

Explorations in Time: Rhythm, Meter, and Tempo

Terminology

■ Beat

■ Rhythm

- Irregular note divisions
- Syncopation
- Polyrrhythm (cross-rhythms)

■ Meter

- Hemiola
- Mixed meters
- Polymeter

■ Tempo

- Temporal (metric) modulation
- Polytempo



	Binary	Ternary
Simple	2 4	3 4
Compound	6 8	9 8



Composite (additive)

5	2 + 3
8	3 + 2
7	3 + 2 + 2
8	2 + 3 + 2
	2 + 2 + 3

Béla Bartók: "Change of Time" from *Mikrokosmos* (1926-39)

126 Allegro pesante, $\text{♩} = 250$

126 *f* *sf*

10 *sf* *p*

15 *sf* *f* *sf*

20 *sf*

extension --->

voice crossing

25

30 *cresc.* *ff*

35


40 sec

Aaron Copland: *El Salón México* (1938)

Two ways of notating meter:

Metric Notation 1 — using mixed composite meters:

Allegro vivace



ff

This musical score illustrates Metric Notation 1, which uses mixed composite meters. The piece is in 2/4 time and marked 'Allegro vivace' and 'ff'. The score consists of two staves. The first staff contains measures 1 through 10, with measures 2, 3, 4, 5, 6, 7, 8, 9, and 10 each marked with a triangle symbol. The second staff contains measures 11 through 20, with measures 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20 each marked with a triangle symbol. The notation includes various note values, rests, and dynamic markings.

Metric Notation 2 — using simple meters with syncopation:


Allegro vivace





ff

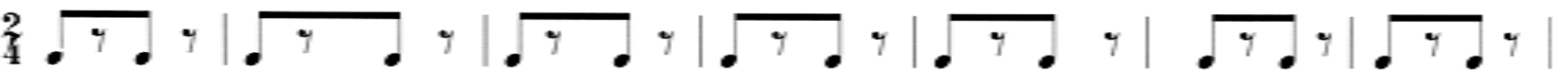
This musical score illustrates Metric Notation 2, which uses simple meters with syncopation. The piece is in 2/4 time and marked 'Allegro vivace' and 'ff'. The score consists of two staves. The first staff contains measures 1 through 10, with measures 2, 3, 4, 5, 6, 7, 8, 9, and 10 each marked with a triangle symbol. The second staff contains measures 11 through 20, with measures 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20 each marked with a triangle symbol. The notation includes various note values, rests, and dynamic markings.

Igor Stravinsky: *L'Histoire du Soldat* (1918)—I. Marche du Soldat
Polymetric Layering

1. 

2. 

3a. 

3b. 

- 1. clarinet, bassoon, trombone
- 2. percussion
- 3. violin (a), contrabass (b)

Igor Stravinsky: *L'Histoire du Soldat* (1918)—I. Marche du Soldat

10

Solo

Cl.

Solo

Fg.

Solo

Trb.

T.de B.

C.cl.

Gr.C.

VI.

C.B.

sempre simile

p sub.

stacc.

11

Cl.

Fg.

Solo

C.à P.

Trb.

T.de B.

C.cl.

Gr.C.

VI.

C.B.

sempre stacc.

Igor Stravinsky: *L'Histoire du Soldat* (1918)—I. Marche du Soldat

12 13

Cl.
Fg.
C.à P.
Trb.
Tde B.
C.cl.
Gr.C.
Vl.
C.B.

Solo
pp sub.
p

*) Pour les baguettes et leur distribution comme ci-dessus

14

Cl.
Fg.
Vl.
C.B.

poco cresc.
simile

Lecture (rythmée)
Vorlesung (rhythmisch)
Reading (rhythmic)

*)
S'im - pa - tiente d'ar - ri - ver parce qu'il a beau-coup mar-ché.
Wan - dert ü - ber Stock und Stein, sehnt sich längst da-heim zu sein.
Longs to find him-self at home, Counts the wear - y miles to come.

Se ré - jou - it d'être ar - ri - vé.
Freut sich längst da-heim zu sein.
No more wear - y miles to roam.

Cl.
Fg.
C.à P.
Trb.
C.cl.
Gr.C.
Vl.
C.B.

mf
mp
mp
mf

Subdivisions of Simple and Compound Beat Units

Simple Meter

Equal Units per Measure	Time Signature: $\frac{2}{4}$
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
etc.	

Compound Meter

Equal Units per Measure	Time Signature: $\frac{6}{8}$	
1		
2		or
3		
4		or
5		or
6		
7		or
8		or
9		
10		
11		
12		
etc.		

These alternative versions are often preferred in relatively simple rhythmic textures:

The alternative versions above should not be used if the rhythms are more complex than the last quadruplets shown.

