The Circle of Fifths

Why a circle?

The cyclical nature of musical notes

Using a circle diagram to study music can be extremely helpful because of the mathematical beauty of music. In previous lessons, we have touched on the fact that musical notes repeat themselves in predictable patterns going up in pitch. When the sound wave frequency of any particular note is *doubled*, that same note is produced but at a higher pitch. That note is what we call an octave note; it is one octave *above* the note below which is half its frequency.

You can view this in a linear way, visualizing the notes from left to right in a straight line, as we have done from time to time using the piano keyboard as a diagram:

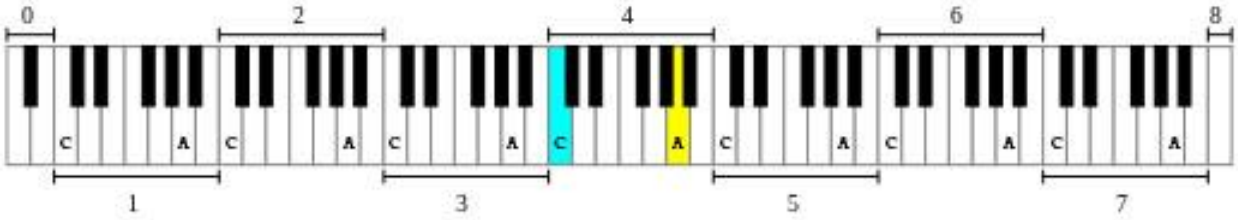

Fig. 1, the seven octaves of the 88-key piano keyboard.

In this diagram, I have marked some C notes and A notes on the piano keyboard to illustrate how they repeat themselves, going higher in pitch as you move from left to right. The C note with a blue (cyan) background color is known as “middle C” or also as C4, because it appears in the fourth full octave contained on a standard 88 key keyboard. This C note is twice the sound frequency of the next lower C to the left (C3). It is half the sound frequency of the next highest C to the right (C5).

The A note with a yellow background (A4) is important because it is the note most often used these days as the “concert pitch” – it is the note that is traditionally used for all instruments in an orchestra to tune to, so that everyone plays in tune together. If you use an electronic tuner or pitch-pipe, the notes you tune to are probably based on A4 at 440Hz. (Hz = hertz, a measure of wave frequency). So, if this A4 is set at 440HZ, then A3 is 220Hz, it is lower in pitch and the sound wave is half the frequency of A4. A5 would be 880Hz, double the frequency of A4.

As you can see from the linear layout of the piano keyboard, the notes repeat in predictable mathematical patterns in cycles—thus, an unbroken circle can be really useful in studying, understanding and memorizing relationships between musical notes and ideas in Western music.

Imagine a Helix

I like to imagine a helix to represent the upward climb of musical notes. Imagining such a spiral can help you to understand why flattening this helix into a circle can be helpful. Use figure two below to help in imagining such a spiral.

