Major Scales, Intervals, & Formulae

By Ben Higgins

Any "Major" Scale is constructed the same way: whole step-whole step-half step----whole step-whole step-whole step-half step.

"C" Major Scale:

C_D_E-F_G_A_B-C
w w h w w w h

The "C" Major Scale does not require #'s or b's because, long ago, it was decided that a natural half step would exist between: E-F and B-C.
Any other major scale will require the use of #'s or b's in its construction.

"G" Major Scale:

G_A_B-C_D_E_F# -G
w w h w w w h

Much of the work that needs to be done to make music theory useful involves learning the harmonic relationships that can be related to one key (major scale). Because every major scale is constructed the same way; they will each have the same sound. We will be talking about the "C" Major Scale, in particular, as the primary example of "any" major scale. As an introduction to "harmonic relationships," it is necessary to understand "INTERVALS."

ALL ABOUT INTERVALS:

Intervals are to musicians as a tape-measure is to a master carpenter. Intervals are used to measure the DISTANCE BETWEEN TWO TONES. The notes of a major scale can be numbered:

"C" Major Scale: C_D_E-F_G_A_B-C
                      1 2 3 4 5 6 7 8(1)

There are 5 different types of intervals:

1) "major" intervals (maj.)
2) "perfect" intervals (per.)
3) "minor" intervals (min.)
4) "diminished" intervals (dim.)
5) "augmented" intervals (aug.)

All intervals measured from the "root"(1) of a major scale are, either: "major" intervals; or "perfect" intervals. These are the intervals that are inherent in the "C" major scale:

$C - D$ = maj. 2nd (2 half steps)
$C - E$ = maj. 3rd (4 half steps)
$C - F$ = per. 4th (5 half steps)
$C - G$ = per. 5th (7 half steps)
$C - A$ = maj. 6th (9 half steps)
$C - B$ = maj. 7th (11 half steps)
$C - C$ = octave(8th) (12 half steps)

These intervals are refered to by "FORMULA" as:

$$C - D = (1,2)$$
$$C - E = (1,3)$$
$$C - F = (1,4)$$
$$C - G = (1,5)$$
$$C - A = (1,6)$$
$$C - B = (1,7)$$
$$C - C = (1,8); \text{ or } (1,1)$$

"Minor" intervals are major intervals that have been "flatted" or lowered by one half step:

$$C - Db = \text{min. } 2^{nd} \quad (1, b2)$$
$$C - Eb = \text{min. } 3^{rd} \quad (1, b3)$$
$$C - Ab = \text{min. } 6^{th} \quad (1, b6)$$
$$C - Bb = \text{min. } 7^{th} \quad (1, b7)$$

There are two "Diminished" intervals: diminished 5th; and diminished $7^{th.}$

The diminished. 5th interval is created by "flatting" or lowering the perfect 5th interval by one half step:

$$C - Gb = \text{dim. } 5^{th} \quad (1, b5)$$

The diminished 7th interval is created by "flatting" or lowering the minor 7th interval by, yet, another half step. The diminished 7th interval is, technically, a "double flatted" major 7th interval (bb7);but, is actually, in truth, a major 6th interval:

$$C - Bbb \quad (C - A) = \text{dim. } 7^{th} \quad (1, bb7) = (1, 6)$$

Augmented intervals are perfect intervals that have been "sharped" or raised by one half step:

$$C - F\# = \text{aug. } 4^{th} \quad (1, \#4) \text{ or } (1, +4)$$
$$C - G\# = \text{aug. } 5^{th} \quad (1, \#5) \text{ or } (1, +5)$$

ENHARMONICS:

Enharmonics are the result of the fact that a single tone (note) can have two different names: ie; "F#" and "Gb"; "C#" and "Db"; or "Bbb" and "A".
In the same respect; certain INTERVALS may have more than one identity:

$C - Gb = \text{dim. } 5^{th}$	$C - Ab = \text{min.} 6^{th}$	$C - A = \text{maj. } 6^{th}$
$C - F\# = \text{aug. } 4^{th}$	$C - G\# = \text{aug.} 5^{th}$	$C - Bbb = \text{dim.} 7^{th}$

SUMMARY OF INTERVALS:

