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Musofun: Joseph Schillinger's Musical Game between American Music, the Soviet Avant-Garde, and Combinatorics

Joseph Schillinger (1895–1943) was an important figure of early Soviet musical life but also of American music of the interwar period. In this article I provide an analysis of his manuscript “MUSOFUN. Music by Chance. Games and Pastimes.”¹ It describes a proposed new musical game whose principles are based on Schillinger's mathematics-inspired methods of composition. I argue that Musofun exemplifies Schillinger's long-standing interest in the mathematization of musical practice and that this interest came from Schillinger's involvement in the avant-garde musical thought of the early Soviet period. By analyzing the Musofun manuscript, this article contributes to a better understanding of Schillinger's musical thinking and fosters the rediscovery of cultural links that crossed multiple musical, economic, and political boundaries during the first half of the twentieth century.

As a composer, Schillinger was an academic modernist and later a proponent of electronic music.² Yet his role as a cultural relay between early Soviet and American music went beyond these areas of musical practice. Before immigrating to the United States in 1928, Schillinger tried, on the brink of a Stalinist cultural backlash, to argue for the importance of jazz in Russia. Giving a lecture accompanying a concert of the

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An example of the cards supplied with the game

M U S O F U N

E (Blue) 5

May

Emerald

Dahlia

5 E

Figure 1. The proposed design of a Musofun card. "Musofun," added part, page 3. Joseph Schillinger Papers, Arthur Friedheim Library, Peabody Institute, Johns Hopkins University.

First Concert Jazz Band in Leningrad on April 28, 1927, he asserted that in its role as a truly popular music, jazz realized the Communist goal of "music for the masses" and was "fully qualified to play a central part in the reorganization of life and work in the USSR."³ He also seems to have claimed that the future electrification of music would eliminate the need for human composers. Schillinger's unorthodox stance was met with staunch opposition from both the elitist Andrey Rimsky-Korsakov (son of Nikolay Rimsky-Korsakov), who argued against the "vulgarity" of jazz, and the aggressively antimodernist Marian Koval', a member of the Russian Association of Proletarian Musicians (RAPM).⁴ While Schillinger left the Soviet Union shortly thereafter, the head of the First Concert Jazz Band, Leopold Teplitsky, was convicted of espionage (a standard pre-text of Stalinist terror) and imprisoned at the infamous White Sea-Baltic Canal, becoming one of the many victims of the cultural and political consolidation of Stalin's rule.⁵

Having escaped from the increasingly hostile cultural environment of the Soviet Union, Schillinger was at the same time left without a clearly defined role in the American musical landscape. His artistic output as a composer never recovered from this disruptive shift, and he barely composed any new works after emigration. However, he was able to create a new foundation for his musical interests as a teacher and author of a mathematically inspired system of composition. In doing so, he brought aesthetic attitudes and the thinking of the early Soviet avant-garde into American popular music.

The Fate of the Schillinger Method

In New York Schillinger became both famous and affluent as a teacher of his own theories. On the one hand, he could list high-profile musicians as his pupils (Gershwin, Glenn Miller, and others), and, on the other hand, he disseminated his methods among the numerous commercial arrangers of his time, often through correspondence courses. Determined to distribute his ideas as widely as possible, Schillinger gave *Kaleidophone*, his only book to be published before his early death, the telling lengthy subtitle *An Aid to Composers, Performers, Arrangers, Teachers, Song-Writers, Students, Conductors, Critics and All Who Work with Music*.⁶ When in 1942 one of Schillinger's students published a pamphlet advertising the system, he not only asserted that it was used by "leading radio stations, . . . top-notch dance bands and motion picture music departments" but even claimed that the system was employed "in at least one half of the national radio programs in which music is an ingredient."⁷ While the latter claim might be difficult to confirm statistically, Schillinger's success as a teacher seems to indirectly validate it, and his overall influence has been retrospectively summarized as follows: "Aspects of the Schillinger System . . . constitute a hidden . . . undercurrent in American popular music from the 1930s."⁸

Schillinger's mathematics-inspired musical thinking was not an isolated phenomenon. Having studied composition and conducting and having worked professionally in the field of music during the first ten years of Soviet rule, Schillinger inherited many typical traits of the early Soviet culture that surrounded him, including a strong modernist aversion to musical tradition. Although he was embedded in the early Soviet musical avant-garde, individual aspects of his methods can also be compared to other "mathematical" systems of his time and of previous times, notably to Arnold Schoenberg's twelve-tone technique, as well as to serialist concepts.⁹ Schillinger's approach also had a certain influence on later experimental composers, including authors of computer music. Notably, the American composer Earle Brown has repeatedly stressed the importance of Schillinger's thinking for his aleatoric and serialist compositions.¹⁰

After Schillinger's life was interrupted abruptly by severe illness at the age of forty-seven, his methods, collected from his notes and correspondence courses, were edited, expanded, and made available in published form by several pupils and experts of the system. They all worked under the guidance of his widow, Frances Schillinger, who, despite having no deep understanding of Schillinger's theories, successfully supervised the preservation and dissemination of his legacy. Among the books published posthumously, *The Schillinger System of Musical Composition* and *The Mathematical Basis of the Arts*, published within five years of Schillinger's death and comprising over twenty-three hundred pages, stand out as the most visible monument to Schillinger's work.¹¹ Schillinger's archive was also subsequently distributed by Frances Schillinger among several American institutions, including the Arthur Friedheim Library, which holds the *Musofun* manuscript, the New York Public Library, and a number of museums.¹² More recently, a digitized version of examples of Schillinger's correspondence courses and other teaching materials has been made available by the Berklee College, shedding light on the prehistory of his books.¹³

After severing connections to his colleagues in the Soviet Union by emigrating, Schillinger found a new collaborator in Leon Theremin, the famous inventor of the Theremin electric musical instrument. Riding on a wave of phenomenal success resulting from the theatrical qualities of his instrument, which could be played without being touched, Theremin left the Soviet Union in 1927, a year before Schillinger. They collaborated on several projects. After Schillinger created the *First Airphonic Suite for Theremin and Orchestra*, a much-needed original work that showcased the instrument, he was invited in 1931 to give a series of lectures at Theremin's five-story studio in Midtown Manhattan.¹⁴ Schillinger's interest in the Theremin, which started long before his emigration, resulted from his fundamental belief that electronic instruments constituted the future of music.¹⁵ But the instrument that captivated Schillinger's musical-mathematical imagination the most was the *Rhythmicon*, a rhythm-producing machine proposed by the American composer Henry Cowell in 1930 and built by Theremin. Despite not being devised directly by Schillinger, it was the perfect practical realization of his method of combining rhythmic pulses. The extent to which Schillinger saw the *Rhythmicon* as an integral part of his theories is demonstrated by his discussion of the instrument, in which he explains it using exclusively the terms of his own method and mentions Theremin while omitting Cowell's name. One of his most well-known photographs shows Schillinger standing behind this imposing electromechanical device, whose core principle, however, follows a line of thought that goes back to much earlier experiments in acoustics, including the siren.¹⁶

While Leon Theremin became the key collaborator for Schillinger during his New York years, the conductor, composer, and author Nicolas Slonimsky became his most important supporter. Slonimsky was educated at the Saint Petersburg conservatory and belonged to the same generation as Schillinger and Theremin.¹⁷ He knew about the roots of Schillinger's musical thinking and was sympathetic to his mathematics-inspired methods. In his publications he tried to convey the idea that although Schillinger's success as a teacher was mostly grounded in the practical application of his ideas by people who worked in the American music industry, his ideas grew out of research that was carried out at early Soviet institutions devoted to a radical reconstruction of music.¹⁸ In a positive review of the Schillinger method published in 1946, Sidney Robertson Cowell and Henry Cowell quoted Slonimsky's comparison of Schillinger's wish to systematize all possible musical structures and the influential periodic table of elements devised by the Russian chemist Dmitri Mendeleev.¹⁹

