ABRIDGED e-BOOK

UNDERSTAND MUSIC

with

MATIAS NOTATION

EDGAR MATIAS

Understand Music with Matias Notation

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Summary :

We can all read words, and we can all read numbers,
so why can't we all read *music?*
This book presents a *NEW way* of writing music, that we *ALL* can read.

Find out more:

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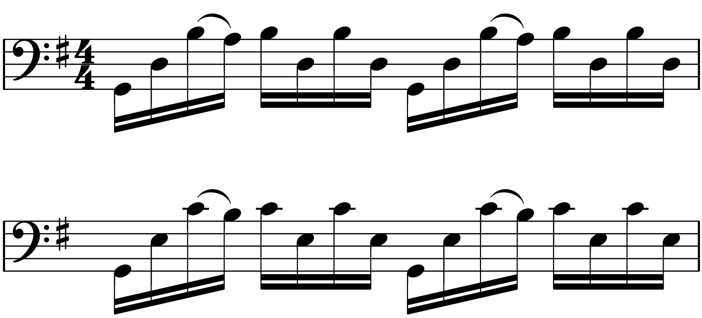
0. Resolution

This little book explains music in a whole new way — a way that requires *almost NO memorization.*

It will teach you all the chords you need to start *reading* music, and by the end of it, *you* will know enough to understand the underlying logic *of this passage* just by looking at it…



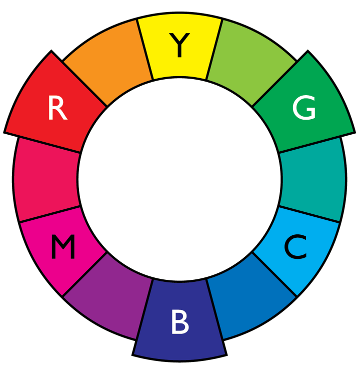
1. What is music?

Imagine if civilization collapsed, and we had to start over.

If we could only pass on *one sentence* of musical knowledge to *New World* musicians, this would be it:

Music is the circle of fifths

The circle of fifths is the palette of sound frequencies (or *notes*) that music is made from.



It is the *colour wheel* for musical notes. Just as paintings & photos are made from a palette of colours, music is made from a palette of notes. The circle of fifths is that palette.

The more notes in your palette, the more clever you need to be, to not make a mess of things.

Songbirds (for example) sing from very small palettes — no mess.

At the other extreme is *atonal music*. Atonal composers often use *the ENTIRE* palette, and it can get pretty messy.

Classical and most popular music generally uses just over half the palette (~7 notes) at any given time. Jazz tends to use a little more that (~8 notes).

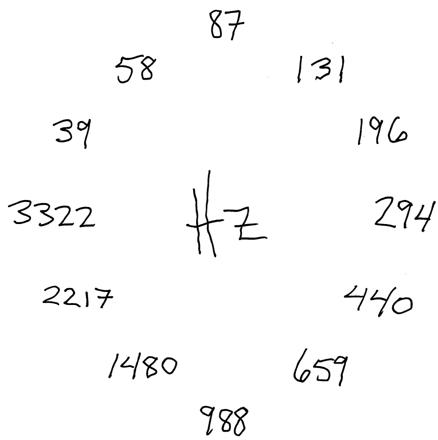
Blues musicians use around half the palette (~6 notes), while traditional folk music, Asian music, and guitar soloists like to play it safe, using just under half (5 notes).

It's time to see what the circle actually looks like…

Sound is air vibrations, and air vibrations are measured by how fast they vibrate — how *frequently* they vibrate, in each second of time (the *frequency*). We call these frequency measurements *Hertz* values (*Hz*). 440Hz is 440 vibrations each second. That particular frequency (440Hz) is called *Concert Pitch* or *Concert-A* or *A440* or *A4*.

When orchestras tune their instruments before a performance, that's the frequency you're hearing them tune towards.

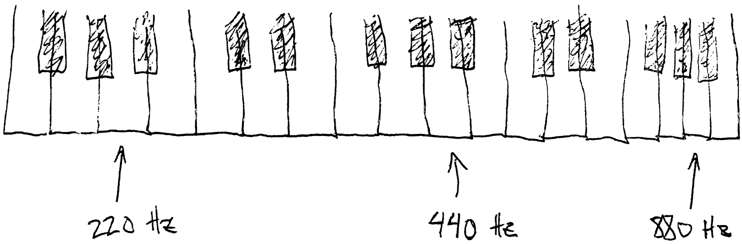
Here is the circle of fifths, expressed in Hz values — you can see *Concert-A* (440Hz) in the circle:



Going clockwise around the circle, each note frequency increases by *approximately* 50% — a *musical fifth,* which is different from a *mathematical fifth* (1/5).

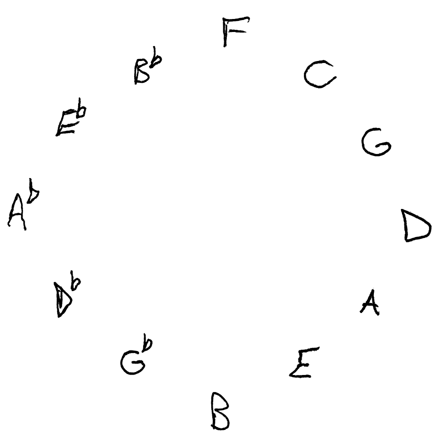
Multiplying any one of these values by 2 gives you the same note but an octave higher — it sounds almost the same, only higher. 880Hz is one octave *HIGHER* than A440, and 220Hz is an octave *lower.*

On a piano, each repeating group of keys is one octave above the previous group.

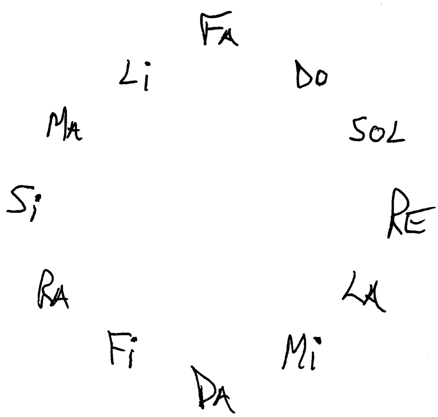


While this is very clear and interesting, referring to individual notes by their frequencies is not very convenient. It's too much information.

Perhaps we could use *symbols* instead — like maybe letters of the alphabet — which is exactly what our ancestors did:



You're probably familiar with musical notes expressed as letters. We've been doing it this way for a *LONG time* — over 1000 years — so long, that it's actually *older* than our current alphabet, even before the letter J was created.



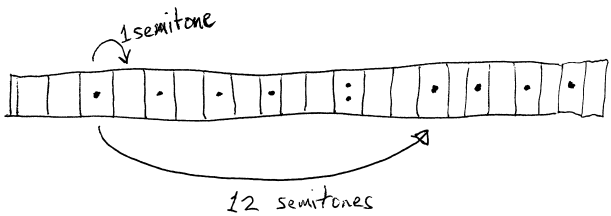
Singers use one-syllable vocalizations to name the notes — *Do Ré Mi Fa Sol La Ti Do.*

This system is called *solfège* (or *solfeggio*) and is the way notes are named in most of Europe, Latin America, and Quebec.

There are many different variants of solfège, and they can differ from each other by *a lot.* For example, *Ti* is commonly vocalized as *Si.*

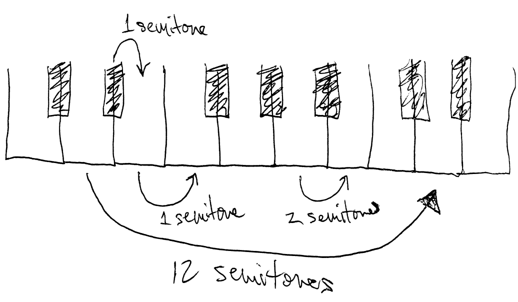
The circle of fifths, shown above, is in a simpler variant of solfège (with *Ti* vocalized as *Da*).

Letters and solfège are both more convenient than Hz values, but they also hide a lot of useful information, so a more recent (but less common) approach has the circle expressed in numbers — semitones...

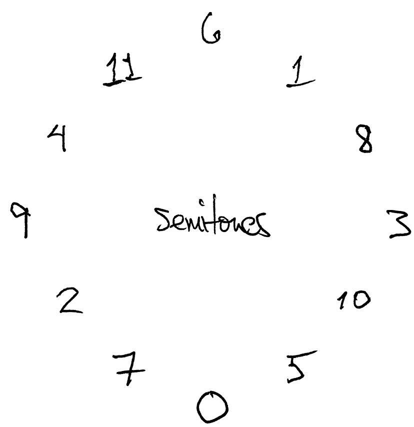


If you look at the neck of a guitar, the lines are called *frets,* and a semitone is the distance of 1 fret. An octave is 12 frets (12 semitones).

On a piano, because of the way keys are grouped and coloured, semitone distances are a little obscured, but you can still see them if you look carefully.



Getting back to the circle of fifths, here it is, expressed in semitones:



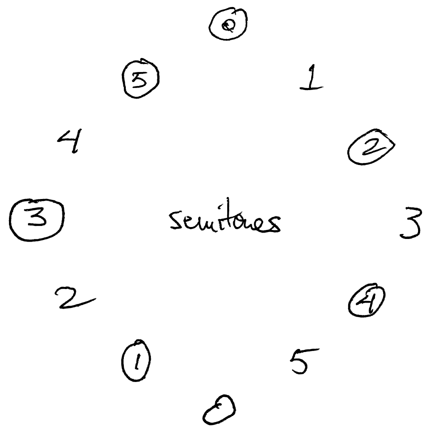
Now, you can clearly see how far apart each note is from every other note in the circle… C is 1 and A is 10, so A is 9 semitones above C (1 + 9 = 10).

Also, each number in the circle is either *+7 more* or *-5 less* than the one before it. This *seems* strange, but it's how music works.