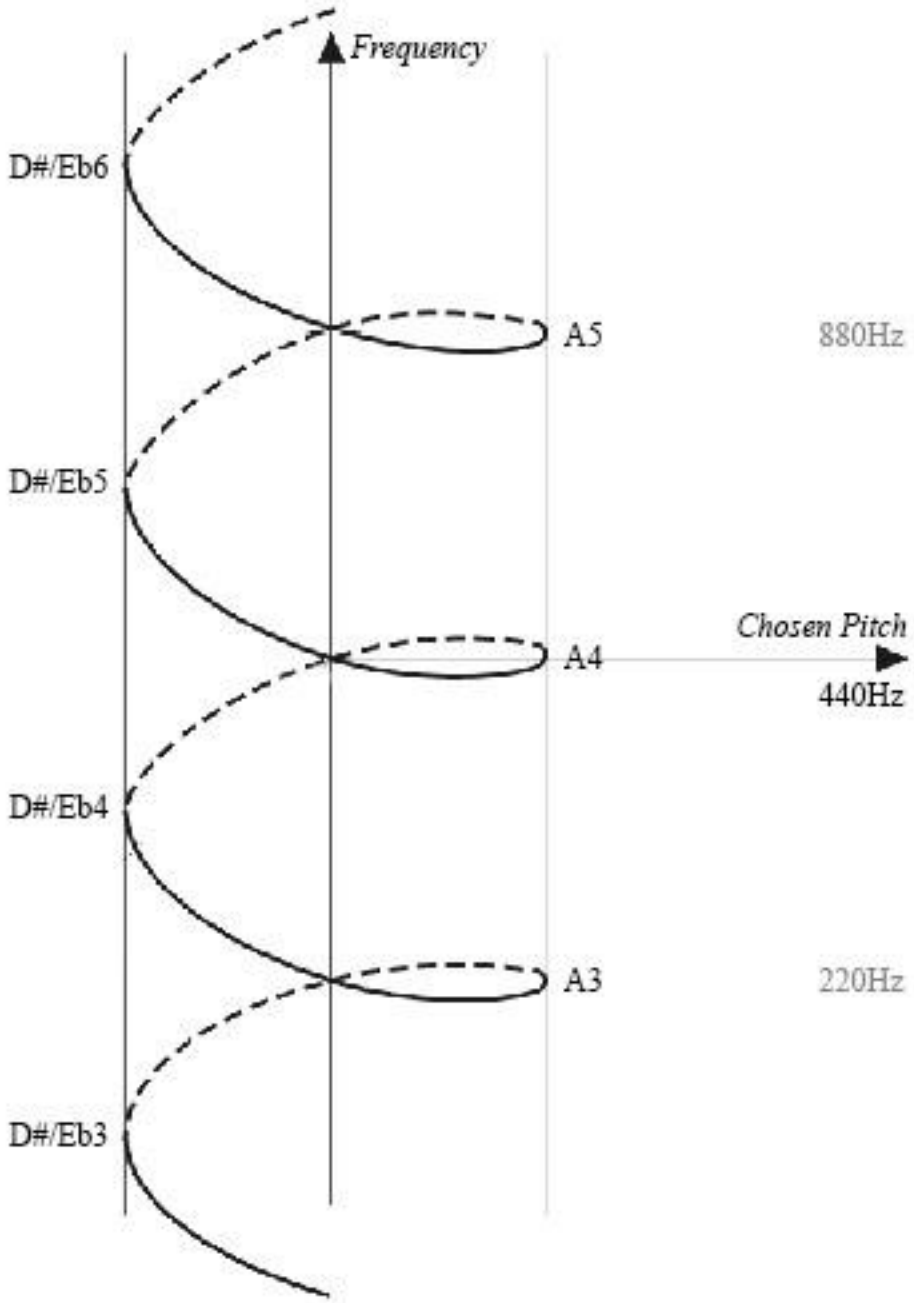

Fig. 2 Helix illustrating musical pitches.

This helix can be imagined as a spiral going upward (and downward) into infinity. Points align on the helix where frequencies are doubled. Twelve (12) points can be imagined equally spaced around the helix to represent the twelve notes of Western music. In the illustration above, our starting point would be the note A at 440Hz. The point directly across from this would be D#/Eb. Since this is a spiral, that point would be found on the spiral at a higher (or lower) frequency giving the corresponding pitch. This musical note helix extends into infinity going upward (and downward) eventually beyond the range of human hearing.

We can flatten the helix into a circle of notes:

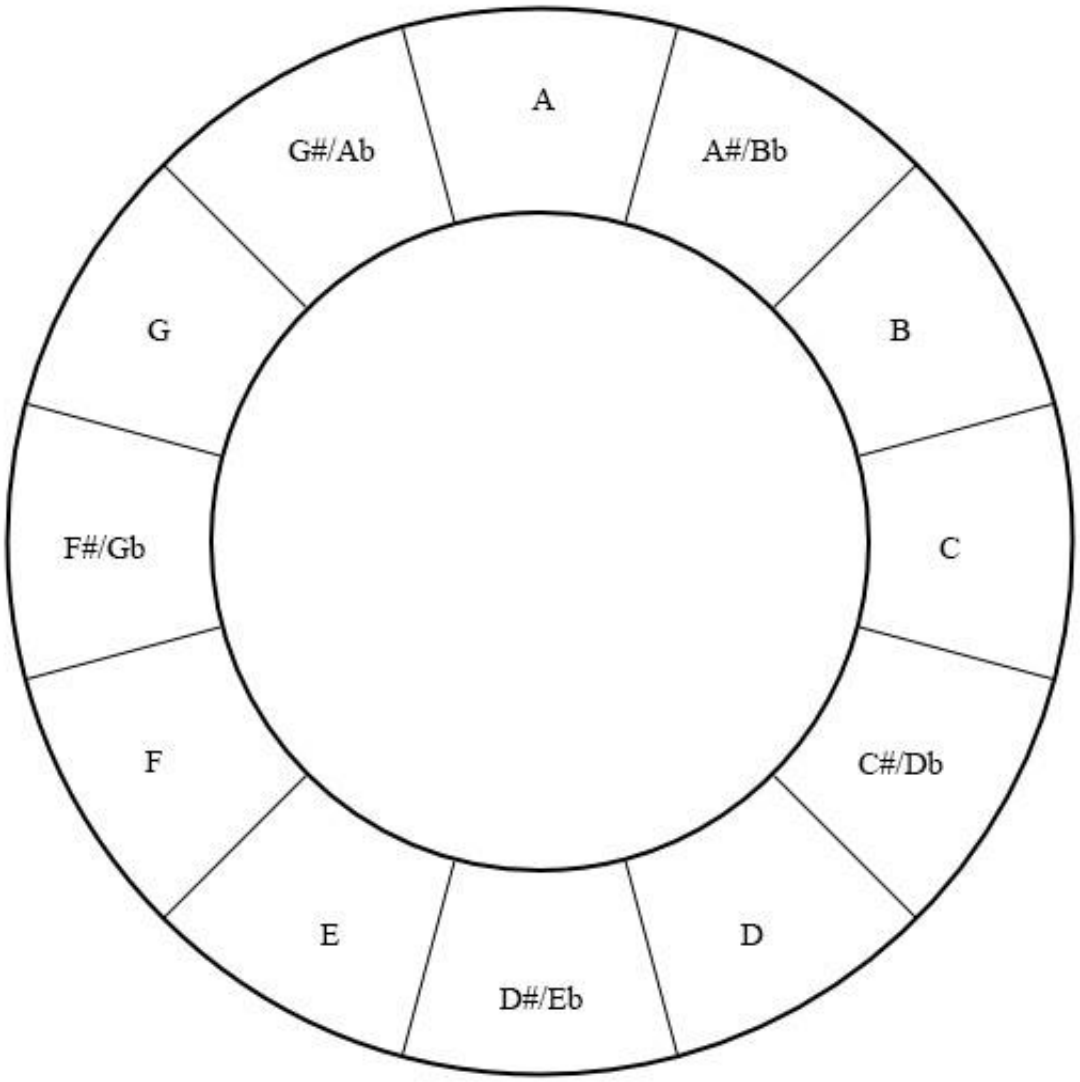

Fig. 3 A circle of notes representing the position of the twelve notes of Western music. This circle is called the Chromatic Circle.

This brief study of the mathematical, cyclical nature of musical notes illustrates why circular diagrams can be useful in understanding relationships between elements of music theory. For me, it also illustrates the mysterious perfection of music in the abstract, and nearly illustrates something of the kinship of music and mathematics to the fiber of the universe. I consider the natural occurrence of spirals and helixes in nature—the spiral of a snail's shell, the double helix of the DNA molecule, etc.—and I can't help but to be amazed at the interconnectivity of all things. Consider the spiral shapes of the outer ear, the semicircular canals and the spiraling cochlea of the inner ear with which we hear the spiraling wonders of musical notes.

Once we've imagined the infinite helix of musical notes, and flattened it into a circle, we're ready to consider the value of a circular chart that proceeds in order of fifths.

Why Fifths?

Harmonically, the fifth note of a major scale is the closest consonant tone to the key note other than the octave. Basically, what this means is that it sounds good played together with the key note. We won't get too deep into whys and wherefores, but you can test it for yourself: Playing the key note and the fifth note of a scale together sounds very good. We have seen in previous lessons that to make a major chord we use the 1st, 3rd and 5th note of a scale, which gives a hint as to the importance of the fifth note in harmony. Another indicator of its importance that some of you may be familiar with is the so-called *power chord* that's used so much in rock and roll guitar. It's also used as a double-stop on mandolin quite frequently. It's simply the major chord with 3rd omitted, in other words, the 1st and 5th note of the scale, as we've been discussing. Also, when playing harmony (chords) in a song, the V chord (pronounced "five chord") is the strongest chord other than the key.

Again, not to get too deep in whys and wherefores, but the fourth degree of a major scale is known as the "perfect fourth" and the fifth note is referred to as the "perfect fifth". The chords that are built on these "perfect" intervals will be the most likely chords you will find in any given key. Take the key of C for example: The fifth note is a G and the fourth note is an F. You will find that hundreds of thousands of songs can be played using only those three chords in the key of C: C, F and G major chords – the I, IV and V.

The Circle of Fifths as we know it today gives us instant access visually to the IV and V chords of any key. One of the best things any musician can do to facilitate their competency in playing is to memorize the order of fifths shown in the Circle of Fifths, and that is the ultimate goal of this lesson.

The cool relationship between the perfect 4th and 5th

There are four pitches that are named "perfect" in a major scale; they are the *perfect unison* which is the first (or tonic, or key) note of the scale, the *perfect octave* which is the eighth note and same as the first but double the frequency, the *perfect fifth* which we have seen is the closest consonant tone to the key note other than the octave, and finally the *perfect fourth*. Interestingly, in the *Diatonic Harmony* of a major key, there are only three major chords (the rest are minor or diminished chords) and those are the I, IV and V chords, which also happen to be the most often used chords in accompanying song melodies.

