RE: PSEUDO-SCIENCE IN MUSIC

By John Backus

Joseph Schillinger (1895-1943) was a well-known teacher of musical composition in New York City. He included among his students a number of established musicians, the most famous being George Gershwin, who, it is claimed, wrote Porgy and Bess under Schillinger's tutelage.[1] His teaching career became important enough to warrant mention in Collier's Encyclopedia, Baker's Biographical Dictionary of Musicians, and other reference works.

The results of these years of teaching are embodied in two books. The first of these is The Schillinger System of Musical Composition (Copyrighted 1946 by Carl Fischer, Inc., New York. Subsequent excerpts quoted with their permission.) The second book is entitled The Mathematical Basis of the Arts (published in 1948 by the Philosophical Library). The first is a compilation of the material Schillinger used in his teaching, the second includes the results of his investigations in the fields of art and design as well as music.

These two works are quite formidable. Composition runs to 1690 pages in two large volumes. Each volume is divided into sections, beginning with Book I, "Theory of Rhythm," in Vol. I and concluding with Book XII, "Theory of Orchestration," in Vol. II. In addition to a large number of musical examples, the work contains quantities of mathematical symbols, algebraic expressions, tables, and graphs. Mathematical Basis uses a more concise 696 pages; it has an even greater density of mathematical language, and contains in addition a considerable number of complicated geometric patterns. Both works give the appearance of requiring years of study for their mastery.

The aims of these works are awe-inspiring. Composition opens with a preface, "Overture to the Schillinger System," by Henry Cowell, who says: "The idea behind the Schillinger System is simple and inevitable; it undertakes the application of mathematical logic to all the materials of music and to their functions, so that the student may know the unifying principles behind these functions, may grasp the method of analyzing and synthesizing any musical materials that he may find anywhere or may discover for himself, and may perceive how to develop new materials as he feels the need for them." In the subsequent laudatory Introduction by Arnold Shaw and Lyle Dowling, Composition is described more concisely with the broader statement: "The Schillinger System is a synthesis of musical theory and the most recent discoveries of modern physics, psychology, and mathematics. Historically, it represents the first successful effort to classify scientifically the resources of our musical system." Finally, Schillinger himself says of Mathematical Basis: "Its goal is to disclose the mechanism of creatorship as it manifests itself in nature and in the arts."

1. For an evaluation of this claim, see David Ewin's biography of Gershwin, A Journey to Greatness (Henry Holt, N.Y.), p.243 ff.

These are substantial goals indeed, and one might well wonder with some anxiety to what extent Schillinger has realized them. If the composition of music can be reduced to the application of mathematical logic, it is high time we realized the fact and incorporated it into our musical thinking. Two possible consequences come to mind: on the one hand, so much new material would be available to composers that music would grow and blossom rapidly in fresh directions, dwarfing in new glory all that has been done before; on the other hand, with composing reduced to mathematical principles, practically everyone could be his own composer, and music might smother in its own surfeit. Either of these consequences seems important enough to warrant an evaluation of Schillinger's work.

A search of the professional journals unfortunately does not help us to arrive at such an evaluation. Reviews of Composition upon its publication cover quite a range of opinion. There is praise of the work as a great advance in revitalizing musical theory and placing it on a scientific foundation [1;2], complaints about its mathematical approach [3;4], and assertions that the whole thing is worthless [5;6;7]. In a very conscientious and careful review [8] J. Murray Barbour concludes that the claims made by Shaw and Dowling regarding the value of the work are not substantiated by a critical examination, and that Schillinger is not as competent an authority in all fields of music as he pretends to be.

Aside from the reviews, there is very little mention of Schillinger in the literature, and that which exists has generally a little of the flavor of patent medicine testimonials.[2] Nowhere is there an evaluation of the scientific and mathematical foundations of Schillinger's system to help the non-mathematical musician assess its importance. Musicians in general seem rather unwilling to discuss the subject; not being mathematicians and scientists, they are understandably reluctant to criticize a system which claims to have a foundation in mathematics and science. Even if its musical results do not amount to much at present, there is the possibility that basically it is sound and will ultimately realize the claims made for it by its spokesmen.