Iannis Xenakis

PALIMPSEST

(1979)

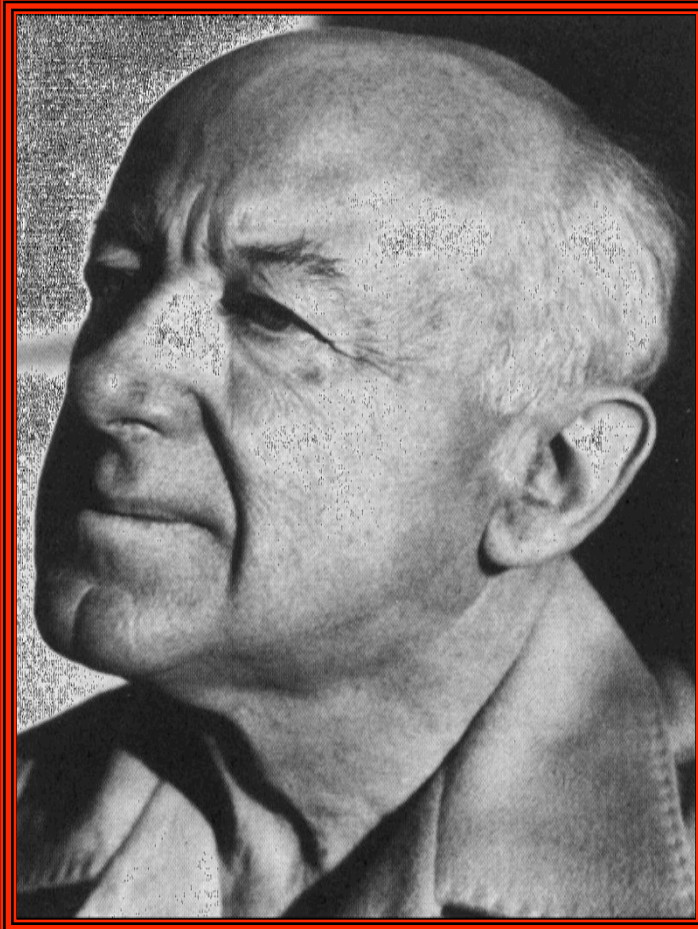
The musical score for Iannis Xenakis' *Palimpsest* (1979) is presented for a large ensemble. The score is divided into two systems, with the first system starting at measure 12. The instruments are listed on the left: Htb (Horn), Cl (Clarinet), Fg (Flute), Cor (Cor Anglais), Pno (Piano), Perc (Percussion), VI 1 (Violin I), VI 2 (Violin II), A (Viola), Vlc (Violoncello), and Cb (Contrabass). The score features complex rhythmic patterns, often indicated by vertical lines and dots, and dynamic markings such as ff , f , mf , and mp . The notation includes various musical symbols, including notes, rests, and articulation marks. The score is written in a complex, non-traditional style, characteristic of Xenakis' work.

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Iannis Xenakis: *Palimpsest* (1979)



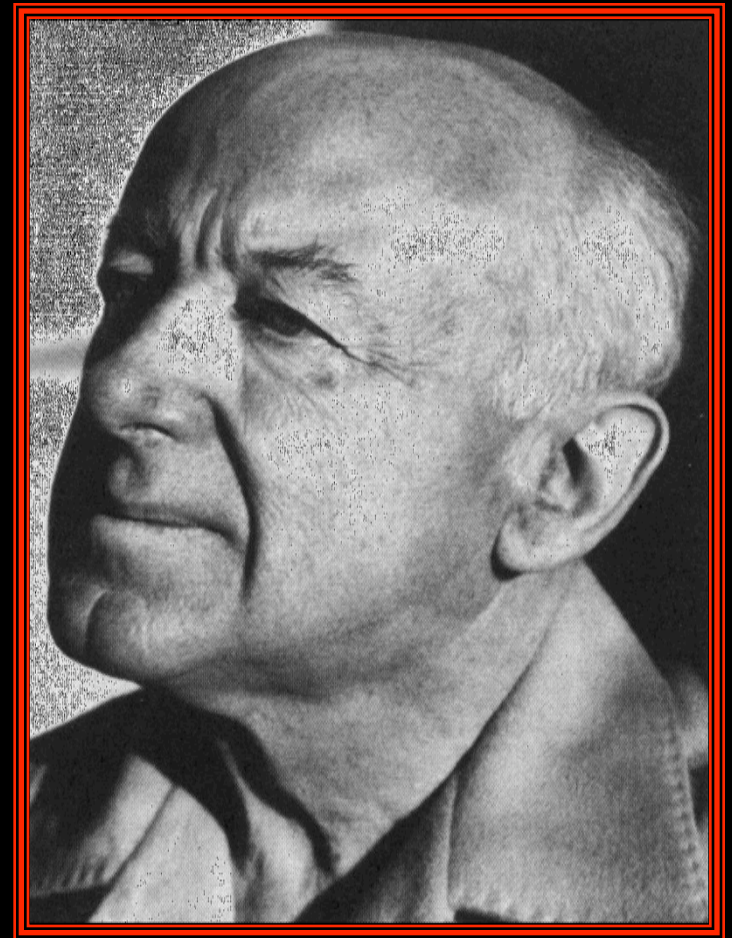
Henry Cowell
(1897-1965)



Background

- Born and raised in Northern California.
- Irish heritage has an important influence—both musical and extra-musical—on his composition.
- Self-taught musician who composed and performed his first solo piano works as a teenager
- Proposed a number of rhythmic, timbral, and harmonic innovations including inside piano techniques and tone clusters.
- A key figure among a group of “ultra-modernist” American (and international) composers in the 1920s and 1930s.
- Influential to many composers, including Béla Bartók, Conlon Nancarrow, and John Cage.
- Organized New Music Society (1925); co-founded Pan-American Association of Composers (1928); published *New Musical Resources* (1930).
- His music turned strikingly conservative beginning in the 1940s.