The interesting relationship between the 4th and 5th scale degrees is shown in the chart below:

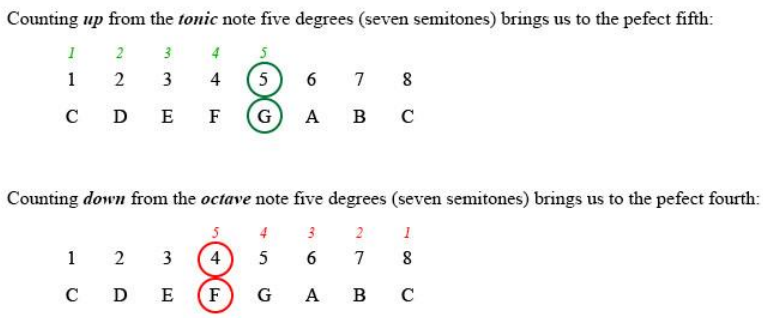

Fig. 4 Perfect Fifth and Fourth

A grammar of music

We've already probably discussed more than you ever wanted to know about the uncanny mathematics of music, but I don't think there's any way to get around that if a person really wants to know music well—despite the fact that I've spent a lifetime eschewing mathematics. I was one of those kids who never memorized multiplication tables—but as a businessman and as a musician, math has been important all my life, no matter how much I despise working in math.

Grammar, syntax, philology, linguistics, language and literature, on the other hand, have always fascinated me. As evidence of this particular bent to my own mind, I've not only been a lifelong reader but also an editor and writer. I've studied grammars of many of the Indo-Germanic tongues. I studied *Koine Greek* in depth, diagramming Greek sentences from the book of Ephesians and I John of the New Testament, etc., etc. A bit of a technical geek as it were.

Brad Laird begins *Mandolin Master Class* by referring to "Learning the Language of Music" and in reality that's what this study group is all about. Interestingly enough, the Circle of Fifths idea was first published in by Nikolai Diletskii in his late 1670's treatise on composition called the *Grammatika* (Grammar of Music). In 1728, Johann David Heinichen improved upon the design to bring us the modern version we use today.

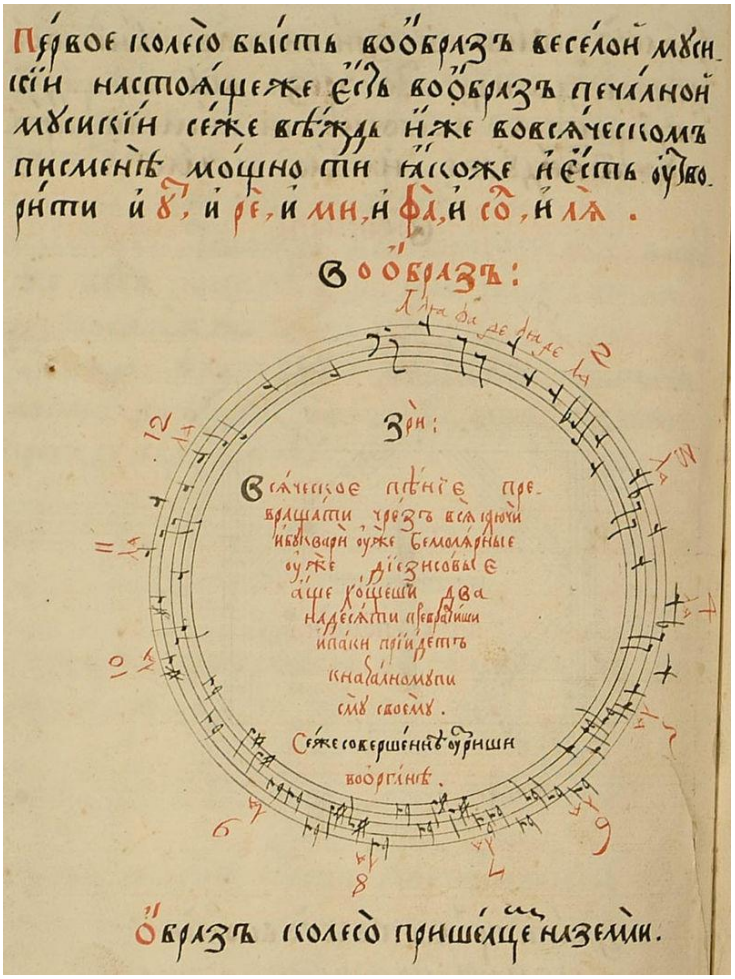

Fig. 5 Diletsky's Circle

Our Circle of Fifths

Simplest form of the circle

What we have here is a very simple representation of the Circle of Fifths. This is what we are set to memorize in this lesson.