It also creates a new problem… going around the circle is some pretty messy math.

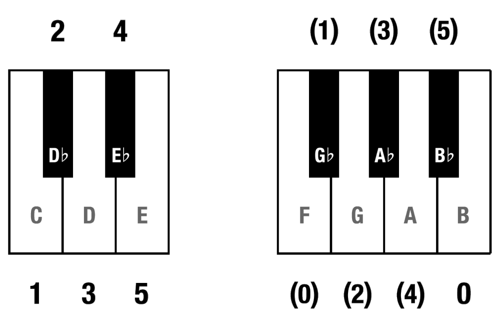
Fortunately, we have an *even better* solution for this.

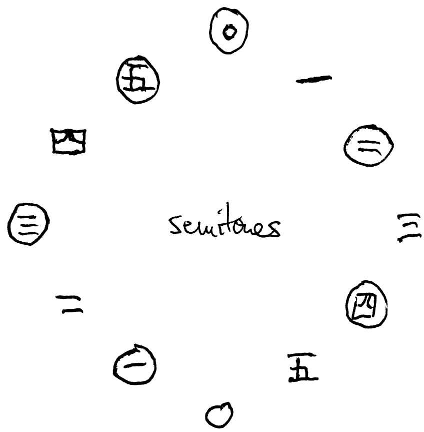
To fix *all* that messiness, in this book we present a *new way* to express the circle of fifths — in *Matias numerals:*



It looks absurdly simple, compared to the others.

We are not adding 7 or subtracting 5, as we go around the circle. Instead, we're adding 1, and adding or removing parentheses (circling or uncircling the note value). *Very messy* musical math is made *trivial,* if you express notes in *Matias numerals*.





In Asia, where they have a second number system based on traditional Chinese numerals, the circle of fifths would look similar — but in *Sino-Matias numerals*.

This chapter is a lot to digest all at once. You may not have understood all of it — that's *totally* normal.

Just keep going.

We're just getting started, and it'll all be explained again (in more detail) in later chapters. The fog will lift, as you make your way through the book.

In the mean time, you can entertain yourself with a few videos about the circle of fifths (and a few tangents)…

Circle of 5ths in songs you know (remastered). *Michael Jesse* (YouTube): youtu.be/yHE5k67oqik

https://matiasnotation.com/b1c1qr1

Songs that use the Circle of Fifths progression. *David Bennett Piano* (YouTube): youtu.be/-DQJmicTFGQ

https://matiasnotation.com/b1c1qr2

The math behind the circle of fifths. *Polychoron Productions* (YouTube): youtu.be/WHmqW0OYK4A

https://matiasnotation.com/b1c1qr3

The Cataclysm Sentence | Radiolab Podcast. *Radiolab* (YouTube): youtu.be/wufMiMrRONo

https://matiasnotation.com/b1c1qr4

2. How do you say 5, (0), (1) … ?

The English number word and pronunciation for each *Matias numeral* is listed below — suggestions for various other languages are in the *Reference* section, at the end of the book.

0	zero / oh	(0)	ess-oh / six
1	one	(1)	ess-one
2	two	(2)	ess-two
3	three	(3)	ess-three
4	four	(4)	ess-four
5	five	(5)	ess-five

Here's how *Matias numerals* relate to the *decimal* numbers we use in daily life…

0	=	0	6	=	(0)
1	=	1	7	=	(1)
2	=	2	8	=	(2)
3	=	3	9	=	(3)
4	=	4	10	=	(4)
5	=	5	11	=	(5)

If a Matias numeral is in *parentheses* (or circled) that just means *"add 6"* to its sub value, to get the decimal value.

(0) = 0 + 6 = 6 in decimal

(1) = 1 + 6 = 7 in decimal

(2) = 2 + 6 = 8 in decimal

A brief history of numerical systems – Alessandra King.
TED-Ed (YouTube): youtu.be/cZH0YnFpjwU

https://matiasnotation.com/b1c2qr1

What is zero? Getting something from nothing – with Hannah Fry. *The Royal Institution* (YouTube): youtu.be/9Y7gAzTMdMA

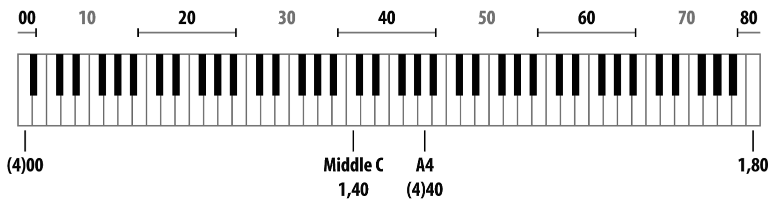
https://matiasnotation.com/b1c2qr2

The weird truth about Arabic numerals. *SciShow* (YouTube): youtu.be/Ar7CNsJUm58

https://matiasnotation.com/b1c2qr3

3. Each octave has a number

In *Chapter 1,* I mentioned how doubling the frequency takes you up an octave — so we're going to need a way to indicate which octave is which.



Matias numerals that include an octave designation are called *Musical Numbers.*

Middle-C and *Concert-A* are both in the 4th octave. Traditionally, they are written as C4 and A4.

As *Musical Numbers*, we'll be writing and saying them like this…

C4	Middle-C	1,40	one-forty
A4	Concert-A	(4)40	ess-four-forty

40 means 4th octave, 30 means 3rd octave, etc.

Finally, below are the *Matias numerals* that correspond to traditional *letter names* and *solfège*…

0	=	B	C♭		Da
1	=	C	B♯	Do	
2	=		C♯ / D♭		Ra
3	=	D		Ré	
4	=		D♯ / E♭		Ma
5	=	E	F♭	Mi	
(0)	=	F	E♯		Fa
(1)	=		F♯ / G♭	Fi	
(2)	=	G			Sol
(3)	=		G♯ / A♭	Si	
(4)	=	A			La
(5)	=		A♯ / B♭	Li	

That concludes our mathematical interlude.

We now return to music.

4. String instruments

I mentioned that string instruments in an orchestra tune to A at 440Hz, before a performance. The actual procedure is interesting…

Every instrument in the string section has an A string, so everybody tunes that one first, all at once.

The A strings on violins and violas are tuned to 440Hz *specifically.* Instruments outside that range will tune to a multiple of 440Hz — divide by 2 to go down an octave. The A string on a cello is one octave lower (220Hz) and the A string on bass is two octaves lower than that (55Hz).

Tighter strings vibrate at higher frequencies (notes) than looser strings. When you hear the orchestra tuning up, they are loosening then tightening their strings, until the frequencies all match up. When they all match, they are “in tune.” If one doesn’t match, it is “out of tune” (usually the guitar player).

Once all the A strings are in tune, the other strings are then tuned relative to those A strings. The tunings follow a certain pattern for each instrument. I’ve listed them below (as letters).

Violin	G - D - A - E
Viola	C - G - D - A
Cello	C - G - D - A
Bass	E - A - D - G

If you look carefully, you’ll see that they share patterns in common, but they’re a little tricky to identify.

Below is the same list again, as *Matias numerals* — now the patterns are *obvious.* The strings are tuned according to the circle of fifths, with the bass going in the opposite direction around the circle.

Violin	(2) - 3 - (4) - 5
Viola	1 - (2) - 3 - (4)
Cello	1 - (2) - 3 - (4)
Bass	5 - (4) - 3 - (2)

A few more interesting details…

The violin and viola share 3 strings in common, with the violin going higher by one string, and the viola going lower.

Violas are physically larger than violins, to allow for that lower string. As you go lower, the instruments get bigger and longer. The longer wavelengths of lower notes require longer instruments — which is why double basses in an orchestra are taller than their players.

Violas and cellos share the same tuning, but are one octave apart. You might think that would allow the player of one to easily switch to the other, but no. The size and ergonomic differences present difficulties, so switching is not common. Violin and viola are much better swap candidates.

Guitar	5 - (4) - 3 - (2) - 0 - 5
Bass	5 - (4) - 3 - (2)

Guitars are tuned like a bass, but one octave higher, and with two extra strings that do a little trick to make chords easier to play…

Guitar	5 - (4) - 3 - (2) - 0 - 5
Minor chord	(2) - 0 - 5

If you play the highest three strings, you get a *Minor chord* with 5 as the root note. To get higher transpositions, you barre your finger across those three strings on any fret, up the neck.

Guitar	5 - (4) - 3 - (2) - 0 - 5
Major chord	3 - (2) - 0

If you mute the highest string and play the next highest three strings, you get a *Major chord* with (2) as the root note.

If you're confused right now, it's because we haven't discussed chords yet, so you should come back and read this part again, after we have.

Opening (orchestra tuning). *echizen77* (YouTube): youtu.be/F31FdsiYK_M

https://matiasnotation.com/b1c4qr1

String orchestra tuning sequence. *Williamsport Orchestras* (YouTube): youtu.be/bAEfcIe18RM

https://matiasnotation.com/b1c4qr2

NYO-U: Mastering the tuning "A". *NYO-USA / NYO2 / NYO Jazz* (YouTube): youtu.be/Pe-eFi7zMrc

https://matiasnotation.com/b1c4qr3

The ABCs of tuning. *Minnesota Orchestra* (YouTube): youtu.be/bnuuduLMCM8

https://matiasnotation.com/b1c4qr4

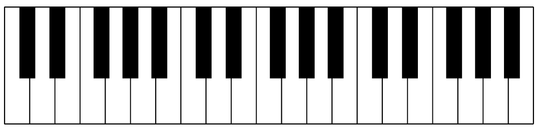
A440 orchestra tuning | Warner Brothers. *Jermaine Stegall* (YouTube): youtu.be/bdih8IPQjqE

https://matiasnotation.com/b1c4qr5

Albrecht Mayer beguiles with the sound of his oboe | with Sarah Willis. *DW Classical Music* (YouTube): youtu.be/_po72IgykUU

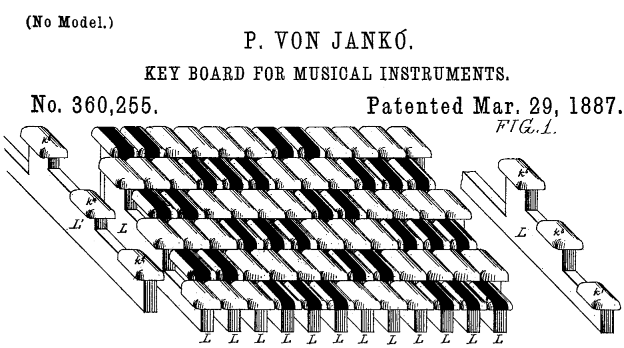
https://matiasnotation.com/b1c4qr6

5. Piano keyboards

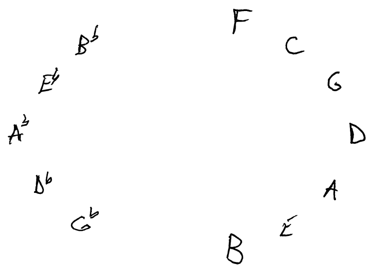


Pianos are also string instruments, but the strings are hidden under hammers that are engaged by keys on the keyboard. Typically, all you see are the keys.