Henry Cowell
(1897-1965)



Henry Cowell: Proposed Rhythmic Notation (1930)







Whole-Note Series

Oval-shaped notes

Whole-note:  half-note:  quarter-note:  8th-note:  16th-note:  32nd-note: 







Third-Note Series

Triangular-shaped notes

2-3rds-note:  3rd-note:  6th-note:  12th-note:  24th-note:  48th-note: 







Fifth-Note Series

Square notes

4-5ths-note:  2-5ths-note:  5th-note:  10th-note:  20th-note:  40th-note: 







Seventh-Note Series

Diamond-shaped notes

4-7ths-note:  2-7ths-note:  7th-note:  14th-note:  28th-note:  56th-note: 







Ninth-Note Series

Oblong notes

8-9ths-note:  4-9ths-note:  2-9ths-note:  9th-note:  18th-note:  36th-note: 







Eleventh-Note Series

Oval notes with stroke

8-11ths-note:  4-11ths-note:  2-11ths-note:  11th-note:  22nd-note:  44th-note: 







Thirteenth-Note Series

Triangular notes with stroke

8-13ths-note:  4-13ths-note:  2-13ths-note:  13th-note:  26th-note:  52nd-note: 

Fifteenth-Note Series

Square notes with stroke

8-15ths-note:  4-15ths-note:  2-15ths-note:  15th-note:  30th-note:  60th-note: 

Henry Cowell: *Fabric* (c.1917)

Andante

The musical score is written for piano in 2/4 time, marked Andante. It consists of four systems of two staves each. The first system includes the instruction *Principal melody in Alto* and dynamic markings *p* and *mf*. The score features complex rhythmic patterns, including triplets, quintuplets, and septuplets, as well as various accidentals and slurs. The notation is dense and characteristic of early 20th-century experimental music.

Principal melody in Alto

Henry Cowell: *Fabric* (c.1917)

10

13

16

19

sf

rit. e dim.

ppp

This musical score is for Henry Cowell's *Fabric* (c.1917). It consists of four systems of piano music, each with a treble and bass staff. The first system (measures 10-12) features a treble staff with eighth-note patterns and a bass staff with a descending line of flats, marked with a forte (*sf*) dynamic. The second system (measures 13-15) continues the melodic and harmonic development. The third system (measures 16-18) shows a more complex texture with overlapping lines. The fourth system (measures 19-21) concludes with a *rit. e dim.* (ritardando and diminuendo) marking and a final *ppp* (pianissimo) dynamic. The score is written in a key with one flat (B-flat) and a 2/4 time signature.

Fl.

Ob.

Cl.

Bass'n

Hr.

Trpt

Tromb.
Tuba

Sn.Dr.
Bass Dr.

Piano

VI.I

VI.II

Viola

Cello

Bass

cresc. poco a poco

pp

mp

Charles Ives:
Three Places in New England
 (1903-14)

II. "Putnam's Camp"

4:3 polytempo
 (MM 120 against MM 90)



Charles Ives:
Three Places in New England
(1903-14)

II. “Putnam’s Camp”

Charles Ives:
Three Places in New England
 (1903-14)

II. "Putnam's Camp"

Più mosso (about 94-100:♩)

Fl.

Ob.

Cl.

Bas'n

Fln

Trpt

Tromb.
Tuba

Sn.Dr.
Bass Dr.

cresc poco a poco

Più mosso (about 96-100:♩)

(slightly more active)

Piano

cresc. poco a poco

Ossia
Piano

Vi. I

Vi. II

Viola I

pp

p pizz.

Cello

Bass

arco



Elliott Carter (b. 1908)



Background

- Born in New York City; as a teenager was encouraged to pursue music by Charles Ives.
- Studied English literature and music at Harvard University; further composition studies with Nadia Boulanger (1932-35).
- Early works influenced by the neoclassicism of Stravinsky and Hindemith.
- Abandoned diatonicism and populist musical aesthetic in the late 1940s, adopting an atonal and more rhythmically sophisticated language.
- Pioneered a technique known as “metric modulation” in the early 1950s.
- Music is characterized by complex and contrapuntally rich textures comprised of multiple polyrhythmic strands.
- Organic use of pitch material, based on pitch-class sets and interval classes.
- Instruments often treated as “characters” within a dramatic construct.
- Two-time recipient of the Pulitzer Prize in Music (1960, 1973)



Elliott Carter (b. 1908)

Elliott Carter: "Canaries," from *Eight Pieces for Timpani* (1966)

The image displays four musical staves, each illustrating a different rhythmic concept. The first staff, labeled 'Triple subdivisions (compound)', shows a bass line in 6/8 time with a tempo of 90. It features eighth-note triplets and is marked with a circled 'C' and a circled 'N'. The second staff, labeled 'Duple subdivisions (simple)', shows a bass line in 6/8 time with a tempo of 120. It features eighth-note pairs and is marked with a circled 'R', a circled 'N', and a circled 'C'. The third staff, labeled 'Additive meter (3+2)', shows a bass line in 6/8 time with a tempo of 120. It features eighth-note pairs and is marked with a circled 'C' and a circled 'N'. The fourth staff, labeled 'Duple groupings Triple subdivisions Duple groupings', shows a bass line in 6/8 time with a tempo of 180. It features eighth-note pairs and is marked with a circled 'C' and a circled 'N'. The staves are numbered 5, 11, and 17, indicating their position in a larger work.

Elliott Carter: "Canaries," from *Eight Pieces for Timpani* (1966)

The image displays four staves of musical notation for the piece "Canaries" from *Eight Pieces for Timpani* by Elliott Carter. The notation is in bass clef with a key signature of one sharp (F#). The staves are numbered 23, 29, 36, and 42.