C – Db = min. 2nd (1, b2) ----------------------- 1 halfstep.
C – D = maj. 2nd (1, 2) ----------------------- 1 wholestep.
C – Eb = min. 3rd (1, b3) ---------------------- 1 wholestep + 1 halfstep.
C – E = maj. 3rd (1, 3) ---------------------- 2 wholesteps.
C – F = per. 4th (1, 4) ----------------------2 wholesteps + 1 halfstep.
C – F# = aug. 4th (1, #4) [Enharmonic: C – Gb = dim. 5th (1, b5)] ------- 3 wholesteps.
C – G = per. 5th (1, 5) ----------------------- 3 wholesteps + 1 halfstep.
C – G# = aug. 5th (1, # 5) [Enharmonic: C – Ab = min. 6th (1, b6)] ------ 4 wholesteps
C – A = maj. 6th (1, 6)   [Enharmonic: C – Bbb = dim. 7th (1, bb7)] ----- 4 wholesteps +
1 halfstep.
C – Bb = min. 7th (1, b7) ---------------------- 5 wholesteps.
C – B = maj. 7th (1, 7) ----------------------- 5 wholesteps + 1 halfstep.
C – C = octave   (1, 8) or (1, 1) -------------- 6 wholesteps.

POINTS TO UNDERSTAND REGARDING INTERVALS:

It is important to understand that each and every interval is a STANDARD unit
of measurement: a major 3rd will always be the distance of 2 wholesteps; a minor 3rd
will always be the distance of 1 wholestep + 1 halfstep; a perfect 5th will always be
the distance of 3 wholesteps + 1 halfstep; etc...

All possible intervals have,thus far, been presented in such a way that the "ROOT" of
a single "TONAL KEY CENTER" { the 12 tones that exist between the root ("C") and
its octave ("C")} functioned as the "ROOT" of each interval,whereby; each "INTERVAL"
was directly related (by formula) to the specific tone(s) that create the Major Scale of
that "Tonal Key Center."

The above paragraph should be read again because it serves to clarify (4) important
points that will come back to haunt you in further studies:

1) A "tonal key center" includes all 12 tones (notes) that exist within an octave.
2) 7 of those tones: 1,2,3,4,5,6,7 (1w2w3h4w5w6w7h1), construct a "major scale"
   within that tonal key center.
3) All "FORMULAS" that you ever encounter in music theory are interpreted as
   if the numbers (1,2,3,etc...) are the tones (notes) of a hypothetical major scale.
   The "ROOT" of this hypothetical major scale is always represented by the # (1).
4) The lower note (tone) of an interval is said to be the ROOT of the interval. The
   upper or higher tone (note) is said to be the INTERVAL itself:

   C – G = per. 5th -----"C" is the "ROOT" ; "G" is the "PERFECT 5th" (from that root).
   (1) (5)   (1)   (5)

INVERTING INTERVALS:

Intervals may be "inverted" by, simply, "flipping" the the two notes:
the ROOT of a given interval will be sounded "above" the INTERVAL and
the INTERVAL itself becomes the ROOT. This is usually accomplished by
replacing the ROOT with its octave; thereby, causing the INTERVAL to be
the "lower" tone. When an interval is inverted; a new interval is created.
There is, actually, a fastenating correlation between each interval and
its inversion.

an inverted	min. 2nd -----	becomes a	maj. 7th	(C – Db / Db – C)
an inverted	maj. 2nd -----	becomes a	min. 7th	(C – D / D – C)
an inverted	min. 3rd ------	becomes a	maj. 6th	(C – Eb / Eb – C)
an inverted	maj. 3rd ------	becomes a	min. 6th	(C – E / E – C)
an inverted	per. 4th ------	becomes a	per. 5th	(C – F / F – C)
an inverted	per. 5th ------	becomes a	per. 4th	(C – G / G – C)
an inverted	min. 6th ------	becomes a	maj. 3rd	(C – Ab / Ab – C)
an inverted	maj. 6th ------	becomes a	min. 3rd	(C – A / A – C)
an inverted	min. 7th ------	becomes a	maj. 2nd	(C – Bb / Bb – C)
an inverted	maj. 7th ------	becomes a	min. 2nd	(C – B / B – C)

an inverted octave -------- remains an   octave   (C – C) / C – C)

an inverted aug. 4th(dim. 5th) ---- becomes "another" aug. 4th (dim. 5th)   (C – F# / F# -- C)

The unique position of the aug.4th (dim. 5th) interval as the "center tone" between the
two tones of the octave earned it another name: THE "TRI –TONE" INTERVAL.
This interval plays an important role in harmonic movement (chord progression).