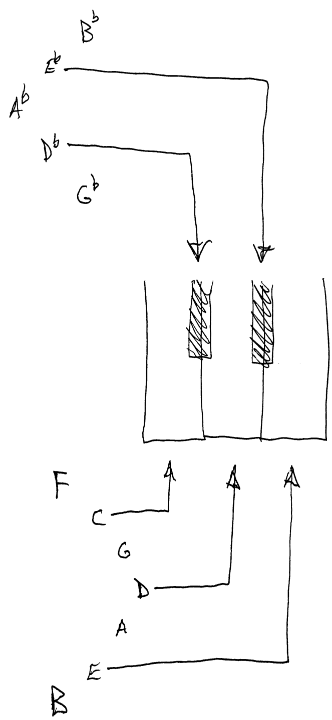
At first sight, the key layout is a little odd. It looks difficult to navigate — which has led to the invention of seemingly easier alternatives (none of which have caught on). Like this one…

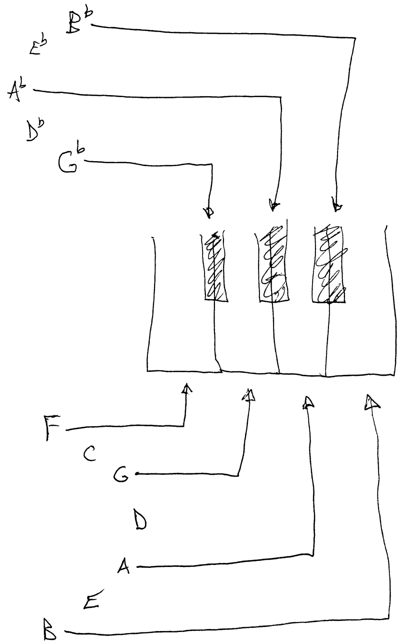


As you might've guessed, the circle of fifths reveals the logic behind the piano keyboard layout…



If you divide up the circle as shown, you get the black and white keys of the piano.

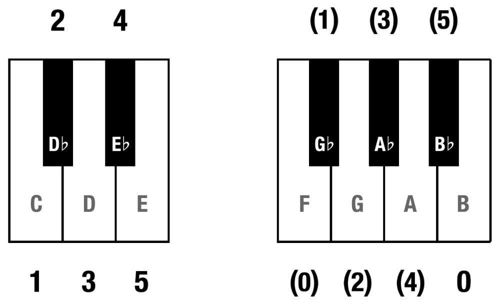




Also, you can see that there are fewer black keys — 5 black vs 7 white keys.

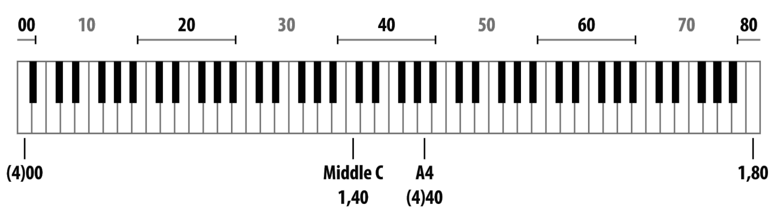
Those *5 black keys* make up the palette of notes that we call the *Pentatonic Scale*. I mentioned earlier that smaller palettes are less messy — if you're a beginner, try playing just the black keys. You'll find it easier to make music, even without training.

The *7 white keys* make up the *Diatonic Scale* — or scales. You can actually get 7 different scale patterns, depending on which white key you start on (your *tonic note*). The white keys *starting on C* give you the *C Major scale*. The white keys *starting on A* give you the *A Minor scale*.



Scales that share the same palette of notes are called *modes*. You get a different mode by starting on a different note in the palette. *C Major* and *A Minor* are modes of each other — *Diatonic Modes*. This is a much bigger topic, beyond the scope of this book.

Most pianos have a range of almost 8 octaves (88 keys), starting at (4)00 at the far left (four octaves *below* Concert-A) and going all the way up to 1,80 (four octaves *above* Middle-C).



Martha Argerich: 80 Year Old SUPER VIRTUOSO!! How Is This Even Possible? *Rick Beato* (YouTube): youtu.be/AYkQleTcck8

https://matiasnotation.com/b1c5qr1

How does a Grand Piano work? – Part 1. *Jared Owen* (YouTube): youtu.be/NDvS2V7HbnY

https://matiasnotation.com/b1c5qr2

How does a Grand Piano work? – Part 2. *Jared Owen* (YouTube): youtu.be/6effL4ATZVo

https://matiasnotation.com/b1c5qr3

The Fascinating World Inside of a Piano. *Nahre Sol* (YouTube): youtu.be/OpCpBWdl-ic

https://matiasnotation.com/b1c5qr4

How to play the C major scale RIGHT hand. *Piano From Scratch* (YouTube): youtu.be/i-buhBdqwtY

https://matiasnotation.com/b1c5qr5

How to play the C major scale LEFT hand. *Piano From Scratch* (YouTube): youtu.be/Aednzm_TiqQ

https://matiasnotation.com/b1c5qr6

How to play the C major scale BOTH hands together.
Piano From Scratch (YouTube): youtu.be/Q1W0U7Vfv2o

https://matiasnotation.com/ b1c5qr7

6. Making music

Generally speaking, there are two approaches to making music: *melody* and *harmony*.

Melody is one note played after another, to a rhythm — like when you whistle a tune.

Melodies are fairly forgiving of mistakes. If you happen to play a wrong note, a right note is usually just a semitone away. Go up or down a semitone, and keep on playing. It'll sound like you did it on purpose (and no one will know any different).

Harmony is multiple notes played simultaneously — like the sound of a full orchestra, or strumming a guitar. Harmony is *less* forgiving of mistakes. If you play a *really* wrong note, *everybody* hears it. It stands out.

Because harmony is more constrained, there's an even smaller palette of notes (less mess) that's specifically designated for harmony. It's called a *chord*.

Chords are groups of 2 or more notes. There's a whole framework for identifying chords within scales. You can even play a chord melodically (one note after another, rather than simultaneously) — when you do that, it's called an *arpeggio* (ar-peh-jee-oh) or *broken chord.*

In the next few chapters, you will learn the three most important chords to know: *Major*, *Minor*, and *Diminished*. These are the *Diatonic Triads* (the 3-note chords found in *Diatonic scales*) and they are all you need to start making music.

Can you spot the *melody* and *harmony* in this performance…?

Vulfpeck /// Dean Town (live in Dublin). *Vulf* (YouTube): youtu.be/3ruXOh74xRE

https://matiasnotation.com/b1c6qr1

Victor Wooten: Bass Lesson. *Hudson Music* (YouTube): youtu.be/UvKEpAYZjlE

https://matiasnotation.com/b1c6qr2

What Makes This Song Great? *Rick Beato* (YouTube): youtube.com/playlist?list=PLW0NGgv1qnfzb1klL6Vw9B0aiM7ryfXV_

https://matiasnotation.com/b1c6qr3

7. Flipping notes

Before we start on chords, I want to highlight one of the most useful properties of Matias numerals: they can be *flipped*.

Learning music requires memorization — memorizing chords, memorizing scales, memorizing transpositions of chords and scales… It's a lot of memorization.

By *flipping* Matias numerals, you reduce memorization *by half*.

For each set of notes you memorize, you've actually memorized *TWO sets*.

Memorize this:

0 3 (1)

…and you *automatically* also know this:

(0) (3) 1

This is true for any set of Matias numerals, and it means that you will only ever have to memorize *6 variations* of any note pattern, to learn *ALL* transpositions of that pattern — like the *Minor chords*, for example…

0	3	(1)
(1)	(4)	2
2	5	(3)
(3)	0	4
4	(1)	(5)
(5)	2	(0)

In letter notation, you would have to memorize 21 — 7 natural + 7 flat + 7 sharp transpositions…

B	D	F♯
C	E♭	G
D	F	A
E	G	B
F	A♭	C
G	B♭	D
A	C	E

B♭	D♭	F
C♭	E𝄫	G♭
D♭	F♭	A♭
E♭	G♭	B♭
F♭	A𝄫	C♭
G♭	B𝄫	D♭
A♭	C♭	E♭

B♯	D♯	F𝄪
C♯	E	G♯
D♯	F♯	A♯
E♯	G♯	B♯
F♯	A	C♯
G♯	B	D♯
A♯	C♯	E♯

In fact, if I listed double flats ♭♭/𝄫 and double sharps ♯♯/𝄪 (I won't) we'd get 14 more (35 in total).

Why does this happen?