- Staff 23:** Marked with a circled 'N'. A red dashed box highlights a tempo change: $\text{♩} = \text{♩} = 90$. The music begins with a *pp* dynamic.
- Staff 29:** Marked with a circled 'R' and a circled 'C'. A red annotation "Return to Tempo I" is placed above the staff. The music features a *f sub.* dynamic followed by a *p stacc.* section.
- Staff 36:** Marked with a circled 'C'. The music includes a *f sub.* dynamic and a *f* dynamic section.
- Staff 42:** Marked with a circled 'C'. A red dashed box highlights a tempo change: $(\text{♩} = \text{♩}) (\text{♩} = 120)$. The music begins with a *mp sub.* dynamic, followed by a *cresc.* section, and ends with a *f marc.* dynamic.

Red markings include dashed boxes around tempo changes and brackets under the *cresc.* section on staff 42.

Duple subdivisions, accented in triple groupings Triple subdivisions

Elliott Carter: "Canaries," from *Eight Pieces for Timpani* (1966)

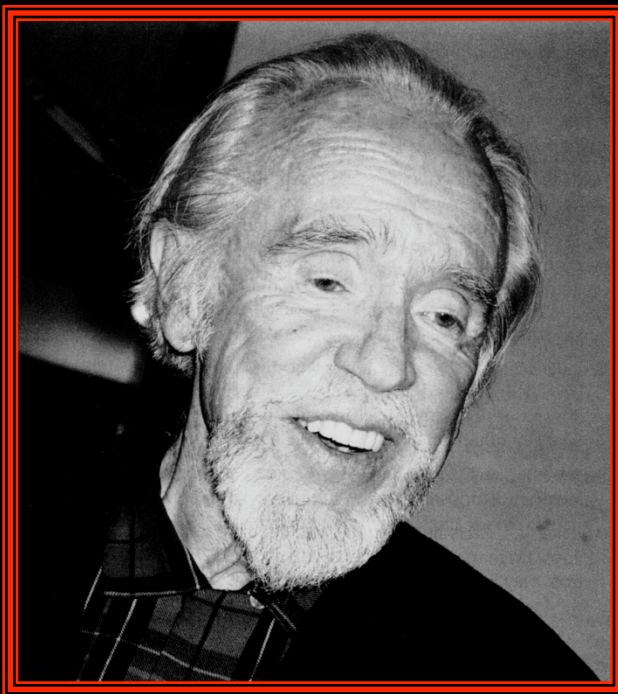
The image displays four staves of musical notation for the piece "Canaries" from *Eight Pieces for Timpani* by Elliott Carter. The notation is in bass clef with a key signature of one sharp (F#). The staves are numbered 46, 50, 55, and 61, with circled letters (N), (C), (R), and (N) indicating different rhythmic patterns or sections.

Annotations and markings include:

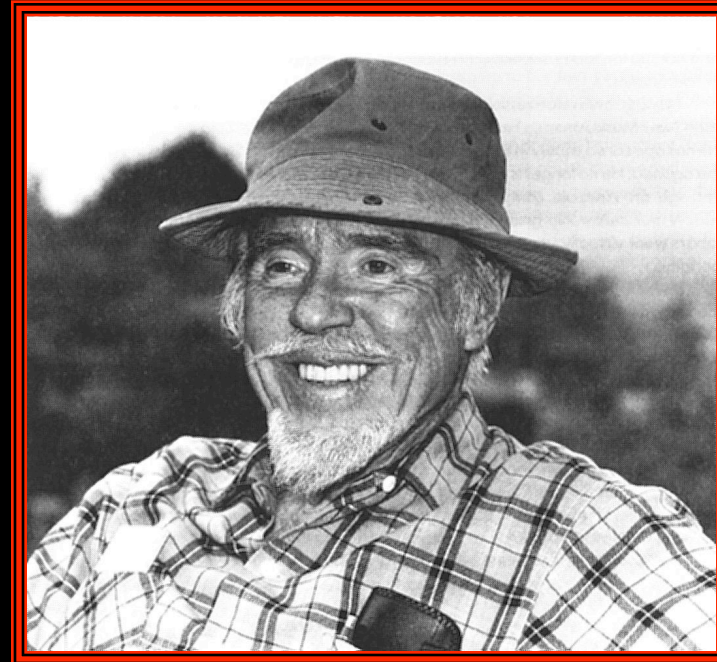
- Staff 46:** A red dashed box highlights a measure with a tempo marking $\text{♩} = 120$. Below the staff, red brackets indicate "Quintuple groupings".
- Staff 50:** A red dashed box highlights a measure with a tempo marking $\text{♩} = 96$. Above the staff, circled letters (C), (R), and (N) are placed over different rhythmic groups. Dynamics include *mp*, *mf*, and *f*. Trills are marked with *tr*.
- Staff 55:** A red dashed box highlights a measure with a tempo marking $\text{♩} = 64$. Above the staff, circled letters (R), (C), and (N) are placed over different rhythmic groups. Dynamics include *p*, *mf*, *f*, and *mp*. Trills are marked with *tr*.
- Staff 61:** A red dashed box highlights a measure with a tempo marking $\text{♩} = 64$. Above the staff, circled letters (C) and (N) are placed over different rhythmic groups. Dynamics include *p*, *mf*, *f*, and *mp*. Trills are marked with *tr*.

Additional annotations include:

- polyrhythms:** A red label pointing to the complex rhythmic patterns in the lower staves.
- 3:2:** A red label indicating a 3:2 polyrhythm.
- 9:4 within 6 (cont.):** A red label indicating a 9:4 polyrhythm within a 6-measure cycle.

