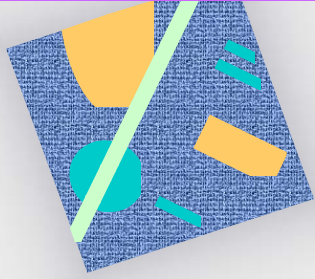


Joseph Schillinger

Music Science or Musical Science Fiction

Part 2



Dr Warren Brodsky

*Music Science Research
Department of the Arts*

Ben-Gurion University of the Negev, Beer-Sheva, Israel

81

Multi-Media

- Described multimedia art forms
- Predicted that television would undoubtedly stimulate further fusion of existing art forms
- Dreamed of a kinetic art appealing to all of the senses at one time
- Evolved the first scientific theory of the arts; individual and compound art theory based on the five senses, space, and time

82

- Developed a permutation approach to the arts before the computer era defining 18 different art forms involving sound, mass, odor, flavor, light, pigment, and surface in relation to general components of time and space

83

Graphic Arts

- Composed pictures demonstrating color harmonies
- Evolved a new system of projective geometry making all curves expressible in circular areas

84

Graphic & Industrial Design

- Created designs for fashion, fabrics, carpets, and household items
- Produced designs for wall paper, book covers, and posters
- Designed wooden furniture (including his personal Steinway piano)
- Worked on compositions in pure and industrial design with A. Winogradow & V. Pregram at Architectural League of New York

85

Movement & Dance

- Developed a graphic notation of human movement notation using the metaphor of an orchestra to depict the movement of the human body (rather than that of a single instrument)
- Human movements were analyzed by their geometrical shape
- Notation plots movements onto a graph co-ordinating movement in two dimensions: trajectory and time (spatial-temporal)

86

JOSEPH SCHILLINGER

GRAPH METHOD OF DANCE NOTATION



$$\frac{\pi}{4} + \frac{\pi}{2} + \frac{3\pi}{4} + \pi + \frac{5\pi}{4} + \frac{3\pi}{2} + 2\pi$$
$$\angle 45^\circ + 90^\circ + 135^\circ + 180^\circ + 225^\circ + 270^\circ + 315^\circ + 360^\circ$$
$$r = 1, 2, 4.$$



A Cervera Press Publication

Photography & Film

- Developed and taught correct set designs for movie and stage scenes, and for finding the correct angles for filming
- Developed and produced photographs and films - experimented with shadows and optical illusions
- Produced geometric moving pictures and experimented in animated color abstractions
- Developed theory of colors based on photochemical evidence (reaction of the emulsion in color film)

88

- Wrote essays on motion picture theory Cinema Synchronization with M. E. Bute and L. Jacobs
- Produced light-ray and wood block compositions and pure animated designs
- Developed photographic compositions illustrating stage design and interior decoration

89

- Constructed abstract animated color compositions with G. Goldberg, M. E. Bute, and E. Katz



Verbal Arts

Wrote and published poetry depicting:

- Visual imagery
- Mathematically devised poetry and prose

91



“Theurgian’s Commandments”
a set of poems published by
Seb Publishers, 1920. Depicting
fusion of the senses in art of the future

- Mystical poems: “Bright Message” a book published by Seb Publishers



Music Theory

- Catalogued the number of chords (n=36) which result from major and minor thirds (opposed to 4 which have been traditionally used in music prior to the 1920s)
- Developed graphic methods of musical notation
- Evolved a compound tuning system eliminating the controversies of all other pervious systems

