Sounding Number
Dr. Rachel Hall

The Major Scale

A *scale* is an ascending or descending sequence of pitches that form a particular pattern of intervals. The pitches in a *major scale* form a repeating pattern of seven intervals. For example, if you play the white notes on a piano, starting at middle C and going up in pitch, you play a major scale. A *semitone*, the fundamental unit of pitch, is the distance in pitch between two adjacent keys on the piano. Two semitones equals one *tone*. We can write the intervals in the ascending major scale as

tone - tone - semitone - tone - tone - tone - semitone   or   2, 2, 1, 2, 2, 2, 1,

after which the same list of intervals repeats. Notice that $2 + 2 + 1 + 2 + 2 + 2 + 1 = 12$, so the pattern starts over again an octave higher.

There are many major scales on the piano because the scale is determined by its intervals, not its starting pitch. Therefore, we can't give letter names (like "A" or "C") to the pitches in a scale. Instead, we can use the *solfege* system

do   re   mi   fa   sol   la   ti

made famous by the song "*Do*, a deer" (Rodgers & Hammerstein, 1959), which also teaches the pronunciation of the syllables:

> Doe, a deer, a female deer
> Ray, a drop of golden sun
> Me, a name I call myself
> Far, a long long way to run
> Sew, a needle pulling thread
> La, a note to follow sew
> Tea, I drink with jam and bread
> That will bring us back to doe.

The starting note of the major scale is always called *do*, then *re* is two semitones above *do*, *mi* is two semitones above *re*, etc. Because the pattern of intervals repeats after an octave, the names are recycled—the last line of the song, "that will bring us back to doe" actually ends on the pitch that is one octave higher than the original starting pitch.

EXERCISE 11. Find the number of semitones from

1. *do* up to *me*

2. *do* up to *re*

3. *do* up to *fa*

4. *do* up to *sol*

5. *re* up to *la*

6. *mi* up to *ti*

Pitch class   As we have seen both with the letter names of keys on the piano and with the solfege syllables, names are reused after an octave. This is because our brains are hard-wired to hear pitches that are an octave apart as extremely similar. Two pitches or frequencies that are an octave apart belong to the same *pitch class.* For example, 440 Hz, 880 Hz, 220 Hz, 110 Hz, etc. all belong to the same pitch class (corresponding to pitches 77, 69, 81, 93, etc.). This pitch class is labelled by the letter "A" and all its members are called "A"s. Every pitch class has infinitely many members, because you could keep going up or down by octaves forever (though you would eventually exceed the limits of human hearing).

EXERCISE 12. Give MIDI numbers for at least five members of the pitch class C.

EXERCISE 13. Find a mathematical representation of the pitch class C.

EXERCISE 14. How many different pitch classes are represented on the piano?

Because the system of pitch classes repeats after an octave, they are often depicted on a circle, called the *pitch class circle.* Normally, C is at the top.
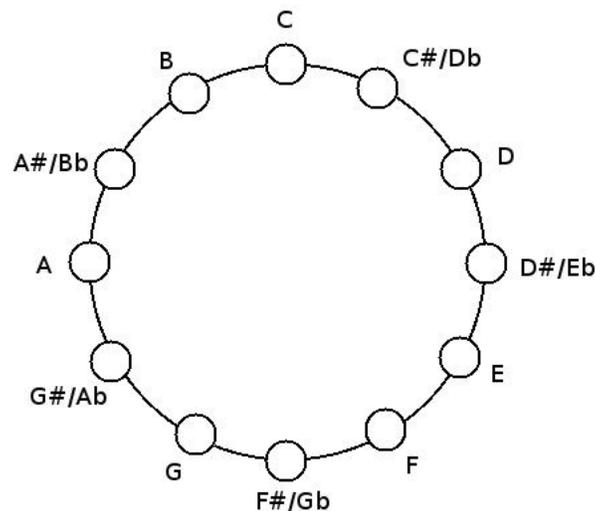
EXERCISE 15. Name the pitch classes in a C major scale (use *do* = C).

EXERCISE 16. Name the pitch classes in a D major scale (use *do* = D).