

Typesetting Musical Rhythms May Be Subtle

Jean-Michel Hufflen

Bach_oT_EX 2023

29th April 2023

Introduction

Dividing by two

Time signatures

Using several time signatures

Irrational signatures

More developments

Conclusion

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Memoizing music

Interesting for music already composed.

Memoizing music

Interesting for music already composed.
Expresses the *structure* of a musical piece,

Memoizing music

Interesting for music already composed.
Expresses the *structure* of a musical piece,
but what is displayed graphically should be preserved.

Memoizing music

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Interesting for music already composed.

Expresses the *structure* of a musical piece,

but what is displayed graphically should be preserved.

Example: multiple editions of Beethoven's symphonies.

Designing new music

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Designing, not *composing*, because that may be some new arrangement of an existing piece.

Designing new music

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Designing, not *composing*, because that may be some new arrangement of an existing piece.

Using some tools for checking that rhythms are correct, that is, successive bars are correctly filled in

Designing new music

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Designing, not *composing*, because that may be some new arrangement of an existing piece.

Using some tools for checking that rhythms are correct, that is, successive bars are correctly filled in (in addition to personal checking of what we hear).

Figures

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion



Shortest duration's figure

Theoretically \leftarrow sixty-fourth note.

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Shortest duration's figure

Theoretically \leftarrow sixty-fourth note.
But some (rare) examples using
one-hundred-and-twenty-eighth notes

Shortest duration's figure

Theoretically \leftarrow sixty-fourth note.

But some (rare) examples using one-hundred-and-twenty-eighth notes (Beethoven's *Emperor Concerto*).



The image shows a musical score for piano (p) with two staves. The music is written in a key with two sharps (D major or F# minor) and a common time signature (C). The notes are extremely short, appearing as a dense cluster of dots on the staff, representing one-hundred-and-twenty-eighth notes. The score is marked with a piano (p) dynamic.

Western way

Dividing *long* musical rhythm figures originate from Western habits.

Western way

Dividing *long* musical rhythm figures originate from Western habits.

Some Asian or African music consider *short* durations and *combine* them.

Binary/ternary rhythms

Dotted note \Leftarrow multiply its duration by 1.5 ('modern' interpretation):

$$\begin{aligned} \circ\cdot &= \circ + \text{♩} \\ \circ\cdot\cdot &= \circ + \text{♩} + \text{♩} \\ &\vdots \end{aligned}$$

Contents

Introduction

Dividing by two

Time signatures

Using several time signatures

Irrational signatures

More developments

Conclusion

Binary/ternary rhythms

Dotted note \Leftarrow multiply its duration by 1.5 ('modern' interpretation):

$$\begin{aligned} \circ\cdot &= \circ + \text{♩} \\ \circ\cdot\cdot &= \circ + \text{♩} + \text{♩} \\ &\vdots \\ \circ\dots &= \circ + \text{♩} + \text{♩} + \text{♩} + \text{♩} \end{aligned}$$

Contents

Introduction

Dividing by two

Time signatures

Using several time signatures

Irrational signatures

More developments

Conclusion

Binary/ternary rhythms

Dotted note \Leftarrow multiply its duration by 1.5 ('modern' interpretation):

$$\begin{aligned} \circ\cdot &= \circ + \text{♩} \\ \circ\cdot\cdot &= \circ + \text{♩} + \text{♩} \\ &\vdots \\ \circ\cdots &= \circ + \text{♩} + \text{♩} + \text{♩} + \text{♩} \end{aligned}$$

At the Middle Ages:

Perfectus \Leftarrow beat is divided by 3,
imperfectus \Leftarrow 2.

Contents

Introduction

Dividing by two

Time signatures

Using several time signatures

Irrational signatures

More developments

Conclusion

Binary/ternary rhythms

Dotted note \Leftarrow multiply its duration by 1.5 ('modern' interpretation):

$$\begin{aligned} \circ\cdot &= \circ + \text{♩} \\ \circ\cdot\cdot &= \circ + \text{♩} + \text{♩} \\ &\vdots \\ \circ\cdot\cdot\cdot &= \circ + \text{♩} + \text{♩} + \text{♩} + \text{♩} \end{aligned}$$

At the Middle Ages:

Perfectus \Leftarrow beat is divided by 3,
imperfectus \Leftarrow 2.

Nowadays: basic figure is dotted or not.