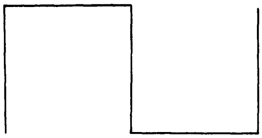
Let us therefore examine as much of Schillinger's work as may be necessary to evaluate its soundness in the areas of science and mathematics.

Composition begins with Book I, "Theory of Rhythm." An editorial preface states that this theory is basic to the entire work, so we shall examine it in detail.

Chapter I begins with a discussion of graphs, illustrated by the representation of a simple musical sound such as the sound wave from a tuning fork (the curve mathematicians call a sine wave). In the discussion of this curve on p. 2, we find two errors: the word phase is used incorrectly, and the term amplitude is taken to be synonymous with intensity. Physically, intensity is proportional to the square of the amplitude of a simple sound wave, so the two words are not synonymous. However, we find on reading further that Schillinger actually

2. See, for example, The Musical Quarterly, Vol. 33 (1947):102.

wishes to define what he calls a "rhythm graph" which looks like this:



in which horizontal distances represent time and vertical lines represent the instant something happens, such as the sounding of a note. This graph has so little in common with the *sine* wave discussed earlier that the material of the first two pages of the book might just as well have been omitted.

Chapter 2, "Interference of Periodicities," discusses the "generation of resultant rhythmic groups as produced by the interference of two synchronized monomial periodicities." This highbrow language is apparently meant to add dignity to a very elementary process. This process Schillinger calls finding the "resultant" of two numbers or "generators," and is expressed as $r_{a \div b}$.

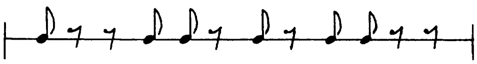
In trying to understand Schillinger's work, we are constantly beset by two difficulties. One is his use of familiar terms in other than the usual meanings; the use of the division sign ÷ as above is only the first of numerous examples. Of course, one might argue that using familiar signs with new meanings could be preferable to inventing new ones, in that the material would have a more familiar and less frightening appearance than if all new symbols were used.

The second and much greater difficulty is the language and literary style. When, in addition to familiar symbols, familiar words are used in new and undefined meanings, we really get into trouble. On p. 6, for example, we read: "... even the most noted composers of today do not seem to know that to express a bar before a non-uniform group is offered is to *represent the scheme of uniformity with respect to the periodicity of accents*." This must be an important statement, since the italics are Schillinger's, but a great deal of study has failed to squeeze a drop of meaning out of it. Unless we know what Schillinger means by "express a bar," "scheme of uniformity," etc., we are helpless. Perhaps Schillinger knew what this sentence means; it is doubtful if anyone else does, at least from reading the material.

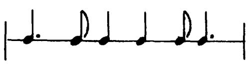
The unfortunate language makes it impossible to determine from the description alone the nature of the process of finding the "resultant $r_{a \div b}$" of the "binary synchronization" of two "generators" *a* and *b*. However, by studying the diagrams given as illustrations we can determine what the process is. We find that the "resultant" of say 4 and 3 is the rhythmic pattern obtained when we play 4 notes against 3. For example, to play the following,

we could assume it to be written in $\frac{12}{8}$ time (4 x 3 = 12) and rewrite the passage like this,

which gives the rhythmic pattern,

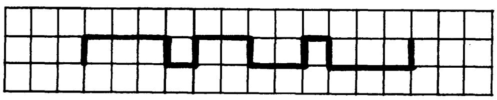
$\frac{12}{8}$ 

or, omitting the rests,

$\frac{12}{8}$ 

To describe the process somewhat differently: to find the "resultant" of 4 and 3, assume a measure of 4 x 3 = 12 beats, such as eighth notes; put a note on the first beat; put a note after every 4th beat (5th and 9th beats); then put a note after every 3rd beat (4th, 7th, and 10th beats). The result is the eighth note pattern above.