Traditional notation has *enharmonics* — multiple ways to write the same thing — so you get *lots* of duplication (enharmonic duplication):

A𝄪 = A♯♯ = B = C♭

A♯ = B♭ = C♭♭ = C𝄫

The way around this is to think in Matias numerals *but ALSO* memorize the letter names they correspond to…

0	=	B	C♭
1	=	C	B♯
2	=		C♯ / D♭
3	=	D	
4	=		D♯ / E♭
5	=	E	F♭
(0)	=	F	E♯
(1)	=		F♯ / G♭
(2)	=	G	
(3)	=		G♯ / A♭
(4)	=	A	
(5)	=		A♯ / B♭

This way, you'll be able to communicate with other musicians *in their language,* while still having *only 6 transpositions* to memorize, each time you learn a new chord or scale.

Learn them *once* and each new set of 6 will automatically get you the traditional 21 or 35 transpositions.

Adding 6 to any Matias numeral, flips it:

0 + 6 = (0)

1 + 6 = (1)

2 + 6 = (2)

etc.

Adding 6 again, flips it back:

(0) + 6 = 0

(1) + 6 = 1

(2) + 6 = 2

etc.

Similar to how numbers are classified as *even* or *odd,* we refer to *how they're flipped* as either *ess* or *not ess* …

(0) (1) (2) (3) (4) (5)

are all ***ess***
(or *ess* numbers)

0 1 2 3 4 5

are all ***not ess***
(or *not ess* numbers)

If you're a Jazz musician, and your ears have been perked up this whole time, yes, this is *perfect* for doing *tritone subsitutions*. In Matias notation, tritone subs are easy.

Flipping a pattern of notes is trivial to do, on the fly — because it looks *so similar* to the unflipped original. That similarity allows us to skip the step of memorizing the flipped transposition. You get two transpositions *(tritone pairs)* for the price of one.

Memorizing *6 things* is much less work than *21 things* or *35 things* — especially if you can quickly translate back & forth between them. That gives you the best of both worlds.

As you'll see in the next few chapters, it's not just less to memorize, it's also *much easier* to memorize — because Matias numerals *accentuate* musical patterns.

8. Diminished chords

We're learning Diminished chords first because they are the easiest to remember — once you know them, the Major and Minor chords will be easy too.

Diminished chords are written in two different ways:

$$\text{Cdim} = \text{C}^\circ = 1^\circ$$

For Matias numerals, we use the shorter of those two ways.

The trick to learning diminished chords is knowing three pairs of numbers:

0 and 3

1 and 4

2 and 5

When you hear (or see) any one of those numbers, the other should immediately come to mind.

Spend a few minutes getting them straight in your head. Throughout the day, repeat them to yourself, until they're etched in your brain. Recall should be automatic and instant.

The next step is to think of them as a repeating pattern of notes:

0 3 (0) (3) 0 3…

You now know all transpositions of diminished chords that start with 0 or 3 or (0) or (3):

0 3 (0)

3 (0) (3)

(0) (3) 0

(3) 0 3

The same is true for diminished chords that start on 1 or 4 or (1) or (4):

1 4 (1) (4) 1 4…

1 4 (1)

4 (1) (4)

(1) (4) 1

(4) 1 4

Finally, we have diminished chords starting with a 2 or 5 or (2) or (5):

2 5 (2) (5) 2 5…

2 5 (2)

5 (2) (5)

(2) (5) 2

(5) 2 5

There we are. You've now learned *ALL transpositions* of the diminished triad. Learning them in Matias numerals is a trivial exercise.

Time to hear how they sound…

C diminished triad drone. *JoseCastilloMusicLessons* (YouTube): youtu.be/iud2Id2evlg

https://matiasnotation.com/b1c8qr1

Songs that use Diminished Chords. *David Bennett Piano* (YouTube): youtu.be/2Q_dpxMb328

https://matiasnotation.com/b1c8qr2

How to use the Diminished chord (and fix your boring progressions!). *Paul Davids* (YouTube): youtu.be/8ftgt0Ot0pc

https://matiasnotation.com/b1c8qr3

9. Minor chords

The Minor chords are almost as easy to learn as the Diminished chords, so they are next...

There are a variety of ways to indicate a minor chord:

$$\text{Cmin} = \text{Cm} = \text{C}^{-} = 1^{-}$$

Again, we use the more succinct representation for the Matias numeral equivalent.

The first and last notes of a minor triad are one step around the circle of fifths:

0 __ (1)

1 __ (2)

2 __ (3)

3 __ (4)

4 __ (5)

5 __ 0

(0) __ 1

(1) __ 2

(2) __ 3

(3) __ 4

(4) __ 5

(5) __ (0)

Pretty easy so far.

Next, the middle note follows the same pattern as *the beginning* of a Diminished chord — remember the three key phrases from the previous chapter:

0 and 3

1 and 4

2 and 5

We start with this:

0 __ (1)

…and then apply the key phrase:

0 3 (1)

We do the same for the others:

1 __ (2)

1 4 (2)

2 __ (3)

2 5 (3)

etc.

Below is the complete list.

0	3	(1)
1	4	(2)
2	5	(3)
3	(0)	(4)
4	(1)	(5)
5	(2)	0
(0)	(3)	1
(1)	(4)	2
(2)	(5)	3

(3) 0 4

(4) 1 5

(5) 2 (0)

As you can see, in Matias numerals, the Diminished chord fragments and the circle of fifth patterns really stand out.

We can also see that a Minor triad is just a Diminished triad with the last note raised by a semitone.

You've now learned *ALL the Minor triad transpositions*.

Time to hear how they sound…

C minor chord drone. *JoseCastilloMusicLessons* (YouTube): youtu.be/ecwq9u67AJ8

https://matiasnotation.com/b1c9qr1

Why are Minor chord songs so rare? *David Bennett Piano* (YouTube): youtu.be/xnoxNEgOw-s

https://matiasnotation.com/b1c9qr2

10. Major chords

Finally, we arrive at the Major chords. They are just as easy as Minor chords.

Major triads are usually abbreviated simply as the root note of the chord, but you'll see longer variants as well:

$$\text{Cmaj} = \text{C}^{\textbf{MAJ}} = \text{CM} = \text{C} = 1 = 1^{\textbf{MAJ}}$$

Just like Minor triads, the first and last notes of Major triads are a step around the circle:

0 __ (1)

1 __ (2)

2 __ (3)

3 __ (4)

4 __ (5)

5 __ 0

(0) __ 1

(1) __ 2

(2) __ 3

(3) __ 4

(4) __ 5

(5) __ (0)

Next, the middle note follows the same pattern as *the END* of a Diminished chord — recall the three key phrases:

0 and 3

1 and 4

2 and 5

We start with this:

2 __ (3)

…and then apply the key phrase:

2 (0) (3)

We do the same for the others:

3 __ (4)

3 (1) (4)

4 __ (5)

4 (2) (5)

etc.

The complete list is below.

0 4 (1)

1 5 (2)

2 (0) (3)

3 (1) (4)

4 (2) (5)

5 (3) 0

(0) (4) 1

(1) (5) 2

(2) 0 3

(3) 1 4

(4) 2 5

(5) 3 (0)

You now know *ALL transpositions* of the Major, Minor, and Diminished triad chords.

Most musicians only know a few transpositions of chords they use on a regular basis — you know *all of them*.

Now is the time to get yourself an instrument, and start playing!

C major chord drone. *JoseCastilloMusicLessons* (YouTube): I2-pS4d6D6s

https://matiasnotation.com/b1c10qr1

11. Chord spotting

In the wild, the notes of a chord don't always appear in order, or even with all notes present, so we address those cases next…

The *first note* of a chord is called *the root note* (or simply *the root*).

The root of a chord is usually the *lowest note* — but not always. When it's not, we call it *an inversion*. If the *second note* of a chord is the lowest note, that's called *first inversion*. If the *third note* is lowest, that's *second inversion*, etc.

This complicates the identification of chords. If the lowest note isn't the root, which one is? How do you know? How do you identify a chord if you don't know the root?

This is actually an exam question — identify the root for each of the following chords:

E𝄫 C♭ G♭

F A♭ C

C♯ E A

In Matias numerals, it is trivially easy to spot the root:

3 0 (1)

(0) (3) 1

2 5 (4)

You just look for the notes in the chord that are one step around the circle of fifths — the root is the first of those two numbers:

0 __ (1)

(0) __ 1

(4) __ 5

Here are the same chords, re-ordered to root position:

0	3	(1)
(0)	(3)	1
(4)	2	5

Here they are again, in their original order:

3	0	(1)	0 minor chord, first inversion
(0)	(3)	1	(0) minor chord, root position
2	5	(4)	(4) major chord, first inversion

It’s also common for one note of a chord to be omitted — usually one of the circle of fifth notes — with the bass playing that missing note…

Guitar		3	(1)
Bass	0		

Guitar		(1)	3
Bass	0		

Guitar		0	3
Bass	(1)		

Guitar		3	0
Bass	(1)		

In a full orchestra, it’s common to have each note of a chord played by different instruments, especially with larger chords.

Finally, we present the *Power chord* or *Fifth chord:*

$$C^{5} = 1^{5}$$

It's simply two adjacent notes in the circle of fifths:

0 (1)

1 (2)

2 (3)

etc.

These are among the safest, most consonant chords you can play.

If the guitar plays a power chord, the bass can turn it into a *major* or *minor* chord, simply by playing the missing middle note. This means that *the bass player* decides what chord *the guitar* is playing (which is comical).

You can now go back to re-read page 30, and actually understand it — progress!

Your 60 second piano lesson: C major triad. *ThePianoforever* (YouTube): youtu.be/FKdYeoX8gsw

https://matiasnotation.com/b1c11qr1

Songs that use inversions. *David Bennett Piano* (YouTube): youtu.be/kfvrwCxa720

https://matiasnotation.com/b1c11qr2

12. Jazz chords

Jazz is beyond the scope of this book, but Jazz *chords* are not.

We're almost at the end, so we're jumping in the pool (metaphorically speaking).

