The sixth article, "The Physics of Violins," by Carleen Maley Hutchins, provides basic technical information regarding the violin family and its historic development. She explains the new violin family of eight instruments which she was largely instrumental in designing and constructing. These instruments are scientifically designed as a well-integrated family ranging from a large bass to a small treble violin.

The seventh article, "The Physics of the Bowed String," by John C. Schelleng, explains what actually happens when a violin string is bowed. Using modern concepts and laboratory apparatus he shows the interaction between the bow, the string, and the instrument. This thorough study contributes greatly to a better understanding of how bow technique, the string, and the instrument influence the production of both normal violin tones and "wolf notes."

The last article, "Architectural Acoustics," by Vern C. Knudsen, deals with an important link in the chain of musical production and enjoyment. The fundamentals of reflection, defraction, and decay of sound waves in rooms are clearly presented along with the influence of resonances in rooms.

The authors demonstrate a thorough understanding of their subjects and make important contributions toward an accurate understanding of the physics of music that could be very helpful to musicians and music lovers. The articles also can create a better appreciation of musical instruments and for those who have helped in their development.

EARLE L. KENT
1600 Lawndale Road
Elkhart, Indiana 46514

The Unity of the Senses: Interrelations Among the Modalities

L. E. Marks

Academic Press, New York, 1978.
289 pp. Price $17.50.

This thoughtful and stimulating book provides a detailed analysis of the theory of sensory correspondences; that is, the assumptions and observations concerning sensory similarities and interrelations. The book is divided into two main sections. The first examines sensory correspondences from a philosophical and scientific point of view; the second is concerned with sensory correspondences as reflected in language.

In the first section, five major "Doctrines of Sensory Correspondence" are considered in detail. The first, the "Doctrine of Equivalent Information," states that different senses can provide us with the same information about the external world. The second, the "Doctrine of Analogous Sensory Attributes and Qualities," states that certain attributes are supersensory, i.e., they are not limited to a single sensory modality. The third, the "Doctrine of Common Psychophysical Properties," states that the different senses may react to impinging stimuli in analogous fashions, so that there exist certain universal psychophysical principles. The fourth, the "Doctrine of Neural Correspondences," states that there are neural analogues to the sensory correspondences postulated in the first three doctrines. This doctrine states, therefore, (a) that special neural mechanisms integrate information from the different senses, and (b) that when sensory processes are analogous for different modalities their underlying neurophysiological processes are also analogous. The fifth, the "Doctrine of the Unity of the Senses," interprets the different senses as modalities of a general, phylogenetically more primitive, sensitivity.

As Marks points out, several of these doctrines have their roots in the Aristotelian notion of a *sensus communis*, or common sense, which is postulated to exist at a level above that of the specific senses, and to mediate perception of those attributes which are not specific to any one sense. These attributes, according to Aristotle, are size, shape, motion, rest, number, and unity. The doctrines are also closely related to Locke's distinction between primary and secondary sensory qualities. Secondary qualities, such as color, pitch, cold, and warmth, are limited to a single sense, whereas primary qualities, such as shape or size, may be perceived through different senses. Such distinctions can be shown to lead to difficulties when viewed as philosophical theories about the world. However, Marks treats them instead as a set of empirical hypotheses concerning the organization of our sensory systems. He argues, for instance, that when cross-modal perception of size, shape, motion, or duration occurs, neural interactions between different sensory systems must necessarily also occur. Similarly, when we appreciate the presence of analogous attributes from different sensory modes, somewhere in the nervous system the appropriate sensory information must converge. From these and other arguments, Marks postulates that features of the environment which can be perceived alternatively through different senses, must be heteromodally represented in the nervous system. This, he asserts, is Aristotle's *sensus communis* in modern garb.

Although the book does not examine auditory perception in detail, the arguments advanced here have important implications for auditory theory. If Marks' reasoning is correct, then whilst certain aspects of auditory perception should be interpreted in terms of mechanisms that are specific to audition, others should be interpreted instead in terms of mechanisms that exist beyond the auditory system.

The final two chapters in the book deal with sensory correspondences as revealed in language, especially in poetry. For those interested in the scientific bases of aesthetic experience these chapters are very illuminating; particularly the last one which deals with synesthetic metaphor.

Altogether this is an admirable book; exceptionally well written, well organized, and challenging. In addition to its theoretical value for those engaged in the study of sensory mechanisms, the book could be used in upper division or graduate courses covering sensation and perception.

DIANA DEUTSCH
University of California, San Diego
La Jolla, California 92093

Éléments d'Acoustique Physique

Miguel C. Junger and Mariano Perulli

Maloine S. A. Éditeur, Paris, 1978.
191 pp. (in French). Price 128 FFr.

Most textbooks on any field of acoustics start out with an introductory chapter discussing basic properties of acoustic waves. The present volume is no exception but the authors make it a point early in the text to let the reader know that mathematical formulations do have their limitations when various physical constraints and parameters have to be considered. This attitude should be particularly valuable to students and technicians for whom the book is written.

The book, the second in a series of Collections of the University of Compiegne, deals with some elements of physical acoustics which are based largely on material covered during university lectures. The pedagogical value of the work is enhanced by occasional excursions into other fields of physics, e.g., the development of the wave equation is augmented by appropriate sections taken from courses in fluid mechanics, thermodynamics, and vector analysis.

The introductory chapter is followed by sections on sound sources. Here the authors develop the topic by starting with the description of a pulsating bubble reduced to a point source and then go on through dipole radiation to piston and other plane sources. This chapter is handled very thoroughly and includes guidelines for the student for accomplishing some integrations, and a comprehen-