Practical Music Theory for Guitar Players

Version 1.67, by Dale Cotton, © 2010

(from http://daystarvisions.com/Music/index.html)

Intro

This tutorial teaches the bare *minimum* amount of (western) music theory needed by an amateur guitar player to work with groups of musicians ("OK, everyone – this song is in the key of B flat, and here are the chords"), arrange songs, and transpose songs from one key to another. Most music theory courses are geared toward the use of "standard" musical notation (G clef, notes like this ♫ on a staff, etc.) and assume that the student plays and has access to a piano. The emphasis will be on just the practical aspects of music theory, not the near-infinite complexities beloved of ivory-tower theorists. If you ask a professional musician whether he or she knows music theory, the answer you'll almost invariably get is "not enough to hurt my playing". That minimal amount of theory is what we'll cover here. We'll concentrate on the theory behind popular music forms, while providing further reading references for the more technical aspects that are relevant to jazz and experimental music.

This tutorial assumes you know how to play (at least at the beginner level) and have access to a guitar. It *doesn't* assume that you read standard notation. And it assumes you know how to read guitar tablature or tab, which is about as difficult to learn as zipping up a zipper. (But if you don't already read tab, see Appendix I at the end of this document.)

You cannot learn theory just by reading words on a page; you really have to follow along on the guitar. What your ear learns is every bit as important as what your brain learns. Play each example, then follow up by experimenting on the guitar with each new idea. The material is broken up into units that cover a set of related topics like rhythm or scales; and each unit is broken up into lessons, 25 in all. For best results tackle no more than one new lesson per day, then "digest" the material in that lesson by playing with the new ideas it contains.

Note: In this tutorial we're going to dig into *why* things work as well as *how* things work. When you understand the why's of music theory (and they're by no means rocket science) the fact that a diatonic scale has seven notes or the fact that an inverted A chord starts on the note E move out of the realm of rote memorization and into the realm of things you'll remember for decades, because everything fits together like the pieces of a jigsaw puzzle.

Unit 1: Sound, Notes, Scales, Keys, Modes

Lesson 1: Really basic stuff

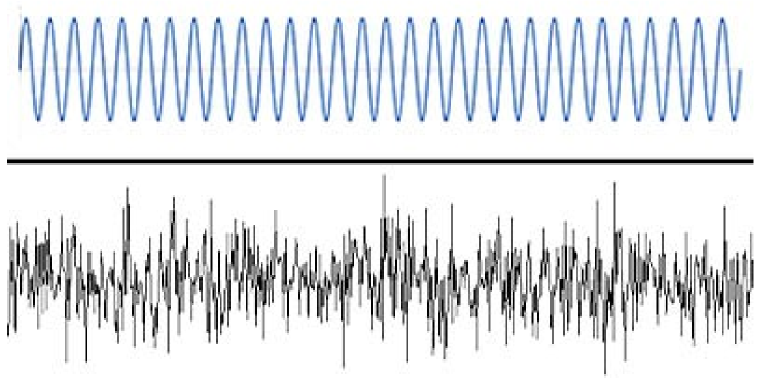


Fig. 1*: Sound vs. noise*

Sound. Music, like digestion, is all about regularity. Irregularity in sound = noise. The ticking of a clock or a metronome underlies everything. If you could set the metronome to tick so quickly that the ticking sounds blur together you'd hear a musical tone. Put more technically, all sound is just rapid changes in local air pressure. The difference between a musical sound, or tone, and noise is that the musical sound has a (relatively) constant pressure change ***frequency***. Frequency, in the case of sound, simply means how many air pressure changes take place per second. Each pressure change from lowest pressure to highest pressure can be called a pressure change ***cycle***. In Fig. 1 the blue line shows the constant frequency of a simple musical tone, such as a tuning fork or a chimed note on a guitar, while the black line below shows the irregularity of noise.

The slowest frequency humans can reliably hear is variously reported as being either 12 or 20 pressure change ***cycles per second*** (***cps***). Slower than that and we feel the individual pressure changes with our skin, rather than with our ears. (The lowest, sixth, string on the guitar sounds an E at 82.4 cps, and the lowest note on the piano, an A, sounds at 27.5 cps.)

> **Trivia time #1**: Elephants can hear even slower pressure change cps and use them for long distance communication.

Humans vary greatly at the other extreme, but somewhere around 20,000 cps (think nails on chalkboard) is the upper limit for most humans beyond which we no longer hear sound. (The highest note on a guitar is roughly 1000 cps; the highest note on the piano, a C, is still “only” 4186 cps.)

> **Trivia time #2**: Dogs can hear frequencies higher than 20,000 cps and find the sound of a dog whistle highly annoying ... even though humans hear nothing at all.

Intervals. Within that range from 12 to 20,000 cps every doubling of the frequency is experienced as a special sensation by humans, which we call an ***octave interval***, for reasons that will become apparent later. If we hear, for example, a 55 cps tone then hear a 110 cps tone, we recognize that there is a special relationship between those two tones (but of course have little idea what the cycles per second are). If we hear those two tones played at the same time the higher pitched tone (110 cycles) tends to disappear, or merge with, the lower pitched (55 cps) tone.

```
e---------------|---
B---------------|---
G---------------|---
D---------2-----|-2-
A---------------|---
E---0-----------|-0-
```

Hands on: To hear this in action, play the open sixth string on your guitar (tuned to the usual E), then play the fourth string fretted at the 2nd fret (also an E, but one octave higher). Now play the open sixth string while still holding down the fourth string at the 2nd fret.

If your guitar is very precisely tuned, the fourth string will vibrate along with the sixth string. Now play both notes at the same time. The more precisely your guitar is tuned, the more difficult it will be to separate the sound of the fourth string from the sound of the sixth string. You can do the same thing with any two octave pairs on the guitar, such as the C on the fifth string, 3rd fret, and the C on the second string 1st fret.

```
e--------------------5------17---
B--------------------------------
G-----------2--------------------
D--------------------------------
A---0----------------------------
E--------------------------------
   A2     A3     A4      A5
   110    220    440     880
```

For obscure historical reasons western music has arbitrarily settled on the frequency of 440 cps as the standard for one of the "official" tones that we call middle A, or A4. 220 cps is also an A tone (A3) but an octave lower, as is 110 cps (A2), 55 cps (A1), etc. Similarly, 880 cps (A5) is the next octave above A 440, etc.

Note: The actual frequency numbers, like 220 cps, are not in the least important to know or memorize: we're discussing them here just to make it easier to get a handle on certain fundamental relationships.

```
E--0----5----12---   ---------5----10---   ---------5----9----
B-----------------   ---3---------------   --2----------------
G-----------------   -------------------   -------------------
D-----------------   -------------------   -------------------
A-----------------   -------------------   -------------------
E-----------------   -------------------   -------------------
  E3   A4   E5         D4    A4   D5          C♯4  A4   C♯5
  330  440  660        280.5 440  587         275  440  550
```

Another interval the human nervous system responds to is called the ***fifth***, which we get when we divide the frequency of any note by 2/3 or multiply by 1.5. So the fifth below A 440 is 330 cps (E3), and the fifth above is 660 cps (E5). Two other highly recognizable intervals are the ***fourth***, and the ***major third***. The fourth has a ratio of 4:3 and the major third's ratio is 5:4., so the tone a fourth interval above A 440 is D5 at 587 cps and the major third is C♯5 at 550 cps. The native music traditions of various populations around the world generally make use of the octave, fourth, and fifth but add three or four other intervals. What we now call the western music tradition is rooted in two different seven interval sequences called the major and minor scales.

Lesson 2: Scales

A musical scale is a procedure for dividing an octave into multiple tones or notes. Using the fifth, fourth, and major third intervals, for example: we can create a four-tone scale starting on A 440 like so:

```
e-5----9----10----12----17--
B---------------------------
G---------------------------
D---------------------------
A---------------------------
E---------------------------
  A4   C♯5   D5    E5    A5
  440  550   587   660   880
```

If we add just one more interval, the ***major sixth*** (5:3 ratio) we can get a very pleasing five-tone or ***pentatonic*** (in Greek = five tones) scale:

```
e-5----9----10----12----14---17--
B--------------------------------
G--------------------------------
D--------------------------------
A--------------------------------
E--------------------------------
  A4   C♯5  D5    E5    F♯5   A5
  440  550  587   660   733   880
```

or the minor pentatonic scale by using a minor third and sixth instead:

```
e-5----8----10----12----13---17--
B--------------------------------
G--------------------------------
D--------------------------------
A--------------------------------
E--------------------------------
  A4   C5   D5    E5    F5    A5
  440  523  587   660   700   880
```

If you take your guitar and plonk out the notes in either pentatonic scale above and their various octaves anywhere on the fretboard, it's very hard not to get a reasonably pleasant melody. Nevertheless, the current western musical system is based on seven intervals, not five, so two more are needed. Again arbitrarily starting from A 440 we get:

```
e-5----7----9----10----12----14---16---17--
B------------------------------------------
G------------------------------------------
D------------------------------------------
A------------------------------------------
E------------------------------------------
  A4   B4   C♯5  D5    E5    F♯5  G♯5  A5
  440  490  550  587   660   733  830  880
```

Seven intervals is called a ***diatonic*** scale (in Greek diatonic = seven tones) and the above A 440 scale is an example of the ***major*** diatonic scale, while this next one is an example of the ***natural***

minor diatonic scale:

```
e—5———7———8———10———12———13——15——17——
B———————————————————————————————————
G———————————————————————————————————
D———————————————————————————————————
A———————————————————————————————————
E———————————————————————————————————
  A4   B4   C5   D5   E5   F5   G5   A5
 440  490  528  587  660  704  892  880
```

We can now understand where the word ***octave*** comes from. In both the above scales, the note A repeats after eight steps. As in octopus, the *oct*- syllable is from the Latin word *octo* for the number eight.