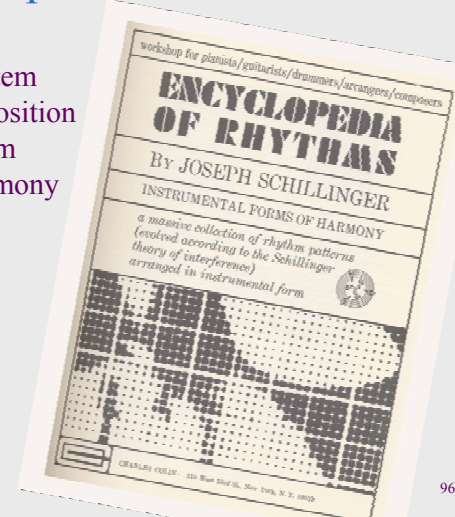
94

- Developed a solution to the problem of tempo interpretation, especially changes in tempi (usually left to the discretion of the performer), by writing out in exact notation the values of the notes of a retard or acceleration (which resulted in complicated metric signatures)

95

Music Composition/Orchestration

- Developed system of music composition based on rhythm rather than harmony



96



- Revolutionized the art of orchestration by presenting unique combinations of scales, chords, harmonies, and instruments



- Solved the problem of the coordination of sound track/film track by developing a concept of background music to fit the time, mood, and excitement of motion pictures
- Developed a psychological dial - a practical device for correlating music and emotion utilizing a set of general laws governing relationships between sound and emotional reactions



- With the adoption of an engineering technique, the entire approach to musical composition Schillinger revealed that all the processes involved in the creation of music composition may be represented by elementary mathematical procedures
- Schillinger quoted ancient Philosophers who long ago suspected there were unconscious mathematical procedures behind conscious musical intentions
- Music becomes the mathematics of the soul

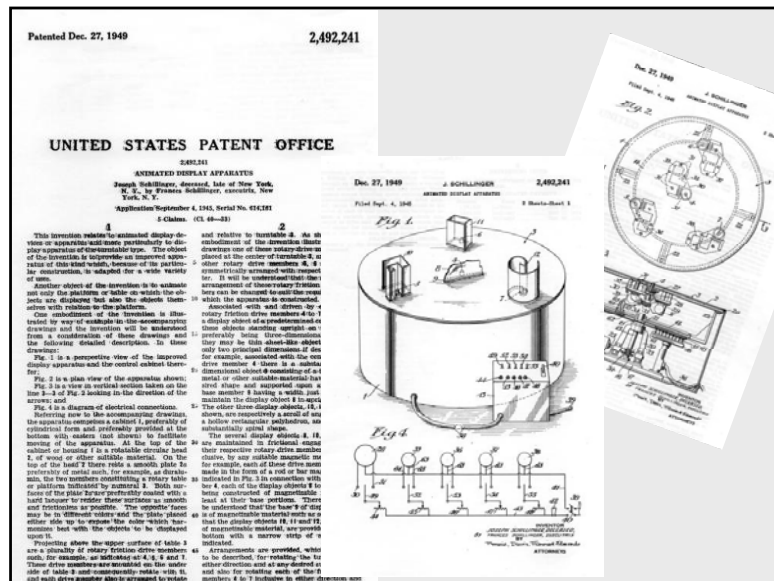


Inventions

- Collaborated with Leon Theremin (Russian inventor and physicist) on research in musical acoustics and psychoacoustics
- With Theremin designed and constructed:
 - a. Electronic organ with micro-tuning & volume control of differential tones (1932)
 - b. First electronic synthesizer (before Robert Moog) manufactured by RCA Victor

- Developed the Rhythmicon (a early ancestor of drum synthesizer)
- Outlined a set of futuristic instruments:
 1. Musmaton (for producing auditory designs, i.e., MIDI synthesizers, soundcards, and external sound modules)
 2. Graphomaton (for producing linear designs, i.e., graphics software and laser color printers)
 3. Luminaton (for producing designs by projected light, i.e., animation software and SVGA color monitors)

101



Prophecies

- The men responsible for the music of radio and television would neither be composers nor performers, but a new kind of music engineer, who would operate the machines that compose and perform music (1940)
- As electronically produced sound was far superior to conventional instruments, all-electric symphony orchestras would make present-day orchestras obsolete

