and passion of Rossing and his students. Committing this vast experience to text goes a long way towards elevating the status of percussion instruments along-side those of the other instruments of the orchestra.

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Science in culture

The harmonious hand

Marin Mersenne and the science of memorized music. Martin Kemp

The history of the study of the human hand is permeated by a sense of awe. Described by Aristotle as the "instrument of instruments", the hand was seen as the unique tool of the intellect and as the bodily organ that best denoted the distinction of humans from "brutes". Not only was it wondrously engineered, but it also served as a subtle register of emotion, as a device for computation, as a formal means of communication in rhetoric and sign language, and as a prime visual site for the exercise of the 'art of memory'. In this last capacity, it performed a particularly notable role in music.

The eleventh-century theorist and teacher Guido d'Arezzo, who was responsible for important innovations in musical notation and sight-singing, is also credited with the invention of a much-used system that assigned musical pitches to the joints of the hand. In the words of the great seventeenth-century French composer Jean-Philippe Rameau: "It will be seen readily enough that the five fingers of the hand are very capable of representing the five lines upon which music is written: for if one contemplates or imagines the hand held well open, with the little finger nearest the ground, one may see the five lines with their spaces — which are gaps separating the lines formed by the fingers."

In an age where memorization of complicated sets and sequences was crucial, the Guidonian hand served as a significant aid in the learning of intricate scores, particularly by young singers. The many illustrations in manuscripts and printed books generally display the left hand, leaving the right index finger available for pointing by the instructor.

No one made more ambitious use of the hand

eelami Bajdred Cfol Gute Bolafol aalastri Bolafol Gelami Bolafol Gelami Gin Golafol Gelami Gin Golafol Golafol Gin Golafol Gin Golafol Golafol Gin Golafol Golafol Gin Golafol Golafol

b fa/ b fa/ a la/mids b fa/ a la/mids b fa/ a la/mids b fa/ f mi c sol/fa b fa/ t mi a la/mide b fa/ f mi c sol/fa t mi a la/mide b fa/ t mi a la/mide b fa/ t mi c sol/re/ut f fa/ut f as a site for musical notation than Marin Mersenne (1588–1648), Christian philosopher, mathematician, encyclopaedist of music, pioneer of acoustics and the man personally responsible for a pan-European 'internet' of correspondence on all manner of intellectual concerns. Among other claims to fame, Mersenne seems to have been responsible for the addition of the note *si* at the end of the sequence *ut* (later *do*) *re mi fa sol la*.

Characteristically, the French *savant* was not content to use the Guidonian hand merely as a memory device, but transformed it into a location for his all-embracing theories of universal harmony. His mission was to rework the mathematical foundations of music laid down by Pythagoras in order to accommodate polyphony and the new modes of consonance and dissonance, correlating ancient and modern theories. To accomplish this, he brought his considerable sophistication in advanced mathematics to bear on the physical processes in vibrating strings and bodies that generate sounds.

In his illustration of the harmonious hand, which appears twice in the second volume of his 1636 *Harmonie Universelle. Traité de la Voix et des Chants*, he shows on the left "the tetrachord divided into 12 sounds or 12 strings". Above, he demonstrates "the same divided into 9 strings". At the foot of the page he places "a composition by the same author [that is, Mersenne himself] in 8 parts". The text could not be more fitting: "Behold how good and how pleasant it is for brethren to dwell in unity."

Mersenne was a supreme representative of that philosophical, scientific and aesthetic tendency that aimed to establish a kind of 'unified field theory', in which every level of order in the universal and world systems was representative of the same underlying structures. To discern the harmonic architecture of these deep structures, the natural philosopher needed to divine the most abstract subtleties of mathematics and the actual properties of physical things. In this Mersenne was at one with the mathematician and astronomer Johannes Kepler.

The detailed components of the particular unity sought by Mersenne, not least the musical elements inherited from antiquity, did not survive later scrutiny. But his underlying ambition to place data from scientific experiment within the embrace of an overarching theory of mathematical organization is still recognizable as a potent motivation in modern physics. *Martin Kemp is in the Department of the History of Art, University of Oxford, 59 George Street, Oxford OX1 2BE, UK.*

The plate of the "Guidonian Hand" is on view at the exhibition "Writing on Hands: Memory and Knowledge in Early Modern Europe" at the Folger Shakespeare Library, Washington DC, until 4 March 2001.

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