Schillinger uses his "rhythm graphs" to picture these patterns. The last pattern above (without rests) would look like the following,



where time is plotted horizontally, as mentioned before, and the small squares represent eighth notes. He also expresses them numerically, getting for the pattern

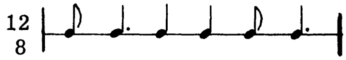
$$3 + 1 + 2 + 2 + 1 + 3$$

where the digits represent the number of eighths per note.

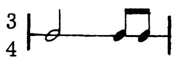
Neither of these representations is necessary, as the process described above may be used to find "resultants" directly in terms of musical notes. Schillinger, however, is very fond of both methods of representation. He is also very fond of working out great numbers of numerical examples by substituting, ad infinitum, into simple algebraic expressions, rather than by showing a few examples and letting the reader of ordinary intelligence go on by himself. In Appendix A of Mathematical Basis there are 54 pages of "resultants" shown numerically and graphically. Although these are impressive enough at first glance, the contents are little more than extensive doodling, and can be called mathematical only by courtesy.

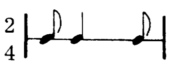
Whatever their mathematical content, the important question concerning "resultants" is their usefulness. Schillinger makes broad claims. For example, on p. 6 he writes: "Through the procedure described above, one may obtain all the rhythmic patterns of the past, present, and future." And on p. 10: "All rhythmic patterns in music are either complete or incomplete resultants." These statements are preposterous. Take any "resultant," such as the one obtained above, and interchange any two unequal numbers; the result will be a rhythmic pattern that cannot be obtained by Schillinger's procedure, as can be easily proven.[3] The pattern (to use Schillinger's notation)

$$1 + 3 + 2 + 2 + 1 + 3$$

(or in notes) 

obtained by interchanging the first two digits or notes of the 4 to 3 pattern obtained above is not a "resultant." To go even further, any number of simple rhythmic figures may be devised which are not "resultants" or parts of "resultants." All of the following are in this category:





We conclude, therefore, that Schillinger's "resultants" do not give all possible rhythms, as claimed; in fact, the number obtainable by his method is quite small. However, there is another and more important claim made for them, which is not explicitly stated in the first chapter and which we will discuss below.

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3. In any "resultant" obtained by the method described, it may be easily seen that each number in the "resultant" is either the "minor generator" or else one of a pair of adjacent numbers whose sum equals the "minor generator." For example, in the 4 to 3 "resultant" above,

$$3 + (1 + 2) + (2 + 1) + 3$$

the bracketed pairs add up to the "minor generator" 3. Therefore, any pattern not having this property cannot be a "resultant."

Let us proceed. Chapter 3 is unimportant. Chapter 4 describes a method of obtaining "resultants with fractioning." Again the verbal description of the process is impossible to follow; analysis of the examples given shows a process even more arbitrary than the previous method of obtaining "resultants." Describing this process would serve no useful purpose.

Chapter 5 discusses rhythmic groups formed by combinations of both kinds of "resultants." Here we find a statement which is important in shedding some light on Schillinger's point of view; after a discussion of Beethoven's crudities in composition, he states: "as the resultants which have identical generators have a great deal in common, such performance gives the utmost esthetic satisfaction (p. 21)." That is, if we add the "resultant" of 4 and 3 to the "resultant with fractioning" of 4 and 3, we get something aesthetically superior by virtue of having the numbers 4 and 3 represented in both parts.

