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Book Review: Emblems of Mind, The Inner Life of Music and Mathematics, by Edward Rothstein

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Emblems of Mind: The Inner Life of Music and Mathematics. Edward Rothstein. Times Books: New York, 1995. 263 pp, ISBN 0-8129-2560-2.

While many writers have commented on mathematics and music, this author ultimately pursues a deeper relationship between those subjects. The connection that the author describes and promotes is along aesthetic, philosophical, even religious lines. Rothstein's credentials indicate that he is definitely up to the task. He has studied graduate-level algebra, analysis and topology as well as music and literature. He is an award-winning musical critic and chief musical critic of The New York Times.

To support his arguments, Rothstein calls upon a veritable cast of superstars of Western thought and art. To evoke a feeling for the inner life of the two subjects the author makes references to the works of Cantor and Chopin, Dedekind and Debussy, Helmholtz and Haydn, and many others. Many wonderful quotes

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"May not Music be described as the Mathematics of sense, Mathematics as the Music of reason?"

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are sprinkled throughout the book, which give testimony from great thinkers as to a math/music connection. Here is one from James Sylvester: "May not Music be described as the Mathematic of sense, Mathematics as the Music of reason?" From musician Igor Stravinsky: "The musician should find in mathematics a study as useful to him as the learning of another language is to a poet."

In order to make the connection comprehensible, there is of necessity a good deal of preliminary spadework. This is done in the first three chapters, appropriately

titled, "Prelude", "Partita", and "Sonata." In Prelude, Rothstein adopts as a guiding metaphor for the entire book, the journey of William Wordsworth to the peak of Mount Snowdon.

In "Partita", Rothstein discusses the inner life of mathematics. Although the discussion is declared to proceed heuristically, and to be sparing on details, two proofs of the infinitude of the set of primes are pre-

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sented, compared, and contrasted. Additionally, fundamental concepts from set theory, analysis, and topology are described. The prerequisite for reading the book as given in the introduction is: no more than high school mathematics and no more music than what is learned in elementary school. A year of college-level mathematics would seem to be a more suitable prerequisite.

One of the longest chapters, titled, "Sonata", presents the author's opinion of the inner life of music. It is rich in musical nomenclature and references almost all the well-known composers of the past as well as the contemporary musician, David Lewin, who is described as a musical topologist. Some of the terminology of this chapter is a marriage of mathematical and musical terms such as, "musical regions with different centers of gravity," "continuous musical surfaces," and "musical modelling."

One of the goals of Chapter 4 is to convince the reader that it makes as much sense to call mathematics beau-

tiful as it does music. Rothstein backs up this premise with quotes such as this from Hermann Weyl: "My work always tried to unite truth with the beautiful; but when I had to choose one or the other, I usually chose the beautiful." The Cantor set, formulae involving pi, and several pages on the Golden Ratio are included as examples of beauty in mathematics.

In Chapter 5, "Fugue: The Making of Truth," the aesthetic/religious natures of mathematics and music are described to show what the author considers the really important connections of these subjects. We are

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reminded that both mathematics and music have been closely associated with religious ritual. How do mathematics and music seem so "other worldly" yet impact our lives daily? This question is not about the internal workings of the subjects but about how they "map into" the world - it is a question about meaning and truth. Rothstein describes mathematical proof as ritual and uses a quote from G. H. Hardy to support his contention: "If we were to push it to its extreme, we should be led to rather a paradoxical conclusion: that there is, strictly, no such thing as mathematical proof; that we can, in the last analysis, do nothing but point; that proofs are . . . gas, rhetorical flourishes designed to affect psychology."

We are finally prepared for the point: The mathematician, the musician, the poet, all imitate "Nature at work, reproducing in their creations the emblems that Nature had bodied forth in hers . . . A mathematician will spin out a new theory or a composer create a miniature sonic universe; a poet will turn an experience into metaphor, a scene into a source of illumination. And each creator will, 'mid circumstances awful and sublime,' be as astonished by the result as was Kepler or Bach."
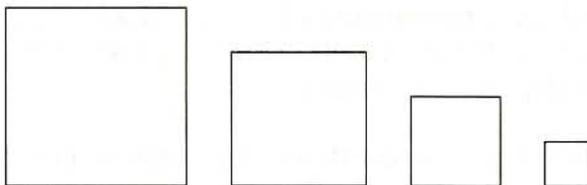
The book is really a wonderful work which glorifies two subjects of great importance to any civilization. It would be excellent as a required or ancillary reading in a Liberal Arts Mathematics course.

Mathematical Rebuses

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$$\begin{pmatrix} M & R & X \\ R & A & I \\ X & I & T \end{pmatrix}$$ = Symmetrical Matrix

 = Method of the Littlest Squares