We're going to learn *four* Jazz chords in this one chapter — the four that you would learn, if you could *only learn four* — and we're learning them in *pairs* . . .

Below are the *B Major 7th* and *minor 7th chords:*

B maj7	=	0^{Δ}	=	0	4	(1)	(5)

B m7	=	0^{-7}	=	0	3	(1)	(4)

They're both easy to spot — just look for *overlapping fifths:*

B maj7	=	0^{Δ}	=	0		(1)	
					4		(5)

B m7	=	0^{-7}	=	0		(1)	
					3		(4)

Now that we've seen this — we have the opposite problem — they look so similar, how do we tell them apart . . . ?

. . . with our trusty *minor 3rd* interval pairs:

0 and 3   1 and 4   2 and 5

For the ***maj7 chord,*** those overlapping fifths are bound together ***in the centre*** by a *minor 3rd* interval — *4 and (1)* in the example below:

					4	(1)	
B maj7	=	0^{Δ}	=	0			(5)

In contrast, the ***m7 chord*** has ***two*** *minor 3rd* intervals on the ***outside edges*** of the chord:

						(1)	(4)
B m7	=	0^{-7}	=	0	3		

The *dominant B7* and *E♭ half-diminished* (m7♭5) chords are next...

B7	=	0^7	=	0	4	(1)	(4)	
E♭ m7♭5	=	4⌀	=		4	(1)	(4)	2

The *dominant B7 chord* and the *E♭ m7♭5 chord* (AKA *E♭ half-diminished*) are ***diminished triads*** with an *overlapping **fifth*** on ***one side***:

					4	(1)	(4)	
B7	=	0^7	=	0		(1)		

						(1)		2
E♭ m7♭5	=	4⌀	=		4	(1)	(4)	

Again, these chords are easy to spot . . . if you see a *diminished chord,* check for a *fifth overlapping* the *centre note* — the *side it overlaps* tells you which of the two possible chords it is.

That was your three-page introduction to Jazz chords.

Good luck!

What is Electro Swing? Electro Swing Explained in 2 minutes. *Dave Wave* (YouTube): youtu.be/nz-Dh5-qdkM

https://matiasnotation.com/b1c12qr1

Bebop, As Digested by a Classical Musician. *Nahre Sol* (YouTube): youtu.be/oZ16m7MyXJ8

https://matiasnotation.com/b1c12qr2

The 7 Levels of Jazz Harmony. *Adam Neely* (YouTube): youtu.be/lz3WR-F_pnM

https://matiasnotation.com/b1c12qr3

7 types of 7th chord EXPLAINED. *David Bennett Piano* (YouTube): youtu.be/o00YUSEPu_8

https://matiasnotation.com/b1c12qr4

The most feared song in jazz, explained. *Vox* (YouTube): youtu.be/62tIvfP9A2w

https://matiasnotation.com/b1c12qr5

John Coltrane — Giant Steps — Circle of Fifths Diagram. *Kyrla* (YouTube): youtu.be/1lkJTSdGLG8

https://matiasnotation.com/b1c12qr6

Changes Like Coltrane. *12tone* (YouTube): youtu.be/SalBNnzUVME

https://matiasnotation.com/b1c12qr7

Jazz Piano Tutorial — Coltrane Changes Explained. *Walk That Bass* (YouTube): youtu.be/64xv1FeU1rY

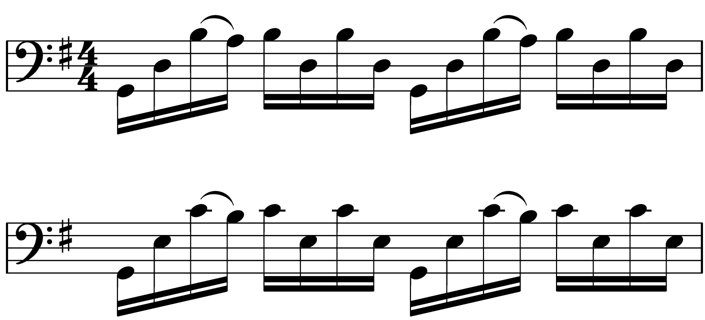
https://matiasnotation.com/b1c12qr8

A Brief History Of Cool Jazz. *Insights For Creatives* (YouTube): youtu.be/PLAIXdMD-N8

https://matiasnotation.com/b1c12qr9

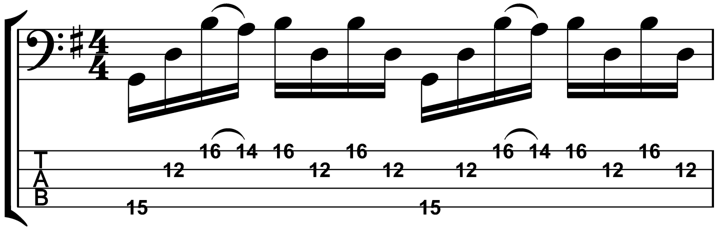
13. Matias staff notation

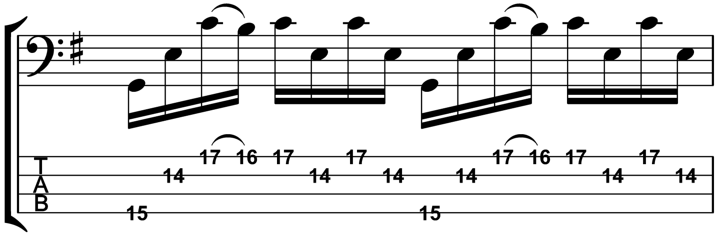
Traditional music notation is *beautiful* and clever… It's space efficient, *quick* to sight read at speed, and draws attention to scale chords in a simple (visual) way.



Unfortunately, it's also buried in so many rule exceptions that even some professional musicians don't read it. If you learned it as a child, none of that matters — it will be as effortless as reading this page.

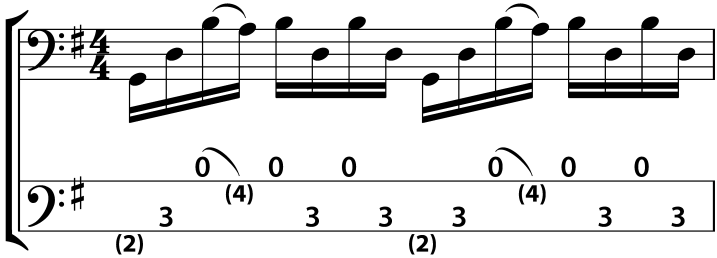
If you're learning as an adult (from scratch) it's a lot more daunting. Every exception to a rule will feel like another rug pulled out from under you — every key signature, every clef, every enharmonic, every line or space that changes pitch because you added a sharp ♯ or flat ♭ …

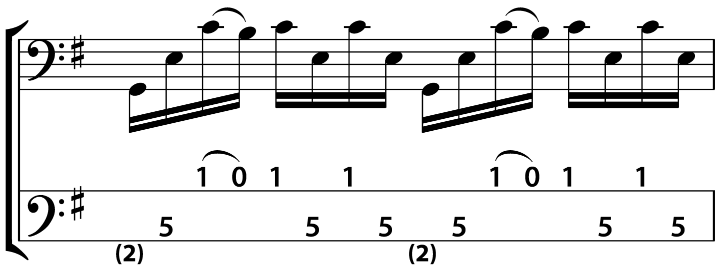




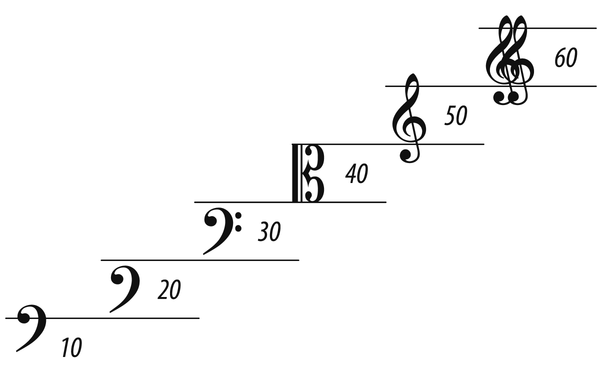
Many self-taught players of guitar or bass have turned to tablature (tab) instead — lines represent strings and the numbers are fret numbers, so you know exactly where on the neck to place your fingers. It's much easier, but also less musical (more mechanical). You don't know which notes you're playing, and it hides all the musical patterns that we've enjoyed exploring in this book.

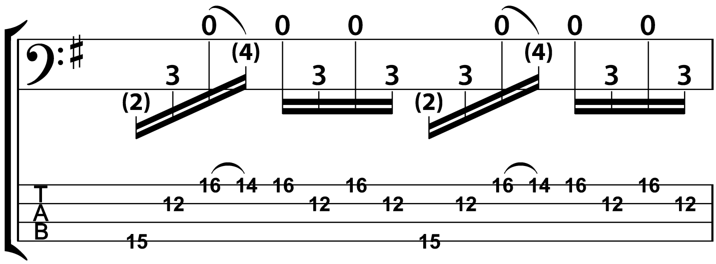
Which brings us to our last topic: *Matias staff notation*. It's not as pretty as traditional notation, and not as mechanical as tablature, but it shows you all the musical patterns — and it's *easy*…

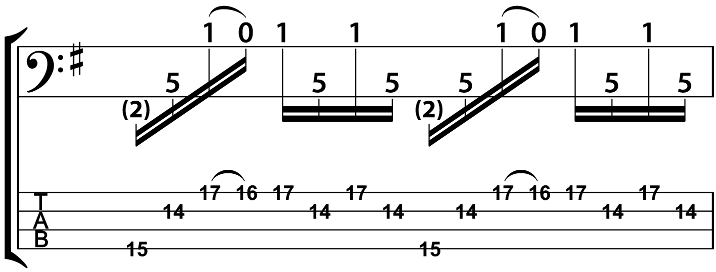




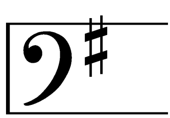
There are only 2 staff lines, and a clef dictates the octave of the notes between those two lines. Notes outside the lines are an octave higher above the staff, and an octave lower below. Here are the clefs for each octave:



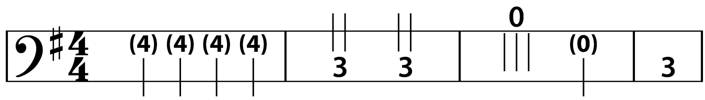




For self-taught players of guitar or bass, Matias notation pairs well with tablature — one shows you the musical patterns, while the other shows where your fingers go.