This idea is carried further in Chapter 6, "Utilization of Three or More Generators." Here he states: "It happens that <u>all generators pertaining to one family of rhythm belong to the same series of number values</u> (p. 24)." (It is not clear what is meant by a "family of rhythm.") An editorial footnote here states that this crucial sentence will be explained fully in <u>Mathematical Basis</u>; unfortunately a search of this volume uncovers no such explanation. It is clear, however, that considerable aesthetic importance is attached to certain sequences of numbers. Further down on the page Schillinger says: "I have found in the field of music that each style (or family) of rhythm evolves through the series of such types ["summation series"]. Here are all the series that are useful for musical purposes:

I. 1, 2, 3, 5, 8, 13 . . .
II. 1, 3, 4, 7, 11, 18 . . .
III. 1, 4, 5, 9, 14, 23 . . .

As previously mentioned, all rhythmic groups (or patterns) of one style are the resultants of the generators of the same series."

This is a sweeping statement and one which makes quite clear Schillinger's basic point of view. The statement itself is somewhat unsatisfactory; we should perhaps like to have a better idea of what constitutes a family or style of rhythm; having this, we should then like to see a convincing number of examples demonstrating clearly the connection of these families with the numerical sequences cited (the word series is incorrectly used). However, we have only Schillinger's bold statement, "I have found . . . ," with no evidence whatever that he has found anything. His point of view is clear enough, however; if we start, for example, with the "summation" sequence 1, 2, 3, 5, 8 . . . (each term after the second being the sum of the two preceding), juggle numbers out of it by finding "resultants" as above, and turn these numbers into music, we will have something aesthetically superior by virtue of being based on this series.

What Schillinger begins to reveal is not a mathematical or scientific point of view at all; instead, it is pure numerology.

To proceed, omitting unimportant material, Chapter 8, "Coordination of Time Structures," has at first glance quite a straightforward structure. The problem to be discussed is stated as "the distribution of a duration group through instrumental and attack groups." There follows a list of the definitions of the terms to be used, then some pages of mathematical equations using these terms together with musical examples. Examining this material in more detail in order to try to make sense of it is a most frustrating experience. Looking at the list of terms defined under "Notation" (p. 35), we see the following:

(a) pli number of places in the instrumental-group
(b) pla number of places in the attack-group
(c) a_a number of attacks in the attack-group

An "attack-group" is apparently a sequence of notes, but what is the difference between "attacks" and "places"? Next is:

(d) a_T number of attacks in the duration-group

The term "duration group" has not previously been defined, nor is it here. At the back of Vol. II is a glossary compiled by the editors; if we turn to it for help, we find "duration-group" defined as "a group of one or more durations in time," which is very little help. Then we see:

(e) PL the final number of places

Places of what? We turn to the glossary; "places" is not listed. There follows:

(f) A the synchronized attack group (the number of attacks synchronized with the number of places.

Here is more trouble; it is not clear whether we are to use "places" from (a), (b), or (e) above. Worse still, how do we "synchronize" these quantities? This word apparently has a different meaning in Chapter 8 than it did in Chapter 2. The glossary defines it as "making two series occupy the same time," which means nothing. There are more terms defined, but we need not waste time on them; the whole list is hopelessly obscure.

If we now look at the mathematical symbolism on the following pages for help, we get none. The terms appear in equations as obscure as the definitions; symbols, letters, numbers, and bars of musical notes are mixed up in a hodge-podge that makes no sense whatever as mathematics. Whatever ideas Schillinger is trying to express here would be much more easily understood if the "mathematical" trappings were removed. The whole chapter is a fine example of what we might term pseudo-mathematics. It is not surprising to find pseudo-mathematics in a theory whose basis is numerology.

Chapter 9, with the impressive title, "Homogeneous Simultaneity and Continuity (Variations)" begins with an erroneous definition of circular permutations. There follows in this and the subsequent two chapters a good illustration of Schillinger's penchant for working out examples in profusion; instead of simply stating that the letters a b c d may be permuted in 24 ways, for example, he writes out all 24 permutations (p. 56).

