

INTRODUCTION

PYTHAGOREAN LAMBDOMA HARMONIC KEYBOARD—SYSTEM ANALYSIS

Barbara Hero, inventor of the Pythagorean Lambdoma Harmonic Keyboard (PLHK), got the inspiration for her life's work from a book she found at the Boston Public Library in 1968: *Tone: a Study of Musical Acoustics* by Siegmund Levarie and Ernst Levy, both of whom were professors of music at Brooklyn College at the time. *Tone* was the accompanying text to a curriculum Levarie and Levy had developed together, to teach students about the foundations of the Western standard tuning system, the harmonic series, and the science of acoustics.

The primary philosophical and scientific basis of their discussion in *Tone* was a mathematical construct credited to the grandfather of philosophical practice and father of Western music theory, Pythagoras. This construct is known as the Pythagorean Table, and is sometimes referred to as the Pythagorean Lambdoma. Levarie and Levy had learned of the Lambdoma from the writings of German "harmonicist" Hans Kayser (1891-1964), who in turn had discovered the Lambdoma in the writings of the Prussian scholar Albert Freiherr von Thimus (1806-1878). Von Thimus had read of the Lambdoma in the writings of neo-Pythagoreans such as Iamblichus (c. 245-c. 325 CE) and written of it in his own masterwork, *Die harmonikale Symbolik des Alterthums* ("Harmonic Symbolism in Antiquity," 1868).

The Pythagorean Table is an infinitely extendable grid of ratios, starting at its apex with 1/1 and extending along one arm to $x/1$ (where x = any number greater than 1, up to infinity) and along the other arm to $1/x$. The Table is, in musical terms, a map of all conceivable tonal relationships; after all, from the first theorists of antiquity to the modern practitioners of Just Intonation, harmonic intervals were first defined by their basis in mathematics and acoustics—as ratios of whole numbers. The $1/1$ — $x/1$ arm of the Table represents the ascending harmonic series, and the $1/1$ — $1/x$ arm represents the descending subharmonic series.

Levy went on to write another Lambdoma-inspired work, *A Theory of Harmony*, where he uses the Table as the basis of his own set of harmonic laws. He saw this work as a means of establishing a link, in his own work as a composer, between the harmonic symbolism of Kayser and the modern musical theories of Hugo Riemann. However, Levy always remained firmly ensconced in 12-tone equal temperament, adapting the Just Intonation musicality of the Lambdoma into a standard tuning paradigm—the musical equivalent of forcing a square peg into a round hole.

Hero designed the full PLHK with a 16 by 16 Lambdoma, resulting in a 49-tones-to-the-octave Just Intonation system, spread out over 256 keys and an eight-octave range. In her instrument we have the opportunity to appreciate the musicality of the Lambdoma in its original and uncorrupted form. Perhaps even more interesting, the Lambdoma provides a unique opportunity for reevaluation of the original theoretical ideas of Hugo Riemann, the 19th century German music theorist who inspired many 20th century "Neo-Riemannian" theorists such as Richard Cohn, Brian Hyer and David Lewin. Riemann's original version of the *Tonnetz* was conceived in Just Intonation, and has much in common with the Lambdoma.

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Through analysis of the Lambdoma system, and the ability to hear all intervals of the Lambdoma in just tuning, we are given the chance to ponder: just how much are the commonly accepted principles of Western music theory applicable to the pure interval system of the Lambdoma? Must all its concepts be abandoned at the Lambdoma's gates, or are at least some of its truths universal in nature?