Lesson 3: Scales and the semi-tone

If we play both the A major and A minor scales on the guitar starting with the open fifth string (standard tuning), we find we get to the same place – the A at the 12th fret – but we get there by two different sets of one-fret and two-fret jumps. In other words, we're skipping some of the possible notes in both cases, but which ones we skip differ between the two scales. For historical reasons, every one-fret jump on the guitar is called a semi-tone or half-tone change in pitch. Play any string on the guitar at the 1st fret, then again at the 2nd fret, and you've increased pitch by one semi-tone. Play the same string at the 9th then the 10th fret and you've still increased pitch by one semi-tone. To our ears there is an equivalence between any two semi-tones, but this is true in spite the fact that the actual difference in frequency numbers is rarely the same. What we hear is a *relationship* not an absolute number of cycles per second. This same equivalence relationship applies to any other interval, whether a third, a fifth, an octave, a twelfth, or whatever. The interval between C3 and G3 is a perfect fifth and *sounds* to be the same "size" as the interval between A6 and E6, which is also a perfect fifth. Yet C3 happens to be 65.4 cps, while G3 happens to be 98 cps, so the separation between them is about 32 cps. While A6 happens to be 1760 cps and E6, 1318.5, for a much larger 441.5 cps gap. This tells us that our ears and brain aren't counting frequencies but are instead noting the *ratios* between frequencies.

Getting back to semi-tones, physics tells us that every time we go one semi-tone higher in pitch we're taking a larger step in frequency than the one before; but our ears tell us that every semi-tone is the same as the one before it or the one after it. And all other intervals can be considered as a stretch of multiple semi-tones, so we see again that the same equivalence applies to all intervals. Suppose we take a hundred identical children's blocks and lay them side by side to form a straight line, then remove blocks 10, 11, and 12. Now suppose we then remove blocks 78, 79, and 80. Both gaps will be the same size, since they're both 3-block gaps.

Above, we looked at the A major and A minor scales. These are particular examples of the class of all major and all minor scales. Every major scale begins and ends on a different note, but all major scales get from the starting note to the ending note by following the same pattern of semi-tones:

Starting note (2 semi-tone jump) next note (2 semi-tone jump) next note (1 semi-tone jump) next note (2 semi-tone jump) next note (2 semi-tone jump) next note (2 semi-tone jump) next note (1 semi-tone jump) final note

We can abbreviate this like so:

2 2 1 2 2 2 1

Again for historical reasons, two consecutive semi-tones can be called a whole tone or just a tone. So we could express the same pattern as above in whole tones like so:

1 1 ½ 1 1 1 ½

The semi-tone approach is particularly nice for guitar players because it matches the fact that all frets are located at semi-tone intervals, so let's stick with it. The natural minor scale's pattern in semi-tones looks like so:

2 1 2 2 1 2 2

Putting these two patterns to work we can start on any of the guitar's six strings played open to create a particular major or minor scale. On the G string like so:

```
e————————————————————————————————————————————————
B————————————————————————————————————————————————
G—0————2————3————5————7————8————10————12—
D————————————————————————————————————————————————
A————————————————————————————————————————————————
E————————————————————————————————————————————————
```

G natural minor scale (what are the note names at each fret?)

we create a G major or G minor scale by following the appropriate pattern. Ultimately, the simple fact is that there are 12 semi-tones in one octave. Any scale, whether pentatonic, hexatonic (six-note), diatonic, major or minor or whatever, has to cover those 12 semi-tones one way or another. The major pentatonic scale we looked at above:

A4 C♯5 D5 E5 F♯5 A5

follows the semi-tone pattern of:

4 1 2 2 3

Start on any note, follow that semi-tone pattern and you have a pentatonic major scale. Here's the same pattern starting from C2:

```
e——————————————————————————————————
B——————————————————————————1———
G—————————————————0————2——————
D——————2————3—————————————————
A—3————————————————————————————
E——————————————————————————————————
  C     E     F     G     A     C
```

The sound or note created by sounding any string at any fret has been assigned a letter name which we use for ease of reference. Every guitar player learns that the first string, 3rd fret is called a G while the note at the first string, 5th fret is an A, etc. Once again this nomenclature is a historical legacy that would be more rational if it took into account all twelve semitones in an octave. But as it is we're stuck with an irrational system in which some semi-tones having simple single-letter names and some having sharp or flat designations like G sharp (G♯) or A flat (A♭). To add insult to injury, both G♯ and A flat refer to exactly the same note, but one has to use the "correct" name depending on the context. The names of the 12 semi-tones using sharps run:

A A♯ B C C♯ D D♯ E F F♯ G G♯

Using flats that's:

A B♭ B C D♭ D E♭ E F G♭ G A♭

Same notes, different names.

Trivia time #3: why isn't there a B♯ and an E♯ or a C♭ and an F♭? Note naming likely got started during the Middle Ages by monks assigning one letter to each note of the minor scale: A B C D E F G A. In that scale B and C are only one semi-tone apart. Same with E and F. When the idea of having scales start on different letters took hold names were needed for the semi-tones between the other letters, such as between A and B.

Lesson 4: More minor scales

Why major and minor? Not because the major scale is intrinsically any more “important” than the minor. In fact, to the ancient Greeks, who pretty much got diatonic scales on a serious footing, what we call the “minor” scale – they called it the ***Aeolian mode*** – was considered serious and dignified, while to them the “major” scale – ***Ionian mode*** – was some sort of radical punk perversion (outside Ionia, of course). This situation lasted pretty much through the middle ages, then apparently a new spirit of hope, and even gaiety, settled into the psyche of Europe, causing the cheerier major scale to be used ever more frequently (smile and the whole world smiles with you). During that transition we hear the minor scale being diluted by adding more major scale notes.

The version of the minor scale we have considered so far is called the ***natural*** or Aeolian minor scale. As European ears became familiar with major scale music, the natural minor scale became increasingly corrupted by the major scale's seductive semi-tone finality. This culminated in the modern ***harmonic*** and ***melodic*** minor scales, two different attempts to replace the natural minor's final whole tone step with the major scale's final semi-tone. The harmonic minor's pattern is 2 1 2 2 1 3 1. Perversely, the melodic minor goes 2 1 2 2 2 2 1 when moving from a lower to higher note, but descends with the natural minor pattern, 2 1 2 2 1 2 2. You can hear the melodic minor scale at work in the song *Greensleeves*. Here are all three minor patterns starting from the note A:

```
e-------------------|----------------|------------------------------
B-------------------|----------------|------------------------------
G-------------0-2---|----------1-2---|-----------1-2-0--------------
D-------0-2-3-------|----0-2-3-------|-----0-2-4-------3-2-0--------
A-0-2-3-------------|-0-2-3----------|-0-2-3-------------------3-2-0-
E-------------------|----------------|------------------------------
```

natural minor | harmonic minor | melodic minor

In fact, the natural minor scale is now just a footnote of history, and the harmonic and melodic minor scale patterns are now considered standard.

So why this fixation on the single semi-tone ending of the major scale? It serves as an important auditory cue. It acts as a marker that the end is near, and adds to that solved-the-puzzle sense of completion that we use to bring a piece of music, or a single phrase in a piece of music, to a tidy conclusion. That's why the natural minor scale, with its concluding whole tone step, mutated into the harmonic and melodic minor scales, with concluding semi-tone steps.

Lesson 5: Scales and keys

Now, let's use the major (diatonic) scale semi-tone pattern, start with a D, and generate the D major scale. D is the first note, two semi-tones:

↓ 2 ↓ 2 ↓ 1 ↓ 2 ↓ 2 ↓ 2 ↓ 1 ↓

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

so the note's we've marked are:

D E F♯ G A B C♯ D

As long as you stick to the correct semi-tone pattern and stay on the same row (the row of sharp names *or* the row of flat names), you're guaranteed to come up with the correct *notes* for that scale. As guitarists we tend to be most familiar with a handful of major scales: C D, E, G, and A. Using them so frequently we know which notes they include. But if circumstances force you out of that comfort zone – for example, you need to play a song in B flat major – no need to have memorized that scale, just use the 2 2 1 2 2 2 1 pattern, apply it to the row of flat names to work out which notes it includes (B♭ C D E♭ F G A B♭). Similarly, you can use the major scale pattern on the fretboard to find the notes, whether you care about note names or not. Later we'll learn how to find the most important chords for any given scale.

Scale vs. key: So far, we've only used the word *scale* to avoid confusion, but in practice the word ***key*** is used to refer to a specific major or minor scale. So we normally say a piece in in the *key* of C♯ major or G minor rather than in the *scale* of C♯ major or G minor. We'll use scale to refer to a general pattern, such as diatonic major or pentatonic minor; and we'll use the word key to refer to a particular set of notes that follow a scale pattern, such as D major. We'll also leave off the word diatonic, so when we say the major scale or the A minor key, we'll understand that we mean the *diatonic* major scale or the *diatonic* A minor key. In the rare case we're talking about something non-diatonic, we'll make sure to specify what that is, such as pentatonic or hexatonic.

Yet another word you'll come across from time to time is ***mode***. Mode is nearly always used to refer to any diatonic semi-tone pattern *other* than the major or minor scales (which as we've seen are actually themselves just the two most common modes, Ionian and Aeolian). For example, the Dorian mode is:

2 1 2 2 2 1 2

Modes, like pentatonic and hexatonic scales, are fairly rare and exotic beasts in mainstream western music, so having acknowledged their existence, we'll give them no further thought.]

Lesson 6: Intervals and ear training

Previously, we focused on the octave, fourth, and fifth as important intervals, or jumps, between notes. Every melody can be described as a sequence of intervals, some stepping up to the next note, some stepping down, some repeating the previous note (*Old MacDonald had a farm*...). If you start with any string on your guitar played open, then play the same string fretted at any fret along its length, you've played some official interval. The intervals that form the major diatonic scale are the ones we hear most often.

```
e-----|---   -----|---   ------|---   ------|---   ------|---   ------|---   ------|---
B-----|---   -----|---   ------|---   ------|---   ------|---   ------|---   ------|---
G-----|---   -----|---   ------|---   ------|---   ------|---   ------|---   ------|---
D-----|---   -----|---   ------|---   ------|---   ------|---   ------|---   ------|---
A-0-1 |-1-   -0-2 |-2-   -0-3- |-3-   -0-4- |-4-   -0-5- |-5-   -0-6- |-6-   -0-7- |-7-
E-----|-5-   -----|-5-   ------|-5-   ------|-5-   ------|-5-   ------|-5-   ------|-5-
 semi-tone   whole tone  minor third  major third  perfect fourth  tritone  perfect fifth
```

Play the A string open, then fret it at the 2nd fret, and you've played a whole-tone interval. Open then 3rd fret is a minor third interval. Et cetera. Play the above sequence, then continue through to the octave interval. If you can listen to a melody then describe its succession of intervals, you've got a nicely trained ear. Developing that ability is one of several important tasks for any musician who aspires to play along with other musicians, so time spent drilling yourself on intervals is time well spent.