Chapter 12 begins with a discussion of "series of factorial-fractional continuity," each "series" having a "determinant $\frac{t}{t}$." The term determinant is not used here in its accepted mathematical meaning, and there is no such thing in mathematics as "factorial-fractional continuity." A discussion of the application of these "series" to music ensues; this material would be very important to musical analysis if it had any verifiable basis, but again not a single example or illustration is given to lend credence to the assertions made. (There is one minor exception, a reference to the literature on p. 72, the first such, incidentally, to appear in the book.)

A typical Schillinger assertion appears on p. 74: "The law of distributive powers is a common esthetic law of proportionate distribution of harmonic contrasts." This sounds important, so we would like to know what it means. The subsequent material discusses "distributive powers" using numbers and graphs, and this time we are able to discover what the term signifies. It is simple enough: if, for example, we multiply out (3 + 1) x (3 + 1) we get 9 + 3 + 3 + 1, applying the usual algebraic rules. This result is what Schillinger calls the "distributive square of a binomial." We can of course use longer strings of numbers, change their order in arbitrary ways, and raise to higher powers. Schillinger is very fond of this process; 140 pages of *Mathematical Basis* are filled with such numerical trivia. The word "synchronize" appears again, in a still different and undefined meaning. There is no evidence presented to show that these "distributive powers" have anything at all to do with any aesthetic law; we are still in the realm of numerology.

Chapter 13, continuing the discussion, makes the statement: "*All the consecutive interference-groups generated by one determinant constitute the evolution of all rhythmic patterns in the corresponding family (style)*." (Emphases Schillinger's) We can recognize this now as another assertion with no basis but numerology.

The concluding chapter of the "Theory of Rhythm" begins with the statement: "The only constant velocity known in the physical world is that of light." This is nonsense; the velocity of light is not constant, but depends on the medium in which the light is traveling. Schillinger obviously has heard somewhere the postulate of the special theory of relativity, that light has the same velocity for all observers regardless of their state of relative motion, and has misinterpreted it. The second paragraph begins with the sentence: "The ratios of acceleration through gravity grow rapidly." The acceleration of gravity is a constant at any given place, varying only slightly over the earth's surface, and cannot grow at all; the expression "ratios of acceleration" is meaningless.

Having considered "Theory of Rhythm" in some detail, we can form several conclusions: (a) there is practically nothing in it that can be dignified by the name mathematics; (b) it contains a number of errors and much misused mathematical terminology; (c) terms important to the discussion are frequently defined incomprehensibly or not at all; and (d) completely unverified assertions are made regarding the aesthetic value of the numerical manipulation which fills the book. We now have a fair idea of what to expect in subsequent chapters, but let us look a little further before passing final judgment.

We next encounter Book II, "Theory of Pitch Scales." In Chapter 2 of this book we find that any group of from one to eleven consecutive notes within an octave taken in an upward direction is one of the "First Group of Pitch-Scales." Picking out one such scale, its notes may be permuted in various ways, giving other groups of notes; these groups may then be permuted, etc., etc. Schillinger fills the chapter with lengthy examples of these permutations.

In Chapter 3, "Evolution of Pitch-Scale Styles," we find scales of few notes used to generate scales of more notes by "interference." What the process is this time is not explained; it is not the "interference of monomial periodicities" we discussed before. Whatever the process may be, it is supposed to produce families of scales all having the same "style."

The "Second Group of Pitch-Scales," (Chapter 5) is derived from the first by a process of "expansion." For once, the process used is clearly explained; it is also quite arbitrary. The assertion is made that by "expanding" music by Mozart we can produce music in the style of Ravel.

We are introduced to the "Third Group of Pitch-Scales" by Chapter 6, which tries to connect the musical styles of various composers to the various roots of the number 2. Some illustrative musical examples here would be of great value, since considerable study has failed to derive any meaning from the discussion. We read, for example (p. 146), that Wagner used harmonic forms built on $\sqrt[4]{2}$, while Liszt used those based on $\sqrt[3]{2}$. A musician might assume that this statement is clear to a mathematician, and conversely; to one acquainted with both fields, however, it makes no sense at all.

