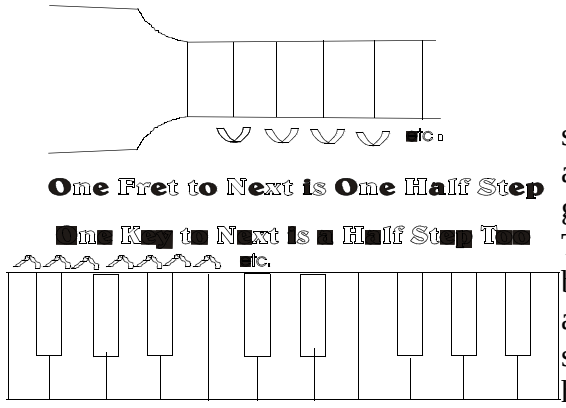
Intervals and Pitch Class:

Introduction

All cultures recognize resonances between tones, or pitched sounds, whether sounding **melodically** (sequentially) or **harmonically** (simultaneously). Some of these resonances are universally recognized. The most primary example of these vibratory resonances are the sounding of a pitch along with a pitch vibrating at twice the frequency of the first – a relationship westerners (meaning people and traditions of European origins) have dubbed the **octave**. We call it the octave because we use seven note scale, and on the eighth note (oct) we return to a note our ancestors have given the same name of the starting note: from C to shining C. Other universally recognized pitch combinations western academics have dubbed the "**fifth**" and "**fourth**" (see below for definitions of these terms). Other pitch combinations are not as thoroughly agreed upon.

This short treatise deals with "**classical western**" choices and names. Since so much music thrust upon us that's steeped in this western nomenclature and pitch choices, it's a good place to start our understanding of the language used by many musicians to describe notes (dots on pages), tones (things we actually hear), and pitch (ways of naming vibration relationships of tones). Please, please explore other pitch combinations! Discover the beauty of other scales and modes. Many traditional cultures, such as East Indian, Native American, Middle Eastern, and even Appalachian, use other scales (like 22 pitches in an "octave") and "in-between" intervals.

All these plans limit the note choices. This is good: it reigns in the number of relationships we need to understand. It makes it easier to relate to what's happening. In western music we start with a twelve tone "**chromatic**" scale and then limit it even more to a seven tone "**major**" scale.



Half & Whole Steps

After years of trial and experimentation, western music has settled on twelve notes to the octave. These pitch relationships are cast in stone (or metal and wood) by the piano, frets on guitars, and holes and valves on winds and brass instruments. This twelve tone scale is called "**chromatic**." The distance between any two consecutive pitches (adjacent frets on guitars, adjacent keys on the piano) is called a "**half-step**." Two half-steps makes a **whole-step**, three half-steps equals one-and-a-half-steps, four half-steps equals two whole-steps and so on. So, one way to define the relationship between two notes is by counting steps, halfs, wholes or combinations of the two.

The Major Scale

On top of these twelve notes we impose another "filter," **the scale**. There are numerous scale choices, the dominant one being an eight note scale, be it major or minor.

Interval & Pitch Class Page 2

We'll start with the **major scale**, also called the **Ionian Mode**. The major scale is a pattern of half and whole steps (one whole step = two half steps). The pattern is:
Whole - Whole - Half - Whole - Whole - Whole - Half (W - W - H - W - W - W - H).

The "all natural" major scale starts at C. On the piano a C note is found immediately to the left of the left most "two" black keys. As the scale "ascends," each step of the way is given a name, after the next letter of the alphabet, but ending at G, then starting at A. Eventually (on the eighth note) we come to a same-named note an octave higher.

Notice how the "natural" pattern of the scale is the major W- W- H - W - W - W - H. Again, every major scale follows this pattern: as we change from ascend or descend the scale we go the next name, and we create the W- W- H - W - W - W - H sequence.

So, let's build one in another key. Suppose we want A to be the tonic or root. Now that we've chosen the tonic, we build the W-W-H-W-W-W-H pattern. A to B is a whole step, we have to sharp the C so the step from B to C# becomes whole. C# to D is a half step, D to E is a whole step. But we need to raise F and G to F# and G# to make the W-W-H-W-W-W-H pattern. Now we have:

A - B - C# - D - E - F# - G# - A
W - W - H - W - W - W - H
An A major scale.