Contents

Introduction

Dividing by two

Time signatures

Using several time signatures

Irrational signatures

More developments

Conclusion

Irregular divisions

Example: *triplet*, instead of 2:



Irregular divisions

Example: *triplet*, instead of 2:



4-uplets, 5-uplets, 7-uplets, etc.



Unambiguous notation...

... for a musician.

Often numbers are dropped in case of repeated irregular groups...

Unambiguous notation...

... for a musician.

Often numbers are dropped in case of repeated irregular groups...

or in case of *sol*

Unambiguous notation...

... for a musician.

Often numbers are dropped in case of repeated irregular groups...

or in case of *solis* (Henri Tomasi's *Bassoon Concerto*):

A musical score for a bassoon solo in 6/8 time. The notation is written on a single staff with a treble clef and a key signature of one flat. The piece is marked with a forte dynamic (*ff*) and the tempo/style marking *fulgurant*. The melody consists of a series of eighth notes, with a long, sweeping slur over the entire phrase. The notes are written in a way that is difficult to read, with some notes appearing to be repeated or grouped in a way that is not clearly indicated by numbers or other markings. The notation is presented as a challenge to the reader's ability to interpret it without the aid of a musician's knowledge.

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

More

Durations *cumulated* in the complete figure.

More

Durations *cumulated* in the complete figure.
Irregular groups may be *nested* (Arvo Pärt's *Second Symphony*).

Fag.

The image shows a musical score for Bassoon (Fag.) in a single staff. The notation includes a double bar line at the beginning, followed by two rests. The first rest is marked with a '2.' above it. The second rest is marked with a '3' above it. The first note is a quarter note, followed by a quarter note, and then a quarter note. The second note is a quarter note, followed by a quarter note, and then a quarter note. The third note is a quarter note, followed by a quarter note, and then a quarter note. The fourth note is a quarter note, followed by a quarter note, and then a quarter note. The fifth note is a quarter note, followed by a quarter note, and then a quarter note. The sixth note is a quarter note, followed by a quarter note, and then a quarter note. The seventh note is a quarter note, followed by a quarter note, and then a quarter note. The eighth note is a quarter note, followed by a quarter note, and then a quarter note. The ninth note is a quarter note, followed by a quarter note, and then a quarter note. The tenth note is a quarter note, followed by a quarter note, and then a quarter note. The eleventh note is a quarter note, followed by a quarter note, and then a quarter note. The twelfth note is a quarter note, followed by a quarter note, and then a quarter note. The thirteenth note is a quarter note, followed by a quarter note, and then a quarter note. The fourteenth note is a quarter note, followed by a quarter note, and then a quarter note. The fifteenth note is a quarter note, followed by a quarter note, and then a quarter note. The sixteenth note is a quarter note, followed by a quarter note, and then a quarter note. The seventeenth note is a quarter note, followed by a quarter note, and then a quarter note. The eighteenth note is a quarter note, followed by a quarter note, and then a quarter note. The nineteenth note is a quarter note, followed by a quarter note, and then a quarter note. The twentieth note is a quarter note, followed by a quarter note, and then a quarter note. The notation is marked with *ff stacc.* above and below the staff.

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Rule for irregular groups

Put *more units* than normal division.

Rule for irregular groups

Put *more units* than normal division.
Seven notes for a quarter note

Rule for irregular groups

Put *more units* than normal division.

Seven notes for a quarter note seven *eighteenth notes*.

Rule for irregular groups

Put *more units* than normal division.

Seven notes for a quarter note seven *eighteenth notes*.

Sometimes \Leftarrow seven *thirty-second* notes, although it is incorrect.

Binary rhythm inside ternary context

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Two notes for a quarter dotted note

Binary rhythm inside ternary context

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Two notes for a quarter dotted note two *quarter notes*.

Binary rhythm inside ternary context

Two notes for a quarter dotted note two *quarter notes*.
Often removing a dot may be observed.

Binary rhythm inside ternary context

Two notes for a quarter dotted note two *quarter notes*.

Often removing a dot may be observed.

Remark 2-..., 4-... not really needed \implies dotted notes.

Complete notation

... *for* ...

Example of a 7-uplet.

Time signature

Numerator \Leftarrow number of beats
Denominator \Leftarrow figure for a beat

Time signature

Numerator \Leftarrow number of beats
Denominator \Leftarrow figure for a beat

Figure for a beat \Leftarrow 1 for a whole note, 2 for a half note,
etc. power of 2.