In the subsequent Chapter 7 we find scales with 2, 3, 4, 6, and 12 "tonics." These arise from the circumstance that there are 12 notes in the octave, and 12 is divisible by each of the above numbers. For example, dividing the octave into three parts, we get the notes C, E, A^b, the frequencies of these notes in the tempered scale being in the ratio $1:2^{\frac{1}{3}}:2^{\frac{2}{3}}$. Interpolating additional notes between these, we get "3-tonic" scales. By picking out notes with frequency-ratios given by other fractional powers of 2, we get "2-tonic scales," "4-tonic scales," and even "12-tonic scales." When every note in the chromatic scale is a "tonic," what do we do for dominants? The term "tonic" has such a well-established meaning in music that to use it in any other sense is indefensible. True to form, Schillinger writes out in detail all the possible "N-tonic" scales starting on C.

Using certain other fractional powers of 2, Schillinger gets the "Fourth Group of Pitch Scales." One of these extends over a range of eleven octaves; its usefulness would seem to be limited, since the normal hearing range is less than ten octaves.

The "Theory of Pitch Scales" thus turns out to be no theory at all, but a collection of arbitrary numerical rules for getting sequences of notes which are called "scales," and which are supposed to have aesthetic value from having such a numerological basis. We could assert with equal validity the usefulness of scales selected by throwing dice.

Book III, "Variations of Music by Means of Geometrical Projection," need not detain us long. Schillinger announces the discovery of "geometrical inversions" — the processes of inverting a melody, playing it backwards, and inverting it backwards — as though they were something new instead of devices known long before Bach. Introducing some rearrangements of Bach's Two-Part Invention No. 8, Schillinger states (p. 193): "By comparing the music of J. S. Bach with the following illustrations, the full range of what he could have done with the method of geometrical inversions becomes clear." Again, on the next page: "In another case, that of Fugue No. 8 from Bach's Well-Tempered Clavichord, V. 1, if we compare the first 12 bars of the original with the version evolved from this same theme by means of geometrical inversion, we cannot fail to see the esthetic advantage of this method of composition over the more casual one derived partly from dogmatic and partly from intuitive channels." Again, on p. 202: "This device is superior to the ingenuity of any composer using an intuitive method . . . ." The effrontery of these statements is staggering; but let us go on.

Book IV discusses "Theory of Melody." (By this time we are a little suspicious of the use of the word theory as a description of Schillinger's assertions.) We find in Chapter 3 the "primary axis of melody" defined as a "pitch-time maximum"; that is, the primary axis of a melody is the note which has the longest total duration when all its occurrences are added. With this concept Schillinger shows (p. 250) that the opening 8-bar melody of the second movement of Beethoven's Piano Sonata, Op. 13, is not in A^{b} major after all, but starts out in the Mixolydian mode and then modulates to the Dorian mode. The next paragraph shows how the theme of the third movement can be improved. Musicians may judge for themselves the validity of these assertions; there is no basis in either physics or mathematics for a "primary axis of melody."

There follow some 75 pages of graphs whose function is completely obscure. On p. 305 we note the mathematical terms sine and cosine incorrectly used.

Finally, we arrive at Chapter 8, "Use of Organic Forms in Melody." This chapter contains a most stupendous mathematical error. Schillinger again discusses the "summation series" mentioned earlier, the sequence 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144 . . . which he now calls the "Fibonacci Series." He then proceeds to present a geometrical construction which he claims will give these numbers. The construction is shown in Fig. 103, p. 330, with the above sequence of numbers written along the bottom of the figure as though they resulted from the given construction. Any good high school trigonometry student could show that this diagram is nonsense; it does not at all give this sequence of numbers. In fact, the indicated construction cannot possibly produce a summation sequence; a simple calculation shows that it produces a sequence of numbers each of which is 3/2 the preceding, and is therefore a geometric progression.[4] It is inconceivable that anyone who claims to know mathematics could make and publish a mistake of this magnitude.