> **Close enough for Bach**. That's about it for intervals, scales, and keys. Hopefully, you've got the idea that scales are ways to divide up octaves into useful notes and that keys are scales starting on a particular note. You also should remember that all notes form simple whole number ratios, like 1:2 or 3:4, with each other ... except that they don't ... quite. See Appendix III for the gory details.

Lesson 7: Over to you

If you use the guitar primarily as a chording instrument instead of a lead or single-voice instrument, there are only so many keys that are practical to play in standard tuning, given the difficulty of the chords in other keys. The practical major keys are A, C, D, E, and G. The practical minor keys are A minor and E minor. To play in other keys we use the capo or a non-standard tuning. For example, to play in the key of B major, we can capo at the 2nd fret, then play as if in the key of A. To play in D♭ we can tune all six strings down one semi-tone, then play as if in the key of D.

It so happens that the practical major and minor keys are all either natural (C major and A minor) or use sharps instead of flats. What you now need to do is use the sharps semi-tone row:

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

together with the major and minor semi-tone patterns to work out the notes in all seven practical keys. Then find those notes on your guitar's fretboard in at least two octaves.

For example, we can extend the C major to:

```
e----------------------------------0--1--3--5--7--8---
B------------------------0--1--3----------------------
G-----------------0--2--------------------------------
D----0--2--3------------------------------------------
A-3---------------------------------------------------
E-----------------------------------------------------
  C  D  E  F  G  A  B  C  D  E  F  G  A  B  C
```

Doing the same for the other six practical keys will not only help your guitar playing but also help to ensure all this abstract theory stuff doesn't just go in one ear and out the other.

> **Key signatures**: As you plough through the above, you'll notice a pattern emerging. The key of G major contains 1 sharped note; D major has 2 sharped notes; A major 3 sharped notes, etc. These are called *key signatures*. Musicians who work in staff notation instead of tablature, often think of and refer to keys by their signature. So if you hear someone say a piece is in 2 sharps, they're most likely referring to D major (although it could be B minor). The same sort of pattern exists for the flatted scales. For example F major has 1 flat and B♭ major has 3.

Unit 2: Meters and Beats

In the first unit we looked at the fundamentals of organizing musical tones into intervals, scales, and keys. Each musical tone has multiple components: timbre (tone colour), pitch, loudness, and duration are the most obvious. In this unit and the next we will concentrate on the duration and loudness components.

Lesson 8: Of meters and metronomes

In the previous unit we learned that an individual musical tone is distinguished from noise by a regular pattern of air pressure changes. Music typically begins to happen when multiple individual tones are in turn organized within some regular time sequence. In fact, that regular time sequence is more essential than the presence or absence of musical tones. Drum sounds do not typically have a regular frequency component, so presumably an individual drum beat is technically a form of noise. Yet few would argue that a drum solo is not a musical event, let alone the output of a drum ensemble. Drumming becomes musical as soon as the listener senses that an underlying regularity of time demarcations is being established. That's quite an abstract phrase to pin on to what is actually a very simple and familiar concept; let's see if we can get a good handle on the concept itself.

A traditional wind-up clock creates a regular pattern of sounds and silences we denote in words by "tick, tick, tick, tick" or "tick, tock, tick, tock". Most of us have had enough experience with such clocks to understand that each tick occurs after the passage of exactly the same length of time following the previous tick. A wind-up metronome goes one step further by letting us set the rate at which those ticks occur; in other words: the interval between ticks. There is some indication that the human nervous system fights against the equal weighting of consecutive sound events. By this I mean that our brains may tend to turn a real **tick**, **tick**, **tick**, **tick** sequence in which every tick is exactly as loud as the next into a subjective **tick**, tock, **tick**, tock or louder, softer, louder, softer. In music there seems to be a real tendency to hear a pattern of louder, softer, louder, softer or louder, softer, medium, softer.

Getting back to drumming, if you simply tap or clap a few times at a regular pace like a clock's, you establish an *expectation* that the sequence will continue. Even if you stop abruptly, the listener's brain has already predicted when the next sound will be expected. Musicians refer to this as *establishing a beat*. If you establish a beat with a few taps, then pause for some duration then resume, listeners will have some sense whether you resumed at the correct instant and also whether you continued at the same pace or at a new pace. This takes us back to that abstract phrase above: "underlying regularity of time demarcations". We can now see that this refers to that which we establish when we establish a beat. And that "thing" we establish is a purely mental phenomenon, a sort of imaginary grid or graph scale or set of yard lines in time that our minds put in place while listening to music.

That imaginary time scale is called ***meter*** in music theory. Meter establishes an imaginary framework of regular points in time called ***beats***. Beats are points in time to which sound events can be pegged. Meter is the entire framework. Beats are the individual points in time within the framework.

> **Trivia time #4**: Interestingly, homo sapiens seems to be the only animal species to have a sense of meter. I live with two parrots. They can imitate the singing or whistling of a song quite accurately; they can also improvise their own "melodies". But when they do improvise, the notes fall at fairly random intervals; they have no sense of being on the beat. Ditto for chimpanzees and apes.

But more than that, this meter framework is a very flexible thing. We're perfectly comfortable having the framework smoothly speed up or slow down to a new pace. We're also perfectly comfortable when the sequence of beats gets sub-divided into smaller fractions. If someone claps out a regular sequence of beats, then a second person starts clapping at the half way point between each beat, we have no problem with that at all. Or the second person could clap on one beat, skip the next, then clap half way between the skipped beat and the one that follows it, then continue to repeat that sequence. We experience this as two patterns of beats, both being pegged onto the same meter framework. We don't experience it as two separate meter frameworks in collision. (The fun part comes when you try to tap both patterns at once, one with the left hand or foot and one with the right.)

Lesson 9: Duple, triple and measures

Heard enough about meter to last you a lifetime? Sorry: we're not done yet. Think about a ruler or yard stick. That ruler will be divided into inches. The inches will have big ticks to mark them off, then there will be a slightly shorter tick at the half-inch points, then slightly shorter ticks at the quarter-inch point. And so forth. The imaginary meter framework we're talking about does the same thing. **Strong,** weak**, medium,** weak is just like an inch with a long tick at the beginning, then a short tick for the first quarter-inch point, then a medium tick for the half-inch point, then another short tick for the second quarter-inch point, then repeat.

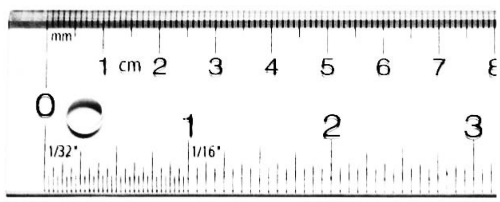


Fig. 2*: Inch markings*

There are few things in nature that resemble a three-beat meter. Perhaps a four-legged animal with one wounded leg ambling along would be one example. A three beat meter goes **strong,** weak, weak, or **strong,** weak, weak**, medium,** weak**,** weak. Technically the terms are ***duple*** time for **strong,** weak meters vs. ***triple*** time for **strong,** weak**,** weak meters. There is a certain preciousness or artificialness about the ONE, two, three, ONE, two, three of the waltz or minuet in western culture, at least.

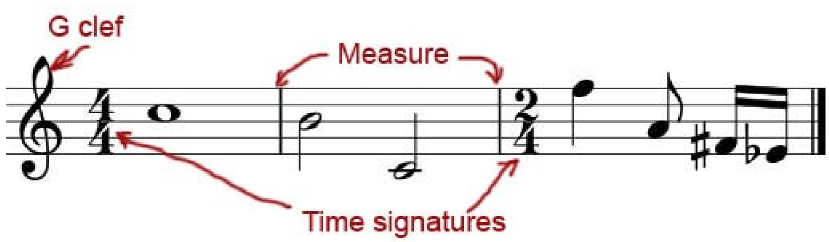


Fig. 3*: Some standard notation symbols*

Even if you don't read standard notation, you've undoubtedly heard expressions like "this piece is in four-four time" or "this piece is in six-eighths time". In standard or staff notation each piece of music starts with a symbol like the G clef that's needed to nail down which note letter each line of the staff refers to. But the next thing is a fraction such as the $\frac{4}{4}$ and $\frac{2}{4}$, in the example above. Translated into English $\frac{2}{4}$ means "two beats to the measure and the quarter note gets one beat". There are several new concepts there that we need to unpack.

A *measure* is a single pattern unit within a meter. If the meter goes **strong,** weak**, medium,** weak and repeats, that **strong,** weak**, medium,** weak is one measure. Measure is the 25 cent term, the nickel term is *bar*. If someone says "this piece is a 12 bar blues", that means that its melodic content can be divided up into some number of 12 measure (12 bar) packets (more below).

In both staff notation and in tablature a vertical line is drawn across the horizontal lines to mark the end of each measure (this is what really *should* be called a *bar* or *bar line*). This makes it easier to keep one's place in the composition when reading along.

So the top number of a fraction like $\frac{3}{4}$ time tells us that each bar/measure has three beats in it. The bottom number, however, is purely arbitrary. It says that whoever wrote down this piece of music decided to use the quarter note symbol to denote one beat. From time to time you'll hear college-aged musicians wisely discussing the difference in feel or tempo between, say, $\frac{3}{8}$ time and $\frac{3}{4}$ time. This is pure stuff and nonsense. You can take the same Strauss waltz and write it out in $\frac{3}{8}$ time on one sheet of paper, then write it again in $\frac{3}{4}$ time. When you play the two they will sound *exactly* the same; just as a poem will sound exactly the same whether it is written in Times Roman type or Helvetica type. The only practical difference will be if one happens to be easier to sight-read than the other. Hopefully, the published sheet music for that piece has been written out using whichever notation – 3/2 or $\frac{3}{4}$ or $\frac{3}{8}$ or 3/16, etc. – that is easiest to read. There is nothing corresponding to this bottom number in tablature, so when a piece is written out as tablature the whole issue goes away.

Lesson 10: Compound and complex meters

Popular music tends to parse out as two, three, or four beat measures. Two beat measures are **strong,** weak**, strong,** weak**, strong,** weak, etc. Three beat measures are **strong,** weak**,** weak**, strong,** weak**,** weak, etc. Four beat measures are **strong,** weak**, medium,** weak, etc. A four beat measure can be thought of as two consecutive two beat measures fused together. In the same way fusing together two three beat measures we get **strong,** weak**,** weak**, medium** weak**,** weak, which is a six beat rhythm. Similarly, fusing together three three beat measures gives **strong,** weak**,** weak**, medium,** weak**,** weak**, medium,** weak**,** weak, for a total of nine beat to the measure. Six, nine, and twelve beat measures are the most commonly employed compound meters in western music but are used more for “classical” than popular music. Debussy's famous *Clair de Lune*, for example, has a $\frac{9}{8}$ time signature.