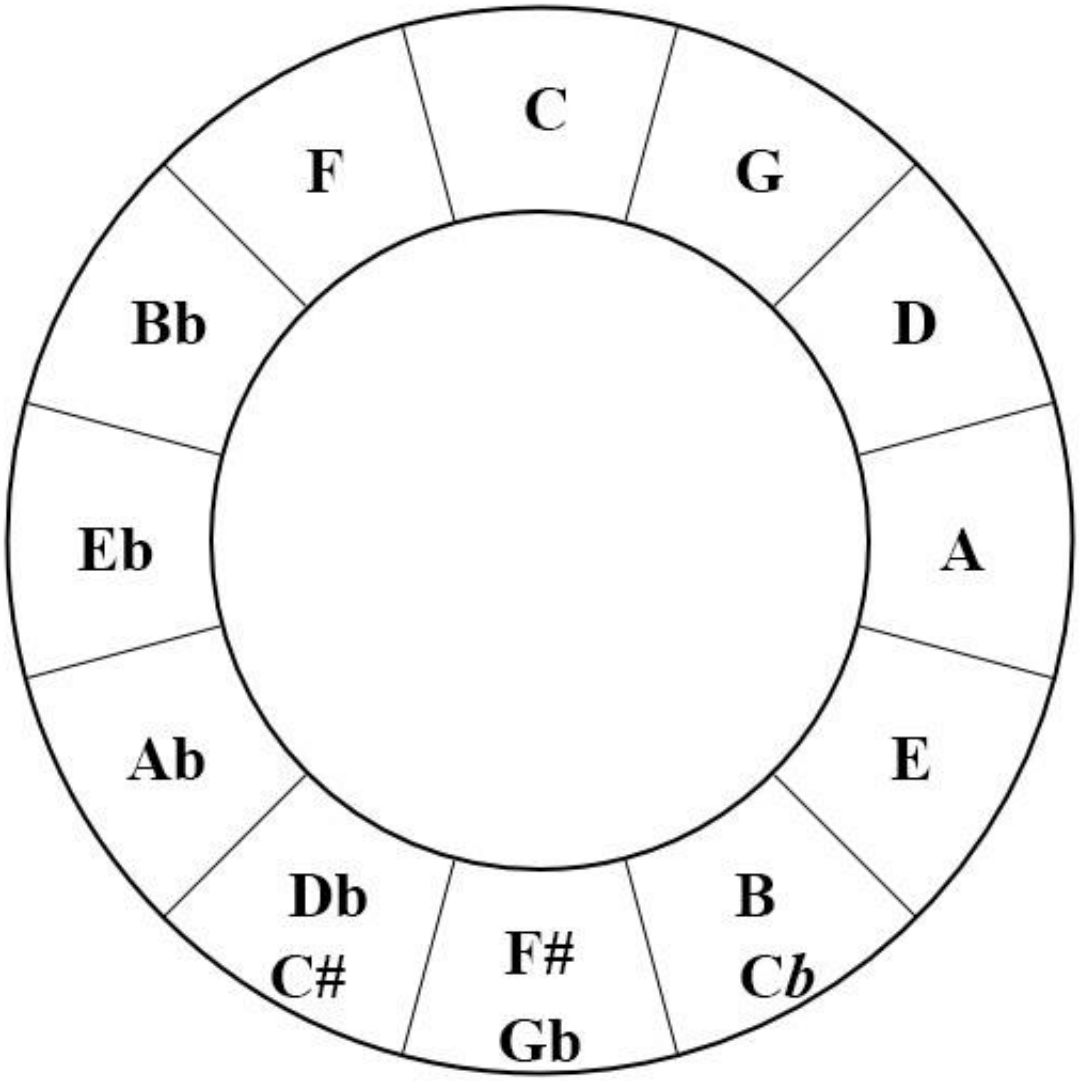

Fig. 6 A very simple Circle of Fifths

Using this lesson, together with lesson four on major arpeggios, we'll learn to memorize this basic Circle of Fifths—that is, we'll learn to start at C, and know which key or chord comes next going clockwise around the circle. We won't be trying to simply memorize all this by rote memorization—if you do that, fine, but it isn't necessary—we're going to do it by practice. We'll do it by playing arpeggios with our mandolins using a backing track that plays chords around the Circle of Fifths.

For now, we'll continue on with "more information than you need to know" as I discuss some of the ways we can use the Circle of Fifths.

What all is contained in the Circle of Fifths?