Yet Slonimsky's attempts at popularizing Schillinger's theories may have actually contributed to their almost universal falling out of use in the subsequent decades. The reason for this is the specific political situation of the late 1940s. In one of his articles Slonimsky stresses that Schillinger was a "revolutionary" "by education, by his early experience, and by conviction" and that he "grew in the environment of the Russian Revolution."²⁰ Surely, these remarks were only meant to underscore the innovative character of Schillinger's theories. But the moment of their publication (March 1947) coincided directly with President Truman's Executive Order 9835, which marked the beginning of what was later called the era of McCarthyism. Moreover, 1947 was also the year in which the House Committee on Un-American Activities became especially active in Hollywood, leading to the conviction of the Hollywood Ten group.²¹ In 1928 Schillinger came to America at the invitation of the American Society for Cultural Relations with Russia.²² In 1950 the careers of numerous persons working in the American creative industries were damaged by the publication of a booklet entitled *Red Channels: The Report of Communist Influence in Radio and Television*, which accused them of subversive tendencies because of even less "suspicious" contacts with the Soviet Union.²³ Thus when Broadway and Hollywood composer Charles Previn published in 1947 his appraisal of the Schillinger system together with Slonimsky's incautious remarks on the "revolutionary" character of Schillinger's theories, he may have unwittingly risked damaging both his own career and that of other Hollywood composers whom he counted as proponents of the Schillinger method in film music.²⁴ Given these circumstances, it seems probable that support for Schillinger's theories waned in the 1950s not only because of changing aesthetic attitudes but

also for political reasons connected to the growing tensions in the Cold War.

By 1960, however, when John Backus's sweeping condemnation of Schillinger's methods came out, the era of McCarthyism was already over. The focus of Backus's objections, as well as of his ardent polemics, was different: Schillinger's and his pupils' claims about the scientific character of his theories. Backus's main complaint did not concern the errors in Schillinger's mathematics but the fact that Schillinger did not provide a proof for the functioning of his methods: "Completely unverified assertions are made regarding the aesthetic value of the numerical manipulation which fills the book," and "assertions regarding the aesthetic superiority of certain arbitrary procedures must be taken on faith."²⁵

Here, Backus follows a line of criticism that had already manifested itself in Elliott Carter's review of Schillinger, published in 1946. Like Slonimsky, Carter pointed to Schillinger's indebtedness to the avant-garde of the 1920s, citing the Bauhaus as an especially close resemblance. His judgment of this aesthetic tradition, however, is diametrically opposed to Slonimsky's benevolence. In Carter's words, Schillinger's book "apes mathematical texts," employs "pseudo-algebraic formulas," uses a "rhetorical method . . . aimed at . . . a kind of surprise and shock effect," and is full of "dogmatic assertion." Hinting sarcastically at Schillinger's success with commercial arrangers, Carter writes: "For musicians interested in filling up radio time or in writing descriptive background music of a not too original character this system will save a lot of trouble and thought."²⁶

On the one hand, Backus was right in saying that no empirical data are provided that, for example, show that listeners attach a greater aesthetic value to a melody created by Schillinger's methods than to a melody created intuitively or using the traditional devices of music composition. On the other hand, the topic of aesthetic judgment is significantly more complex than the one-dimensional image of it that underlies Backus's thinking. First, the creation of works that are aesthetically pleasing to the largest possible proportion of the audience might not be at all the goal of Schillinger's attempts at innovation. Despite his success as a teacher of commercial arrangers, the roots of his aesthetics are rather located in the subversive avant-garde of the early Soviet period, when the overthrowing of old musical traditions was essential. Second, Backus fails to acknowledge that aesthetic judgment in music is at least partially grounded in the listener's exposure to a certain tradition. In a way, the principal provocation of Schillinger's "arbitrary procedures" (Backus) consisted exactly in hinting at the possibility of accepted methods of Western music not being any less arbitrary—just ingrained through centuries-long use. Finally, Schillinger and his pupils

did hope that they had provided at least a preliminary proof that their methods could be successfully employed. By pointing to popular works by Gershwin and Glenn Miller and, in the case of Schillinger, also by teasing the musical public by creating imitations of classical styles out of randomized material, they made every effort to demonstrate that Schillinger's mathematical ideas were at the very least as suitable to the creation of music as the established methods taught at music schools.

Also, the paradox of early Soviet modernism was that it hoped to become a truly popular aesthetics despite or even because of its dismissal of earlier traditions. Because they were allegedly unspoiled by the "deca-dent" and "inefficient" musical tradition, the "proletarian masses" were believed by Soviet modernists to be especially receptive to new tendencies. In a review of concerts held in Moscow and Leningrad in 1927, the Soviet intellectual Orest Cehnovicer wrote: "Works by . . . Schillinger and others were taken up by the working masses with enthusiasm, and we know why. . . . The proletarian who grew up surrounded by city build-ings, who was rhythmically raised by the machine, and who ingested machine oil on a par with his mother's milk certainly asks for a modern music that feels native and in tune and not for the music of the bourgeois salon, not for a music that was born during the era of cartwheels and the Stephenson's locomotive."²⁷ Coming from this line of thinking, Schillinger clearly believed that a true popularity of new methods in music was possible. Seemingly, the only adjustment needed to transplant the early Soviet modernist experiments into American popular culture was to assume that the listeners in the New World were also deeply removed by their everyday experience from the bourgeois scenery of nineteenth-century European music.

While new methods of composition, including some mathematics-inspired approaches such as serialism, did in fact proliferate in post-World War II musical avant-garde, the popularity of the Schillinger system declined rapidly after his death. An attempt was made at disseminating it not only through posthumously published books but also via institutionally rooted courses such as the one offered by the then newly established Schillinger House. However, in 1954 this institution was renamed, removing the Schillinger reference from its title. While in 1961 Schillinger's methods were still taught at what then became the Berklee School of Music, in the following decades they increasingly slipped into obscurity.²⁸

Recently, a reemergence of interest in Schillinger has become visible. Overviews of his archives at different institutions and of his life and work were published in the early 2000s. A large-scale publication of Russian sources that was conceived at around the same time finally came out in 2015. Musical-historical and cultural analyses started to appear in print.²⁹ Practical courses based on the Schillinger method are being

offered online.³⁰ Today, a reevaluation of Schillinger's thinking, based on both his early Soviet roots and his role in American music, as well as on an understanding of the historical tradition of mathematical methods of composition, is indispensable for a deeper insight into the prehistory of the current technology-driven musical culture.

Musofun

Schillinger's manuscript "MUSOFUN. Music by Chance. Games and Pastimes" proposes a system for the assembly of melodies out of individual cards containing musical material. The order of the cards, which also contain letters, numbers, and other information, can be random, or it can represent some sort of initial sequence, such as a name or a date.³¹ The manuscript (a typescript with handwritten musical material) has been preserved by the Arthur Friedheim Library at Johns Hopkins University and consists of the following main parts: (1) Schillinger's proposal (fifteen pages), (2) an expansion of Schillinger's idea (seventy pages), (3) Schillinger's "Author's note" (three pages), (4) the "Memo on Musofun for JS" (one page), and (5) Frances Schillinger's introduction for publishers (one page). The materials contain a number of duplicate pages, some of which lack the handwritten notes and thus probably represent an earlier stage in the development of the manuscript.

