the precise frequency with which certain style characteristics occur. Instead, expressions like "sometimes" or "quite often" are employed. For example, Dr. Benton observes that "*sometimes* [italics mine] the second theme-group begins with material similar to that of the first group but in a related key and treated differently" (p. 155). She then gives two musical examples which illustrate this procedure. One would like to know exactly how frequently this does occur. Then one could determine whether Hüllmandel employs this procedure more or less often than other composers. There are other advantages in tabulating the precise frequency of the style characteristics studied. One is that such a tabulation tends to oblige the writer to define the characteristics with greater care. Another is that it assures the reader that the writer has not relied merely upon his general impressions when making statements of frequency.

My last two paragraphs should not obscure the fact that Dr. Benton has written a good book that is of real value to students of 18th-century music.

ROGER KAMIEN teaches at Queens College. He completed his dissertation on problems of 18th-century musical style at Princeton, 1964.

Arthur Michael Daniels
The De musica libri septem
of Francisco de Salinas

Ann Arbor: University Microfilms (UM order no. 62-6046), 1961. (535p., pos. film $6.80; University of Southern California diss.)

Peter Bergquist

Arthur Daniels' dissertation is a detailed study of Salinas' *De musica* (Salamanca, 1577; facsimile reprint, ed. Kastner, in *Documenta Musicologica,* Bärenreiter, 1958) based on a complete translation from the original Latin. *De musica* is a massively learned treatise on harmonics and metrics by a blind organist who was also one of the most eminent musical scholars of his day. In this work Salinas is concerned with music only as a mathematical science and touches on problems of composition and performance peripherally as they impinge on harmonics and metrics. Yet, he is not so doctrinaire as to reject the testimony of the ear; he emphasizes throughout that sensory perception must join with reason in the study of music. Reason is the ultimate authority and must supply proof for what the senses perceive as correct, since the unaided senses may judge

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defectively. But reason should not lead one to take a position that is completely opposed by the ear.

This attitude is the rationale for Salinas' preference for justly tuned consonances rather than the harsher Pythagorean intervals; not only do the just intervals sound better, but their numerical description and derivation is simpler and more logical. Salinas' classification of the perfect fourth is also affected by this attitude. He insists that the fourth is consonant because its numerical ratio is simple, because the simplest division of the octave (2:3:4) produces the fifth and fourth, and also because it is almost always found at the end of compositions as part of a fully consonant sonority. But he does acknowledge that the fourth can seldom stand alone and ordinarily requires the support of the fifth below. Thus he arrives at the same position taken by composers and most practical theorists of the period.

De musica is divided into seven books, the first four on harmonics, the last three on metrics. Book I, as Daniels describes it, is "one of the most comprehensive expositions of neo-Pythagorean number theory ever written by a music theorist." In Book II Salinas studies the numerical ratios which define intervals and classifies the intervals as consonant or dissonant. Salinas here begins to expound his preference for just intervals, a central concern of the books on harmonics. Daniels suggests that Salinas reflects the increased interest of 16th-century composers in the full triad. Similarly, the account of the diatonic, chromatic, and enharmonic genera in Book III reflects the greater interest of composers in chromaticism. This section culminates in Salinas' ideal tuning which includes 24 tones to the octave and achieves just harmony throughout the circle of fifths. Book III also contains detailed descriptions of three meantone temperaments for keyboard instruments and one equal temperament for fretted instruments. The three meantone temperaments reduce the perfect fifth respectively by 1/3, 2/7, and 1/4 of the syntonic comma. The first was invented by Salinas, the second by Zarlino, and the third was first described by Pietro Aaron. Salinas intends that all should be applied to an octave of 19 tones in order to equalize the greater and lesser tones of just tuning, an adjustment which he recognizes as a practical necessity for keyboard instruments since they cannot achieve the perfect tuning and fine gradations of which the human voice is capable. The work on tuning and temperament is one of Salinas' major claims to fame. He is credited with the first precise mathematical definition of equal temperament, and his 24-tone division of the octave is one of the earliest and best multiple division, according to J. Murray Barbour.