We can see that fully half the beats in a two beat meter are strongly accented. This emphatic-ness makes two beat meters perfect for military marches; but is also used in really high-energy jazz forms. Three beat meters are one-third strong beats, which still has a relatively emphatic quality, as we see in the European waltz and polka dance forms. Four, six, nine, and twelve beat meters are progressively more dilute, making them more suitable for music in which melodic and rhythmic subtlety outweighs sheer energy.

You've probably noticed that we've skipped a few numbers. What about a five or a seven beat meter -- not to mention, ten, eleven, and so forth? These are called ***complex*** meters. Five beats fragments into either **strong**, weak**,** weak**, strong** (or **medium**), weak; or into **strong,** weak**, strong** (or **medium**), weak**,** weak. That's either a 3 beat plus 2 beat pattern or a 2 beat plus 3 beat pattern. This hardly comes naturally and takes a significant amount of sheer effort for most of us to even begin to play in, let alone compose or improvise in. But if you're a song writer looking for a way to separate your output from the pack, complex meters like five and seven beats would be a great way to go.

Another a-typical approach is to mix up various meters in a non-repeating pattern. This happens in twentieth century "classical" music as experimentalism became the order of the day. Simple, regular meters, like two, three, and four beats, dominate western musical output for a reason. They are grounded in muscular patterns, such as walking, running, and clapping. They are spontaneous, easy to dance and sing to, and easy for multiple musicians to play together in.

* * *

Finally, ***syncopation***, is deliberately accenting notes that fall on a weak beat. For example, once a metrical pattern like **strong,** weak**, medium,** weak has been established, if the performer plays one or more bars of weak**, strong,** weak, **strong**, that would be syncopation.

Unit 3: Triads, Chords, and Harmony

Lesson 11: Triads, take 1

Take the key of C major:

```
e—————————————————————————
B———————————————————0—1—
G—————————————0—2————————
D———0—2—3—————————————————
A—3———————————————————————
E—————————————————————————
  C  D  E  F  G A  B  C
```

The C triad is **C E G**. All that means is that you take a note, chuck the next, take the note after that, chuck the next, then take the note after that. So D and F are skipped in the C triad:

```
e———————————————— | ———
B———————————————— | ———
G—————————————0—— | —0—
D—————2—————————— | —2—
A—3—————————————— | —3—
E———————————————— | ———
  C D E F G A B C
```

(triad from the first note of the C major scale)

Notice how pleasant (harmonious) these three notes sound when played simultaneously. We can do exactly the same thing starting with any note in the C scale. The D triad is **D F A**:

```
e———————————————— | ———
B———————————————— | ———
G—————————————2—— | —2—
D—————3—————————— | —3—
A—5—————————————— | —5—
E———————————————— | ———
C D E F G A B C
```

(triad from the second note of the C major scale)

Similarly, the E triad is **E G B**:

```
e———————————————— | ———
B———————————————— | ———
G—————————————4—— | —4—
D—————5—————————— | —5—
A—7—————————————— | —7—
E———————————————— | ———
C D E F G A B C
```

(triad from the third note of the C major scale)

and so forth. You might want to write out the triads starting on F, G, A, and B to nail down the concept. Oh – and that's just the key of C major. The D triad in the key of C is **D F A**, but what is it in the key of D? And what about all those minor keys?

Lesson 12: Harmony

All triads have the same sort of harmonious quality, the question is why? What is at the root of this perception that some sounds are harmonious and some not? They say a picture is worth a thousand words, here's one from Wikipedia:

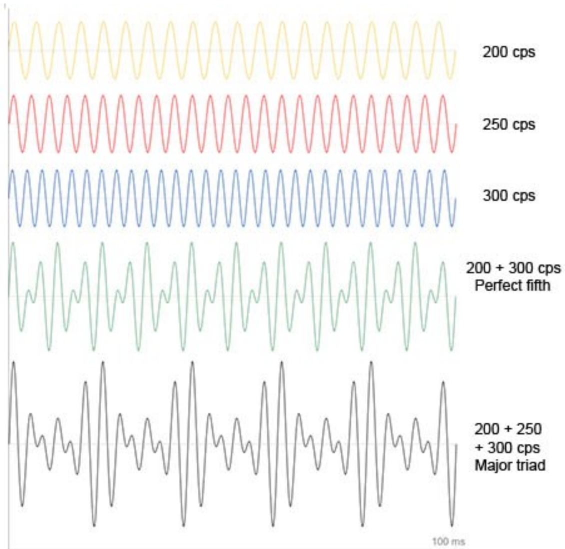


***Fig. 4**: assembling a major triad*

The yellow, red, and blue graphs show how the sound from three different tuning forks would appear on an oscilloscope display. The 200 cps (cycles per second) tuning fork is the first note of a triad, the 250 cps fork is the 2nd note, the 300 cps fork is the third note (you'll recall that the numbers for "real" notes aren't usually so even). The bottom, black, graph is what you'd see on an oscilloscope if all three forks were set to sound at the same time. We can see how smooth the shape still is, but equally importantly it's very similar to the shape you'd see if you simply played only the 200 cps note as a chime on the guitar or played it on a flute or bell or similar sweet-sounding musical instrument.

Over to you. To hear what Fig. 4 sounds like (at a higher frequency), tune the first string of your guitar down to D, then simultaneously chime the first, second, and third strings at the 12th fret.

The particular quality that makes up the sound of one musical instrument vs. another musical instrument (called *timbre*) is in fact just the same thing we see here. When we play a note on the guitar we hit one string at one fret but produce a complex combination of several simpler notes that are each in a simple ratio to the main note, such as perfect fifth and octave. These are technically called ***upper partials***, but everyone calls them *overtones* or *harmonics*. In theory, you could come very close to reproducing the exact timbre of any musical instrument simply by playing the right combination of tuning forks simultaneously. So harmony and timbre both function by triggering the brain's mechanism for grouping smooth wave shape sounds together that are related by simple ratios like 1:2, 2:3, 3:4 and so forth. Noise and musical discords, on the other hand, look more like this:

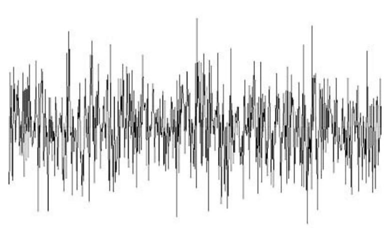


***Fig. 1b**: white noise*

Not only messy to the eye but messy to the ear.

Lesson 13: Triads, take 2

```
E-------------|---   ------------|---   ------------|---
B-------------|---   --------1---|-1-   --------3---|-3-
G--------0----|-0-   -----2------|-2-   -----4------|-4-
D-----2-------|-2-   --3---------|-3-   -5----------|-5-
A-3-----------|-3-   ------------|---   ------------|---
E-------------|---   ------------|---   ------------|---
  -- I triad ---      -- IV triad --     -- V triad --
```

Some clever person a thousand years ago or more found that you can harmonize (accompany) any melody that stays in the same (diatonic) key, by using just three triads: the first note triad (**I**), the fourth note triad (**IV**), and fifth note triad (**V**). So in the key of C those are the C triad (**C E G**), the F triad (**F A C**), and the G triad (**G B D**). If there's an E note in the melody, you can play a C triad along with it as the harmony, if there's a B or D note you can play the G triad along with it. If there's a C or G in the melody, you can use either a C triad or a G triad to taste. Each note of the C scale is covered by at least one of those three triads.

For example, here is *Twinkle, Twinkle Little Star* harmonized with just the **I**, **IV** and **V** triads.

```
e|---------3---3---|-5---5---3--------|-1---1---0---0---|------------------|
B|-1---1---1-------|-6-------1--------|-1-------1-------|-3---3---1--------|
G|-0-------0-------|-5-------0--------|-2-------0-------|-0-------0--------|
D|-2-------2-------|-3-------2--------|-3-------2-------|-0-------2--------|
A|-3-------3-------|-3-------3--------|-3-------3-------|-2-------3--------|
E|-----------------|------------------|-1---------------|-3----------------|
   Cmaj    Cmaj      Fmaj    Cmaj       Fmaj    Cmaj      Gmaj    Cmaj
```

The same logic applies to any diatonic (8-tone) scale. If instead of C we go to the key of E major:

```
e---------------------------
B---------------------------
G---------------------------
D--------------------1--2---
A-----------0--2--4---------
E-0--2--4-------------------
  E  F♯ G♯ A  B  C♯ D♯ E
```

The **I** triad is **E G♯ B**, the **IV** triad is **A C♯ E**, and the **V** triad is **B D♯ F♯**. The key of F major is:

```
e---------------------------
B---------------------------
G---------------------------
D-----------------0--2--3---
A--------0--1--3------------
E-1--3----------------------
  F  G  A  B♭ C  D  E  F
```

and the key of B minor is:

```
e---------------------------
B---------------------------
G-----------------0--2--4---
D--------0--2--4------------
A-2--4----------------------
D---------------------------
  B  C♯ D  E  F♯ G  A  B
```

If you can write out the `I`, `IV`, and `V` triads for F major and B minor, you'll know you're in the groove.

> **Other triads**. Technically (and music theory is nothing if not technical), there are multiple species of triads just as there are multiple species of chords. We've concentrated on the major triad, such as **C E G**, but there is also a minor triad, such as **D A F**, an ***augmented*** triad, and a ***diminished*** triad. See Wikipedia's Triads entry (http://en.wikipedia.org/wiki/Triad_%28music%29) for all the gruesome details.

Lesson 14: Chords

Theoretically, the word chord simply means any three or more notes sounded at the same time (two notes sounded at the same time being simply an interval). In practice, a chord is normally based on a triad, but can have extra notes. Triads as discussed above are chords, but so are other combinations of the same notes at different octaves. Plus, chords may include notes that aren't in the triad.

```
e—0———1———6—
B—0———1———6—
G—1———2———7—
D—2———3———8—
A—2———3———8—
E—0———1———6—
  Emaj  Fmaj  B♭maj
```

If we play the standard Emaj chord in first position (2^{nd} fret on fifth and sixth strings, 1^{st} fret on third string, rest open), all notes are in the E major triad (**E G♯ B**), but with the octaves of the E and the B thrown in. In fact the G♯ only shows up as an octave. As long as there are only the three triad notes (in whatever octave) plus the lowest note is the root – in this case, an E – then we name it after the triad – in this case, an E major chord.