As evidenced by Frances Schillinger's introduction, the preparation and expansion of the manuscript were carried out in hope of publishing it as a book. The exact dates when *Musofun* was created by Schillinger and then expanded by an editor are not given in the manuscript. The copyright note stating the year 1942 possibly marks the moment when Schillinger worked on *Musofun*, but the later expansion most probably happened after his death. One of the existing copies of the title page contains a handwritten note: "This ms. submitted by [Ted Royal] re: contract between him & FSS." The initials FSS refer here to Schillinger's widow's full name, Frances Schillinger Shaw, which she acquired when in 1951 she married Arnold Shaw (they divorced in 1957). The name of the editor (Ted Royal) has been deliberately erased from the note, but it is still legible. This raises the complicated question of authorship of the manuscript. The core idea of *Musofun* is deeply rooted in Schillinger's methods and has various counterparts in his main published works, lending credibility to the manuscript's attribution of the fifteen-page proposal to Schillinger himself. However, the editor and Schillinger's widow also played a significant role in creating what now constitutes the surviving text. On the one hand, the added text is more than four times longer than Schillinger's proposal. On the other hand, Schillinger's widow also needs to be regarded as a contributor. Because she envisaged

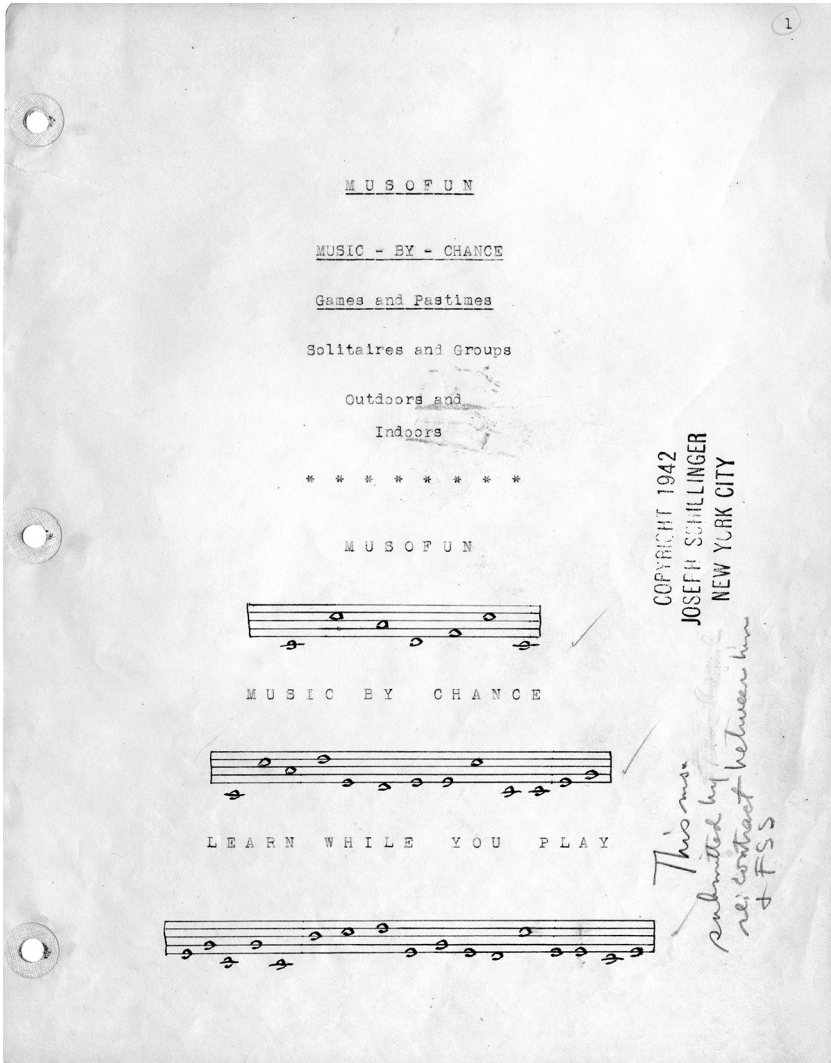


Figure 2: "Musofun," title page. Joseph Schillinger Papers, Arthur Friedheim Library, Peabody Institute, Johns Hopkins University.

and organized the expansion of the proposal, in this case her input can be compared to the role of a producer.

Ted Royal (1904–81) was an arranger who studied Schillinger's method between 1939 and 1942. He was listed as an authorized teacher of the Schillinger system in 1947.³² Frances Schillinger's introductory note only says that she has "had a Schillinger student develop the game into

a completed book,” but the binder holding the Musofun manuscript bears the initials “TR,” again corroborating Ted Royal’s coauthorship, stated in the written note. Also, the part added by the editor uses “Ted Royal” (along with other names, mostly of celebrities) as example material. Other publications of Schillinger’s texts did contain names of additional authors.³³ Why the name of the editor was withheld in this case remains open to speculation.

Musofun exemplifies Schillinger’s endeavors to popularize his system, as well as his belief that highly experimental methods and the music that comes out of them can be enjoyed by the general public. Schillinger’s fifteen-page proposal opens with short instructions explaining the basic use of the cards. It then quickly deviates into the description of an additional procedure that expands the initial random sequence of notes through a specific kind of permutation (playing the whole sequence starting with the first note, the second, etc.). For rhythm, Schillinger proposes a simple but effective method of assigning to all notes of one sequence the same length, except for the last note, which is held until the end of the measure. This rule is independent of the length of the sequence and of the chosen time signature, and Schillinger illustrates its functioning in different meters.

With this description, Schillinger specifies a procedure that is mechanical enough to be called an algorithm. When followed exactly, it will yield a melody for which all parameters (pitch and rhythm) have been derived from the original random material exclusively through an application of clearly defined rules. The following part of Schillinger’s proposal illustrates the translation of names and other initial material into pitch values (but not the creation of rhythm described above). Numerous examples are given, starting with “Franklin Delano Roosevelt” and “Charles Spencer Chaplin.” Jessica Dragonette, the popular singer who gave a vivid depiction of Schillinger’s personality in her memoir, is used for illustration, as is Gandhi (whose name is misspelled).³⁴ Overall, nineteen examples are given at this point, even if the principle becomes perfectly clear after its explanation and the first couple of applications, evidencing Schillinger’s predilection for an iterative style of presentation.

Schillinger then turns to an expansion of his original idea, proposing the use of a variation of the underlying principle for a parlor game. After

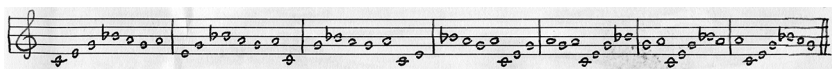


Figure 3. Permutations of a melody. The original melody given in the first measure is played beginning with the second note in the second measure, and so on. “Musofun,” Schillinger’s proposal, page 5. Joseph Schillinger Papers, Arthur Friedheim Library, Peabody Institute, Johns Hopkins University.

asking the participants simple questions such as “What is your favorite color?,” the game master uses cards to assemble melodies out of the answers. The participants then vote to determine whose melody is the best.