Time signature

Numerator \Leftarrow number of beats
Denominator \Leftarrow figure for a beat

Figure for a beat \Leftarrow 1 for a whole note, 2 for a half note,
etc. power of 2.

Time signatures appeared in the 16th century, *bar lines* only
in the 17th one.

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Time signature

Numerator \Leftarrow number of beats
Denominator \Leftarrow figure for a beat

Figure for a beat \Leftarrow 1 for a whole note, 2 for a half note,
etc. power of 2.

Time signatures appeared in the 16th century, *bar lines* only
in the 17th one.

Provided for beat 2, 3 or 4, and binary rhythms.

Time signature

Numerator \Leftarrow number of beats
Denominator \Leftarrow figure for a beat

Figure for a beat \Leftarrow 1 for a whole note, 2 for a half note,
etc. power of 2.

Time signatures appeared in the 16th century, *bar lines* only
in the 17th one.

Provided for beat 2, 3 or 4, and binary rhythms.

Ternary rhythms \Leftarrow if the numerator is 6, 9 or 12, divide it
by 3 and consider the third of the denominator figure.

Time signature

Numerator \Leftarrow number of beats
Denominator \Leftarrow figure for a beat

Figure for a beat \Leftarrow 1 for a whole note, 2 for a half note,
etc. power of 2.

Time signatures appeared in the 16th century, *bar lines* only
in the 17th one.

Provided for beat 2, 3 or 4, and binary rhythms.

Ternary rhythms \Leftarrow if the numerator is 6, 9 or 12, divide it
by 3 and consider the third of the denominator figure.

Example: 6/8

Time signature

Numerator \Leftarrow number of beats
Denominator \Leftarrow figure for a beat

Figure for a beat \Leftarrow 1 for a whole note, 2 for a half note,
etc. power of 2.

Time signatures appeared in the 16th century, *bar lines* only
in the 17th one.

Provided for beat 2, 3 or 4, and binary rhythms.

Ternary rhythms \Leftarrow if the numerator is 6, 9 or 12, divide it
by 3 and consider the third of the denominator figure.

Example: $6/8 \Rightarrow 2\downarrow$.

Abbreviations

Baroque music:

$$2 \implies 2/2$$

$$4 \implies 4/4$$

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Abbreviations

Baroque music:

$$2 \implies 2/2$$

$$4 \implies 4/4$$

C common time (*imperfectus*) 4/4

C cut time (*alla breve*) 2/2

Better notation

3/♩ 2/♩.

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Better notation

3/♩ 2/♩.

Coined by French composer Jean-Philippe Rameau.

Better notation

3/♩ 2/♩.

Coined by French composer Jean-Philippe Rameau.
Used by Carl Orff.

The 'classical' notation is ambiguous

$6/4 \implies$ beat 6♩ or 2♩.?

The 'classical' notation is ambiguous

$6/4 \implies$ beat 6♩ or 2♩.?

Classically, there is no beat-6 signature, but what about 18/8?

Other beats

5, 6, 7 and more. . .

using *dotted* bar lines to emphasise division.

Other beats

5, 6, 7 and more. . .

using *dotted* bar lines to emphasise division.

(Arvo Pärt's *First Symphony*):

43
8
4 ♩ = 120

pp

mf

The image shows a musical score for measures 43 and 44 of Arvo Pärt's First Symphony. The score is in 8/4 time with a tempo of 120 beats per minute. Measure 43 features a piano (*pp*) dynamic with a dotted bar line. Measure 44 features a mezzo-forte (*mf*) dynamic with a dotted bar line. The notation includes eighth and sixteenth notes, rests, and dynamic markings.

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Other beats

5, 6, 7 and more...

using *dotted* bar lines to emphasise division.

(Arvo Pärt's *First Symphony*):

43
8
4 $\text{♩} = 120$

pp

mf

The image shows a musical score for two staves. The first staff begins with a treble clef, a key signature of one sharp (F#), and a time signature of 8/4. The tempo is marked as quarter note = 120. The first measure of the first staff contains a single quarter note followed by a dotted half note. The second staff contains a complex rhythmic pattern of eighth and sixteenth notes, with a dotted bar line after the eighth measure. The first staff is marked *pp* and the second staff is marked *mf*.

9, 12...