103

- Future musical compositions (classical and popular) will not be created by exceptionally talented people in periods of emotional activity, but rather by everyday intelligent layman who have access to a system
- Proposed music in the machine age would involve music for wholesale entertainment in the promotion of sales (based on 1936 data indicating the investment of 200 advertisers (\$32,000,000) on broadcasting

104



Music of the Future

Prior to his death (1943) Schillinger begun to work on a new “revolutionary” project involving the electronic reproduction of music without the use of conventional musical instruments or musicians

105



“New-Age” Education

- Natural and Tempered Systems of Tuning
- New Art Forms: a speculative theory of art
- Physical and Psycho-Physiological Nature of Sound
- Processes of Musical Structure
- Rhythmic Design
- Statics and Kinematics of Musical Matter
- The Variety of Musical Experience
- Theory of Musical Perception
- Tone Space and Musical Matter

106



Texts on Music Subjects (Russia before 1928)

- Rudiments of Music
- Musical Propedeutics
- Impressionism in Music
- Ways of Modern Music
- New Era of Polyphony
- Symphonic Drama
- Conductorless Orchestra

107



Texts on Music Subjects (In USA)

- Evolution of Musical Instruments (from the beginning up to electronic sound-production)
- Problem of Musical Education
- A System of Musical Harmony
- A Manual For Playing the Space-Controlled Theremin (The Victor-Theremin ether-wave instrument)

108

MODERN MUSIC
A Quarterly Review

MUSIC AND THE MACHINE

DEBON FOR THE AGE OF STEEL... *Lee Simonson* 2

MAN, MUSIC AND THE MACHINE... *Boris de Schloezer* 3

FILM OPERA—SCREEN VS. STAGE... *Hans Heinsheimer* 10

MUSIC OF AND FOR THE RADIO... *Max Baating* 15

THE ORCHESTRA ON THE AIR... *Charles Weyl* 20

SCENE FROM WOZZECK... *Robert Edmund Jones* 25

ELECTRICITY, A MUSICAL LIBERATOR... *Joseph Schillinger* 26 ✓

MUSIC OF AND FOR THE RECORD... *Henry Cowell* 32

PIONEERS OF MOVIE MUSIC... *Richard Hammond* 35

DANCERS OF THE SEASON... *Mary Blizstein* 38

WINTER CHRONICLE, NEW YORK... *Galia McPhee* 42

SCHÖNBERG'S SUPER-FILM MUSIC... *Alfred Einstein* 45

WORLD ALMANAC OF RADIO... *Marvin Bauer* 46

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VOLUME VIII FIFTY CENTS A COPY NUMBER 3

- Electricity, a Musical Liberator

Selected Scientific Conceptualizations

Brain Functioning

- Relationship between creation (perception) of new esthetic patterns with biochemical patterns in brain functioning
- All pattern making has its general source in electro-chemical patterns of the brain functioning

- This bio-generator asserts certain tendencies which in turn produce certain configurations and certain colors
- The near future might demonstrate that creative experiences are merely geometrical projections of the electro-chemical patterns of thought on various materials having sensory effects on us



Development of Awareness

- Conceptualized scheme for understanding the development of art experiences linked five Morphological Zones:
- Pre-esthetic (biological, tactile)
- Traditional-esthetic (religious, reproductive, magical)
- Emotional-esthetic (unconscious, art for art's sake)
- Rational-esthetic (experimenting, novel)
- Post-esthetic (scientific, analytic, synthesis, abstract, fusion)

113



Psycho-physiological Effects

- The meaning of music evolves in the form of quantitative psycho-physiological correspondences. Regularity is stability, and simplicity is relaxation. The loss of stability is caused by powerful excitors
- The awareness of instability comes through the variation in blood circulation sensed through heartbeat, and in blood pressure, resulting in respiratory movements

114

- The simple organism at rest is thus comparable to a simple harmonic motion.
- The whole organism is a variation of stability, fluctuating between certain extreme of restfulness and restlessness
- The constitution of music is equivalent to that of an organism - it is a variation of the stability in frequency and intensity