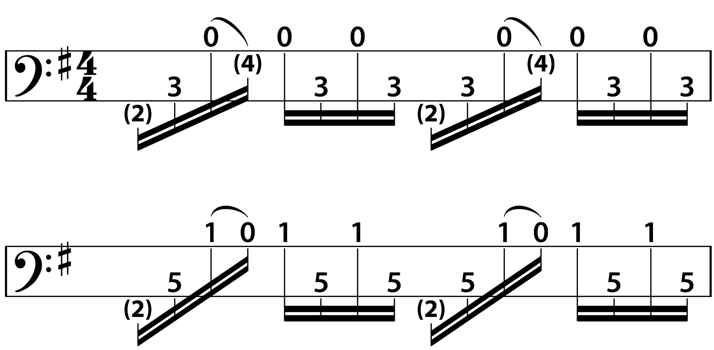


Accidental symbols (sharps & flats: ♯ ♭) from traditional notation still indicate the key signature, but aren't strictly necessary — since they don't affect the pitch values of the notes as written.

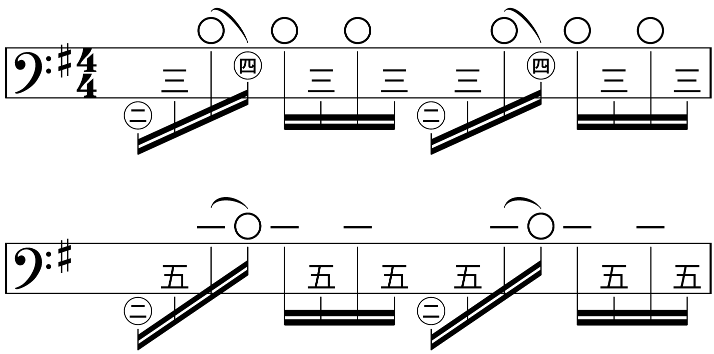


Rhythm mostly follows traditional notation, with one exception… one stem indicates a quarter note (1 beat); two stems indicate a half note (2 beats); three stems indicate a dotted half note (3 beats); no stems indicate a whole note (4 beats). For more than 4 beats, use ties to tie together whatever combination of beats are needed.

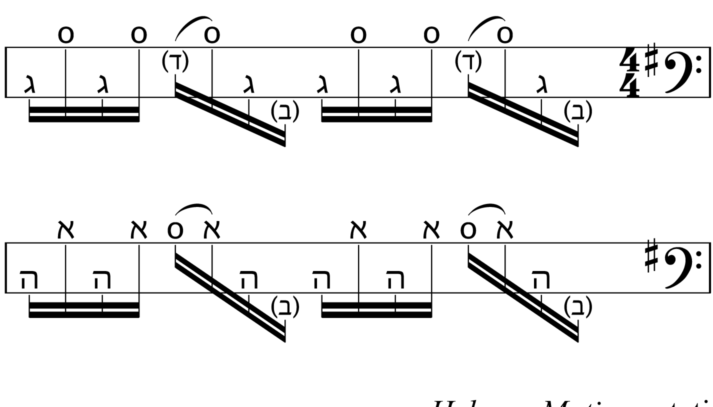
The notes are *Matias numerals* but could also be *Sino-Matias* numerals or *Hebrew-Matias* numerals (etc.) in whatever font or style the music engraver deems appropriate.



Matias notation



Sino-Matias notation



Hebrew-Matias notation

In these videos, you can hear how the music above actually sounds… (full *sheet music* in the next chapter)

That famous cello prelude, deconstructed. *Vox* (YouTube): youtu.be/UIge2mYdTtM

https://matiasnotation.com/b1c13qr1

Bach — Cello Suite No. 1, [BWV 1007: 1. Prelude]: Played by Lorraine Campet, Double Bass. *String Virtuoso* (YouTube): youtu.be/HdAIF6C21i8

https://matiasnotation.com/b1c13qr2

Bach Cello Suite No.1 Prelude - Solo Electric Bass. *Fabian Wendt* (YouTube): youtu.be/_5Vdxg06Bqs

https://matiasnotation.com/b1c13qr3

These videos briefly explain how traditional staff notation and tablature (tab) are read…

Read sheet music in 7 minutes! (Guitar). *Redlight Blue* (YouTube): youtu.be/8bzAjQ4PxyA

https://matiasnotation.com/b1c13qr4

Note naming: Everything you need to know in 9 minutes. *Brad Harrison Music* (YouTube): youtu.be/exTi3gFBVFU

https://matiasnotation.com/ b1c13qr5

How to read Guitar Tab for beginners. *JustinGuitar* (YouTube): youtu.be/FofCWizp43Y

https://matiasnotation.com/b1c13qr6

These videos discuss the history and philosophy of music notation…

How sheet music lies to you. *12tone* (YouTube): youtu.be/quOLtE0wfAo

https://matiasnotation.com/b1c13qr7

Why you shouldn’t use Tab (and it’s not why you might think!). *Adam Neely* (YouTube): youtu.be/4X7qgBVnMfY

https://matiasnotation.com/ b1c13qr8

Music notation is more complicated than you think. *Sounds Good* (YouTube): youtu.be/H1U46z7QvOY

https://matiasnotation.com/b1c13qr9

The curious history of the clef. *Orchestra of the Age of Enlightenment* (YouTube): youtu.be/U0t59VxBPfE

https://matiasnotation.com/b1c13qr10

Gregorian chant. *Early Music Sources* (YouTube): youtu.be/QuRrd35kvUo

https://matiasnotation.com/b1c13qr11

Roman Numeral Analysis was designed for upper-class amateurs. *Nikhil Hogan Show* (YouTube): youtu.be/ZGNCOTKKxNM

https://matiasnotation.com/b1c13qr12

96: Elam Rotem (Renaissance Counterpoint). *Nikhil Hogan Show* (YouTube): youtu.be/MO1jz_SAWkQ

https://matiasnotation.com/b1c13qr13

Notation Must Die: The Battle For How We Read Music.
Tantacrul (YouTube): youtu.be/Eq3bUFgEcb4

https://matiasnotation.com/b1c13qr14

14.

Chords as circles of fifths

We began with the claim that “Music is the circle of fifths.”

We end here with *chords* that are *circles of fifths:*

0^{5}	0 (1)

Overlapping fifths:

0^{-}	0 **3** (1)
0^{-7}	0 **3** (1) **(4)**
0^{-9}	0 **3** (1) **(4)** 2
0^{-11}	0 **3** (1) **(4)** 2 **5**
0^{-13}	0 **3** (1) **(4)** 2 **5** (3)
0^{MAJ}	0 **4** (1)
$0^{\triangle}$	0 **4** (1) **(5)**
$0^{\triangle 9}$	0 **4** (1) **(5)** 2
$0^{\triangle \sharp 11}$	0 **4** (1) **(5)** 2 **(0)**
$0^{\triangle 13 \sharp 11}$	0 **4** (1) **(5)** 2 **(0)** (3)

Overlapping opposing fifths (in opposite directions):

$0^{-\flat 6}$	0 **3** (1) **(2)**
0^{6}	0 **4** (1) **(3)**

$0^{\text{sus 4}}$	0 **5** (1)
$0^{7\ \text{sus 4}}$	0 **5** (1) **(4)**
$0^{9\ \text{sus 4}}$	0 **5** (1) **(4)** 2
$0^{6/9}$	0 4 (3) 2
$0^{\text{sus 2}}$	0 2 (1)

Chords with more than three notes are called “extended chords” and we think of them as *extensions* of a smaller three-note *major chord* or *minor chord* or (suspended) *sus chord.*

But after seeing all these patterns of overlapping fifths, calling them “extensions” might be backwards thinking…

It may be better to think of them like *icebergs* — where most of the chord is hidden (underwater), and the tip that’s visible (*above* the waterline) is a *major* or *minor* or *sus chord.*

The *diatonic triads* are just the most exposed bits of bigger chords — and most chords are just another manifestation of the circle of fifths.

15. Where to from here

We've covered a lot of musical terrain in a very short time.

There may be some parts that you didn't quite get. This is normal. Don't hesitate to re-read sections of the book, until you understand them. Like re-watching a movie, you'll see things that you missed the first time through.

If there's some concept that has you stumped, don't worry about it. Sleep on it and try again later — let your subconscious mull it over a while. It'll sink in eventually; no need to force it.

With music, there is always more to learn. This book is just a start. There are other books and blogs and teachers and schools. There's YouTube. There are *amazing* resources out there.

If you don't play an instrument, now is a great time to start. They are less expensive (and better built) than at any time in human history. Plus, there are bargains to be found on the 2nd hand market. Or (like a bird on a wire) you can always whistle, or sing — those cost nothing.

We are living in a *golden age* of music. Enjoy it!

And if civilization collapses, remember the circle of fifths — and pass it on.

What guitar would I buy under $500. *Phillip McKnight* (YouTube): youtu.be/0qAgCv6UJPI

https://matiasnotation.com/b1c15qr1

Buying a used guitar can be fun or not. *Dave's World of Fun Stuff* (YouTube): youtu.be/a-sZHwIe5ik

https://matiasnotation.com/b1c15qr2

"All musicians are subconsciously mathematicians."

Thelonious Monk

16. Reference

This chapter is one last morsel for the mathematically inclined. Needless to say, you’re not obliged to read it.