Once you have the circle in your memory, you'll have access to all this and more:

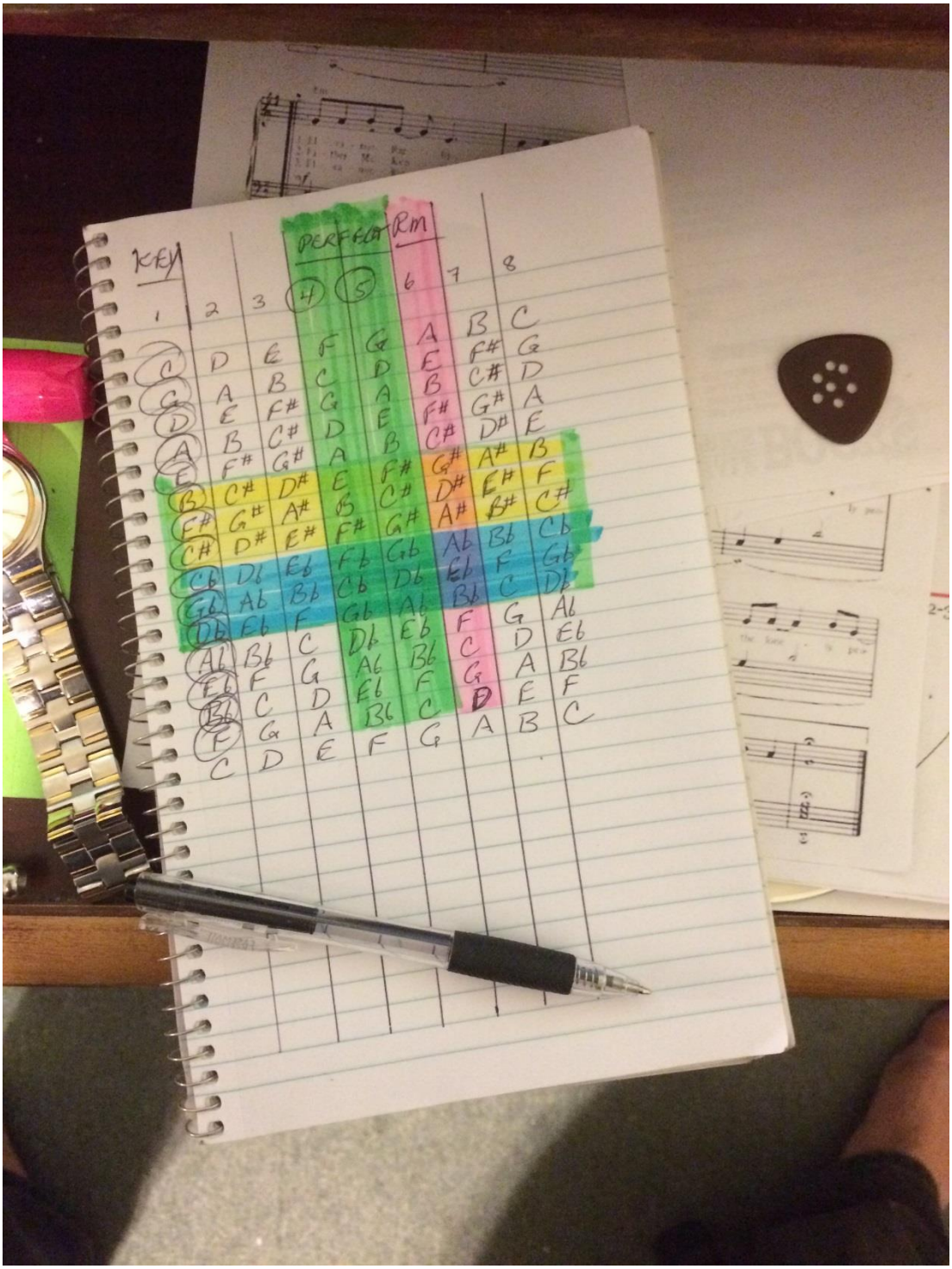

Fig. 7 Scales represented in the Circle of Fifths

What I've done in figure seven is written out all the scales represented by each key going around the circle of fifths, beginning with the key of C. The perfect 4th and 5th of each scale are found in the two green columns. Look at the scale of C at the top of figure seven, the 4th is an F and the 5th is a G. Now look at the C at top of the circle of fifths, figure six. On the left is an F (4th) and on the right is a G (5th).

If you compare each scale I've written out in figure seven with the corresponding key on the circle, you'll find that the 4th always appears on the circle immediately to the left of the key, while the 5th always appears to the right. Since these are the most important chords of many songs and tunes written in these keys, this is invaluable information to have at your fingertips, or committed to memory. Pretty cool, huh?

Now look again at figure seven. Halfway in, beginning with the B scale, there is a yellow section followed by a blue section. These scales actually overlap. Compare that section of my handwritten notes with the lower three keys in the circle in figure six, and you'll see what I mean.

Why do only these three keys overlap? And why are there flats on the left side of the circle? When writing scales on the right side of the circle we add sharps, but on the left side, when we write the scales there are flats. Why is that? Have you ever wondered? Well, let's consider what happens when we write out the scales for the circle, as I've done in figure seven.