Like the individual version of the game, the parlor game is, in principle, a clearly defined algorithm. From today’s point of view, its automation (through the use of the computer and programming) might seem promising and even logical. Yet while these methods might be easily programmed (precisely because they are fashioned like an algorithm), doing so would probably contradict the very motivation for using them. As a solitaire game (and even more so as a parlor game), Musofun arguably would not be able to justify the presence of the word “fun” in its name if the participants were not supposed to actively contribute to the process by following the prescribed procedures. Once programmed, Musofun could produce thousands of name- or number-based melodies in a matter of seconds, but the player, then reduced to a passive observer, would lose interest quickly. By contrast, the involvement of the player in the mechanical execution of the algorithm can, paradoxically, contribute to a curiously attractive sense of being active without controlling the process or the outcome, yet yielding results that closely resemble melodies created by educated musicians. Musofun thus gives everyone the possibility to playfully try out the role of a skillful composer—and to indulge in an alienation from one’s own thinking that results from the mechanical mental execution of the complicated algorithm.

Schillinger’s part ends with two pages of illustrations showing the application of a number of additional methods derived from his general mathematics-inspired approach to the creation of melodies. Since they are not accompanied by text, these pages probably constitute an unfinished attempt at expanding the methodical palette of Musofun by introducing further procedures, such as deriving melodies from geometric constructions.³⁵ From the point of view of a practical realization of Musofun as a commercial game, these additional methods are superfluous, as they are given without any explanation and thus cannot be understood without a previous study of the Schillinger system. Their inclusion into a proposal meant to attract publishers might have contributed to the project’s rejection.³⁶ It also probably illustrates Frances Schillinger’s inability to fully control the presentation of her late husband’s ideas without having a background in music theory.

The seventy-page anonymous additional part is based on the same basic idea of using cards (shuffled or arranged in such a way as to represent a name, number, or some other piece of information). Yet it significantly differs from Schillinger’s procedure described in the first part, ultimately making the reader wonder which of the two versions is the actual proposed game. While the cards of the expanded version contain

many more entries than the cards originally envisioned by Schillinger, the algorithm of the game has been simplified. Notably, the process of consecutively starting the melody on the first note, the second note, and so on has been removed. This new version of the cards now also contains—in addition to a number, a letter, and a note—a color, a month, and even three chords for the harmonization of the resulting note, one of which was called a “tonic.”³⁷

This inclusion of a musical device derived from standard Western harmony contradicts Schillinger’s original idea to use strictly modernist harmonies constructed from his mathematical methods, which is evidenced by his proposal to create chords out of permutations of randomly chosen intervals.³⁸ However, this inconsistency of the manuscript seems to come from gradual changes in Schillinger’s own position, not from the editing process. A detailed table is provided in the manuscript that describes the numbers, names, and other fields contained on the cards. Yet the chords mentioned above are not included, and the scale is not chromatic (as in Schillinger’s fifteen-page proposal) but diatonic. It seems that at some moment in the development of *Musofun* Schillinger abandoned his original highly modernist positions in favor of a larger conformity with the expectations of the unprepared user. In his “Author’s note” he writes that he not only chose the diatonic scale but even provided for a higher probability of the C major chord, or the tones leading to the tonic, occurring by mapping letters and numbers more often to the notes C, E, G, D, and B than to other notes.³⁹

The “Author’s note” also contains a telling digression that illustrates Schillinger’s firm belief that musical taste and tradition are ultimately historically contingent and are indeed malleable to a large degree: “The players may find that some of the melodic intervals will sound, at first, a little strange, but like a new pair of shoes, all new melodies are strange until the ear, or feet in the first case, becomes accustomed to them.”⁴⁰ While the “blasphemous” parallelism between the perception of new music and the discomfort of wearing new shoes has been crossed out in the manuscript either by Schillinger himself or by an editor, it is remarkable that he even had to include this note of caution despite the fact that he had already adapted his idea to the Western musical tradition.

The use of fifty-two cards is proposed in the manuscript, which is the standard size of a card deck and at the same time the quadruple of the number thirteen, which underlies Schillinger’s proposal. This creates a connection between the number of notes within an octave (twelve plus the upper octave note, used in Schillinger’s chromatic scale proposal), the number of months (January was repeated for the upper octave note), and the number of letters in the English alphabet (two times thirteen).

The remainder of the added part consists of the application of the principle to various initial pieces of data, such as addresses and telephone

numbers, as well as of a detailed explanation of methods for creating rhythm, permutations, and counterpoint-like inversions, all similar to procedures proposed in Schillinger's System of Musical Composition. As the techniques for treating the musical material become more and more complex in this part, the initial game-like character of Musofun is increasingly replaced by an elaboration of various Schillinger methods, and the cards stop being essential for the execution of the proposed ideas.⁴¹

Musofun and the Avant-Garde

In his critique of Schillinger's System, Elliott Carter writes: "It is curious that a method which gives such a high place to abstract art . . . should be followed by practitioners mostly occupied with the most functional aspect of music."⁴² Indeed, Schillinger's openly antitraditionalist stance and his predilection for the mathematization of the compositional process might seem too esoteric to be appreciated by the commercial arrangers of his time. Even Schillinger's supporter Slonimsky could not withhold a kind of a sarcastic amazement at Schillinger's popularity among arrangers of popular music, writing in one of his otherwise benevolent texts: "Shrewd Broadway musicians flocked to his studio in search of practical formulae, and were willing to pay good Broadway money for the initiation into the mysteries of Schillinger lore."⁴³ Yet the belief of some parts of the early Soviet avant-garde that new musical methods might actually be more appropriate for a new public seems to have applied to interwar American popular music as well.

There might be several reasons for creators of popular music of this period to be interested in Schillinger's methods. First, harmonically and rhythmically their music did indeed differ from earlier styles, and there might have been hope to find in Schillinger some musical-theoretical devices that would give a result that would not sound as if it were from an earlier century. Second, the promise of the Schillinger method seems to be at least partially that it can enable a faster, more "rational" workflow for the arranger or composer, as compared to earlier, more "intuitive" approaches. Finally, the association of famous names such as Gershwin and Glenn Miller with the Schillinger method, as well as the participation of fellow arrangers in Schillinger's courses, might have created a kind of a snowball effect that made Schillinger's lessons more and more popular.⁴⁴

While Schillinger succeeded in attracting a large number of pupils, it is difficult to quantify exactly how much of his methods really made it into pieces that were popular in pre-World War II America.⁴⁵ Yet his success as a teacher clearly suggests that there was at least a broad interest in learning these methods, mostly with the goal of putting them to work in the creation of radio and dance band arrangements, as well as Hollywood and Broadway music.

Schillinger's pupils might have been unaware of the fact that his methods were in many ways a continuation of several lines of thought that were popular among modernist and avant-garde composers in Russia before and shortly after the 1917 Bolshevik seizure of power. Slonimsky suggested as much in his publications (which came out after Schillinger's death), as did Carter. Specifically, Slonimsky mentioned names of early Soviet research institutions whose experimental work he saw as formative for Schillinger's thinking: the State Institute of Musical Science (Gosudarstvennyj institut muzykal'noj nauki, GIMN), which was active in Moscow from 1921 to 1931, and the State Institute of the History of Arts (Gosudarstvennyj institut istorii iskusstv, GII) in Leningrad (1912–31).⁴⁶

Analyzing the roots of Schillinger's method, Detlef Gojowy sees Futurism as the most prominent influence: "Basic ideas and visions of Futurism coalesce in his mathematical-philosophical-aesthetical system," and "the tendency to strive for a new, all-encompassing order that would supersede the obsolete, brittle and inadequate former orders, which was typical for Schillinger's system of thought, comes from the spirit of Futurism."⁴⁷ Similarly, in his conversation with Earle Brown, Louis Pine stressed the influence of the Soviet avant-garde on Schillinger and agreed with Brown in seeing Schillinger's theories as compatible with the basic ideas of constructivism and the Bauhaus.⁴⁸

Charting a broader picture of changes in aesthetics that followed World War I, Joseph Auner sees "conscious control and codified systems" as their defining characteristic and contrasts them with the "individualistic and subjective approaches to music, often based on appeals to the unconscious," that preceded them.⁴⁹ Schillinger's distaste for "intuitive" approaches corresponds directly with this shift in preferences.