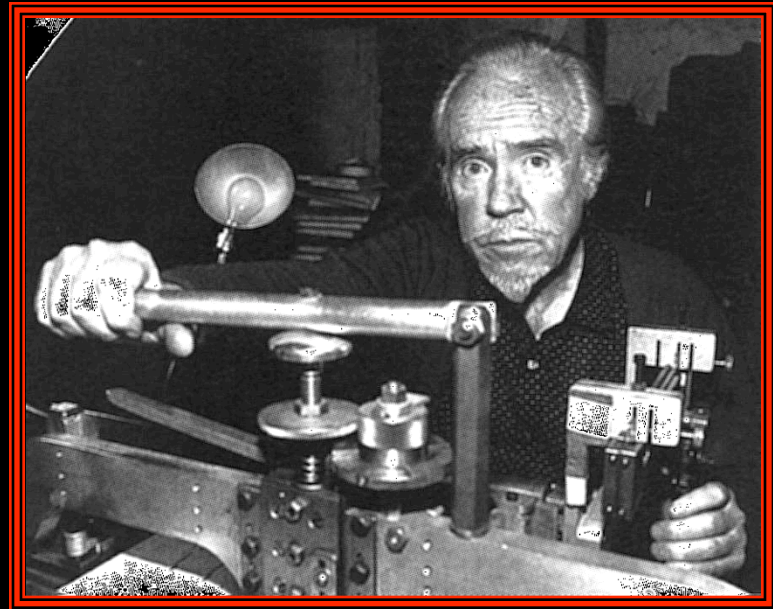


Conlon Nancarrow (1912-1997)

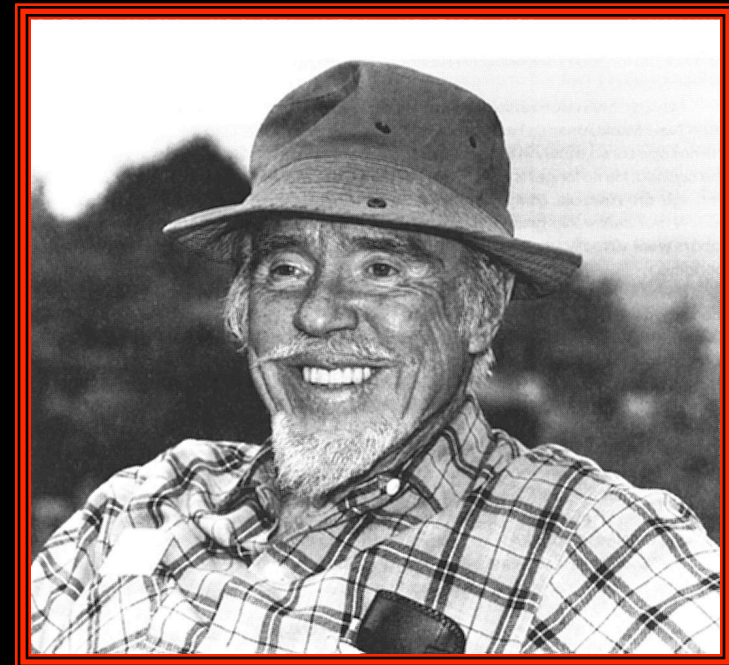


Background

- Born in Texarkana, Arkansas.
- Played jazz trumpet in his youth; later studied composition in Cincinnati and Boston with Walter Piston, Roger Sessions, and Nicolas Slonimsky.
- Joined Communist Party; fought with the Abraham Lincoln Brigade against Francisco Franco in the Spanish Civil War (1937-39).
- Moved to Mexico City in 1940 to avoid persecution for his Communist affiliation; lived there for the remainder of his life.
- Technical demands of early works yielded unsatisfactory results in performance, forcing him to seek alternative solutions.
- Adopted player piano after reading Cowell's *New Musical Resources*.
- Composed in relative obscurity until being "discovered" in the late 1970s, prompting international dissemination of his work.



Conlon Nancarrow (1912-1997)



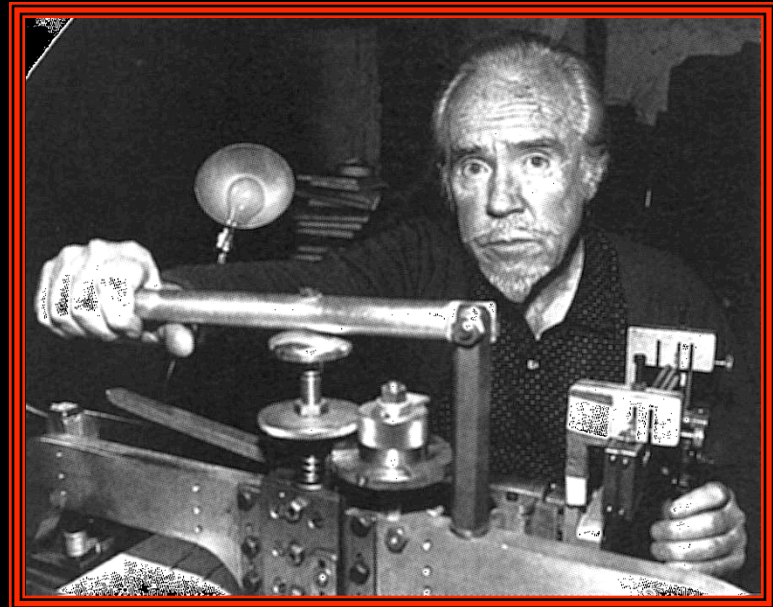
Musical characteristics

- Harmonic and rhythmic language reflects a distinct jazz influence (particularly in his early works), reminiscent of Art Tatum.
- Explored complex temporal relationships through canonic studies; “temporal dissonance.”
- His works successfully combine mathematical elegance with musical expressiveness and unabashed humor.
- Examples of unusual proportional relationships in Nancarrow’s Studies:

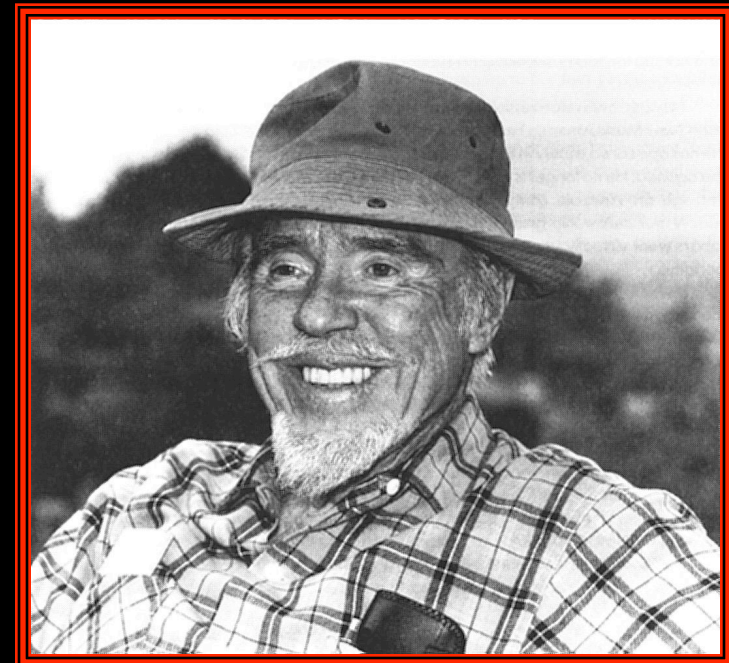
$$\text{No 34: } \frac{9}{4/5/6} / \frac{10}{4/5/6} / \frac{11}{4/5/6}$$

$$\text{No 27: } 5\% / 6\% / 8\% / 11\%$$

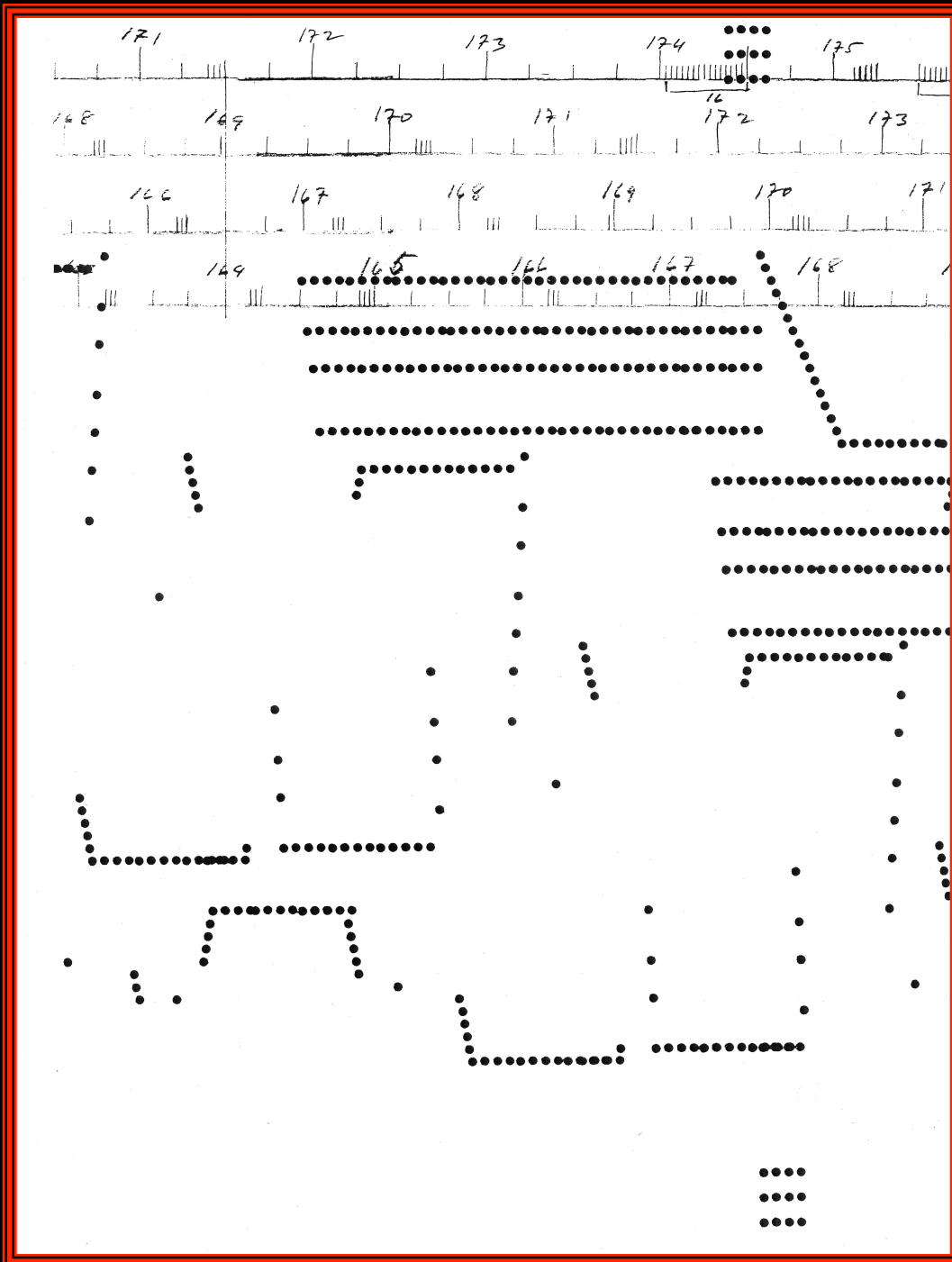
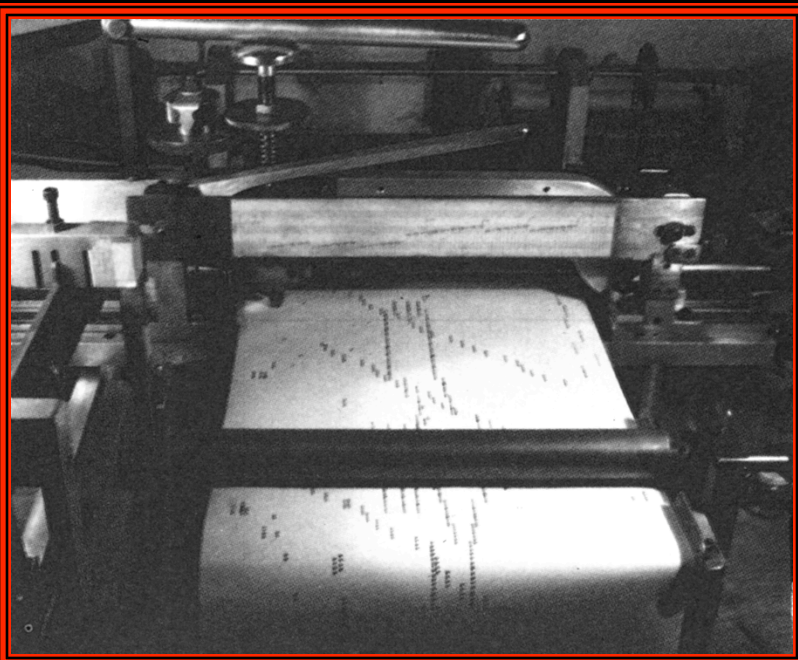
$$\text{No 33: } \frac{\sqrt{2} \times (\sqrt{2}/2)}{2 \times (\sqrt{2}/2)}$$