Book IV concludes the study of harmonics with an extensive account of the Greek tonal systems, containing what is still one of the clearest explanations of the difference between *harmoniae* and *tonoi.* Salinas was one of the first musical scholars to obtain an extensive knowledge of the original sources of Greek theory, and his lucid presentation shows how well he mastered this material. He acknowledges also the

confusion among the sources on some points and states that not everything in these writings can be clarified completely, an admission which only increases one's respect for his ability to unravel as much as he did. Book IV concludes with a detailed critique of several ancient and contemporary theorists, especially with regard to their adherence to or deviation from just intonation. Salinas does not hesitate to criticize the most eminent figures; the Pythagoreans, Aristoxenus, Ptolemy, Gafori, Glareanus, and Zarlino are among those who suffer his closely reasoned censure.

The three books on metrics present their material in a largely traditional and uncritical manner. Book V defines and classifies rhythm and poetic feet, Book VI treats meter, and Book VII explains verse construction. This last book contains the examples of Spanish and other folk music which have been Salinas' chief claim to fame. Daniels asserts that the inclusion of these tunes is not the most valuable feature of Salinas' treatise, because they are intended only as illustrations of poetic meters and are not studied from any other point of view. Moreover, many are fragmentary. Although they are valuable as examples of 16th-century folk music, Salinas was interested in them not as such but only as accessories to his humanistic aims. The most important part of the treatise is certainly the section on harmonics. Daniels says as much, devotes the bulk of his study to the first four books, and passes over the last three almost completely except for transcribing and commenting on the examples of folk song.

Daniels' study is admirably thorough, very well written, and extremely readable, despite the technical nature of much of it. The extensive quotations Daniels has included, frequently entire chapters, add even more to the value of his work. No major errors of fact are apparent. The only mis-statement I found was the observation on p. 414 that Gafori's "treatise in the vernacular" must be lost. In fact, Salinas was referring to Gafori's *Angelicum ac divinum opus musicai* (Milan, 1508), of which all but the title is in Italian. This is plainly a small matter and hardly a serious reflection on Daniels' work.

In his opening chapter Daniels develops the idea that music and the other arts of the Renaissance reveal a common belief in the mystical power of number to express universal truth. This explains why Salinas emphasized harmonics rather than practical music in *De musica.* Daniels cites later examples of a similar attitude, in Helmholtz for one, and ties it further to the growth in the 20th century of interest in mathematical acoustics, in Hindemith's theories, in serial music, and in writings of such people as Milton Babbitt. He closes with a quotation from Lord Kelvin to the effect that what we can measure numerically we know, and only what we can measure do we know. Salinas' approach surely has something in common with the other figures Daniels names, but to go so far as Kelvin perhaps overstates the intention of Salinas and the other musicians mentioned. Other modes of knowledge than the numerical are possible, and in

an art such as music, perhaps preferable. One can measure endlessly and still fail to understand the nature of a work's musical language or esthetic value. Numerical measurement unquestionably has its uses, but a book like *De Musica,* that concentrates exclusively on measurement, is somewhat limited in value and interest when compared with the work of other theorists from the same period such as Zarlino, who treat more immediately and extensively the design of the art-work and the methods of its composition and performance. Writers such as Zarlino and Gafori say much more about what musicians now want and need to know regarding Renaissance music than Salinas.

These reservations aside, Salinas still deserves our attention as a distinguished musical humanist, for the light his work sheds on the history of music theory in general, and possibly for what he might contribute to present attempts to find alternatives to equal temperament. Daniels' study is an ideally thorough treatment of Salinas' work and can be heartily and unreservedly recommended to anyone concerned with music theory of the Renaissance.

PETER BERGQUIST completed the Ph.D. in musicology at Columbia University in 1964, and is presently assistant professor at the University of Oregon. His dissertation treats the theoretical writings of Pietro Aaron.

Wallace C. McKenzie, Jr. The Music of Anton Webern

Ann Arbor: University Microfilms (UM order no. 60-2792), 1960. (507 p., pos. film $6.45; North Texas State College diss.)

Dika Newlin

Reading this thesis reminded me anew how much progress we have made in accepting contemporary musical trends as fit subjects for musicological research. Such was not always the case. I vividly remember the furor caused twenty years ago when it was announced that my Columbia thesis subject would be *Bruckner, Mahler, Schoenberg.* What! a thesis partly about a still living composer? Horrors! Thus the reaction of a sizeable portion of the musicological world. Thanks to enlightened advisors, the project was nonetheless fulfilled, and I like to think that this pioneer work helped prepare for the greater liberality of today in this respect.

When reading this work, it is necessary to remember that it was finished in 1960. Of course, more Webern material has come to publication since then. There are the Webern essays *Der Weg zur neuen Musik,* the Jone-Humplik correspondence, Kolneder's study in the