Chord shapes. Now let's put all this to some use. If we want to harmonize the open E note of the first string, that Emaj chord will do the trick. If instead we want to harmonize the F note of the first string at the 1^{st} fret, we can just bar the entire 1^{st} fret, then fret the same shape of the Emaj chord but one fret higher (3^{rd} fret on fifth and sixth strings, 2^{nd} fret on third string). That's an E-shape, Fmaj chord. Move the whole thing up any number of frets and we have a chord that will harmonize whatever note is on the first string at that position. For example, move the barred E-shape to the 6^{th} fret to get an B♭maj chord. Jazz players do that sort of thing all the time – taking a valid chord shape from the first position and moving it up and down the neck to harmonize the melody.

Another example: here's the simple Amaj7 chord in first position, then moved up the neck to a few random frets using the bar:

```
e—0————3————7—
B—2————5————9—
G—1————4————8—
D—2————5————9—
A—0————3————7—
E—————————————
  Amaj7  Cmaj7  Emaj7
```

And of course the Fmaj chord in the second bar of *Twinkle, Twinkle* above is a D-shape barred at the 3^{rd} fret.

Lesson 15: Seventh chords

```
e—0————0—
B—1————0—
G—4————0—
D—2————1—
A—3————3—
E——————0—
 Cdom7  Cmaj7
```

As mentioned, chords can contain other notes than those in a triad or their octaves. For example, a C 7^{th} chord will usually have at least one each of the triad notes C, E, and G, but will also have the seventh note of the scale, counting from C, as we see in the two examples above. A bit of a complication is that this seventh note will either be an B♭ Or a B, depending on whether you're playing a **IV** triad in the G major scale or a **I** triad in the C major scale. Technically, if you use a B♭ Instead of a B, that's actually the C major dominant 7^{th} chord, or Cmaj dom7, but the distinction is rarely noted, since the dominant form is by far the most commonly used version. So you'll usually see the above two Cmaj dom7 chords labelled as just Cdom7 or even C7. Confused? All you really need to remember is that most 7^{th} chords use the seventh note of the key, but one semi-tone flatter.

I wrote above that the **I**, **IV**, and **V** triads can be used to harmonize any diatonic melody. This is true, but in practice the dominant 7^{th} version of the **V** chord is almost always used, in other words: the **I**, **IV**, and **V7** triads. (The change from **V7** to **I** adds a feeling of coming to a conclusion, just like the final semi-tone interval in the major scale, as discussed above.) We'll put this to work for us in Unit 6.

If instead of using the dominant seventh note, we use the normal seventh note of the scale – in this case B natural instead of B♭ – We have a "normal" seventh chord. Play the above C chords to hear the very significant difference between the two. The major 7^{th} is not a harmony you'll hear much of in Bach, or in any other music before the impressionists.

> **Over to you**: In the previous and following lessons we use the C major triad chord as our example and starting point to explain each new concept. You should now be able to apply each concept to all other triads. So having learning that Cdom7 contains the notes **C E G B♭**, in order to really get a handle on the new material, you then need to apply that pattern to many other triads – essentially, until you can do it in your sleep. For example, you would take the E minor triad – **E G B♭** – and add the dominant seventh note, **D**, to make the Emin dom7 chord. I recommend doing this on the guitar. Take any common triad chord you already know, such as F major, play it, then think through what the dominant seventh note would be, then add that note to the chord, and play that. In any case, you need to cram for the test... ;)

Lesson 16: Chord complications

Inversions

```
e—0————0————0—
B—1————1————1—
G—0————0————0—
D—2————2————2—
A—3————3————3—
E——————0————3—
 Cmaj  C/E maj  C/G maj
```

The above are all Cmaj chords and contain only the triad notes and their octaves. However, the second version starts with the triad note G, instead of the root note, C. Having the lowest note be the root is such an important auditory cue that any exception is notable and is called *inversion*. If the second note in the triad is lowest that's called the first inversion; if the third note is lowest that's called the second inversion. There are a few different ways to name inverted chords; the method shown above is one of the more common; but the most common method is to simply ignore the inversion and name all three chords above as Cmaj.

Suspended chords

```
e--0--------0--------0--
B--1--------1--------1--
G--0--------0--------0--
D--2--------0--------3--
A--3--------3--------3--
E-----------------------
   Cmaj    Csus2   Csus4
```

The C major triad is **C E G**. If we add one of the notes – D or F – that have been omitted from the inside of the triad, that's called a *suspended* chord.

Added-note chords

```
e--0--------0--------1--
B--1--------3-------(1)-
G--2--------0--------0--
D--2--------2--------2--
A--3--------3--------3--
E-----------------------
  Cadd6   Cadd9   Cadd11
```

If we add any other non-triad note to the triad, that's called an added-note (or added tone) chord, such as C**add**6. In theory this would include the seventh, second, and fourth scale notes, but since these already have special designations, the **add** designation is omitted. But if we add an octave of the second or fourth, that's now an **add** note: namely, Cadd9 and Cadd11.

We've now covered all the bread-and-butter chord types, but there are many more exotic species in the chordal zoo. Essentially, any combination of notes that can be put together from among the twelve semi-tones has a chord name assigned to it, and has probably been used by some jazz or experimental composer.

> To learn about even more exotic chords, see Wikipedia's Chord Music (http://en.wikipedia.org/wiki/Chord_%28music%29). If you come across a chord symbol we haven't discussed, another Wikipedia entry, Chord Names and Symbols (http://en.wikipedia.org/wiki/Chord_names_and_symbols_%28jazz_and_pop_music%29#Extended_tertian_chords), is a good reference point.

Over to you. I warned you there'd be a test. ;) All you have to do is pencil in the name below each of these chords:

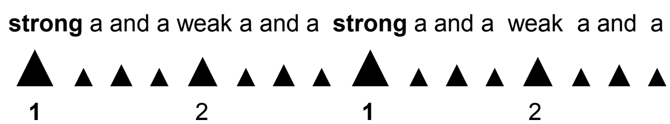
```
---2---   ---0---   ---2---   ---2---   ---3---   ---9---   ---7---
---0---   ---2---   ---0---   ---0---   ---5---   ---7---   ---8---
---0---   ---2---   ---2---   ---1---   ---3---   ---7---   ---7---
---0---   ---4---   ---0---   ---2---   ---5---   ---0---   ---9---
---2---   ---0---   ---2---   ---2---   ---3---   ---0---   ---7---
---3---   -------   -------   ---0---   ---3---   -------   -------
_______   _______   _______   _______   _______   _______   _______
```

Unit 4: Rhythm, tempo, and structure

Lesson 17: Rhythm, take 1

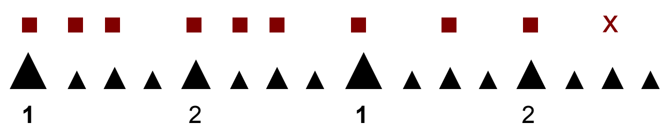
In Unit 2 we explored the concept of meter, which we can think of as an abstract framework on which to hang actual notes. The notes that actually get played within that framework each have a certain pitch and each last for a certain length of time. If we ignore pitch and just concentrate on the time lengths of notes, that succession of time lengths is called rhythm. More simply: meter tells us where notes *might* exist; rhythm tells us where notes *do* exist.

Intuitively, we think of rhythm as being a regular pattern of time values, such as the drummer or bass player lays down during a song. The samba is in a two beat meter, but so is the polka; even if played at the same tempo, there's no mistaking the two. In Unit 2 we talked about meter using just words, such as strong and weak. We now need to introduce a more visual notation. Here are two bars of a two beat meter, shown both verbally and visually:

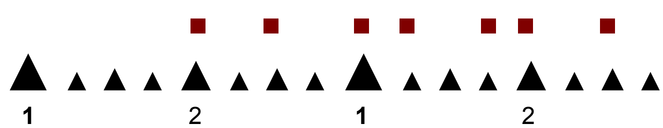


We can use this visual notation to show the difference between the polka and the samba like so:

Polka:



Samba:



The red blocks show the note pattern, or rhythm, for both dances that gets repeated for the duration of the dance. Just as with meter, it's not that notes have to be sounded on those beats and only those beats. Rather: the pattern has to be established by actual notes so the listener knows what to expect. Once that's done, the players can add or skip notes, so long as they don't break the pattern by establishing a new one. If the drummer and/or bass player sticks fairly closely to the pattern, that frees the lead players or vocalists to do something a little more rhythmically creative.

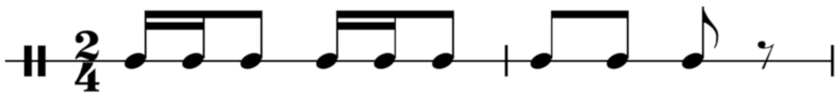
> ***Over to you***. To move this out of the realm of theory: for each rhythm example in this unit, tap on the beat with a foot. At the same time clap the red blocks, repeating each sequence multiple times. This can be tricky at first, but don't give up!

The red blocks are fine for clapping out a rhythm, but they can't show is how long a note sound would sound if played on an instrument or sung. Notes that continue to sound right up until the next note starts are called ***legato***. Notes that get chopped off right after they start sounding are called ***staccato***. Notes of in-between duration can be called ***mezzo staccato*** or ***non-legato***, but neither is in common use.

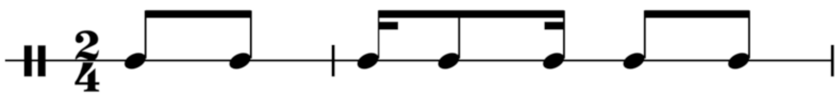
Lesson 18: Rhythm, take 2

To get a better feel for actual note durations, let's look at the same rhythm patterns expressed in standard:

Polka:



Samba:



Both use the convention of note duration values you probably remember from grade school:

***Fig. 5**: standard notation time values*

Each such note sounds for its full duration unless the composer puts a dot over it to indicate staccato. If the composer wants a longer gap between notes, he uses a silence symbol, called a *rest*:

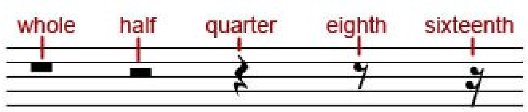


***Fig. 6**: standard notation rest values*

We see the eighth note rest at the end of the polka pattern above. Whether or not we use standard notation the important thing is that notes and rests can most often be expressed in whole-bar, half-bar, quarter-bar, eighth-bar, and sixteenth-bar values, tying rhythm back to the underlying meter.