The Healing Power of Music

The organizing power of music - a sound can signal and induce fear (evil), or cause a counteract and attract the favorable and good. Medicinal applications of music as a healing device. Forms of treatment by means of sound waves. Quantitative difference between low frequency waves (sound waves) and high frequency waves (x-rays)

116



Emotional Effects of Music

- Music can effect the formation of ideas and ethics (morals)
- Music can both serve as a release of obsessions, and become an obsession itself
- Some musical scales were rejected in the past on the assumption that they caused negative influence over the younger generation. Some people in society today (ca. 1935) still believe that certain patterns in musical scales (exotic and jazz scales) have a bad influence on our generation

117

- Frequently musical abilities develop on account of other abilities. There are many musicians with subnormal mentality as well as people who are insane (in the medical sense of the word) who possess extraordinary musical abilities and an almost supernaturally retentive musical memory (i.e., Idiot Savant)



Music and Emotions

Connection of human emotions with tensions produced by musical dissonance

119



Effects of Training

There are different reactions to music among students from music departments versus non-music departments

120

Music Education

- Rational Music Education more important than acquisition of one type of routine which may be useless ten years in future. Music Education must include:
- Technical training
- Thorough knowledge of sound material
- Complete understanding of general methods involved in musical procedures

121

Musicality

- Musicality is:
- Immunity and dislike of existing music
- Inventiveness in handling the raw material of intonation
- Kinesthetic sense of sound in motion which permits the composer to emphasize long periods of musical flow without ever having heard them before
- Sensation of tension and release through patterns of musical motion

122

- Sense of propagation, in its mathematical meaning, with regard to the character and quantity of sound
- Independence, initiative, keen observation, analytic sense, and freedom from the prejudice and routine imposed by the established forms of musical education

Absolute Pitch

- Contended that Perfect Pitch has nothing to do with musicality
- Absolute Pitch has no chance what so ever to withstand comparison to other absolutes (absolute zero' temperature, or the melting/boiling point or certain substances)
- Absolute A=440 is a standard set by various national and international conferences. The fact that a certain wave frequency is called A is not a natural phenomenon, but a mutual agreement by groups of experts, valid in certain locality, in a certain period of time

124



Synthetic and Multi-Sensory Associations

- Music in synthesis of arts, music and light, music and color, colored hearing. Fusion of the sensations. Color hearing, sound seeing, temperature and texture reactions on tone-qualities
- Mutli-sensory associations. Transformation and co-existence of optical forms based on musical patterns

125



Musical Priming

Musical priming of words, i.e., different understanding of words as a result of being primed by musical motifs or phrases


126



Notation of Temporal Stimuli

- Standard notation does not portray the most essential property of the temporal mode of music - motion. The notational record is not in itself a musical work, but merely a conventional statuary thereof
- In this respect preference must be given in principle to paper rolls for mechanical instruments (if they have been prepared by the composer himself)

127

- 
- In contradiction to the notational graphic system, rolls give expression of the process which is geometrically precise and adequate to temporal relations. When set in motion they represent exactly (as far as the mechanisms of the instrument permits) the musical work, transferring it by means of a moving special projection, from the category of consciousness into the category of being

128

Human Perception

- Human perception is based upon two categories of consciousness: space and time
- All forms of Art can be classified into two groups: static and kinetic
- Static are forms crystallized in space. They do not change in time. They can be observed by various stationary positions, each point of observation revealing a different from

129

- Kinetic forms result from generation, degeneration, and transformation of forms in time continuity
- A kinetic impression can be obtained from unchangeable static optical forms (by gradually displacement of the point of observation), or by changeable optical forms (by varying points in space)

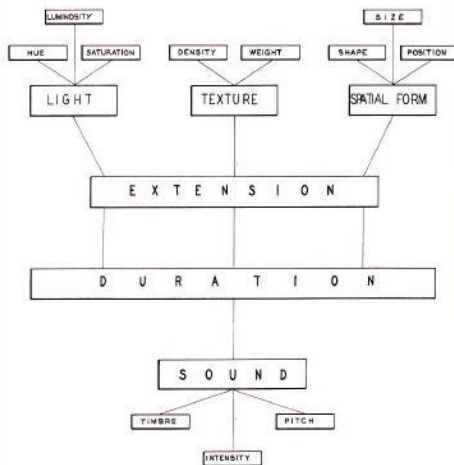


Figure 6. Components of a combined kinetic art form.