A second, complementary explanation of Schillinger's aesthetics connects him to earlier developments in Russian music theory and practice. A parallel between Schillinger's interest in scales created by equal divisions of the octave and methods employed by Rimsky-Korsakov has been suggested by Ilya Levinson.⁵⁰ Connecting Schillinger to a slightly later line of thought, Larry Sitsky wrote about Schillinger's mathematical approaches: "He brought to fruition a long line of Russian speculation along such lines, going back to Tanev."⁵¹ The composer Sergej Tanev (1856–1915) published in 1909 a book dedicated to counterpoint in which he consistently used calculations and symbols that resembled mathematical notation to present what he saw as the rules of this form of music. Paralleling Schillinger's later attitude, Tanev posited: "The doctrine presented in this book seems to me to be more exact, simple, and approachable because of its application of elementary algebraic techniques to contrapuntal combinations and its replacement of verbal explanation . . . by artificial symbols."⁵² Striving to give the musical discourse a new, exact form of notation that would match the efficiency

of mathematics, Taneev proposed the use of compounds such as $IV = 5$ (meaning the upward transposition of the upper voice by a sixth), which resembled Schillinger's later use of symbols.⁵³ Taneev's mathematical system of counterpoint also employed the Russian word *proizvodnoe*, which translates as Schillinger's English "resultant," albeit in a different sense from Schillinger's combination of meters.

One year later, in 1910, the painter and early theoretician of the Russian avant-garde Nikolaj Kul'bin (1868–1917) published his manifesto-like collection of short articles entitled *Free Art as the Basis of Life*. In it he championed some of the aesthetic attitudes that were later central to Schillinger's methods and ideas. Kul'bin posited that harmony and dissonance are the basic phenomena of the world, that they are universal, and that art is based on them.⁵⁴ This is mirrored by Schillinger's belief that there is a deep structural parallelism between forms of nature and works of art, including music. This belief was part of Schillinger's broader conviction that there are universal, all-encompassing principles that underlie all aesthetic phenomena. Based on this idea, Schillinger wrote in his preface to *The Mathematical Basis of the Arts* that the goal of his book is to "disclose the mechanism of creatorship as it manifests itself in nature and in the arts."⁵⁵

Kul'bin argued for the use of microintervals and scale-free music, pointing to bird song, which does not follow the established scales. Schillinger is interested in microintervals and lists animal sounds (along with thunder and the echo) as sources of music.⁵⁶ The list of similarities between the two thinkers goes on, including the idea of a graphical notation system for music that forgoes the traditional system of the musical staff and notes. Notably, Kul'bin discusses artistic possibilities that lie in the creation of correspondences between notes (or keys) and colors or numbers.⁵⁷ All of these similarities make *Musofun* appear almost as a covert realization of early Russian avant-garde methods in the medium of a presumably simple game aimed at an unwitting audience.

Ultimately, however, the parallels between Kul'bin and Schillinger do not attest to an adoption of Kul'bin's ideas by Schillinger but rather to a shared background of early twentieth-century musical thought.⁵⁸ For example, the quasi-synesthetic association of tones and colors was also employed by Alexander Skryabin in his orchestral piece *Prometheus: The Poem of Fire* (1910), in which he presented a "key-color-scheme" and wrote a special part for a proposed device whose purpose was to control a set of differently colored lights. Therefore, Frances Schillinger was probably right when she wrote in her acknowledgments to *The Mathematical Basis of the Arts* that this book represents twenty-five years of her late husband's research, which locates the beginnings of the underlying ideas in the early period of post-1917 Russia. However, her dismissive remark that the creation of music from numbers proposed in *Musofun*

is a “number trick” and a “gimmick” shows that she was not aware of Musofun’s deeper implications within the musical-mathematical line of thought from which Schillinger developed his methods.⁵⁹

Schillinger’s Combinatorics

Combinatorics—the mathematical method of enumerating and listing possible combinations and permutations of elements—is at the core of Musofun and Schillinger’s thinking in general. Critics have noted that Schillinger was prone to creating large, repetitive tables by writing out endless examples, all of which resulted from the same simple principle.⁶⁰ As shown above, this observation is also true for Musofun. Obviously, Schillinger was fascinated, and hoped to fascinate his pupils, by what is now commonly called the “combinatorial explosion”—the mathematical fact that the combination or permutation of even a small number of elements can yield an unimaginably large number of results. For example, a set of 7 notes can be arranged in 5,040 different ways. By studiously showing every possible combination of some simple elements, Schillinger hoped to instill faith in the student of his method that there are endless possibilities for using it in composition.

Schillinger shared this fascination with another, much earlier proponent of musical combinatorics. A look into Athanasius Kircher’s book *Musurgia Universalis*, published in 1650, reveals that Kircher also often listed all possible results of a combinatorial set-up. An example of this is his table of all possible permutations of a set of five notes, two of which repeat other notes in the set (the notes are C, D, E, D, C). Kircher lists all thirty possibilities for this case, then goes on to list all twenty permutations of A, A, A, H, H, H.⁶¹ Overall, Kircher’s book, especially its part dedicated to musical combinatorics, contains impressive examples of such lists, paralleling some of Schillinger’s tables. Given that Schillinger stated that he had a solid knowledge of Latin and French (among other languages), it is possible that he read Kircher’s *Musurgia Universalis* or other historical musical treatises that employ this method of presentation.⁶² Similar examples of this early practice of creating comprehensive lists of combinatorial material that could have had an impact on Schillinger’s style can be found in Marin Mersenne’s *Harmonie universelle* from 1636.⁶³

Combinatorics as a mathematical discipline was still in its infancy in the seventeenth century, and, certainly, music theorists were not at the forefront of mathematical developments either. It is therefore understandable that the works of early authors contained long lists instead of a single formula that would have enabled the reader to create the table. Schillinger’s recourse to such an old style of presentation might seem out of synch with the state of mathematical education in the twentieth

century. Backus has even derided Schillinger's tables as "extensive doo-dling."⁶⁴ Yet they might also have served a didactic purpose. They not only make the effects of combinatorial explosion palpable for the student by literally filling pages of Schillinger's books but also give the teacher a possibility to check the student's results.⁶⁵

In his book, Kircher has sometimes used letters and numbers instead of musical notation to illustrate the possibilities of combinatorics as applied to the creation of musical material.⁶⁶ By doing so, he encoded music with a different set of symbols. Musofun's core idea of creating new, arbitrary connections between letters, numbers, and notes (instead of the traditional use of certain letters for note names) follows this tradition. Therefore, the whole alphabet is used in this case and not only the letters that have been historically employed as note names. Musofun also follows the Baroque method of encoding external information with notes, exemplified by the famous interpretation of the tones B (B-flat), A, C, H (B) as Bach's musical signature or the D, Es (E-flat), C, H motif in Shostakovich's case.