Another error in elementary physics occurs on p. 359. Schillinger gives the vibration-ratios for the diatonic major triad as 4:5:6, which is correct, and in the same sentence gives the ratios for the minor triad as 5:6:15, which is quite wrong, and the ratios for the dominant seventh chord as 4:5:6:7, which is also wrong. His physics is obviously no better than his mathematics.

We need not waste time on the remainder of the work. We continue to see formidable arrays of formulas and graphs, but the actual mathematical content remains infinitesimal.

One might hope that Mathematical Basis (Schillinger's "masterwork") would contain some of the illustrative material so lacking in Composition, material necessary to lend some validity to the assertions made and to raise the work at least somewhat above the level of numerology. Unfortunately, a study of Mathematical Basis reveals nothing more than the same pseudo-mathematical jargon and extensive numerical working out of trivial mathematical formulas. The numerology is extended to cover art and design as well as music; the sections on music are copied verbatim from Composition, and the whole hodge-podge is given the impressive title, "Theory of Regularity and Coordination."

We conclude finally that Schillinger's claim to have established a scientific and mathematical basis for music and the arts is nonsense. What little science and mathematics we find is trivial when not actually erroneous. Assertions regarding the aesthetic superiority of certain arbitrary procedures must be taken on faith, since the musical data necessary to establish their validity are lacking. The essence of the scientific method is the resort to observation and experiment to test the correctness of theory and hypothesis; one finds none of this in Schillinger's work.

Mathematical Basis was first introduced to the author by a musician acquaintance of the Hollywood school, who commented in awed tones on the vast amount of science and mathematics it contained. However, a strong "crackpot" odor was evident on the first examination, and was confirmed on more detailed subsequent investigation. Judgment in this instance was facilitated by experience with similar material in the field of physics. Science departments in universities are continually bombarded with communications from individuals proposing new and revolutionary theories which they have developed. Much of it is nonsense; the remainder can be refuted by anyone with an elementary training in science. This scientific insanity has certain characteristics which usually enable one to classify it immediately.[5] One of these is a wordy and confused style which can sound important but

4. The only positive term summation sequence which is also a geometric sequence is the one beginning with the two terms a, $\frac{a}{2}(1 + \sqrt{5})$.

5. For an interesting and amusing account of some of the absurdities propounded as science, see Martin Gardner's Fads and Fallacies in the Name of Science, Dover Publications, Inc., New York.

means nothing when analyzed. A second is its isolation; your pseudo-scientist develops his theories alone, not utilizing the work of others in his field as a foundation for his own. The average scientific paper is crammed with references to other papers; the pseudo-scientific publication disdains them. In fact, a third characteristic of the "crackpot" is the contempt he has for the predecessors and co-workers in the field he is revolutionizing. Schillinger's work has all of these characteristics. As such, it is just the sort of stuff to appeal to pseudo-musicians, low-grade composers, semiconductors (the term semiconductor has become very important in physics, and might be useful in music as well), and the like.

Of course, if anyone finds Schillinger's methods useful in the composing of music, by all means let him use them. A composer is certainly free to use a prime number series or a number from the telephone directory (see p. 491) in his work if he wishes, but the result must withstand judgment as music and not be claimed somehow superior because prime numbers or telephone numbers are contained in it. Schillinger's methods have no scientific or mathematical foundation, and to claim they have is to perpetrate a fraud on a defenseless musical public.

References

1. Library Journal, Vol. 71 (1946):121.
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3. Music Library Association Notes, Vol. 4 (1947):183.
4. Music & Letters, Vol. 28 (1947):389
5. U.S. Quarterly Booklist, Vol. 2 (1946):272
6. The Nation, Vol. 163 (1946):332.
7. The Music Review, Vol. 8 (1947):311.
8. Music Library Association Notes, Vol. 3 (1946):274.