- An interplay exists between the components of light composition which render it either mobile spectral colors projected on a two dimensional screen, or a three-dimensional form, changing structure and color in time continuity. Hence, the space form is kinetic - similar to aural forms which are sound transforming in time - and therefore must be looked at as kinetic transformations in time

What is Music?

Is music...

- What the composer imagined?
- What the composer wrote?
- What the performer played?
- What the listener heard?
- What the critics reported?

Art and Relativity

A theory whereby the graphic arts, sound, light, and movement are reduced to mathematical principles

134

Scientific Vaudeville

Large scale performance involving human actors (pantomime, drama, dance, acrobatics, singing, and declamation), stage settings of different types (static, kinetic, shadow-play, and cinematic), different types of lighting, and optical variations of appearances of scenery and actors

135

Result in increased attention of the audience because of the excitement of two or more senses with the constant predominance of one

The constant modification of one material into another appeals to several senses simultaneously, heightening the psychological reaction of the audience



Science of the Arts

- A practical correlation of all arts and sciences accomplished by scientific experimentation
- Must deal with the relationship that develops between works of arts as they exist in their physical forms and emotional responses as they exist in their psycho-physical form, i.e., between the forms of the excitors and the forms of the reaction

137

- As long as an art-form manifests itself through the physical medium, and is perceived through as organ of sensation, memory, and associative orientation, it is a measurable quantity. Measurable quantities are subject to the laws of mathematics
- The experiment in Fantasia proved that no artist can coordinate several art forms without a scientific method

“Mr. Disney, not knowing how music can be projected into form and color resorted to accessories of music, and a made a mistake in seeking a fundamental relationship between forms of musical sound and the physical forms of musical instruments. Unity is absent from the production in other ways. For even with the help of Leopold Stokowski and Deems Taylor Fantasia failed to solve the problem of combining visual images with music. This could only be done through mathematical methods.”



Components of Rhythmic Features in Cinema

- The Plot - rhythm of events
- The Action - rhythm of actions
- The Form - spatial and temporal rhythm of forms and dimensions
- The Color - spatial and temporal rhythm of the color sequence
- Musical Episodes - rhythm of the sequence
- Musical Sound - rhythm of durations, pitch, intensity, and tone-quality

140

- Rhythmic Coordination of the components:
- Co-ordination between the plot with the visual forms and color
- Co-ordination of the plot with the auditory forms
- Co-ordination of the visual and auditory forms

- The presence of any of the components or combination thereof bears an imprint of the psychological category
- There are an infinite number of configurations but experts of Schillinger's System would be able to tell at a glance whether a certain configuration is a projection of humorous, contemplative, or heroic mood

Geometric Projections of Psychological Categories

- Each mood, character, or action can be mathematically expressed in the form of a geographic pattern. The graphic pattern is not an actual image to be used, but a configuration which expresses the rhythm of a spatial or temporal form
- This configuration can be translated into many components or combination of components

142

Creative Freedom

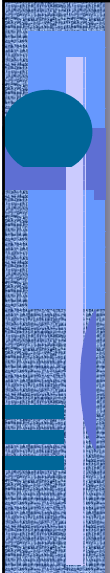
- Artists are not really free - they are subjected to the limitations of their immediate surroundings, culture, the manner of execution, and the materials used in their art form
- Further, artists only speak the language of their own geographical and historical backgrounds

144

- The key to real freedom - and artistic emancipation - is through a scientific method
- Real freedom lies in the discovery and mastery of the principles
- Creation directly from principles and not through imitation of appearances leads to originality (the product of knowledge and not guesswork)