Schillinger was not the first author who tried to devise an algorithm-like procedure that involved a certain degree of randomness and allowed for a semiautomatic creation of music. Kircher's *Musurgia Universalis* already contains a description of a box with movable slates holding musical tables, called an *arca musurgica* or, alternatively, *arca musarithmica*. This mechanical device was proposed by Kircher as an aid in the execution of the combinatorial method of composition depicted in his book.⁶⁷ Later examples of combinatorial musical systems are the *Musikalisches Würfelspiel* attributed to Mozart, Antonio Calegari's *Gioco pitagorico musicale* (1801), the anonymously published *Melographicon* system (undated, ca. 1825), and John Clinton's *Quadrille Melodist* (undated, nineteenth century). All of these combinatorial systems are, like Schillinger's *Musofun*, explicitly geared toward the musical amateur, with titles stressing their game-like character and the possibility of creating music without a knowledge of musical theory.

While it is probable that Schillinger knew about the famous *Musikalisches Würfelspiel*, which employs dice and a table of predefined snippets of music, the other systems mentioned above have remained relatively obscure and were therefore probably not known to him. Some of these less known systems that preceded Schillinger's manuscript also make use of cards to create music. Notably, Clinton's *Quadrille Melodist* contains a set of 462 cards with excerpts of piano music that can be recombined to create new variations of the pieces on which these cards are based.

Schillinger's use of combinatorial methods and randomness also raises questions about the statistical properties of his initial material (names, birthdays, addresses), which he seemingly assumes to be fully unpredictable in themselves. It is not clear whether Schillinger was aware of

the fact that some of his proposed sources of initial data contain a higher degree of intrinsic order than others. Telephone numbers, for example, can be seen as a more or less random sequence of digits. Birthdays are already structured to some degree by the numerical boundaries of the calendar system. Words taken from human languages (such as names) follow certain phonetic patterns that make them pronounceable for the speakers of that language. For example, a reader of an English word can reasonably expect a vowel to follow each group of two or three consonants. Thus in *Musofun* Schillinger uses some sources of initial data that are intrinsically coherent to a certain degree. Yet he makes them into a source of unpredictability by recoding them with a different set of symbols. While predicting the occurrence of a vowel in an English word is relatively easy, once this word has been recoded according to the procedure given in *Musofun*, such predictions become virtually impossible, at least without an extensive amount of practice.

It is also not clear whether Schillinger knew that some letters of the English alphabet appear more often than others, shifting the balance of notes in the resulting melodies. One source of information on the existence of an intrinsic order in the words of the human language that might have been accessible to Schillinger is the statistical method of Markov chains, named for the Russian mathematician Andrei Markov (1856–1922). Markov famously analyzed the probability of vowels following vowels and consonants in two texts of Russian literature, establishing the idea of applicability of statistical methods to aesthetic phenomena. In 1924, while Schillinger was still in the Soviet Union, a book of Markov's mathematical texts was published in Moscow that contained an article that described this experiment, which he carried out nine years earlier, in 1913.⁶⁸ This article was written for an audience of professional mathematicians and was most probably not understandable for Schillinger without external help. Yet whatever Schillinger did or did not know about the statistical properties of his initial material, he clearly demonstrated an early interest in the use of data for the creation of aesthetic artifacts.

Conclusion

Joseph Schillinger's unpublished manuscript exemplifies a whole host of ideas that stem from his mathematics-inspired method of composition. Its underlying assumptions are deeply embedded into the broader picture of Schillinger's aesthetic convictions, as well as into the course of Schillinger's work in Soviet Union and in the United States. The roots of Schillinger's thinking lie in the mathematization of the musical-theoretical discourse, in his belief in a unity of all art forms based on natural phenomena, and in the antitraditional stance of early Soviet modernism.

Inspired by the exactness of mathematics, it exhibits striking parallels to the musical-theoretical attitudes of Schillinger's Russian contemporaries. Thus the allegedly simple musical game Musofun draws on impulses coming from the musical culture of the Russian Empire's last and the Soviet Union's first decades.

At the same time, Schillinger also followed a line of thought that was grounded in combinatorial methods from the Baroque period and the nineteenth century. His iterative presentation style is, despite his avant-garde background, deeply rooted in the structure of a Baroque musical treatise like Kircher's *Musurgia Universalis*. Schillinger's use of combinatorial methods of composition came shortly before the digital computer became available as a tool to automatically carry out such operations. Therefore, his work can be seen as preparing the ground for the subsequent mathematization and technologization of music, as evidenced by computer-aided compositions of the post-World War II period, even if his aesthetical reasoning and mathematics were, at times, out of tune with later developments.

NOTES

I would like to thank the reviewers for their thoughts and suggestions.

1. Joseph Schillinger [and unknown], "MUSOFUN. Music by Chance. Games and Pas-times" (1942), PIMS.0048, Joseph Schillinger Papers, Arthur Friedheim Library Special Collections, Peabody Institute, Johns Hopkins University, <https://cdm16613.contentdm.oclc.org/digital/collection/p16613coll4/id/272>. The manuscript bears a stamped mark reading "Copyright 1942 / Joseph Schillinger / New York City." The expansion of the manuscript likely happened at a later point in time, most probably before 1959, when Joseph Schillinger's widow, Frances Schillinger, began disseminating his documents among libraries, archives, and museums. For a history of Schillinger collections, see Ned Quist, "Toward a Reconstruction of the Legacy of Joseph Schillinger," *Notes* 58, no. 4 (2002): 768.

2. For a discussion of typical traits of Schillinger's compositions, see Larry Sitsky, *Music of the Repressed Russian Avant-Garde, 1900–1929* (Westport, CT: Greenwood Press, 1994), 266–70.

3. Frederick S. Starr, *Red and Hot: The Fate of Jazz in the Soviet Union 1917–1991* (New York: Limelight Editions, 1994), 75.

4. Andrey Rimsky-Korsakov, "Džaz-band v kapelle" (1927) and Marian Koval', "Propa-ganda džaz-banda" (1927), in *Dve žizni Iosifa Šillingera. Žizn' pervaja. Rossija. Žizn' vtoraja. Amerika*, ed. Alla Bretanickaja (Moscow: Moskovskaja konservatorija, 2015), 188–91. While the description of Schillinger's claim about the future of human composers comes from the biased account of the lecture by Koval' and is probably an exaggeration of Schillinger's ideas, his later proposals did suggest the practical realization of machines for the automatic creation of music and art. See Joseph Schillinger, *The Mathematical Basis of the Arts* (New York: Philosophical Library, 1948), 673–74.

5. For a discussion of the cultural effects of the first five-year plan (from 1928, the year Schillinger left the Soviet Union), see Starr, *Red and Hot*, 80–82. Details on Teplitsky's conviction can be found in E. V. Šarahaeva, "Leopol'd Jakovlevič Teplickij (k 120-letiju so dnja roždenija)," 2010, <http://library.karelia.ru/kalend2010/kalendar2010/months/html/11.03.1890.html> (accessed January 24, 2019).