Conlon Nancarrow (1912-1997)



Piano roll punching machine (below)
and sample portion of roll (right).



Conlon Nancarrow: *Player Piano Study No. 24* (1948-60)

Handwritten musical score for Conlon Nancarrow's *Player Piano Study No. 24* (1948-60). The score is written for three staves, numbered 14, 15, and 16 on the left. The notation includes treble and bass clefs, a key signature of one sharp (F#), and a time signature of 3/8. The tempo is indicated by three metronome markings in red dashed boxes: $J. = 170 \frac{2}{3}$ for staff 14, $J. = 160$ for staff 15, and $J. = 149 \frac{1}{3}$ for staff 16. The notation includes various musical symbols such as notes, rests, and accidentals. Red arrows point from specific notes in the upper staves to corresponding notes in the lower staves, indicating a relationship or transformation between the parts. The bottom of the page shows the continuation of the score on two more staves.

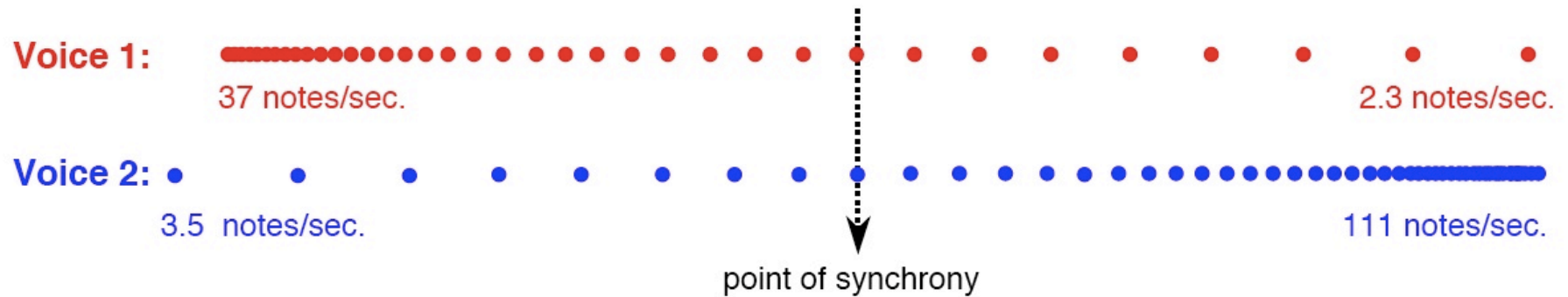
Conlon Nancarrow: *Player Piano Study No. 24* (1948-60)

The image displays a handwritten musical score for Conlon Nancarrow's *Player Piano Study No. 24*. The score is organized into two systems, each consisting of three staves. The first system includes a single treble staff at the top, followed by a grand staff (treble and bass staves) enclosed in a brace. The second system follows a similar layout. The notation is characterized by complex rhythmic patterns, including many beamed sixteenth and thirty-second notes, and frequent use of slurs and accents. The manuscript is written on aged paper with visible horizontal lines. A large, empty grand staff is positioned between the two systems of music.