Fig. 5 and Fig. 6 above show us the standard notation scheme for time values. In Fig. 5 we see the whole-bar note that's just a circle taking up one bar, then two half-bar notes taking up the next bar. In the final bar we first see a quarter-bar note, followed by an eighth-bar note, followed by two sixteenth-bar notes. Fig. 6 shows the rest or silence equivalents. As mentioned in Unit 2, the **4/4** pair at the start of the first of the two illustrations is called a ***time signature***. The upper **4** tells us that each bar to follow contains four beats. The lower **4** tells us that the quarter-bar note is one beat long.

Unfortunately, this nice correlation between note length and bar length *only holds good for **4/4** time*. In general, all we can say is that a whole note sounds twice as long as a half note, which sounds twice as long as a quarter note, etc. If the time signature is **3/8**, then there are three eighth notes per bar and neither the whole nor the half note can be used, since they both cross bar lines.

Lesson 19: Tempo

But for all that, there's nothing in either of the above notation schemes to tell us *how long* any given note actually sounds. As soon as we know that each bar lasts exactly one second in a given piece of music, then we can at last say that each note lasts a specific length of time: whole notes last one second, each half note lasts one-half second, etc. Tempo can be indicated in two different ways.

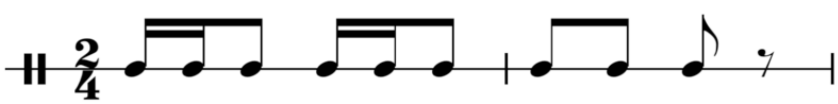
One is to indicate a specific number of beats per minute, such as ♪=120, or a range of beats per minute, such as ♪=120-140. This is often written as M.M. = 120; M.M. abbreviating Maelzel's metronome. Your resting pulse is likely in the range of 70 to 80 beats per minute, and 60 beats per minutes is one beat per second.

The other tempo indicator is to use words like ***andante*** and ***allegro***. (Italian has become the international language of western music notation.) To crib from Wikipedia:

- *Larghissimo* — very, very slow (20 bpm and below)
- ***Lento*** — very slow (40–60 bpm)
- ***Largo*** — very slow (40–60 bpm), like lento
- *Larghetto* — rather broadly (60–66 bpm)
- *Grave* — slow and solemn
- ***Adagio*** — slow and stately (literally, "at ease") (66–76 bpm)
- *Adagietto* — rather slow (70–80 bpm)
- ***Andante*** — at a walking pace (76–108 bpm)
- *Andante Moderato* — a bit faster than andante
- *Andantino* – slightly faster than andante
- ***Moderato*** — moderately (101-110 bpm)
- *Allegretto* — moderately fast (but less so than allegro)
- *Allegro moderato* — moderately quick (112–124 bpm)
- ***Allegro*** — fast, quickly and bright or "march tempo" (120–139 bpm)
- *Vivace* — lively and fast (~140 bpm) (quicker than allegro)
- *Vivacissimo* — very fast and lively
- *Allegrissimo* — very fast
- ***Presto*** — very fast (168–200 bpm)
- *Prestissimo* — extremely fast (more than 200 bpm)

I've highlighted the tempo names that you need to be familiar with even for pop music. As you can see, *andante* is an especially grey area that actually includes moderato in its scope.

Once you have an idea of how many beats per minute the tempo is, you then need to know what the meter is. Looking again at our polka rhythm, for example:



Just hearing those notes, it might be difficult to know whether the beat was on the quarter note (two beats per measure) or the eighth note (four beats per measure). In some way you need to establish the down beat, the strong beat that starts each measure. This can come about by reading the sheet music or playing from a chord chart or having the beat clapped out by whomever is teaching you the piece of music. Once you know that there are two beats per measure and that the tempo is 120 beats per minute, you know that the eighth notes in the above example are each ¼ second long and the sixteenth notes, therefore, are half that in length. You'll need to play with a metronome to get that precise speed, but after enough experience you'll come pretty close just by ad-libbing. Our life-long experience with the ticking of a clock is always a good starting point.

It would be nice if the story ended there, but of course it doesn't. Dance pieces, like the polka and samba, at least maintain the same tempo from start to finish. Popular vocal pieces generally maintain the same tempo, except that the vocalist will insist on lengthening the last measure of each section for dramatic effect. “Classical” compositions will very often specify changes in tempo at various points. When the composer wants you to smoothly speed up the tempo, he'll write ***accelerando*** or ***accel***. for accelerate. When the composer wants you to smoothly slow down the tempo, he'll write ***ritardando*** or ***rit**.* for decelerate. Such changes are difficult for groups of musicians to coordinate, so absent a conductor, everyone else would need to closely follow a designated lead (such as the vocalist), but most often popular music defaults to maintaining the same tempo throughout.

Lesson 20: Foreign intrusions

The above snippet from Erroll Garner's *Misty* happens to be in three flats (E♭ major) and 4/4 time. Don't panic; just notice the little 3 above several clusters of notes. In the first bar, normally we could either have two eighth notes or four sixteenth notes in both places where what looks like three eighth notes appear. This is saying that both the second and the fourth beats should be divided into three equal parts – third notes – instead of two or four equal parts. At the end of the second bar we see a cluster of three quarter notes. Here three notes need to be played (actually, sung) evenly across the time in which there would normally be two beats, or half the bar. Everyone's heard *Misty* so many times that we can all hear how the tune goes. Translating the above phrase into our super-duper rhythm notation, we get the following:

■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲
1 2 3 4 **1** **2** 3 4
can't understand, I get mist-y just hold-ing your

By far the easiest way to learn such a tricky passage is to hear someone else play it first. Failing that you need to clap or tap out the beats while simply squeezing in the notes that fall between beats as smoothly as possible. Try it!

> **Trivia time #5**. If it makes you feel any better, Erroll Garner himself couldn't read music. When Johnny asked Erroll Carson on the Tonight Show why he'd never learned to read music, Erroll said: “Man, when you've seen one note, you've seen them all!”.

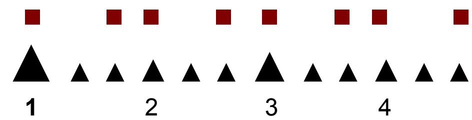
Before departing the exotic shores of triplet land we need to make a final excursion. Here is about the most basic possible rhythm, playing every note of a four beat measure on the beat, or in this case, on the ½ beat:

■ ■ ■ ■ ■ ■ ■ ■
▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲
1 2 3 4

Here we do the same thing, except with a twelve beat measure:

■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■ ■
▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲ ▲
1 2 3 4

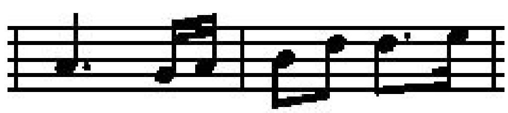
That sounds pretty much like **one** two three, **one** two three, etc. If we skip the middle note of each threesome, we get **one** ... three, **one** ... three, etc. Like so:



That **daaah** d'**daaah** d'**daaah** rhythm is very commony used to add a bit of swing to notes that are written on the beat. This is called playing with a ***triplet*** feel. It's not uncommon for the composer to indicate that he wants the composition played that way. In part, this could be taken that he is too lazy to tediously write it out in an endless series of actual broken triplets. But more than that to play a string of actual broken triplets has too much lilt to it. The idea is to move slightly away from on the beat, but not to go all the way into full lilting triplets.

Finally, triplets aren't the only such foreign rhythms that crop up in music. Rarely, you'll see things like two or four notes intrusions in three beat meters or five or six beat intrusions in four beat meters.

Lesson 21: Dotted notes...



The above snippet from *Oh, Susanna* shows yet another time notation you need to be aware of. We learned previously that a composer can put a dot above a note to indicate staccato playing. Here we see dots beside notes. This is shorthand for saying that the time value of the note is half again as long as the note shown. The very first note is dotted; since it's a quarter note and since it's dotted, it needs to sound for a quarter note plus an eighth note duration. The second-last note is a dotted eighth note so it needs to sound for an eighth note plus sixteenth note duration.

The second-last note is followed by a sixteenth note, so together they make up the duration of two eighth notes. This dotted long-short pairing is very common in music; and if you tap out their rhythm you hear that they have even more of a **daaah** d'**daaah** d'**daaah** lilt or swing than triplets. But in this case the composer really does want them played that way.

...and a note on tab notation

In order to give any sense of time values to tab, at a minimum we need to indicate where the beats are. Here I've put beat markers and a crude representation of half-beat pairs (using high ASCII box-drawing characters) above the first four bars of John Fahey's *Sunflower River Blues*:

```
     |    ┌─┐ ┌─┐ ┌─┐   ┌─┐ ┌─┐ ┌─┐ ┌─┐   |  |  ┌─┐ ┌─┐   |  ┌─┐ ┌─┐  |
e ||------------------|-----------------|----------------|----------------||
B ||-----------3------|-3-------3-------|3-----------3---|---------3------||
G ||*-------4-------4-|---------3-----2-|--------2H4-----|-----2---------*||
D ||*----0-------0----|-----0-------0---|---0-------0----|---0-------0---*||
A ||-2-------2--------|2--------1-------|----------------|----------------||
D ||------------------|-----------------|0------0--------|0------0--------||
```

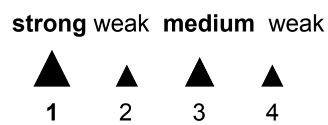
(Notice that the sixth string is tuned down to D.) We see that the bass line (called double-thumbing) falls nicely on the beat; while the melody line mostly falls half way between each beat. We'd use quarter notes and eighth notes to write that quite handily in standard notation. However, if we go back to the snippet from *Misty* shown in standard notation above, we have to resort to something like this in tablature:

```
            3       3                    __ 3__
     |    ┌─┬─┐ |   ┌─┬─┐   ┌  |    ┌    |   |   |
e |-3------4-6--------1-3|-4--------------------1-|
B |-----------4----------|-----1----1---3---4-----|
G |----------------------|------------------------|
D |----------------------|------------------------|
A |----------------------|------------------------|
```

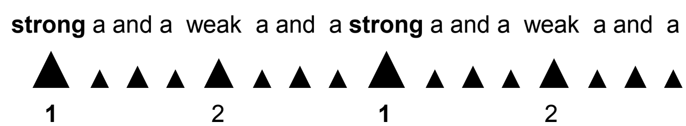
This sort of time value accuracy is normally simply ignored in on-line tablature or glossed over with a note to refer to a recording for exact timing.