6. Joseph Schillinger, *Kaleidophone: New Resources of Melody and Harmony* (New York: Witmark & Sons, 1940), title page.
7. Lyle Dowling, *A Brief Note on the Schillinger System: The Scientific Way to Success in Music* (copyright by Joseph Schillinger, 1942), 4 (use in radio programs) and 7 (use in dance bands).
8. Warren Brodsky, "Joseph Schillinger (1895–1943): Music Science Promethean," *American Music* 21, no. 1 (2003): 47.
9. Schillinger's wife's memoir reports that he deeply respected Schoenberg's method of composition, no doubt because of their perceived shared interest in mathematically inclined methods. It is, however, also true that, despite his own antitraditional stance, he harshly criticized any modern art that relied, in his view, on intuition and imagination instead of a "scientific" and mathematical procedure. See Frances Schillinger, *Joseph Schillinger: A Memoir* (New York: Da Capo Press, 1976), 74–75, 50–51.
10. With the financial help of the GI Bill, Brown studied the Schillinger method between 1946 and 1950 at the Schillinger House (now the Berklee College of Music). See Elena Dubinets, "Between Mobility and Stability: Earle Brown's Compositional Process," *Contemporary Music Review* 26, no. 3–4 (June 2007): 409–26; Louis Pine, "Earle Brown's Study and Use of the Schillinger System of Musical Composition," in *Beyond Notation: The Music of Earle Brown*, ed. Rebecca Y. Kim (Ann Arbor: University of Michigan Press, 2017), 27–79; and Pine, "Conversation with Earle Brown about Constructivism and Schillinger's System of Musical Composition," *Contemporary Music Review* 30, no. 2 (April 2011): 167–78. For examples of connections between computer music and Schillinger's methods, see Jeremy Arden, "Old Tricks New Media: Schillinger Techniques Are Relevant to All Kinds of Contemporary Music Irrespective of Style," *Contemporary Music Review* 30, no. 2 (April 2011): 127–41; Bruno Degazio, "The Schillinger System of Musical Composition and Contemporary Computer Music," *Diffusion!*, 1988, https://source.sheridancollege.ca/faad_publications/12 (accessed January 24, 2019); and Nick Collins, "Origins of Algorithmic Thinking in Music," in *The Oxford Handbook of Algorithmic Music*, ed. Alex McLean and Roger T. Dean (Oxford: Oxford University Press, 2018), 70–71.
11. Joseph Schillinger, *The Schillinger System of Musical Composition*, 2 vols. (New York: Carl Fischer, 1946); and Schillinger, *The Mathematical Basis*.
12. For an overview of the Schillinger collections of American institutions, see Quist, "Toward a Reconstruction," 765–86.
13. Jerome Gross and Bert Henry Papers on the Schillinger System, BCA.006, Berklee College Archives, <https://library.berklee.edu/archives/archives-virtual-display/jgbh>; and Lawrence Berk Papers on the Schillinger System, BCA.007, Berklee College Archives, <https://archives.berklee.edu/bca-007-berk-schillinger-papers> (accessed January 24, 2019).
14. See Albert Glinsky, *Theremin: Ether Music and Espionage* (Urbana: University of Illinois Press, 2005), 131–36.
15. See Schillinger, *The Schillinger System*, 2:1485.
16. See Schillinger, *The Mathematical Basis*, 274, 665–67. The photograph is available at http://collections.si.edu/search/detail/edanmdm:AAADCD_item_8363 (accessed January 24, 2019). For a discussion of the siren, see Alexander Rehding, "Instruments of Music Theory," *Music Theory Online* 22, no. 4 (2016), <http://www.mtosmt.org/issues/mto.16.22.4/mto.16.22.4.rehding.php> (accessed January 24, 2019); and Rehding, "Of Sirens Old and New," in *The Oxford Handbook of Mobile Music Studies*, ed. Sumanth Gopinath and Jason Stanyek (Oxford: Oxford University Press, 2014), 2: 87–88. See also Andrej Smirnov, "Theremin. Touchless Music; Terpsitone. Dancing in Tune; Rhythmicon. Rhyth'n'light," in *Zauberhafte Klangmaschinen: Von der Sprechmaschine bis zur Soundkarte*, ed. IMA Institut für Medienarchäologie (Mainz: Schott, 2008), 135–39, 188–90.

17. See Paula Morgan, "Slonimsky, Nicolas," Grove Music Online, 2001, <https://doi.org/10.1093/gmo/9781561592630.article.25972> (accessed January 24, 2019).
18. See Nicolas Slonimsky, "Schillinger of Russia and the World," Music News: Joseph Schillinger (booklet reprinted from the March 1947 issue of Music News), 1947, 2; and Slonimsky, "Review of the Schillinger System of Musical Composition," Musical Quarterly 32, no. 3 (1946): 465.
19. Sidney Cowell and Henry Cowell, "Charting the Musical Range," Modern Music 23, no. 3 (1946): 226. Later, Henry Cowell also taught Schillinger methods at the New School for Social Research. See John D. Spilker, "The Curious Afterlife of Dissonant Counterpoint: Jeanette B. Holland's Class Notes from Henry Cowell's 1951 Advanced Music Theory Course," American Music 30, no. 4 (2012): 405–25.
20. Slonimsky, "Schillinger of Russia," 1–2.
21. For documents and an analysis of this period, see Ellen Schrecker, *The Age of McCarthyism: A Brief History with Documents*, 2nd ed. (New York: Palgrave, 2002).
22. Sitsky, *Music of the Repressed*, 265.
23. *Red Channels: The Report of Communist Influence in Radio and Television* (New York: Counterattack: The Newsletter of Facts to Combat Communism, 1950), <https://brbl-dl.library.yale.edu/vufind/Record/3524993> (accessed January 24, 2019).
24. Charles Previn, "Schillinger's Influence on Film Music," Music News: Joseph Schillinger, 1947, 13–16.
25. John Backus, "Re: Pseudo-Science in Music," Journal of Music Theory 4, no. 2 (1960): 229, 231.
26. Elliott Carter, "Fallacy of the Mechanistic Approach," Modern Music 23, no. 3 (1946): 228–30.
27. Orest Cehnovicer, "Novaja muzyka i proletariat" (1927), in *Bretanickaja, Dve žizni Iosifa Šillingera*, 186 (translation by the author).
28. Ted Pease, "Berklee Today: The Schillinger/Berklee Connection," n.d., <https://www.berklee.edu/bt/122/connection.html> (accessed January 24, 2019).
29. Quist, "Toward a Reconstruction"; Brodsky, "Joseph Schillinger"; *Bretanickaja, Dve žizni Iosifa Šillingera*; Sitsky, *Music of the Repressed*, 264–72; Eckhard John, "Music of the Future on the Move: Joseph Schillinger and the Emigration of Russian Musicians to the U.S.A.," in *Crosscurrents: American and European Music in Interaction, 1900–2000*, ed. Felix Meyer et al. (Suffolk: Boydell Press, 2014), 210–18; Elena Dubinets, "Between Mobility and Stability: Earle Brown's Compositional Process," *Contemporary Music Review* 26, no. 3–4 (June 2007): 409–26. See also the chapter on Schillinger in Julian Georg Bauer, *Theorie, Komposition und Analyse: Der Einfluss der Mathematik auf die Musik im 20. Jahrhundert* (Frankfurt am Main: Peter Lang, 2010).
30. For example, <https://www.schillingersociety.com/> (accessed January 24, 2019).
31. The title page of the manuscript (fig. 2) gives an example of how the method works. The word "Musofun" is encoded there as the sequence F, C, B-flat, G-flat, B-flat, C, F. Since each note is assigned two letters in Schillinger's scheme, both "s" and "f" yield the note B-flat, while "m" and "n" yield F, leading to a symmetrical melody.
32. For a short biography, see George J. Ferencz, "Royal, Ted," Grove Music Online, 2001, <https://doi.org/10.1093/gmo/9781561592630.article.45958> (accessed January 24, 2019). For the list of authorized teachers, see Music News: Joseph Schillinger, 17. It is also possible that multiple editors worked on different versions of the manuscript during its creation, with the textual editing being carried out by a different person from the one who wrote the additional parts. The fact that Ted Royal's name was erased from the note attributing the manuscript to him might mean that this attribution is problematic.
33. "Musofun," added part, 7. The Encyclopedia of Rhythms contained the following note: "Mrs. Joseph Schillinger wishes to acknowledge the work done by Arnold Shaw and

Charles Colin. Mr. Shaw wrote the Preface, A Note to the Teacher and Student, and Mr. Collin wrote the Supplementary and Explanatory Key” (Joseph Schillinger, *Encyclopedia of Rhythms: Instrumental Forms of Harmony* [New York: Da Capo Press, 1976], w.