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Using sums

Expressing (asymmetrical) division, e.g.:

$$\frac{3 + 3 + 2}{8} \text{ instead of } \frac{8}{8}$$

Added value

Adding a sub-value at the extreme part, e.g.:

$$\frac{3 + \frac{1}{2}}{4}$$

(Edgar Varèse's *Intégrales*)



The image shows a musical score for two staves. The top staff is in 4/4 time and features a complex rhythmic pattern. It begins with a half note, followed by a quarter note, and then a group of three eighth notes beamed together. A bracket above this group indicates a total duration of 3 + 1/2 eighth notes. The bottom staff is in 4/4 time and features a similar complex rhythmic pattern, starting with a half note, followed by a quarter note, and then a group of three eighth notes beamed together. A bracket above this group indicates a total duration of 3 + 1/2 eighth notes. The score is marked with 'ff' (fortissimo) and includes various dynamic markings and articulation symbols.

Overlapping *accents*

$2/4$ x x x x x x ...
 $3/4$ x x x x x x ...

Equivalence between bars

Same beat:



Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Equivalence between bars

Same beat:



or not:



Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

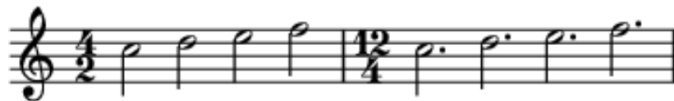
More
developments

Conclusion

Irrational time signatures

Coined by some modern British composers: Brian Ferneyhough, Thomas Adès, . . .
Avoids the notation of added values.

Example



Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

**Irrational
signatures**

More
developments

Conclusion

Example



is equivalent to:



Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

**Irrational
signatures**

More
developments

Conclusion

Example



is equivalent to:



Before: 3 \downarrow instead of 2 \downarrow .

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

**Irrational
signatures**

More
developments

Conclusion

Example



is equivalent to:



Before: 3 ♩ instead of 2 ♩.

$$\frac{4}{2} * \frac{2}{3} = \frac{4}{3}$$

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

**Irrational
signatures**

More
developments

Conclusion

Example (continued)

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Huffman

Contents

Introduction

Dividing by two

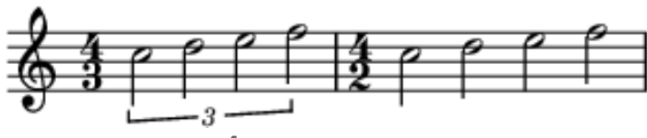
Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion



More accurate

Thomas Adès's *Catch*:

The image shows a musical score for Piano (Pno) in 2/4 time. The score is divided into two systems. The first system starts with a rest in the right hand and a bass line. The second system begins with a key signature change to one flat and a tempo marking of *f marc. rit.*. A red box highlights a section of the score where the right hand has a complex rhythmic pattern of eighth notes and triplets, and the left hand has a bass line with triplets and a 2/3 time signature. Dynamic markings include *pp marc.*, *pp*, and *mf*. The score ends with a 2/4 time signature.

Number of elements of *triplets* \leftarrow 12 for a \circ

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Mathematically

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

**Irrational
signatures**

More
developments

Conclusion

$$\frac{1 + \frac{2}{3}}{4} = \frac{5}{3} * \frac{1}{4}$$

Mathematically

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

**Irrational
signatures**

More
developments

Conclusion

$$\begin{aligned}\frac{1 + \frac{2}{3}}{4} &= \frac{5}{3} * \frac{1}{4} \\ &= \frac{5}{12}\end{aligned}$$

Free and random rhythms

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Luciano Berio's *Folk Songs*:

The musical score is arranged in five staves. The top two staves are for Viola and Vcello, both marked 'con sord. pont.' and 'ppp', with a 'sempre' bracket indicating a continuous rhythmic pattern. The third staff is for Tamb. basco, with two parts: I and II. Part I starts with 'p' and 'col pollice', and Part II starts with 'mf'. A vertical dashed line separates the two parts, after which Part I is marked 'mf' and Part II 'p'. The fourth staff is for Voce, with a tempo marking of quarter note = 60. The lyrics 'tri - stu pas - si - ril - lan ti.' are written below the vocal line. A 'COI' bracket groups the Viola and Vcello staves.

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

My advice for conectors of music software

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Clearly separate structure and layout.

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

My advice for conectors of music software

Typesetting
Musical Rhythms
May Be Subtle

Jean-Michel
Hufflen

Contents

Introduction

Dividing by two

Time signatures

Using several time
signatures

Irrational
signatures

More
developments

Conclusion

Clearly separate structure and layout.
Encourage experiment!