You may have found it a bit cumbersome to indentify some of the inverted intervals
with their respective formulai because it was necessary to relate the new ROOTS
with their respective major scales. What is required to overcome this is the ability
to "spell" all the major scales. It takes some practice, but, the 1st step in the practice
is to memorize the "spellings." Combine your knowledge of intervals with a good
command of the major scales and you have completed a thorough course of the
fundamentals of harmonic theory; allowing future discussions to become less tedious
and more practical.

THE MAJOR SCALES:

Not only are there 12 tones that exist between any given octave; but, there are only 12 tones that exist period. This means that there are only 12 possible tones that can be used as ROOTS of tonal key centers – and only 12 possible "TONICS" from which to build major scales. The word TONIC is another name for ROOT. The reason for the two different words is that when the word "TONIC" is used; it is usually refering, specifically, to the way the ear hears the "ROOT" in relation to any given scale or chord structure.

There are, actually, 15 different key signatures; but, 3 of them are enharmonically related. There are 7 major scales that contain one or more sharped (#) notes;and there are 7 major scales that contain one or more flatted (b) notes in their spelling. The key of "C" major, of course, is the one that contains no "accidentals" (#'s or b's).

MEMORIZE THESE NOTES IN ORDER:

SHARP KEYS: >>>>>>>>>> F#, C#, G#, D#, A#, E#, B#   (FCGDAEB)
                                                              >>>>>>>>

FLAT KEYS: (BEADGCF)   Bb, Eb, Ab, Db, Gb, Cb, Fb <<<<<<<<<<
             <<<<<<<<

SHARP KEYS:

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               1 2 3  4 5 6  7  1
G Major Scale  G, A, B,  C, D ,E,  F#, G   contains 1 sharp:  F#
D Major Scale  D, E, F#, G, A, B, C#, D   contains 2 sharps: F#, C#
A Major Scale  A, B, C#, D, E,F#, G#, A   contains 3 sharps: F#, C#, G#
E Major Scale  E, F#,G#,A, B,C#, D#, E   contains 4 sharps: F#, C#, G#, D#
B Major Scale  B, C#,D#,E,F#,G#.A#, B   contains 5 sharps: F#, C#, G#, D#, A#
F# Major Scale F#,G#,A#,B,C#,D#,E#, F#   contains 6 sharps: F#, C#, G#, D#, A#, E#
C# Major Scale C#,D#,E#,F#,G#,A#,B#,C#   contains 7 sharps: F#, C#, G#, D#, A#, E#, B#
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(notice that the tonics of these major scales move by a perfect 5th interval as each new (#) is added)

FLAT KEYS:

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                1 2 3 4  5 6 7 1
F  Major Scale  F, G, A, Bb, C, D, E, F  contains 1 flat:  Bb
Bb Major Scale  Bb,C, D, Eb, F, G, A, Bb contains 2 flats: Bb, Eb
Eb Major Scale  Eb,F, G, Ab, Bb, C, D, Eb contains 3 flats:  Bb, Eb, Ab
Ab Major Scale  Ab, Bb,C, Db,Eb, F, G, Ab contains 4 flats:  Bb, Eb, Ab, Db
Db Major Scale  Db,Eb, F,Gb,Ab,Bb,C, Db contains 5 flats:  Bb, Eb, Ab, Db,Gb
Gb Major Scale  Gb,Ab,Bb,Cb Db,Eb,F, Gb  contains 6 flats: Bb, Eb, Ab, Db, Gb, Cb
Cb Major Scale  Cb,Db,Eb, F, Gb Ab,Bb,Cb  contains 7 flats: Bb, Eb, Ab, Db, Gb, Cb, Fb
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(notice that the tonics of these major scales move by a perfect 4th interval as each new (b) is added)