How about:

Bb - C - D - Eb - F - G - A - Bb. For a Bb major scale. See if you can figure out a few others, along with why we call this Bb and not A#.

Names and Numbering Schemes

It makes sense to be able to talk about the relative nature of the relationships between notes. To do this there are at least a couple numbering schemes commonly imposed on our system. The first is "**scale degree**" and the second, "**interval**." To keep things more or less separate, scale degree is often denoted by Roman numerals. Intervals use Arabic numerals.

So, in C the scale degrees are numbered:

C D E F G A B C D E F G A B C
I II III IV V VI VII I II III ...

Roman Numerals don't go past VII (seven).

Arabic numbers are used in a more relative sense. We can start anywhere to give a count to the interval between two notes:

C D E F G A B C D E F G A B C
1 2 3 4 5 6 7 8 9 10 11 12 13 ....
Or: 1 2 3 4 5 6 ....

So the **interval** between any note and another is assigned a number by "counting letters," starting with the number one. C to G is a "fifth." C to F over an octave and a half is an "eleventh." E to C is a "sixth." E to C an octave up is a "thirteenth." Etc.

Capital and Lower-Case Roman Numerals

At some point we might discuss building chords in a key. When we do we'll find out that, depending on where we start, we'll find major chords, minor chords, and a diminished triad. Often CAPITALIZED Roman numerals denote major chords, lower-case Roman numerals indicate minors (and the diminished). When numbered this way, the scale degrees of a major scale look like this:

I ii iii IV V vi vii

Interval & Pitch Class Page 3

Examining the A major scale and making A the root by setting A to 1 demonstrates the relative nature of the relationships between notes:

A	B	C#	D	E	F#	G#	A	B	C#	D	E	F#	G#	...
1	2	3	4	5	6	7	8	9	10	11	12	13	14	...
I	ii	iii	IV	V	vi	vii	I	ii	iii	IV	V	vi	vii	...

Now, these numbers don't require sharps and flats, just counting to the next letter name. So, A to Gb is a seventh, as are A to G and A to G#. These sevenths do change in quality (sound). A to Gb is 9 half steps, A to G is 10 half steps, and A to G# is 11 half steps. The following words are used to name the differences in quality: **minor**, **major**, **perfect**, **diminished**, and **augmented**.

Exploring the relationships of a major scale helps us define these interval qualities. A to B is a whole step and called a **major second**. A to C#: a **major third**, two whole steps. A to D, a **perfect fourth**.

To alter major to minor, flat the higher note: A to C is a **minor third**. A to Bb is a **minor second**. Flatting the minor interval "**diminishes**" it: A to Cb is a diminished third. Sharping a major interval augments it: A to C## (double sharp) is an **augmented fourth**.

The perfect intervals can be diminished (flattened) and augmented (sharped). They have no minor/major double-quality state.

Another important word is "**enharmonic**," which refers to different names for the same number of steps. Example: A to F# is a major sixth, an interval of 4½ steps. A to Gb is a diminished seventh, and is also an interval of 4½ steps.

Check your references. When speaking of these numbers it's possible to get references confused. "When she said, 'go to the fifth,' did she mean scale degree or the interval?" Usually context makes it easy to tell.

Although it's all a bit convoluted, it does make a bit of sense, and it's a standard for communicating musical ideas. At any rate, we've finally defined enough terms to discuss Pitch Class.

Unison:	Perfect: 0 steps, C to C the same Augmented: ½ step up, C - C# Diminshed: ½ step down, C - Cb
Second:	Major: 1 step C - D Minor: ½ step, C - Db Augmented: 1½ steps, C - D# Diminished: 0 steps, C - Dbb
Third:	Major: 2 steps, C - E Minor 1½ steps, C - Eb Augmented: 2½ steps, C - E# Diminished: 1 step, C - Ebb
Fourth:	Perfect: 2½ steps, C - F Augmented: 3 steps, C - F# Diminished: 2 steps, C - Fb
Fifth:	Perfect: 3½ steps, C - G Augmented: 4 steps, C - G# Diminished: 3 steps, C - Gb
Sixth:	Major: 4½ steps, C - A Minor 4 steps, C - Ab Augmented: 5 steps, C - A# Diminished: 3½ steps, C - Abb
Seventh:	Major: 5½ steps, C - B Minor 5 steps, C - Bb Augmented: 6 steps, C - B# Diminished: 4½ steps, C - Bbb
Octave:	Perfect: 6 steps C - C Augmented: 6½ steps C - C# Diminished: 5½ steps C - Cb