Lesson 22: Structure

If we go back to our initial discussion of meter, you'll recall that it all starts with the tendency of the human auditory cortex to transform **tick tick tick tick** into **tick** tock **tick** tock – in other words to create a strong weak or strong weak medium weak pattern in time:



But when we need shorter note values between the beats we simply nest a strong weak or strong weak medium weak pattern inside the main pattern, such as:



All this happens within one bar of a piece of music. But the same **strong** weak **medium** weak patterning operates to group multiple bars together. As a rule, western-world popular songs divide up into multiples of four-bar phrases. In western culture (and now in most of the rest of the world), nearly all popular songs can be categorized into those with eight bar, twelve bar, or sixteen bar themes.

> **Trivia time #6**. Apparently, breaking the 8/12/16 bar rule is rare enough that, if you ask a country blues musician whether he can play Mississippi John Hurt's beautiful *Stack O'Lee*, he'll probably respond: "oh, you mean that weird eleven bar song?"

Strangely, this 8/12/16 "rule" also applies to triple time compositions like waltzes. You'd think a waltz would break out into multiples of three-bar phrases, but such is not the case. I think of the four-bar phrase as being like a box car on a freight train. A freight train can have as many box cars as the engine(s) can pull, but there is never a half-box-car or a third-box-car in the mix.

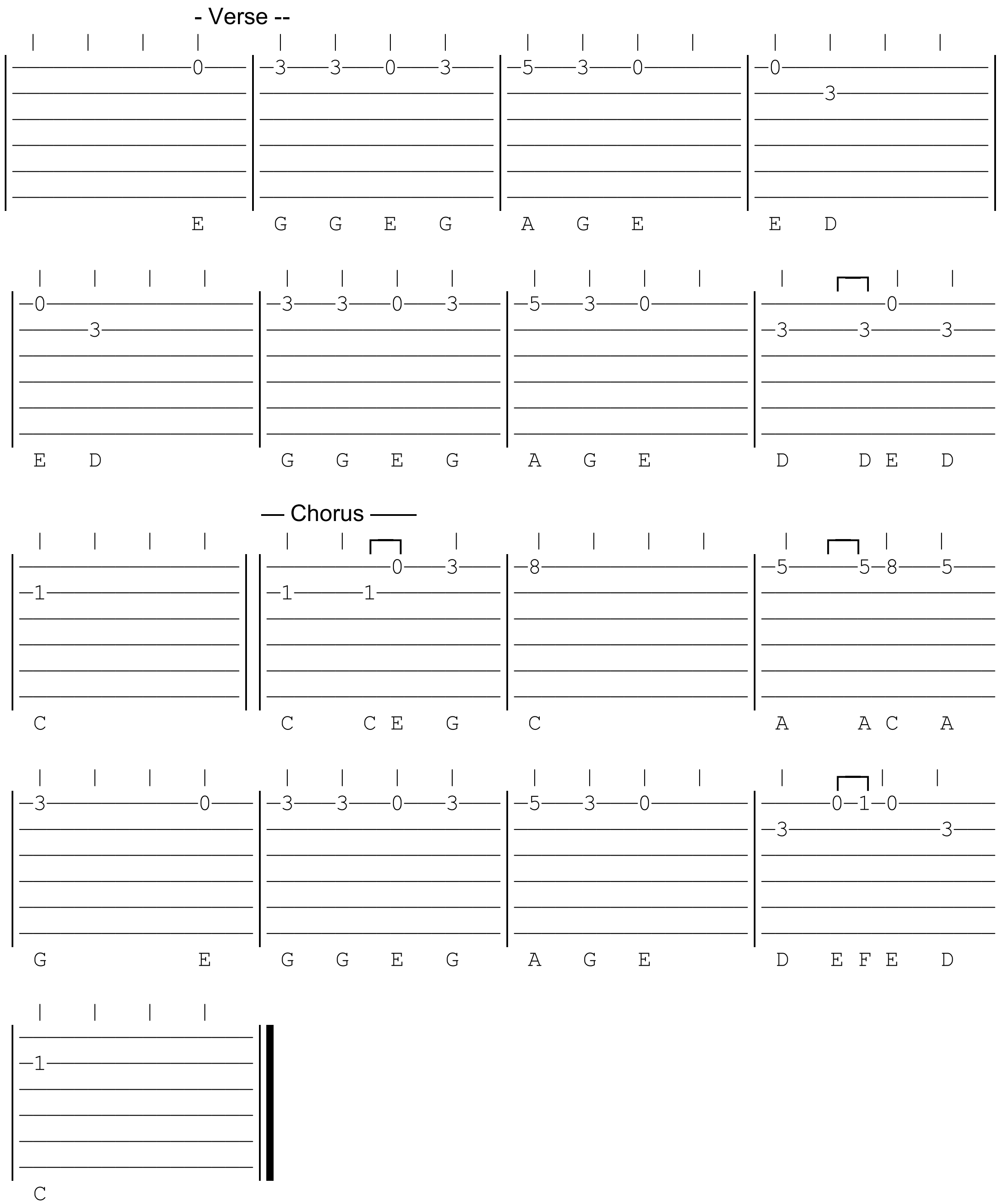
Most popular music is vocal and follows a ***verse*** + ***chorus*** structure. Both verse and chorus are often eight bar units. Each verse has the same melody but different lyrics, while the chorus has both the same melody and the same lyrics throughout. Popular compositions frequently have additional material included: an ***intro*** occurring once at the start, a ***coda*** occurring once at the end, and a ***bridge*** section somewhere within the body of the piece, dividing it into two halves. Unfortunately, intro, coda, bridge, and any other transitions between sections are not restricted to the four-bar-multiples rule, so that's the end of our neat-and-tidy freight train metaphor.

Beyond verse + chorus, "Classical" music and jazz typically follow a theme and variations or theme and development structure. A starting melodic phrase is repeated multiple times but deliberately mutated each time around.

Unit 5: Harmonizing a Melody

Lesson 23: Basic harmonizing

Let's say you want to play *Camptown Races* by Stephen Foster. You pick out the tune on your guitar and come up with the following:



What key is this in? The first thing a new recruit in the military learns is that every speech to an officer must begin and end with the word: “Sir!”. In music the very similar rule as that popular music begins and ends in the root chord of the key of the composition. There are certainly exceptions to this rule;

but it is true much more often than it's false; and if the composition doesn't start and end on the same chord, then the end chord almost always wins. Also: the final note of the melody is almost always the tonic or first note of the key the piece is in. In this case, the key of C.

But in many cases we have another clue. Above, I wrote in the note names to each note just below each row of tab. It so happens there are no sharped or flatted notes in the entire melody. This only happens in C major and the (rare) natural form of A minor. Since the last note is C, and since all notes are in the key of C major, the case is closed. (Actually, there's something else we can learn from the note names. Notice F only appears once and B is entirely missing. This song is very nearly in C major pentatonic; to be really picky, the presence of the one F note makes it C major hexatonic.)

We've got the note pitch and timing values and we've established the key (or in technical jargon, the ***tonality***). All we need now are the chords to harmonize it (accompany the melody). Since we're doing this by ear, we don't know what chords Stephen Foster used; what we want to do is come up with a believable set of chords of our own. Now we can fall back on something we learned in Unit 3: every diatonic melody can be harmonized with just the `I`, `IV` and `V` triads. In the key of C that's the C major triad (**C E G**), the F major triad **(F A C**), and the G major triad (**G B D**). We also noted that it's traditional to add dominant 7 (**F**) to the `V` triad (**G B D** + **F**).

The simplistic approach would be to take every note, ask which triad it can be found in, then use that triad as the chord to harmonize that note. Applying that to the first few bars, we get:

```
  |    |    |   C|    G7|    |   C|    |     F|   G|   C|    |      | G7|    |    |
||-------------0---|-3---3---0---3---|-5---3---0-------|-0-------------||
||-----------------|-----------------|-----------------|-----3---------||
||-----------------|-----------------|-----------------|---------------||
||-----------------|-----------------|-----------------|---------------||
||-----------------|-----------------|-----------------|---------------||
||-----------------|-----------------|-----------------|---------------||
               E      G   G   E   G     A   G   E          E   D
```

(Notice that we only mark chord *changes* and assume the same chord is used for each note until we write a new chord.) However, too many chord changes are choppy and often difficult to finger. The first several notes are all in the C triad, so the switch to Gdom7 is a candidate for removal. Since this is the very beginning of the song, staying in the C triad will help to establish that the melody is in the key of C, which is a good thing in itself. So we have two reasons to eliminate the initial Gdom7.

Tradition says that a single note that jumps out of the triad that comes before and after it can still be harmonized with the same triad as the preceding and following notes. This is called a ***passing note***. The A at the start of the third bar is such a note, in that it is surrounded by Cs, Es, and Gs, all of which are in the C triad. So we could harmonize the entire third bar by simply staying in the C triad. If we do that, another way to look at that A is as a Cadd6 chord, which is all to the good.

However, the D in the fourth bar actually sustains for three beats and so merits the chord change to Gdom7. Apply the same reasoning to the rest of the song and see what you come up with.

Lesson 24: Harmonizing for mood

Camptown Races is a simple, jolly piece, so a simple, all-major-chord harmony works quite well. But the whole idea of chords is not just to fill the air with more sound, but to enhance the emotional “message” of the melody.

One tool in that tool belt is to use the minor triads that involve the same notes as appear in the composition's key (or if the composition is in a minor key, then the opposite: use major triads). For example, in C major the A minor triad (**A C E**), D minor triad (**D F A**) and E minor triad (**E G B**) are all good candidates. These triads all have the sombre/sad emotional tone that comes from the minor third interval at their core, so their use in a given passage would change the emotional tone in that direction

– which may or may not be appropriate.

The seventh, suspended, and added-note chord types we explored at the end of Unit 3 each has its own emotional import – some wistful, some less easily defined. Just as the master chef uses a rich variety of spices to appropriately (and often surprisingly) enhance a variety of dishes, so the composer, arranger, and improviser will experiment with the full panoply of chords to find just the right touch for every phrase.