- Since the sense organ react to frequencies and intensities, and not to associative psychological forms and images, esthetic objects are capable of direct stimulation by number of frequencies and proportions present in the artistic media (sound and color)
- Conditioned reflexes associated with pleasure and delight grow through repeated experiences. The beauty of a composition results from the harmonic relations of harmonically developed components (spatial and temporal components)

Physical Basis of Beauty

- 
- Phasic differences, causing instability in wave motion, are the actual factors controlling esthetic varieties. Visual and auditory stimuli (perception) lead either to unstable, healthy synchronized, or over-active instability biological rhythms (sub-biological, biological, or supra-biological)
 - Esthetic pleasure correlates directly to frequency (however, visual and auditory modes differ in casual affects)

- Phasic qualities are: under-stimulation, normal stimulation, and over-stimulation. Psychological entities are: sub-normal, normal, and super-normal
- Low-frequency 'Red' affects us as under-stimulation; Mid-frequency 'yellow,' 'green,' and 'blue' as normal stimulation; and High-frequency 'violet' as over-stimulation. Camera pictures provide photo-chemical evidence comparing colors of sunset (over-abundance of red), midday (balanced spectrum), and forenoon (ultra-violet predominance) through reaction of the emulsion in color film

- Quality of sound largely depends on form and frequency
- When the frequency is low the impression is that of insufficiency and retarded life speed
- When the frequency is normal the impression is of healthy existence and well being
- When the frequency is high the impression is of accelerated precipitated, and tense existence

Hence..

- Low-pitches (low frequencies) produce quiescent, nocturnal, sub-biological understimulating effects
- The middle range, particularly the one corresponding to the human voice approximately 64-1200 cycles, embraces the psychological range of normal stimulation
- The high frequencies produce overstimulation particularly when abundant with beats

The Meaning of Music

- The controversies ascribing to semantic connotation (descriptive or symbolic) will vanish when the real meaning of music has been unveiled
- Meaning in music relates to physico-physiological correspondences, which are quantitative, and express form
- Formation of patterns are due to: Configuration and Periodicity (both of which can be simple or complicated in a mathematical sense)

151

- Periodicity defines the recurrence of forms (which may also be of different degrees of complexity)
- Regularity means stability, and simplicity means relaxation. The loss of stability is caused by powerful excitors affecting the very existence and equilibrium

Double Equal Temperament

- Tuning System unifies all intonation systems used in the west world based on 12 basic intervals and 144 micro-intervals
- Permits higher degree of precision in equal temperament, mean temperament, just-intonation, and the special string and vocal inflections of jazz and gypsy music
- Electronic organ with micro-tuning and a specially designed keyboard was built by Theremin in 1932 for the performance of Double Equal Temperament

153

Rhythmicon

- Instrument constructed by Leon Theremin
- First modern instrument that composes music automatically (rhythmic patterns in the acoustical scale of intonation)



- Sounds produced by the interference of 1-16 generators resulting in 65,535 poly-rhythms
- Schillinger claimed: if we used a mean 10s per combination, then.. it would take 10,922.5 hours to play all the combinations, which is.. 455 days, 2 hr, 30 min



Solidrama

- Solidrive is device which allows the artist to represent motion and transformation of solids by using magnetic drives and screens.
- Can be synchronized with light and sound

156

Poetic Meaning

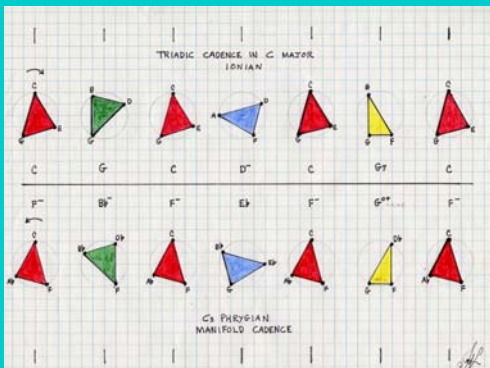
- Poetic structure may be arranged into sonic and semantic scales
- Sonic scales represent: syllabic configurations, with specified accents, assonance, and alliteration
- Semantic scales represent direct and indirect (metaphoric) associational classifications and are arranged through the degrees of connotational intensity (associative power)

