

Physics of Musical Sound

Perceptual Pitch

What does it take to produce a clear sensation of pitch?

- Need clearly separate partials
- Need evenly spaced partials to predominate
- Need Harmonically ($f = n \cdot f_0$) related partials to dominate

What pitch do we hear?

- We do not hear the pitch of the lowest partial
- We do hear the repetition frequency which is also the frequency of the fundamental of the harmonic series even if it is missing

Representing Pitch

Physically we represent the pitch of a sound with a frequency.

- We use the frequency of the pure sine wave that our ears agree has the same pitch as the complex sound.

In Western music we represent pitch using note names chosen from a very limited set of pitches.

- Some non-western musical traditions use a much wider range of pitches and some modern western musicians have also experimented with wider ranges of pitches--microtonal music.

Basis of all Western traditions is the Octave, the interval made up of two frequencies related by $f_2 = 2 f_1$

Western Pitch Choices

Each individual pitch is given a name consisting of a single letter of the alphabet possibly with a modifying adjective (sharp or flat).

Two pitches that are 1 octave apart are always given the same name.

The octave interval is split into 12 identical frequency intervals chosen so that the ratio of two successive notes is $\sqrt[12]{2} = 1.059463094\dots$

Each such interval is called 1 [semitone](#).

Western Pitch Names

The 12 semitones that make up 1 octave are assigned note names using the following curious scheme.

A A#/Bb B C C#/Db D D#/Eb E F F#/Gb G G#/Ab A

- Note that five of the notes have modified names and each one has two different forms, a sharp (#) form and a flat (b) form.

The scheme is historical in origin and we shall study its origins in more detail later.

The complete set of 12 distinct pitches make up the [chromatic scale](#).

Pitches and Scales

A **scale** is a set of (usually) 7 notes chosen from the 12 possible notes and arranged in order of increasing frequency.

The simplest scale in common western use is called the **diatonic major scale**. Its simplest form is the set of notes

C D E F G A B C

called the **diatonic scale on C**.

Other common scales include the rising and falling forms of the diatonic minor scale, the harmonic minor scale, and the chromatic scale.