34. “Musofun,” Schillinger’s proposal, 4–8. Roosevelt’s name, for example, is encoded as B-flat, A, F, F, E-flat, E, C-sharp, F, G-sharp, A, E, F, F, F-sharp, A, F-sharp, F-sharp, B-flat, A, C-sharp, A, E, B. For Dragonette’s description of Schillinger’s studio, see Jessica Dragonette, *Faith Is a Song: The Odyssey of an American Artist* (Patterson, NJ: St. Anthony Guild Press, 1951).

35. “Musofun,” Schillinger’s proposal, 14–15.

36. It is not known whether the manuscript was actually offered to publishers, but this

was probably seen as a practical possibility. The introductory note describes the manuscript as a “book . . . ready for publication,” and the “Memo for JS” proposes the demonstration of the book and its game at bookstores.

37. “Musofun,” added part, 2–3.

38. “Musofun,” Schillinger’s proposal, 13.

39. “Musofun,” added part, 16a–16b; “Author’s note,” 70–71.

40. “Musofun,” “Author’s note,” 71.

41. “Musofun,” added part, 60–66.

42. Carter, “Fallacy,” 229.

43. Slonimsky, “Schillinger of Russia,” 2.

44. The 1942 pamphlet advertising the Schillinger system includes a large list of successful pupils and works purportedly carried out using the system. See Dowling, *A Brief Note*, 4, 7, 9–14.

45. According to Frances Schillinger’s memoir, Schillinger first gave twenty-six hours of lessons per week and later switched to teaching four times a week for eight hours. See Schillinger, *Joseph Schillinger: A Memoir*, 182, 38, 87.

46. See Slonimsky, “Schillinger of Russia,” 2; and Slonimsky, “Review,” 465.

47. “Es sind futuristische Grundideen und Visionen, die sich in seinem mathematisch-philosophisch-ästhetischen System verketten”; “Rein futuristischen Geistes war jedoch die auch Schillingers Gedankensystem innewohnende Tendenz zur Erstrebung einer neuen, umfassenden Ordnung, die die bisher bestehenden, überaltert und brüchig gewordenen, unzulänglichen Ordnungen ablösen werde” (Detlef Gojowy, “Joseph Schillinger—Komponist und Utopist,” in *Jazz und Avantgarde*, ed. Jürgen Arndt and Werner Keil [Hildesheim: Olms, 1998], 136–37, translation by the author).

48. Pine, “Conversation.” See also Evgeniya Lianskaya, “Joseph Schillinger and the Russian Avant-Garde in the 1920s,” in *New Music in the “New” Europe 1918–1938: Ideology, Theory, and Practice*, ed. Geoffrey Chew (Prague: KLP, 2007), 158–61.

49. Joseph Henry Auner, *Music in the Twentieth and Twenty-First Centuries* (New York: W. W. Norton & Company, 2013), 124, 138–39.

50. Ilya Levinson, “Kashchey in Blue: The Rimsky-Korsakov-Schillinger-Gershwin Connection,” in *Rimskij-Korsakov i ego nasledie v istoričeskoj perspektive*, ed. L. O. Ader (St. Petersburg: GMTiMI, 2010), 407–14.

51. Sitsky, *Music of the Repressed*, 266.

52. Sergej Taneev, *Podviznoj kontrapunkt strogago pis'ma* (Leipzig: Beljaev, 1909), 2, translation by the author.

53. *Ibid.*, 23.

54. See Nikolaj Kul’bin, “Svobodnoe iskusstvo kak osnova žizni,” in *Russkij avangard. Manifesty, deklaracii, programmnye stat'i (1908–1917)*, ed. I. S. Vorobjov (St. Petersburg: Kom-positor, 2008), 30.

55. Schillinger, *The Mathematical Basis*, preface.

56. See Kul’bin, “Svobodnoe iskusstvo kak osnova žizni,” 45; and Schillinger, *The Mathematical Basis*, 5. Schillinger’s interest in microintervals is evidenced by his concept of the “double equal temperament system.”

57. See Kul'bin, "Svobodnoe iskusstvo kak osnova žizni," 51–56.
58. For examples of similar developments in Russian musical thought of this period, see Elizaveta Ivanova, "Iosif Šillinger o muzykal'nom ritme," *Izvestija Rossijskogo gosudarstvennogo pedagogičeskogo universiteta imeni A. I. Gercena*, no. 171 (2014): 131, 133. Note especially the parallels to the metrotektonizm mathematical theory of musical form proposed by Georgij Konjus (1862–1933).
59. See Schillinger, *Joseph Schillinger: A Memoir*, 45.
60. See, for example, Backus, "Re: Pseudo-Science," 224.
61. Athanasius Kircher, *Musurgia Universalis Sive Ars Magna Consoni et Dissoni in X. Libros Digesta* (Rome: Corbelletti; Grignani, 1650), 2:10–11. For a discussion of combinatorics in *Musurgia Universalis*, see John Zachary McKay, "Universal Music-Making: Athanasius Kircher and Musical Thought in the Seventeenth Century" (PhD diss., Harvard University, 2013). For comparisons of different early applications of combinatorics in musical treatises, see Eberhard Knobloch, "The Sounding Algebra: Relations between Combinatorics and Music from Mersenne to Euler," in *Mathematics and Music: A Diderot Mathematical Forum*, ed. Gerard Assayag, Hans Georg Feichtinger, and Jose Francisco Rodrigues (Berlin: Springer, 2002), 27–48.
62. See Schillinger's autobiographical draft, reprinted in Elena Dubinets, ". . . Pereros muzyku kak takovuju," in *Bretanickaja, Dve žizni Iosifa Šillingera*, 247–48.
63. See Mersenne's listing of all 720 permutations of ut, re, mi, fa, sol, la, which extends over five pages. Marin Mersenne, *Harmonie universelle, contenant la théorie et la pratique de la musique* (Paris: Sebastien Cramoisy, 1636), *Livre des chants*, Proposition IX, 111–15, <https://gallica.bnf.fr/ark:/12148/bpt6k5471093v/f440.image> (accessed January 24, 2019).
64. Backus, "Re: Pseudo-Science," 225.
65. In 1947 there were eighteen "fully authorized" teachers of the Schillinger system. See *Music News: Joseph Schillinger*, 17.
66. See Kircher, *Musurgia Universalis*, 2: 3–4, 6, and his number-encoded tables, beginning with the Pinax I, 2:60.
67. See McKay, *Universal Music-Making*, 301–6.
68. Andrei Markov, "Zamečatel'nyj slučaj ispytaniy, svjazannyh v cep'," in *Isčislenie verojatnostej* (Moscow: Gosudarstvennoe izdatel'stvo, 1924), 552–81. See also Brian Hayes, "First Links in the Markov Chain," *American Scientist* 101, no. 2 (April 2013): 92–96.