Also: not all compositions are diatonic (confined to the notes of a major or minor key). Since Impressionism in the mid-1800s, even popular music can be melodically ***chromatic***, in this case meaning notes outside the seven notes of the diatonic scale appear. We've already seen that *Misty* is a great example of this, as are *White Christmas*, and *Michelle*. Chromatic melodies work together with seventh, suspended, and added-note chords the same way paprika goes together with goulash.

Lesson 25: Over to you

Okey-doke, folks, start sweating because here’s your final exam! Pick out the melody for Harold Arlen's *Over the Rainbow* on your guitar in the key of G, such that the first few notes go:

```
 - Verse --
   |   |   |   |     |   |   |   |     |   |   |   |     |   |   |   |
e|-----------3----|-2-----0-2---3--|-----------0----|----------------|
B|----------------|----------------|----------------|-3--------------|
G|-0--------------|----------------|----------------|----------------|
D|----------------|----------------|----------------|----------------|
A|----------------|----------------|----------------|----------------|
E|----------------|----------------|----------------|----------------|

   |   |   |   |     |   |   |   |     |   |   |   |     |   |   |   |
e|----------------|----------------|----------------|----------------||
B|----------------|----------------|----------------|----------------||
G|----------------|----------------|----------------|----------------||
D|----------------|----------------|----------------|----------------||
A|----------------|----------------|----------------|----------------||
E|----------------|----------------|----------------|----------------||

 - Chorus --
   |   |   |   |     |   |   |   |     |   |   |   |     |   |   |   |
e|----------------|----------------|----------------|----------------|
B|----------------|----------------|----------------|----------------|
G|----------------|----------------|----------------|----------------|
D|----------------|----------------|----------------|----------------|
A|----------------|----------------|----------------|----------------|
E|----------------|----------------|----------------|----------------|

   |   |   |   |     |   |   |   |     |   |   |   |     |   |   |   |
e|----------------|----------------|----------------|----------------||
B|----------------|----------------|----------------|----------------||
G|----------------|----------------|----------------|----------------||
D|----------------|----------------|----------------|----------------||
A|----------------|----------------|----------------|----------------||
E|----------------|----------------|----------------|----------------||
```

After you pencil in the rest of the verse and chorus melodies, add the note names above or below each note, then harmonize. You can start with the **`I`**, **`IV`** and **`V`** triads, but this is a wistful composition, so freely use minor triads, major 7 chords instead of dominant 7th, and anything else that feels right.

Coda and credits

...And that's all, folks. If you wish to learn more simply type music theory in Wikipedia and explore from there and/or dig into the resources listed in Appendix 1. It's my hope that what you have under your belt now at least represents that happy minimum of understanding that you can build in areas of special interest to you but won't hurt your playing ... or at least not fatally... ;)

Last, but far from least:

My thanks go to all the good folk who worked on the Wikipedia music entries that served to refresh my memory of things studied long ago and far away. Also, my thanks to fellow-Faheyans William Brown and Fred Harrison for unflagging encouragement and input throughout the writing process; and to guitarist/composer Andrew Stranglen (http://www.myspace.com/lectrikdog), to Mike Spindloe (http://madisonblues.ca/images/bios/Mike.jpg), and to Malcolm Kirton for helping me to better understand music structure, long an area of weakness for me.

Appendix I: Further reading

1. To learn how to read (and write) tablature, see:

The Guide to Tab Notation: How to Read and Write Tab

by Howard Wright

(http://www.classtab.org/tabbing.htm)

2. The real bible of music theory is:

On the sensations of tone as a physiological basis for the theory of music

by Hermann von Helmholtz, 1863.

(http://www.amazon.com/Sensations-Tone-Hermann-Helmholtz/dp/0486607534/ref=sr_1_1?s=books&ie=UTF8&qid=1289311332&sr=1-1)

Because the copyright is expired, it's actually available on-line at Google Books.

(http://books.google.com/books?id=GwE6AAAAIAAJ&pg=PA44&dq=resonators+%22On+the+Sensations+of+Tone+as+a+Physiological+Basis+for+the+Theory+of+Music%22&hl=en&ei=gli0TPT-NcGclgegzvTKCg&sa=X&oi=book_result&ct=result&resnum=1&ved=0CCUQ6AEwAA#v=onepage&q&f=false)

But it's over 500 pages long, so I'd really recommend buying it. Hard to believe but Helmholtz' book is so complete that it hasn't been made obsolete in the succeeding 150 years. Everything I know of since Helmholtz has been dotting i's and crossing t's. Because it documents Helmholtz' step-by-step efforts to unravel the mysteries of sound, it actually reads more like Sherlock Holmes ferreting out the clues to some mystery than a science treatise. No equations or anything more technical than the frequency numbers in the first unit of this tutorial.

Amazingly, acoustics was just a side interest for Helmholtz, who is primarily known for his work in a whole slew of other areas of science, including physiology and optics. He played the flute in an orchestra as a hobby but was dissatisfied with the tone and range of even the best instruments available at the time. The book is a record of his systematic investigations on how sound works; but for him that was just the means to the end of figuring out how to improve the flute. The result is that the modern (Boehm) flute is made of metal, not wood, and has mechanical keys, instead of simple finger holes. This is all based on Helmholtz and in turn revolutionized the design of the other orchestral wind instruments like the clarinet and led to the creation of the saxophone.

3. But for all that Helmholtz' book only covers portions of music theory: sound and harmony, but not chords, meter, and rhythm. This is apparently the standard university text book that covers all that material under one cover:

Tonal Harmony with an Introduction to Twentieth Century Music

by Stefan Koska

(http://www.amazon.com/Tonal-Harmony-Introduction-Twentieth-Century-Music/dp/0072415703)

I haven't seen this, but I guarantee it will only skim over the underlying principles of acoustics, musical tones, and harmony that Helmholtz explores and that tie everything together. Also: it's based on the piano, not the guitar, and uses standard (clef) musical notation, not tablature.

4. For the traditionalist any decent music dictionary, such as the pocketbook Harvard one dozing in a box in my basement, can be a useful quick reference and memory jog. For the rest of us there's Wikipedia.

Appendix II: Open Tunings

Open tunings are usually just a matter of re-tuning each string of the guitar to one of the notes in a triad, usually the closest note to the standard tuning note for that string. So to get to open G major tuning we want to change all six strings to be either a G, a B, or a D:

E A D G B E
↓ ↓ ↓
D G D G B D

e—0— d—0—

```
B—0—    B—0—
G—0—    G—0—
D—0—    D—0—
A—0—    G—0—
E—0—    D—0—
```

Playing all six unfretted strings of a guitar in standard tuning (**E A D G B E**) is technically some sort of E minor chord (I suppose it could be called Emin7 sus4), but mainly it just sounds like noise. ;) OTOH, playing all six unfretted strings of a guitar in open G tuning yields a harmonious Gmaj chord, since all six notes are in the triad.

```
d—0———5———7———9—
B—0———5———7———9—
G—0———5———7———9—
D—0———5———7———9—
G—0———5———7———9—
D—0———5———7———9—
  Gmaj  Cmaj  Dmaj  Emaj
```

If you're in open G and bar all six strings at the 5th fret with your index finger or with a metal or glass slide, you raise all six strings equally in pitch by five semi-tones so the strings are now **G C G C E G**, which is a perfectly valid Cmaj chord (the **IV** triad of the key of G major). Do the same at the 7th fret to get **A D A D F♯ A**, a Dmaj triad chord. (You might want to follow along on a guitar tuned to open G, so all this doesn't get too abstract).

Still in open G, if you play a melody line on the first string, for each note you play you could just bar at that fret to get some sort of valid harmony for that note. So if the next note in the song happens to be the B on the first string at the 9th fret, barring that gives you **B E B E G♯ B**. That's an Emaj chord, which certainly harmonizes the note B, even though it takes you right out of the key of G major. (So all is not perfect in open tuning heaven.)

Some of the more common open tunings are:

G major: **D G D G B D**

D major: **D A D F♯ A D**

D minor: **D A D F A D**

C major: **C G C G C E**

In each case a simple bar across any fret creates a triad-based chord.

Appendix III: Equal temperament (AKA the fudge factor)

By the time of the European renaissance the technology used to make musical instruments had become consistent enough and advanced enough that complex instruments like the harpsichord were possible to build. Further: instruments, such as the members of the violin family or the winds, were being made accurately enough that they could be played in ensembles without serious issues around getting in tune with one another. In this environment musicians and composers found they had the new capability of creating music in different keys.

On a harpsichord it's easy to see that the same pattern that makes a D major scale can also be bumped one semi-tone higher to make a D♯ major scale. Only problem was that, due to the underlying mathematics of the note ratios, the C♯ of one key, for example, was not necessarily the same C♯ as in another key. Previously, many musical instruments were limited in a very practical sense to the notes of only certain keys, the majors and minors of A, C, and D. For example, the flute, oboe, and clarinet with holes and mechanical keys to cover all 12 semi-tones was still three hundred years in the future (see Appendix I). But instruments like the harpsichord and violin family had no such limitations and began to drive musical development.

In all our examples above, the frequency numbers, such as 523 cps for C3, are based on the pure ratio numbers that all western musicians considered accurate. But the desire to expand the reach of music into all the possible keys of the minor and major scales collided with the discrepancies between various semi-tones mentioned above. The 1500s saw the gradual development of competing rules for systematically compromising on the exact frequency of each semi-tone. In many ways it was an anguished era in musical history, because any compromise on the exact pitch of a note simply sounds *wrong* to the well-trained ear. People kept looking for the magic recipe that would allow complete chromatic flexibility while somehow not offending their ears with audible compromises. Among all his other accomplishments, J. S. Bach was a key developer and proponent of the ultimate solution to this problem – the one we still use today – called ***equal temperament***. Essentially, Bach said "these are the compromises needed for fully chromatic music; and everyone will just have to get used to how weird they sound". (***Chromatic*** = all 12 semi-tones.)

If we look at the table of current (equal-temperament-modified) frequencies for the notes on the guitar as shown on the web page How Acoustic Guitars Work (http://entertainment.howstuffworks.com/guitar3.htm), we see that only the A 440 series are nice, even numbers. Some of the other notes have decimal point values, in part because of the ratios involved. But all the other notes are slightly skewed to one degree or another by the equal temperament recipe of compromises. In particular, the third and seventh notes of the major scale are noticeably off to someone like an Indian raga musician, who grew up with the pure note ratios. But in the west we grew up hearing those compromises even in the cradle. To us, it's ironically the *pure* third and *pure* seventh that sound wrong to our ears.