After writing out the C scale, on the next line I started with the 5th of C and wrote out the scale of G. Then I took the 5th of G and wrote the D scale on the next line. I continued in this fashion until I got to the scale of C#. Since the scale of C has all natural notes, writing a C# scale means that *all the notes must be sharp*. Studying the circle (fig. 6) along with my chart (fig. 7), we see that going to the right, key of G has one sharp, key of D has two sharps, key of A has three sharps, and so on. Each next key adds a sharp, and when we get to C# *all notes are sharp*—we now have seven sharps. The fifth of C# is G#, but if I were to continue in that manner, I'd need to have *eight sharps*. Every note in G# would be sharp, except for F## (F double-sharp). This is impractical for us in Western music. F## is the same note as G. And if we kept going in this manner, we'd add a new double sharp in each proceeding scale. So, scales like that are considered theoretical scales.

What I did when I got to C# is, I stopped. Then I used a yellow highlighter to highlight the last three scales, and I wrote out the scale for Cb, which contains 7 flats—I wouldn't want to have more than that. This is the same notes of the B scale, since B is a half-step less than C, and so these scales overlap. From that point, I started out writing scales from the 5th of each proceeding scale, starting with Gb, and continued until I came to the F scale, whose 5th is C, and which brings us all the way around the circle.

The Circle of Fifths tells you which keys are actually used in the writing of music. The natural, flat or sharp keys appearing on the circle in figure six are the keys used for writing music. It is of some interest that the left side keys are most often used in orchestra music, while the right side keys are more often used in popular music such as folk or country. Also, it is not very common to find music written in C# or Cb. It's just generally easier to write in the key of B (5 sharps) instead of Cb (7 flats), and the key of Db (5 flats) is easier to manage than C# (7 sharps).

That's just too many flats!