Unanswered Questions

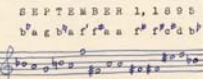
- Unconscious mathematical procedures behind conscious music intentions?
- What faculties constitute musicianship?
- There are geometric shapes in nature. Does sound in nature causes geometrical and mathematical organizations?
- What is the role of audience applause - collective reflexes?
- Are there different types of listeners and their reactions? Types of critics and their reactions?

Against Schillinger

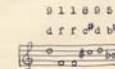
- Focus on the mathematical nature of the system; a widespread belief that anything artistic which has contact with math will become mechanical and contrived



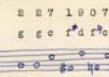
Game 2. Birthdates



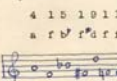
Or using the month as a number: September = 9



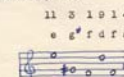
FEBRUARY 27, 1907



April 16, 1911



November 3, 1914



- Schillinger system replaces intuition, inspiration, and improvisation

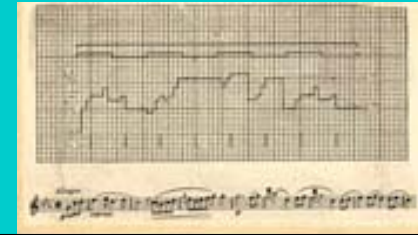
with..

formulae and intellectual processes

- Misconception that the system is meant exclusively for creating background and incidental music because it has been used by composers of Radio and Hollywood.
- Schillinger's deeply rooted connections and intimate relationship with well known celebrities was booed by the classical music performance and academic community as proof of an overall intellectual harlotry.



- Misunderstanding arising from Schillinger's use of unconventional terminology such as graph notation whereby the abscissa indicate relative duration and the ordinate shows the number of semitones



Or for example...

$$E(\sigma) = S3p (E1)$$

which means a given harmonic aggregate (Sigma) is a structure (S) in three parts (p) in the first expansion (E1) - that is, a diatonic scale strung out in thirds by skipping every other note - otherwise known as

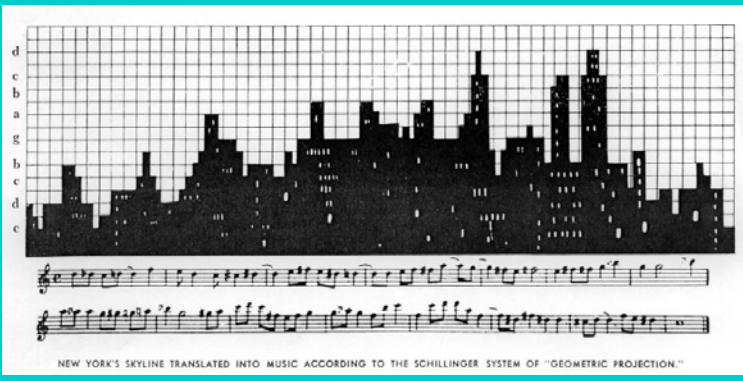
the common major triad

- Schillinger declared well known composers as un-musical including Wagner and Beethoven because they composed through trial and error evidenced by many sketches
- Criticized Rimsky-Korsokov for helpless attempts at modulations in modes (other than Dorian and Mixolydian)
- Guffawed at Chopin's and Schumann's very chaotic styles of piano writing (demonstrating that compositions emerged from piano improvisation)

- Found Bach's resources deficient not reaching the potential use of inversions as a result dogmatic and partly intuitive channels of composition (which would not have resulted had he used mathematical theories of geometry)
- Denounced practice as a process that leads to musicality and discredited absolute hearing as a gift
- Under Schillinger's system any individual could be a capable composer, yet lack any kind of ability to play an instrument

- Voiced a low opinion on most conventional symphony orchestra instruments as tools evolved on un-scientific trial and error methods throughout the years
- Made negative statements about great performers, such as "the performer is glorified as a hero, though from the viewpoint of the natural sciences he should be classified as a parasite"
- Schillinger students need about three and a half years to master system: 300 lessons at \$15 totaling \$4,500 (in 1936)

- Schillinger often performed sensational stunts such as playing pieces that he composed from sources such as the morning's stock market, or the skyline of New York City.