Pitch Class:

Now, that we've named intervals, western music defines two kinds of pitch classes: **Major/Minor** and **Perfect**. Unisons, Octaves, Fourths and Fifths (elevenths, etc.) are in the "Perfect" class. There is no "minor fifth." Seconds, thirds, sixths, and sevenths (ninths, thirteenths, etc.) are in the Major/Minor class. There is a "minor third," and "major third." If you flatten something out of it's class, it's then said to be "diminished." If you sharpen it, it's said to be "augmented." A few examples in the key of D:

D to A is a fifth, a "perfect" interval (seven half steps)
D to A# is an augmented fifth (eight half steps)
D to Ab is a diminished fifth (six half steps)

D to C# is a major seventh (eleven half steps)
D to C natural is a minor (ten half steps)
D to Cb is a diminished seventh (nine half steps – enharmonic with a major sixth)
D to C## (double sharp) is the augmented seventh D (twelve half steps – enharmonic with an octave)

Notice that, in our equal tempered scale, C## is enharmonic to D and Cb is enharmonic to B! So the augmented seventh is enharmonic to the root, and the diminished seventh is enharmonic to the major sixth. It's important to note that even though we are playing the same note, their relationship when these "spellings" occur are meaningful. That is, in a contextual sense, the diminished seventh is different than a major sixth.

An example is the diminished seventh (dim7) chord, which includes a diminished seventh. The D diminished seventh cord is spelled: D – F – Ab – Cb. The intervals between each consecutive note is a minor third. That's a minor third from D to F, a minor third from F to Ab, etc. The intervals from the root, D, are as follows:

D to F – minor third (three half steps)
D to Ab – diminished fifth (six half steps)
D to Cb – diminished seventh (nine half steps)

(Aside: the "half diminished" or "minor seventh, flat five" is the same chord with a C natural, or "minor seventh," spelled: D – F – Ab – C.)

Interval Inversions and Pitch Class

The "inversion" of an interval is the interval found when turning it "upsidedown." Example:

D up to B is a major sixth (nine half steps up)
D down to B is a minor third (three half steps)

Exploring the inversions of intervals gives us a clue as to why western music defines these two types of Pitch Classes: Major Interval inversions produce Minor Intervals, Perfect Interval inversions produce Perfect Intervals. Listed:

The inversion of a perfect unison is a perfect unison (C - C above C - C below)

Interval & Pitch Class Page 5

The inversion of a minor second above is a major seventh below (C - Bb above, C - Bb below)
The inversion of a major second above is a minor seventh below (etc.)
The inversion of a minor third above is a major sixth below
The inversion of a major third above is a minor sixth below
The inversion of a perfect fourth above is a perfect fifth below
    Oddball: the augmented fourth, or diminished fifth, AKA: ***Tritone*** (3 whole steps)
    The inversion of a tritone is a tritone
The inversion of a perfect fifth above is a perfect fourth below
The inversion of a minor sixth above is a major third below
The inversion of a major sixth above is a minor third below
The inversion of a minor seventh above is a major second below
The inversion of a major seventh above is a minor second below
The inversion of a perfect octave above is a perfect octave below

Major to minor, perfect to perfect. The only oddball is that note right in the middle, that tritone.

More on Melodic and Harmonic Intervals

As stated earlier, when two intervals are played consecutively, one following the other, it's called melodic. Melodies are made up of sequential melodic intervals. Each of these intervals and combinations of intervals have qualities we can learn to recognize. Learning to hear these is called "**ear training**," and permits us to identify and transcribe songs, solos, and the like.

When intervals are played simultaneously they are called harmonic. Chords are a blending of harmonic intervals (and a future handout). Learning to recognize these permits us to discern if the chords being used are minor, major, diminished, augmented, etc.

Music is made up of melodic and harmonic parts. At the risk of being pedantic: the "**chord progression**" supporting the melody is a harmonic progression. The melody is a melodic progression. A "**harmony part**" is a melodic progression that combines with the original melody in a harmonic manner. A jazz chord solo is both melodic and harmonic. The two are intimately intertwined.

Western music theory uses these filters: harmonic and melodic progressions, along with rhythm to analyze and categorize music. This is only the briefest of introductions.