Letter name	Matias numeral	Solfège	Duodecimal	Decimal
B	0	Da	0	0
C	1	Do	1	1
	2	Ra	2	2
D	3	Ré	3	3
	4	Ma	4	4
E	5	Mi	5	5
F	(0)	Fa	6	6
	(1)	Fi	7	7
G	(2)	Sol	8	8
	(3)	Si	9	9
A	(4)	La	A	10
	(5)	Li	V	11

Musical Number	SPN	MIDI	Hz	Musical Decimal
(5)90	A♯9		14 917	119
(4)90	A9		14 080	118
(3)90	A♭9		13 290	117
(2)90	G9	127	12 544	116
(1)90		126	11 840	115
(0)90	F9	125	11 175	114
5,90	E9	124	10 548	113
4,90		123	9 956	112
3,90	D9	122	9 397	111
2,90		121	8 870	110
1,90	C9	120	8 372	109
0,90	B8	119	7 902	108
(5)80		118	7 459	107
(4)80	A8	117	7 040	106
(3)80		116	6 645	105
(2)80	G8	115	6 272	104
(1)80		114	5 920	103
(0)80	F8	113	5 588	102
5,80	E8	112	5 274	101
4,80		111	4 978	100
3,80	D8	110	4 699	99
2,80		109	4 435	98
Musical Number	SPN	MIDI	Hz	Musical Decimal
1,80	C8	108	4 186	97
0,80	B7	107	3 951	96
(5)70		106	3 729	95
(4)70	A7	105	3 520	94
(3)70		104	3 322	93

(2)70	G7	103	3 136	92
(1)70		102	2 960	91
(0)70	F7	101	2 794	90
5,70	E7	100	2 637	89
4,70		99	2 489	88
3,70	D7	98	2 349	87
2,70		97	2 217	86
1,70	C7	96	2 093	85
0,70	B6	95	1 976	84
(5)60		94	1 865	83
(4)60	A6	93	1 760	82
(3)60		92	1 661	81
(2)60	G6	91	1 568	80
(1)60		90	1 480	79
(0)60	F6	89	1 397	78
5,60	E6	88	1 319	77
4,60		87	1 245	76
3,60	D6	86	1 175	75
2,60		85	1 109	74
1,60	C6	84	1 047	73
0,60	B5	83	988	72
(5)50		82	932	71
(4)50	A5	81	880	70
(3)50		80	831	69
(2)50	G5	79	784	68
(1)50		78	740	67
(0)50	F5	77	698	66
5,50	E5	76	659	65
4,50		75	622	64
3,50	D5	74	587	63
2,50		73	554	62
1,50	C5	72	523	61
0,50	B4	71	494	60
(5)40		70	466	59

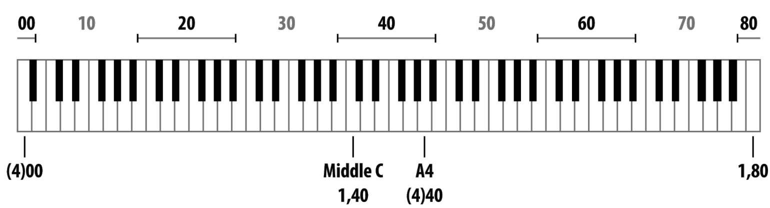
(4)40	**Concert A4**	**69**	**440**	**58**
(3)40		68	415.3	57
(2)40	G4	67	392.0	56
(1)40		66	370.0	55
(0)40	F4	65	349.2	54
5,40	E4	64	329.6	53
4,40		63	311.1	52
3,40	D4	62	293.7	51
2,40		61	277.2	50
1,40	**Middle C4**	**60**	**261.6**	**49**
0,40	B3	59	246.9	48
(5)30		58	233.1	47
(4)30	A3	57	220	46
(3)30		56	207.7	45
(2)30	G3	55	196.0	44
(1)30		54	185.0	43
(0)30	F3	53	174.6	42
5,30	E3	52	164.8	41
4,30		51	155.6	40
3,30	D3	50	146.8	39
2,30		49	138.6	38
1,30	C3	48	130.8	37
0,30	B2	47	123.5	36
(5)20		46	116.5	35
(4)20	A2	45	110	34
(3)20		44	103.8	33
(2)20	G2	43	98.00	32
(1)20		42	92.50	31
(0)20	F2	41	87.31	30
5,20	E2	40	82.41	29
4,20		39	77.78	28
3,20	D2	38	73.42	27
2,20		37	69.30	26
1,20	C2	36	65.41	25

0,20	B1	35	61.74	24
(5)10		34	58.27	23
(4)10	A1	33	55	22
(3)10		32	51.91	21
(2)10	G1	31	49.00	20
(1)10		30	46.25	19
(0)10	F1	29	43.65	18
5,10	E1	28	41.20	17
4,10		27	38.89	16
3,10	D1	26	36.71	15
2,10		25	34.65	14
1,10	C1	24	32.70	13
0,10	B0	23	30.87	12
(5)00		22	29.14	11
(4)00	A0	21	27.5	10
Musical Number	SPN	MIDI	Hz	Musical Decimal
(3)00		20	25.96	9
(2)00	G0	19	24.50	8
(1)00		18	23.12	7
(0)00	F0	17	21.83	6
5,00	E0	16	20.60	5
4,00		15	19.45	4
3,00	D0	14	18.35	3
2,00		13	17.32	2
1,00	C0	12	16.35	1
0,00	B-1	11	15.43	0
(5)10-		10	14.57	-1
(4)10-	A-1	9	13.75	-2
(3)10-		8	12.98	-3
(2)10-	G-1	7	12.25	-4
(1)10-		6	11.56	-5

(0)10-	F-1	5	10.91	-6
5,10-	E-1	4	10.30	-7
4,10-		3	9.723	-8
3,10-	D-1	2	9.177	-9
2,10-		1	8.662	-10
1,10-	C-1	0	8.176	-11
Musical Number	SPN	MIDI	Hz	Musical Decimal

SPN (scientific pitch notation) combines the letter name of a musical pitch with an octave number, as defined by the *ISO 16:1975* standard.

MIDI note numbers represent musical pitches by counting semitones, as specified by the *MIDI Tuning Standard* (MTS).



Chord			Interval	Semitones	Matias Numeral Pattern	Multiplier
I	1	P1	Perfect Unison	0	0	1
ii	♭2	m2	minor 2nd	1	1	1.059463
II	2	M2	Major 2nd	2	2	1.122462
iii	♭3	m3	minor 3rd	3	3	1.1892
III	3	M3	Major 3rd	4	4	1.259921
IV	4	P4	Perfect 4th	5	5	1.33484
♯IV ♭V	♯4 ♭5	A4 d5	Augmented 4th diminished 5th	6	(0)	1.4142
V	5	P5	Perfect 5th	7	(1)	1.4983
vi	♭6	m6	minor 6th	8	(2)	1.5874
VI	6	M6	Major 6th	9	(3)	1.6818
vii	♭7	m7	minor 7th	10	(4)	1.7818
VII	7	M7	Major 7th	11	(5)	1.88775
VIII	8	P8	Perfect Octave	12	10 + 0	2
ix	♭9	m9	minor 9th	13	10 + 1	2.118926
IX	9	M9	Major 9th	14	10 + 2	2.44924
x	♭10	m10	minor 10th	15	10 + 3	2.3784
X	10	M10	Major 10th	16	10 + 4	2.519842
XI	11	P11	Perfect 11th	17	10 + 5	2.66968
♯XI ♭XII	♯11 ♭12	A11 d12	Aug 11th dim 12th	18	10 + (0)	2.8284
XII	12	P12	Perfect 12th	19	10 + (1)	2.9966
xiii	♭13	m13	minor 13th	20	10 + (2)	3.1748
XIII	13	M13	Major 13th	21	10 + (3)	3.3636
xiv	♭14	m14	minor 14th	22	10 + (4)	3.5636
XIV	14	M14	Major 14th	23	10 + (5)	3.7755
XV	15	P15	Perfect 15th	24	20 + 0	4

CONVERSIONS

Musical Number to Musical Decimal…

octave# / 10 x 12

Add *sub#* value

if ( ) then Add 6

Musical Decimal to MIDI note number…

Add 11

MIDI note number to Musical Decimal…

Subtract 11

Musical Decimal to Frequency in Hz…

440 x 2^[[*d* – 58] / 12]

d = *Musical Decimal*

Frequency in Hz to Musical Decimal…

58 + [12 x log[*frequency* / 440] / log[2]]

Semitones to Multiplier…

2^[*n* / 12]

n = # of *semitones*

Multiplier to Semitones…

log[*multiplier*] / log[2^[1/12]]

Multiplier to Semitones…

log2[*multiplier*] x 12

Multiplier to Semitones…

(simple close approximation)

log[*multiplier*] x 39.863

Multiplier to Semitones…

(simpler closer approximation)

ln[*multiplier*] x 17.31234

A *semitone* (or *half tone* or *half step*) is the smallest musical interval used in Western tonal music. Equal tempered musical notes are counted in semitones.

Mathematically speaking, a semitone is the multiplier *1.059463x* (approx). Multiplying a pitch *(frequency)* by that number will give you the note *1 semitone above* that initial pitch. Multiply again for another semitone above.

When you listen to music, you're listening to frequencies multiply & divide, and your brain is processing them all *in real time* — and enjoying every minute of it.

Semitones can also be defined as logarithms of base 2^[1/12]. The base 2^[1/12] log of any multiplier will give you the number of semitones that multiplier represents:

semitones = log[*multiplier*] / log[2^[1/12]]

At the very beginning of the book, I mentioned that multiplying the frequency by 2 will give you the note one octave higher. If we pop that number into the equation, you'll see that we get an octave…

$$\log[\ \mathit{2}\ ] \ / \ \log[\ 2\text{^}[1/12]\ ] = 12 \text{ semitones}$$

We get exactly 12 semitones, which is an octave — the math works out.