Getting the most from the circle

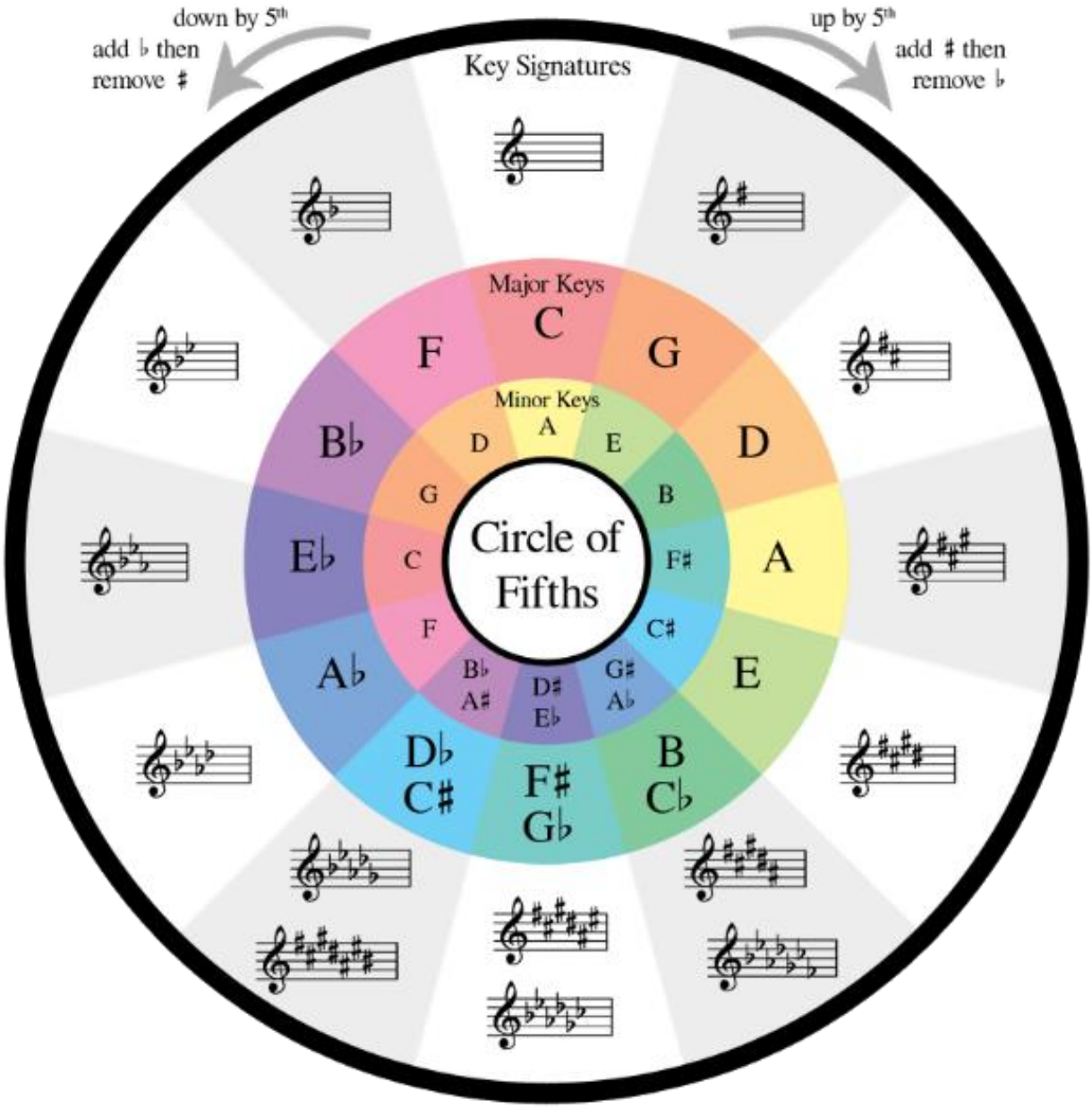

Fig. 8 The beautiful, colorful Circle of Fifths, the mighty Circle of Fifths

Now that we have seen why, for practical reasons, flat keys appear on the left side, let's look at this another way. When starting at C, when you move to the right you add sharps, one at a time on the way around until you get to C#—this is because you are moving ***up*** by fifths. But when starting at C and going left you add flats, one at a time on the way around until you get to Cb—this is because you are moving ***down*** by fifths. And as we saw in figure four, moving down by a fifth gives the same note as the fourth degree of the scale. That's one of the beauties of this circle.

The true beauty of this chart in figure eight is that it gives you more information. To the outside, it shows the key signature found in written music for each of these keys. Also, near the center of the circle it gives you the *relative minor* of each key.

Learning key signatures from the circle of fifths

We've already mentioned how sharps are added one at a time for each key as you go around the circle clockwise, and flats are added one at a time as you go around the circle counter-clockwise. This is a handy feature. If you see a piece of music that has a key signature with 3 sharps, you can determine the key by counting three key notes from C around the circle to the right—the key is either A or its *relative minor*, F# minor.

Likewise, if a key signature has two flats, you can tell that the key must be two to the left of C, the key is either Bb or its *relative minor*, G minor.

The chart in figure 8 spells this out for you, but you could easily determine this by counting around the simple chart in figure six.

But which notes are sharp or flat in any given key? You can find them by just writing out the scale, if you remember the definition of the major scale intervals. But, the answer to this is also hidden here in the circle! When adding sharps, just start at the F note name to the left of C and go around to the right. So, a key signature with two sharps will have an F# and a C#. A key signature with four sharps will have F#, C#, G# and D#.

And adding flats? Always start with the note name that is *opposite the F* on the circle—that's the B note name—and move counter-clockwise to add flat notes. So a key signature with only one flat will have a Bb in the scale. A key signature with three flats will have Bb, Eb and Ab.

What is a relative minor?

Every major scale has a relative minor. It is called a relative minor because it contains exactly the same notes as its relative major scale in which it is found. The relative minor is always the 6th degree of the major scale.

Look again at figure seven and you will see that I have made a pink column that represents the relative minor of each scale. For the G scale, the relative minor is Em. If you start at the E note and play all the same notes of the G scale but starting and stopping on E, you will hear the minor intervals. You are now laying the Em scale.

Since all the notes are the same between any major scale and its relative minor scale, including the sharps and flats, the key signature on sheet music for a major scale will always be the same as for the relative minor scale.

How Do I Begin to Internalize All This?

1. I believe it's important to print out a good Circle of Fifths diagram to put on the wall and some to put in your music binders or instrument cases that you can refer to frequently. Put one in your instrument case.

2. Practice the Arpeggio Circle of Fifths exercise PDF that was included in lesson four, and use a Circle of Fifths practice track to play along with. Brad included such an mp3 with the *Mandolin Master Class Course.* You can use any number of slow-down programs with it to get started.
3. Think about the names of each key as they come around while you are playing. This is an excellent exercise for starting to learn the fingerboard as well as the Circle of Fifths by memory and by ear.

Conclusion

I have tried to give a lot of information in this primer from my own perspective. Hopefully, it will enlighten rather than confuse you. But, we all do not learn the same ways, or understand things in the same terms.

The important thing in this lesson is to pick up your mandolin as often as possible and practice playing the arpeggios with a backing track. If the stuff I wrote out in this primer helps you, that's great, that's been my intention. If it is not clear enough, just discard anything that isn't helpful—or ask questions about it in the Woodshed Study Group at the Mandolin Café forums.

Then, pick up your mandolin as often as possible and practice playing the arpeggios with a backing track!

When you persevere, you'll find that this exercise will go a long way toward helping you to learn where notes are located on the fretboard, and learning what comes next in the progression of fifths.

My Circle of Fifths Video

Arpeggio Practice PDF