Conlon Nancarrow: *Player Piano Study No. 24* (1948-60)

The image displays a handwritten musical score for Conlon Nancarrow's *Player Piano Study No. 24*. The score is written on five systems of staves, each system containing three staves (treble, alto, and bass clefs). The notation is highly complex, featuring numerous accidentals, ties, and slurs. A red dashed box highlights a tempo marking $J. = 149\frac{2}{3}$ on the right side of the fourth system. Below this, a red curved arrow points to a tempo marking $J. = 160$ (labeled (15)) on the fifth system. Another red curved arrow points from the $J. = 160$ marking to a tempo marking $J. = 170\frac{2}{3}$ on the fifth system. The number 16 is written in red next to the $J. = 160$ marking, and the number 14 is written in red next to the $J. = 170\frac{2}{3}$ marking. A red square is located at the bottom right corner of the page.

Conlon Nancarrow: *Player Piano Study No. 21* — “Canon X” (1948-60) Analysis

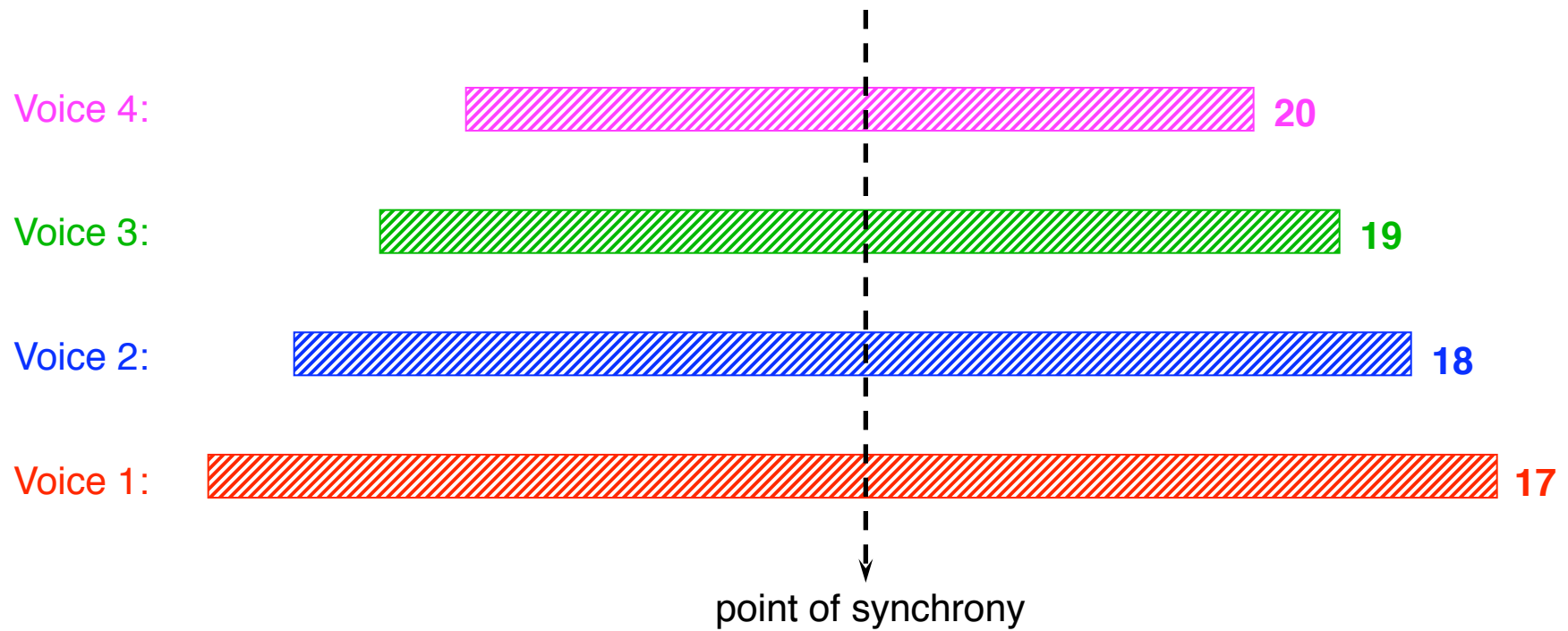


- *Rate* of tempo change is a function of the tempo.
- Each voice is based on a melodic cycle of 54 notes:



- Initial tone of melodic cycle is omitted with each pass (e.g., 54, 53, 52,...3, 2, 1).
- Series is transposed with each pass according to a separate four-and-a-half twelve-tone sets (=54 notes).
- Harmonic language evolving toward “pantonality.”
- Last study to utilize incremental hole-punching mechanism.

Conlon Nancarrow: *Player Piano Study No. 36* (1965-77)
Analysis



Conlon Nancarrow: *Player Piano Study No. 21* — “Canon X” (1948-60)

$\overline{\hspace{10em}} = 120$
All notes staccato

PP

8va

loco

8va

loco

Conlon Nancarrow: *Player Piano Study No. 21* — “Canon X” (1948-60)

The image displays a handwritten musical score for a Player Piano Study. The score is organized into three systems, each consisting of two staves. The first system features a treble staff with a complex, rapid melodic line and a bass staff with a simple, slow-moving accompaniment. The second system continues the melodic line in the treble staff and the accompaniment in the bass staff. The third system also continues the melodic line in the treble staff and the accompaniment in the bass staff. The notation is handwritten and includes various musical symbols such as notes, rests, and accidentals. The score is written on a single page with a red square in the bottom right corner.