If instead we got some decimals at the end, we'd be out of tune to some degree. For example, let's try the multiplier *1.5x*…

$$\log[\ \mathit{1.5}\ ] \ / \ \log[\ 2\text{^}[1/12]\ ] \approx 7.02 \text{ semitones}$$

Just like money, the first two decimal places are the *cents* value. We're 2 cents higher than 7 semitones, and (just like money) 2 cents is not much — so we're in tune.

We'd have to be off by *at least* 6 cents to even start to hear a difference, and most people can't hear *that precisely.* We could be off by as much as 18 cents and it would still sound good.

Matias numerals are base-12 numbers with a sub-base of 6, and are written using these glyphs:

0 1 2 3 4 5 (0) (1) (2) (3) (4) (5)

Equivalent glyphs (allographs) for different languages or different fonts can be devised in a similar fashion…

〇 一 二 三 四 五 ⓪ ㊀ ㊁ ㊂ ㊃ ㊄

0 1 2 3 4 5 ⓿ ❶ ❷ ❸ ❹ ❺

o א ב ג ד ה (o) (א) (ב) (ג) (ד) (ה)

The glyphs for *duodecimal* numbers are:

0 1 2 3 4 5 6 7 8 9 A V

Musical Numbers are mixed radix & composed of:

- a single-digit *Matias numeral* note
- followed by a comma if the numeral is less than (0)
- followed by the octave number in *duodecimal*

Musical Decimals are *Musical Numbers* that have been converted to decimal.

Matias numeral 0 is assigned to *pitch class* B.

While contrary to tradition, the reasoning is as follows:

Locrian is the prime form of the Diatonic set (7-35).

In the natural transposition of Locrian, the tonic is B.

B = 0 would make F = (0).

F is the natural transposition of Lydian. In terms of brightness/darkness, Lydian & Locrian are opposites. Jazz theorist *George Russell* and *Miles Davis* both considered F to be more central than C, so F = (0) affirms that belief.

Locrian was found to be prime through mathematical reasoning, so B = 0 seems like a reasonable corollary of that. It is certainly a *less arbitrary* choice than C or A.

C = 1 implies the Leading Tone. Assigning C to 1 implies that there is a number preceding it. That number is 0, which is the Leading Tone — 0 leads to 1.

Finally, F = (0) and B = 0 simplifies the order of sharps & flats (♯ ♭)... with the *first* ess numeral (1) being the first ♯ = (1), and the *last* ess numeral (5) being the first ♭ = (5). Thus... ♯ ♯ ♯ = (1) 2 (3) and ♭ ♭ ♭ ♭ = (5) 4 (3) 2 etc. *Key signatures* simplify in a similar fashion... the order of flats ♭ gives you the tonic for Lydian (flip to get the Locrian tonic), and the order of sharps ♯ gives you the Locrian tonic (flip for Lydian). The Ionian tonic is a 5th above Lydian. The Aeolian tonic is a minor 3rd below Ionian.

The English number words & pronunciations for *Matias numerals* are below, followed by suggestions for various other languages — but ultimately, it's up to the native speakers of *those languages* to decide for themselves.

English

0	zero / oh	(0)	ess-oh / six
1	one	(1)	ess-one
2	two	(2)	ess-two
3	three	(3)	ess-three
4	four	(4)	ess-four
5	five	(5)	ess-five

Microtonal pitches can be notated in a similar fashion, with *brackets* [ ] and *braces* { } indicating "add 0.5" and "add 6.5" to the sub-value, and vocalized as "kay-" and "ark-" (respectively).

French

0	zéro	(0)	par-o
1	un	(1)	par-un
2	deux	(2)	par-deux
3	trois	(3)	par-trois
4	quatre	(4)	par-quatre
5	cinq	(5)	par-cinq

German

0	null	(0)	sechs
1	eins	(1)	einsechs
2	zwei	(2)	zweisechs
3	drei	(3)	dreisechs
4	vier	(4)	viersechs
5	fünf	(5)	fünfsechs

Italian

0	zero	(0)	seio
1	uno	(1)	seiuno
2	due	(2)	sedue
3	tre	(3)	sestre
4	quattro	(4)	sequattro
5	cinque	(5)	sessinque

Spanish

0	cero	(0)	seis
1	un	(1)	sesuno
2	dos	(2)	sedos
3	tres	(3)	setres
4	cuatro	(4)	secuatro
5	cinco	(5)	sesinco

Korean

0	영	yeong
1	일	il
2	이	i
3	삼	sam
4	사	sa
5	오	o
(0)	육	yug
(1)	육일	yug-il
(2)	육이	yug-i
(3)	육삼	yug-sam
(4)	육사	yug-sa
(5)	육오	yug-o

Portuguese

0	zero	(0)	meio-zero
1	um	(1)	meio-um
2	dois	(2)	meio-dois
3	três	(3)	meio-três
4	quatro	(4)	meio-quatro
5	cinco	(5)	meio-cinco

Chinese (Sino-Matias numerals)

〇		ling
一		yī
二		èr
三		sān
四		sì
五		wǔ
ⓞ	六〇	liù ling
㊀	六一	liù yī
㊁	六二	liù èr
㊂	六三	liù sān
㊃	六四	liù sì
㊄	六五	liù wǔ

Japanese (む = 6)

〇	れい	rei
一	いち	ichi
二	に	ni
三	さん	san
四	よん / し	yon / shi
五	ご	go
⓪	むれい	mu-rei
㊀	むいち	mu-ichi
㊁	むに	mu-ni
㊂	むさん	mu-san
㊃	むよん / むし	mu-yon / mu-shi
㊄	むご	mu-go

Numbers in Japanese. *Japanese Calligrapher Takumi* (YouTube): youtu.be/7bPD7YfnOB4

https://matiasnotation.com/b1c16qr1

Hebrew (Hebrew-Matias numerals)

o	אֶפֶס	efes
א	אַחַת	achat
ב	שְׁתַּיִם	shtayim
ג	שָׁלֹשׁ	shalosh
ד	אַרְבַּע	arba’
ה	חָמֵשׁ	chamesh
(o)	[שֵׁשׁ] ו אֶפֶס	[shesh] ve efes
(א)	[שֵׁשׁ] ו אַחַת	[shesh] ve achat
(ב)	[שֵׁשׁ] ו שְׁתַּיִם	[shesh] ve shtem
(ג)	[שֵׁשׁ] ו שָׁלֹשׁ	[shesh] ve shlosh
(ד)	[שֵׁשׁ] ו אַרְבַּע	[shesh] ve arba’
(ה)	[שֵׁשׁ] ו חָמֵשׁ	[shesh] ve chamesh

How to write Hebrew alphabet | Hebrew handwriting. *Japanese Calligrapher Takumi* (YouTube): youtu.be/Jj1VGMmbQvs

https://matiasnotation.com/b1c16qr2

In a *mathematical* context, we would *NOT* use *mixed-radix* Musical Numbers; we'd use *positional notation . . .*

phi	=	1.618033988749894848...
	=	1.,74VV6772802A46A6A1...
	=	1.,(1)4(5)(5)(0)(1)(1)2(2)02(4)4(0)(4)(0)(4)1...

α	≈	0.0072973525643
	≈	0.,010739940471
	≈	0.,010(1)3(3)(3)404(1)1

1 / α	≈	137.035999177
	≈	V5.,052258V72
	≈	(5)5.,05225(2)(5)(1)2

To distinguish *base-12 numbers* and *Matias numerals* from our standard *decimal numbers,* we use *dual* decimal points (.,) vs the standard decimal point (.) as shown above and below:

Duodecimal		Matias		Decimal
0.,	=	0.,	=	0.

1.,	=	1.,	=	1.
2.,	=	2.,	=	2.
		. . .		
8.,	=	(2).,	=	8.
9.,	=	(3).,	=	9.
A.,	=	(4).,	=	10.
V.,	=	(5).,	=	11.
10.,	=	10.,	=	12.
11.,	=	11.,	=	13.
		. . .		
16.,	=	1(0).,	=	18.
		. . .		
19.,	=	1(3).,	=	21.
1A.,	=	1(4).,	=	22.
1V.,	=	1(5).,	=	23.
20.,	=	20.,	=	24.
		. . .		
60.,	=	(0)0.,	=	72.
		. . .		
VV.,	=	(5)(5).,	=	143.
100.,	=	100.,	=	144.

50 Centuries in 50 Minutes (A Brief History of Mathematics). Lecture by *Prof. John Dersch,* on Sept 19, 2012. *GRCCtv* (YouTube): youtu.be/YsEcpS-hyXw

https://matiasnotation.com/b1c16qr3

The Hidden Patterns Inside Spiky Shapes. *Combo Class* (YouTube): youtu.be/448ciyoSZTw

https://matiasnotation.com/b1c16qr4

Why “Threeven” Should Be in the Dictionary. *Combo Class* (YouTube): youtu.be/BRQLhjytJmY

https://matiasnotation.com/b1c16qr5

Why does the west use Arabic Numerals? (Short Animated Documentary). *History Matters* (YouTube): youtu.be/j9WV2T7Y_E4

https://matiasnotation.com/b1c16qr6

Bach Cello Suite №1
Prelude in G major

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John Coltrane's Giant Steps

(Lead Sheet)

VIEW sheet music samples @

www.matiasnotation.com

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About the author

Edgar Matias is a product designer, with over 30 years of experience designing primarily computer keyboards (including firmware, keycaps, and keyswitches) for the company he co-founded (www.matias.ca).

Born in Canada to Portuguese immigrant parents, he had the good fortune of growing up in the *one city* with the *one school* that had the *one lab* with the *one research group* devoted to the study of *input devices* (keyboards, mice, pens, etc.) and led by the top researcher and expert in the field, *Prof. Bill Buxton*.

This book is a lucky but unintended consequence of that experience, for which the author is forever grateful.

In his spare time, he plays bass, and is (very slowly) learning piano.

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