- Through these stunts he victimized Music Professors in front of their pupils as they guessed wrongly about the sources of these compositions
- While stunts as these delighted some, they distracted considerably from the more serious aspects of his work and system
- Schillinger students were reported to have written many of their pieces with melodies taken from incidental sources such as plotted graph paper, lists of telephone numbers, charts, and vital statistics

- During his own lifetime no Schillinger works had been published. Many different and indifferent criticisms were made about the Master's own voice
- Some real musicians thought that Schillinger was an iconoclast desecrating sacred traditions of music

- Schillinger did not choose to disseminate his system through the academic channels and life style, but through the more lucrative outlet of Tin Pan Alley and Hollywood
- The majority of his customers were craftsmen, tunesmiths, and arrangers mainly interested in acquiring techniques to facilitate grinding out the commercial clichés in which they specialized
- This assisted in blackening the name of Schillinger himself and his more serious disciples

Schillinger: A Legend

- He influenced more than half of all the musical writers of American radio and motion picture studios) in the 1930s-40s
- All Schillinger students achieved success and fame on radio, TV, film, in Hollywood or on Broadway - as composers, arrangers, conductors, and performers
- Students were privileged to refer others to the Master's studio (or via correspondence); 'Schillingerites' or 'Brotherhood' used their own lingo which other musicians (not even first year students) could not understand ¹⁷¹

Statements

- "If art implies selectivity, skill and organization, ascertainable principles must undoubtedly underlay it. Once such principles are discovered and formulated, works of art may be produced by scientific synthesis"

- “Scientific method in the arts provides an inconceivable number of ideas, technical ease, perfection, and ultimately, a feeling of real freedom, satisfaction and accomplishment”
- “This theory of art is not limited to the conventional form but embraces all the possible forms that can be evolved in space and time, and perceived through organs of sensation”

- “An esthetic reality may be either a natural product, a product of human creative intuition, or a product of scientific synthesis, realized through computation by mathematical logic. In actuality, all three aspects coexist in perceptual interaction”

Joseph Schillinger 1895-1943



Died of cancer at age
47 in his home....
875 5th Avenue
New York City

Postscript

- Ironically.... as a result of the GI Bill a phenomenal interest in the system by returning serviceman prompted the establishment of accredited Schillinger courses. Several authorized teachers of the Schillinger System were besieged by students in the late 1940s and early 1950s:
 - Franklin Marks (Hollywood)
 - Rudolph Schramm (NYU)
 - Ted Royal (Julliard)
 - Asher Zlotnick (Peabody)

Coda al e fine

Music Science or Musical Science Fiction?

The Institute of Musical Science.

A logical complement to manifold institutions of musical art.

- 1) A unique and model institution.
- 2) Its world importance.
- 3) Its pioneering character, opens new vistas in domain of music.
- 4) Revolution in musical education.
- 5) Art for the first time based on strictly scientific foundations.
- 6) Musical science as a contribution to general culture.
- 7) Authoritative consulting center for the musical educational institutions.
- 8) Its tremendous influence on the musical life of U.S.A.
- 9) J.M.S. as a channel to American leadership in world's music.
- 10) A tool against musical dilettantism and ignorance.

No plans for administration but as a condition sine qua non

Scientific and artistic Council which dictates the policy of the entire institution

Interexchange of prominent scientists and distinguished students with foreign countries.



PERGAMON

Transportation Research Part F 4 (2002) 219–241

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The effects of music tempo on simulated driving performance and vehicular control

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WARREN BRODSKY

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